Glades Region Master Plan

Glades Region Master Plan Appendices Palm Beach County

February 14, 2015

Funded by: HUD Office of Economic Resilience

45006-003c003

APPENDIX A

Market Overview and Economic Development Analysis – Treasure Coast Regional Planning Council, December 2014

GLADES REGION MASTER PLAN

MARKET OVERVIEW & ECONOMIC DEVELOPMENT ANALYSIS
PALM BEACH COUNTY, FL

Prepared For: Treasure Coast Regional Planning Council
On Behalf of Palm Beach County

Prepared By: WTL +a

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General & Limiting Conditions

Every reasonable effort has been made to ensure that the data contained in this study reflect the most accurate and timely information possible. These data are believed to be reliable at the time the study was conducted. This study is based on estimates, assumptions, and other information developed by WTL+a from its independent research effort, general knowledge of the market and the industry, and consultations with the client and its representatives. No responsibility is assumed for inaccuracies in reporting by the client, its agent and/or representatives, or any other data source used in preparing or presenting this study.

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1. Introduction to the Study

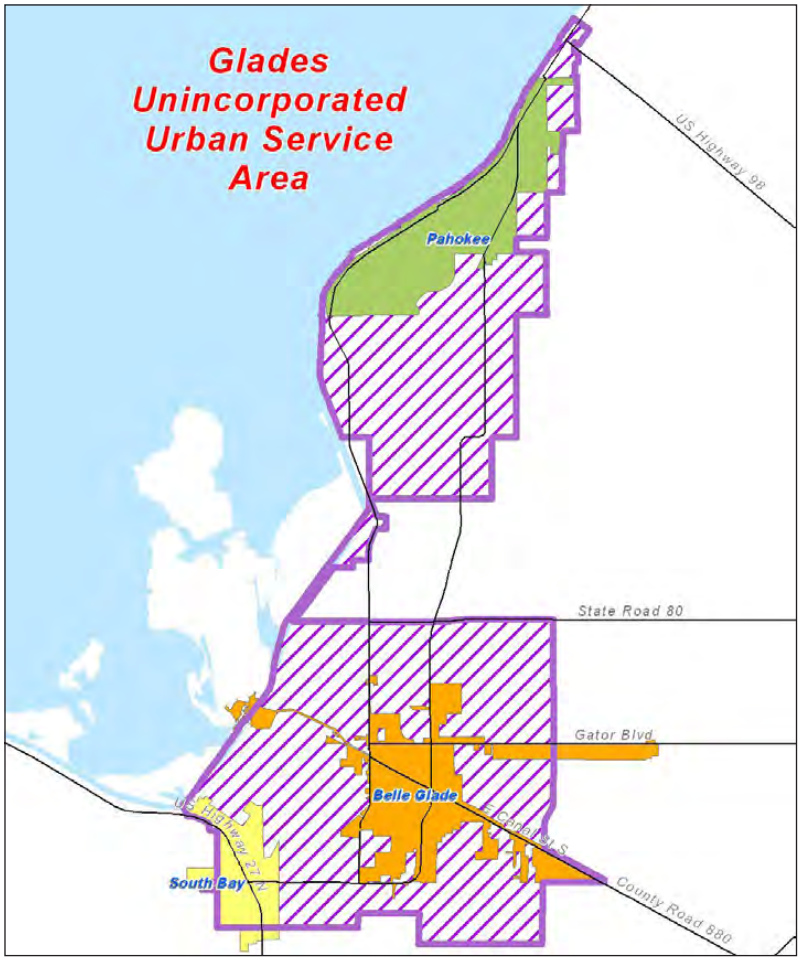
WTL+a, a national real estate and economic development consulting firm based in Washington, DC, was retained by Treasure Coast Regional Planning Council (TCRPC) of Stuart, FL, on behalf of the Palm Beach County Department of Economic Sustainability to prepare a real estate market analysis and economic development strategy as part of the Glades Region Master Plan in western Palm Beach County, FL.

The Glades Region Master Plan has been initiated as the result of a $1,980,504 Community Challenge Planning Grant awarded to Palm Beach County in late 2011 by the U.S. Department of Housing & Urban Development. The plan is a collaboration between Palm Beach County departments of Engineering, Planning, Zoning & Building, Water Utilities, and Palm Tran; TCRPC; the Palm Beach Metropolitan Planning Organization (MPO); CareerSource Palm Beach County; and the Florida Department of Transportation (FDOT) District 4 on behalf of the cities of Belle Glade, South Bay, Pahokee, and unincorporated areas surrounding these three municipalities.

As illustrated in Figure 1, the study area encompasses approximately 25,671 acres in both unincorporated Palm Beach County as well as three municipalities—Belle Glade, Pahokee and South Bay. The unincorporated portions of the study area, which contain 19,063 acres, are known as the Glades Unincorporated Urban Service Area. The three municipalities contain 6,608 acres within the study area, which is located approximately 36 miles west of the Palm Beach International Airport.

The Glades Region Master Plan's primary objectives include: improving mobility by providing more transportation choices; providing equitable/affordable housing; enhancing quality of life and economic competitiveness/sustainability; supporting existing communities; coordinating policies; and leveraging investments to help enhance communities and neighborhoods in the Glades Region.

Figure 1
Glades Region Study Area



TCRPC has prepared the public outreach and planning/design elements of the master plan, including:

- Assisting in creation of a comprehensive Master Plan for key areas of the Glades in western Palm Beach County;
- Reviewing land use and development regulations in order to recommend improvements designed to incentivize desired redevelopment and business creation;
- Preparing a market overview of real estate market conditions, demographic characteristics, and key market trends in the study area and region;
- Evaluating existing and emerging industry clusters and measuring their potential in the Glades Region as part of an economic development analysis and job-creation strategies; and
- Crafting a community-based vision for an economically sustainable Glades Region.

The Market Overview and Economic Development Analysis elements of the Glades Region Master Plan focus on those "building blocks" guiding preparation of a comprehensive economic development strategy which is reflective of existing goods and services and employment opportunities relative to the residential population. In addition, the economic analysis is intended to provide a base understanding of existing and emerging clusters and their potential in the Glades Region. The "building blocks" address the Glades Region's economic challenges of high unemployment and poverty, disinvestment, lack of jobs, and declining tax revenues. The five key components of the economic analysis include:

- Demographic & Economic Profile
- Real Estate Market Conditions
- Target Industry/Emerging Cluster Update
- Economic Development Potentials & Strategies
- Economic Impacts

Methodology/Key Tasks: WTL+a served as the prime contractor to TCRPC, and was assisted by Retail & Development Strategies, LLC, of Arlington, VA, in preparing the Market Overview and Economic Development Analysis. The economic analysis, which commenced in August 2013 with a site reconnaissance and initial outreach, comprised the following sequential tasks:

Task 1: Site/Market Reconnaissance and Public Outreach: Conducted a site and market reconnaissance tour of the study area and participated in a series of interviews with key stakeholders as identified by TCRPC. In November 2013, we participated in two week-long planning workshops with the planning team.

Task 2: Demographic & Economic Profile: Evaluated relevant demographic characteristics of the study area's existing resident population and analyzed those factors informing market potentials: growth in population, households and employment by occupational sector, household consumer spending, and other key indicators. The profile focused on those sectors of the regional economy that affect opportunities for economic development.

Task 3: Real Estate Market Conditions: Examined key metrics in the study area's residential and commercial 'workplace' uses (e.g., office, retail, industrial), and lodging/ hospitality estate markets, including: recent and current market conditions; building inventory; vacant building stock; home ownership trends; and other similar indices over the past five to 10 years to understand the study area's competitive market position to accommodate new uses/economic development initiatives, and to guide specific strategies aimed at job creation.

Task 4: Target Industry Review: Reviewed previous relevant economic studies and their technical appendices as provided by TCRPC, Palm Beach County, and/or others to understand ongoing economic initiatives and other planning efforts in the study area as the basis for identifying specific economic development strategies. This included: reviewing recent target industry studies that identify emerging industry clusters; assessing

those industries with the strongest growth potentials in western Palm Beach County; and, evaluating the implications of the target industry/emerging cluster update on economic development potentials and land use in the Glades Region study area.

Task 5: Economic Development Potentials & Strategies: Outlined a preliminary set of economic development strategies that consider the findings of each preceding task above. This task focused on strategies designed to meet critical objectives, such as net new job creation, training and workforce development, entrepreneurial opportunities, and considered recent and current public investments made by Palm Beach County; proposed major investment projects such as the Intermodal Logistics Center; the sale and prospective redevelopment of the 211 acres comprising the former Glades Correctional Institution in Belle Glade; and, other relevant existing or planned economic activities, such as those underway by Palm Beach County's Department of Economic Sustainability, Business Development Board, and/or local entities such as the Lake Okeechobee Regional Economic Development Initiative (LORE).

Task 6: Economic Impacts: Measured preliminary economic impacts for each municipality generated by market/development potentials prepared as part of the market study. This included estimating the construction value of specific types of real estate (for example, industrial, residential, etc. from Task 5), calculating ad valorem taxes, and estimating secondary impacts such as temporary construction jobs and permanent jobs and wages.

Addenda

In October 2014, Palm Beach County provided revised population forecasts through 2035. Based on these changes (which primarily affect the Unincorporated Area of the Glades Region and the City of Belle Glade), WTL+a updated selected parts of the study. These changes are reflected in the following sections of the report: Table 1; in the analysis of housing opportunities in Section 5; and, in the economic impact analysis in Section 6 of this report.

2. Demographic and Economic Profile

This task serves as a "building block" of the economic development analysis, to understand characteristics of the existing resident population, by examining the "drivers" of real estate market demand for specific land uses utilizing available economic and demographic data. A key objective of this profile is to identify those indicators that could be expected to enhance entrepreneurial opportunities in the Glades Region.

The profile includes such factors as population and household growth; employment and occupational trends and forecasts, by industry sector; household consumer spending patterns; household incomes; race and ethnicity; population by age cohort; and, other indices intended to inform initiatives for economic development in each of the three municipalities as well as unincorporated parts of the Glades Region study area.

WTL +a utilized various secondary public and private sources in this analysis, including: the U.S. Census Bureau; the University of Florida Bureau of Business & Economic Research; the State of Florida Agency for Workforce Innovation (now part of the Florida Department of Economic Opportunity/DEO); Palm Beach County; ESRI Business Analyst; Woods & Poole, Inc.; and other sources. Key findings for each municipality (as well as unincorporated parts of the study area based on available data) are summarized below; data are illustrated in Table 1 through Table 17.

Population Trends and Forecasts (2000-2035)

To understand local and regional historic population patterns and growth forecasts in Palm Beach County and the study area, WTL+a reviewed forecasts prepared by state and county agencies such as the University of Florida Bureau of Business & Economic Research (BEBR) and Palm Beach County's Department of Planning, Zoning & Building. Population forecasts through 2035 are part of the county's 2013 Population Allocation Model. Various findings are summarized as follows and illustrated in Table 1:

Table 1
Demographic Trends and Forecasts, 2000-2035

	2000	Share of County	2010	Share of County	2013	Share of County	Change: 2000-2013 Amount	Change: 2000-2013 CAGR (2)	2020	2025	2030	2035	Change: 2013-2035 Amount	Change: 2013-2035 CAGR (2)
Population														
Palm Beach County	**1,131,184**		**1,320,134**		**1,322,306**		**191,122**	**1.2%**	**1,415,700**	**1,485,200**	**1,549,400**	**1,606,900**	**284,594**	**0.89%**
City of Belle Glade	14,906	1.3%	17,467	1.3%	17,402	1.3%	2,496	1.2%	18,879	20,496	21,925	22,990	5,588	1.3%
City of Pahokee	5,985	0.5%	5,649	0.4%	5,858	0.4%	(127)	-0.2%	6,359	6,839	7,393	7,793	1,935	1.3%
City of South Bay	3,859	0.3%	4,876	0.4%	4,711	0.4%	852	1.5%	5,275	6,177	7,156	8,018	3,307	2.4%
Unincorporated (Est.)	6,694	0.6%	5,119	0.4%	5,626	0.4%	(1,068)	-1.3%	6,897	8,741	10,774	12,829	7,203	3.8%
Study Area:	**31,444**	**2.78%**	**33,111**	**2.5%**	**33,597**	**2.54%**	**2,153**	**0.51%**	**37,410**	**42,253**	**47,248**	**51,630**	**18,033**	**2.0%**

(1) Based on the 2035 low-medium-high population forecasts prepared by BEBR. Analysis uses moderate projection scenario for Palm Beach County.

(2) CAGR=Compound Annual Growth Rate.

(3) Population projections for study area municipalities provided by Palm Beach County Department of Planning, Zoning & Building from the 2013 Population Allocation Model (updated October 2014). Revised population estimates/forecasts are highlighted in

http://censusviewer.com/city/FL/

Source: U.S. Census Bureau; University of Florida, Bureau of Business & Economic Research; ESRI Business Analyst; Palm Beach County Department of Planning, Zoning & Building; WTL+a, updated October 2014.

Palm Beach County

Over the past 13 years, the population of Palm Beach County increased by more than 191,200 new residents—from 1.13 million in 2000 to fully **1.32 million residents** in 2013, reflecting sustained annual growth of 1.2% per year since 2000. Using the moderate growth scenario prepared by University of Florida's Bureau of Economic and Business Research (BEBR) through 2035, the county's population is forecast to continue increasing, albeit at a slower pace of approximately 0.9% per year. This would translate into a countywide population of 1.6 million residents by 2035, resulting in almost **284,600 new residents over the next 22 years.**

284,600 New Residents
Across Palm Beach County by 2035

If the current countywide average of 2.38 persons per household is maintained, future population growth might translate into more than **119,500 new households by 2035** across Palm Beach County. However, the actual number of households might vary if household size changes, which will impact market demand for new housing and specific product types.

Study Area Municipalities & Unincorporated Area

Since 2000, the study area's population has shifted as a result of annexations of unincorporated areas by both the cities of Belle Glade and South Bay, resulting in reallocations of population to both of those municipalities. In fact, between 2000 and 2013 Belle Glade's population expanded by almost 2,500 new residents and South Bay's population increased by 850, which subsequently reduced the population of the unincorporated area surrounding these jurisdictions.

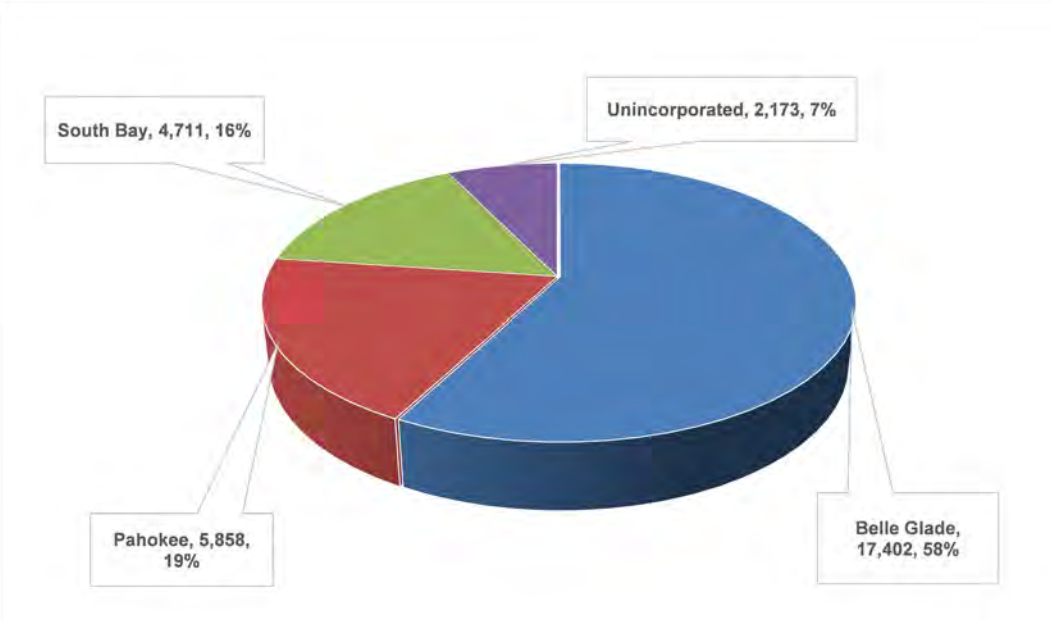
As the county's population continued to increase over the past 13 years, the study area's population also increased during this period, albeit at a slower rate. As illustrated in Table 1, the three municipalities and unincorporated area comprising the **Glades Region study area experienced a slight population increase of almost 2,200 residents—from 31,444 in 2000 to 33,597** in 2013—reflecting an annual average growth rate of 0.51% per year. However, as a result of greater growth elsewhere in Palm Beach County, the study area's share of Palm Beach County's total population declined slightly. In fact, the study area's share of the county's population decreased—from 2.78% in 2000 to 2.54% in 2013. This is known as fair share.

According to the *amended* 2013 Population Allocation Model prepared by the Palm Beach County Department of Planning, Zoning & Building (revised in October 2014), the three municipalities are forecast to gain population over the next 20+ years. As illustrated in Table 1, these forecasts suggest:

- Net new population growth of **more than 18,000 new residents between 2013—2035**, which the county attributes to various initiatives that could be expected to strengthen and diversify the study area's economy, such as the Intermodal Logistics Center, workforce training, job creation and others. The county's population forecasts are distributed as follows:

Municipality/Area	2013—2035 Growth
Belle Glade	5,600
Pahokee	1,935
South Bay	3,300
Unincorporated Area	7,300
Total:	18,000+

Figure 2
Glades Region Population Distribution, 2013



Other Demographic Indices (2012—2017)

The following highlights other demographic characteristics in greater detail for each municipality and, to the extent available, the unincorporated portions of the Glades Region study area. These data are based on trends (2000—2012) and five-year forecasts (2012—2017) prepared by various sources, including ESRI Business Analyst, Dun & Bradstreet, Inc., and other sources as noted above.

This analysis summarizes key indices, such as population and household growth, and changes in racial composition, age cohorts, and household incomes. Greater detail is illustrated in each accompanying table. For clarity, key findings are organized by municipality. While each table illustrates trends in housing tenure (occupancy patterns), these are analyzed more fully in Section 3 of the report.

Palm Beach County

- As illustrated in Table 2, over the next five years the population of Palm Beach County is expected to continue growing, albeit at a slower pace than the sustained annual rate of 1.2% per year that has occurred since 2000. ESRI forecasts an overall gain of more than 30,200 new residents in almost 8,400 new households, to 1,352,000 residents in 555,300 households by 2017. This yields an annual growth rate of 0.45% per year.

- The county's population is aging, with an increase of 48,400 expected in the number of residents in each of the age cohorts over 55 years by 2017. For Palm Beach County as a whole, the median age of residents is also expected to increase—from 44 years to 45.1 years—over the next five years.

- Notably, short-term forecasts also suggest a decline of more than 22,500 residents in specific age cohorts—young adults (15—24) as well as those in their peak-earning years/empty nesters (35—54). This reinforces the importance of countywide economic development initiatives focused on job growth, business retention and recruitment, as well as the attendant housing needed to accommodate the newly formed households.

- Average annual incomes among county households are forecast to increase over the next five years—from $72,905 in 2012 to almost $82,800 in 2017, reflecting a sustained, annual rate of growth of 2.6% per year. While this could be expected to strengthen household buying power, an aging population (which spends less on retail) may not necessarily translate into significantly greater demand for retail goods.

Table 2
Demographic Trends & Forecasts - Palm Beach County, 2000-2017

	2000	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Demographic Profile								
Population	1,131,184	1,320,134	1,322,306		1,352,520		**30,214**	**0.45%**
Households	474,175	544,227	546,908		555,286		**8,378**	**0.30%**
Avg. HH Size	2.34	2.39	2.38		2.40			
Median Age		43.5	44.0		45.2			
Race								
White		970,298	962,639	73%	957,584	71%	(5,055)	-0.1%
Black		228,383	231,404	18%	246,159	18%	14,755	1.2%
American Indian		6,601	5,289	0%	6,763	1%	1,473	5.0%
Asian, Pacific Islander		33,003	34,380	3%	40,576	3%	6,196	3.4%
Other		52,805	55,537	4%	63,568	5%	8,032	2.7%
Two or More Races		30,363	33,058	3%	37,871	3%	4,813	2.8%
Hispanic *(1)*		250,825	264,461	20%	307,022	23%	42,561	3.0%
Age Distribution								
0-14		220,462	218,180	17%	221,813	16%	3,633	0.3%
15-24		153,136	150,743	11%	143,367	11%	(7,376)	-1.0%
25-34		146,535	148,098	11%	151,482	11%	3,384	0.5%
35-44		165,017	161,321	12%	158,245	12%	(3,076)	-0.4%
45-54		188,779	182,478	14%	170,418	13%	(12,061)	-1.4%
55-64		159,736	166,611	13%	175,828	13%	**9,217**	1.1%
65-74		130,693	138,842	11%	167,712	12%	**28,870**	3.9%
75+		154,456	156,032	12%	166,360	12%	**10,328**	1.3%
Average HH Income			$ 72,905		$ 82,776			**2.6%**
Median HH Income			$ 50,797		$ 57,506			**2.5%**
Housing Profile								
Owner-occupied	353,888	388,787	380,092		391,162		11,070	0.6%
% of Total	64%	59%	57%		57.0%			
Renter-occupied	120,188	155,515	166,919		164,014		(2,905)	-0.4%
% of Total	22%	23%	25%		23.9%			
Vacant	82,351	120,292	123,346		131,074		7,728	1.2%
% of Total	15%	18%	18%		19.1%			
Total Units:	**556,428**	**664,594**	**670,356**		**686,249**		**15,893**	**0.5%**
Median Value			$ 168,784		$ 186,195			**2.0%**
Average Value			$ 223,864		$ 234,266			**0.9%**

(1) Persons of Hispanic origin are a subset of other race categories; therefore, totals do not add.

Source: ESRI Business Analyst; WTL +a, March 2014.

City of Belle Glade

As illustrated in Table 3, Belle Glade's population expanded by 900+ residents between 2000—2012, for a current population of 17,800+ residents in almost 5,800 households. In comparing the differences in the city's population between Table 1 (county data) and Table 3 (ESRI data), ESRI has adjusted its 2000 estimates to account for population increases that occurred as a result of annexation(s) after 2000.

- According to the 2012 American Community Survey (ACS), Belle Glade has a current unemployment rate of 19% and a poverty rate of 35%.

- Over the next five years ESRI forecasts suggest that Belle Glade will grow at a rate of 0.94% per year—above that which occurred between 2000—2012. If this growth materializes, it will translate into more than 850 new residents in 250+ new households in Belle Glade over the next five years, for 18,600 residents in 6,000+ households by 2017.

- In examining changes in specific age cohorts, Belle Glade is also expected to mirror the county's aging population trend. In fact, 82% of the city's population growth over the next five years is expected to occur among those ages 55 and older. Other cohorts expected to grow include children (0—14) and young adults (25—34). Growth of young adults may enhance demand for new housing in Belle Glade, including homeownership opportunities, contingent on growth in jobs and household incomes.

- Average annual incomes among Belle Glade's households are forecast to increase over the next five years—from $38,000 in 2012 to $42,700 in 2017, reflecting a sustained, annual rate of growth of 2.4% per year. Nonetheless, incomes in Belle Glade remain significantly below that of Palm Beach County as a whole, reinforcing the importance of job retention and creation to bolster both gross and disposable income levels in Belle Glade.

- Over the next five years, the racial composition of the city's residents is expected to remain the same—with a distribution of White (31%), Black (56%), and Other (13%).

Table 3
Demographic Trends & Forecasts - City of Belle Glade, 2000-2017

	2000	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Demographic Profile								
Population	16,854	17,467	17,784		18,635		**851**	**0.94%**
Households		5,651	5,791		6,048		**257**	**0.87%**
Avg. HH Size		3.06	2.99		3.01			
Median Age		30.5	31.4		32.5			
Race								
White		5,438	5,539	31%	5,748	31%	209	0.7%
Black		9,831	9,995	56%	10,380	56%	385	0.8%
American Indian		29	24	0%	26	0%	2	1.6%
Asian, Pacific Islander		109	116	1%	123	1%	7	1.2%
Other		1,719	1,764	10%	1,979	11%	215	2.3%
Two or More Races		341	345	2%	378	2%	33	1.8%
Hispanic *(1)*		5,979	6,021	34%	6,690	36%	669	2.1%
Age Distribution								
0-14		4,577	4,490	25%	4,667	25%	177	0.8%
15-24		2,891	2,881	16%	2,807	15%	(74)	-0.5%
25-34		2,177	2,298	13%	2,404	13%	106	0.9%
35-44		2,101	2,116	12%	2,134	11%	18	0.2%
45-54		2,193	2,203	12%	2,133	11%	(70)	-0.6%
55-64		1,777	1,911	11%	2,111	11%	**200**	2.0%
65-74		1,103	1,212	7%	1,589	9%	**377**	5.6%
75+		648	671	4%	790	4%	**119**	3.3%
Average HH Income			$ 37,961		$ 42,772			**2.4%**
Median HH Income			$ 25,125		$ 29,566			**3.3%**
Housing Profile								
Owner-occupied		2,165	2,188		2,338		150	1.3%
% of Total		34%	34%		34.3%			
Renter-occupied		3,486	3,603		3,710		107	0.6%
% of Total		55%	55%		54.4%			
Vacant		717	727		773		46	1.2%
% of Total		11%	11%		11.3%			
Total Units:		**6,368**	**6,518**		**6,821**		**303**	**0.9%**
Median Value			$ 93,736		$ 111,621			**3.6%**
Average Value			$ 106,321		$ 125,267			**3.3%**

(1) Persons of Hispanic origin are a subset of other race categories; therefore, totals do not add.

Source: ESRI Business Analyst; WTL +a, March 2014.

City of Pahokee

As illustrated in Table 4, ESRI data suggest that Pahokee's population has steadily declined over the past 12 years. Since 2000, Pahokee reportedly lost more than 730 residents, for a 2012 population of almost 5,500 residents in 1,640 households. By comparison, County data (Table 1) suggest that Pahokee's population is slightly greater—with 5,858 residents in 2013.

- According to the 2012 American Community Survey (ACS), Pahokee has a current unemployment rate of 27% and a similar poverty rate of 27%.

- Over the next five years ESRI forecasts suggest that the rate of population loss in Pahokee will slow—with a forecast decline of approximately 120 residents and a loss of 50 households by 2017. At this pace, this would translate into a 2017 population of 5,351 residents in 1,589 households.

- In examining changes in specific age cohorts, Pahokee is also expected to mirror the county's trend in a population that is aging. While population declines are expected in every other age cohort, the number of residents ages 55 and older is forecast to increase by 125. This suggests a housing strategy aimed at aging-in-place product, thus allowing residents to remain in Pahokee as they age in a range of housing types, such as assisted living.

- Average annual incomes among Pahokee's households are forecast to increase over the next five years—from almost $38,800 in 2012 to $45,000 in 2017, reflecting a sustained, annual rate of growth of 3.0% per year—the second-highest rate of growth among the study area's jurisdictions. Notably, among the study area's municipalities, Pahokee has the highest household incomes after Canal Point.

- Over the next five years, the racial composition of Pahokee's residents is expected to diversify. While declines are forecast among both White and Black residents, the number of Hispanic and residents of Other Races is expected to increase, resulting in a distribution of White (29%), Black (56%), and Other Races (15%).

Table 4
Demographic Trends & Forecasts - City of Pahokee, 2000-2017

							Change: 2012-2017	
	2000	2010	2012	% Dist.	2017	% Dist.	No.	CAGR %
Demographic Profile								
Population	6,212	5,649	5,474		5,351		**(123)**	**-0.45%**
Households		1,684	1,640		1,589		**(51)**	**-0.63%**
Avg. HH Size		3.21	3.22		3.25			
Median Age		33.2	32.9		34.2			
Race								
White		1,630	1,607	29%	1,545	29%	(62)	-0.8%
Black		3,170	3,125	57%	3,019	56%	(106)	-0.7%
American Indian		18	17	0%	17	0%	-	0.0%
Asian, Pacific Islander		24	21	0%	21	0%	-	0.0%
Other		643	555	10%	591	11%	36	1.3%
Two or More Races		615	150	3%	159	3%	9	1.2%
Hispanic *(1)*		1,911	1,710	31%	1,808	34%	98	1.1%
Age Distribution								
0-14		1,302	1,313	24%	1,266	24%	(47)	-0.7%
15-24		969	902	16%	817	15%	(85)	-2.0%
25-34		666	661	12%	644	12%	(17)	-0.5%
35-44		662	602	11%	569	11%	(33)	-1.1%
45-54		734	668	12%	600	11%	(68)	-2.1%
55-64		645	644	12%	663	12%	**19**	0.6%
65-74		406	419	8%	505	9%	**86**	3.8%
75+		265	267	5%	287	5%	**20**	1.5%
Average HH Income			$ 38,799		$ 45,009			**3.0%**
Median HH Income			$ 25,928		$ 29,358			**2.5%**
Housing Profile								
Owner-occupied		990	818		808		(10)	-0.2%
% of Total		49%	41%		40.4%			
Renter-occupied		694	822		780		(42)	-1.0%
% of Total		35%	41%		39.0%			
Vacant		318	355		413		58	3.1%
% of Total		16%	18%		20.6%			
Total Units:		**2,002**	**1,995**		**2,001**		**6**	**0.1%**
Median Value			$ 80,778		$ 92,133			**2.7%**
Average Value			$ 94,774		$ 117,946			**4.5%**

(1) Persons of Hispanic origin are a subset of other race categories; therefore, totals do not add.

Source: ESRI Business Analyst; WTL +a, March 2014.

City of South Bay

As illustrated in Table 5, ESRI data suggest that South Bay's population increased by over 1,000 new residents between 2000 and 2012, for a current population of 4,900+ residents in 900 households. By comparison, County data (Table 1) suggest that South Bay's population increase during that period totaled approximately 850—with slightly more than 4,700 residents in 2013.

- According to the 2012 American Community Survey (ACS), South Bay has a current unemployment rate of 22% and a poverty rate of 42%.

- Over the next five years ESRI forecasts suggest that South Bay will gain 155 new residents and 39 new households by 2017, reflecting an annual growth rate of 0.62% per year. At this pace, this would translate into a 2017 population of 5,088 residents in 943 households.

- In examining changes in specific age cohorts, South Bay is also expected to mirror both the county's and study area's trend toward an aging population. While population declines are expected in several age cohorts, fully 80% of South Bay's population increase is expected to occur among those ages 55 and older. Similar to Pahokee, this suggests a housing strategy aimed at aging-in-place product, thus allowing residents to remain in South Bay as they age in a range of housing types, such as congregate care and assisted living.

- Average annual incomes among South Bay's households are forecast to increase over the next five years—from almost $36,110 in 2012 to almost $42,300 in 2017, reflecting a sustained, annual rate of growth of 3.2% per year—the highest rate of growth among the study area's jurisdictions.

- Over the next five years, the racial composition of South Bay's residents is expected to diversify. While declines are forecast among the number of White residents, the number of Black, Hispanic and residents of Other Races is expected to increase, resulting in a distribution of White (25%), Black (63%), and Other (12%).

Table 5
Demographic Trends & Forecasts - City of South Bay 2000-2017

	2000	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Demographic Profile								
Population	3,859	4,876	4,933		5,088		**155**	**0.62%**
Households		883	904		943		**39**	**0.85%**
Avg. HH Size		3.40	3.41		3.43			
Median Age		35.5	35.5		36.0			
Race								
White		1,198	1,270	26%	1,260	25%	(10)	-0.2%
Black		3,169	3,090	63%	3,189	63%	99	0.6%
American Indian		9	10	0%	12	0%	2	3.7%
Asian, Pacific Islander		29	29	1%	30	1%	1	0.7%
Other		1	1	0%	2	0%	1	14.9%
Two or More Races		378	425	9%	477	9%	52	2.3%
Hispanic *(1)*		93	107	2%	117	2%	10	1.8%
Age Distribution								
0-14		802	800	16%	828	16%	28	0.7%
15-24		605	614	12%	599	12%	(15)	-0.5%
25-34		987	1,003	20%	1,025	20%	22	0.4%
35-44		958	954	19%	960	19%	6	0.1%
45-54		775	762	15%	750	15%	(12)	-0.3%
55-64		406	426	9%	458	9%	**32**	1.5%
65-74		208	226	5%	290	6%	**64**	5.1%
75+		135	150	3%	178	3%	**28**	3.5%
Average HH Income			$ 36,110		$ 42,276			**3.2%**
Median HH Income			$ 25,249		$ 27,048			**1.4%**
Owner-occupied		497	460		497		37	1.6%
% of Total		46%	42%		43.4%			
Renter-occupied		386	444		446		2	0.1%
% of Total		36%	40%		39.0%			
Vacant		194	194		201		7	0.7%
% of Total		18%	18%		17.6%			
Total Units:		**1,077**	**1,098**		**1,144**		**46**	**0.8%**
Median Value			$ 77,527		$ 84,398			**1.7%**
Average Value			$ 81,291		$ 93,410			**2.8%**

(1) Persons of Hispanic origin are a subset of other race categories; therefore, totals do not add.

Unincorporated Area

In addition to the three municipalities, the study area contains approximately 19,063 acres of unincorporated areas in western Palm Beach County, much of which is in agricultural production. Based on available data, key demographic characteristics and forecasts are illustrated in Table 6, and summarized below:

- ESRI data estimates suggest that the population of the unincorporated parts of the study area shifted by over 4,000 residents between 2000 and 2012, attributable to annexations by both Belle Glade and South Bay during this period. Today, ESRI estimates suggest that the unincorporated area contains a population of approximately 2,550 residents in 500+ households. By comparison, County data (Table 1) suggest that the unincorporated area contains a current population of 5,600+ residents. The difference between the two sources is likely one of geography, as the ESRI estimates were obtained based on an approximation (i.e., a hand-drawn polygon when the data were ordered) of the actual study area boundaries.

- According to the 2012 American Community Survey (ACS), the unincorporated area has a current unemployment rate of 21% and a poverty rate of 50%.

- Over the next five years ESRI forecasts suggest that the unincorporated area remain stable, with negligible declines in population and households by 2017. This would translate into a 2017 population of 2,526 residents in 512 households, suggesting that there is no immediate demand for additional housing.

- Average annual incomes among unincorporated area households are forecast to increase over the next five years—from almost $36,300 in 2012 to $41,400 in 2017, reflecting a sustained, annual rate of growth of 2.9% per year—likely on par with the rate of inflation.

- The data on racial composition indicate the complexities associated with multiple categories. This is best illustrated in the unincorporated area's distribution of ethnic/racial identities. For example, Hispanic and Black residents may self-categorize up to two races; today, fully 95% of the unincorporated area's population is Black, of which approximately 67% self-identify as Hispanic and/or Other Race. Over the next five years, this is expected to increase to 77% of the total population.

Table 6
Demographic Trends & Forecasts - Unincorporated Study Area 2000-2017

	2000	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Demographic Profile								
Population	6,694	2,604	2,554		2,526		**(28)**	**-0.22%**
Households		541	528		512		**(16)**	**-0.61%**
Avg. HH Size		3.14	3.12		3.14			
Median Age		32.1	32.5		33.4			
Race								
White *(1)*		56	(84)	N/A	(147)	N/A	(63)	N/A
Black		2,494	2,421	95%	2,435	96%	14	0.1%
American Indian		5	10	0%	8	0%	(2)	-4.8%
Asian, Pacific Islander		22	18	1%	47	2%	29	20.6%
Other		421	601	24%	651	26%	50	1.6%
Hispanic *(2)*		645	1,109	43%	1,276	51%	167	2.8%
Age Distribution								
0-14		601	622	24%	634	25%	12	0.4%
15-24		400	399	16%	391	15%	(8)	-0.4%
25-34		484	434	17%	415	16%	(20)	-0.9%
35-44		257	232	9%	256	10%	23	1.9%
45-54		398	364	14%	373	15%	9	0.5%
55-64		262	278	11%	308	12%	30	2.0%
65-74		88	111	4%	113	4%	2	0.4%
75+		84	111	4%	104	4%	(7)	-1.3%
Average HH Income			$ 36,326		$ 41,370			**2.6%**
Median HH Income			$ 23,153		$ 26,838			**3.0%**
Housing Profile								
Owner-occupied	37%	36%	34%		34%			0.3%
Renter-occupied	52%	52%	54%		53%			-0.4%
Vacant	11%	12%	12%		13%			1.1%
Median Value			$ 87,782		$ 101,328			**2.9%**
Average Value			$ 99,717		$ 119,239			**3.6%**

(1) Discrepancies in the data indicated by:

(2) Persons of Hispanic origin are a subset of other race categories; therefore, totals do not add.

Source: ESRI Business Analyst; WTL +a, May 2014.

Household Retail Spending

Household retail spending is the primary driver of demand for retail space such as shopping centers, "Big Box" stores such as Wal-Mart or Target, and specialty or destination retail projects. Household spending in specific merchandise categories is illustrated in Table 7 and summarized below for the three municipalities and Canal Point in the unincorporated area:

- Total annual household retail spending ranges from a low of $9,757 per year in South Bay to as much as $11,800 per year by households in Canal Point. By comparison, Belle Glade households spend $10,757 per year and Pahokee households spend $10,561 annually.

- We note that data on retail spending for households residing in the unincorporated areas (outside of Canal Point) was not available. However, if these additional 382 households spend the overall study area average of $10,593 per household per year, this would generate an additional $4.046 million in gross annual spending.

- When combined, the region's almost **8,900 households spend an estimated $91.3 million per year on consumer retail goods**, including: clothing, entertainment/ recreation, electronics, groceries, food & beverage, furnishings and health care. This is significantly below the national and state averages, and reflects various demographic characteristics, including aging population (which spend less on retail goods) and lower-income households.

- Assuming an investment-grade sales (productivity) performance averaging $250 per sq. ft. suggests that all households in the Glades Region could *potentially* support approximately 365,000 sq. ft. of gross retail space annually. To understand how much space this is, it would compare to existing retail developments in Palm Beach County:
  - Village Shoppes/Royal Palm Beach 337,600 SF
  - City Place/West Palm Beach 600,000 SF
  - The Mall at Wellington Green 1,273,000 SF

- Annual spending on retail, which accounts for fully 27% of the average household incomes in each community in the Glades Region, is greatest in the following categories:
  - Food At Home—28%
  - Food Away From Home—17% to 18%
  - Household Furnishings—12% to 13%

Table 7
Annual Household Consumer Spending, 2012

	City of Belle Glade	Canal Point CDP	City of Pahokee	City of South Bay
Total Households (2012)	**5,791**	**146**	**1,640**	**904**
Apparel & Accessories				
Men's Wear	$ 147	$ 176	$ 148	$ 138
Women's Wear	247	298	250	233
Children's Wear	175	204	173	160
Footwear	120	143	121	111
Watches & Jewelry	78	89	78	75
Apparel Products & Services	93	122	91	79
Subtotal:	**$ 860**	**$ 1,033**	**$ 861**	**$ 796**
Computers				
Computers & Hardware	$ 108	$ 131	$ 107	$ 103
Software & Accessories	19	21	18	17
Subtotal:	**$ 127**	**$ 152**	**$ 125**	**$ 120**
Entertainment & Recreation				
Membership Fees for Clubs	$ 79	$ 89	$ 80	$ 79
Fees for Participant Sports	57	64	55	54
Admission to Movie/Theatre/Opera/Ballet	82	98	80	75
Admission to Sporting Events	31	37	31	32
Fees for Recreational Lessons	57	76	55	52
Dating Services	0	0	0	0
Subtotal:	**$ 307**	**$ 364**	**$ 301**	**$ 292**
TV/Video/Audio				
Cable & Satellite TV Services	$ 494	$ 561	$ 526	$ 478
Televisions	93	105	93	89
Satellite Dishes	1	1	1	1
VCRs, Video Cameras & DVD Players	8	8	7	7
Miscellaneous Video Equipment	5	5	5	5
Video Cassettes & DVDs	21	24	21	19
Video Game Hardware/Accessories	17	20	17	16
Video Game Software	18	22	18	17
Streaming/Downloaded Video	2	2	2	2
Rental of Video Cassettes & DVDs	16	18	15	15
Installation of Televisions	0	1	0	0
Audio	61	73	61	57
Rental & Repair of TV/Radio/Audio	2	3	3	2
Subtotal:	**$ 738**	**$ 842**	**$ 768**	**$ 708**

Table 7 (Continued)
Annual Household Consumer Spending, 2012

	City of Belle Glade	Canal Point CDP	City of Pahokee	City of South Bay
Other Entertainment				
Pets	$ 328	$ 349	$ 351	$ 329
Toys & Games	77	93	77	71
Recreational Vehicles & Fees	85	101	86	83
Sports/Recreation/Exercise Equipment	77	89	77	73
Photo Equipment & Supplies	39	48	39	37
Reading	74	87	77	71
Catered Affairs	12	18	12	11
Subtotal:	**$ 693**	**$ 787**	**$ 719**	**$ 675**
Food & Alcohol				
Food at Home	$ 2,888	$ 3,342	$ 2,983	$ 2,726
Food Away from Home	1,805	2,069	1,817	1,679
Alcoholic & Non-alcoholic Beverages	562	664	572	523
Subtotal:	**$ 5,256**	**$ 6,075**	**$ 5,372**	**$ 4,929**
Household Furnishings & Equipment				
Household Textiles	$ 56	$ 66	$ 57	$ 52
Furniture	265	298	269	255
Floor Coverings	11	15	11	10
Major Appliances	141	145	149	141
Housewares	34	39	34	32
Small Appliances	23	27	24	22
Luggage	5	5	5	5
Telephones & Accessories	29	33	29	27
Lawn & Garden	188	201	208	194
Housekeeping Supplies	395	439	414	383
Maintenance & Remodeling Materials	120	126	129	125
Subtotal:	**$ 1,267**	**$ 1,395**	**$ 1,328**	**$ 1,246**
Health & Personal Care				
Non- & Prescription Drugs	$ 311	$ 332	$ 348	$ 320
Optical	42	49	45	42
Personal Care Products	258	281	262	242
School Supplies	109	131	109	102
Smoking Products	295	349	323	286
Subtotal:	**$ 1,016**	**$ 1,143**	**$ 1,086**	**$ 992**
TOTAL:				
Total Annual Spending	**$ 59,429,732**	**$ 1,721,349**	**$ 17,320,286**	**$ 8,820,337**
Per Household	**$ 10,262**	**$ 11,790**	**$ 10,561**	**$ 9,757**
As % of Average HH Income	27.03%	27.04%	27.22%	27.02%

Source: ESRI Business Analyst; WTL +a, March 2014.

Economic Characteristics

Employment Trends — Palm Beach County

Job growth is a key barometer of demand for "workplace" uses such as industrial, commercial retail, and multi-tenant office space. WTL+a examined trends and forecasts in employment growth, utilizing data for Palm Beach County as prepared by the state's labor agency, the Department of Economic Opportunity (formerly known as the Agency for Workforce Innovation/AWI), for the period between 1995 and 2013. The agency defines Palm Beach County as the "West Palm Beach/Boca Raton/Boynton Beach Metro Division" for statistical purposes. Key findings are summarized below and illustrated in Table 8:

- **Palm Beach County added 166,600 new jobs in the 10-year period between 1995 and 2005**. This growth, which translates into more than 16,000 new jobs annually, was focused largely in specific sectors, including: Professional/Business Services (55,800), Construction (19,800) and Leisure & Hospitality (19,000). In particular, growth in Professional/Business Services fueled demand for office space in key locations across Palm Beach County during this period.

- Other sectors with solid job growth during this period also included: Education (18,900); Retail Trade (15,300); and Government (15,600).

Palm Beach County Gained 166,600 Jobs (1995—2005) & Lost 16,300 Jobs (2007—2013)

- By contrast, the economic downturn of 2007—2009 resulted in the loss of 57,000 jobs in Palm Beach County; since 2010, however, job gains in specific sectors have reduced net job losses to (16,300) between 2007—2013. Job losses were greatest in specific sectors, including: Construction (14,600) and Government (4,900). Notably, the Services sector has recovered more quickly than others, gaining 13,400 new jobs over the past six years.

- In 2013, Palm Beach County contained 555,700 jobs, reflecting a jobs-to-population ratio of 0.42. That is, there are 0.4 jobs per resident for the 1,322,306 residents in the county. By comparison, Florida's state jobs-to-population ratio in 2013 was 0.39, which reflects the large number of retirees in the state, while the jobs-to-population ratio for the United States in 2013 was 0.63.

- It should also be recognized however, that there is a disparity in employment levels between the eastern and western portions of Palm Beach County that the countywide jobs-to-population ratio does not reflect. According to the American Community Survey, unemployment rates in the Glades are estimated to range between 19% in Belle Glade to 22% in South Bay to 27% in Pahokee. Ongoing high unemployment reinforces the critical importance of major economic development initiatives such as the ILC, and its key roles in strengthening the Glades Region economy and creating

Table 8
Employment Trends, West Palm Beach/Boca/Boynton Metro, 1995-2013

Industry Sector	1995	2000	2005	Change: 1995-2005 Amount	Change: 1995-2005 CAGR %	2007	2009	2011	2013	Change: 2007-2013 Amount	Change: 2007-2013 CAGR %
In 000s											
Construction	27.7	36.4	47.5	19.8	5.5%	42.0	25.8	24.1	27.4	(14.6)	-8.2%
Manufacturing	28.0	28.5	20.9	(7.1)	-2.9%	19.2	16.0	15.4	15.8	(3.4)	-3.8%
Transp/Warehousing/Utilities	7.6	8.2	9.8	2.2	2.6%	10.3	9.3	9.3	9.9	(0.4)	-0.8%
Trade											
Wholesale	14.8	18.1	22.5	7.7	4.3%	23.8	21.7	21.6	22.3	(1.5)	-1.3%
Retail	61.3	74.1	76.6	15.3	2.3%	76.7	69.4	71.9	75.4	(1.3)	-0.3%
Information	9.5	13.3	11.2	1.7	1.7%	11.0	9.0	9.1	9.6	(1.4)	-2.7%
Financial Activities	29.1	37.8	41.3	12.2	3.6%	40.2	35.1	36.5	37.9	(2.3)	-1.2%
Services											
Prof'l/Business/Mgmt./Admin	41.7	82.1	97.5	55.8	8.9%	96.0	84.2	90.5	99.5	3.5	0.7%
Education/Health Services	58.1	65.3	77.0	18.9	2.9%	80.3	81.9	83.7	87.0	6.7	1.6%
Leisure & Hospitality	53.5	62.5	72.5	19.0	3.1%	74.9	68.9	73.8	77.7	2.8	0.7%
Other Services	23.1	25.6	28.6	5.5	2.2%	29.1	27.4	28.2	29.5	0.4	0.3%
Government	51.1	57.8	66.7	15.6	2.7%	68.5	66.4	63.8	63.6	(4.9)	-1.5%
Total (In 000s):	**405.5**	**509.7**	**572.1**	**166.6**	**3.5%**	**572.0**	**515.1**	**528.0**	**555.7**	**(16.3)**	**-0.6%**
Change During Period:		*104.2*	*62.4*			*(0.1)*	*(57.0)*	*12.9*	*27.7*		

(1) As of year-end for each reported year.

http://floridajobs.org/labor-market-information/data-center/statistical-programs/current-employment-statistics

Source: Florida Department of Economic Opportunity; WTL +a, May 2014.

new jobs in the Glades for the area's un- and underemployed residents. New jobs in sectors/types that do not currently exist in the Glades will also require workforce and job training as noted elsewhere in this report.

Employment Forecasts—Palm Beach County

Employment forecasts for specific jurisdictions in Florida are also prepared by the Department of Economic Opportunity. As illustrated in Table 9, these forecasts suggest that:

- **Palm Beach County is expected to add over 84,000 new jobs between 2013 and 2021**, reflecting a sustained annual pace of 10,500 new jobs expected annually over this eight-year period.

- The Services sector is expected to comprise fully 57% of all new jobs in the county—adding over 48,300 new jobs—with the largest gains expected in Health Care, Professional/Business Services and Administrative sectors.

- Today, there are almost **6,800 agricultural-related jobs in Palm Beach County.** However, the Department of Economic Opportunity forecasts suggest that the number of jobs in agriculture will decline by more than 600 over the next eight years. Declines are expected in two occupations related to agriculture—Farm Workers and Farm Workers/Laborers, Crops, Nurseries & Greenhouse.

Employment in the Glades Region

In Florida, employment forecasts by industry sector are tabulated at only the county (or workforce region) levels and not by municipality. At the municipal level, there are two sources to examine historic employment trends, by industry sector (but no forecasts):

- As illustrated in Table 10, the U.S. Census Bureau tabulates full-time payroll employment at the Zip Code level (by North American Industry Classification System/ NAICS codes). However, in small geographies such as the municipalities in the Glades Region, data are sometimes aggregated or not available due to insufficient reporting sizes.

- As a result, a second source is employment and business data by industry sector (by both NAICS and former SIC codes) tabulated by Dun & Bradstreet, Inc. and ESRI Business Analyst. We understand that this also includes seasonal employment for one-year (2012) as a "snapshot in time". It is, however, the most detailed way to estimate demand potentials (and identify economic development opportunities) by industry sector. For purposes of this analysis, top-line data, by industry sector, were used.

Therefore, both data sets are presented for analysis. Key findings for each municipality are summarized below and illustrated in Table 11 through Table 17.

Table 9
Employment Forecasts for Palm Beach County, 2013-2021

Employment Category	2013	% Dist.	2021	% Dist.	Change: 2013-2021 Total	CAGR
Agriculture/Mining/Construction						
Agriculture	6,580		5,971		(609)	-1.2%
Mining	200		239		39	0.0%
Construction	25,670		34,439		8,769	3.7%
Subtotal:	**32,450**	**3.0%**	**40,649**	**3.5%**	**8,808**	**2.9%**
Manufacturing						
Durable Goods Manufacturing	11,113		12,268		1,155	1.2%
Non-Durable Goods Manufacturing	4,599		4,322		(277)	-0.8%
Subtotal:	**15,712**	**1.5%**	**16,590**	**1.4%**	**878**	**0.7%**
Transportation/Communications/Public Utilities						
Public Utilities	1,443		1,546		103	0.9%
Transportation & Warehousing	7,637		8,134		497	0.8%
Subtotal:	**9,080**	**0.8%**	**9,680**	**0.7%**	**600**	**0.8%**
Wholesale & Retail Trade						
Wholesale Trade	21,643		24,463		2,820	1.5%
Retail Trade	70,628		77,779		7,151	1.2%
Subtotal:	**92,271**	**8.6%**	**102,242**	**8.8%**	**9,971**	**1.3%**
Finance/Insurance/Real Estate						
Information	9,227		9,579		352	0.5%
Finance & Insurance	22,955		24,182		1,227	0.7%
Real Estate, Rental & Leasing	14,517		16,861		2,344	1.9%
Subtotal:	**46,699**	**4.3%**	**50,622**	**4.4%**	**3,923**	**1.0%**
Services						
Professional, Scientific & Technical Services	40,948		50,362		9,414	2.6%
Management of Companies & Enterprises	8,758		9,739		981	1.3%
Administrative & Waste Management	43,546		51,040		7,494	2.0%
Educational Services	8,655		11,025		2,370	3.1%
Health Care & Social Assistance	74,403		90,272		15,869	2.4%
Arts, Entertainment & Recreation	15,984		18,734		2,750	2.0%
Accommodation & Food Services	59,540		66,892		7,352	1.5%
Other Services (Except Government)	24,035		26,039		2,004	1.0%
Subtotal:	**275,869**	**25.7%**	**324,103**	**27.9%**	**48,234**	**2.0%**
Government	**61,265**	**5.7%**	**68,809**	**5.9%**	**7,544**	**1.5%**
Self-Employed & Unpaid Family Workers	**53,046**	**4.9%**	**57,421**	**4.9%**	**4,375**	**1.0%**
TOTAL: ***(1)***	**589,178**		**673,375**		**84,197**	**1.7%**
Annual Increase (Rounded):					**10,500**	

(1) When summed, the totals for 2013 and 2021 differ from data provided. For 2013, the sum is 586,127; for 2021, it is 669,848, for a difference of 83,721 new jobs over the period.

Source: Florida Department of Economic Opportunity; WTL +a, March 2014.

Table 10
Study Area Business Mix & Employment Trends (By NAICS Code), 2003-2012

Municipality	Zip Code	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Change: 2003-2012 No.	Change: 2003-2012 %
No. of Establishments													
Belle Glade	33430	328	318	321	308	308	309	293	284	282	294	(34)	-10%
Canal Point	33438	13	18	15	10	11	9	11	13	10	10	(3)	-23%
Pahokee	33476	70	70	66	54	68	56	54	50	48	46	(24)	-34%
South Bay	33493	37	38	42	40	34	27	33	37	32	37	-	0%
Total-Study Area:		**448**	**444**	**444**	**412**	**421**	**401**	**391**	**384**	**372**	**387**	**(61)**	**-14%**
% Annual Change		*-*	*-1%*	*0%*	*-7%*	*2%*	*-5%*	*-2%*	*-2%*	*-3%*	*4%*		
Distribution by Municipality													
Belle Glade		73%	72%	72%	75%	73%	77%	75%	74%	76%	76%		**4%**
Canal Point		3%	4%	3%	2%	3%	2%	3%	3%	3%	3%		**-11%**
Pahokee		16%	16%	15%	13%	16%	14%	14%	13%	13%	12%		**-24%**
South Bay		8%	9%	9%	10%	8%	7%	8%	10%	9%	10%		**16%**
Total-Study Area:		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**		
Total Employment													
Belle Glade		4,337	3,956	4,057	3,456	3,958	3,773	3,478	3,256	3,253	3,301	(1,036)	-24%
Canal Point	*(1)*	75	61	83	104	-	-	-	-	-	96	21	28%
Pahokee		829	764	591	782	778	757	662	717	564	764	(65)	-8%
South Bay		1,219	1,185	1,241	1,119	1,123	1,036	1,026	1,163	975	1,125	(94)	-8%
Total-Study Area:		**6,460**	**5,966**	**5,972**	**5,461**	**5,859**	**5,566**	**5,166**	**5,136**	**4,792**	**5,286**	**(1,174)**	**-18%**
% Annual Change													

(1) No data reported.

http://censtats.census.gov/cgi-bin/zbpnaic/zbpcomp.pl

Source: U.S. Census Bureau; WTL+a, June 2014.

City of Belle Glade

- As illustrated in Table 10, according to Census data the number of businesses (by NAICS code) in Belle Glade has declined by 10% since 2003—from 328 to 294 businesses. Despite this decline, as the largest municipality in the Glades Region, Belle Glade has maintained—and even increased—its share of the region's business mix, from 73% to 76% since 2003.

- With the decline in the number of businesses there has been an accompanying drop in full-time payroll jobs. In fact, the city's employment base has declined by more than 1,000 jobs—from 4,300 in 2003 to 3,300 in 2012, a decline of 24%.

- Table 11 illustrates Dun & Bradstreet data on jobs in Belle Glade for key industry sectors (by SIC code) for 2012. As noted, understanding the types of jobs (i.e., by industry sector) is key to estimating demand potentials for specific types of real estate—such as industrial parks, office space, retail centers and the like.

- According to Dun & Bradstreet, in 2012 Belle Glade contained almost 4,200 full- and part-time and seasonal employees in an estimated 740 businesses (by SIC code). The largest sectors include: Services and Retail, with 50% and 25% of the city's jobs base, respectively.

- **Belle Glade contains only 0.66% of the total (i.e., full- and part-time and seasonal) jobs in Palm Beach County**. This suggests that the city's current jobs-to-population ratio is 0.24 (i.e., there are only 0.24 jobs for each of the 17,800 residents in Belle Glade).

City of Pahokee

- As illustrated in Table 10, according to Census data the number of businesses (by NAICS code) in Pahokee has declined by 34% since 2003—from 70 to 46 businesses. Pahokee's share of the region's business mix has also declined by 24%, from 16% to 12% since 2003.

- With the decline in the number of businesses there has been an accompanying drop in full-time payroll jobs. The city lost roughly 65 jobs—declining from 829 jobs in 2003 to 764 in 2012, a decline of 8%.

- As illustrated in Table 12, according to Dun & Bradstreet Pahokee contained 1,510 full- and part-time and seasonal employees in an estimated 211 businesses (by SIC code) in 2012. The largest sectors in Pahokee include Services and Retail, with 62% and 15% of the city's jobs base, respectively.

- **Pahokee contains only 0.24% of the total (i.e., full- and part-time and seasonal) jobs in Palm Beach County**. This suggests that the city's current jobs-to-population ratio is 0.28 (i.e., there are only 0.28 jobs for each of the 5,474 residents in Pahokee).

Table 11
Business Mix - City of Belle Glade, 2012

NAICS Category	Businesses No.	Businesses % of Total	Employees No.	Employees % of Total
Mining & Natural Resources	**38**	5.1%	**240**	5.7%
Construction	**21**	2.8%	**134**	3.2%
Manufacturing	**7**	0.9%	**48**	1.1%
Transportation & Warehousing	**55**	7.4%	**126**	3.0%
Communications	**4**	0.5%	**12**	0.3%
Utilities	**4**	0.5%	**60**	1.4%
Wholesale & Retail Trade				
Wholesale	29		203	
Retail	152		851	
- Home Improvement	8		48	
- General Merchandise	8		25	
- Food Stores	26		250	
- Auto Dealers/Gas Stations	12		38	
- Apparel & Accessory Stores	15		49	
- Furniture/Home Furnishings	5		20	
- Eating & Drinking Places	41		221	
- Miscellaneous & Non-store Retail	37		200	
Subtotal - All Retail:	**181**	24.5%	**1,054**	25.2%
Finance/Insurance/Real Estate	**48**	6.5%	**198**	4.7%
Services				
- Hotel/Lodging	4		9	
- Automotive Services	14		38	
- Motion Pictures & Amusements	11		22	
- Health Services	47		192	
- Legal Services	11		25	
- Educational Institutions	16		756	
- Other Services	269		1,065	
Subtotal - Services:	**372**	50.3%	**2,107**	50.4%
Government	**10**	1.4%	**203**	4.9%
TOTAL:	**740**	**100.0%**	**4,182**	**100.0%**

ANALYSIS:	
2012 Total Employment	4,182
As Share of Palm Beach County	**0.66%**
2012 City Population	17,784
Jobs/Population Ratio	**0.24**

Source: ESRI Business Analyst; Dun & Bradstreet, Inc.; WTL +a, March 2014.

Table 12
Business Mix - City of Pahokee, 2012

NAICS Category	Businesses		Employees	
	No.	% of Total	No.	% of Total
Mining & Natural Resources	**17**	8.1%	**139**	9.2%
Construction	**12**	5.7%	**44**	2.9%
Manufacturing	**1**	0.5%	**1**	0.1%
Transportation & Warehousing	**21**	10.0%	**54**	3.6%
Communications	**2**	0.9%	**7**	0.5%
Utilities	**-**	0.0%	**-**	0.0%
Wholesale & Retail Trade				
Wholesale	5		10	
Retail	37		216	
- Home Improvement	4		13	
- General Merchandise	2		14	
- Food Stores	6		102	
- Auto Dealers/Gas Stations	4		13	
- Apparel & Accessory Stores	1		2	
- Furniture/Home Furnishings	-		-	
- Eating & Drinking Places	12		43	
- Miscellaneous & Non-store Retail	8		29	
Subtotal - All Retail:	**42**	19.9%	**226**	15.0%
Finance/Insurance/Real Estate	**11**	5.2%	**54**	3.6%
Services				
- Hotel/Lodging	2		3	
- Automotive Services	4		6	
- Motion Pictures & Amusements	1		3	
- Health Services	7		172	
- Legal Services	1		3	
- Educational Institutions	7		513	
- Other Services	75		238	
Subtotal - Services:	**97**	46.0%	**938**	62.1%
Government	**8**	3.8%	**47**	3.1%
TOTAL:	**211**	**100.0%**	**1,510**	**100.0%**

ANALYSIS:	
2012 Total Employment	1,510
As Share of Palm Beach County	**0.24%**
2012 City Population	5,474
Jobs/Population Ratio	**0.28**

Source: ESRI Business Analyst; Dun & Bradstreet, Inc.; WTL +a, March 2014.

City of South Bay

- As illustrated in Table 10, according to Census data the number of businesses (by NAICS code) in South Bay has remained stable since 2003—with 37 businesses. While there was a decline in the number of businesses during the 2007—2009 recession in South Bay, several new businesses have been created during the subsequent economic recovery over the past several years. As a result of declines in the number of businesses elsewhere in the study area, South Bay's share of the Glades Region's business mix has increased slightly—from 8% to 10%.

- While the number of businesses has not changed, there has been a slight decline in full-time payroll jobs in South Bay. The city lost roughly 94 jobs—declining from 1,219 jobs in 2003 to 1,125 jobs in 2012, a decline of 8%.

- As illustrated in Table 13, according to Dun & Bradstreet South Bay contained almost 1,400 full- and part-time and seasonal employees in an estimated 113 businesses in 2012 (by SIC code). The largest sectors include Government and Services, with 56% and 31% of South Bay's jobs base, respectively.

- **South Bay contains only 0.22% of the total (i.e., full- and part-time and seasonal) jobs in Palm Beach County**. This suggests that the city's current jobs-to-population ratio is 0.28 (i.e., there are only 0.28 jobs for each of the 4,933 residents in South Bay).

Table 14 illustrates the relative range of non-agricultural business categories and employment in 2012 in Palm Beach County based on data from Dun & Bradstreet, Inc. Notably, the county's business and employment mix is not reflective of the types of businesses located in the Glades, which are less service-oriented. As the ILC is developed over time, this will serve to increase both the number and employment base of key sectors, such as Transportation & Warehousing/Distribution.

Table 13
Business Mix - City of South Bay, 2012

NAICS Category	Businesses No.	Businesses % of Total	Employees No.	Employees % of Total
Mining & Natural Resources	**5**	4.4%	**7**	0.5%
Construction	**5**	4.4%	**37**	2.6%
Manufacturing	**1**	0.9%	**1**	0.1%
Transportation & Warehousing	**13**	11.5%	**38**	2.7%
Communications	**2**	1.8%	**59**	4.2%
Utilities	**-**	0.0%	**-**	0.0%
Wholesale & Retail Trade				
Wholesale	5		16	
Retail	9		22	
- Home Improvement	-		-	
- General Merchandise	-		-	
- Food Stores	6		20	
- Auto Dealers/Gas Stations	1		-	
- Apparel & Accessory Stores	1		2	
- Furniture/Home Furnishings	-		-	
- Eating & Drinking Places	1		-	
- Miscellaneous & Non-store Retail	-		-	
Subtotal - All Retail:	**14**	12.4%	**38**	2.7%
Finance/Insurance/Real Estate	**6**	5.3%	**12**	0.9%
Services				
- Hotel/Lodging	2		2	
- Automotive Services	3		39	
- Motion Pictures & Amusements	2		2	
- Health Services	2		6	
- Legal Services	-		-	
- Educational Institutions	3		73	
- Other Services	50		308	
Subtotal - Services:	**62**	54.9%	**430**	30.8%
Government	**5**	4.4%	**776**	55.5%
TOTAL:	**113**	**100.0%**	**1,398**	**100.0%**

ANALYSIS:	
2012 Total Employment	1,398
As Share of Palm Beach County	**0.22%**
2012 City Population	4,933
Jobs/Population Ratio	**0.28**

Source: ESRI Business Analyst; Dun & Bradstreet, Inc.; WTL +a, March 2014.

Table 14
Business Mix - Palm Beach County, 2012

NAICS Category	Businesses No.	Businesses % of Total	Employees No.	Employees % of Total
Mining & Natural Resources	**3,220**	2.6%	**13,087**	2.1%
Construction	**9,635**	7.8%	**40,990**	6.5%
Manufacturing	**3,567**	2.9%	**26,478**	4.2%
Transportation & Warehousing	**3,186**	2.6%	**15,969**	2.5%
Communications	**1,018**	0.8%	**5,767**	0.9%
Utilities	**238**	0.2%	**3,517**	0.6%
Wholesale & Retail Trade				
Wholesale	5,418		26,423	
Retail	14,940		108,081	
- Home Improvement	659		5,097	
- General Merchandise	224		11,704	
- Food Stores	1,395		19,701	
- Auto Dealers/Gas Stations	1,150		8,471	
- Apparel & Accessory Stores	1,449		7,551	
- Furniture/Home Furnishings	1,589		6,249	
- Eating & Drinking Places	3,390		25,691	
- Miscellaneous & Non-store Retail	5,084		23,617	
Subtotal - All Retail:	**20,358**	16.5%	**134,504**	21.4%
Finance/Insurance/Real Estate	**12,540**	10.2%	**54,115**	8.6%
Services				
- Hotel/Lodging	400		7,385	
- Automotive Services	1,992		6,472	
- Motion Pictures & Amusements	2,760		17,840	
- Health Services	7,164		50,479	
- Legal Services	2,404		10,022	
- Educational Institutions	1,158		44,827	
- Other Services	53,150		171,159	
Subtotal - Services:	**69,028**	56.0%	**308,184**	48.9%
Government	**545**	0.4%	**26,983**	4.3%
TOTAL:	**123,335**	**100.0%**	**629,594**	**100.0%**

ANALYSIS:	
2012 Total Employment	**629,594**
2012 County Population	**1,322,306**
Jobs/Population Ratio	**0.48**

Source: ESRI Business Analyst; Dun & Bradstreet, Inc.; WTL +a, March 2014.

Retail "Recapture" Opportunities

To understand the relative strengths and weaknesses among specific retail categories, the performance among retailers located in the Glades Region and economic development opportunities to strengthen and expand retail uses in the study area, WTL +a prepared a retail sales and "recapture" analysis based on data provided by Claritas, Inc. This analysis compares demand (i.e., household spending) with supply (i.e., store sales). The resulting difference is either a gap or a surplus in retail sales. That is, a gap would indicate an opportunity to recapture retail sales among households in various municipalities in the study area when spending in specific categories exceeds the sales generated by existing retailers. Conversely, a surplus in sales suggests that these businesses generate net imported sales from households from outside of the Glades Region (e.g., households in nearby rural counties).

Key findings for each municipality are highlighted below and illustrated in Table 15 through Table 17 (data for the unincorporated parts of the study area are not available):

City of Belle Glade

- Claritas, Inc. includes merchandise categories (such as Building Materials) not contained in the household spending estimates illustrated in Table 6 provided by ESRI. As illustrated in Table 15, Claritas data suggests that households in Belle Glade spend approximately $61.1 million per year, which translates into $10,553 in annual household spending (on par with the $10,262 estimate by ESRI in Table 7). This is retail demand.

- By comparison, retail businesses in Belle Glade generate estimated annual sales of $84.7 million per year. This is retail supply. Annual sales volumes equate to overall performance of $180 per sq. ft. in sales among the city's estimated 469,700 gross square feet of retail inventory. Retail rents typically range from 8% to 12% of total sales; this would suggest that rents in Belle Glade should average $18 per sq. ft. For purposes of retail attraction and growth, location criteria for new stores would suggest both higher sales productivity (on a per square foot basis) and/or higher rents will be necessary to reach "investment-grade" retail, or about $225 to $350 in sales productivity per square foot (thus yielding average rents of $22.50 to $35 per sq. ft.).

- The difference between demand and supply reflects an overall "surplus" of roughly $23.6 million. This suggests that Belle Glade's retail businesses generate net inflow in sales from other sources, such as residents of other nearby communities, pass-through traffic, etc. In fact, among specific retail categories, inflow is substantial, including:
  - Food & Beverage—$10.5 million
  - Food & Beverage/Grocery Stores—$14.9 million
  - Health & Personal Care/Drug Stores—$5.7 million

In other categories, however, there is excess (i.e., surplus) spending among the city's households that could potentially be captured by existing retailers in Belle Glade. This is known as retail leakage (occurs when members of a community spend money outside that community), and includes:

- General Merchandise/Department Stores—$11.5 million
- Furniture/Home Furnishings—$490,000
- Leisure & Entertainment—$407,700

City of Pahokee

- Claritas, Inc. includes merchandise categories (such as Building Materials) not contained in the household spending estimates illustrated in Table 6 provided by ESRI. Claritas data suggests that households in Pahokee spend approximately $17.8 million per year (see Table 16), which translates into $10,859 in annual household spending (on par with the $10,561 estimate by ESRI in Table 7). This is retail demand.

- By comparison, retail businesses in Pahokee generate estimated annual sales of $15.3 million per year. This is retail supply. Annual sales volumes equate to **overall performance of $199 per sq. ft. in sales among the city's estimated 76,800 gross square feet of retail inventory**.

- The difference between demand and supply reflects an overall opportunity "gap" (i.e., leakage) of $2.5 million being spent by households at retailers outside Pahokee. This suggests that retail businesses in Pahokee could potentially capture additional sales from resident households. In fact, the opportunity gap is sizable in eight of 10 merchandise categories, such as:
  - General Merchandise/Department Stores—$2.1 million
  - Clothing & Accessories—$1.3 million
  - Electronics & Appliance Stores—$653,200

- The only merchandise category with inflow of sales to Pahokee is Food & Beverage Stores, with a "surplus" (i.e., net inflow) of $3.8 million.

City of South Bay

- Claritas, Inc. includes merchandise categories (such as Building Materials) not contained in the household spending estimates illustrated in Table 6 provided by ESRI. As illustrated in Table 17, Claritas data suggests that households in South Bay spend $9.1 million per year, which translates into $10,081 in annual household spending (on par with the $9,757 estimate by ESRI in Table 7). This is retail demand.

- By comparison, retail businesses in South Bay generate reported estimated annual sales of only $895,900 per year. This is retail supply. If this sales estimate is valid, annual sales volumes equate to **overall performance of only $22 per sq. ft. in sales among the city's estimated 40,060 gross square feet of retail inventory**. This would suggest a discrepancy that cannot be documented based on available data.

- The difference between demand and supply reflects an overall opportunity "gap" (i.e., leakage) of $8.2 million being spent by households at retailers outside South Bay. This suggests that retail businesses in South Bay could potentially capture significant additional sales from resident households. In fact, the opportunity gap is sizable in all 10 merchandise categories, such as:
  - General Merchandise/Department Stores—$2.09 million
  - Food Service Places (Restaurants)—$1.3 million
  - Food & Beverage/Grocery Stores—$1.48 million

Table 15
Retail "Recapture" Opportunities, City of Belle Glade, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
General Merchandise Stores			
Department Stores Excl Leased Depts.	$ 5,086,008	$ 1,524,976	$ 3,561,032
Other General Merchandise Stores	8,852,670	857,449	7,995,221
Subtotal:	**$ 13,938,678**	**$ 2,382,425**	**$ 11,556,253**
Clothing & Accessories Stores			
Clothing Stores	$ 4,312,657	$ 4,875,217	$ (562,560)
Shoe Stores	740,137	696,052	44,085
Jewelry, Luggage, Leather Stores	625,385	2,307,085	(1,681,700)
Subtotal:	**$ 5,678,179**	**$ 7,878,354**	**$ (2,200,175)**
Furniture & Home Furnishings Stores			
Furniture Stores	$ 1,086,526	$ 1,492,023	$ (405,497)
Home Furnishing Stores	895,574	-	895,574
Subtotal:	**$ 1,982,100**	**$ 1,492,023**	**$ 490,077**
Electronics & Appliance Stores			
Appliances, TVs, Electronics Stores	$ 2,285,263	$ 1,982,495	$ 302,768
Subtotal:	**$ 2,285,263**	**$ 1,982,495**	**$ 302,768**
Leisure & Entertainment			
Sporting Goods Stores	$ 1,265,673	$ 121,133	$ 1,144,540
Books, Periodicals & Music	603,084	1,339,940	(736,856)
Subtotal:	**$ 1,868,757**	**$ 1,461,073**	**$ 407,684**
Food Services & Drinking Places			
Full-Service Restaurants	$ 4,321,309	$ 2,218,399	$ 2,102,910
Limited-Service Eating Places	3,814,866	17,205,257	(13,390,391)
Special Food Services	359,757	93,269	266,488
Drinking Places -Alcoholic Beverages	550,619	-	550,619
Subtotal:	**$ 9,046,551**	**$ 19,516,925**	**$ (10,470,374)**

Table 15 (Continued)
Retail "Recapture" Opportunities, City of Belle Glade, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
Food & Beverage Stores			
Grocery Stores	$ 14,016,516	$ 26,778,031	$ (12,761,515)
Specialty Food Stores	389,541	1,064,875	(675,334)
Beer, Wine & Liquor Stores	563,962	2,029,941	(1,465,979)
Subtotal:	**$ 14,970,019**	**$ 29,872,847**	**$ (14,902,828)**
Health & Personal Care Stores			
Health & Personal Care Stores	$ 6,778,905	$ 12,503,119	$ (5,724,214)
Subtotal:	**$ 6,778,905**	**$ 12,503,119**	**$ (5,724,214)**
Building Material, Garden Equipment Stores			
Building Materials & Supplies	$ 1,997,256	$ 3,179,914	$ (1,182,658)
Lawn & Garden Equipment & Supplies	333,179	818,585	(485,406)
Subtotal:	**$ 2,330,435**	**$ 3,998,499**	**$ (1,668,064)**
Miscellaneous Store Retailers			
Florists	$ 80,310	$ -	$ 80,310
Office Supplies, Stationery, Gift Stores	725,269	287,271	437,998
Used Merchandise Stores	174,820	1,539,232	(1,364,412)
Other Miscellaneous Retail Stores	1,258,099	1,856,179	(598,080)
Subtotal:	**$ 2,238,498**	**$ 3,682,682**	**$ (1,444,184)**
TOTAL:			
HH Demand vs. Retail Sales	**$ 61,117,385** *(2)*	**$ 84,770,442**	**$ (23,653,057)**
Estimated Retail Inventory (Sq. Ft.)		**469,719**	
Productivity (Sales/Sq. Ft.)		**$ 180**	

(1) Claritas' "Retail Market Power" data is derived from two major sources of information. Demand data are derived from Consumer Expenditure Surveys fielded by the U.S. Bureau of Labor Statistics (BLS). Supply data are derived from the Census Bureau. The difference between demand and supply represents the "recapture opportunity", or surplus, available for each retail category in the reporting geography. When demand is greater than supply, there is an apparent opportunity for additional retail space in that category. By comparison, when demand is less than supply, there is a surplus of sales in that retail category (i.e., positive value = recapture opportunity, while negative value = surplus of sales).

(2) Total household retail spending excludes spending on Non-Store Retailers (Internet); Motor Vehicle Parts and Dealers; and Gas Stations.

Source: Claritas, Inc.; WTL +a, March 2014.

Table 16
Retail "Recapture" Opportunities, City of Pahokee, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
General Merchandise Stores			
Department Stores Excl Leased Depts.	$ 1,467,152	$ 950,106	$ 517,046
Other General Merchandise Stores	2,612,896	986,066	1,626,830
Subtotal:	**$ 4,080,048**	**$ 1,936,172**	**$ 2,143,876**
Clothing & Accessories Stores			
Clothing Stores	$ 1,242,355	$ 122,508	$ 1,119,847
Shoe Stores	213,266	-	213,266
Jewelry, Luggage, Leather Stores	176,641	170,744	5,897
Subtotal:	**$ 1,632,262**	**$ 293,252**	**$ 1,339,010**
Furniture & Home Furnishings Stores			
Furniture Stores	$ 312,026	$ -	$ 312,026
Home Furnishing Stores	255,971	-	255,971
Subtotal:	**$ 567,997**	**$ -**	**$ 567,997**
Electronics & Appliance Stores			
Appliances, TVs, Electronics Stores	$ 653,249	$ -	$ 653,249
Subtotal:	**$ 653,249**	**$ -**	**$ 653,249**
Leisure & Entertainment			
Sporting Goods Stores	$ 362,910	$ -	$ 362,910
Books, Periodicals & Music	173,004	-	173,004
Subtotal:	**$ 535,914**	**$ -**	**$ 535,914**
Food Services & Drinking Places			
Full-Service Restaurants	$ 1,227,450	$ 1,445,813	$ (218,363)
Limited-Service Eating Places	1,084,807	652,330	432,477
Special Food Services	102,538	-	102,538
Drinking Places -Alcoholic Beverages	155,207	-	155,207
Subtotal:	**$ 2,570,002**	**$ 2,098,143**	**$ 471,859**

Table 16 (Continued)
Retail "Recapture" Opportunities, City of Pahokee, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
Food & Beverage Stores			
Grocery Stores	$ 4,128,391	$ 7,746,098	$ (3,617,707)
Specialty Food Stores	114,296	-	114,296
Beer, Wine & Liquor Stores	162,144	468,448	(306,304)
Subtotal:	**$ 4,404,831**	**$ 8,214,546**	**$ (3,809,715)**
Health & Personal Care Stores			
Health & Personal Care Stores	$ 2,035,077	$ 1,859,910	$ 175,167
Subtotal:	**$ 2,035,077**	**$ 1,859,910**	**$ 175,167**
Building Material, Garden Equipment Stores			
Building Materials & Supplies	$ 557,787	$ 481,140	$ 76,647
Lawn & Garden Equipment & Supplies	105,317	208,166	(102,849)
Subtotal:	**$ 663,104**	**$ 689,306**	**$ (26,202)**
Miscellaneous Store Retailers			
Florists	$ 24,600	$ 80,069	$ (55,469)
Office Supplies, Stationery, Gift Stores	211,749	33,200	178,549
Used Merchandise Stores	50,228	-	50,228
Other Miscellaneous Retail Stores	379,416	72,716	306,700
Subtotal:	**$ 665,993**	**$ 185,985**	**$ 480,008**
TOTAL:			
HH Demand vs. Retail Sales	**$ 17,808,477** *(2)*	**$ 15,277,314**	**$ 2,531,163**
Estimated Retail Inventory (Sq. Ft.)		**76,800**	
Productivity (Sales/Sq. Ft.)		**$ 199**	

(1) Claritas' "Retail Market Power" data is derived from two major sources of information. Demand data are derived from Consumer Expenditure Surveys fielded by the U.S. Bureau of Labor Statistics (BLS). Supply data are derived from the Census Bureau. The difference between demand and supply represents the "recapture opportunity", or surplus, available for each retail category in the reporting geography. When demand is greater than supply, there is an apparent opportunity for additional retail space in that category. By comparison, when demand is less than supply, there is a surplus of sales in that retail category (i.e., positive value = recapture opportunity, while negative value = surplus of sales).

(2) Total household retail spending excludes spending on Non-Store Retailers (Internet); Motor Vehicle Parts and Dealers; and Gas Stations.

Source: Claritas, Inc.; WTL +a, March 2014.

Table 17
Retail "Recapture" Opportunities, City of South Bay, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
General Merchandise Stores			
Department Stores Excl Leased Depts.	$ 759,069	$ -	$ 759,069
Other General Merchandise Stores	1,327,497	-	1,327,497
Subtotal:	**$ 2,086,566**	**$ -**	**$ 2,086,566**
Clothing & Accessories Stores			
Clothing Stores	$ 634,860	$ 141,303	$ 493,557
Shoe Stores	108,122	-	108,122
Jewelry, Luggage, Leather Stores	92,667	-	92,667
Subtotal:	**$ 835,649**	**$ 141,303**	**$ 694,346**
Furniture & Home Furnishings Stores			
Furniture Stores	$ 162,936	$ -	$ 162,936
Home Furnishing Stores	132,386	-	132,386
Subtotal:	**$ 295,322**	**$ -**	**$ 295,322**
Electronics & Appliance Stores			
Appliances, TVs, Electronics Stores	$ 339,961	$ -	$ 339,961
Subtotal:	**$ 339,961**	**$ -**	**$ 339,961**
Leisure & Entertainment			
Sporting Goods Stores	$ 185,977	$ -	$ 185,977
Books, Periodicals & Music	88,687	-	88,687
Subtotal:	**$ 274,664**	**$ -**	**$ 274,664**
Food Services & Drinking Places			
Full-Service Restaurants	$ 629,550	$ -	$ 629,550
Limited-Service Eating Places	557,539	-	557,539
Special Food Services	52,436	-	52,436
Drinking Places -Alcoholic Beverages	80,272	-	80,272
Subtotal:	**$ 1,319,797**	**$ -**	**$ 1,319,797**

Table 17 (Continued)
Retail "Recapture" Opportunities, City of South Bay, 2012

Retail Category	Demand (HH Spending)	Supply (Store Sales)	"Recapture" Opportunity
Food & Beverage Stores			
Grocery Stores	$ 2,092,849	$ 649,173	$ 1,443,676
Specialty Food Stores	57,869	105,411	(47,542)
Beer, Wine & Liquor Stores	83,169	-	83,169
Subtotal:	**$ 2,233,887**	**$ 754,584**	**$ 1,479,303**
Health & Personal Care Stores			
Health & Personal Care Stores	$ 1,039,492	$ -	$ 1,039,492
Subtotal:	**$ 1,039,492**	**$ -**	**$ 1,039,492**
Building Material, Garden Equipment Stores			
Building Materials & Supplies	$ 291,730	$ -	$ 291,730
Lawn & Garden Equipment & Supplies	53,723	-	53,723
Subtotal:	**$ 345,453**	**$ -**	**$ 345,453**
Miscellaneous Store Retailers			
Florists	$ 12,680	$ -	$ 12,680
Office Supplies, Stationery, Gift Stores	109,070	-	109,070
Used Merchandise Stores	25,883	-	25,883
Other Miscellaneous Retail Stores	195,061	-	195,061
Subtotal:	**$ 342,694**	**$ -**	**$ 342,694**
TOTAL:			
HH Demand vs. Retail Sales	**$ 9,113,485** *(2)*	**$ 895,887**	**$ 8,217,598**
Estimated Retail Inventory (Sq. Ft.)		**40,060**	
Productivity (Sales/Sq. Ft.)		**$ 22**	

(1) Claritas' "Retail Market Power" data is derived from two major sources of information. Demand data are derived from Consumer Expenditure Surveys fielded by the U.S. Bureau of Labor Statistics (BLS). Supply data are derived from the Census Bureau. The difference between demand and supply represents the "recapture opportunity", or surplus, available for each retail category in the reporting geography. When demand is greater than supply, there is an apparent opportunity for additional retail space in that category. By comparison, when demand is less than supply, there is a surplus of sales in that retail category (i.e., positive value = recapture opportunity, while negative value = surplus of sales).

(2) Total household retail spending excludes spending on Non-Store Retailers (Internet); Motor Vehicle Parts and Dealers; and Gas Stations.

Source: Claritas, Inc.; WTL +a, March 2014.

3. Real Estate Market Conditions

WTL +a evaluated market conditions across a range of real estate sectors in the Glades Region to understand how recent market trends, current economic conditions, and key initiatives such as the proposed ILC and others affect both near- and longer-term opportunities for economic growth in each community and in the unincorporated portions of the study area. The findings from this analysis are critical in guiding specific economic development initiatives and strategies in the Glades Region Master Plan as defined in Section 5 of this report.

This section of the report analyzes those factors, such as housing conditions, residential development patterns, historic and current inventory, occupancy and vacancy levels, annual absorption (leasing) activity, historic development trends, and other appropriate market indices for residential and 'workplace' uses based on available data. Key findings are summarized below and illustrated in Table 18 through Table 25.

Housing Profile

WTL+a reviewed market conditions in the Glades Region's housing stock based on data from ESRI Business Analyst and the 2008—2012 American Community Survey (ACS). Findings for each of the three municipalities are highlighted in the accompanying text and tables.

City of Belle Glade

- As illustrated in Table 18, the City of Belle Glade contains 6,518 housing units in a mix of housing product.

- As of 2012, only 34% of the city's housing stock is owner-occupied and 55% is rental. Approximately 11% (717 units) are unoccupied (latest data available as of the 2010 Census). In 2012, the median unit value of all housing units in Belle Glade was $93,736. Notably, fully 78% of housing in Belle Glade is valued at less than $200,000.

- The city's housing stock is distributed among single-family detached (39%) and small multi-family product (i.e., comprising 2 to 49 units) (46%). Another 715 units (11%) are mobile homes.

- Over the next five years, median housing values in Belle Glade are expected to increase at a compound annual rate of 3.6% per year. This is above the rate of inflation, suggesting that there will be some real growth in value in Belle Glade's housing stock.

- More specific analysis of the city's vacant housing stock indicates that the combination of seasonal units as well as units that are sold but not yet occupied reveals that Belle Glade's true housing vacancy rate is lower than 11%—in the range of 8.9%, or 566 units.

City of Pahokee

- As illustrated in Table 19, the City of Pahokee contains 1,995 housing units in a mix of housing product.

- As of 2012, approximately 41% of the city's housing stock is owner-occupied, and another 41% is rental. Notably, 17.8% (318 units) are unoccupied (latest data available as of the 2010 Census), an increase since 2010, when 15.9% were unoccupied. In 2012, the median value of all housing units in Pahokee was $80,778. Fully 77% of housing in Pahokee is valued at less than $200,000.

- The city's housing stock is distributed among single-family detached (55%) and small multi-family product (i.e., comprising 2 to 49 units) (20%). Another 382 units (19%) are mobile homes.

- Over the next five years, median housing values in Pahokee are forecast to increase at a compound annual rate of 2.7% per year. However, forecasts indicate that the number of vacant units in Pahokee will also increase, suggesting that one of the economic development initiatives should focus on housing stabilization, including comprehensive strategies aimed at code enforcement, rehabilitation, programs and incentives to increase owner occupancies and others aimed at strengthening the city's housing stock.

Table 18
Housing Profile, City of Belle Glade, 2010—2017

	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Housing Tenure							
Owner-occupied	2,165	2,188		2,338		150	1.3%
% of Total	34.0%	33.6%		34.3%			
Renter-occupied	3,486	3,603		3,710		107	0.6%
% of Total	54.7%	55.3%		54.4%			
Vacant	717	727		773		46	1.2%
% of Total	11.3%	11.2%		11.3%			
Total Units:	**6,368**	**6,518**		**6,821**		**453**	**0.9%**
Owner-Occupied Value							
$50,000 - $99,999		922	42%	798	34%	(124)	-2.8%
$100,000 - $199,999		820	37%	1,029	44%	209	4.6%
$200,000 - $299,999		110	5%	224	10%	114	15.3%
$300,000 - $399,999		40	2%	68	3%	28	11.2%
$400,000 - $499,999		6	0%	7	0%	1	3.1%
$500,000 - $749,999		2	0%	3	0%	1	8.4%
$750,000+		-	0%	-	0%	-	0.0%
Median Value		**$ 93,736**		**$ 111,621**			**3.6%**
Average Value		**$ 106,321**		**$ 125,267**			**3.3%**

Unoccupied Housing Units By Status (2010 Census)		
Unoccupied for Other Reasons		
Rented (Not Occupied)	17	11%
For Sale Only	31	21%
Sold (Not Occupied)	5	3%
Seasonal Use	92	61%
For Migrant Workers	6	4%
Subtotal:	**151**	**21%**
True Vacancies		
Other Vacant	127	22%
Vacant, For Rent	439	78%
Subtotal:	**566**	**79%**
Total Unoccupied Units:	**717**	**11.3%**

TRUE VACANCY:	
Vacant Units	566
True Vacancy Rate	8.9%

Housing Units By Structure (2008-2012 American Community Survey 5-Year Estimates)		
Detached	2,632	39%
Attached	151	2%
2 Units	718	11%
3 or 4 Units	907	14%
5 to 9 Units	433	6%
10 to 19 Units	597	9%
20 to 49 Units	418	6%
50+ Units	129	2%
Mobile Home/Other	715	11%
Total Units:	**6,700**	**100%**

Source: ESRI Business Analyst; American Community Survey; WTL +a, March 2014.

Table 19
Housing Profile—City of Pahokee, 2000—2017

	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Housing Tenure							
Owner-occupied	990	818		808		(10)	-0.2%
% of Total	49.5%	41.0%		40.4%			
Renter-occupied	694	822		780		(42)	-1.0%
% of Total	34.7%	41.2%		39.0%			
Vacant	318	355		413		58	3.1%
% of Total	15.9%	17.8%		20.6%			
Total Units:	**2,002**	**1,995**		**2,001**		**(1)**	**0.1%**
Owner-Occupied Value							
$50,000 - $99,999		450	55%	375	46%	(75)	-3.6%
$100,000 - $199,999		193	24%	249	31%	56	5.2%
$200,000 - $299,999		32	4%	73	9%	41	17.9%
$300,000 - $399,999		5	1%	11	1%	6	17.1%
$400,000 - $499,999		1	0%	3	0%	2	24.6%
$500,000 - $749,999		2	0%	6	1%	4	24.6%
$750,000+		3	0%	3	0%	-	0.0%
Median Value		**$ 80,778**		**$ 92,133**			**2.7%**
Average Value		**$ 94,774**		**$ 117,946**			**4.5%**
Unoccupied Housing Units By Status (2010 Census)							
Unoccupied for Other Reasons							
Rented (Not Occupied)	10	19%					
For Sale Only	33	63%					
Sold (Not Occupied)	1	2%					
Seasonal Use	7	13%					
For Migrant Workers	1	2%					
Subtotal:	**52**	**16%**					
True Vacancies							
Other Vacant	111	42%					
Vacant, For Rent	155	58%					
Subtotal:	**266**	**84%**					
Total Unoccupied Units:	**318**	**15.9%**					
TRUE VACANCY:							
Vacant Units	266						
True Vacancy Rate	13.3%						
Housing Units By Structure (2008-2012 American Community Survey 5-Year Estimates)							
Detached	1,092	55%					
Attached	57	3%					
2 Units	143	7%					
3 or 4 Units	126	6%					
5 to 9 Units	61	3%					
10 to 19 Units	58	3%					
20 to 49 Units	25	1%					
50+ Units	40	2%					
Mobile Home/Other	382	19%					
Total Units:	**1,984**	**100%**					

Source: ESRI Business Analyst; American Community Survey; WTL +a, March 2014.

- More specific analysis of the city's vacant housing inventory indicates that the combination of seasonal units as well as units that are sold but not yet occupied reveals that Pahokee's true housing vacancy rate is lower than 17.8%—in the range of 13%, or 266 units.

City of South Bay

- As illustrated in Table 20, the City of South Bay contains almost 1,100 housing units in a mix of housing product.

- As of 2012, 42% of the city's housing stock is owner-occupied, and another 40% is rental. Notably, the number of owner-occupied units in South Bay has decreased since 2010. Further, 17.7% (194 units) are unoccupied (latest data available as of the 2010 Census), which is unchanged since 2010. In 2012, the median value of all housing units in South Bay was $77,527. Fully 98% of housing in South Bay is valued at less than $200,000.

- The city's housing stock is distributed among single-family detached (56%) and small multi-family product (i.e., comprising 2 to 49 units) (35%). There are 68 mobile homes (7%).

- Over the next five years, median housing values in South Bay are forecast to increase at a nominal annual rate of 1.7% per year.

- More specific analysis of the city's vacant housing inventory indicates that the combination of seasonal units as well as units that are sold but not yet occupied reveals that South Bay's true housing vacancy rate is lower than 17.7%—in the range of 12.9%, or 139 units.

Table 20
Housing Profile—City of South Bay, 2000—2017

	2010	2012	% Dist.	2017	% Dist.	Change: 2012-2017 No.	Change: 2012-2017 CAGR %
Housing Tenure							
Owner-occupied	497	460		497		37	1.6%
% of Total	46.1%	41.9%		43.4%			
Renter-occupied	386	444		446		2	0.1%
% of Total	35.8%	40.4%		39.0%			
Vacant	194	194		201		7	0.7%
% of Total	18.0%	17.7%		17.6%			
Total Units:	**1,077**	**1,098**		**1,144**		**67**	**0.8%**
Owner-Occupied Value							
$50,000 - $99,999		355	77%	334	67%	(21)	-1.2%
$100,000 - $199,999		97	21%	137	28%	40	7.1%
$200,000 - $299,999		9	2%	26	5%	17	23.6%
$300,000 - $399,999		-	0%	-	0%	-	
$400,000 - $499,999		-	0%	-	0%	-	
$500,000 - $749,999		-	0%	-	0%	-	
$750,000+		-	0%	-	0%	-	
Median Value		**$ 77,527**		**$ 84,398**			**1.7%**
Average Value		**$ 81,291**		**$ 93,410**			**2.8%**

Unoccupied Housing Units By Status (2010 Census)		
Unoccupied for Other Reasons		
Rented (Not Occupied)	3	5%
For Sale Only	49	89%
Sold (Not Occupied)	3	5%
Seasonal Use	-	0%
For Migrant Workers	-	0%
Subtotal:	**55**	**28%**
True Vacancies		
Other Vacant	70	50%
Vacant, For Rent	69	50%
Subtotal:	**139**	**72%**
Total Unoccupied Units:	**194**	**18.0%**

TRUE VACANCY:	
Vacant Units	**139**
True Vacancy Rate	**12.9%**

Housing Units By Structure (2008-2012 American Community Survey 5-Year Estimates)		
Detached	513	56%
Attached	10	1%
2 Units	99	11%
3 or 4 Units	113	12%
5 to 9 Units	69	7%
10 to 19 Units	12	1%
20 to 49 Units	37	4%
50+ Units	-	0%
Mobile Home/Other	68	7%
Total Units:	**921**	**100%**

Source: ESRI Business Analyst; American Community Survey; WTL +a, March 2014.

Table 21
10-Year Housing Starts for Glades Region, 2004—2013

Municipality	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total Starts	Annual Average	% of County
Single-family Detached													
Belle Glade	9	22	22	11	9	7	7	-	1	-	88	9	0.2%
Pahokee	39	45	36	13	4	1	2	-	-	-	140	14	0.4%
South Bay	10	-	-	-	-	2	-	-	-	-	12	1	0.03%
Unincorporated	3	1	2	2	-	-	-	-	-	-	8	1	0.02%
SFD-Palm Beach County:	**10,266**	**8,689**	**4,652**	**2,101**	**1,278**	**1,102**	**1,251**	**1,895**	**2,247**	**2,669**	**36,150**	**3,615**	**65%**
Annual Change	-	*(1,577)*	*(4,037)*	*(2,551)*	*(823)*	*(176)*	*149*	*644*	*352*	*422*			
Multi-family													
Belle Glade	2	-	2	16	9	5	3	3	-	-	40	4	0.2%
Pahokee	-	-	-	-	-	-	-	-	-	-	-	-	0.0%
South Bay	-	-	-	-	-	-	-	-	-	-	-	-	0.0%
Unincorporated	-	-	-	-	-	-	-	-	-	-	-	-	0.0%
MF-Palm Beach County:	**4,253**	**3,802**	**3,725**	**1,029**	**905**	**329**	**255**	**575**	**2,389**	**2,466**	**19,728**	**1,973**	**35%**
Annual Change	-	*(451)*	*(77)*	*(2,696)*	*(124)*	*(576)*	*(74)*	*320*	*1,814*	*77*			

http://socds.huduser.org/permits/

Source: U.S. Census Bureau; U.S. Dept. of Housing & Urban Development; WTL+a, updated August 2014.

Table 21 (Continued)
10-Year Housing Starts for Glades Region, 2004—2013

Municipality	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total Starts	Annual Average	% of Total
Total Starts													
Belle Glade	11	22	24	27	18	12	10	3	1	-	128	13	0.23%
Pahokee	39	45	36	13	4	1	2	-	-	-	140	14	0.25%
South Bay	10	-	-	-	-	2	-	-	-	-	12	1	0.02%
Unincorporated	3	1	2	2	-	-	-	-	-	-	8	0.8	0.01%
TOTAL-Palm Beach County:	**14,519**	**12,491**	**8,377**	**3,130**	**2,183**	**1,431**	**1,506**	**2,470**	**4,636**	**5,135**	**55,878**	**5,588**	**100%**
Municipalities As % of County	***0.4%***	***0.5%***	***0.7%***	***1.3%***	***1.0%***	***1.0%***	***0.8%***	***0.1%***	***0.0%***	***0.0%***	***0.52%***		

http://socds.huduser.org/permits/

Source: U.S. Census Bureau; U.S. Dept. of Housing & Urban Development; WTL+a, updated August 2014.

Housing Starts

In order to document how population and household growth affects opportunities for new residential development throughout the Glades Region, we reviewed information on annual housing starts/residential building permits. Key findings indicate that:

- Over the past 10 years (including the boom years of 2004-2006, the 2007-2009 recession and subsequent recovery), housing starts across Palm Beach County resulted in delivery of more than 55,800 new housing units. In terms of unit distribution, this includes 36,150 single-family units (65% of the total) and 19,700+ multi-family units (35%). **Over the past 10 years, growth in Palm Beach County has generated average annual deliveries of more than 5,500 units per year.**

- Compared to high-growth areas elsewhere in the county, the Glades Region has experienced very limited new residential development since 2004. In fact, **the three municipalities and unincorporated area comprising the Glades Region added only 248 single-family units and 40 multi-family units**, which translates into an annual average of approximately 29 housing starts per year.

- Over the past 10 years, new housing construction was clustered in Pahokee (140 units) and Belle Glade (128 units, including 40 multi-family units). According to Palm Beach County records, only eight single-family housing starts were recorded in the unincorporated parts of the study area during this period.

Over Past 10 Years, Glades Region Averaged Annual Delivery of Only 29 New Housing Units/Year

'Workplace' Uses

A critical component of the Market Overview & Economic Development Analysis includes a detailed review of market conditions in the Glades Region's 'workplace' real estate. Workplace real estate is defined as industrial, commercial retail and office uses. This market profile is key to testing demand potentials for such uses generated by key initiatives, including job growth, spin-off opportunities created by the Inland Logistics Center, and tourism potentials for supporting amenities such as hotel/lodging.

WTL+a evaluated market performance based on available data from CoStar, Inc., a national real estate database, for 2004 through 2013, including: total inventory, construction deliveries, annual leasing/absorption activity, vacant stock, vacancy rates, and rental rates. Key findings are illustrated in Table 22 through Table 25 and summarized by municipality below:

City of Belle Glade

As illustrated in Table 22, the City of Belle Glade contains a reported 672,721 sq. ft. of workplace-related real estate in 66 buildings, with retail space comprising the predominant use. Specific market characteristics for each use are summarized as follows:

- **Office**—Belle Glade has a limited **office inventory of 56,712 sq. ft.** in 10 buildings. The tenant mix is characteristic of small "garden" office buildings, oriented to professional services such as medical, legal, accounting, etc. Over the past 10 years (covering multiple economic cycles), the inventory has remained unchanged (i.e., no new construction). Vacancy rates have fluctuated—from full occupancy to a **current vacancy rate of almost 19%**, with 10,700 sq. ft. of vacant office space. Net absorption (i.e., leasing activity) has been negative; that is, more office space was vacated than leased during this period. Between 2004 and 2013, total **office absorption was -5,695 sq. ft.,** illustrative of the lack of demand, declining number of jobs in Belle Glade, and limited inventory. Data on office rents are not available from CoStar.

- **Retail**—Belle Glade serves as the Glades Region's primary retail destination, with **469,700 sq. ft. of retail space** in 45 centers/properties. The lion's share of retail space is located on Highway 80/South Main Street in freestanding pads such as Walgreen's, the Winn-Dixie center, and in multiple commercial buildings/blocks in the core of the Belle Glade. CoStar reports a very low retail vacancy rate of 1.3% (although the

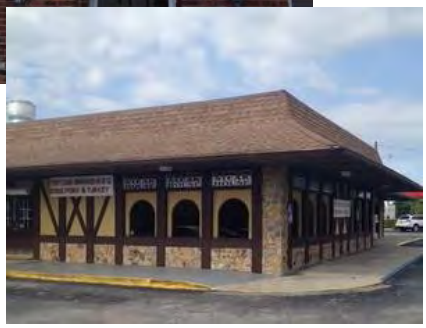


Table 22
Workplace Real Estate Profile—City of Belle Glade, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Office													
Inventory	56,712	56,712	56,712	56,712	56,712	56,712	56,712	56,712	56,712	56,712	-		
No. of Buildings	10	10	10	10	10	10	10	10	10	10	-		
Vacant Stock (Relet & Sublet)	2,000	2,700	1,000	1,600	-	-	-	10,695	10,695	10,695	**8,695**		
Vacancy Rate	3.5%	4.8%	1.8%	2.8%	0.0%	0.0%	0.0%	18.9%	18.9%	18.9%			**20.5%**
Total Net Absorption	3,100	(700)	1,700	(600)	1,600	-	-	(10,695)	-	-	**(5,595)**	(560)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		
Retail (Data Available Only After 2006)													
Inventory *(1)*			469,719	469,719	469,719	469,719	469,719	469,719	469,719	469,719	-		
No. of Buildings/Properties			45	45	45	45	45	45	45	45	-		
Vacant Stock (Relet & Sublet)			16,900	16,200	4,600	9,200	2,500	2,969	2,469	5,971	**(10,929)**		
Vacancy Rate			3.6%	3.4%	1.0%	2.0%	0.5%	0.6%	0.5%	1.3%			**-13.8%**
Total Net Absorption *(2)*			(3,000)	700	11,600	(4,600)	6,700	(469)	500	(3,502)	**7,929**	991	
Construction Deliveries			-	-	-	-	-	-	-	-	-		
Average Rental Rate			$ -	$ -	$ 11.00	$ 11.00	$ 11.00	$ 12.00	$ 12.04	$ 12.89			**3.2%**
Years to Stabilized (95%) Occupancy:													

Table 22 (Continued)
Workplace Real Estate Profile—City of Belle Glade, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Industrial													
Inventory	153,570	153,570	153,570	153,570	153,570	153,570	153,570	153,570	153,570	146,290	**(7,280)**		
No. of Buildings	12	12	12	12	12	12	12	12	12	11	**(1)**		
Vacant Stock (Relet & Sublet)	7,800	23,833	23,833	1,000	3,100	3,200	15,840	4,140	3,640	-	**(7,800)**		
Vacancy Rate	5.1%	15.5%	15.5%	0.7%	2.0%	2.1%	10.3%	2.7%	2.4%	0.0%			**-100.0%**
Total Net Absorption	(7,800)	(16,033)	-	22,833	(2,100)	(100)	(12,640)	11,700	500	(3,640)	**(7,280)**	**(728)**	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	**-**		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		
All Workplace Uses													
Inventory	210,282	210,282	680,001	680,001	680,001	680,001	680,001	680,001	680,001	672,721	**462,439**		
No. of Buildings/Properties	22	22	67	67	67	67	67	67	67	66	**44**		
Vacant Stock (Relet & Sublet)	9,800	26,533	41,733	18,800	7,700	12,400	18,340	17,804	16,804	16,666	**6,866**		
Vacancy Rate	4.7%	12.6%	6.1%	2.8%	1.1%	1.8%	2.7%	2.6%	2.5%	2.5%			**-6.8%**
Total Net Absorption	(4,700)	(16,733)	(1,300)	22,933	11,100	(4,700)	(5,940)	536	1,000	(7,142)	**(4,946)**	**(495)**	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	**-**		
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		

Source: CoStar, Inc.; WTL+a, March 2014.

amount of vacant commercial retail space in the city's core is not known). Since 2006, there has been **more than 7,900 sq. ft. of positive net absorption/leasing activity**, equating to less than 1,000 sq. ft. per year. Retail rents range from $11 to $12.89 per sq. ft., which is not considered investment-grade.

- **Industrial**—Belle Glade has an i**ndustrial inventory of 146,300 sq. ft.** in 11 buildings. This would include the Belle Glade Business Park, which includes several warehousing & distribution tenants associated with the study area's agricultural production. Over the past 10 years (covering multiple economic cycles), the city's industrial inventory has remained unchanged (i.e., no new construction). Vacancy rates have fluctuated—from a high of 15.5% in 2005 to a current vacancy rate of 0%. Similarly, net absorption (i.e., leasing activity) has varied significantly, with years of both positive and negative absorption. Over the reporting period, however, total **net absorption was -7,800 sq. ft.**, illustrative of market dynamics similar to that of Belle Glade's office market, including: lack of demand, declining number of jobs in Belle Glade, and limited inventory. Data on industrial rents are not available.

City of Pahokee

As illustrated in Table 23, the City of Pahokee contains a reported 1**26,000 sq. ft. of workplace-related real estate** in 20 buildings, with retail space comprising the predominant use. A key property available for re-use includes the former Glades Hospital site, which was vacated when the new Lakeside Medical Center was opened on Highway 80 in 2012. The property may be adaptable for conversion to either office and/or industrial uses given its horizontal footprint. However, specific information on the property's functionality, size, physical condition, and degree of obsolescence is not known at this time. Specific market characteristics for each use are summarized as follows:

- **Office**—Pahokee has a limited **office inventory of 27,048 sq. ft.** in four buildings.

The tenant mix is characteristic of small "garden" office buildings, oriented to professional services such as medical, legal, accounting, etc. Over the past 10 years (covering multiple economic cycles), the inventory has remained unchanged (i.e., no new construction). Vacancy rates have fluctuated—from full occupancy to a **current vacancy rate of 32%**, with 8,675 sq. ft. of vacant office space. Net absorption (i.e., leasing activity) has been negative; that is, more office space was vacated than leased during this period. Between 2004 and 2013, total **office absorption was -3,775 sq. ft.,** illustrative of the lack of demand, declining number of jobs in Pahokee, and limited inventory. Data on office rents are not available from CoStar.

- **Retail**—Pahokee is a secondary retail destination, with limited inventory of **76,800 sq. ft. of retail space** in 13 centers/properties. The lion's share of retail space is located in several commercial buildings/blocks in the historic core of Pahokee, such as the Circle S Pharmacy and the new PNC Bank. The "downtown" area provides the Glades Region's strongest walkable, compact commercial core. CoStar reports generally low retail vacancy rates in Pahokee—ranging from 0% (full occupancy) to a peak of 6.6% during the recession in 2009. Currently, the retail vacancy rate is 3%. Since 2006, net absorption/leasing activity fluctuated, with years of both positive and negative absorption. In total for the eight-year period, however, **retail absorption in Pahokee was only slightly negative**.

- **Industrial**—Pahokee has a limited **industrial inventory of 22,000 sq. ft.** in three buildings. Over the past 10 years (covering multiple economic cycles), the city's industrial inventory has remained unchanged (i.e., no new construction). Vacancy rates have fluctuated—from 0% (full occupancy) to a current high of 45%. Similarly, net absorption (i.e., leasing activity) has varied significantly, with years of both positive and negative absorption. Over the reporting period, however, total **net absorption was -9,974 sq. ft.**, illustrative of market dynamics similar to that of the Glades Region's other submarkets, including: lack of demand, limited number of new jobs in Pahokee, and limited inventory. Data on industrial rents are not available from CoStar.

Table 23
Workplace Real Estate Profile—City of Pahokee, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Office													
Inventory	27,048	27,048	27,048	27,048	27,048	27,048	27,048	27,048	27,048	27,048	-		
No. of Buildings	4	4	4	4	4	4	4	4	4	4	-		
Vacant Stock (Relet & Sublet)	4,200	3,200	500	500	-	500	600	5,708	5,808	8,675	**4,475**		
Vacancy Rate	15.5%	11.8%	1.8%	1.8%	0.0%	1.8%	2.2%	21.1%	21.5%	32.1%			**8.4%**
Total Net Absorption	700	1,000	2,700	-	500	(500)	(100)	(5,108)	(100)	(2,867)	**(3,775)**	(378)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ 10.87	$ 9.88	$ 9.52	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		
Retail (Data Available Only After 2006)													
Inventory			76,800	76,800	76,800	76,800	76,800	76,800	76,800	76,800	-		
No. of Buildings/Properties			13	13	13	13	13	13	13	13	-		
Vacant Stock (Relet & Sublet)			2,500	2,000	-	5,096	1,500	3,511	-	2,328	**(172)**		
Vacancy Rate			3.3%	2.6%	0.0%	6.6%	2.0%	4.6%	0.0%	3.0%			**-1.0%**
Total Net Absorption			(500)	500	2,000	(5,096)	3,596	(2,011)	3,511	(2,328)	**(328)**	(41)	
Construction Deliveries			-	-	-	-	-	-	-	-	-		
Average Rental Rate			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		

Table 23 (Conitnued)
Workplace Real Estate Profile—City of Pahokee, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Industrial													
Inventory	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174	22,174	-		
No. of Buildings	3	3	3	3	3	3	3	3	3	3	-		
Vacant Stock (Relet & Sublet)	1,000	500	500	-	500	600	700	1,000	9,974	9,974	**8,974**		
Vacancy Rate	4.5%	2.3%	2.3%	0.0%	2.3%	2.7%	3.2%	4.5%	45.0%	45.0%			**29.1%**
Total Net Absorption	(1,000)	500	-	500	(500)	(100)	(100)	(300)	(8,974)	-	**(9,974)**	(997)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy: Based on Average Annual Absorption											**N/A**		
All Workplace Uses													
Inventory	49,222	49,222	126,022	126,022	126,022	126,022	126,022	126,022	126,022	126,022	-		
No. of Buildings/Properties	7	7	20	20	20	20	20	20	20	20	-		
Vacant Stock (Relet & Sublet)	5,200	3,700	3,500	2,500	500	6,196	2,800	10,219	15,782	20,977	**17,477**		
Vacancy Rate	10.6%	7.5%	2.8%	2.0%	0.4%	4.9%	2.2%	8.1%	12.5%	16.6%			**5.2%**
Total Net Absorption	(300)	1,500	2,200	1,000	2,000	(5,696)	3,396	(7,419)	(5,563)	(5,195)	**(14,077)**	(1,408)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy: Based on Average Annual Absorption											**N/A**		

Source: CoStar, Inc.; WTL+a, March 2014.

City of South Bay

As illustrated in Table 24, the City of South Bay contains a reported **223,075 sq. ft. of workplace-related real estate** in 12 buildings, with industrial space comprising the predominant use. Specific market characteristics for each use are summarized as follows:

- **Office**—South Bay has a limited **office inventory of 48,157 sq. ft.** in three buildings. Like its counterparts in Belle Glade and Pahokee, the tenant mix in South Bay's office buildings is characteristic of small "garden" product, oriented to professional services such as medical, legal, accounting, etc. Over the past 10 years (covering multiple economic cycles), the inventory has remained unchanged (i.e., no new construction). Vacancy rates have fluctuated significantly—from a low of 2.5% vacancy to a **current vacancy rate of 16.4%**, with 7,889 sq. ft. of vacant office space. Notably, vacancies peaked between 2009 and 2012, when fully 95% of South Bay's office inventory was empty. In 2013, there was 38,000 sq. ft. of positive net absorption (i.e., leasing activity), which reduced vacancies to their current level of 16.4%. Between 2004 and 2013, total reported **net absorption was negative, at -5,689 sq. ft.**, illustrative of the lack of demand, limited job growth in South Bay, and limited inventory. Data on office rents are not available from CoStar.

- **Retail**—South Bay is a tertiary retail submarket, with an inventory of **40,060 sq. ft. of retail space** in seven centers/properties in scattered locations, primarily on U.S. Route 27 or State Route 80. CoStar reports that retail vacancy rates in South Bay have fluctuated over the past eight years—ranging from 0% (full occupancy) to a current peak of 22.6%, as 9,070 sq. ft. were vacated in 2013. Since 2006, net absorption/ leasing activity has fluctuated, with years of both positive and negative absorption. For the eight-year period, however, net retail absorption in South Bay was negative,

Table 24
Workplace Real Estate Market Profile—City of South Bay, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Office													
Inventory	48,157	48,157	48,157	48,157	48,157	48,157	48,157	48,157	48,157	48,157	-		
No. of Buildings	3	3	3	3	3	3	3	3	3	3	-		
Vacant Stock (Relet & Sublet)	1,200	1,400	1,500	1,000	-	38,500	45,889	45,889	45,889	7,889	**6,689**		
Vacancy Rate	2.5%	2.9%	3.1%	2.1%	0.0%	79.9%	95.3%	95.3%	95.3%	16.4%			**23.3%**
Total Net Absorption	1,000	(200)	(100)	500	1,000	(38,500)	(7,389)	-	-	38,000	**(5,689)**	(569)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ 3.79	$ 3.79	$ 3.79	$ 4.32	$ 4.50			**4.4%**
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		
Retail (Data Available Only After 2006)													
Inventory			40,060	40,060	40,060	40,060	40,060	40,060	40,060	40,060	-		
No. of Buildings/Properties			7	7	7	7	7	7	7	7	-		
Vacant Stock (Relet & Sublet)			1,500	1,000	4,750	2,963	3,250	500	-	9,070	**7,570**		
Vacancy Rate			3.7%	2.5%	11.9%	7.4%	8.1%	1.2%	0.0%	22.6%			**29.3%**
Total Net Absorption *(2)*			(500)	500	(3,750)	1,787	(287)	2,750	500	(9,070)	**(8,070)**	(1,009)	
Construction Deliveries			-	-	-	-	-	-	-	-	-		
Average Rental Rate		$ -	$ -	$ 8.00	$ 8.00	$ 8.00	$ 8.00	$ 8.00	$ -	$ 8.00			**0.0%**
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											**N/A**		

Source: CoStar, Inc.; WTL+a, March 2014.

Table 24 (Continued)
Workplace Real Estate Market Profile—City of South Bay, 2004—2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total	Ann'l Avg.	CAGR %
Industrial													
Inventory	134,858	134,858	134,858	134,858	134,858	134,858	134,858	134,858	134,858	134,858	-		
No. of Buildings	2	2	2	2	2	2	2	2	2	2	-		
Vacant Stock (Relet & Sublet)	7,300	500	500	500	3,900	4,200	4,700	7,300	-	-	(7,300)		
Vacancy Rate	5.4%	0.4%	0.4%	0.4%	2.9%	3.1%	3.5%	5.4%	0.0%	0.0%			-100.0%
Total Net Absorption	(7,300)	6,800	-	-	(3,400)	(300)	(500)	(2,600)	7,300	-	-	-	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											N/A		
All Workplace Uses													
Inventory	183,015	183,015	223,075	223,075	223,075	223,075	223,075	223,075	223,075	223,075	40,060		
No. of Buildings/Properties	5	5	12	12	12	12	12	12	12	12	7		
Vacant Stock (Relet & Sublet)	8,500	1,900	3,500	2,500	8,650	45,663	53,839	53,689	45,889	16,959	8,459		
Vacancy Rate	4.6%	1.0%	1.6%	1.1%	3.9%	20.5%	24.1%	24.1%	20.6%	7.6%			5.6%
Total Net Absorption	(6,300)	6,600	(600)	1,000	(6,150)	(37,013)	(8,176)	150	7,800	28,930	(13,759)	(1,376)	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-	-		
Average Rental Rate	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Years to Stabilized (95%) Occupancy:													
Based on Average Annual Absorption											N/A		

Source: CoStar, Inc.; WTL+a, March 2014.

with -8,070 sq. ft. Retail rents in South Bay are reportedly in the range of $8.00 per sq. ft., which is not considered investment-grade.

- **Industrial**—South Bay has a reported industrial inventory of 134,858 sq. ft. in two buildings. Over the past 10 years (covering multiple economic cycles), the city's industrial inventory has remained unchanged (i.e., no new construction). Vacancy rates are illustrative of generally stabilized occupancies—varying from 0% (full occupancy) to no more than 5% in both 2004 and 2011. This suggests that spin-off demand generated by the ILC (combined with aggressive business recruitment and marketing) may yield demand potentials sufficient for construction of new industrial space in South Bay. Net absorption (i.e., leasing activity) has varied, with years of both positive and negative absorption. Over the reporting period, however, total net absorption of industrial space in South Bay was flat, illustrative of market dynamics similar to that of the Glades Region's other submarkets, including: lack of demand, limited number of new jobs in South Bay, and limited inventory. Data on industrial rents are not available from CoStar.

Unincorporated Area

CoStar, Inc. real estate data indicated that there is little, if any, workplace real estate in the unincorporated parts of the Glades Region study area. The data documented only one industrial building in Canal Point, which comprises 8,504 sq. ft. of rentable area. This property is reportedly fully leased. No information was available on absorption activity or rental rates.

Otherwise, its database does not track any commercial retail or office buildings in the unincorporated areas.

Summary of Real Estate Market Conditions

The analysis of market performance based on data compiled by CoStar, Inc., a national real estate database for the three municipalities comprising the Glades Region suggests the following findings:

Workplace Real Estate

- As illustrated in Table 25, there are 1.02 million sq. ft. of workplace real estate uses in 98 buildings/properties, including general office, commercial retail and industrial in the three municipalities, and one industrial building in Canal Point containing 8,504 sq. ft. of rentable area. This inventory excludes the sugar refineries owned and operated by Florida Crystals and U.S. Sugar, and the size of their holdings is not known.

- Despite fluctuations in vacancies and absorption/leasing activity since 2004, **overall vacancy rates have generally been in the range of 5% to 8% over the past 10 years, suggesting stabilized occupancies among the Glades' workplace real estate uses**. That said, net absorption is uneven—with both positive and negative absorption driven by the 2007—2009 economic downturn, business contractions, limited job growth/job losses, and other factors that have combined to produce total negative absorption of -32,783 sq. ft. over the past 10 years.

Housing

Compared to high-growth areas elsewhere in Palm Beach County, the Glades Region has experienced very limited new residential development since 2004. In fact, **the three municipalities comprising the Glades Region added 248 single-family units and 40 multi-family units**, which translates into an annual average of only 29 housing starts per year compared to a countywide average of more than 5,500 units per year over the past 10 years.

Over the past 10 years, new housing construction was clustered in Pahokee (140 units) and Belle Glade (128 units, including 40 multi-family units). According to Palm Beach County records, only eight single-family housing starts were recorded in the unincorporated parts of the study area during this period.

Table 25
Summary of Workplace Real Estate Market Performance, 2004-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change: 2004-2013 Total Sq. Ft.		CAGR %
All Workplace Uses													
Inventory	442,519	442,519	1,029,098	1,029,098	1,029,098	1,029,098	1,029,098	1,029,098	1,029,098	1,021,818	(7,280)	*(1)*	
No. of Buildings	34	34	99	99	99	99	99	99	99	98	(1)	*(1)*	
Vacant Stock (Relet & Sublet)	23,500	32,133	48,733	23,800	16,850	64,259	74,979	81,712	78,475	54,602	31,102		**1.6%**
Vacancy Rate	5.3%	7.3%	4.7%	2.3%	1.6%	6.2%	7.3%	7.9%	7.6%	5.3%			**1.7%**
Total Net Absorption	(11,300)	(8,633)	300	24,933	6,950	(47,409)	(10,720)	(6,733)	3,237	16,593	**(32,782)**	**(3,278)**	
Construction Deliveries	-	-	-	-	-	-	-	-	-	-			

(1) CoStar has tracked the region's office/industrial inventories since 2004, but did not start tracking the retail inventory until 2006. Therefore, changes in inventory reflect 2006-2013 only.

Source: CoStar, Inc.; WTL+a, June 2014.

4. Target Industry Review

Several economic studies have been completed to-date that examined potential, or emerging, industry clusters as part of overall economic development initiatives in the Glades Region. Among others, these include:

- A Comprehensive Economic Development Strategy (CEDS), 2012—2017, by Treasure Coast Regional Planning Council, 2012

- The Florida Rural Economic Development Study, prepared by Boyette Strategic Advisors (BSA), contracted by Enterprise Florida, Inc., 2012, that examines growth potentials among specific industry clusters/sectors

- 21st Century Palm Beach County Strategic Economic Development Plan, by Palm Beach County Board of County Commissioners, 2007

These and other studies were collected and reviewed to gain a better understanding of ongoing economic initiatives and other planning efforts in the study area as the basis for identifying specific economic development strategies.

Key Findings: CEDS Study

The CEDS study, which was prepared in 2011-12 by TCRPC, is "intended as a guide or business plan for regional and local collaboration on economic development initiatives". It is designed to help the Treasure Coast region achieve long-term regional competitiveness and economic sustainability. The study recognizes that the Treasure Coast's long-term economic sustainability is tied to the global economy, and that the regional economy needs to be focused on expanding economic diversity, enhancing innovation, and aligning educational opportunities with workforce needs, which is a critical objective of the Glades Region Master Plan.

The study noted that the Florida Department of Economic Opportunity (DEO) projects average annual employment growth across all industries in the Treasure Coast region of 1.8% per year for the 2011-2019 forecast period. Growth in employment was forecast to be greater than the 1.1% forecasted growth in population during this period. Moreover, the region's fastest growing industries are concentrated in the Services and Retail Trade sectors and are strongly correlated to population growth; many of these industries also have average wages that are lower than the average annual regional wage of $43,300.

The CEDS study noted that this pattern underscores the prevailing tendency of the region to continue to experience high employment growth in relatively low-wage industries. With the exception of Professional/Scientific/Technical Services and perhaps Specialty Trade Contractors, relatively low-wage industries are over-represented in the Treasure Coast region, and that trend is forecast to continue into the future.

The CEDS study also included preparation of a "location quotient" (LQ) analysis that measured the overall competitiveness of locations in the four-county service area in relation to other locations by measuring the relative concentration of employment within specific industry sectors. The CEDS LQ analysis was combined with an analysis of employment growth trends to evaluate the overall potential of specific geographies (in this case, each of the four counties) to accommodate future job growth within those sectors. These industry sectors are typically categorized as "Mature," "Stable," "Potentially Emerging" and "Emerging."

The study concluded that those industries with the highest LQs for Palm Beach County include:

- Arts/Entertainment/Recreation & Visitor—LQ of 1.45
- Bio-medical/Bio-technical/Life Sciences—LQ of 1.02
- Business & Financial Services—LQ of 1.21

Notably, Agri-business/Food Processing/Technology scored highest in Indian River and Martin Counties, with LQs of 2.58 and 1.90, respectively. **Agri-business/Food Processing scored lower in Palm Beach County, with a LQ of 0.75 primarily because employment in agriculture is relatively low as a proportion of the county's employment base.** Transportation & Logistics, which would encompass trucking, warehousing and distribution (similar to those functions in an Intermodal Logistics Center), also scored lower in Palm Beach County, with a LQ of 0.42.

Selected Industry Cluster Review

As a result of the findings of the CEDS study, The consulting team evaluated three selected industry clusters and their near- and longer-term potentials to form the basis of economic development strategies, recommended actions, and potential opportunities for the Glades Region and, in particular, for Belle Glade, Pahokee and South Bay. It is clear that each community has both challenges and specifically-identified opportunities as the basis to focus economic development efforts designed to provide a stronger workforce skills base, additional demand for housing and retail, and targeted elements and assets that will sustain stronger local economies into the future.

The three identified industry clusters reviewed as part of this study include:

- Agri-business/Food Processing & Production
- Recreation & Visitor/Tourism (and Supporting Retail Services)
- Transportation & Logistics (related to the proposed Intermodal Logistics Center/ILC)

Each category's current status in Palm Beach County is discussed below:

Industry Cluster: Agri-business/Food Processing & Production

Agriculture is a major part of Florida's economic base; the state is second only to California in production of produce, and is ranked second nationally in provision of floriculture (i.e.,

tropical plants, landscaping nursery plants, herbs, and potted growing stock). Florida produces more processed sugar than any other state, and **Palm Beach County produces the majority of sugar grown and processed in Florida**. While citrus products and other fruits may generate higher cash crop amounts, the **sugar and table-fresh vegetable industries (including growing, cultivation, processing, packing and shipping) comprise the second largest industry in Palm Beach County after tourism.**

Although the food production industry is large and prominent (reportedly generating over $2 billion per year from Palm Beach County alone, including both direct and indirect economic impacts), the scale of local food production is not as well-known to many Palm Beach County residents and most tourists/visitors to the county as its economic importance would suggest. Agriculture and food production are significant drivers of revenue and economic sustainability in Palm Beach County. Located to the west of the densely populated coastal part of the county, there are two areas, related in impacts by different products that have established Palm Beach County as one of Florida's preeminent jurisdictions involved in agricultural production. These two locations include: a north-south band extending through Loxahatchee that produces vegetables, and the miles of sugar fields from Loxahatchee to the county's western boundary. In fact, **Palm Beach County is ranked first in Florida in wages paid for agricultural industries, totaling $316 million in 2010-2011.**

As a land-use, land dedicated to agricultural production in Palm Beach County includes about 37% of total acreage, or an estimated total of 460,000 acres. Of that total, approximately **397,000 acres are allocated to sugar cane cultivation**, or just over 83% of the total acreage dedicated to agriculture in the county.

Major agricultural production categories in Palm Beach County include:

Sugarcane, Sugar & Sugar Seed

This includes: sugar for cooking and baking; black strap molasses, a by-product used for animal feed and resulting in part from the centrifugal forces involved in production from cane; sugar seed to propagate new cane plantings; and the fibrous portion of the cane stalks (also called bagasse), which is used to fuel electricity production in cogeneration plants in which the power generated exceeds that of the waste cane used in its production. This is estimated to be a net positive result from an energy production standpoint.

The three principal cane growers and producers are Florida Crystals, United States Sugar and the Florida Sugar Cane Growers Cooperative. There are three major sugar mills in Palm Beach County as well as a major sugar refinery. All are located in western Palm Beach County, and none are open to the public for safety reasons, nor are most of the county's tourist populations aware of the importance and presence of this major industry. Moreover, sugar production is a highly valuable crop that is particularly well-suited for western Palm Beach County due to the characteristics of the rich 'muck' soils that are located here at the northern head of the Everglades and surrounding the lower half of Lake Okeechobee. Muck (similar to peat) is a compressive substance that is rich

in nitrogen, and well-suited for sugarcane growth. Muck is less stable than other soil categories, which causes significant issues pertaining to engineering and construction costs for roadways, buildings and infrastructure throughout the Glades Region.

According to data from the Florida Department of Agriculture and Consumer Affairs, Palm Beach County produces about 75% of all sugarcane acreage and 75% of total harvested sugarcane tonnage grown in Florida. The remaining three counties with commercial cane cultivation include: Martin, Glades and Hendry Counties, which share the remaining 25% of the state's sugarcane production. As illustrated in Table 26:

- Sugar is Palm Beach County's largest cash crop, representing approximately **$750 million per year in sales**
- The value of sugar crop production increased by an estimated $284.7 million, or 60.5%, between 2008 and 2012

Table 26
Sugar Exports—Palm Beach County, 2008—2012

Year	Export Sugar Value	% Annual Change
2008	$ 470,801,680	-
2009	$ 517,054,170	9.8%
2010	$ 501,815,160	-2.9%
2011	$ 600,139,730	19.6%
2012	$ 755,459,840	25.9%
Change Over Period (2008-2012):	**$ 284,658,160**	**60.5%**

Source: Euromonitor International; RDS, LLC; May 2014.

Table 27
Sugar Production in Palm Beach County, 2009—2010

	Harvested (Acres)		Yield per Acre (Tons)		Total Production (Tons)	
Location	2009	2010	2009	2010	2009	2010
Palm Beach County	300,000	295,000	35.2	33.4	10,533,000	9,860,000
State of Florida	370,000	374,000	35.9	32.7	13,283,000	12,230,000

Source: Florida Department of Agriculture; RDS LLC, May 2014.

Sugarcane is a type of tropical grass plant native to Asia that has been cultivated in areas around southern Lake Okeechobee since the 1920s. This area is suited for cane cultivation for the following key reasons:

- Nitrogen-rich muck soil
- Plentiful sunshine and mild climate
- Warming benefits of proximity to Lake Okeechobee during colder winter months (which moderates the air temperature and prevents killing frosts in its immediate vicinity), and
- Availability of water from the lake for field irrigation

Typically, a sugarcane field is replanted every two to four years. After a first harvest, it is kept free of weeds and a second crop of stalks (called a 'ratoon') grows from the older cane 'stubble'. The second crop is harvested about a year after the first one, but the yield decreases with each growth, and when the cane is no longer productive enough, it is either replanted with cane through vegetative propagation or is rotated with another crop such as rice or sweet corn. As an integrated business, large sugar producers such as Florida Crystals also have subsidiary companies that grow, harvest and process rice to keep fields in production as much as possible.

Sugarcane is typically harvested from late October through mid-April with the highest yields occurring after December; because the harvest process must occur relatively quickly and the cultivation areas in Palm Beach County are so large, it is not possible to harvest all the cane crop at optimal times of the season, so some fields are harvested earlier or later than the optimal yield periods. The sugarcane fields are set on fire in controlled burns immediately before harvest. These fires are fast, with a 40-acre field typically burning within 20-30 minutes. The fires occur only during the daytime and create large plumes of smoke visible from great distances. The cane is burned to remove leaves, the weight of moisture in the cane and biomass that would otherwise absorb sugar during the extraction process (as absorbed sugar cannot be recovered).

After burning, mechanical harvesters cut the cane and place the burned cane into field wagons, which haul the cane onto trucks or rail cars for hauling to the sugar mills. At the mill, the cane is crushed in heavy rollers to extract the juice; moisture is added and additional crushes are completed to extracts the maximum amount of juice from the stalks. The juices (sucrose) are then filtered and concentrated by evaporation until raw sugar crystals are formed. Liquid sugar (including the blackstrap molasses largely used for animal feed and other sweetening liquids) is transported in tanker trucks for use in beverages, processed foods and baked goods.

Sugar production in Florida was largely done by hand from the 1950s until the late 1980s; by 1993, most of the process was fully mechanized across the state. This resulted in reduced employment in the Glades Region, particularly for immigrant populations from the Caribbean that had traditionally produced sugar for centuries. According to 2013 data

from the Performance Analysis Department of the Florida Workforce Alliance, seasonal and full-time employment in sugar production in Palm Beach County averaged just over 1,800. U.S. Sugar has noted that the modernization of its sugar mill resulted in a reduction of employees of about 100 between 2011 and 2013. The Sugar Cane Growers Coop estimates that their total employment is the most stable year round, with 560 employees each year during peak harvest and the production month of January (2011- 2013).

In terms of industry positioning for sugar as a domestic product, the sugar industry in the United States is ranked sixth among international sugar-producing nations, but it should be noted that Brazil, as the largest sugar producer in the world, generates approximately five times the amount of sugar produced in the United States (including both cane and beet sugar), and exports about 80% of what is produced in the country.

Table 28
Sugar Production & Estimated Per Capita Consumption, 2010—2011

Country	Production (Million Tons)	Production Ranking	Exports (Million Tons)	Export Ranking	Population (Millions)	Ann'l/Capita Sugar Consumption (Lbs.)	Consumption Ranking
Brazil	39.014	1	27.590	1	203.0	134.2	1
India	27.837	2	2.911	4	1,263.0	41.8	8
European Union	18.549	3	2.174	5	499.0	77.1	4
China	12.184	4	N/A	N/A	1,383.0	22.0	10
Thailand	11.347	5	8.520	2	70.0	83.7	3
United States	**7.257**	**6**	**N/A**	**N/A**	**321.0**	**66.2**	**6**
Mexico	5.467	7	1.000	8	113.0	74.6	5
So African Dev't Communities	5.435	8	1.960	6	263.0	28.6	9
Australia	5.167	9	3.061	3	22.0	108.0	2
Pakistan	5.109	10	N/A	N/A	196.0	46.2	7

Source: Illovo Sugar Company, 2012; RDS, LLC, May 2014.

Three other factors are likely to affect long-term economic prospects for cultivation of sugarcane and sugar production in Palm Beach County, the cost of growing and processing sugar as a food commodity, and the relative positioning of the United States in the global marketplace. These factors include:

- Production costs & pricing
- Annual U.S. per capita sugar consumption rates
- Cane sugar vs. alternatives

Production Cost & Pricing

The United States sugar industry has received special trade and pricing controls since the 19th Century, due in part to the desire to protect sugar production from dependence on foreign suppliers in an unstable commodities market. Generally, demand for sugar has grown consistently at a rate of about 2.2% per year, outstripping U.S.-produced supply, and therefore requiring imported sugar from partner countries to close the gap

in available supply. Over the past 20 years, NAFTA and other Free Trade agreements in North America (the entire continent) have resulted in reduced tariffs on surplus cane sugar grown in Mexico (there is currently no tax on Mexican sugar imports), and even on the relatively small amount of beet sugar produced in Canada, thus making it easier to import sugar to meet U.S. demand from trade partners, but putting pressure on production costs here. Florida produces about half of the refined sugar consumed in the U.S., so these production cost considerations are sometimes considered a consumer products protection, since pricing in other countries for refined sugar is often higher than in the U.S. due to our price and import controls.

Domestic sugar production receives pricing protections based on import quotas and price supports to protect the U.S. industry from being undermined by foreign pricing systems that vary according to governmental policy and fluctuating production deficits and surpluses in annual volumes. These price supports are granted in part in response to the significant differences in labor costs between the U.S. and less developed countries with much lower labor costs. Also, the production volume of sugar in Hawaii was drastically reduced in the 1980s and 1990s (declining from one million tons per year to around 225,000 tons). The cane sugar industries in Louisiana and Texas are less centralized, smaller-scale operations, and are more fragmented in ownership. The coastal areas of both states have suffered more from weather-related impacts due to hurricanes and heat than has Florida. The larger scale and greater efficiency of sugar processing mills in Florida is ahead of competing states, and Florida Crystals Sugar created the first certified organic sugar process in the country. Even considering increased mechanization and all of these factors, data suggests that it **still costs more to produce sugar in Palm Beach County than in other competing countries, so sugar import/export policy remains a critical issue in terms of supporting a viable sugar industry as a cash crop**. One study suggests that about 70 % of sugar produced is consumed in the country of origin (except Brazil). This proportion can work, but also assumes that production volume can stay in balance with demand, which is increasing.

Annual U.S. per Capita Sugar Consumption Rates

The U.S. Department of Commerce and the U.S. Department of Agriculture report annual production of sugar, but neither agency reports on per capita consumption. While data suggests that per capita consumption of sugar in the U.S. has steadily increased over time (about 2.2% per year since the 1940s), there is no consensus on how much sugar Americans consume, in part because the definition of sugar and sweeteners have been combined in some studies, but not in others. For example, although sugar produced from cane and sugar produced from sugar beets is chemically identical, there are other types of sweetening agents that may not technically be sugar, but which convert to a form of sugar while digested.

As illustrated in Table 28, a sugar industry report estimated that, based on annual per capita consumption of 'real' sugar in the U.S., consumption totaled approximately 66 pounds in 2011/2012. Notably, this is less than half of per capita consumption in Brazil, also the highest volume producer of sugar. But another estimate (which includes alternatives

such as corn-based high fructose syrup or other non-sugar alternatives) estimates that Americans consumed over 109 pounds of sugar per capita in 2012. The recent focus on healthier eating and exercise to offset the increase in average weight in the U.S. and increasing rates of diabetes have attracted media attention, but so far, documented annual consumption of sugar is still increasing. **This suggests that sugar will remain a significant and commercially viable crop for Palm Beach County at least as long as pricing is in place to make it a profitable business.**

Cane Sugar vs. Alternatives & Impacts on Food & Beverage Employment

The soft drink industry in the United States was once a major consumer of cane sugar as a principal ingredient. However, whether it is the syrup manufacturing process or the bottling/distribution part of the beverage industry (both of which require sweeteners), the Federal subsidy for corn production in the early 1980s made high fructose corn syrup (HFCS) a less costly alternative to use of cane sugar. The use of HFCS as the primary sweetener for soft drinks varies from country to country based on cost and efficiency of transporting raw materials. In Mexico, Coca Cola is still made with cane sugar, and selected bottling companies in the U.S. will still make cane sugar-based sodas for 'cult followers' of this product category. With raw materials pricing as the primary determinant, cane sugar has largely been replaced in the beverage industry by HFCS. In addition, non-caloric sweeteners (e.g., saccharine, aspartame, and others) have increased their share of the beverage market due to concerns about soda/soft drink consumption, calorie intake, and general health.

These dietary concerns and the relative employment patterns that reflect them trickle down to the demand for sugar as a food and beverage ingredient. Among major sugar-using food industry segments, employment decreased across all categories between 2007 and 2010, reflecting the recent trend of reduced consumer demand for sweetened products:

- The largest single employment category for sugar-using food products is for bread and bakery products, and that decreased nationally by almost 29,000 jobs (13%)

- Cookie/cracker and pasta manufacturing employment decreased by 19,000 jobs (30%), and

- Fruit and vegetable canning, drying and pickling employment decreased by almost 19%, or over 18,000 jobs.

Changes in employment reflect changing tastes in consumption by the U.S. population. Companies are now targeting Hispanic and African-American submarkets, because consumption of soft drinks and other sweetened products appears to have opportunity for increased market share with these sub-groups than with more traditional audiences, who are increasingly reducing their consumption levels.

According to the U.S. Census Bureau and the Economic Census and Annual Survey

of Manufacturers, **employment in sugar production industries decreased by 22.6% between 1997 and 2010. This reflects a decline of over 3,700 jobs nationally**, which also affected unemployment in the Glades Region. For those sugar industry employees seeking to keep their jobs, increasingly sophisticated mechanization of equipment and increased reliance on technology suggests that education and skills enhancement will become increasingly important for workers to keep their jobs and increase annual income.

Other Food Products in Florida & Palm Beach County

Florida is second only to California in production of food products in the United States, with generally mild weather that extends the growing season for many food crops to 100-200 days per year. The state also has the highest amount of average annual precipitation of all states, and has been the dominant grower of citrus fruit and products. In fact, Florida accounts for over 70% of annual U.S. citrus production. The Florida citrus industry is both a large employer (approximately 76,000 employees statewide) and a significant contributor to the state's agricultural economy, representing yearly dollar volume of over $9 Billion.

Along with other citrus-producing states (on the Gulf of Mexico, Arizona and California, Hawaii and U.S. territories such as Puerto Rico and American Samoa), Florida has been profoundly affected by the widespread occurrence of an incurable citrus disease known as 'Citrus Greening' or sometimes 'Citrus Canker.' The disease is caused by a bacterium spread by a tiny insect called the Asian Citrus psyllid, and usually becomes apparent in citrus groves around six- to eight-years old, although it has been determined that infected trees can grow for 10 years without showing any of the symptoms of wilt and early fruit drop. The disease was first identified in Florida in 1910 and has had periodic recurrences since then, but the onset of wide infestation in 2010 has not been stopped despite billions of dollars spent by public and private laboratories seeking either effective treatments or a cure; to date, neither has been discovered.

In terms of land use, 32 of Florida's 67 counties are citrus producing areas, and the state has approximately 557,000 acres of citrus groves and over 75 million citrus trees. The current infestation has been identified as 'uncontainable' and has already killed millions of citrus trees. Extensive research has been undertaken, so far unsuccessfully, to stop the disease. The Coca Cola Company, owners of Minute Maid Orange Juice, have committed to spend $2 Billion to replant 25,000 acres of groves to replace the dead and dying trees, but other predictions suggest that Citrus Greening could mean the end of the citrus industry as a 'brand' product for Florida. This may result in both hundreds of thousands of acres of land that are no longer productive for citrus growth as well as loss of thousands of agriculture- and food-related jobs in the state.

In addition to the dominant citrus industry, Florida also produces produce and vegetables, and other fruits such as strawberries and watermelons. According to the Florida Department of Economic Opportunity, the state had over 47,500 commercial farms totaling over 9 million acres of land in 2010, and the number of farms was increasing. Farm products include: produce; sugar; livestock (including horses, cattle and calves, cultivated and

wild-caught edible fish); greenhouse and nursery products (ranked second nationally after California); and, paper and pulp production from trees. While many Americans may think of Florida as a state of beaches, international culture, and amusement parks, the state is a nationally significant agricultural producer, ranked ninth in total agricultural sales, first in the value of production of citrus, squash, sweet corn, market-fresh snap beans and tomatoes. The state also ranked second in production of strawberries and bell peppers, and reportedly provides up to 80% of the fresh vegetables consumed in the U.S. during the months of January, February and March.

While this is a major change for Florida's agriculture and food economy, the loss of citrus products is less meaningful in Palm Beach County as it has no significant commercial citrus production, so the impacts on the county's agricultural economy are not likely to be significant. In addition to sugar, Palm Beach County's other major cash crop is fresh vegetables, including large-scale hydroponic vegetable cultivation and more traditional 'truck' farming of tomatoes, sweet corn, snap beans, squash, cucumbers, Chinese vegetables and leafy vegetables such as cabbage. Palm Beach County is also a major producer of nursery plant materials with 476 horticultural nurseries of varying sizes. Most of the vegetable and produce production area of the county is located in a vertical band west of the densely populated coastal zone (closer to Loxahatchee and Wellington), but before the sugar fields that begin about halfway across the county and extend to Lake Okeechobee and beyond.

Industry Cluster: Recreation & Visitor/Tourism

Tourism is Florida's (and Palm Beach County's) largest economic driver, generating billions of dollars in direct and indirect economic impacts and more than one million tourism-based jobs statewide. Since these jobs are related to specific locations and attractions, they are not subject to outsourcing or transfer to other states or countries.

Tourism in Florida

As a proportion of total statewide visitation, Florida's major metropolitan areas reporting the following domestic (U.S. based) visitors:

- Orange County (Orlando) 35%
- Miami-Dade and Miami Beach 9.5%
- Hillsborough County (Tampa) 9.1%
- Broward/Fort Lauderdale 8.9%
- Palm Beach County 5.5%

VISIT FLORIDA, the statewide agency charged with Florida's tourism industry development, recently reported that the state attracted 94.3 million visitors in 2013, an increase of 3.5%

over total visitation in 2012. This was a record year for visitation to the state, and VISIT FLORIDA anticipates that the state is tracking to draw 100 million visitors within the next few years.

Tourism is also a major driver of employment in the state. In fact, in 2013 the number of direct travel-related jobs was estimated at 1,088,000 employees whose jobs were tied to tourism and visitor services. Hotel room revenues in Florida have rebounded more quickly, and at a rate higher than comparable increases in national hotel rates (8.2% vs. 6.2%).

Of the 94.3 million total visitors to Florida in 2013, 79.5 million (84%) were domestic travelers; 11.1 million visitors (12%) originated overseas; and, 3.7 million of the total (4%) originated in Canada. Of overseas points of origin, Brazil was the largest foreign market after Canada, with 1.8 million visitors in 2013, followed by the U.K. with 1.5 million. Argentina and Venezuela are the next largest sources of foreign travel, with 808,000 and 617,000 visitors per year, respectively.

Visitation levels from the U.S. domestic market in 2013 were generally equally apportioned between quarters of the year:

• January through March	22.1 million person-trips	27.7 %
• April through June	19.9 million person-trips	25.0%
• July through September	19.5 million person-trips	24.5%
• October through December	17.9 million person-trips	22.6%

As might be expected, Canadian visitors disproportionately visit Florida between January and June, with 2.6 million of a total 3.7 million visitors arriving during that period. Other foreign-based visitors are the opposite, with the highest level of visitation (27.5%) occurring during the last quarter of the year.

Table 29
Top-Ranked States by Visitors to Florida, 2013

Ranking	Origin State	% of Total	Subtotal By State
2013 Total Domestic Visitors:			**79,518,000**
1	Georgia	11.9%	9,462,642
2	New York	9.7%	7,713,246
3	Texas	5.9%	4,691,562
4	Alabama	5.6%	4,453,008
5	Illinois	4.9%	3,896,382
6	New Jersey	4.7%	3,737,346
7	Ohio	3.9%	3,101,202
8	Michigan	3.8%	3,021,684
9	Massachusetts	3.7%	2,942,166
10	North Carolina	3.6%	2,862,648
11	Virginia	3.6%	2,862,648
12	Pennsylvania	3.6%	2,862,648
13	Tennessee	3.2%	2,544,576
14	California	3.2%	2,544,576
15	Louisiana	2.8%	2,226,504

Source: VISIT Florida, 2013; RDS, LLC, May 2014.

Direct tourism spending at the state level was estimated at over $76 billion in 2013, an increase of approximately 25% since the recession-based decrease in tourism spending between 2006 and 2010. In fact, total tourism spending and employment in Florida have increased steadily since 2010, with spending totals increasing from $62.7 billion in 2010 to over $76 billion in 2013, reflecting an increase of more than 21%. Moreover, tax revenues generated by tourism to the State of Florida increased by the same rate, and tourism-related employment increased from 988,000 to 1,096,700, or almost 11%. Clearly, tourism, both domestic and international, has a significant impact on Florida's economic base.

Tourism in Palm Beach County

The tourism industry in Palm Beach County is differentiated between three geographic parts of the county: from the dense coastal development to the central sector around Wellington (which has emerged as a major equine-based center) to the western end in the Glades surrounding Lake Okeechobee.

According to the Palm Beach County Convention & Visitors Bureau, Palm Beach County ranked ninth in 2012 in total visitation statewide, with tourism increasing from 5.47 million visitors to between 5.5 and 6.0 million in 2013. The CVB recently reported that tourism generated $6.8 billion of total impact on the county's economy, with: $1 billion in taxes and $120 million in local hotel taxes. State and county statistics suggest that every 85 to 100 tourists who come to Florida create a tourism-based job.

It should be noted that 38% of visitors to Palm Beach County are arriving from within Florida, confirming that Floridians travel extensively within the state to take advantage of its range of beach and attraction-based destinations. The largest out-of-state source of origin for visitors to Palm Beach County was New York State, with 21% of the total. The average total expenditures (i.e., all trip costs included) of visitors to Palm Beach County were estimated at $1,100 per day per visitor.

In 2012, Palm Beach County Ranked 9th in Statewide Visitation
With 5.5 to 6.0 million visitors in 2013

Hotel occupancies are a principal source of information on visitor markets, and measures of demand for hotel development follow general industry patterns that identify markets as ready to add more room capacity. The general thresholds used in the capital markets to test growth capacity for new hotel rooms include: Average Daily Rates (or ADRs) and average annual occupancy levels (allowing for possible seasonal changes). Notably, the **hotel industry considers a market with average annual occupancy between 65% and 72% as stabilized enough to support additional room capacity and warrant development of new hotel projects.**

Palm Beach County's average annual occupancy in 2012 was 71.2%, suggesting that there is room for growth, reinforced by an increase in ADRs to approximately $148 per night. The location and pricing of new hotels is highly dependent on proximity to available business and leisure markets as well as to the amenities that visitors require. These include: a range of offerings of restaurants and food service; nearby shopping; attractions that can draw visitors; and safe, attractive environments.

Hotel-based room taxes are a major contributor to Palm Beach County's tourism revenues, but they do not represent a full profile of visitors who come to stay. There is another category known as VFRs (Visiting Friends & Relatives); these visitors may not be counted among those overnight visitors staying in hotels, but they constituted over 50% of all visitors to Palm Beach County in 2012. As VFRs also spend on dining out, entertainment and gifts for their hosts, they have a demonstrably major impact on local retail businesses. Data from the CVB suggests that there has been a shift in the profile of visitors to Palm Beach County between 2011 and 2012. Table 30 demonstrates the apparent changes that have occurred.

Table 30
Demographic Characteristics of Visitors to Palm Beach County, 2011—2012

Visitor Characteristics	2011	2012	Notes
Average Visitor Age	47	53	Older markets; higher spending capacity
Average Household Income	$ 93,600	$ 93,900	
% Married	62%	52%	More single persons to Palm Beach County
Average Size of Visitor Party	2.1	2.1	
% Traveling in Pairs	48%	40%	Correlates with more single visitors
% with Children in the Visitor Party	24%	15%	
Average Household Size	2.7	2.3	Smaller households correlate with age, marital status
% of One-Person Households	17%	28%	More single persons to Palm Beach County
% of Two-Person Households	35%	37%	
% of Three or More in Household	48%	35%	Correlates with smaller HHs, older visitor markets

Source: Palm Beach County Convention & Visitors Bureau; RDS, LLC; May 2014.

Summary of Visitor Trends

These findings suggest that the typical visitor to Palm Beach County in 2012 was older, more affluent; and fewer were married and traveling in a smaller average party size. Notably, **more visitors to Palm Beach County stay with friends and relatives than in hotels, affecting both hotel demand and opportunities to capture collateral expenditures**. While hotel occupancies and growth in tourism to Palm Beach County suggest that additional hotel capacity may be warranted, opportunities for additional hotel development will be highly related to location, market profile, and proximity to reasons for travel (e.g., convention, beach activities, fishing, shopping, equine activities, etc.).

Recreation & Fishing

Sport fishing is another major tourism/visitor niche for both Florida and for Palm Beach County. According to data from the Sport Fishing Association from 2007 (the most recent year for which data has been collected), Florida ranked first in the top 10 states for the number of anglers, with 2.8 million fresh- and salt-water both included. Florida also ranked first in the following:

- Annual expenditures by anglers on fishing equipment and trips ($4.4 billion)
- Employment supported by anglers and fishing activities (75,000+ jobs)
- Annual state and local revenues, such as permits, licenses, other taxes ($440.6 million)

Among all fishing categories (both salt water and freshwater), bass fishing is the most important, with bass anglers spending an average of 19 days per year. While average expenditures on salt water fishing are somewhat higher than for freshwater fishing, anglers for Black Bass, on average, spend $944 per year for fishing guides, fishing equipment,

boat operating costs, etc.; this accounts for daytrip fishing excursions by in-state Florida residents in addition to overnight-stay fishing trips by in-state and out-of state anglers. Data from 2011 from the Florida Department of Environmental Protection (FDEP) indicates that:

- Florida residents included 3.3 million fishing participants, with about 1.2 million involved in freshwater fishing.

- Freshwater Florida anglers spend approximately $1 billion, generating overall economic impact of $1.7 billion and supporting 14,000 jobs related to freshwater fishing (e.g., guides, services, charters, equipment, etc.).

- The gender mix is about 2/3 male and 1/3 female anglers, with the strongest growth potentials in both the female and Hispanic market sub-segments, in part because fishing has traditionally been male-dominated, and in part because the Hispanic population is underrepresented in its share of fishing and outdoor activities, a pattern that is rapidly changing according to state fishing information.

For Palm Beach County, **access and market opportunities related to fishing on Lake Okeechobee are both potentially significant and seriously under-realized, particularly for locations like Pahokee and the marina and facilities located there**. The Lake has a relatively limited number of points of water access, as the dike surrounding the Lake is elevated for flood control and can be observed from the top of the 30 foot high levees constructed and maintained by the U.S. Army Corps of Engineers. The Lake is approximately 30 miles wide and 37 miles long, covering an area of 730 square miles and at an average depth of about nine to 10 feet, but depths change seasonally based on rainfall patterns and Army Corps of Engineers water flow controls through the canals that lead from Lake Okeechobee to the Atlantic and Gulf coasts. Based on volume, Lake Okeechobee represents about 15% of all of Florida's fresh surface water area.

While there are a series of bass fishing destinations across central Florida, Lake Okeechobee is reported to have more seven-pound+ largemouth bass than any other lake in the U.S., and possibly the world. This means that within the world of amateur and professional fishing and fishing tournaments, Lake Okeechobee is recognized as a world-class destination for freshwater fishing, not only for largemouth/lunker bass but also as a major destination for bluegill and crappie fishing. Currently, most of the organized charter fishing and fishing tournaments on Lake Okeechobee are not located in the central Glades area, suggesting that there is a market opportunity to be addressed. Clewiston on the south and Okeechobee at the northern part of the Lake are two major tournament activity centers.

Bass tournaments on Lake Okeechobee can be characterized as two types: (1) the regular tournaments organized and operated by local guide services; and (2) major destination tournaments that are sanctioned and draw both larger crowds of participants and larger numbers of anglers from farther away. Fishing tournament expenditures by participating anglers are not well documented nationally, but a spending analysis was completed for

a bass fishing tournament on Lake Toho in Osceola County in 2011 by the University of Florida/FAS Extension Service. The study documented spending categories for the Lake Toho bass tournament. It should be noted that the typical local tournament is usually 2 days, with early morning fishing starting the first day (most often a Saturday), followed by a second partial day, but with somewhat lower participation. This behavior suggests that lodging and dining opportunities would be greater on Friday nights, with some tournament participants going home late on Saturday or on Sunday, depending on the distance to be traveled. Florida freshwater fishing guides have participants from all over Florida, across the U.S. (though primarily from the southeast where bass fishing is most popular), and some anglers who arrive from Europe and Asia to fish 'The Lake' based on its reputation as a great angler destination. As might be expected, the total amount spent correlates to both the amount of time spent in the tournament as well as the distance traveled.

The largest proportions and amounts of spending at tournaments are for boat fuel and oil, overnight lodging (affected in part by the quality and number of rooms available), and truck/vehicle fuel to get to and from the tournament. These three categories represent over 65% of total expenditures; tackle, equipment and dining in restaurants total about 23% of total expenditures; and non-restaurant food purchases, clothing and incidentals, and parking fees consume most of the remaining average total spend. For every participant from out of Osceola County, average spending was over $700 for one tournament alone. This represents expenditure potentials for larger destination tournaments, rather than for the more regularly scheduled tournaments that take place several times a month on Lake Okeechobee.

Of course, expenditures such as those illustrated in Table 31 will not be made if the existing businesses and mix are incompatible with consumer demands and preferences. In other words, if there are multiple restaurant choices and options for lodging available, average spending could be higher, or lower if those choices are not available. **These spending patterns could be considered a preliminary indicator of sales potentials for destination tournaments in the Glades Region only if the tourism infrastructure is enhanced**.

The consulting team assessed the number of bass fishing tournaments currently scheduled on Lake Okeechobee, though not in the Glades. Using data from Florida Bass Tournaments' website, it was estimated that regularly scheduled/repeating bass tournaments attract approximately 600 to 1,200 angler visits annually, with tournaments occurring every month. The number of tournaments varies from a low of seven in July to a high of 23 in April. While individual tournament participation is not fully documented, by comparing awards listed, it is possible to suggest that the range of participation varies from a low average of 50 anglers per tournament (mostly participating in the first day) to a high of 100 participants (also mostly participating the first day).

As illustrated in Table 32, using expenditure potentials from the 2011 Lake Toho destination tournament, annual spending for these events (using a conservative average of low- to moderate- spending) results in a total of approximately $3.3 million. Using the same expenditures for a major tournament with estimated participation of 425 anglers

Table 31
Fishing Tournament Expenditures, Lake Toho, 2011

No.	Category	Amount Per Out-of-County Participant	% of Total Spent
1	Boat Fuel & Oil	$ 161.06	22.9%
2	Lodging	147.77	21.0%
3	Truck Fuel	138.24	19.6%
4	Tackle & Sports Equipment	87.21	12.4%
5	Food from Restaurants	74.96	10.6%
6	Food & Beverages from Stores	55.97	8.0%
7	Clothing	17.30	2.5%
8	Miscellaneous (sunscreen, souvenirs, etc.)	16.83	2.4%
9	Entertainment/Movie Purchase	3.40	0.5%
10	Ramp, Mooring, Parking Fees	1.21	0.2%
Total:		**$ 703.95**	**100%**

Source: University of Florida-IFAS Extension; RDS, LLC, May 2014.

and visitors, the economic value of each major tournament spending is approximately $225,000. This suggests that there are residual spending potentials that could support retail, food and lodging businesses in specific locations with good access points to the lake, assuming that reasonable quality options are available. With offerings that are higher quality and more varied than what is available today, indicators from other locations suggest that angler-related expenditures could range as high as $4.8 million per year, which would serve as a solid base for expansion into complementary non-fishing tourism recreation such as wildlife viewing, fan boat tours or other options that are compatible with conditions on Lake Okeechobee.

While a number of improvements to the Glades Region's tourism infrastructure will be required to achieve and sustain these types of expenditures, the consulting team notes that there are opportunities for retail and food service in communities like Pahokee that can provide a village center character, access to Lake Okeechobee at the Pahokee Marina, and (longer-term) specialty development opportunities on Torrey Island that could create destinations for lodging and food service in an 'Old Florida' setting and character. Since Lake Okeechobee is already a fishing destination and a proven commodity in attracting local/regional, state, national and selected international anglers, providing both infrastructure elements, adequate staffing levels and management, and carefully targeted marketing to selected segments could make this option possible in the near-term, as other tourism options can grow and develop over time.

Table 32
Lake Okeechobee Fishing Tournaments, 2014

Month	Tournaments Per Month	Participants Low	Participants Moderate	Participants High	Total Spend Low	Total Spend Moderate	Total Spend High	Total Annual Spending *(1)*	Major Annual Tournament Spending @ $704 Per *(2)*
January	21	50	75	100	$ 258,720	$ 665,280	$ 960,960	$ 591,360	
February	14	50	75	100	172,480	443,520	640,640	308,000	
March	14	50	75	100	172,480	443,520	640,640	308,000	
April	23	50	75	100	283,360	728,640	1,052,480	506,000	
May	11	50	75	100	135,520	232,320	503,360	183,920	
June	9	50	75	100	110,880	285,120	411,840	198,000	
July	7	50	75	100	86,240	221,760	320,320	154,000	
August	11	50	75	100	135,520	348,480	503,360	242,000	
September	10	50	75	100	123,200	316,800	457,600	220,000	
October	10	50	75	100	123,200	316,800	457,600	220,000	
November	11	50	75	100	135,520	348,480	503,360	242,000	
December	6	50	75	100	73,920	190,080	274,560	132,000	
TOTAL:	**147**	**600**	**900**	**1,200**	**$ 1,811,040**	**$ 4,540,800**	**$ 6,726,720**	**$ 3,305,280**	**$ 224,400**

(1) Assumes midpoint between low and moderate spending categories of existing tournaments.
(2) Assumes 425 participants, of which 75% are visitors.

Source: www.FLBassTournaments.com; RDS, LLC, May 2014.

Industry Cluster: Transportation & Logistics (Intermodal Logistics Centers)

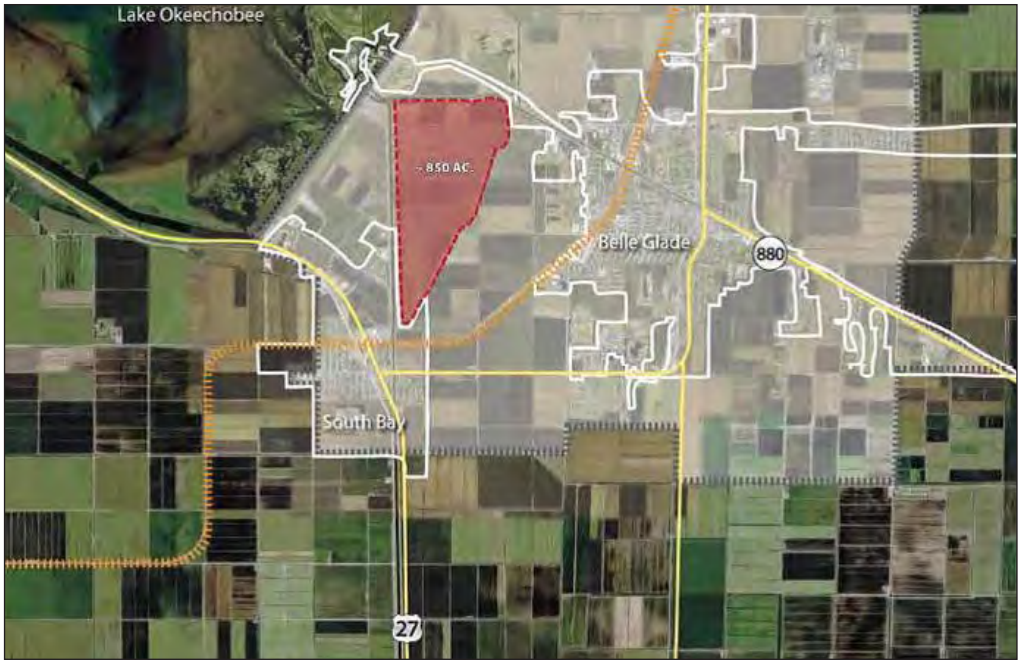
The announcement of future development of a major Intermodal Logistics Center (ILC) in the Glades, to be located between South Bay and Belle Glade, has generated significant interest in the opportunities for workforce skills enhancement and training programs to provide them, as well as opportunities for collateral industries that are necessary for operations of logistics and warehousing/transfer facilities.

South Florida Intermodal Logistics Center (ILC)

Based on information provided by Palm Beach County Department of Economic Sustainability, the South Florida Intermodal Logistics Center (ILC) is a priority project for the county. The ILC is proposed on an 850-acre site located in unincorporated western Palm Beach County. The project can include the following:

- Up to 9.7 million sq. ft. of distribution center and warehouse functions
- Up to 252,000 sq. ft. of office space, and
- An Intermodal Container Transfer Facility (ICTF) and a container yard

Figure 3
Proposed Location—Intermodal Logistics Center (ILC)



As illustrated in Figure 3, the property is nearly adjacent to U.S. Highway 27 and State Road 80 as well as the Florida East Coast (FEC) Railway, which connects to the main line of the FEC Railway in Fort Pierce and to the CSX in Sebring. The property is proximate to both Belle Glade and South Bay, which would provide an available workforce to enable prompt construction and a long-term employment base.

Figure 4
Proposed Site Plan (As of 05/01/2012) - Intermodal Logistics Center (ILC)

Access to the ILC property would be via Avenue E, which is located at the site's eastern perimeter. A second access point is planned with the extension of Hooker Highway that would tie into the ILC at its northern end. A third access point can be provided at the site's southwestern tip to provide direct access to U.S. Highway 27. A railway connection to the FEC Railway is planned at the site's southern tip and along the Avenue E right-of-way.

While many specifics of the proposed ILC are not available (i.e., projected employment levels by category, phasing and types of facilities to be constructed over time, key market segments to be served, range of modal connections in the proposed ILC network), there are certain operating and competitive characteristics that are likely to emerge as part of an implementation strategy for the Glades ILC. To understand the range of market potentials for the project and site, the context for development of Intermodal Logistics Centers should be considered.

The increase in globalized trade and evolution of related freight logistics has created a new focus on how and where goods are produced, shipped, transferred and delivered in the United States. The background is complex, both in terms of geographic differences and available freight volumes and in the capacity of existing ports and intermodal centers to handle them. Transportation modes include: trucks (dependent on trucks and interconnected highway networks); ships (dependent on water- and land-side capacities for freight handling, especially of Twenty-foot Equivalent Units or TEUs, generally known as containers); air (reliant on airport handling capacity and security management for airplane-delivered freight); and rail (which is controlled by private companies and is less expensive than truck-based shipping and less flexible in its destination adaptability.

Non-containerized shipped goods may be described under three major categories:

- **Break Bulk Cargo**—non-containerized and shipped as bulk materials in many sizes. This cargo category refers to commodities and products such as lumber, paper products, steel, vehicles or other processed or finished goods.

- **Dry Bulk Cargo**—usually raw materials such as coal, grain, ores, cement or other materials and commodities that do not adapt well to TEU- based shipments.

- **Liquid Bulk Cargo**—such as oil and petroleum, compressed natural gas (CNG), chemicals, and liquid edibles.

Those products that cannot be shipped in TEUs should not be considered as likely cargo types for the Glades ILC, as the location does not lend itself to break bulk, dry bulk or liquid bulk cargo products. The ILC will need to plan for the shipping, transfer, consolidation, warehousing, and distribution of goods arriving or departing on different transportation modes. Rail and highway connections for truck-based shipping will be the primary unit type to be managed and handled at the ILC site.

By definition, an intermodal logistics center (ILC) should be serviced by at least two modes of transportation shipment and should provide efficient means to transfer goods between modes. In water ports, ship-to-rail or ship- to-truck transfers represent the intermodal system connection. For inland port/logistics facilities such as the Glades ILC, it is more likely that the intermodal transfers will occur between rail and truck modes, with the accompanying storage facilities for TEUs, appropriate warehousing facilities suited to particular products (e.g., refrigerated, non-refrigerated, storage yards for TEUs, free trade zones or other commercial/regulatory facilities, and additional ancillary functions). The size and connectivity of any ILC will affect its ability to meet market demand and evolve with future transitions in the shipping and freight logistics industry.

ILCs are also sometimes combined with freight distribution centers, which can provide services that add value to products. These services can include warehousing and storage of goods until delivery to specific consumer markets (for example, a Wal-Mart distribution center might receive, re-package, load and ship goods from large scale deliveries to

store-specific trucks managed to take exactly what is needed to re-merchandise shelves). Alternatively, finished products such as foreign-made appliances may be shipped to central warehousing facilities and held until requested by a wholesaler, retailer or other business type. Warehousing and distribution centers (DCs) are often located adjacent to ILCs and may be constructed as build-to-suit facilities linked to a specific manufacturer, or may be more speculative, completing space in anticipation of future storage demand from multiple locations and producers. Other services may include packaging/re-packaging or labeling.

The amount of time spent in the facility can also affect both cost and function; for example, in a FedEx or UPS freight-forwarding facility, the goods arrive, are transferred and shipped out very rapidly, but a warehousing facility may hold goods for some time until it is requested from the consumer or reseller. The time-value of each facility will differ accordingly. The future build out of the Glades ILC has not been publicly finalized, nor should it be, as the full buildout and mix of land uses may change over time.

As global trade has increased, both for raw commodities and finished products, logistics have taken on a more prominent role in economic development. One estimate says that the financial costs of logistics, shipping and transfer now account for 10% to 15% of total world GDP. For commodities products, and economies that are dependent on extraction of raw goods, logistics costs typically range from 20% to 50% of total added value.

This means that, as more goods are moving further across the world and between production and product consumption centers, the efficiency with which those goods are moved, transferred and delivered has a significant effect on added value and profitability. This is particularly true for higher-valued finished products, as the holding time taken by less efficient logistics systems adds carrying costs which reduce margins, and deplete some of the value-added by manufacturing or producing in lower labor cost locations.

Florida's global competitive position for logistics and intermodal shipping trade has undergone a major shift in the past five years. The traditional role of Florida's ports and rail systems was to serve the Latin American and Caribbean markets, with a dominant role played by the Port of Miami. However, as Asian production centers expanded at a much higher rate than Latin America, the state needed to shift toward goods delivered from that region, and became dependent (as are other North American ports along the Gulf of Mexico and the Atlantic Ocean) on the Panama Canal for shipments to and from Asia. Western U.S. ports have traditionally handled about 26% of all goods shipped to the United States, with the South Atlantic (Miami to Norfolk, VA) serving another 24%. Northeastern ports (Baltimore, Philadelphia, the Port of New York, etc.) generate another 22% of total goods shipped.

Changing demand on East Coast ports and logistics centers has had an effect on Florida's (and the Southeast's) port and rail facilities, particularly since the early 1990s. Because Florida's traditional focus was on slower-growing markets in the Caribbean and Latin America, the explosion of Asia as a production center for goods intended for North

American and European markets resulted in two initial outcomes. First, California and Washington state ports grew exponentially in size and shipment volumes, which required substantial land adjacent or near the ports where ships arrived from Asia to simply hold and transfer TEUs to rail cars for shipment to central parts of the U.S. and cities on the East Coast. As volume demand exceeded supply, western ports could not handle the increased number of TEUs and the time needed to move goods by rail across country became problematic.

Second, container ships have been increasing in size for decades but were constrained by two global 'pinch points'—the Panama Canal and the Suez Canal. The Suez Canal is considerably larger than the Panama Canal in terms of ship size, but the political instability of the region has resulted in great pressure to expand the width of the Panama Canal, located in a dollarized economy and a country that will not be allowed to become unstable due to the global implications. The Panama Canal is currently being supplemented with a second series of canals and locks that are capable of handling far larger container ships. The volume of TEU capacities is increasing—from a range of 14,000 to 16,000 TEUs per ship—and is anticipated to grow to 20,000 TEUs per ship in the new Panama Canal (these vessels are sometimes called "Post Panamax Ships", and have re-set the minimum requirements for ports and ILCs.

Ports located in both Charleston, SC and Savannah, GA repositioned their facilities to accommodate increased containerized shipping capacity between 1996 and 2006. The Port of Savannah increased its capacity the most, growing to 340% of its 1996 volume of container shipping by 2006. This translated into growth from about 700,000 containers per year to 2.2 million containers per year. The Port of Charleston also expanded, although relatively somewhat less, increasing from 1.1 million containers per year to approximately two million containers per year, a growth rate of 180% of the port's earlier volume. By comparison, during this same period, cargo activity at the Port of Palm Beach remained relatively flat, growing from 350,000 containers per year to about 500,000 per year. The Port of Miami increased more than Palm Beach, but was constrained by its limited ship draft depth of 35 feet and the landside limitations of the rail, highway and truck access for loading/off-loading at the Port site.

In response to reduced market share for its ports and logistics/handling capacity, the State of Florida undertook a statewide effort to identify and develop what is known as the "Strategic Infrastructure System" (SIS), which incorporates 15 deep-water ports as well as the state's network of highways and rail lines (including the FEC, CSX and smaller regional rail systems developed in the 20th century). The SIS initiative has resulted in major dredging of channels to provide Post Panamax boat depths of 40+ feet, additional equipment such as the container cranes that can off-load ships directly to rail cars or trucks, and additional land capacity to provide for container storage and holding areas. The need for additional land- and truck/rail-based warehousing and distribution will be handled by a series of strategically located ILCs.

From a real estate perspective, ILCs may be developed in several ways. The proposed air-to-rail cargo facility adjacent to Miami International Airport in Miami Springs is already owned by the Florida East Coast Railroad, providing an instantaneous link to rail transportation along the FEC rail corridor on the eastern coast and through Palm Beach County going north. However, this site also connects directly to U.S. Route 27, which provides direct truck access to Belle Glade and connections to both I-75 and I-95 for truck transport access. CSX is also developing a rail based ILC near its corporate center in Roanoke, VA based on the same logic of rail to truck access due to the convenience and proximity to I-81, which is less congested than I-95 throughout the Northeast.

In addition, there are other ILC-type facilities proposed, including a freight airport facility in Hendry County's Clewiston area, and a proposed 4,000-acre ILC in St. Lucie County. These facilities may be organized and developed in partnership with third-party contract developers, such as Jones Lang LaSalle's industrial unit, or other experienced industrial/ logistics park developers such as CenterPoint. In some cases the facilities may be developed by one or more asset investors but have the facilities managed and operated by third-party logistics companies, often referred to as 3PLs. The consolidated property ownership and evolving public/private deal structure of the Glades ILC does not clearly detail the nature, build-out specifics or other aspects of the project, but the consultant team believes that the statewide SIS network is likely to result in more than one ILC facility in Florida. There are a number of variables that could affect implementation of future ILCs, including the long-term rail capacity of the FEC to handle the required volume of passenger and freight trains in the same corridor, community concerns about rail safety when rail lines are in close proximity to dense commercial and residential districts, public benefits and risks created by collateral development in heavily populated areas, and other issues.

The consulting team reviewed the South Florida Inland Logistics Center Preliminary Market Analysis FINAL Technical Memo, a report prepared by Martin Associates of Lancaster, PA in May 2008 that examined ILCs in Florida. This report (referred to herein as the "Martin Report"), which was prepared on behalf of the Florida Department of Transportation and The Port of Palm Beach, as well as various other industry sources, were reviewed to understand the economic and operating factors affecting costs, location and efficiency in ILCs; any and each may determine the successful outcome of implementation. With regard to the Glades ILC, those factors are:

- **Land Price**—the Glades ILC offers options for consolidated properties between Belle Glade and South Bay. While specific terms are not available, the fact that private land has been owned for some time and that publicly owned land may become available for collateral development, the basis for both types of property should be positioned to be very cost competitive, particularly since land costs are significantly higher in Greater Miami and in the eastern parts of Palm Beach County.

- **Labor Availability**—as identified in Section 2 of the Martin Report, unemployment rates in the Glades Region are high, both by regional and national standards.

Equally important, workforce skills need improvement. Initiatives underway with LORE and Palm Beach State College's cooperative programs with West Tech and its new campus in Loxahatchee, should improve local workforce skills, particularly those complementary to the proposed ILC (e.g., truck driving, truck motor repair and maintenance, logistics training, and other current and potential specialties). Importantly, CareerSource (Palm Beach County's Career Center in Belle Glade) is spearheading efforts to increase employment and economic opportunity in the Glades communities through its ongoing job placement, training and business connection programs.

- **Port of Entry Drayage Costs**—according to the Martin Report, in 2008 the Port of Palm Beach was somewhat less competitive in drayage costs than other Florida and regional ports. By focusing on PPB, Port Everglades in Fort Lauderdale, and the Port of Miami as 'feeder ports' to the Glades ILC, it should be possible to (a) reduce some drayage costs through competition and more efficient operations in the upgraded ports, and (b) counter drayage costs to some degree due to lower operating costs in this part of the county.

- **Rail & Highway Access to Consumption Markets**—the Glades Region does not enjoy the same direct access to major interstate highways that eastern locations do, but those highways are often congested, sometimes to capacity during peak hours. Although the driving distance may be longer, likely congestion delays will be less, simply because this is a less developed part of the state. U.S. Route 27 offers direct access to the Miami markets, I-75 connects to Florida's west coast, and I-95 can be accessed from Highway 98/441. As noted, concerns about road stability due to muck decline and/or the cost premiums resulting from de-mucking and potential truck volumes will need to be addressed.

- **Appropriate Timing (Near-, Mid-, Long-term)**—there are a number of unresolved implementation issues associated with the Glades ILC, but that should not be considered a negative, as the real estate product type of the Intermodal Transit Center is both new and not fully formed. As a development prototype, it will continue to be adapted for specific sites and industries, for site conditions and characteristics, and for unanticipated new directions in transport, shipping and logistics operations. The fact that the 850-acre site is assembled, that funding exists for the project's initial stages, and that the project is potentially part of the SIS network of sites, systems and integrated operations should allow for sufficient flexibility to respond to future changes accordingly.

Employment Estimates & ILCs

Similarly, there are no clear standard applications of economic impacts and employment patterns for ILCs. Research conducted by the consultant team did not identify any standardized practices for either early models of ILCs or the employment projections made for planned facilities. As part of our analysis, the consulting team examined a comparative range of characteristics of logistics centers, including: site sizes, developers, use mix, and employment ratios per 1,000 square feet of vertical development. These findings are illustrated in Table 33 and summarized below:

- Of the seven ILCs reviewed, site sizes vary significantly—from 161 acres at Virginia Inland Port in Front Royal, VA to 17,000 acres at Ross Perot's Alliance Logistics Park adjacent to DFW International Airport in Dallas, TX.

- In total, these seven ILCs comprise more than 23,000 acres of land with more than 47.9 million sq. ft. of vertical development, including warehousing and distribution, light assembly and manufacturing uses as well as commercial office space and hotels/ lodging.

- Several ILCs, including the CenterPoint Intermodal Center in Suffolk, VA and the Michelin @ RidgePort Logistics Center in Wilmington, IL, have significant excess capacity for additional vertical development: 5.8 million sq. ft. and 14 million sq. ft., respectively.

- Based on available data, these seven ILCs provide 36,900 jobs, which equates to a jobs ratio of 1.3 jobs per 1,000 sq. ft. of vertical development.

- While the future/ultimate site capacity for containers at the Glades ILC is unknown at this point, another industry guideline for intermodal logistics centers suggests that between 0.9 and 1.2 permanent jobs are created for every 1,000 containers processed per year.

Table 33
Comparative Ratios of Jobs at Existing and Planned Intermodal Logistics Centers

Name	Location	Site Size (Acres)	Vertical Dev't (SF)	Estimated Jobs	Jobs Per 1,000 SF	Notes
Virginia Inland Port	Front Royal, VA	161	8,500,000	7,000	1.2	
CenterPoint Intermodal Center	Joliet/Elwood, IL	2,300	700,000	1,500	0.5	
CenterPoint Intermodal Center	Houston, TX	689	7,500,000			
Alliance Logistics Park	Alliance (DFW), TX	17,000	29,000,000	28,000	1.0	
CenterPoint Intermodal Center	Suffolk, VA	937	337,000	75	4.5	Capacity for 5.8 million SF
Yanfeng @ Logistics Park KC (LPKC)	Kansas City, MO	443	258,000	263	1.0	
Michelin @ RidgePort Logistics Center	Wilmington, IL	1,500	1,700,000	60	28.3	Capacity of 14 million SF
AVERAGE/TOTAL:		**23,030**	**47,995,000**	**36,898**	**1.3**	
Glades Intermodal Logistics Center	Belle Glade FL	850	TBD	TBD		Capacity of 10 million SF

Source: RDS, LLC, May 2014.

5. Economic Development Strategies

Introduction

The preceding analysis of demographic characteristics, real estate market conditions and target industry reviews is intended to serve as the basis for preparation of a draft set of economic development strategies. These strategies consider local conditions in each of the three municipalities and unincorporated area comprising the Glades Region, and the community's vision to the extent possible, and focus on meeting the objectives identified in the plan, such as net new job creation, training and workforce development, entrepreneurial opportunities, and others as identified.

As each of the land use categories analyzed as part of the plan will have different market and financing requirements as well as thresholds for supporting job creation, training and workforce development, an understanding of the synergies between uses that foster comprehensive economic development is critical.

Key objectives of this task include:

- Estimating overall potentials of land uses analyzed in Section 3 as a framework for economic development initiatives and strategies, such as spin-off impacts generated by the ILC for new housing and general retail uses;

- Translating the findings of the target industry review in Section 4, to the degree possible, into opportunities within specific sectors as a key component of the economic development strategies;

- Identifying entrepreneurial opportunities as part of these strategies designed to meet key objectives such as job creation; and

- Presenting relevant case studies of agriculture and tourism-related businesses as potential models for future implementation under the economic development plan, including profiles of how such operations are funded and operated.

Preliminary economic development initiatives are both regional and local in their applicability. For example, there are systematic regional issues relating to reported construction cost premiums as a result of muck soil to buildings, infrastructure, and roads. At the local level, the differing characteristics of Belle Glade, Pahokee, South Bay, and in the unincorporated areas such as Canal Point each suggest specialized opportunities as well as challenges that will affect the degree and timing of implementation of key recommendations and strategies. It would be inappropriate to assume a single approach would apply equally to all locations. In addition to the community-focused recommendations, there is also a regional tourism concept that relates to the agriculture and sugar industry, sugar production, and its legacy in Florida. That concept is provided as a more regional solution, and in our view would be best located in its own location in the sugar fields, somewhere in an unincorporated part of the study area. This is suggested for two reasons:

- First, the educational value of the agriculture/sugar center is best represented in the setting in which the industry is working–seeing the fields in cultivation and the vastness of the agricultural area is part of the interpretative message;

- Second, the tourist-based infrastructure necessary to make the communities in the Glades study area tourist destinations are not yet evolved to the point that they are tourist-welcoming.

As that process evolves (most likely in incremental changes over a number of years), the total visitor experience for the agriculture/sugar center should be more self-contained and structured as a partial day-trip, with educational exhibits and possible limited food service and retail associated with the message included as part of on-site visitor activities (e.g., selling small bags of organic sugar produced in the Glades, the first organic sugar produced in the United States).

General Recommendations

- Seek sources of funding to finance the installation of clear directional sign systems for key tourism destinations (Pahokee and the future Agriculture/Sugar Visitor Center) from Palm Beach, West Palm Beach and Wellington as well as before Lion Country Safari. Visitors must be 'notified' at each decision point while driving. The 441/80/ Hooker Highway corridor will be the primary tourist path/entry from the eastern part of Palm Beach County, and should be the focus of signage improvements as tourism destinations are completed.

- Seek sources of funding to finance the installation of clear directional signs for the ILC within three months of the opening of its first phase. All truck traffic should be directed away from residential and commercial areas to minimize road damage due to muck soil conditions.

- Continue to seek funding sources which will enable financing the implementation of improvements which address wastewater treatment and management, muck/soils issues, roadway network, drainage, transit stops and services and other infrastructure challenges in the Glades Region; economic development cannot happen without stable, predictable infrastructure services.

- Support continuing education for Glades residents to enhance workforce skills, reduce unemployment levels, and prepare local residents for jobs in the tourism industry (and supporting hospitality and food service businesses) as well as the range of construction and permanent jobs associated with the Glades ILC.

- Continue to build public and private partnerships through County government, the CareerSource West Career Center, Palm Beach County Convention & Visitor's Bureau/Discover Palm Beach County, the Business Development Board, the Palm Beach State College system and other organizations and agencies.

- Seek funding sources to finance the development of updated plans for commercial centers in West County communities to provide direction and priorities for future capital investment projects (both public and private).

- Seek funding sources to finance a comprehensive tourism development strategy to position the Glades Region to attract, provide services for, and sustain a share of the County's tourism market, both for economic development purposes and to capitalize on assets like freshwater fishing and boating on Lake Okeechobee and interpretation/ education about the County's role in agriculture and sugar production.

- Support the upgrade of hotel and food service offerings both for potential visitor markets as well as future ILC-related businesses.

- Support the enhancement of educational programs at WestTech to address future job skills requirements for the ILC (see range of job categories described in Section 5). The Certificate of Professional Preparation and trade-oriented training in engine maintenance, welding, construction and electrical services are a strong base, but will require committed funding, staffing and additional facilities to expand capacity.

- Seek corporate and foundation funding for demonstration projects, innovative redevelopment concepts (such as the Agriculture/Sugar Visitor Center) and other sources to facilitate projects like a small resort concept at Torrey Island and in downtown Pahokee.

The Glades Communities

Before describing specific implementation strategies relating to tourism and business/ development activities associated with the Glades ILC, the market opportunities, strengths and challenges facing the cities of Belle Glade, Pahokee and South Bay are summarized below as context for broader opportunities and challenges in each location.

Each of the communities in the Glades Region have different issues and degrees of relative opportunity to change their economies, largely through enhancements that respond to underserved market uses, whether residential and industrial uses related to the ILC; the need to improve workforce skills and the institutions that are positioning themselves to provide that specialized training; or the ability to access Lake Okeechobee for fishing and traditional Florida outdoor recreation activities such as fan boat tours, other types of boating, camping; and, creation of new lodging alternatives or the supporting retail and food services that tourists expect and need.

Market/development opportunities in each community for key uses, including: new housing (generated by population growth based on revised forecasts prepared by Palm Beach County) as well as 'workplace' uses such as multi-tenant office and general industrial space are illustrated in Table 34 through Table 36 at the end of this section. In addition, a summary of key civic initiatives and recommendations is included for each community. With this context in mind, the following focus areas for longer-term redevelopment are recommended:

City of Belle Glade

With a population of 17,800 residents in 5,800 households, Belle Glade is the largest municipality in the Glades Region. However, it remains a small market by most retail development standards. Its key challenges include: real and perceived crime issues: patterns of disinvestment and physical obsolescence in the central part of the city; a current unemployment rate of 19% and a poverty rate of 35%; and, low average household incomes (of $37,961) suggest that economic repositioning of Belle Glade will be dependent on a combination of factors, most of which will be tied to development and job creation associated with the ILC:

- **New Housing**—Belle Glade needs new housing in a variety of product types, including: 1) replacement housing for current residents living in units suffering from functional and physical obsolescence; and 2) the provision of better quality, market-rate housing options for future employees of the ILC who will have multiple locations and choices on where to live. We have noted elsewhere in this report that the reported 20% premium in construction costs in the Glades Region presents multiple challenges from an engineering standpoint for foundations and infrastructure systems as well as a cost and financing perspective, in which future investors and buyers will likely pay 20% more to get the same product that could be constructed for lower cost in locations without muck soil.

  As illustrated in Table 34, Palm Beach County growth forecasts suggest a **population increase of almost 5,600 new residents in Belle Glade over the next 20 years (2035)**. If the city's average household size of 2.99 is maintained, this could potentially translate into **1,869 new households, or new housing units**. If the city's current distribution of housing types is maintained, this could yield roughly 780 single-family detached and attached units; almost 900 multi-family units; and 200 mobile home units. However, as noted in Section 3, there are an estimated 566 existing (true) vacant housing units in Belle Glade today, and the degree of functional and/or physical obsolescence is not known at this time. That is, an evaluation of existing vacant units needs to be conducted to determine the overall capacity/marketability of existing vacant units to accommodate some portion of future demand for new housing generated by population growth.

  Given the presence of muck soils, it is critical to understand the overall "carrying capacity" in Belle Glade to accommodate new, market-rate (as well as workforce/affordable) housing units. Identifying those locations with the lowest risk/degree of muck soils as a means of reducing the investment risks inherent in this challenge will be critical.

- **Tourism/Visitor Potentials**—the best opportunity for tourism development in Belle Glade is based on its proximity to Torry Island in Lake Okeechobee. This attractive natural setting has previously had several initiatives identified to develop a small fishing, camping and environmental education visitor experience that could draw and sustain a selected number of visitors throughout the year. Fishing guide services already exist in the area, and a fan boat tour program could also work well at Torry Island because of the history and natural environment of its setting.

  However, since the physical and economic challenges of Belle Glade are less well-matched for the overnight visitor market at this time, the stronger opportunity would be to position and market future small resort facilities at Torry Island as stand-alone/self-contained destinations. The beauty of the setting and combination of plant materials, wildlife and fishing would appeal to both Florida residents (for whom wildlife viewing is a top-rated activity, in addition to fishing) as well as domestic and foreign visitors to Palm Beach County. Initial efforts to understand the overall viability of stand-alone tourist facilities on Torry Island are critical, and include market/financial feasibility studies to determine market potentials and investment viability as well as physical planning studies to identify locations, physical opportunities and constraints and the like. Such efforts will guide pursuit of future funding mechanisms, including opportunities for both public and private financing for such ventures.

- **Retail Services & Workplace Potentials**—while Belle Glade serves as the primary retail destination in the Glades Region, with approximately 469,000 sq. ft. of retail inventory, existing retail offerings in the city are generally more limited, due in large part to the relatively small size of the market, low population/household densities, and limited household spending power. In addition, the retail offerings are not centralized, but exist in small clusters located along State Route 80 and local secondary streets such as Avenue A. This reduces opportunities to create critical mass and to benefit from cross-shopping opportunities.

  In terms of retail market potentials in Belle Glade, our analysis indicates limited demand in the near-term. Opportunities for additional food service/restaurant and retail offerings and strengthened market demand for additional/better grocery stores are not likely until a critical mass of new jobs and new residents is generated by build-out of the ILC over time. In the interim, we recommend addressing the following critical issues as near-term core activities which are likely to impact overall marketability for future retail development in Belle Glade:

- Seek funding sources to finance the increased development cost associated with muck soil issues for roads and infrastructure

- Consider locations for new market-rate and workforce/affordable housing, and infrastructure improvements necessary to accommodate future development

- Consider strategies to address crime and crime prevention, and

- Continue efforts to develop jobs skills and workforce training

In terms of "workplace" (i.e., industrial and office) market potentials, several sites in Belle Glade may accommodate future growth. These include the Belle Glade Business Park as well as the site of the former Glades Correctional Institute. We understand that a local group has offered $1.2 million for the vacant correctional facility, which closed in December 2011, and comprises 53 buildings on a 211-acre site. The group is seeking to annex the site into the City of Belle Glade. Market/development potentials for office and industrial uses in Belle Glade are illustrated in Table 35 and Table 36 at the end of this section.

The analysis suggests that Belle Glade's fair share of near-term job growth in Palm Beach County would translate into potentials for **10,000 to 12,000 sq. ft. of office space and 25,000 to 30,000 sq. ft. of general industrial space over the next eight years**. That is, this represents the future share that the city may capture based on natural market growth through 2021 (latest year of employment forecasts). Incremental spin-off opportunities generated by the ILC cannot be determined until more specific, relevant information on the development program, job types and tenant mix for the ILC is provided.

Summary of Key Civic Initiatives—Belle Glade

- Consider ways and means to improve the image of the community, especially along major roadway approaches to Belle Glade.
- Support business improvement activities in downtown Belle Glade, and seek solutions to crime and unemployment over time.
- Support redevelopment efforts and initiatives in downtown Belle Glade.
- Seek funding to complete the roadway connection from Hooker Highway to provide truck access to the northern portion of the ILC site.
- Seek sources of funding to finance the additional cost to develop given muck soil conditions affecting construction of new housing and commercial development as well as existing buildings; this could involve some form of financial subsidy to reduce the estimated 20% cost premium for building on muck soils, as well as targeted engineering of solutions to existing issues.
- As the City's population increases through ILC activities, encourage the addition of stronger retail operators to the mix, including grocery, food & beverage and other retail categories, as market supportable.
- Encourage redevelopment in the downtown area to reduce blight and disinvestment by adding job opportunities and reducing crime and negative perceptions about Belle Glade.
- Consider locations for new infill housing in Belle Glade for future ILC employees who may move to the area, and upgrade housing stock for local residents who want to remain.

City of Pahokee

Pahokee appears to have the strongest prospects to concentrate a mixed-use village center concept in its historic core tied to tourism/visitor potentials. There are a number of older buildings that can be renovated; these include: the former Pahokee High School building on Highway 98 to the north of the center of town; the old Water Tower next to the Lake (which should be preserved and stabilized as a landmark and symbol of Pahokee and 'Old Florida').

- **New Housing**—Similar to Belle Glade, Pahokee also needs new housing in a variety of product types, including: 1) replacement housing for current residents living in units suffering from functional and physical obsolescence; and 2) the provision of better quality, market-rate housing options for future employees of the ILC who will have multiple locations and choices on where to live. Likewise, the challenges associated with muck soil as discussed above will require attention and viable solutions that address foundations and infrastructure systems as well as costs and financing/ feasibility.

  As illustrated in Table 34, Palm Beach County growth forecasts suggest a population increase of 1,935 new residents in Pahokee over the next 20 years (2035). If the city's average household size of 3.22 is maintained, this could potentially translate into 600 new households, or new housing units. If the city's current distribution of housing types is maintained, this could yield roughly 350 single-family detached and attached units; more than 135 multi-family units; and over 115 mobile home units. However, as noted in Section 3, there are an estimated 266 existing (true) vacant housing units in Pahokee today, and the degree of functional and/or physical obsolescence is not known at this time. That is, an evaluation of existing vacant units needs to be conducted to determine the overall capacity/marketability of existing vacant units to accommodate some portion of future demand for new housing generated by population growth.

  Given the presence of muck soils, it is critical to understand the overall "carrying capacity" in Pahokee to accommodate new, market-rate (as well as workforce/ affordable) housing units. Identifying those locations with the lowest risk/degree of muck soils as a means of reducing the investment risks inherent in this challenge will be critical.

- **Tourism/Visitor Potentials**—Pahokee's locational advantages include its adjacency to Lake Okeechobee, providing immediate access to the lake at the Pahokee Marina & Campgrounds, which can be a point of departure for airboat rides, wildlife viewing and fishing. Despite the quaint character and more pedestrian friendly public spaces in Pahokee, there is currently very little food and beverage service that would appeal

to tourists, no conventional lodging facilities tied to reservation systems, and no retail selling fishing tackle, gear or apparel.

While food service operations at the Pahokee Marina have had ongoing management challenges and the marina requires selected dredging to be fully functional, both facilities are functional and can be repositioned as part of a larger visitor strategy with appropriate marketing and funding. If this can occur, it might be possible to create a small inn at the levee, at a building height sufficient to provide lake views above the 30 foot levee. In addition, the vacant site at the intersection of Bacom Point Road and Main Street offers the opportunity to create a small-scale, mixed-use project offering single site control and a unified design concept intended to reinforce the scale of the historic center of Pahokee. In our view, the design should reflect the characteristics, scale and materials of a rural Florida village. While Pahokee has some of the same infrastructure and economic challenges that exist elsewhere in the Glades, its character, potential charm and attractive, palm-tree lined approach from the south on Bacom Point Road combine to create opportunities to reinforce Pahokee's historic past while adding selective new retail, residential, professional office, and possibly a specialized lodging facility to support tourism/visitor activities and strengthen its role as a destination in the Glades Region.

- **Retail Services & Workplace Potentials**—Market/development potentials for office and industrial uses, illustrated in Table 35 and Table 36, suggest that Pahokee's fair share of near-term job growth in Palm Beach County would translate into limited potentials for **5,000 to 7,500 sq. ft. of office space and 3,000 to 5,000 sq. ft. of general industrial space over the next eight years**. That is, this represents the future share that the city may capture based on natural market growth through 2021 (latest year of employment forecasts). Incremental spin-off opportunities generated by the ILC cannot be determined until more specific, relevant information on the development program, job types and tenant mix for the ILC is provided.

Summary of Key Civic Initiatives—Pahokee

- Work toward focusing tourism development opportunities in downtown Pahokee and at the Pahokee Marina which could result in upgrading the quality and range of offerings in proportion to tourism marketing and increased volume over time.
- Consider adding clear directional signs to Pahokee for visitors, who may arrive along Highway 98 from the south or along Muck Road, connecting to Old Connors Highway. This could also involve enhancements to approach roads to reinforce a visitor-friendly character.
- Recognize that fishing and Lake Okeechobee access are the foundations for adding new tourism infrastructure in Pahokee: lodging, food and beverage, selected retail services such as fishing supplies, camping, etc.
- As possible, retain and redevelop existing and historic buildings and structures, such as the Pahokee Water Tower and water facilities plant, the former High School building, and commercial structures located on Highway 98/441. Pahokee has more 'imageable' structures that would be attractive to visitors seeking an 'old Florida' character, but they remain an opportunity, and not yet a fully realized visitor market asset. Historic tax credits available from the Federal government could provide incentives for historic rehabilitation under the Secretary of the Interior's Guidelines; these programs are administered by the Florida State Historic Preservation Office.
- To capitalize on this character, it might be useful to consider developing design guidelines for future infill in downtown Pahokee to encourage the appropriate scale, materials, details and layouts to attract new businesses serving visitors and Pahokee residents.
- Consider streetscape improvements, including tree planting efforts such as the Royal (and other) Palms that have been planted along Bacom Point Road and Highway 98/441 from the south; this is a strong character and identity feature.
- Work to reduce/eliminate blight and disinvestment sites like the former hospital.
- As visitor volumes grow in the Pahokee area, add new food and beverage and targeted retail uses that will serve both tourist and resident markets.
- Pahokee is close to a number of agro-tourism sites, specialty farms and other agro-businesses that could benefit from a focus on Farm-to-Table restaurants and cafes. A food-based retail concept could be considered for downtown Pahokee as part of both the tourism marketing plan and as a business development strategy for the City.
- Consistent with the challenges of muck soils throughout the Glades Region, continue to seek sources of funding to finance the additional cost associated with developing in the Glades given muck soil issues for construction and infrastructure in Pahokee.

City of South Bay

The City of South Bay is located adjacent to the 850-acre site of the proposed Intermodal Logistics Center, and has direct access to Lake Okeechobee on the levee. Its key challenges are in some ways similar to Belle Glade, with real or perceived crime issues: patterns of disinvestment and physical obsolescence; a current unemployment rate of 22% and a poverty rate of 42%, which is the highest in the entire Glades Region; and, low average household incomes (of $36,110) suggest that economic repositioning strategies for South Bay will also be dependent on a combination of factors, particularly development and job creation associated with the ILC:

- **New Housing**—Similar to Belle Glade, South Bay also needs new housing in a variety of product types, including: 1) replacement housing for current residents living in units suffering from functional and physical obsolescence; and 2) the provision of better quality, market-rate housing options for future employees of the ILC who will have multiple locations and choices on where to live. Likewise, the challenges associated with muck soil as discussed above will require attention and viable solutions that address foundations and infrastructure systems as well as costs and financing/ feasibility.

  As illustrated in Table 34, Palm Beach County growth forecasts suggest a **population increase of more than 3,300 new residents in South Bay over the next 20 years (2035)**. If the city's average (large) household size of 3.43 is maintained, this could potentially translate into **970 new households, or new housing units**. If the city's current distribution of housing types is maintained, this could yield roughly 550 single-family detached and attached units; 350 multi-family units; and 70+ mobile home units. However, as noted in Section 3, there are an estimated 139 existing (true) vacant housing units in South Bay today, and the degree of functional and/ or physical obsolescence is not known at this time. Should resources be available, an evaluation of existing vacant units could be conducted to determine the overall capacity/marketability of existing vacant units to accommodate some portion of future demand for new housing generated by population growth.

  Given the presence of muck soils, it is critical to understand the overall "carrying capacity" in South Bay to accommodate new, market-rate (as well as workforce/ affordable) housing units. Should resources be available, identifying those locations with the lowest risk/degree of muck soils as a means of reducing the investment risks inherent in this challenge could be undertaken.

- **Retail Services & Workplace Potentials**—South Bay's locational advantages include its adjacency to the proposed ILC as well as excellent highway access via U.S. Route 27 to the major metropolitan markets in Fort Lauderdale and Miami, located approximately 60 to 120 minutes to the south. With regard to retail opportunities, South Bay's existing 40,060 sq. ft. of food service and retail inventory as well as its lodging supply are not currently conducive to tourism development associated with Lake Okeechobee in the same way as Pahokee's locational characteristics as a walkable, image-able place. However, South Bay's access and proximity to the lake suggest that there could be future opportunities tied to recreational fishing depending on the magnitude and success in creating cohesive strategies and marketing for fishing tournaments. The South Bay RV Park, operated by the county's Parks & Recreation Department, is a very attractive recreational facility that should be included as an integral component of any tourism marketing strategies. However, there exists the possibility of significant negative impacts created by truck traffic of the proposed ILC. The market analysis suggests limited near-term demand for additional retail opportunities.

  Over time and as build-out of the ILC is ongoing, market opportunities for industrial and supporting business facilities (such as warehousing, shipping and forwarding, and other collateral industries) will be enhanced. Other key factors associated with future market potentials for industrial and other supporting uses tied to the ILC include the amount of net developable land available to accommodate these uses at the South Bay Park of Commerce, which has a reported site size of 100 acres. The Park has the potential to create significant value for the City of South Bay in the form of net new property tax revenues, job creation and spin-off economic impacts. Should resources be available, the consulting team recommends that a site carrying capacity analysis be conducted to determine the extent of muck soils and right-of-way required for the proposed road through the Commerce Park linking the ILC to U.S. Highway 27. Again, if resources are available, this should also include order-of-magnitude cost estimates for infrastructure improvements required to ready the park for development, and as the basis to commence marketing and recruitment strategies for end users.

  Market/development potentials for office and industrial uses, illustrated in Table 35 and Table 36, suggest that South Bay's fair share of near-term job growth in Palm Beach County would translate into potentials for approximately **10,000 sq. ft. of office space and 20,000 to 25,000 sq. ft. of general industrial space over the next eight years**. That is, this represents the future share that the city may capture based on natural market growth through 2021 (latest year of employment forecasts). Incremental spin-off opportunities generated by the ILC cannot be determined until more specific, relevant information on the development program, job types and tenant mix for the ILC is provided.

Summary of Key Civic Initiatives—South Bay

- Consider incorporating potential rail and road linkages and improvements to strengthen connections for the ILC site's first phase.
- Consider ways to improve hotel and food service offerings in key locations such as U.S. Route 27 as opening of the ILC approaches; additional variety and ranges of quality will broaden market opportunities.
- Consider locations for one or more major Truck Service Plazas that will complement the ILC traffic and operations; this will include service stations, 24-hour restaurants, lodging, and specialized retail.
- Consider ways and means to improve connectivity and image along approach roads and access to Torrey Island if it becomes a further developed fishing/wildlife visitor destination; improvements could be tied to recommendations identified as part of a comprehensive tourism development plan/strategy for the Glades Region.
- Consider locations for new infill housing in South Bay for future ILC employees who may move to the area.
- Seek sources of funding for additional streetscape enhancements for residential areas of South Bay, and provide both separate routes and clear directional signs for ILC-bound truck and other traffic.

Unincorporated Area

Presuming readily-developable sites, unincorporated parts of the Glades Region study area offer a strong opportunity to introduce new housing of varying product, with market demand generated by job growth and other initiatives identified in the plan that are intended to improve economic opportunities throughout the Glades Region. Based on revised County forecasts prepared in October 2014, the population of the unincorporated area is expected to increase by more than 7,200—to 12,800+ by 2035. As illustrated in Table 34, if the area's current average household size of 3.12 persons per household is maintained, this could potentially translate into market opportunities for more than **2,300 new households, or new housing units**. If the unincorporated area's current distribution of housing types is maintained, this could yield roughly 1,450 single-family detached units, and 850+ multi-family units over the next 20 years somewhere in the unincorporated area.

In total, future population growth of 18,000+ may yield market opportunities for more than 5,700 new housing units throughout the Glades Region study area based on the assumptions above.

Table 34
Housing Potentials, 2013-2035

			County Forecasts *(1)*		
Municipality	2013	As % of County	2035	As % of County	Population Change
Population Forecasts					
Palm Beach County	**1,322,306**		**1,606,900**		**284,594**
City of Belle Glade	17,402	1.3%	23,008	1.4%	5,607
City of Pahokee	5,858	0.4%	7,793	0.5%	1,935
City of South Bay	4,711	0.4%	8,018	0.5%	3,307
Unincorporated Area	2,173	0.2%	7,752	0.5%	5,579
Total-Study Area:	**30,144**	**2.3%**	**46,572**	**2.9%**	**16,428**

	Population Change	Average Household Size *(2)*	2035 Units
Housing Unit Forecasts			
City of Belle Glade	5,607	2.99	1,875
City of Pahokee	1,935	3.22	601
City of South Bay	3,307	3.41	970
Unincorporated Area	5,579	3.12	1,788
Total-Study Area:	**16,428**		**5,234**

	Belle Glade		Pahokee		South Bay		Unincorporated Area	
	% Dist. *(3)*	Units	% Dist. *(3)*	Units	% Dist. *(3)*	Units	% Dist. *(3)*	Units
2035 Potential Unit Types								
Detached	39%	737	55%	331	56%	540	63%	1,125
Attached	2%	42	3%	17	1%	11	0%	-
2 Units	11%	201	7%	43	11%	104	0%	-
3 or 4 Units	14%	254	6%	38	12%	119	15%	263
5 to 9 Units	6%	121	3%	18	7%	73	10%	188
10 to 19 Units	9%	167	3%	18	1%	13	12%	213
20 to 49 Units	6%	117	1%	8	4%	39	0%	-
50+ Units	2%	36	2%	12	0%	-	0%	-
Mobile Home/Other	11%	200	19%	116	7%	72	0%	-
Total Units-2035:		**1,875**		**601**		**970**		**1,788**

(1) Population forecasts obtained from the 2013 Population Allocation Model prepared by Palm Beach County.

(2) In order to convert 2035 population growth into housing units, analysis assumes that each municipality's average household size from 2012 remains the same in 2035.

(3) In order to estimate potential unit types in 2035, analysis assumes that the distribution of housing types in each municipality from 2012 remains the same in 2035.

Source: Palm Beach County Department of Planning, Building & Zoning; WTL+a, June 2014.

Table 35
Office Potentials, 2013-2021

Industry Sector	New Jobs 2013-2021	% Office-Using	SF Occupancy Factor	2021 Demand (In SF)
Palm Beach County				
Resources & Construction	8,808	10%	175	154,100
Manufacturing	878	20%	200	35,100
Transp/Communications/Utilities	600	40%	200	48,000
Wholesale & Retail Trade	9,971	20%	175	349,000
Finance/Insurance/Real Estate	3,923	85%	275	917,000
Services				
Professional, Scientific & Technical Services	9,414	90%	250	2,118,200
Management of Companies & Enterprises	981	60%	250	147,200
Administrative & Waste Management	7,494	35%	175	459,000
Educational Services	2,370	20%	200	94,800
Health Care & Social Assistance	15,869	35%	200	1,110,800
Arts, Entertainment & Recreation	2,750	20%	175	96,300
Accommodation & Food Services	7,352	20%	175	257,300
Other Services (Except Government)	2,004	35%	200	140,300
Government	7,544	60%	150	679,000
Self-Employed	4,375	10%	175	76,600
Total/Weighted Average:	**84,197**	**38%**	**193**	**6,682,700**
+ Vacancy Adjustment @		5%	*(1)*	334,100
+ Cumulative Replacement Demand		7.5%	*(2)*	501,200
Gross Demand - Palm Beach County (SF):				**7,518,000**
Existing Vacant Office Space		4,984,031		
- *Lease-up Required @*	*50%*	(2,492,016)	*(3)*	(2,492,016)
Remaining Vacant Space:		**2,492,016**		
% Vacant		*10.0%*		
2021 Countywide Net Demand (SF):				**5,026,000**
Glades Region Demand				
Palm Beach County Office Inventory (In SF)				**24,920,157**
Fair Share Scenario				
City of Belle Glade Office Inventory				56,712
As % of Palm Beach County				**0.23%**
2021 Demand-Belle Glade (In SF):				**11,400**
City of Pahokee Office Inventory				27,048
As % of Palm Beach County				**0.11%**
2021 Demand-Pahokee (In SF):				**5,500**
City of South Bay Office Inventory				48,157
As % of Palm Beach County				**0.19%**
2021 Demand-South Bay (In SF):				**9,700**

(1) This allows for a 5% "frictional" vacancy rate in new office space delivered to the market (i.e., this accounts for tenant movement to new space).

(2) This represents new space required by existing businesses to replace obsolete or otherwise unusable office space. office space. This is assumed to represent 7.5% of total demand.

(3) From a financing perspective, some portion of existing vacant office space in Palm Beach County will need to be leased before financing of new construction is viable. Since the County's current office vacancy rate is high (20%), the analysis assumes that 50% of existing vacant space is leased, reducing the overall vacancy rate to 10%.

Source: Florida Dept. of Economic Opportunity; CoStar, Inc. Cushman & Wakefield, Inc.; WTL +a, June 2014.

Table 36
Industry Potentials, 2013-2021

Industry Sector	New Jobs 2013-2021	% Industrial-Using	SF Occupancy Factor	2021 Demand (In SF)
Palm Beach County				
Resources & Construction	8,808	40%	350	1,233,100
Manufacturing	878	90%	350	276,600
Transp/Communications/Utilities	600	65%	650	253,500
Wholesale & Retail Trade	9,971	20%	750	1,495,700
Finance/Insurance/Real Estate	3,923	5%	500	98,100
Services	48,234	15%	450	3,255,800
Government	7,544	15%	300	339,500
Self-Employed	4,375	20%	300	262,500
Total/Weighted Average:	**84,197**	**19.2%**	**457**	**7,214,800**
+ Vacancy Adjustment @		5%	*(1)*	360,700
+ Cumulative Replacement Demand		7.5%	*(2)*	541,100
Gross Demand - Palm Beach County (SF):				**8,116,600**
Existing Vacant Industrial Space		2,757,913		
- *Lease-up Required @*	*25%*	(689,478)	*(3)*	(689,478)
Remaining Vacant Space:		**2,068,435**		
% Vacant		*5.0%*		
2021 Countywide Net Demand (SF):				**7,427,100**
Glades Region Demand				
Palm Beach County Industrial Inventory (In SF)				41,786,558
Fair Share Scenario				
City of Belle Glade Industrial Inventory				146,290
As % of Palm Beach County				**0.35%**
2021 Demand-Belle Glade (In SF):				**26,000**
City of Pahokee Industrial Inventory				22,174
As % of Palm Beach County				**0.05%**
2021 Demand-Pahokee (In SF):				**3,900**
City of South Bay Industrial Inventory				134,858
As % of Palm Beach County				**0.32%**
2021 Demand-South Bay (In SF):				**24,000**

(1) This allows for a 5% "frictional" vacancy rate in new industrial space delivered to the market (i.e., this accounts for tenant movement to new space).

(2) This represents new space required by existing businesses to replace obsolete or otherwise unusable industrial space. This is assumed to represent 7.5% of total demand.

(3) From a financing perspective, some portion of existing vacant industrial space in Palm Beach County will need to be leased before financing of new construction is viable. Since the County's current industrial vacancy rate is generally low/stabilized (6.6%), the analysis estimates that 25% of existing vacant space is leased, reducing the overall vacancy rate to 5%.

Source: Florida Dept. of Economic Opportunity; CoStar, Inc. Cushman & Wakefield, Inc.; WTL +a, June 2014.

Recommended Initiatives for Glades Economic Development

As economic development strategies for the Glades Region are implemented over time, in phases, they could be tied to both public and private investment initiatives that will generate additional employment and incremental improvements in succeeding years. The characteristics of the available labor force and the time and specific skills sets that will support employment at the Glades ILC suggest that the ILC's impacts may occur later than tourism infrastructure enhancements that can occur more incrementally and earlier in the process.

The following addresses the characteristics, challenges and opportunities identified in our analysis about the Glades Region study area. As a general observation, from a market perspective low population densities, the economic and demographic characteristics of most residents, and limited level of supporting retail and services for residents in the Glades Region suggest that future improvements will be small-scaled, incremental, and tied to improvements to the region's overall economy.

The four primary strategic implementation areas are described below in the most likely order of timing for both implementation and application of policy and financial incentives (to the degree that either may become possible):

- **Strategy #1: Local & Regional Tourism Development**
- **Strategy #2: Glades-based Visitor Attraction**
- **Strategy #3: Direct ILC-Related Workforce Skills Improvements**
- **Strategy #4: Indirect & Collateral Industries Employment Opportunities & Skills**

Each strategy is discussed in detail below:

Strategy #1: Local & Regional Tourism Development

This is the most likely near-term, and fundamental opportunity, for the Glades Region to reposition and strengthen its specialized offerings to the large and growing tourism market in Palm Beach County. The two prospects identified in our research include:

- Support efforts to attract a portion of the year-round visitors in the county for beach recreation, fishing and cultural experiences; and

- Consider creating a visitor destination related to sugar and agriculture that can draw some portion of visitors to the county's western sugar fields, providing an educational experience for residents, school groups and businesses interested in agriculture in Palm Beach County (see Strategy #2).

Unlike the ILC, which is site- and transportation-network focused, development of a successful tourism market in the Glades Region will require a broader and more complex response to physical conditions, clear way-finding, and directions along major roadways, and improvement of neglected or areas of disinvestment where tourists may go. This process can be catalyzed by one or two early stage initiatives, but they must be considered the baseline of a continuous process of improvement and supplemental services and experience. Tourists might come once for a particular visitor experience, but to sustain jobs and visitor-oriented investment, tourism must be sustained over time and have the ability to draw people back in the future. The decision to compete in the Palm Beach County tourism market is a long-term commitment that will require continuous efforts, not just a short-term strategy.

Most of the 5.5 to 6.0 million tourists and visitors to Palm Beach County stay in the eastern half of the County; drawn by urban densities, beaches, cultural attractions, proximity to airports and major highways, and other factors, the tourism infrastructure for Palm Beach County is clustered there. While the consultant team believes that **there is tourism development potential in western Palm Beach County, it should also be recognized that there are significant requirements in establishing a tourist-friendly character, amenities, hotel and dining options, and availability of attractions interesting enough to draw and sustain a visitor economy as well as to draw visitors back for repeat trips**.

Table 37 documents selected commercial and non-profit tourist attractions in Palm Beach County. The County, and West Palm Beach in particular, include a number of commercial and non-profit attractions that draw visitors from both resident and visitor markets. The top two destinations (Lion Country Safari in Loxahatchee and Rapids Water Park in West Palm Beach) are the two largest draws, with reported annual visitation of 500,000 and 400,000, respectively. Both are commercial (for-profit) enterprises and both charge significantly more than the non-profit museum attractions.

To attract and support capture of a share of total tourism in Palm Beach County, the Glades Region should seek to develop a well-rounded series of components required to support a 'Tourism Infrastructure'. These components could include:

- Destination attraction (or attractions): necessary to appeal to a broad cross section of travelers, ages, interests and income levels
- Easy accessibility: good roads, clear directional signs along that road network, and multiple modes of circulation, as possible
- Supporting services for visitors: hotels, restaurants, recreation/ nightlife/ cultural attractions/ historic representation of place, authenticity, recreational opportunities
- Safe and secure, attractive, clean and enjoyable, and
- Available, well trained labor force to support tourism infrastructure: attractions, hotels, food and retail staff, specialized services such as tour guides, outdoor guides, etc.

Table 37
Selected Visitor Attractions in Palm Beach County

Attraction	Location	Admissions Pricing	Hours of Operation		Estimated Annual Visitors	Tour Length	Type of Tour	Notes
			Days	Time				
Lion Country Safari	Loxahatchee	*Regular tickets:* Adults: $29.95 (10-64); Seniors: $26.99 (65+); Children $21.95 (3-9); *Guided Photo Tours:* 1.5 hour $75 (5 & up) ; 1.5 hours + park *Insider Tour:* $70 per person (10 -up); $46 per person (5-9); *VIP Tours:* $140 per person (10 - up); $110 per person (5-9); *Parking:* $6 per vehicle	Daily	9:30-5:30 (gates close at 4:30pm)	500,000	*Total:* 5 hours 1.5 hours drive through; 3.5 hours walk through	Commercial family-oriented open air drive-through safari experience to see over 800 wild animals roam freely; lions, camels, rhinoceroses, zebras, chimpanzee islands, giraffes; .75 acre water park, Ferris wheel, KOA campsite with 200 sites, 3 food and beverage, 5 stores, amusement rides area, petting zoo, veterinary hospital	Four mile driving safari route; opened 1967. short-term car rentals (no convertibles allowed): $10-$18 per 1.5 hours; 170 employees; sewer treatment plant on site; baby rhino born in 2013
Rapids Water Park	West Palm Beach	$39.95+tax M-F $43.99+tax Sat-Sun Sunset Swim (4-close): $19.99+tax M-F $23.99+tax Sat-Sun Season pass: $114.99+tax	Seasonal: M-F Mar 15-Aug 31 Weekends Sept - Oct	*Varies:* M-F 10-5 Sat/Sun 10-7	400,000	Varies	30-acre commercial water park: 35 slides, lazy river, 25,000 SF wave pool	2 snack bars, retail store; locker rentals: $8 -$12; parking $10, $20 preferred parking area
South Florida Science Center & Planetarium	West Palm Beach	*Museum:* Adults: $14; Seniors: $13.50 (62+); Children: $11.50 (3-12) *Planetarium:* Adults: $4; Seniors & Children: $2; Laser Concerts: $10	Daily	9-5 Mon-Fri 10-6 Sat-Sun	125,000	Varies	Non-profit science museum & planetarium. Changing exhibits, laser concerts, events & special programming on science, gems, outer space/astronomy	Special events, birthday parties, science summer camps; girls' science programs; retail 'science shop'; in-museum Subway sandwich shop
Norton Museum of Art	West Palm Beach	Adults: $12; Students: $5; Free Under 12	Tues - Sun	10 - 5; open late on Thursdays	100,000	Varies	Largest art museum in So FL (7,000 works); two expansions, new Master Plan to expand access, open space	Museum galleries, coffee bar, restaurant, museum store, weddings & event rentals
Palm Beach Zoo at Dreher Park	West Palm Beach	Adults: $18.95; Seniors: $16.95 (60+)	Daily	9-5	30,000		23-acre zoo, 1,400 animals; six major exhibit areas	*Amenities:* Interactive play fountain; Carousel; Tropics Café; gift shop; animal shows; zookeeper talks & demonstrations

Source: RDS, LLC; May 2014.

With these requirements in mind, how does the Glades Region 'stack up' to tourism potentials today?

Strengths & Opportunities

- **Proximity to Lake Okeechobee**— the three communities included in the Glades Region (Belle Glade, Pahokee, South Bay) and the unincorporated area at Canal Point are all proximate in varying degrees to Lake Okeechobee, a major environmental and recreational asset to this part of the state. From a recreational standpoint, 'the Big O' is recognized as one of the best bass fishing destinations in the region and the country. It is a world-class fishing opportunity and destination for the most popular category in U.S. freshwater fishing—bass. There are already successful tournaments on Lake Okeechobee, but some of the best opportunities to capitalize on lake access have not yet been realized.

- **The Agriculture Story**—despite the scale and importance of agriculture as a part of the history and 'story' of Palm Beach County, it's potential as a tourism draw has not been fully enabled. The dimensions of the story can cross many lines—from vegetable and fruit production, sugar production and nutritional characteristics to the historical relationships between sugar and the region, the environmental relationships between Lake Okeechobee and the Everglades, the muck soil and farming all relate to the Glades Region as a specific place, and one that is very different from the eastern part of Palm Beach County. It is a complex, rich story to which visitors can easily relate (farm-to-table, role in national crop production, etc.). The Palm Beach County agriculture industry can be a compelling story and can be crafted into an authentic and differentiated narrative, if the proper components can be created and integrated. There are multiple large sugar companies as well as the Co-op that can present the story of sugar, and multiple organic/hydroponic vegetable producers who can present their stories, sell product, and help to broaden understanding of food production in Palm Beach County. This theme will not necessarily appeal to all beach-oriented tourists, but it offers strong potential for foreign visitors who want a unique 'Florida' experience as part of their vacation. The farm-to-table idea can be presented here year-round, although it is not yet well organized or marketed now.

- **Proximity to Existing Visitor Markets & Destinations**—the geographic and physical characteristics of the eastern and western parts of Palm Beach County are very different, but are not far apart. This proximity to 5.5 to 6.0 million annual visitors presents an opportunity within easy driving distance to the beaches and urban developments in the eastern parts of the county, and the agriculture areas are close to center-county attractions such as Wellington's equestrian draw and Lion Country Safari. The sustained annual visitor attendance levels at Lion Country Safari also offer a strong indication that there is both visitor willingness and market potential to draw tourists away from the beach and the county's more developed areas. The environmental stories and traditions of Lake Okeechobee as an authentic Old Florida experience are also potentially appealing narratives, with consideration of expanded

destinations like parts of Torrey Island already under consideration.

- **Workforce & Skills Enhancement Through Palm Beach State College**—Palm Beach State College has undertaken a series of partnerships, initiatives and facilities enhancements that can be expanded, as possible and sustained by market opportunities, for tourism-related industries, jobs and skills. This opportunity extends beyond tourism into other regionally compatible industries as well, with the recent achievements in re-opening the West Technical Education Center and its newly announced; construction trades program; CareerSource training and job placement and expansion/development of a new $20 million to $25 million campus on 75 acres in Loxahatchee that will provide new career training opportunities for Glades students without the long commutes required to get to campuses in eastern parts of the county. Basic educational infrastructure is in place to serve as the basis for future jobs training and workforce development related to tourism (and other) industries, as capacity and demand increase over time.

- **Cross-County Partnership Potentials**—the strength of the public and private sectors in Palm Beach County provides potential opportunities for enhanced tourism, greater coordination, and cooperation and creation of new destinations linked to established visitor sites and experiences. There is interest among key institutional and private-sector organizations in the eastern county in exploring new opportunities and solutions for economic conditions in the Glades, and this interest can, over time, be focused on a range of tools, incentives, partnerships, investments and workforce development programs that will help build the tourism infrastructure in the west and expand training programs, investment and redevelopment. Key groups such as LORE and the Glades Guardians Collaborative Committee and local government leadership can both benefit from this cross-county interest as well as leverage new partnership opportunities in education and workforce development/job creation, some of it directly related to creating a stronger tourism infrastructure for the Glades Region.

Challenges & Weaknesses

There are a number of ongoing challenges and weaknesses that should be addressed to capitalize on building a sustainable tourism industry in the Glades. Some of these issues can be changed with short-term strategies and targeted efforts, while others may take longer to overcome institutionalized barriers to change that will be necessary to make the area more tourist-compatible. Among others, these include:

- **Limited Existing Tourism Infrastructure Components**—currently, the Glades Region (including the three municipalities and unincorporated area) has limited to almost non-existent visitor support networks. The entire area has a limited number of hotel rooms or restaurants, almost all at budget pricing and of limited range of offerings. Whether industry-related (e.g., transportation, agriculture, etc.) or visitor-oriented (e.g., anglers coming to fish on Lake Okeechobee), there are almost no hotel

rooms or lodging facilities that would attract more affluent visitors. The types and characteristics of both chain-affiliated and locally-owned restaurants need additional upgrades to serve a broader customer base and support tourist expenditures.

- **Safety Perceptions and Realities**—there are both real and perceived issues surrounding safety and security that affect how the Glades Region is viewed by visitors and tourists. The incidence of crime in Belle Glade and, to a lesser degree, South Bay affects the potential to draw visitors to the area. Disinvestment, vacant and deteriorating structures and concentrations of poverty that characterize parts of these communities are a challenge to sustaining a successful tourism experience. While changing these elements will neither be simple or remediated quickly, it will be difficult to either draw (or draw back) a part of the Palm Beach County visitor market without moving in a positive direction.

- **Hotel Capacity & Quality**—the limited range/quality of hotel rooms in the Glades Region does not offer sufficient variety or attractiveness to visitor markets that are more accustomed to the greater range of offerings in the eastern part of Palm Beach County. As illustrated in Table 38, there are 850 hotel rooms in the central county and in areas adjacent or surrounding the Glades Region (including Wellington). Notably, almost all are older properties and are budget-priced with the exception of the Wellington Hampton Inn (which may be characterized as a moderately-priced business and leisure property), the Clewiston Inn, and the Seminole Country Inn in Indiantown (both of which are positioned as historic lodging properties).

  Within the study area, the Horizon Inn & Suites and Travelers Motor Lodge, both in Belle Glade, are the only properties that fall inside these primary communities. Clewiston and Okeechobee have the bulk of the area's hotel room supply, but are 20 to 40 miles from Lake Okeechobee access points in the study area. In addition, in the critical social media links that affect both perceptions and on-line bookings, area hotels have generated weak or negative visitor postings (e.g., "my car was broken into", "not the worst I've stayed in", "nowhere to eat", ""drive on; don't' stay here"). Whether well founded or not, these types of comments (and the facilities to which they refer) are an indication of the critical need to improve hotel and lodging facilities as part of a more tourist-friendly environment. This also suggests that the day-trip market may be more easily targeted for the near-term, as additional new hotels may take considerable time for delivery, and are less likely to be feasible in all three municipalities at the same time.

- **Muck Soil Issues**—the muck soil that characterizes the Glades Region is both an asset and a problem. It is agriculturally fertile, nitrogen-rich and easily irrigated, but has also shown significant tendencies to become compressed over time, resulting in structural characteristics that create long-term building settlement problems, water and sewer infrastructure issues, damaged structural integrity to building and residential foundations, and periodic 'sinking' of sections of area streets and roadways over time because the underlying soil structure is inconsistent. According

to stakeholder interviews, there is an estimated cost premium/increase of 20% over costs in other parts of Palm Beach County to construct buildings in the Glades, adding to the complications in comparing investment risk to less challenging conditions and environments. Muck soil has required millions of dollars spent by the state and particularly County governments to address/correct infrastructure, roadway and building settlement issues, and significant future investment may also be required as the compression of the muck continues in selected locations.

- **Road Network & Directional Signs**—in addition to periodic sinking of sections of roadways, from a visitor's point of view, many roads and directional signs in this part of Palm Beach County need substantial improvement if a visitor market is to be attracted and/or sustained. Roads and destinations are poorly and inconsistently marked, making it easy to become lost, or question a particular route, and the roadway network is challenged by sinking sections caused by instability in the muck soils. Future development of the ILC (and the amount of truck traffic it will create) will add to both the need for better roads, and the cost of reinvestment to keep them functioning at optimal levels.

Table 38
Hotels/Motels in the Glades Region

No.	Hotel Name	Location	No. of Rooms	Rating (Stars)	Year Built	Year Renovated	Miles from Belle Glade
1	Horizon Inn & Suites	Belle Glade	52	3.0	1972	N/A	-
2	Travelers Motor Lodge	Belle Glade	N/A	1.0	N/A		-
3	Holiday Inn Express Hotel & Suites	Clewiston	58	2.5	2006		19.9
4	Historic Clewiston Inn	Clewiston	57	2.5	1923		19.9
5	Executive Royal Inn	Clewiston	25	1.5	2001		19.9
6	Best Western of Clewiston	Clewiston	48	3.0	1998		19.9
7	Hampton Inn Wellington	Wellington	122	2.5	2005		29.9
8	Seminole Country Inn	Indiantown	23	N/A	1926	2000	36.7
9	Travelodge Suites	Okeechobee	39	2.0	N/A	2007, 2011	46.8
10	Holiday Inn Express Lake Okeechobee	Okeechobee	62	2.5	1996	2006	46.8
11	Best Western Lake Okeechobee	Okeechobee	42	2.0	1999		46.8
12	Pier II Resort	Okeechobee	87	2.0	1985	2008	46.8
13	Budget Inn Okeechobee	Okeechobee	24	2.0	1990	2013	46.8
14	Hampton Inn Okeechobee	Okeechobee	85	2.5	2009		46.8
15	Lakeview Inn and Suites	Okeechobee	19	N/A	N/A		46.8
16	Economy Inn	Okeechobee	24	N/A	N/A		46.8
17	Flamingo Motel	Okeechobee	84	N/A	N/A		46.8
Total Rooms:			**851**				

Source: RDS, LLC; May 2014.

Strategy #2: Glades-based Visitor Attraction—Sugar & Agriculture Visitor/Education Center

In addition to development of general tourism infrastructure described in Strategy #1, it is also recommended that a specific visitor attraction project be explored. To educate and inform visitors (and residents) about the sugar and agriculture industry's role in western Palm Beach County, the consulting team recommends that funding be secured to conduct an in-depth study to establish a Glades Visitor Center oriented to the sugar and agriculture industries. There are two key elements requiring significant decisions: 1) who should organize, finance and operate such a center; and 2) identify where such a center should be located in the Glades Region. There are numerous corporate prototypes for this kind of 'product center', although there are very few facilities oriented specifically to sugar (the best example is located in Hawaii). As for potential locations, this type of facility will require approximately one to two acres of land for buildings and surface parking for cars and tour buses. We recommend that a visitor/education center be located somewhere along Highway 98, adjacent to the sugar fields in a rural location, north of Belle Glade in the unincorporated part of the study area. By placing this facility in such a location, full immersion into sugar cane growing and production would be visible from the facility throughout the cultivation and harvesting process. A full description of these types of facilities follows.

Definition of a Corporate Visitor Center or Brand Center

Although not among the most recognized of tourism destinations, corporate visitor centers are a large and widely distributed category of visitor destinations in the United States. They range from basic 'factory tour' formats in which visitors are guided through manufacturing plants to illustrate the steps involved in creating a product through product brand centers, in which product or corporate brand identities are presented and used as a way to communicate corporate 'values', innovation, and/or future product roll outs or brand repositioning strategies.

There are approximately 675 corporate brand centers across the U.S., about half of which are food-product related. This does not include winery 'tours' and tasting rooms, which comprise 400 additional examples (e.g., the Napa and Sonoma areas north of San Francisco alone account for over 260 vineyard and winery tours). Some corporate/product facilities have evolved from basic factory tours (such as the early Coca Cola bottling tours in Tennessee and Atlanta or the 'product history center' at the Dr. Pepper Corporate Headquarters in Dallas) into more sophisticated product interpretive centers that are a combination of history, brand reinforcement, and consumer participation in experiencing the product from start to finish. Such tours frequently ending with a taste of the product: chocolate at Hershey World of Chocolate, or beer at Miller Brewing, Anheuser-Busch, Coors or locally produced craft beers in microbreweries/craft beer breweries with tasting rooms, such as Cigar City Beer in Tampa or Dunedin Craft beers, Florida's oldest microbrewery.

Components of a corporate visitor center frequently include some/all of the following:

- **Physical Tour (or facsimile/representational tour)**—encompassing the product/brand manufacturing process. The second approach is often used if (a) the manufacturing spaces are not configured to accommodate visitors, or (b) being in the manufacturing areas could pose safety hazards for visitors or would be a distraction to employees.

  Examples: Miller Brewing Company Tour, Milwaukee, WI; Harley-Davidson Factory Tour, John Deere Factory Tour, IL; Hershey World, Hershey, PA; Louisville Slugger, Louisville, KY; Gibson Guitar Factory, Memphis, TN; Ben & Jerry's Ice Cream Factory Tour, Waterbury, VT; Anheuser-Busch ImBev Brewery Tours (five US cities, including Jacksonville, FL); Herr's Potato Chips, Nottingham, PA.

- **Product/Brand History Presentation**—describes how a product and/or company began and evolved, presented through an orientation film, interpretive exhibits, interactive exhibits or displays, artifacts, advertising history, or demonstration of the range of products.

  Examples: World of Coca Cola, Atlanta, GA; Jack Daniels distillery in south central TN; King Arthur Flour Baking Education Center, Norwich, VT; Hershey World of Chocolate, Hershey, PA

Financing & Sources of Operating Income

Corporate visitor center facilities are not usually designed to be profit centers for the sponsoring company (or companies); they are brand and marketing centers. Annual operating costs, which typically run from 10% to 15% of the capital investment, are sometimes subsidized by the parent companies as an ongoing marketing cost. If admission is charged, the quality of the exhibitions and visitor experience is generally higher. Capital investment and operating cost variations are affected by factors such as (a) whether the manufacturing process is an actual tour of the manufacturing process (which can require installation of barriers for visitor safety), or if the process is represented through a film or video; (b) if the tour is guided by staff or is self-guided; (c) how often exhibits are 'refreshed'/changed; and (d) the volume of annual visitors and durability of the visitor center flooring, etc.

Operating costs can also be offset by including a brand- or product-associated retail store and by availability of food service on premises to extend the length-of-stay for visitation (which almost always correlates to higher average expenditures). Some corporate visitor centers also provide group rates and discounts/free passes for area schools or residents, which lowers average revenues per admission for paid venues.

Interpretive Approaches

- **Corporate/Product & Family History Presentation**—this includes a history of the founders, often family-owned businesses in which the family legacy is interwoven with the development and growth of a product or brand. For example, the Bacardi Factory Tour in San Juan, Puerto Rico uses its visitor experience program to tell the story of the Cuban Bacardi family and their history as manufacturers of rum. The family symbol (the bat) is part of the Bacardi Rum logo. The Budweiser Beer Corporate tour in St. Louis blends the history of the founding family with the development of beer and the Bud brands as a part of St. Louis's history, though the family legacy has been downplayed somewhat since the company was acquired by a South Africa-based beer conglomerate.

- **Product & Brand Center**—the World of Coca Cola in Atlanta is one of the most successful brand centers in the world; it draws over 1 million visitors per year, and has expanded and relocated from its original site (near Underground Atlanta, which has failed as a retail/entertainment destination at least twice) to a location adjacent to the new Georgia Aquarium and Centennial Park, a major public space that was part of the 1996 Summer Olympics in Atlanta and a catalyst for redevelopment of a downtown neighborhood. Global Coca Cola products are presented and the facility has been expanded since it relocated to accommodate visitor volumes that the former facility could not provide. While a visitor facility in the Glades would not attract this volume, the World of Coca Cola demonstrates the power of a nationally known brand as a visitor attraction, if properly presented and interpreted.

Selected Examples of Food-based Product Centers

- **Hershey World of Chocolate, Hershey, PA**—first opened in 1973, the World of Chocolate has had over 150 million visitors to its original and other locations in Las Vegas, New York City, Dubai, and Shanghai. The Hershey location alone attracts more than two million visitors per year and experienced an 8% increase in attendance in both 2012 and 2013. The attraction is free and includes a 10-minute 'dark ride' through a tunnel with display screens illustrating how chocolate is manufactured. However, there are numerous optional add-on activities ranging from a 4-D film starring Hershey product characters (with entry fees for adults of $7.95 and children of $6.95. This also includes special package tours and other 'visitor experiences' such as "Create Your Own Candy Bar" ($14.95 per person). Visitor pricing includes packages that range up to $39.95 for adults and $29.95 for children. When combined, the package can include four different experiences lasting up to three hours of programmed time. Chocolate World is separate from Hershey Park and other area attractions. In addition to the 230,000 sq. ft. World of Chocolate visitor attraction, there is also a Hershey Museum (located in a different building nearby) that portrays the story of Milton Hershey, his company, and the school founded by Hershey and his wife. The Milton Hershey Trust owns almost all of the candy company's stock as well as Hershey Park and two major hotels, and has an endowment currently valued at $15 billion.

- **The Spam Museum, Austin, MN**—created as a 'brand center' by Hormel Foods, the 16,500 sq. ft. Spam Museum is located across the street from the Hormel Factory and includes exhibits, a tasting room, recipes for cooking with Spam, and examples of production advertising and an extensive collection of Spam-themed gift shop items. Although remotely located (Austin, MN is about 100 miles south of Minneapolis/ St. Paul, the closest large city), the Spam Museum has about 100,000 visitors per year. There is a 15-minute film about the history of Spam; examples of Spam-related advertising and artifacts; and 'Spambassadors' serve as information guides for visitors to the museum. The Spam Museum is open daily, 10am to 5pm Monday through Saturday and 12-5pm on Sundays. Admission to the Spam Museum is free, with an average stay of about 30-45 minutes.

- **King Arthur Flour Baking Education Center, Norwich, VT**—the King Arthur Flour Company is an employee-owned cooperative business venture headquartered in Norwich, VT, a small town located on the Connecticut River in east central Vermont. Norwich is located across from Hanover, NH, the home of Dartmouth College. Although both are small towns, the presence of Dartmouth brings both visitors and a higher than average level of education to this part of the state. The Visitor Center and Baking Education Center were created to reinforce the King Arthur Flour brand, and to feature both baked products (in a bakery and deli) and a demonstration baking school in which consumers learn to bake specialty breads and pastries in classes conducted by KAF staff chefs. The visitor center proved so popular that its size was doubled from 16,600 sq. ft. to over 33,000 sq. ft., and includes a bakery demonstration center and baking classes, a cooks store featuring varieties of King Arthur Flour, cookbooks, baking and kitchen tools and a large bakery/cafe. There is no admission charge to visit the Baking Center, which operates daily from 7:30 am to 6pm; the Visitor Center attracts 250,000 persons per year.

- **Ben & Jerry's Ice Cream Factory Tour, Waterbury, VT**—approximately one hour northwest of King Arthur Flour is the Ben & Jerry's Ice Cream Factory Tour, the largest tourist destination in Vermont, attracting 500,000 visitors per year in a state whose total population is only 625,700. The Waterbury location still produces ice cream each weekday, and the tour includes a tasting of the flavor in production that day. Tours are timed on the half hour, and run from 9 am to 9 pm during peak summer months, and 9 am to 6 pm in the slower seasons. Tours cost $4 for adults, $3 for seniors, students are $2 and children under 12 are admitted free. There is a seven-minute film about the history of the company and its founders, an overlook walk through the production area of the plant, a presentation about quality control in the testing room, and the tasting experience. The facility also offers and indoor/outdoor 'Scoop Shop', a Vermont-themed gift shop and food trucks located around a gathering area in front of the factory. During the summer, the parking lots are 'managed' to keep traffic flowing, and on a hill above the plant is the Ben & Jerry's 'Flavor Graveyard', where the headstones have the names of retired flavors. On summer evenings, movies are shown on the outside wall of the factory building after the Scoop Shop closes, creating a destination for visitors and area residents.

- **Herr's Snack Factory Tours, Nottingham, PA**—Nottingham, PA is a small village just north of the Maryland border in southeast Pennsylvania, and is the corporate headquarters of Herr's Snack Company, a regional brand most often associated with potato chips. The 15,000 sq. ft. Visitors Center was constructed as the original walk-through of the production factory grew in popularity, and safety concerns required that a separated walk-through with viewing windows be constructed during one of the factory's expansions. The current plant size (not including the Visitor Center and tour area) is over 210,000 sq. ft. The tour takes about one hour, and includes a 140-seat theater for the 27-minute film about snack products, the history of the company, and how food production works at the plant. The Herr's Snack Factory Visitor Center averages 100,000 visitors per year; admission is free and the center also offers birthday parties and other events by reservation. Tours are available from 9 am to 3 pm Monday through Thursday, and from 9 am to 11 am on Fridays; timed tour departures are scheduled during peak summer months.

Florida Corporate Visitor Centers & Factory Tours

According to Factory Tours USA, a publication listing tours across the country by state, Florida has 17 factory tour destinations focused on: citrus and food products; aerospace; auto racing; boat construction; and robotics/animatronics for the entertainment industries/ theme parks.

Table 39 details characteristics of Florida-based Corporate Visitor Centers. As illustrated, pricing for the largest attractions is significantly higher than for smaller, more resident-oriented attractions. When compared with the Factory Tours/Corporate Visitor Centers summary, only the Disney 'Keys to the Kingdom" tour, Kennedy Space Center, and Daytona USA attractions have admissions pricing in the same range. Notably, a number of smaller, food-oriented visitor centers are free, suggesting that they are both less complex/ developed and are operated as marketing centers, not as profit centers.

Sugar Processing Museums & Tours

As noted, there are few sugar processing exhibits in the United States, as only four states produce or process sugarcane-based sugar: Florida, Louisiana, Texas and Hawaii (as opposed to beet sugar, which is produced in many locations). The U.S. has a high rate of sugar consumption—over 66 pounds per capita per year—but the process of sugar cultivation, harvesting, and processing is little understood or rarely shown. A number of great family fortunes have been made from sugar production, and there are significant cultural and agricultural precedents resulting from the sugar industry, including historical connections between sugar cultivation and slavery going back to 18th Century England; links across borders between the U.S. and Caribbean islands; rum and molasses production history; and other themes.

Table 40 illustrates characteristics of existing sugar-processing museums and tours. Notably, the Alexander & Baldwin Sugar Museum on the island of Maui in Hawaii offers

Table 39
Florida Corporate Visitor Centers & Factory Tours

Name	Location	Admission Costs	Days Open	Hours	Tour Length	Type of Tour	Notes
Al's Family Farms	Fort Pierce	$6 pp VIP Tour $12 includes on-site lunch	Tues - Friday December - April	n/a	1.5 hours Longer with lunch	Citrus Production and Packing; citrus grove walk, fresh juice production; citrus washing & packaging	Working citrus packing house; Veggie Patch, Gift Shop
Angell & Phelps Chocolate Factory	Daytona Beach	Free	Mon-Fri	10am-4pm	n/a	Walk-by of chocolate manufacturing process	Viewing windows, tied to retail store
Anheuser-Busch Brewery Tour	Jacksonville	Free	Mon-Sat	9am-4pm	1 hour	Beer making and bottling; brewing process factory tour	Free beer in tasting room, gift shop; one of five A-B tours in US
Chalet Suzanne Soup Cannery	Lake Wales	Free	Daily	8:30-3:30	n/a	Guided tour of of on-site soup manufacturing, canning, tasting	Part of 100 acre site w/26 room inn, gourmet restaurant; wine dungeon, spa; ceramic studio/autograph wall; lighted turf landing strip
Davidson of Dundee	Dundee	Free	Daily 9-6 Oct- to-May			Citrus processing and packing plant and gift shop; custom fruit baskets	Citrus products, jellies and marmalades, chocolates, juice bar, citrus candy production
Daytona USA	Daytona Beach	*Speedway tour:* $16 adults children 6-12 $10 *All access tour:* $23 adults children 6-12 $17 *VIP Tour:* $50	Mon-Sat (except race days)	9:30 - 5:00	3 hours	Race track tour; official NASCAR Attraction; World of Racing Museum; IWERKS motion ride; 2 films	Non-race day destination for Daytona Motor Speedway
Florida National Growers Grove House	Lake Wales	Free	9-6 daily, Oct-April 9-5:30 Mon-Sat May-Sept	10am-5pm	1 hour	Visitor Center only; no factory/production tour	Video tour; nutrition, horticulture, packaging; gift shop and citrus grove walks
Hoffman's Chocolates	Greenacres	Free	Year round	N/A	20 min.	Viewing windows to plant	Self-guided tour
Kennedy Space Center	Titusville	Adults: $50; Seniors: $46; Children: $40; Military: Free Astronaut HOF only: Adults: $27, Children: $23 Lunch w/ Astronaut: $22.99 Adults, $15.99 Children Close Up Specialty Tours: Adults $25; Children: $19	Year Round	10am-3:45 (last tour)	6-8 hours	Visitor Center; Launch site; bus tours (2.5 hours); IMAX 3-D theater; Astronaut Hall of Fame; Rocket Garden;	140,000 acre Federal Site; Visitor Center area = 200 acres; Largest Space-Themed retail store in the world; multiple Food Service, special Launch Day Viewing; $10 parking fee
Maverick Boat Company	Fort Pierce	Free; reservations required	Year Round	Fridays 2pm	1 hour	Factory tour; space limited	
Peterbrooke Chocolate Company	Jacksonville	Free	Year round	10am-5pm Mon-Fri	N/A	Video display in 7 stores	Not really a tour
Raymond James Stadium Tours	Tampa	Adults: $6; Children: $4; Seniors: $3; discount for Hillsborough County residents with ID	Year round	VIP tours 9am/10:30am; Public Tours 2pm Tues/Wed/Thu	N/A	Stadium Tour: field, locker rooms, displays, VIP Boxes	Owned by Tampa Sports Authority; public bond financing
Regal Marine Industries	Orlando	Free	Year round	9am-4pm M-F	1-1.5 hours	Fishing boat manufacturing factory tour and product showroom	Marketing center and manufacturing facility tour; located at Orlando Airport
Sally Corporation	Jacksonville	Free	Tues and Thu Sept - June; no tours July or August	Hourly tours 9am-1pm	1.5 hours	Animatronics and Robotics manufacturer for museums and theme parks	Guided tours of entertainment industry animatronic/ robot factory;
Walt Disney World Behind the Scenes 'Insider' Tour	Orlando FL	$58 per person + General Admission ticket cost (currently $101 adults, $95 children for one-day pass)	Year round	AM and PM	Insider tour only: 4.5 hours	Behind the scenes "Keys to the Kingdom": Utilidor tunnels, production center, parade staging and float warehouse	Space available; reservations required. Tour Fee in addition to park admission costs
Whetstone Chocolate Factory	St. Augustine	Adults: $7; Children 5-17: $5	Year round	11am - 3:30pm Tue-Fri	.5-1 hour	Orientation video; guided walk-through of factory; Moulding/ Packing/ Specialty Product Rooms; gift shop	Also offer group rates; Ticket price includes $2 coupon for gift shop purchase
Yeungling Beer Brewery Tour	Tampa	Free	Year round	Tours at 10am and 1 pm	1 hour	Brewery tour and tasting room	Production, brand identity, free beer in tasting room

Source: Factory Tours USA; RDS, LLC, May 2014.

Table 40
Sugar-Processing Museums & Tours in the U.S

No.	Hotel Name	Location	No. of Rooms	Rating (Stars)	Year Built	Year Renovated	Miles from Belle Glade
1	Horizon Inn & Suites	Belle Glade	52	3.0	1972	N/A	-
2	Travelers Motor Lodge	Belle Glade	N/A	1.0	N/A		-
3	Holiday Inn Express Hotel & Suites	Clewiston	58	2.5	2006		19.9
4	Historic Clewiston Inn	Clewiston	57	2.5	1923		19.9
5	Executive Royal Inn	Clewiston	25	1.5	2001		19.9
6	Best Western of Clewiston	Clewiston	48	3.0	1998		19.9
7	Hampton Inn Wellington	Wellington	122	2.5	2005		29.9
8	Seminole Country Inn	Indiantown	23	N/A	1926	2000	36.7
9	Travelodge Suites	Okeechobee	39	2.0	N/A	2007, 2011	46.8
10	Holiday Inn Express Lake Okeechobee	Okeechobee	62	2.5	1996	2006	46.8
11	Best Western Lake Okeechobee	Okeechobee	42	2.0	1999		46.8
12	Pier II Resort	Okeechobee	87	2.0	1985	2008	46.8
13	Budget Inn Okeechobee	Okeechobee	24	2.0	1990	2013	46.8
14	Hampton Inn Okeechobee	Okeechobee	85	2.5	2009		46.8
15	Lakeview Inn and Suites	Okeechobee	19	N/A	N/A		46.8
16	Economy Inn	Okeechobee	24	N/A	N/A		46.8
17	Flamingo Motel	Okeechobee	84	N/A	N/A		46.8
Total Rooms:			**851**				

Source: RDS, LLC; May 2014.

the most substantial and in-depth interpretive model telling the full dimensions of the sugar story as an educational experience.

Relevance to Glades Tourism Potentials

The division in scale of tourism and range of offerings is significant between the eastern and western sides of Palm Beach County. The sugar fields and agricultural areas west of Loxahatchee are in marked contrast to the denser, more developed eastern portions of the county. Near this edge, however, is Lion Country Safari, a major destination for area visitors that reportedly draws 500,000 visitors per year, and is the largest single visitor attraction in Palm Beach County.

That this almost 50-year old wildlife attraction has been able to sustain visitor levels that approach 10% of Palm Beach County's total annual tourism in a location 20 miles from the beaches, suggests that creation of one (or more) well-developed visitor attraction(s) in the West County should be able to attract between 5% and 10% of the County's total annual visitation, or about 25,000 to 50,000 visitors per year. Given the dominant role that agriculture, and particularly sugar, has in the western part of Palm Beach County, opportunities to provide an alternative visitor experience/attraction that represents and interprets this major economic driver would dovetail with an overall expansion of tourism facilities in the West County. This concept, combined with various tours and expanded outdoor recreational opportunities at Lake Okeechobee are the two most likely potential attractions that could draw visitors from the Atlantic beaches. Attracting 25,000 to 50,000 (or more) new visitors to western Palm Beach County can provide a market base for enhanced lodging, food and beverage services at all price levels, specialty retail and sports shopping, visitor services, employment and business development opportunities, and other indirect benefits that will serve as a key economic development initiative designed to be shared by and benefit Glades-area residents.

This preliminary visitor estimate assumes that:

- The attraction is well done and aggressively marketed
- There is sufficient additional infrastructure (restaurants and other food & beverage, supporting retail and other services) available at a higher level of quality and range of offerings than today
- There are clear, multiple directional signs leading to West County attractions along all highways leading to/from the Glades Region
- The attraction(s) are able to be successfully promoted

While agriculture and sugar cultivation are the dominant industries in the western portion of Palm Beach County, aside from a limited capacity driving tour of sugar production and a visit to a sugar mill offered by the Clewiston Chamber of Commerce, there are no other

established sugar tours available at this time. It is not known if either Florida Crystals in Palm Beach County or U.S. Sugar (located primarily in Hendry and Glades Counties) would be willing to sponsor creation of a sugar-based visitor center, but the Clewiston Chamber of Commerce currently offers a guided tour of a production area and sugar mill called the "Sugar Land Tour". The tour is structured as a guided tour with visitors riding a 24-person bus through cane fields, passing near a sugar mill and a juice processing plant; lunch is provided after the tour at the Clewiston Inn. The price is quoted as $42 per person and the tour lasts about 1.5 hours.

In order to succeed, a sugar-themed visitor center needs financial/corporate/institutional/philanthropic sponsorship, sources of operating support, and a supporting network of related tourism infrastructure. However, the success and average annual attendance at Lion Country Safari also suggests that visitors will leave the eastern/coastal area of Palm Beach County if there are strong, viable alternatives. Should the interpretive concept be expanded to incorporate other agricultural products, the range of opportunities to extend exhibitions into crop production, nutrition, and other alternatives for farm-to-table food service could also be possible.

Strategy #3: Direct ILC-Related Workforce Skills Improvements

The third and fourth implementation priorities are closely related, but will occur over a longer time period and are inter-dependent on each other. These include phased development of the ILC and the need to prepare for and provide a skilled workforce to fill the range of jobs it will create. Final phasing of the ILC is not yet determined, although up to a 20-year build-out has been suggested. As a function of time, however, training and preparing an underemployed local workforce has already begun through cooperative efforts by Palm Beach State College, LORE, and local training and certificate programs. By pursuing and expanding skills training, the workforce will be prepared to fill new positions as they open during future phases of the ILC's implementation.

The third strategy is focused on preparing the Glades Region workforce and student population prior to ongoing development of the Glades ILC. At build-out, the proposed Intermodal Logistics Center will reportedly create up to 3,000 new, permanent jobs in the Glades Region. We note that this estimate does not include secondary/spin off jobs resulting from the ILC, for which the developers have not made any estimates. The strategic decision to re-open the West Tech vocational school/facility in a partnership involving Palm Beach State College, area businesses and the Palm Beach County School District will help strengthen the range of skills and job opportunities for training in construction, engine repair and maintenance, truck servicing and, in the future, logistics and management for the warehousing and logistics/transfer facilities envisioned at the ILC. A more detailed description of the range of jobs and skills needs that have resulted from Intermodal Logistics Centers is described later in this section.

Opportunities for new workforce and market-rate housing and net new retail spending in the Glades Region will be tied to the number/amount of new jobs as well as annual salaries/

compensation. New employment will depend on the ability to provide the necessary skills, and skills training will depend on education. Ongoing initiatives aimed at workforce skills improvements are critical and long-term; support from Palm Beach County, the state and other key sectors must continue.

As the Glades Region's economic base is diversified through implementation of the ILC over the next 20 years, there are a number of workforce development skills that can be developed and enhanced to meet future employment demand generated by the ILC project. The Glades campus of Palm Beach State College has already initiated specialized training programs to respond to both needed skills and to address high unemployment in the Glades. The workforce programs partnership with Palm Beach County and with LORE have already led to re-opening of the WestTech campus, and expansion of both Associate of Arts, certificate-based construction training and truck maintenance and repair training programs, all of which will complement and respond to the ILC. This impact will be both direct employment (jobs created and maintained by companies involved in the ILC, its activities and facilities) and indirect (through construction, residential electricians/ plumbers and contractors engaged in residential construction and renovation, and in related retail offerings supported by a larger resident base in Belle Glade, South Bay and Pahokee, as well as in nearby unincorporated parts of the County).

Direct Employment Categories & Skills

The business of commercially developing Intermodal Logistics Centers is relatively new, both in Florida and in the United States. While rail and port terminals have been in existence for decades, the real estate model of commercial intermodal centers has emerged as a new real estate category, usually developed as a public/private partnership between state and local governments (usually based on property and other tax revenues) and the leveraging of public funding to create permanent jobs and diversify the economic base.

The Florida SIS strategy is both more comprehensive and less fully defined as a network than are individually owned and operated ILCs in other states and locations, which are usually focused on one facility and its accessibility through truck and rail traffic, not on an integrated state-wide systems of ports, rail and highway connections, and evolution of the shipping/warehousing and distribution industries.

Employment categories in ILCs span many types of skills and compensation rates, and are highly responsive to prevailing wage rates, whether a location is subject to union employment and collective bargaining (which tends to result in higher negotiated pay levels and benefits). The range of workforce skills can generally be organized into three major categories:

- Operations — On-site
- Maintenance & Repair — On- or Off-site
- Logistics Management & Supporting Services — On- or Off-site

PBSC and LORE have made significant strides in initial workforce skills training for several areas that will prepare local workers for employment at the ILC as well as for jobs training in health care and hospitality (which relate to supporting facilities and services for direct ILC employees). As operations at the Glades ILC are stabilized and grow, the range of workforce skills can be expanded over time to incorporate more specialized training programs and facilities, and new programs as emerging industries choose the ILC as an operating location.

For Intermodal Logistics Centers, the movement, distribution/re-distribution, handling, and storage of goods is the central function; each step of arrival, documentation, movement and handling of goods on-site and between modes of transportation (rail, truck, connections to water-based shipping ports, etc.), warehousing, packaging storage, and distribution to locations off-site involves multiple job categories and skill sets. Each step of each action relates to both some category of employment and to a potential charge to the ultimate customer, whether a company, a service business related to freight shipping and transport, or delivery or the management and tracking of goods and materials. The potential jobs and skills required to provide all these services are described in selected categories below, with the intention that future training programs in the Glades Region may incorporate these types of specialized workforce training subject matter/content in the future.

ILC-Related Jobs & Skills

<u>On-site Operations</u>

- **Gate Staff:** Gate staff are assigned to each point of entry or exit from an intermodal center to check in or check out goods at each portal to the ILC, whether rail or truck-based. This job category requires computer skills, network management and communication skills (sometimes multi-lingual), a knowledge of regulatory controls on shipped goods (whether domestic or imported/exported internationally), logistics management, and an understanding of site operations to direct rail connections, containers and tractor-trailers to specific locations on-site;

- **Drayage:** Drayage is the term used to describe any movement of goods to/from or within an ILC; the term for the staff that performs drayage is a 'drayer'. Drayage charges may include the cost to transport goods to a site, costs to move goods once arrived on a site, or to ship goods off the site;

- **Lading Handlers:** This is defined as the freight or goods that constitute a load, whether shipped by rail, truck, tanker or freight car or container (TEU). Lading charges require documentation upon arrival, time management of goods while on site (as some lading incurs storage charges after an appointed period of time, whether stored in a warehouse, on a dock or within a container. Management of lading and lading charges requires computer tracking skills, logistics management, accounting, security, and/or physical skills to run machinery to move goods within the ILC site. The term

'Bill of Lading' may apply to multiple services provided on-site, not just movement of goods (i.e., transportation, handling, shipping);

- **Packer/Piggybacker Operator:** A packer (or piggybacker) is a type of heavy machinery equipment used to lift rail-based containers/TEUs or trailers on and off of rail flat cars; operators must have skills in heavy machinery, safety practices and communications with yard managers who are responsible for organizing and managing movement of containers/trailers from one mode to another;

- **Lumpers**: Lumpers are site operations staff who unload a trailer or container if the driver is not unloading at the loading docks or ramps; lumpers may be required if collective bargaining agreements do not obligate the driver to do the lifting and transfer of shipped goods;

- **Truck Drivers**: Drivers for trucks, whether delivering/picking up freight, or moving freight within the site; sometimes called 'drop and pull' drivers (as opposed to short-haul and/or long haul drivers who carry goods long distances between rail/shipping lines to ILCs). These categories of drivers are required to obtain a commercial 'Class A' Operator's driver's license. The United States' truck driving staffing is reportedly aging, and there are not enough workers entering this sector to support increasing demand across the country. Compensation levels for contract drivers ranges from $42,000 to $60,000 per year plus performance rewards (for one national company) to $2,200 per week plus a $3,000 signing bonus for another, and both require the ability to earn a Class A commercial driver's license. Drivers may be used for on-site movement of trailers (on Hostler trucks), for short-haul deliveries to nearby cities, long-haul drivers connecting ILCs or the Glades ILC with ultimate corporate receivers, or other trucking categories;

- **Heavy Equipment Operators:** Drivers and operators for different categories of heavy equipment used to move/transfer freight or containers include machinery such as forklifts, drayage within the site, cranes or rubber tire gantry equipment for transferring containers to/from rail car flatbeds or double stacks or side-loaders. This job requires the ability to work in heavy equipment, safety management, and computer entry capabilities;

- **Rail Car Spotters/Identification**: For intermodal centers that include a rail yard (as is planned for the Glades ILC), rail car spotters and identification tasks require specialists who can 'read' electronic identification on rail cars, locate them within large rail yards, and coordinate movement (both in and out) for blocks of cars/products on freight trains; this requires the ability to work in all weather conditions, mobility, computer logging skills, and operational communications with yard managers and dispatchers;

- **Dispatchers**: Dispatchers organize, manage and control movements across modes of transportation, loading and freight load assembly, and require management skills, computer data entry and management skills; dispatchers may also coordinate

transfers of delivered trailers and/or containers or other freight between arrivals and warehousing facilities;

- **Ground Support Staff**: Staff who work as handlers within dock/ramp areas, within warehouses or distribution centers, doing load organization and fulfillment, cleaning services, and/or freight handling between modes of transport or to/from transportation by rail to truck to storage or warehousing facilities;

- **Yard Management System Operators**: Organization and management of truck traffic/ vehicle parking, transfers from rail to truck/truck to rail, or truck to truck; requires spatial and occupancy management, time management for rates and charges, storage transfers and transport-to-storage/storage to shipping processes; this also requires computer skills, communications skills and computer-based documentation for storage and/or handling fees;

- **Warehouse Supervisors**: Logistics and staff management of warehousing facilities are required to address the flow of goods, storage and billings, and general operations in handling shipped items passing through an ILC;

- **Security Services**: Guards, security patrols and safety monitoring services at the ILC; these services could be provided as centralized contract services by ILC management;

- **Load Planners**: Load planners organize and manage efficient movement of goods within the ILC facility, monitoring timing and holding locations, and structuring and billing allowed fees for goods received, held and moved on-site; and

- **Fleet Managers**: Manage and direct truck fleets to assure efficient delivery and returns from the ILC, minimizing empty trailers on trucks and/or intermodal transfers to rail.

Maintenance & Repair Services

Maintenance and repair services may either be retained as in-house corporate employees by one or more companies associated with facilities within the Glades ILC, or could be independent operators in the region that provide direct services on an as-needed basis. Maintenance and repair service employment categories could include:

- **Heavy Equipment Mechanics**: Specially trained mechanics to maintain and repair equipment used at the ILC, such as cranes and gantry equipment, side loaders, forklifts, or other equipment;

- **Truck Mechanics**: Mechanics to provide maintenance and repair to trucks and delivery vehicles servicing the ILC;

- **Tire Repair Mechanics**: Trained tire repair technicians knowledgeable about the specialized tires used for heavy equipment and service vehicles;

- **Container Mechanics**: Repair and maintenance of containers shipped through or stored at the ILC, potentially as a contract service to container owners through the facility; and

- **Railcar & Flatbed Trailer Repairs**: Specialty repairs to railcars, connectors and flatbed trailers used to haul freight to/from the ILC.

Management & Support Services

These business categories generally require higher attained educational levels, specialized licensing or agency relationships, greater legal liability responsibilities or a combination of each to operate and manage ILCs:

- **Bonded Warehouse Employees**: Bonded warehouses are owned by U.S. Treasury-approved operators and operate under bonded agreements or guarantees for strict observance of state and federal revenue laws related to designated shipped goods that pay duties, import/export fees, special taxes or other regulated costs. Staffs require an understanding of legal obligations, no criminal backgrounds, and the ability to operate as licensed, bonded companies;

- **Warehouse & Shipping Clerks**: Document and trace goods as they are received, held and shipped from the ILC; requires accounting and computer skills, but may not require a college degree;

- **IT & Electronic Data Exchange Management (EDI)**: Intermodal centers are increasingly dependent on electronic identification and tracking systems for containers, rail cars, freight storage and aggregation; requires knowledge of IT systems, tracking software, integrated freight management systems and other technology and software;

- **Freight Forwarding Services**: Forwarding services assemble smaller shipments into one large (truck or rail based container-sized) shipments and coordinate the shipping process, break down and delivery at the ultimate destination; truck-based shipments are tendered through over-the-road regulated carriers;

- **Customs Brokers**: Companies or individuals licensed by the U.S. Treasury Department to act on behalf of importers and/or exporters in handling transactions involving U.S. customs, fees, taxes or levies;

- **Regional Account Managers**: monitor and supervise transfers, bills of lading, storage and collection of fees for goods transferred through the ILC; this role may be directed through ILC management companies or may be part of major space occupants in warehousing and distribution facilities; and

- **Intermodal Marketing Companies (IMCs)**: Companies that purchase rail and truck transportation services, organize and manage use of equipment and service providers from multiple operators, manage and aggregate contracted logistics services, and

provide other value-added services under a single freight bill to the ultimate shipper.

Strategy #4: Indirect & Collateral Industries Employment Opportunities & Skills

The fourth strategy pertains to future spin-off business opportunities related to phase-in of the ILC. It is based on currently unknown programming in later phases of the project, and is intended to support and expand workforce training concurrent with the ILC over its build-out period, which is estimated as occurring over 20 years. As described in Section 4, this long-term timetable allows for both flexibility in completing a facility that will be part of a larger statewide SIS network (and inter-dependent with completion of a complementary set of integrated ports, transportation systems and improved competitiveness for Florida as a whole). The Glades ILC will be part of a larger integrated network, and should not be considered strictly as a stand-alone facility. Based on the limited number of examples from other parts of the country, much of the final implementation program and timing for the Glades ILC will relate to other sites, other facilities, timing for port, airport, rail and road improvements, and the changing nature of global trade within the context of Florida's share in it. At the same time, the serious need for a stronger base of employment, diversification of skills and workforce training capabilities, and the need to dislodge long-term patterns of poverty in the Glades Region suggests that the more rapidly the ILC can be initiated and the early phases completed, the more quickly the regional economy will strengthen.

Indirect Employment Opportunities & Skills

Indirect employment opportunities will result from related service industries that will grow as a result of the ILC, including:

- **Truck Servicing & Fueling Plazas**: with the greatest near-term opportunities likely in South Bay due to its highway connections south and west and because the early phases of the ILC will be closest to South Bay;

- **Lodging & Hotels**: as the region's existing lodging supply does not include a range of hotel service levels, more hotel rooms will track with increasing truck activity in the Glades as a result of the ILC;

- **Food and Beverage & Other Supporting/Retail Services**: similarly, both existing and new food and beverage and other retail services for trucking and transportation-based industries will expand over time to serve the ILC;

- **Vehicle Repair & Maintenance Businesses**: related to truck servicing and maintenance, maintenance of heavy equipment, TEU repair and maintenance, crane and rail car maintenance, forklifts and other drayage vehicles, etc.;

- **HVAC Installation & Maintenance**: services to warehouses and distribution centers, management offices, and other facilities located at the ILC;

- **Electrical & Plumbing Services**: services to warehouses and distribution centers, management offices and other facilities located at the ILC;

- **Hydraulics, Pumps & Infrastructure Management**: services to warehouses and distribution centers, management offices and other facilities at the ILC, as well as to vehicles and heavy equipment;

- **Supporting Offices & Services**: space needed for a range of marketing, service aggregating, shipping and trade/customs brokerage services. These office needs may be located on-site at the ILC, or located nearby, depending on the need for direct adjacency to the shipped or stored goods;

- **Welding & Metal Work**: useful for containers, rail cars and truck chassis, heavy machinery and specialty equipment; and

- **Other Specialized Industry Facilities**: this category of facilities is more likely to emerge over time and in response to the specific development program for the Glades ILC, when specialized large space users are secured by ownership of the project; these related industries and the facilities they require may include: health care, background checking services, human resources, insurance brokers, and legal or logistics planning services. Depending on the types of users involved, some of these services may be included as 'in-house' operations dedicated to one tenant or industrial user (e.g., the types of large warehousing and distribution company like Amazon, Wal-Mart, Target, IKEA, Michelin, etc. who have chosen to locate major facilities in other U.S. ILCs), or may need office space from which multiple businesses may contract for services.

The impacts of these business categories may be considered indirect results of the establishment and growth of the Glades ILC; however, until there is an identified timetable for implementation/construction and knowledge of the types of businesses that could elect to locate in the Glades ILC, the number of employees or exact types of businesses are not known.

Long-Term ILC Development: Collateral Industries/Businesses & Workforce Programs

The initial training and educational skills enhancement programs undertaken by the Workforce Task Force, LORE and Palm Beach State College are already providing opportunities for Glades residents to prepare for the first phase of the ILC and its operations. The Glades campus of PBSC currently offers certificates and Associate of Arts degrees in a range of directly applicable skills categories that relate to the ILC's employment needs, including:

- Truck repair & maintenance
- Accounting & audit practices
- Technology & IT management
- Operations & project management
- Sustainable construction
- Finance & management
- Human resources management
- Marketing
- Welding
- Automotive & transportation servicing
- HVAC installation & repair
- Industrial management
- Language skills
- Electric power technology/alternative energy systems
- Residential/commercial & industrial electrician training
- Business & office management
- Business administration
- Hospitality & tourism programs (currently small but likely to grow over time)
- Commercial driver training & license qualifications
- Law enforcement (security & policing training)

These and other areas of study are offered as Corporate and Continuing Education programs and as Associate of Arts or Science degrees in classroom- or online-based education. Another PBSC campus offers training in Hazardous Materials management and mitigation courses; it may be useful to offer this skills enhancement training program at the Glades campus.

It was also noted that the Boca Raton campus of PBSC is host to a Florida Small Business Development Center (SBDC), a public- and private-sector cooperative effort to assist entrepreneurs in establishing and managing small businesses. As the business base for the Glades grows in relationship to attract employees and residents resulting from the ILC, it may be useful to either expand or strengthen the presence of the SBDC in the Glades Region. The Florida Department of Education also offers District Technical Centers in many Florida Counties, but Palm Beach County does not have such a facility. As possible within budget and capacity parameters, establishment of the ILC could warrant creation of a District Technical Center in the Glades Region over time.

5. Economic Development Strategies

Introduction

A key element of this study includes estimating the potential economic impacts generated by specific initiatives such as the ILC and land uses. In this task, we estimated construction values to calculate one-time impacts such as construction wages and jobs. We also estimated ad valorem taxes generated by uses tested in the market study and accruing to each municipality (and Palm Beach County) in the study area based on current (2013) millage rates. We also measured other secondary impacts, including permanent jobs and wages generated by the land uses tested in the market study. Key findings are summarized for each municipality below and illustrated in Table 41 through Table 60.

Key Assumptions

The analysis estimates hard construction costs based on estimates from Marshall & Swift/Swift Cost Estimator. Potential infrastructure costs and costs associated with any public realm improvements are unknown at this time. In addition, the analysis assumes a 20% factor for soft costs as well as a 20% premium to account for muck soil conditions throughout the Glades Region. This premium is an estimate only as provided by project stakeholders. Soft costs include such items as professional fees for architecture/ engineering, general and administrative, financing fees, etc., that are common in building construction.

The analysis assumes an average annual construction salary of $39,950, which reflects actual construction wages in Construction & Extraction and Installation & Repair sectors in Palm Beach County from the Bureau of Labor Statistics as of May 2012. Typically, salaries and wages comprise 40% of the total costs associated with a construction project. The model translates person-years of employment to derive actual construction jobs associated with each use, and assumes a buildout period of 20 years for housing and eight years for workplace uses (office and general industrial). Of course, if these uses are delivered over a shorter time period, the number of one-time/temporary construction jobs will increase.

City of Belle Glade

- As detailed in Section 5, the market analysis suggests a program comprising up to 1,869 housing units (over 20 years), and up to 11,400 sq. ft. of office and 26,000 sq. ft. of general industrial space (over the next eight years) if Belle Glade maintains its fair share of future job growth in Palm Beach County. Presuming an average size of 1,200 sq. ft. per unit, the estimated gross building area for new housing would be 2.25 million sq. ft. Should resources be made available, and as developable sites become available, consider completing a detailed feasibility study to determine a precise product mix of single-family, attached, and multi-family housing units.

- As illustrated in Table 41, this program has an overall construction value of more than **$198.2 million ($87 per sq. ft.) at build-out**. This is a preliminary estimate based on hard and soft construction cost inputs. As noted, it excludes infrastructure and public realm improvements and any costs associated with tenant improvements/ fit-out, which are not known at this time. We note that overall just/market values at stabilized occupancies are likely to be higher.

- One-time construction (labor) income is estimated at approximately 40% of total costs, or **$66.1 million for approximately 150 construction jobs created by the project over the build-out period**, at an average annual wage of $39,950.

- As illustrated in Table 42, these uses could be expected to generate approximately **670 permanent jobs at build-out and stabilized occupancies**. This is likely to include:

    - Approximately 560 jobs associated with 1,869 housing units (at an industry-standard ratio of 3.0 jobs per occupied housing unit, or 1,682 units) at an average salary of $54,654 per year;

    - Up to 54 jobs associated with 11,400 sq. ft. of multi-tenant office uses (assuming stabilized occupancies of 92%) at an average salary of $67,883 per year; and,

    - Up to 54 jobs associated with 26,000 sq. ft. of general industrial uses (assuming stabilized occupancies of 95%) at an average annual salary of $33,124 per year.

- Notably, jobs created by housing are distributed in multiple locations, and include jobs in the following occupations: Property & Real Estate Managers; Installation & Repair; Residential Advisors; Security Guards; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

- Based on actual average wages for relevant employment categories in Palm Beach County as of May 2012, permanent jobs created by this program in Belle Glade could generate more than **$36.1 million in annual wages (in 2012 dollars)**.

- As illustrated in Table 43, this program could generate an estimated **$5.035 million in gross annual property tax revenues** accruing to all current taxing authorities at current property tax millage (mil) rates. Since the actual just/market value of these uses is not known at this time, the analysis assumes a value of $198.2 million based on preliminary construction cost estimates.

- As illustrated in Table 44, these uses could be expected to generate the following annual property tax revenues for each of the following taxing districts (based on current mil rates):

  - $1.29 million per year accruing to the City of Belle Glade
  - $1.674 million per year for Palm Beach County (Operating, Debt, Fire)
  - $1.541 million per year for Palm Beach County School District
  - $120,200 per year for the Palm Beach County Library District
  - $85,000 per year for the Water Management District
  - $373,900 per year for Other/Independent Districts (Children's Services, FIND, Health Care)

- Annual property tax revenues may vary depending on the mix of land uses developed, phasing/delivery dates, and future property tax millage rates for each taxing district. This analysis does not consider any tax abatements such as homestead or other exemptions, or other initiatives such as incentives for economic investment that may be provided as part of any economic development initiative in the Glades Region.

Table 41
One-time Construction Impacts—City of Belle Glade

	Program In SF	Estimated Hard/Soft Costs (1) Per SF	Estimated Hard/Soft Costs (1) Total	One-time Impacts From Construction: Wages As % of Base Costs	Person-Years Employment	Buildout (Years)	Construction Jobs	Construction Income
Average Annual Construction Wage	$ 39,950 (2)							
LAND USES (From Market Analysis)								
Housing								
Total Units	1,869							
Average Unit Size (SF)	1,200							
Gross Building Area:	**2,242,831**	$ 60	$ 134,569,853	40%	1,347	20	67	**$ 53,827,941**
Multi-tenant Office	11,400	$ 110	$ 1,254,000	40%	13	8	2	**$ 501,600**
General Industrial	26,000	70	1,820,000	40%	18	8	2	**$ 728,000**
Subtotal:	**2,280,231**	**$ 60**	**$ 137,643,853**					
Other Costs								
Soft Costs	(3)	$ 12	$ 27,528,771	40%	276	8	34	**$ 11,011,508**
Muck Soil Premium	(3)	14	33,034,525					
Subtotal:		**$ 27**	**$ 60,563,295**					
					(4)			
TOTAL/Weighted Average:	**2,280,231**	**$ 87**	**$ 198,207,149**		**1,654**	**11**	**150**	**$ 66,069,050**

(1) Hard and soft construction costs are estimates. As potential infrastructure and public realm costs are unknown at this time, they are excluded from the analysis.

(2) Based on average annual wages for Construction & Extraction and Installation & Repair jobs in Palm Beach County, May 2012.

(3) Other costs include soft costs (e.g., architecture/engineering, general & administrative, financing fees, etc.), estimated at 20% of hard costs. In addition, we have included an additional premium to account for muck soil conditions, estimated at 20% of hard & soft costs.

(4) Person-years of employment is defined as equivalent jobs generated over the construction period. Buildout periods are assumed to be 20 years for housing and 8 years for office and industrial uses based on the market analysis.

http://www.bls.gov/oes/current/oes_48424.htm

Source: Marshall & Swift, Swift Cost Estimator; Stakeholder Interviews; WTL+a, June 2014.

Table 42
Permanent Jobs & Wages—City of Belle Glade

	Stabilized Occupancies (SF)	Jobs & Wages: Jobs Per SF or Unit	Total Jobs	Avg. Ann'l Wage	Annual Wages
Housing					
Total Units	**1,869**				
@ Stabilized Occupancies	90.0%				
Occupied Units:	**1,682**	**3** (1)	**561**	**$ 54,654** (2)	**$ 30,645,080**
Multi-tenant Office					
Gross Building Area (SF)	11,400				
@ Stabilized Occupancies	92.0%				
Occupied Area (SF):	**10,488**	**193**	**54**	**$ 67,883** (3)	**$ 3,681,049**
General Industrial					
Gross Building Area (SF)	26,000				
@ Stabilized Occupancies	95.0%				
Occupied Area (SF):	**24,700**	**457**	**54**	**$ 33,124** (4)	**$ 1,789,229**
TOTAL:			**669**		**$ 36,115,359**

(1) Housing typically creates one job per every 3.0 occupied housing units. Notably, not all of these jobs will be located on-site. See Footnote #2 for job categories.

(2) Based on average annual wages for employment categories typically associated with multi-family residential development: Property & Real Estate Managers; Construction & Extraction; Installation & Repair; Real Estate Brokers; Real Estate Sales Agents; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

(3) Based on average annual wages for Management, Business & Financial Operations, Architecture/Engineering, Community & Social Services, Legal, Arts/Design/Media, and Office & Administrative Support jobs.

(4) Based on average annual wages for Building & Grounds Cleaning/Maintenance; Construction & Extraction; Installation/ Maintenance & Repair; Production; and Transportation & Material Moving jobs.

http://www.bls.gov/oes/current/oes_48424.htm

Source: U.S. Department of Commerce, Bureau of Labor Statistics; WTL+a, June 2014.

Table 43
Annual Property Tax Revenues, by Use—City of Belle Glade

Housing			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	194,139,799
	Estimated Value/SF @ Buildout	$	87
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**4,932,257**
Multi-tenant Office			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	1,556,786
	Estimated Value/SF @ Buildout	$	137
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**39,551**
General Industrial			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	2,510,564
	Estimated Value/SF @ Buildout	$	97
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**63,783**
TOTAL:			
	Estimated Value @ Buildout	**$**	**198,207,149**
	Annual Property Tax Revenues-All Taxing Authorities	**$**	**5,035,591**

(1) Based on 2013 Final Millage Rates as defined by the Palm Beach County Property Appraiser.

(2) Estimated value at buildout includes hard/soft construction costs as well as each use's proportionate share of soft costs and muck soil premium costs.

http://www.co.palm-beach.fl.us/papa/pdf/Final-Millage-Rates.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

Table 44
Annual Property Tax Revenues, by Taxing District—City of Belle Glade

Taxing District		Annual Amount
Estimated Value @ Buildout	$	198,207,149
City of Belle Glade		
Current Tax Rate/$1,000	$	6.5419
Annual Property Tax Revenues	**$**	**1,296,651**
Palm Beach County (Operating, Debt, Fire)		
Current Tax Rate/$1,000	$	8.4483
Annual Property Tax Revenues	**$**	**1,674,513**
Palm Beach County Library District (Operating, Debt)		
Current Tax Rate/$1,000	$	0.6066
Annual Property Tax Revenues	**$**	**120,232**
Palm Beach County School District (Local, Infrastructure)		
Current Tax Rate/$1,000	$	7.7780
Annual Property Tax Revenues	**$**	**1,541,655**
Water Management District (District, Okeechobee Basin, Everglades)		
Current Tax Rate/$1,000	$	0.4289
Annual Property Tax Revenues	**$**	**85,011**
Other Independent Districts (Children's Services, FIND, Health Care)		
Current Tax Rate/$1,000	$	1.8865
Annual Property Tax Revenues	**$**	**373,918**
TOTAL:		
Annual Property Tax Revenues-All Taxing Authorities *(1)*	**$**	**5,091,981**

(1) Based on available data provided by Palm Beach County using a reported 2013 millage rate of $25.6902 per $1,000 of assessed value. This differs slightly from the 2013 final millage rate of $25.4057 for the City of Belle Glade.

http://www.co.palm-beach.fl.us/papa/pdf/detailedmillagechart.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

City of Pahokee

- As detailed in Section 5, the market analysis suggests a program comprising approximately 601 housing units (over 20 years), and up to 5,500 sq. ft. of office and 3,900 sq. ft. of general industrial space (over the next eight years) if Pahokee maintains its fair share of future job growth in Palm Beach County. Presuming an average size of 1,200 sq. ft. per unit, the estimated gross building area for new housing would be 721,200 sq. ft. Detailed feasibility studies will be required to determine a precise product mix of single-family, attached, multi-family, etc., as developable sites become available.

- As illustrated in Table 45, this program has an overall construction value of more than **$63.5 million ($87 per sq. ft.) at build-out**. This is a preliminary estimate based on hard and soft construction cost inputs. As noted, it excludes infrastructure and public realm improvements and any costs associated with tenant improvements/fit-out, which are not known at this time. We note that overall just/market values at stabilized occupancies are likely to be higher.

- One-time construction (labor) income is estimated at approximately 40% of total costs, or **$21.2 million for approximately 50 construction jobs created by the project over the build-out period**, at an average annual wage of $39,950.

- As illustrated in Table 46, these uses could be expected to generate approximately **215 permanent jobs at build-out and stabilized occupancies**. This is likely to include:

    - Approximately 180 jobs associated with 601 housing units (at an industry-standard ratio of 3.0 jobs per occupied housing unit, or 541 units) at an average salary of $54,654 per year;

    - Up to 26 jobs associated with 5,500 sq. ft. of multi-tenant office uses (assuming stabilized occupancies of 92%) at an average salary of $67,883 per year; and,

    - Up to eight jobs associated with 3,900 sq. ft. of general industrial uses (assuming stabilized occupancies of 95%) at an average annual salary of $33,124 per year.

- Notably, jobs created by housing are distributed in multiple locations, and include jobs in the following occupations: Property & Real Estate Managers; Installation & Repair; Residential Advisors; Security Guards; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

- Based on actual average wages for relevant employment categories in Palm Beach County as of May 2012, permanent jobs created by this program in Pahokee could generate almost **$11.9 million in annual wages (in 2012 dollars)**.

- As illustrated in Table 47, this program could generate an estimated **$1.615 million**

in gross annual property tax revenues accruing to all current taxing authorities at current property tax millage (mil) rates. Since the actual just/market value of these uses is not known at this time, the analysis assumes a value of $63.5 million based on preliminary construction cost estimates.

- As illustrated in Table 48, these uses could be expected to generate the following annual property tax revenues for each of the following taxing districts (based on current mil rates):
  - $415,900 per year accruing to the City of Pahokee
  - $515,100 per year for Palm Beach County (Operating, Debt, Fire)
  - $494,500 per year for Palm Beach County School District
  - $38,600 per year for the Palm Beach County Library District
  - $27,300 per year for the Water Management District
  - $119,900 per year for Other/Independent Districts (Children's Services, FIND, Health Care)
- Annual property tax revenues may vary depending on the mix of land uses developed, phasing/delivery dates, and future property tax mil rates for each taxing district. This analysis does not consider any tax abatements such as homestead or other exemptions, or other initiatives such as incentives for economic investment that may be provided as part of any economic development initiative in the Glades Region.

Table 45
One-time Construction Impacts—City of Pahokee

	Program In SF	Estimated Hard/Soft Costs (1) Per SF	Estimated Hard/Soft Costs (1) Total	One-time Impacts From Construction: Wages As % of Base Costs	Person-Years Employment	Buildout (Years)	Construction Jobs	Construction Income
Average Annual Construction Wage	$ 39,950 (2)							
LAND USES (From Market Analysis)								
Housing								
Total Units	601							
Average Unit Size (SF)	1,200							
Gross Building Area:	**721,169**	$ 60	$ 43,270,112	40%	433	20	22	**$ 17,308,045**
Multi-tenant Office	5,500	$ 110	$ 605,000	40%	6	8	1	**$ 242,000**
General Industrial	3,900	70	273,000	40%	3	8	0	**$ 109,200**
Subtotal:	**730,569**	**$ 60**	**$ 44,148,112**					
Other Costs								
Soft Costs	(3)	$ 12	$ 8,829,622	40%	88	8	11	**$ 3,531,849**
Muck Soil Premium	(3)	15	10,595,547					
Subtotal:		**$ 27**	**$ 19,425,169**					
					(4)			
TOTAL/Weighted Average:	**730,569**	**$ 87**	**$ 63,573,282**		**530**	**11**	**48**	**$ 21,191,094**

(1) Hard and soft construction costs are estimates. As potential infrastructure and public realm costs are unknown at this time, they are excluded from the analysis.

(2) Based on average annual wages for Construction & Extraction and Installation & Repair jobs in Palm Beach County, May 2012.

(3) Other costs include soft costs (e.g., architecture/engineering, general & administrative, financing fees, etc.), estimated at 20% of hard costs. In addition, we have included an additional premium to account for muck soil conditions, estimated at 20% of hard & soft costs.

(4) Person-years of employment is defined as equivalent jobs generated over the construction period. Buildout periods are assumed to be 20 years for housing and 8 years for office and industrial uses based on the market analysis.

http://www.bls.gov/oes/current/oes_48424.htm

Source: Marshall & Swift, Swift Cost Estimator; Stakeholder Interviews; WTL+a, June 2014.

Table 46
Permanent Jobs & Wages—City of Pahokee

	Stabilized Occupancies (SF)	Jobs & Wages: Jobs Per SF or Unit	Total Jobs	Avg. Ann'l Wage	Annual Wages
Housing					
Total Units	**601**				
@ Stabilized Occupancies	90.0%				
Occupied Units:	**541**	**3** *(1)*	**180**	**$ 54,654** *(2)*	**$ 9,853,738**
Multi-tenant Office					
Gross Building Area (SF)	5,500				
@ Stabilized Occupancies	92.0%				
Occupied Area (SF):	**5,060**	**193**	**26**	**$ 67,883** *(3)*	**$ 1,775,945**
General Industrial					
Gross Building Area (SF)	3,900				
@ Stabilized Occupancies	95.0%				
Occupied Area (SF):	**3,705**	**457**	**8**	**$ 33,124** *(4)*	**$ 268,384**
TOTAL:			**215**		**$ 11,898,067**

(1) Housing typically creates one job per every 3.0 occupied housing units. Notably, not all of these jobs will be located on-site. See Footnote #2 for job categories.

(2) Based on average annual wages for employment categories typically associated with multi-family residential development: Property & Real Estate Managers; Construction & Extraction; Installation & Repair; Real Estate Brokers; Real Estate Sales Agents; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

(3) Based on average annual wages for Management, Business & Financial Operations, Architecture/Engineering, Community & Social Services, Legal, Arts/Design/Media, and Office & Administrative Support jobs.

(4) Based on average annual wages for Building & Grounds Cleaning/Maintenance; Construction & Extraction; Installation/ Maintenance & Repair; Production; and Transportation & Material Moving jobs.

http://www.bls.gov/oes/current/oes_48424.htm

Source: U.S. Department of Commerce, Bureau of Labor Statistics; WTL+a, June 2014.

Table 47
Annual Property Tax Revenues, by Use—City of Pahokee

Housing			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	62,445,344
	Estimated Value/SF @ Buildout	$	87
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**1,586,468**
Multi-tenant Office			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	751,240
	Estimated Value/SF @ Buildout	$	137
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**19,086**
General Industrial			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.4057**
(2)	Estimated Value @ Buildout	$	376,698
	Estimated Value/SF @ Buildout	$	97
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**9,570**
TOTAL:			
	Estimated Value @ Buildout	**$**	**63,573,282**
	Annual Property Tax Revenues-All Taxing Authorities	**$**	**1,615,124**

(1) Based on 2013 Final Millage Rates as defined by the Palm Beach County Property Appraiser.

(2) Estimated value at buildout includes hard/soft construction costs as well as each use's proportionate share of soft costs and muck soil premium costs.

http://www.co.palm-beach.fl.us/papa/pdf/Final-Millage-Rates.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

Table 48
Annual Property Tax Revenues, by Taxing District—City of Pahokee

Taxing District		Annual Amount
Estimated Value @ Buildout	$	63,573,282
City of Pahokee		
Current Tax Rate/$1,000	$	6.5419
Annual Property Tax Revenues	**$**	**415,890**
Palm Beach County (Operating, Debt, Fire)		
Current Tax Rate/$1,000	$	8.4483
Annual Property Tax Revenues	**$**	**537,086**
Palm Beach County Library District (Operating, Debt)		
Current Tax Rate/$1,000	$	0.6066
Annual Property Tax Revenues	**$**	**38,564**
Palm Beach County School District (Local, Infrastructure)		
Current Tax Rate/$1,000	$	7.7780
Annual Property Tax Revenues	**$**	**494,473**
Water Management District (District, Okeechobee Basin, Everglades)		
Current Tax Rate/$1,000	$	0.4289
Annual Property Tax Revenues	**$**	**27,267**
Other Independent Districts (Children's Services, FIND, Health Care)		
Current Tax Rate/$1,000	$	1.8865
Annual Property Tax Revenues	**$**	**119,931**
TOTAL:		
Annual Property Tax Revenues-All Taxing Authorities *(1)*	**$**	**1,633,210**

(1) Based on available data provided by Palm Beach County using a reported 2013 millage rate of $25.6902 per $1,000 of assessed value. This differs slightly from the 2013 final millage rate of $25.4057 for the City of Pahokee.

http://www.co.palm-beach.fl.us/papa/pdf/detailedmillagechart.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

City of South Bay

- As detailed in Section 5, the market analysis suggests a program comprising approximately 970 housing units (over 20 years), and up to 9,700 sq. ft. of office and 24,000 sq. ft. of general industrial space (over the next eight years) if South Bay maintains its fair share of future job growth in Palm Beach County. Presuming an average size of 1,200 sq. ft. per unit, the estimated gross building area for new housing would be 1.16 million sq. ft. Detailed feasibility studies will be required to determine a precise product mix of single-family, attached, multi-family, etc., as developable sites become available.

- As illustrated in Table 49, this program has an overall construction value of fully $104.5 million ($87 per sq. ft.) at build-out. This is a preliminary estimate based on hard and soft construction cost inputs. As noted, it excludes infrastructure and public realm improvements and any costs associated with tenant improvements/fit-out, which are not known at this time. We note that overall just/market values at stabilized occupancies are likely to be higher.

- One-time construction (labor) income is estimated at approximately 40% of total costs, or $34.8 million for approximately 75 construction jobs created by the project over the build-out period, at an average annual wage of $39,950.

- As illustrated in Table 50, these uses could be expected to generate approximately 387 permanent jobs at build-out and stabilized occupancies. This is likely to include:

    - Approximately 291 jobs associated with 970 housing units (at an industry-standard ratio of 3.0 jobs per occupied housing unit, or 873 units) at an average salary of $54,654 per year;

    - Up to 46 jobs associated with 9,700 sq. ft. of multi-tenant office uses (assuming stabilized occupancies of 92%) at an average salary of $67,883 per year; and,

    - Up to 50 jobs associated with 24,000 sq. ft. of general industrial uses (assuming stabilized occupancies of 95%) at an average annual salary of $33,124 per year.

- Notably, jobs created by housing are distributed in multiple locations, and include jobs in the following occupations: Property & Real Estate Managers; Installation & Repair; Residential Advisors; Security Guards; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

- Based on actual average wages for relevant employment categories in Palm Beach County as of May 2012, permanent jobs created by this program in South Bay could generate almost $20.7 million in annual wages (in 2012 dollars).

- As illustrated in Table 51, this program could generate an estimated $2.63 million in gross annual property tax revenues accruing to all current taxing authorities at current

property tax millage (mil) rates. Since the actual just/market value of these uses is not known at this time, the analysis assumes a value of $104.5 million based on preliminary construction cost estimates.

- As illustrated in Table 52, these uses could be expected to generate the following annual property tax revenues for each of the following taxing districts (based on current mil rates):
  - $659,300 per year accruing to the City of South Bay
  - $882,800 per year for Palm Beach County (Operating, Debt, Fire)
  - $812,800 per year for Palm Beach County School District
  - $63,400 per year for the Palm Beach County Library District
  - $44,800 per year for the Water Management District
  - $197,100 per year for Other/Independent Districts (Children's Services, FIND, Health Care)
- Annual property tax revenues may vary depending on the mix of land uses developed, phasing/delivery dates, and future property tax mil rates for each taxing district. This analysis does not consider any tax abatements such as homestead or other exemptions, or other initiatives such as incentives for economic investment that may be provided as part of any economic development initiative in the Glades Region.

Table 49
One-time Construction Impacts—City of South Bay

	Program In SF	Estimated Hard/Soft Costs (1) Per SF	Estimated Hard/Soft Costs (1) Total	One-time Impacts From Construction: Wages As % of Base Costs	Person-Years Employment	Buildout (Years)	Construction Jobs	Construction Income
Average Annual Construction Wage	$ 39,950 (2)							
LAND USES (From Market Analysis)								
Housing								
Total Units	970							
Average Unit Size (SF)	1,200							
Gross Building Area:	**1,163,688**	$ 60	$ 69,821,281	40%	699	20	35	**$ 27,928,513**
Multi-tenant Office	9,700	$ 110	$ 1,067,000	40%	11	8	1	**$ 426,800**
General Industrial	24,000	70	1,680,000	40%	17	8	2	**$ 672,000**
Subtotal:	**1,197,388**	**$ 61**	**$ 72,568,281**					
Other Costs								
Soft Costs	(3)	$ 12	$ 14,513,656	40%	145	8	18	**$ 5,805,463**
Muck Soil Premium	(3)	15	17,416,388					
Subtotal:		**$ 27**	**$ 31,930,044**					
					(4)			
TOTAL/Weighted Average:	**1,197,388**	**$ 87**	**$ 104,498,325**		**872**	**11**	**79**	**$ 34,832,775**

(1) Hard and soft construction costs are estimates. As potential infrastructure and public realm costs are unknown at this time, they are excluded from the analysis.

(2) Based on average annual wages for Construction & Extraction and Installation & Repair jobs in Palm Beach County, May 2012.

(3) Other costs include soft costs (e.g., architecture/engineering, general & administrative, financing fees, etc.), estimated at 20% of hard costs. In addition, we have included an additional premium to account for muck soil conditions, estimated at 20% of hard & soft costs.

(4) Person-years of employment is defined as equivalent jobs generated over the construction period. Buildout periods are assumed to be 20 years for housing and 8 years for office and industrial uses based on the market analysis.

http://www.bls.gov/oes/current/oes_48424.htm

Source: Marshall & Swift, Swift Cost Estimator; Stakeholder Interviews; WTL+a, June 2014.

Table 50
Permanent Jobs & Wages—City of South Bay

	Stabilized Occupancies (SF)	Jobs & Wages: Jobs Per SF or Unit	Total Jobs	Avg. Ann'l Wage	Annual Wages
Housing					
Total Units	**970**				
@ Stabilized Occupancies	90.0%				
Occupied Units:	**873**	**3** *(1)*	**291**	**$ 54,654** *(2)*	**$ 15,900,134**
Multi-tenant Office					
Gross Building Area (SF)	9,700				
@ Stabilized Occupancies	92.0%				
Occupied Area (SF):	**8,924**	**193**	**46**	**$ 67,883** *(3)*	**$ 3,132,121**
General Industrial					
Gross Building Area (SF)	24,000				
@ Stabilized Occupancies	95.0%				
Occupied Area (SF):	**22,800**	**457**	**50**	**$ 33,124** *(4)*	**$ 1,651,596**
TOTAL:			**387**		**$ 20,683,852**

(1) Housing typically creates one job per every 3.0 occupied housing units. Notably, not all of these jobs will be located on-site. See Footnote #2 for job categories.

(2) Based on average annual wages for employment categories typically associated with multi-family residential development: Property & Real Estate Managers; Construction & Extraction; Installation & Repair; Real Estate Brokers; Real Estate Sales Agents; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

(3) Based on average annual wages for Management, Business & Financial Operations, Architecture/Engineering, Community & Social Services, Legal, Arts/Design/Media, and Office & Administrative Support jobs.

(4) Based on average annual wages for Building & Grounds Cleaning/Maintenance; Construction & Extraction; Installation/ Maintenance & Repair; Production; and Transportation & Material Moving jobs.

http://www.bls.gov/oes/current/oes_48424.htm

Source: U.S. Department of Commerce, Bureau of Labor Statistics; WTL+a, June 2014.

Table 51
Annual Property Tax Revenues, by Use—City of South Bay

Housing			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.1727**
(2)	Estimated Value @ Buildout	$	100,852,667
	Estimated Value/SF @ Buildout	$	87
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**2,538,734**
Multi-tenant Office			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.1727**
(2)	Estimated Value @ Buildout	$	1,325,664
	Estimated Value/SF @ Buildout	$	137
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**33,371**
General Industrial			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**25.1727**
(2)	Estimated Value @ Buildout	$	2,319,994
	Estimated Value/SF @ Buildout	$	97
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**58,401**
TOTAL:			
	Estimated Value @ Buildout	**$**	**104,498,325**
	Annual Property Tax Revenues-All Taxing Authorities	**$**	**2,630,505**

(1) Based on 2013 Final Millage Rates as defined by the Palm Beach County Property Appraiser.

(2) Estimated value at buildout includes hard/soft construction costs as well as each use's proportionate share of soft costs and muck soil premium costs.

http://www.co.palm-beach.fl.us/papa/pdf/Final-Millage-Rates.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

Table 52
Annual Property Tax Revenues, by Taxing District—City of South Bay

Taxing District		Annual Amount
Estimated Value @ Buildout	$	104,498,325
City of South Bay		
Current Tax Rate/$1,000	$	6.3089
Annual Property Tax Revenues	**$**	**659,269**
Palm Beach County (Operating, Debt, Fire)		
Current Tax Rate/$1,000	$	8.4483
Annual Property Tax Revenues	**$**	**882,833**
Palm Beach County Library District (Operating, Debt)		
Current Tax Rate/$1,000	$	0.6066
Annual Property Tax Revenues	**$**	**63,389**
Palm Beach County School District (Local, Infrastructure)		
Current Tax Rate/$1,000	$	7.7780
Annual Property Tax Revenues	**$**	**812,788**
Water Management District (District, Okeechobee Basin, Everglades)		
Current Tax Rate/$1,000	$	0.4289
Annual Property Tax Revenues	**$**	**44,819**
Other Independent Districts (Children's Services, FIND, Health Care)		
Current Tax Rate/$1,000	$	1.8865
Annual Property Tax Revenues	**$**	**197,136**
TOTAL:		
Annual Property Tax Revenues-All Taxing Authorities *(1)*	**$**	**2,660,235**

(1) Based on available data provided by Palm Beach County using a reported 2013 millage rate of $25.4572 per $1,000 of assessed value. This differs slightly from the 2013 final millage rate of $25.1727 for the City of South Bay.

http://www.co.palm-beach.fl.us/papa/pdf/detailedmillagechart.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

Unincorporated Area

- As detailed in Section 5, the market analysis suggests a program comprising approximately 2,300+ new housing units (over 20 years) based on updated County population forecasts of 7,200 new residents in the unincorporated parts of the study area between 2013 and 2035. Presuming an average size of 1,200 sq. ft. per unit, the estimated gross building area for new housing would be 2.77 million sq. ft. Detailed feasibility studies will be required to determine a precise product mix of single-family, attached, multi-family, etc., as developable sites become available.

- As illustrated in Table 53, this program has an overall construction value of almost **$239.4 million ($86 per sq. ft.) at build-out.** This is a preliminary estimate based on hard and soft construction cost inputs. As noted, it excludes infrastructure and public realm improvements and any costs associated with tenant improvements/fit-out, which are not known at this time. We note that overall just/market values at stabilized occupancies are likely to be higher.

- One-time construction (labor) income is estimated at approximately 40% of total costs, or **$79.8 million for approximately 182 construction jobs created by the project over the build-out period**, at an average annual wage of $39,950.

- As illustrated in Table 54, these uses could be expected to generate approximately **693 permanent jobs at build-out and stabilized occupancies** associated with 2,309 housing units (at an industry-standard ratio of 3.0 jobs per occupied housing unit, or 2,078 units) at an average salary of $54,654 per year.

- Notably, jobs created by housing are distributed in multiple locations, and include jobs in the following occupations: Property & Real Estate Managers; Installation & Repair; Residential Advisors; Security Guards; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

- Based on actual average wages for relevant employment categories in Palm Beach County as of May 2012, permanent jobs created by this program in the unincorporated parts of the study area could generate almost **$37.9 million in annual wages (in 2012 dollars)**.

- As illustrated in Table 55, this program could generate an estimated **$4.51 million in gross annual property tax revenues** accruing to all current taxing authorities at current property tax millage (mil) rates. Since the actual just/market value of these uses is not known at this time, the analysis assumes a value of $239.4 million based on preliminary construction cost estimates.

- As illustrated in Table 56, these uses could be expected to generate the following annual property tax revenues for each of the following taxing districts (based on current mil rates):

  - $2.02 million per year for Palm Beach County (Operating, Debt, Fire)
  - $1.86 million per year for Palm Beach County School District
  - $145,200 per year for the Palm Beach County Library District
  - $102,700 per year for the Water Management District
  - $451,500 per year for Other/Independent Districts (Children's Services, FIND, Health Care)

- Annual property tax revenues may vary depending on the mix of land uses developed, phasing/delivery dates, and future property tax mil rates for each taxing district. This analysis does not consider any tax abatements such as homestead or other exemptions, or other initiatives such as incentives for economic investment that may be provided as part of any economic development initiative in the Glades Region.

Table 53
One-time Construction Impacts—Unincorporated Area

	Program In SF	Estimated Hard/Soft Costs (1) Per SF	Estimated Hard/Soft Costs (1) Total	One-time Impacts From Construction: Wages As % of Base Costs	Person-Years Employment	Buildout (Years)	Construction Jobs	Construction Income
Average Annual Construction Wage	$ 39,950 (2)							
LAND USES (From Market Analysis)								
Housing								
Total Units	2,309							
Average Unit Size (SF)	1,200							
Gross Building Area:	**2,770,385**	$ 60	$ 166,223,077	40%	1,664	20	83	**$ 66,489,231**
Multi-tenant Office	-	$ 110	$ -	40%	-	8	-	**$ -**
General Industrial	-	70	-	40%	-	8	-	**$ -**
Subtotal:	**2,770,385**	**$ 60**	**$ 166,223,077**					
Other Costs								
Soft Costs	(3)	$ 12	$ 33,244,615	40%	333	8	42	**$ 13,297,846**
Muck Soil Premium	(3)	14	39,893,538					
Subtotal:		**$ 26**	**$ 73,138,154**					
					(4)			
TOTAL/Weighted Average:	**2,770,385**	**$ 86**	**$ 239,361,231**		**1,997**	**11**	**182**	**$ 79,787,077**

(1) Hard and soft construction costs are estimates. As potential infrastructure and public realm costs are unknown at this time, they are excluded from the analysis.

(2) Based on average annual wages for Construction & Extraction and Installation & Repair jobs in Palm Beach County, May 2012.

(3) Other costs include soft costs (e.g., architecture/engineering, general & administrative, financing fees, etc.), estimated at 20% of hard costs. In addition, we have included an additional premium to account for muck soil conditions, estimated at 20% of hard & soft costs.

(4) Person-years of employment is defined as equivalent jobs generated over the construction period. Buildout periods are assumed to be 20 years for housing and 8 years for office and industrial uses based on the market analysis.

http://www.bls.gov/oes/current/oes_48424.htm

Source: Marshall & Swift, Swift Cost Estimator; Stakeholder Interviews; WTL+a, updated October 2014.

Table 54
Permanent Jobs & Wages—Unincorporated Area

	Stabilized Occupancies (SF)	Jobs & Wages: Jobs Per SF or Unit	Total Jobs	Avg. Ann'l Wage	Annual Wages
Housing					
Total Units	**2,309**				
@ Stabilized Occupancies	90.0%				
Occupied Units:	**2,078**	**3** *(1)*	**693**	**$ 54,654** *(2)*	**$ 37,853,348**
Multi-tenant Office					
Gross Building Area (SF)	-				
@ Stabilized Occupancies	92.0%				
Occupied Area (SF):	**-**	**193**	**-**	**$ 67,883** *(3)*	**$ -**
General Industrial					
Gross Building Area (SF)	-				
@ Stabilized Occupancies	95.0%				
Occupied Area (SF):	**-**	**457**	**-**	**$ 33,124** *(4)*	**$ -**
TOTAL:			**693**		**$ 37,853,348**

(1) Housing typically creates one job per every 3.0 occupied housing units. Notably, not all of these jobs will be located on-site. See Footnote #2 for job categories.

(2) Based on average annual wages for employment categories typically associated with multi-family residential development: Property & Real Estate Managers; Construction & Extraction; Installation & Repair; Real Estate Brokers; Real Estate Sales Agents; Janitors & Cleaners; and Maids & Housekeeping Cleaners.

(3) Based on average annual wages for Management, Business & Financial Operations, Architecture/Engineering, Community & Social Services, Legal, Arts/Design/Media, and Office & Administrative Support jobs.

(4) Based on average annual wages for Building & Grounds Cleaning/Maintenance; Construction & Extraction; Installation/ Maintenance & Repair; Production; and Transportation & Material Moving jobs.

http://www.bls.gov/oes/current/oes_48424.htm

Source: U.S. Department of Commerce, Bureau of Labor Statistics; WTL+a, updated October 2014.

Table 55
Annual Property Tax Revenues, by Use—Unincorporated Area

Housing			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**18.8638**
(2)	Estimated Value @ Buildout	$	239,361,231
	Estimated Value/SF @ Buildout	$	86
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**4,515,262**
Multi-tenant Office			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**18.8638**
(2)	Estimated Value @ Buildout	$	-
	Estimated Value/SF @ Buildout	$	-
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**-**
General Industrial			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**18.8638**
(2)	Estimated Value @ Buildout	$	-
	Estimated Value/SF @ Buildout	$	-
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**-**
TOTAL:			
	Estimated Value @ Buildout	**$**	**239,361,231**
	Annual Property Tax Revenues-All Taxing Authorities	**$**	**4,515,262**

(1) Based on 2013 Final Millage Rates as defined by the Palm Beach County Property Appraiser.

(2) Estimated value at buildout includes hard/soft construction costs as well as each use's proportionate share of soft costs and muck soil premium costs.

http://www.co.palm-beach.fl.us/papa/pdf/Final-Millage-Rates.pdf

Source: Palm Beach County Property Appraiser; WTL+a, updated October 2014.

Table 56
Annual Property Tax Revenues, by Taxing District—Unincorporated Area

Taxing District		Annual Amount
Estimated Value @ Buildout	$	239,361,231
Palm Beach County (Operating, Debt, Fire)		
Current Tax Rate/$1,000	$	8.4483
Annual Property Tax Revenues	**$**	**2,022,195**
Palm Beach County Library District (Operating, Debt)		
Current Tax Rate/$1,000	$	0.6066
Annual Property Tax Revenues	**$**	**145,197**
Palm Beach County School District (Local, Infrastructure)		
Current Tax Rate/$1,000	$	7.7780
Annual Property Tax Revenues	**$**	**1,861,752**
Water Management District (District, Okeechobee Basin, Everglades)		
Current Tax Rate/$1,000	$	0.4289
Annual Property Tax Revenues	**$**	**102,662**
Other Independent Districts (Children's Services, FIND, Health Care)		
Current Tax Rate/$1,000	$	1.8865
Annual Property Tax Revenues	**$**	**451,555**
TOTAL:		
Annual Property Tax Revenues-All Taxing Authorities *(1)*	**$**	**4,583,361**

(1) Based on available data provided by Palm Beach County using a reported 2013 millage rate of $19.1483 per $1,000 of assessed value. This differs slightly from the 2013 final millage rate of $18.8638 for the unincorporated parts of Palm Beach County.

http://www.co.palm-beach.fl.us/papa/pdf/detailedmillagechart.pdf

Source: Palm Beach County Property Appraiser; WTL+a, updated October 2014.

Intermodal Logistics Center (ILC) Project

Palm Beach County and Treasure Coast Regional Planning Council have received only limited information regarding the proposed development program for the ILC project. As we understand, the applicant is expected to submit plans to Palm Beach County for review and approval of its first phase of development in August 2014. Therefore, in order to prepare a preliminary analysis of the project's economic impacts, we have based the analysis on the following limited information:

- Proposed buildout comprising approximately 10 million sq. ft. of gross building area for the 850-acre site, which is located in unincorporated parts of the Glades Region study area. This is expected to include approximately 250,000 sq. ft. of "commercial" (as yet undefined) uses as well as approximately 9.75 million sq. ft. of general industrial, warehouse and logistics uses.

- A first phase comprising approximately 2.0 million sq. ft. of uses (not defined).

- Total employment of 3,000 jobs at build-out.

- No information was provided on expected construction costs. Therefore, WTL+a has utilized cost estimates for commercial and general industrial uses similar to that used throughout the economic impact model.

Key findings from this preliminary analysis are summarized as follows:

- As illustrated in Table 57, a 10.0 million sq. ft. development program at the ILC has an estimated overall construction value of approximately **$1.02 billion ($102 per sq. ft. in current dollars) at build-out**. This is a preliminary estimate based on hard and soft construction cost inputs. As noted, it excludes infrastructure and public realm improvements and any costs associated with tenant improvements/fit-out, which are not known at this time. We note that overall just/market values at stabilized occupancies are likely to be higher.

- One-time construction (labor) income is estimated at approximately 40% of total costs, or **$340.8 million for approximately 850 construction jobs created by the project over the build-out period**, at an average annual wage of $39,950. If the assumed build-out period (10 to 20 years) changes, this will impact the number of construction jobs.

- As illustrated in Table 58, the applicant's estimate of **3,000 permanent jobs at buildout could generate roughly $116.7 million in annual wages** in relevant employment categories, based on current wages in Palm Beach County as of May 2012.

- As illustrated in Table 59, this program could generate an estimated **$19.3 million in gross annual property tax revenues** accruing to all current taxing authorities at current property tax millage (mil) rates. Since the actual just/market value of these

uses is not known at this time, the analysis assumes a value of $1.02 billion based on preliminary construction cost estimates and the program identified above.

- As illustrated in Table 60, these uses could be expected to generate the following annual property tax revenues for each of the following taxing districts (based on current mil rates for the unincorporated area of Palm Beach County):
  - $8.63 million per year for Palm Beach County (Operating, Debt, Fire)
  - $7.95 million per year for Palm Beach County School District
  - $620,200 per year for the Palm Beach County Library District
  - $438,500 per year for the Water Management District
  - $1.92 million per year for Other/Independent Districts (Children's Services, FIND, Health Care)
- Annual property tax revenues may vary depending on the mix of land uses developed, phasing/delivery dates, and future property tax mil rates for each taxing district. This analysis does not consider any tax abatements such as homestead or other exemptions, or other initiatives such as incentives for economic investment that may be provided as part of any economic development initiative in the Glades Region.
- More specific or refined information on the proposed development program for the ILC may result in different findings/outcomes from that presented herein.

Table 57
One-time Construction Impacts—ILC (Assumed Buildout)

	Program In SF	Estimated Hard/Soft Costs (1) Per SF	Estimated Hard/Soft Costs (1) Total	One-time Impacts From Construction: Wages As % of Base Costs	Person-Years Employment	Buildout (Years)	Construction Jobs	Construction Income
Average Annual Construction Wage	$ 39,950 (2)							
LAND USES								
Commercial Uses (Undefined)	250,000	$ 110	$ 27,500,000	40%	275	10	28	**$ 11,000,000**
General Industrial	9,750,000	70	682,500,000	40%	6,834	10	683	**$ 273,000,000**
Subtotal:	**10,000,000**	**$ 71**	**$ 710,000,000**					
Other Costs								
Soft Costs	(3)	$ 14	$ 142,000,000	40%	1,422	10	142	**$ 56,800,000**
Muck Soil Premium	(3)	17	170,400,000					
Subtotal:		**$ 31**	**$ 312,400,000**					
					(4)			
TOTAL/Weighted Average:	**10,000,000**	**$ 102**	**$ 1,022,400,000**		**8,531**	**10**	**853**	**$ 340,800,000**

(1) Hard and soft construction costs are estimates. As potential infrastructure and public realm costs are unknown at this time, they are excluded from the analysis.

(2) Based on average annual wages for Construction & Extraction and Installation & Repair jobs in Palm Beach County, May 2012.

(3) Other costs include soft costs (e.g., architecture/engineering, general & administrative, financing fees, etc.), estimated at 20% of hard costs. In addition, we have included an additional premium to account for muck soil conditions, estimated at 20% of hard & soft costs.

(4) Person-years of employment is defined as equivalent jobs generated over the construction period. Buildout period for the ILC is assumed to be 10 years for all uses.

http://www.bls.gov/oes/current/oes_48424.htm

http://www.reedconstructiondata.com/Market-Intelligence/Articles/2012/10/RSMeans-dollar-per-square-foot-construction-costs-for-four-industrial-type-buildings-RCD012094W/

Source: Marshall & Swift, Swift Cost Estimator; Palm Beach County; Treasure Coast Regional Planning Council; Stakeholder Interviews; WTL+a, June 2014.

Table 58
Permanent Jobs & Wages—ILC (Assumed Buildout)

	Stabilized Occupancies (SF)	Jobs & Wages			
		Jobs Per SF or Unit	Total Jobs *(1)*	Avg. Ann'l Wage	Annual Wages
Commercial Uses					
Gross Building Area (SF)	250,000				
@ Stabilized Occupancies	92.0%				
Occupied Area (SF):	**230,000**	N/A	**500** *(1)*	**$ 67,883** *(2)*	**$ 33,941,429**
General Industrial					
Gross Building Area (SF)	9,750,000				
@ Stabilized Occupancies	95.0%				
Occupied Area (SF):	**9,262,500**	N/A	**2,500** *(1)*	**$ 33,124** *(3)*	**$ 82,810,000**
TOTAL:			**3,000**		**$ 116,751,429**

(1) The ILC applicant projects 3,000 total jobs at buildout. The distribution of jobs between commercial and industrial uses is not known at this time; therefore, these are estimates only.

(2) Based on average annual wages for Management, Business & Financial Operations, Architecture/Engineering, Community & Social Services, Legal, Arts/Design/Media, and Office & Administrative Support jobs.

(3) Based on average annual wages for Building & Grounds Cleaning/Maintenance; Construction & Extraction; Installation/ Maintenance & Repair; Production; and Transportation & Material Moving jobs.

http://www.bls.gov/oes/current/oes_48424.htm

Source: U.S. Department of Commerce, Bureau of Labor Statistics; Palm Beach County; Treasure Coast Regional Planning Council; WTL+a, June 2014.

Table 59
Annual Property Tax Revenues, by Use—ILC (Assumed Buildout)

Commercial Uses			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**18.8638**
(2)	Estimated Value @ Buildout	$	35,310,000
	Estimated Value/SF @ Buildout	$	141
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**666,081**
General Industrial			
(1)	Combined Tax Rate Per $1,000 AV	**$**	**18.8638**
(2)	Estimated Value @ Buildout	$	987,090,000
	Estimated Value/SF @ Buildout	$	101
	Equalization Ratio		100.0%
Annual Property Taxes:		**$**	**18,620,268**
TOTAL:			
	Estimated Value @ Buildout	**$**	**1,022,400,000**
	Annual Property Tax Revenues-All Taxing Authorities	**$**	**19,286,349**

(1) Based on 2013 Final Millage Rates as defined by the Palm Beach County Property Appraiser.

(2) Estimated value at buildout includes hard/soft construction costs as well as each use's proportionate share of soft costs and muck soil premium costs.

http://www.co.palm-beach.fl.us/papa/pdf/Final-Millage-Rates.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

Table 60
Annual Property Tax Revenues, by Taxing District—ILC (Assumed Buildout)

Taxing District		Annual Amount
Estimated Value @ Buildout	$	1,022,400,000
Palm Beach County (Operating, Debt, Fire)		
Current Tax Rate/$1,000	$	8.4483
Annual Property Tax Revenues	**$**	**8,637,542**
Palm Beach County Library District (Operating, Debt)		
Current Tax Rate/$1,000	$	0.6066
Annual Property Tax Revenues	**$**	**620,188**
Palm Beach County School District (Local, Infrastructure)		
Current Tax Rate/$1,000	$	7.7780
Annual Property Tax Revenues	**$**	**7,952,227**
Water Management District (District, Okeechobee Basin, Everglades)		
Current Tax Rate/$1,000	$	0.4289
Annual Property Tax Revenues	**$**	**438,507**
Other Independent Districts (Children's Services, FIND, Health Care)		
Current Tax Rate/$1,000	$	1.8865
Annual Property Tax Revenues	**$**	**1,928,758**
TOTAL:		
Annual Property Tax Revenues-All Taxing Authorities *(1)*	**$**	**19,577,222**

(1) Based on available data provided by Palm Beach County using a reported 2013 millage rate of $19.1483 per $1,000 of assessed value. This differs slightly from the 2013 final millage rate of $18.8638 for the unincorporated parts of Palm Beach County.

http://www.co.palm-beach.fl.us/papa/pdf/detailedmillagechart.pdf

Source: Palm Beach County Property Appraiser; WTL+a, June 2014.

APPENDIX B

Public Participation Process –
Treasure Coast Regional Planning Council, December 2014

GLADES REGION MASTER PLAN

PALM BEACH COUNTY, FL

PUBLIC PARTICIPATION PROCESS

Prepared for: Palm Beach County
Prepared by: Treasure Coast Regional Planning Council
Funded by: HUD Office of Sustainable Communities, n/k/a Office of Economic Resilience

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Executive Summary

1.0 Introduction and Scope

The Treasure Coast Regional Planning Council has been tasked with managing and overseeing the economic development analysis and strategies as well as conducting the public outreach and collaboration efforts of the Glades Region Master Plan. This public participation section highlights the public process and outreach efforts conducted by TCRPC with the support of Palm Beach County and community stakeholders to identify issues and opportunities and craft a vision to achieve economic sustainability in the Glades Region.

2.0 Planning Framework

Palm Beach County and TCRPC employed a succinct methodology for engaging public involvement in the GRMP that can be summarized as follows:

1. Kicked-off the project in a well-publicized public presentation;
2. Established a core committee of local stakeholders who, on a bi-monthly to monthly basis, met with the team to exchange information and provide updates on project progress;

3. Conducted many one-on-one interviews with citizens, business owners, and community leaders to build an understanding of issues and expectations;
4. Conducted two public workshops followed by week-long mobile offices to engage the community, gain essential insight and detail into existing conditions and issues, and provided a continuous dialogue between the team and citizenry;
5. Developed recommendations and strategies consistent with community concerns and provided multiple opportunities to present those recommendations.

The public processes and workshops were quite successful and better attended than expected. Over 45 (see page 11) individual interviews were conducted and nearly 200 people participated during the public workshops and week-long local offices.

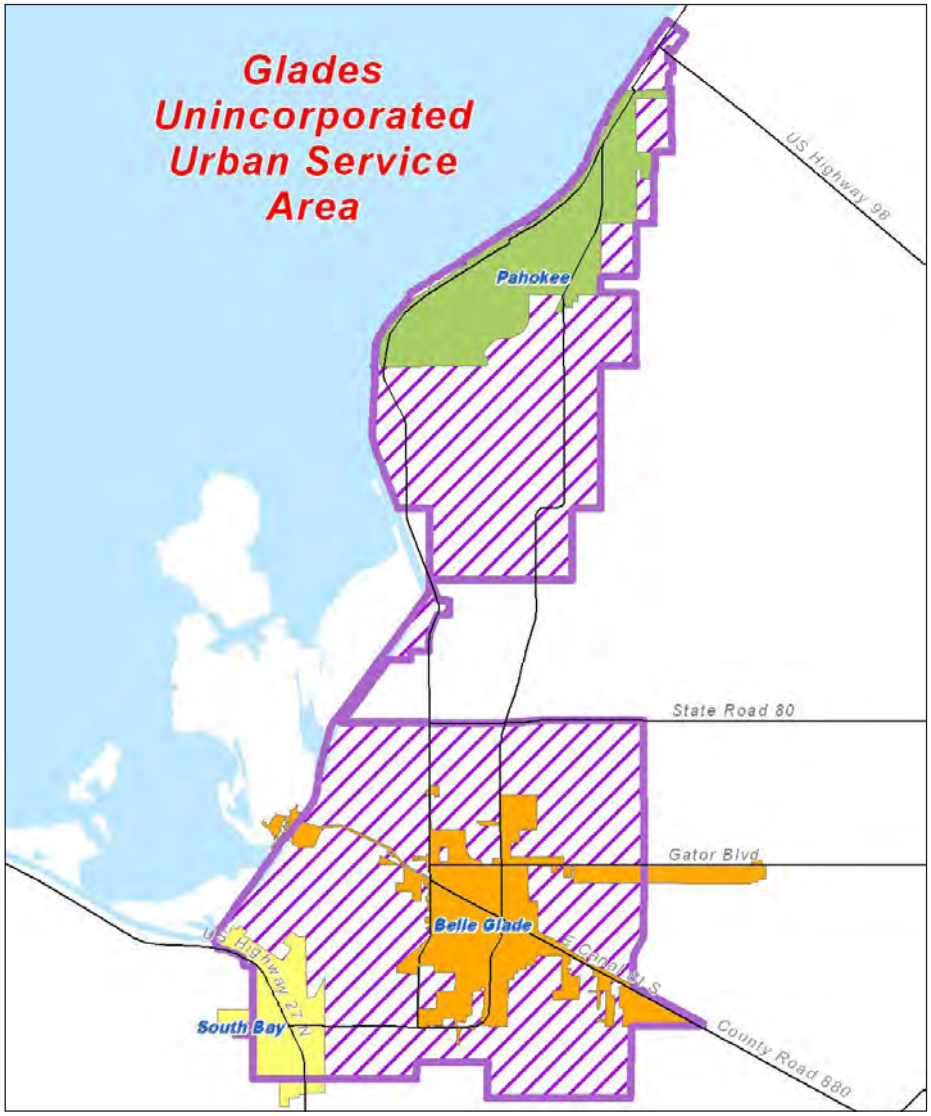
During the week-long mobile offices, the TCRPC team developed detailed analyses and formulated recommendations relating to input provided by the public. The public outreach component also enabled the TCRPC team to educate the community on the other, vital components on the GRMP: the comprehensive potable water master plan; the comprehensive drainage and waste water master plans; and the other infrastructure facets of the effort.

The TCRPC team developed detailed base maps and conducted a building condition assessment for key areas in the Tri-Cities and Canal Point. The team also conducted a street condition assessment to identify areas of concern. Based upon input from the community, the team also developed a series of informational marketing posters intended to suggest a means to bolster awareness of the positive attributes of the Glades areas.

The GRMP team has continued outreach into the communities since the completion of the workshops, has presented the initial findings and recommendations to each of the cities during commission meetings, and developed informational videos summarizing the public workshops that are available on-line and by request.

2.1 Background

The Cities of South Bay, Belle Glade, and Pahokee comprise the “Tri-Cities” in the Glades Region and, including the unincorporated area of Palm Beach County called Canal Point, make up the primary study area for the Grant.



The areas above that are outlined and hatched represent the Glades Region Master Plan Study Area.

Tier	Map Acres	Unincorporated	Incorporated
USA-Glades	25,671	19,063	6,608

2.2 History of the Glades Area

The area known as the Glades Region lies in western Palm Beach County at the southeastern shore of Lake Okeechobee, which is the second largest freshwater lake in the U.S. It is commonly referred to as the "Glades," because the land was formerly part of the Everglades.[1] Coined the nation's "winter vegetable capital," the vast majority of the county's agricultural acreage is situated in the Glades, producing sugar cane, citrus fruit, vegetables, rice and sod. The rich, dark, organic soil of the region is commonly known as muck, and proudly referred to as "black gold" by local growers and residents.

Lake Okeechobee at Belle Glade
Source: Lake Okeechobee Regional Economic Alliance (LORE)

The first wave of farm settlements in the area during the early 1900's began the cultivation of sugar cane.[2] Today, Florida leads the nation in the production of raw sugar from sugar cane, and this remains the primary crop in the Glades, accounting for about 75 percent of Florida's commercial sugar cane acreage.

The agricultural settlements eventually led to the establishment of the cities of Belle Glade, Pahokee, and South Bay. Belle Glade is the largest of the three cities with a population of approximately 30,150 residents and is home to vegetable production and packing. Sometimes referred to as "Muck City" due to the large quantity of muck in the area, Belle Glade visitors are greeted by a welcome sign on major routes which states, "Her Soil Is Her Fortune." It is the home of the Sugar Cane Growers Cooperative of Florida and is known for raising numerous athletes who have gone to pursue professional football careers. Belle Glade was founded in 1919.

Just to the southwest of Belle Glade is the city of South Bay, known as the "Crossroads of South Florida" because it is located at the intersection of State Road 80 and US Route 27. While only 12 families lived in the town in 1917, when it was founded, South Bay became one of the fastest growing metropolitan areas in the nation during the 1980s. In 1997, it was noted as the only city in Palm Beach County with an all-black city commission. Clarence Anthony, South Bay's mayor from 1984 to 2008, served as president of the Florida League of Cities and second vice president of the National League of Cities, drawing widespread attention to the small rural town. South Bay's population is about 4,700.

1 www.pbchistoryonline.org/page/agriculture

2 Glades Community Development Corporation: A Chronicle of a Community Development Intermediary, Prudence Brown and Paul S. Stetzer, Jr., Chapin Hall Center for Children at the University of Chicago, 1998

To the north of Belle Glade lies Pahokee, a city immediately east of the Lake Okeechobee dike. Its current population stands at about 5,800 people. Also an area that once thrived on agribusiness, Pahokee is struggling to revive its town center and marina. Football programs are big here as well, and it is proud to have the county's only K-12 international baccalaureate program.

Historic aerial image of Pahokee, 1958.
Source: State Archives of Florida, Florida Memory

The unincorporated community of Canal Point, which is just to the north of Pahokee, covers less than two square miles and was the first white settlement established on the east side of Lake Okeechobee in 1909. Completion of the West Palm Beach Canal at Canal Point in 1917 gave farmers a direct route to West Palm Beach, where they shipped their products to north markets on the Florida East Coast Railway.[3]

The Glades Region's economic generators are focused around agriculture, primarily sugar cane, tropical fruit and vegetables. Ironically, the region is designated a "Food Desert" by the U.S. Department of Agriculture.

Lake Okeechobee is the source of drinking water for the Glades and also serves as a flood control feature for most of South Florida. It is surrounded by a 110-mile levee known as the Hoover Dike, which was constructed following the devastation caused by the 1928 hurricane that killed more than 2,000 people in Belle Glade. In addition to providing flood protection, the dike also serves as a recreational facility called the Lake Okeechobee Scenic Trail, attracting hikers, bikers, joggers, horseback riders, and nature enthusiasts. Additionally, the lake is internationally renowned for fresh water fishing and boating. In fact, the first industry in the Glades was fishing for catfish and prior to 1912 and before the federal government drained a portion of the Everglades for agriculture, catfish business had grown into a million-dollar industry, employing 1,500 people, and shipping out a whopping 6.5 million pounds of catfish each year. While Lake Okeechobee enjoys an international recognition for its outstanding bass fishing, the lack of tourism infrastructure-restaurants, shops, and hotels, limits tourist growth.

The aftermath of the Hurricane of 1928.
Source: Wikipedia

3 www.pbchistoryonline.org/page/canal-point

Draining the Everglades
Source: State Archives of Florida, Florida Memory

Florida governors serving as far back as 1881 pursued what they felt was their obligation to drain the Glades wetlands for cultivation and settlement. Governor Napoleon Bonaparte Broward is most credited for the project, and by the time the work was completed, five major canals had been dug to drain water from Lake Okeechobee to the Atlantic Ocean. This canal network also provided a new means of transportation for settlers until adequate roads and rail were built.[4]

Sadly, the area also bears a history of great poverty, which was first nationally highlighted in 1960 in the CBS Peabody Award-winning documentary, *Harvest of Shame*. The investigative report, narrated by acclaimed journalist Edward R. Murrow, examined the plight of migrant farm workers and gave millions of Americans their first televised look at what it means to live in poverty.

A surplus of immigrants from Latin American countries and Haiti into the region has kept wages low for picking fruits and vegetables. National Public Radio in a recent story following up on the *Harvest of Shame* documentary noted that today, the average farm worker makes about $10,000 a year.[5]

Early sugar mill at Canal Point.
Source: State Archives of Florida, Florida Memory

While several multi-generational farming families remain in the area, agriculture jobs have continued to dwindle due to mechanized farming techniques, and modern farming faces new challenges due to laws prohibiting the use of certain chemicals and pesticides because of their affect on Everglades restoration projects in South Florida. Some people predict an end to agriculture in the Glades because of its dependence on muck soil, which has subsided over the years, caused by drainage and cultivation of the land, compaction by machinery, burning, oxidation, and shrinkage due to dehydration.

The authors of the report *Glades Community Development Corporation: A Chronicle of a Community Development Intermediary* profoundly note, a sentiment echoed in the Market Overview and Economic Development section of the GRMP report, that the Glades has an abundance of resources-fertile agricultural land, a wonderful climate, easy access to a magnificent lake, and a population that is racially, ethnically, and economically diverse. At the same time however, Glades residents face crippling poverty, limited economic

4 www.pbchistoryonline.org/page/draining-the-everglades

5 www.npr.org, May 31, 2014, Elizabeth Blair

opportunities, and isolation from the dynamic growth and prosperity experienced by the rest of Palm Beach County. The Glades Region has a unique opportunity now to embrace a hopeful future to build a stronger and more sustainable economy by bringing its multi-faceted resources together in new and innovative ways.

Sunset view in the Glades Region.
Source: TCRPC

2.3 The Public Process

Engaging the public in a continuous and meaningful way has been a cornerstone of the Glades Region Master Plan (GRMP) process. In November 2012, Palm Beach County kicked-off the GRMP with an opening presentation and panel forum introducing the community to the multiple aspects of the master plan elements and process. The HUD Community Challenge Planning Grant, which funded this effort, was clear in two particular areas: the grant dollars were meant for "planning" efforts and not capital improvements; and, a meaningful process of public input and engagement was essential.

For the Glades Region Master Plan, the primary process for public input and engagement can be broken into four key components: the Core Planning Committee, the Stakeholder Interview Process, the Public Workshops, and the ongoing outreach through meetings and presentations.

The Core Planning Committee

The Core Planning Committee (CPC) was established early in the process as the key conduit for information exchange with the greater community. The CPC met on a bimonthly and then monthly basis as the project progressed. Members of the committee were invited by the county staff to participate and the meetings, while not publicly advertised, were open to the public. The committee members represent a wide cross-section of the resident, parochial, education, and business community of the Glades. In addition to providing outreach contacts and opportunities, the CPC also reviewed periodic presentations of the other elements of the GRMP. The member organizations represented on the Core Planning Committee are listed here.

Core Planning Committee Representation

Agriculture/Cooperative Extension Service
Belle Glade Chamber of Commerce
Business Development Board
Canal Point CDC
First United Methodist Church of Pahokee
Florida Crystals
Lake Okeechobee Regional Economic Alliance (LORE)
Pahokee Chamber of Commerce
Palm Beach State College
Treasure Coast Regional Planning Council
Career Source Palm Beach County

Stakeholder Interview Process

The TCRPC team scheduled and conducted over 45 one-hour, individual interviews with residents, community and civic leaders, in the summer of 2013. The interviews were mainly conducted at the offices of Workforce Alliance in Belle Glade and provided valuable insight to the issues and concerns of the various communities. While many issues identified were concerns shared by all of the Glades communities (unemployment, crime, job-readiness), there were also ideas and opportunities unique to each locale. The high visibility of South Bay as the "Crossroads of the Glades," the unique backwaters of Torry Island in Belle Glade; the world class open-water marina in Pahokee; and the historical focus of Canal Point were just some of the unique characteristics echoed repeatedly during the interview process. In addition to providing valuable reconnaissance to assist

the project team, the interview process provided a critical forum for the team members to engage key members of the community to explain and demystify the process and project expectations.

Summary of Interviews

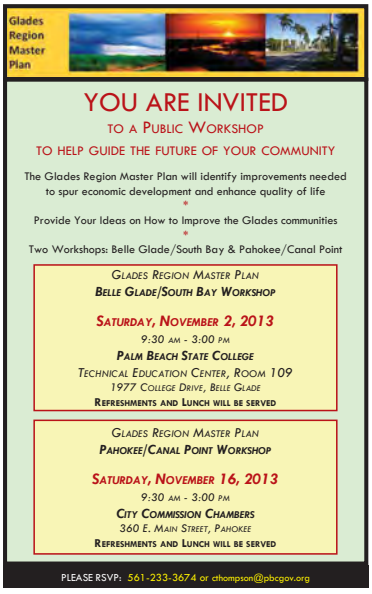
Below is a summary of some of the most frequently heard issues, concerns, and perspectives provided by community members through the interview process.

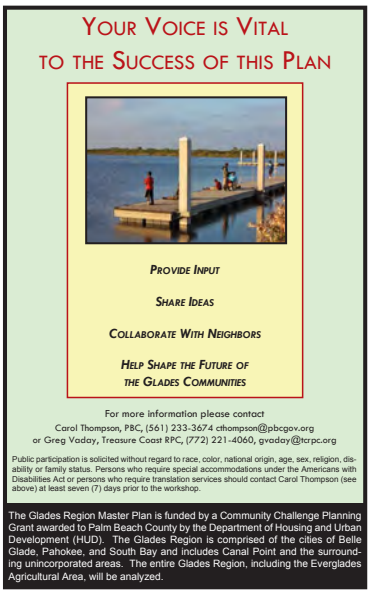
1. The Glades communities need more job opportunities, training for employment prospects, and should work together to diversify the economy.
2. The isolation of the Glades communities, the mechanization of the agricultural industry, the western expansion of Palm Beach County, and the aging infrastructure of the Glades communities have all had impacts on the local economy.
3. There is an intense community pride in the Glades communities that is not well communicated outside of the community.
4. There is a general misunderstanding on the east coast of Palm Beach County of what the Glades has to offer. The Glades areas suffer from negative publicity that focuses on poverty and crime.
5. The outside perceptions of the Glades communities must be improved. Better branding and marketing of the Glades needs to occur.
6. Enormous investment has been made in education, infrastructure, and industry in the Glades that most people are not aware of. Palm Beach State College in Belle Glade and the K-12 International Baccalaureate Program in Pahokee (the only one of its kind in Palm Beach County) are just two examples.
7. Lake Okeechobee is one of the greatest freshwater fishing locations in the country. The lakefront communities need to take greater advantage of that enormous economic engine.
8. The reopening of the West Tech training facility is extremely important to the communities by providing critical job training.
9. A stronger connection needs to be made between the existing agricultural industry and the availability of fresh food in the Glades communities. Although discussed many times in the past, there is a strong desire for a Farmer's Market that sells fresh Glades-grown produce.
10. The Glades economy must diversify and take better advantage of local assets.
11. The Intermodal Logistics Center (ILC) will be a very positive asset to the communities when it is realized. However, the Glades communities must grow and prosper with or without the ILC.
12. The rivalry between the Tri-Cities has a place in tradition and competition however, the cities must work together to bring up the entire Glades community which includes sharing information, resources, and successes.

13. Torry Island is too important an asset and potential economic engine to not be taken full advantage of.
14. The Pahokee Marina needs consistent and dependable management, services, and programming.
15. There is a need for market rate housing in the Glades communities.
16. There is a need for market rate lodging in the Glades communities especially to take full advantage of the Lake and ecotourism.
17. The potable water, drainage, and waste water infrastructure must be improved as soon as possible.
18. Transit service is critical to the Glades residents and should be expanded over time. Intra-city shuttles are desired but funding those operations is a challenge.
19. Social and youth programs are very important in the Glades. Providing role models to the youth is paramount to empowering them going forward. Identify what works and build those programs and institutions.
20. There needs to be an overhaul of the perception of the Glades communities. The Glades communities have a tremendous amount to offer. Those stories need to be told.

The Public Design Workshops

At the core of the TCRPC public outreach and input efforts were the two, week-long public design workshops and in-town "offices." Each week-long public design workshop kicked-off with a Saturday session that included a public presentation of issues and objectives, and provided a forum for input and discussion. In order to provide adequate attention to each of the Glades communities, two week-long workshops were established on a geographic basis: a Belle Glade/South Bay workshop and a Pahokee/Canal Point workshop. Advertising and promotion of the workshops were primarily handled through the assistance of the Core Planning Committee contacts, personal invitations during the





interview process, community groups and local congregations.

The Saturday public input sessions were designed to provide the greatest amount of public input possible in an environment that is congenial and inviting. The following is an overview of the structure of the Saturday workshops.

Opening Presentation
Each Saturday session began with an Opening Presentation that provided an overview of the project and observations of the study area. The opening presentation provided many visual examples of the intent of the project and examples of areas of concern. The presentation was a good way to prepare the participants to think about their communities and to provide verbal, written, and illustrated input. Morning refreshments were provided.

Table Sessions
The rooms in which the Saturday workshops were held was arranged with 10-12 banquet tables with six-to-eight chairs each. As the participants arrived they were encouraged to sit where, and with whom, they felt most comfortable. There was no attempt to group or separate particular individuals or affiliations. At each table a member of the project team served as a facilitator to the group. Most of the team facilitators were architects, planners, or economists. Their role was to keep the discussions flowing and record the group's input. Each table had a large-scale aerial photograph of the study area which was covered with tracing paper. The table facilitators encouraged the table participants to write or draw their ideas and suggestions on the base map. Often participants identified their homes, workplaces, or places of community interest on the maps. This helped provide context to the information provided and the table maps served as important records of information for the team going forward.

Belle Glade/South Bay Workshop
On November 2, 2013, the first week-long public workshop kicked-off at Palm Beach State College in Belle Glade. Nearly 60 participants spent about five hours providing their input, sharing ideas and concerns with neighbors, and presenting their ideas to their peers and the TCRPC team. After an opening Power Point presentation by TCRPC that provided an overview of the project scope, work done to date, and expectations of the workshop itself, the participants worked at tables developing their ideas. Lunch and

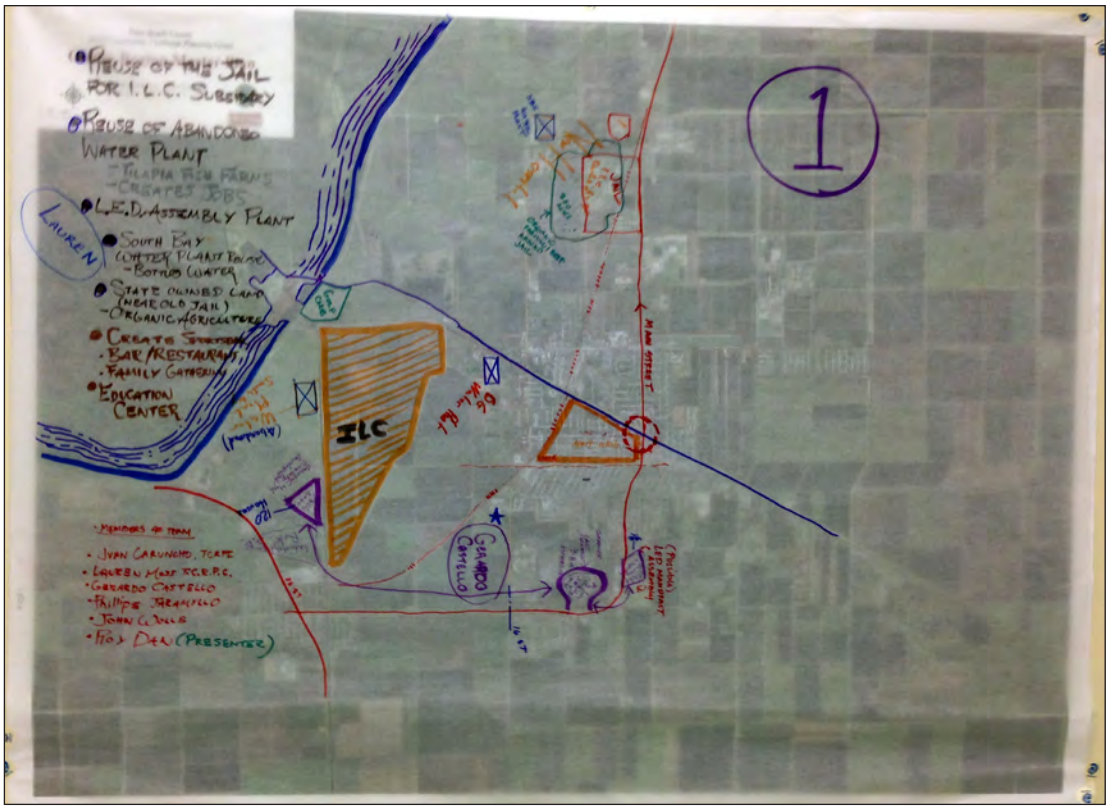
Citizens working at the table sessions during the Belle Glade/South Bay Workshop.

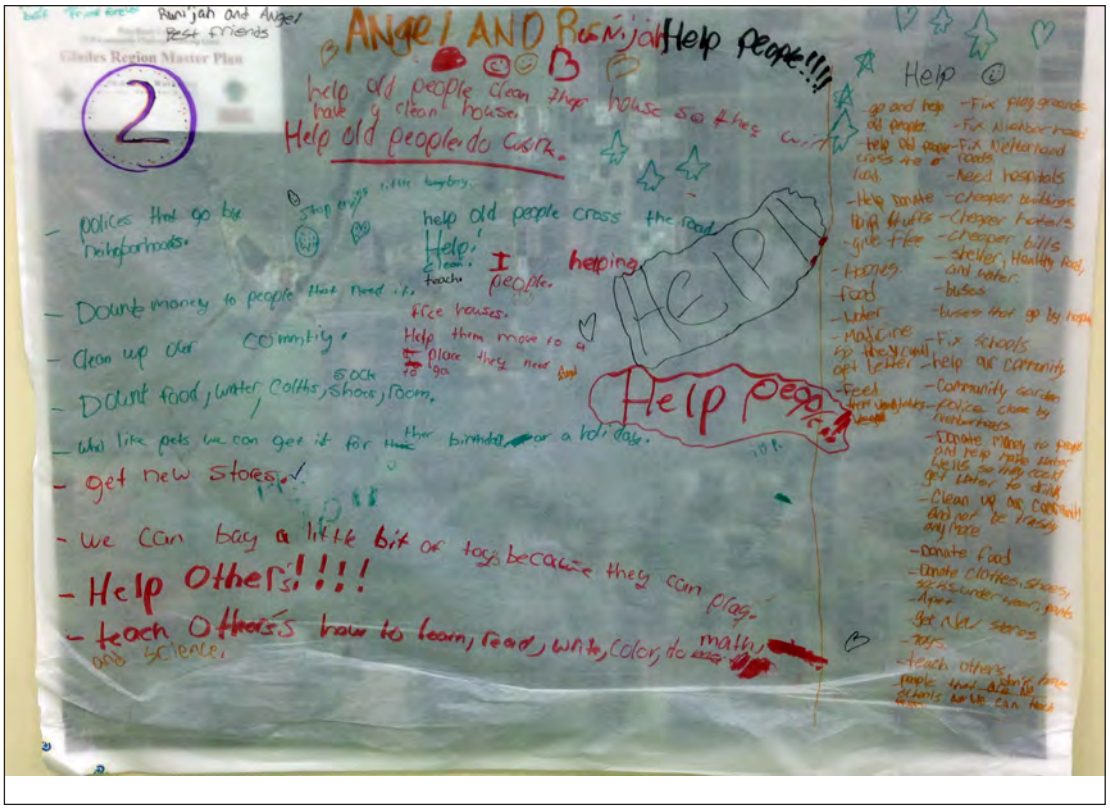
refreshments were provided. After lunch, a representative of each of the table groups presented their ideas back to the overall group. This process was an excellent opportunity for the community to hear from their own friends and neighbors about ways to improve the Glades area. This input was also critical for the project team as it serves as the basis for future recommendations.

3.0 Existing Conditions and Issues - Belle Glade / South Bay

The Belle Glade/South Bay participants developed seven plans which are included in the following pages.

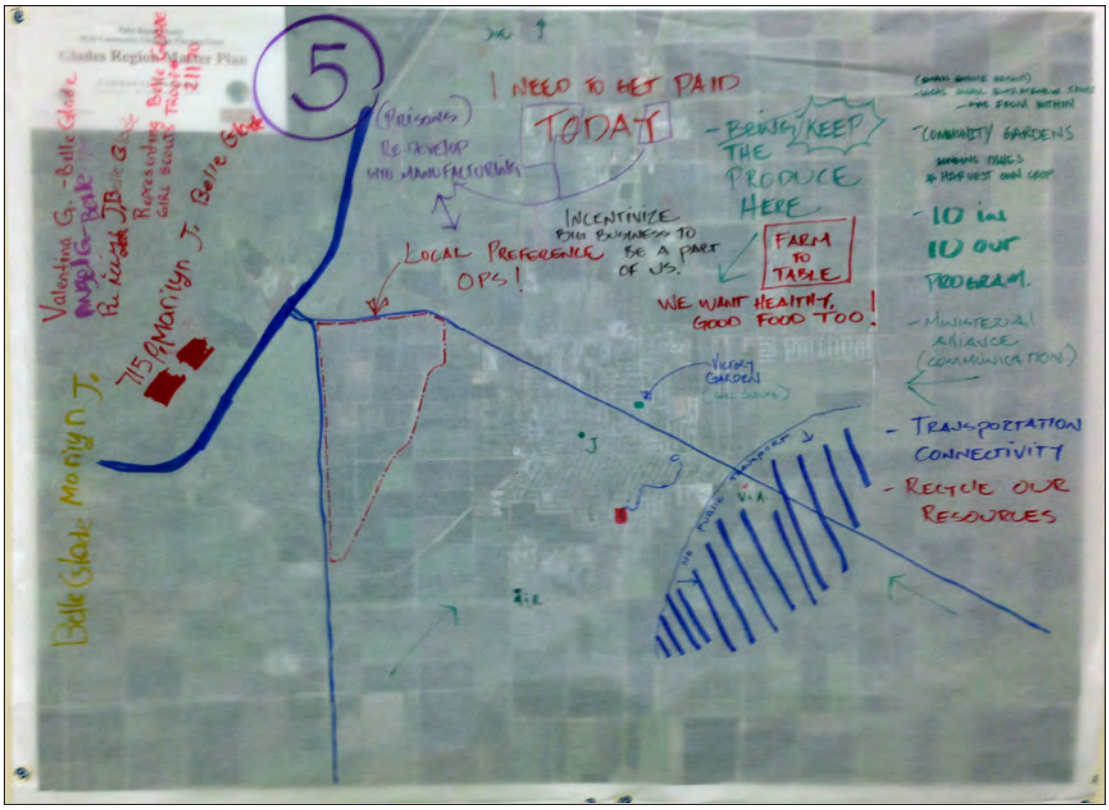
Citizens presenting their ideas during the Belle Glade/South Bay Workshop.

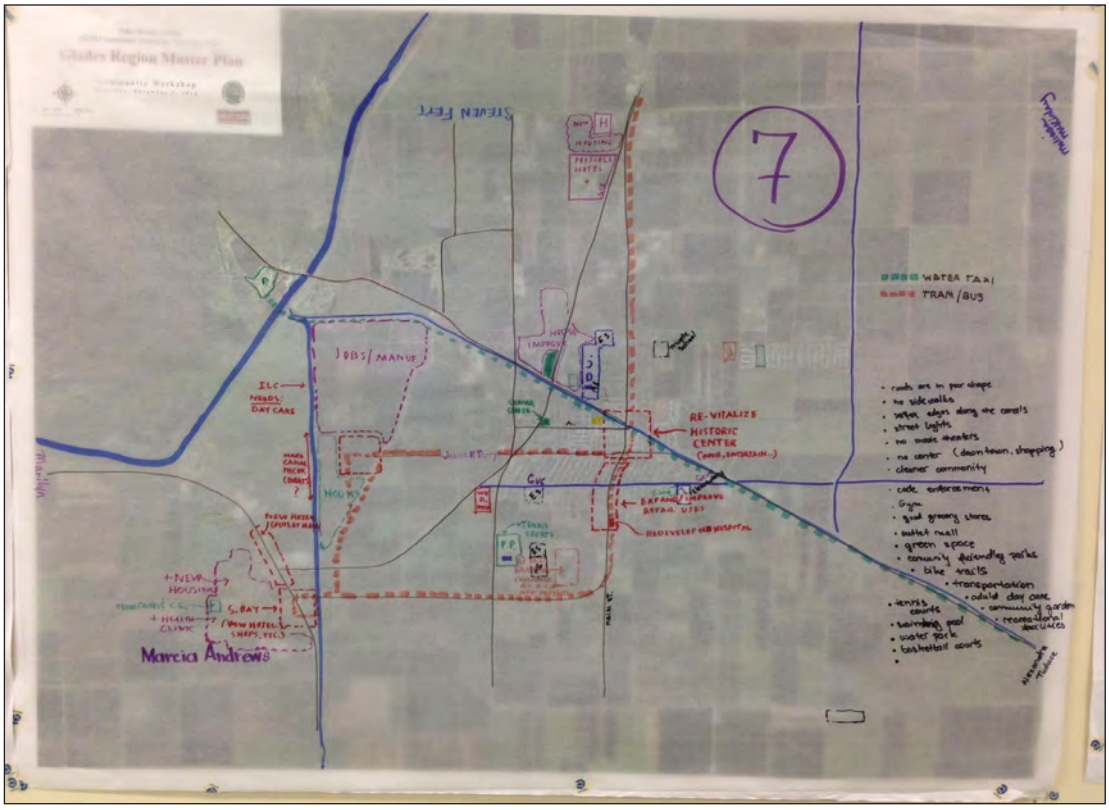




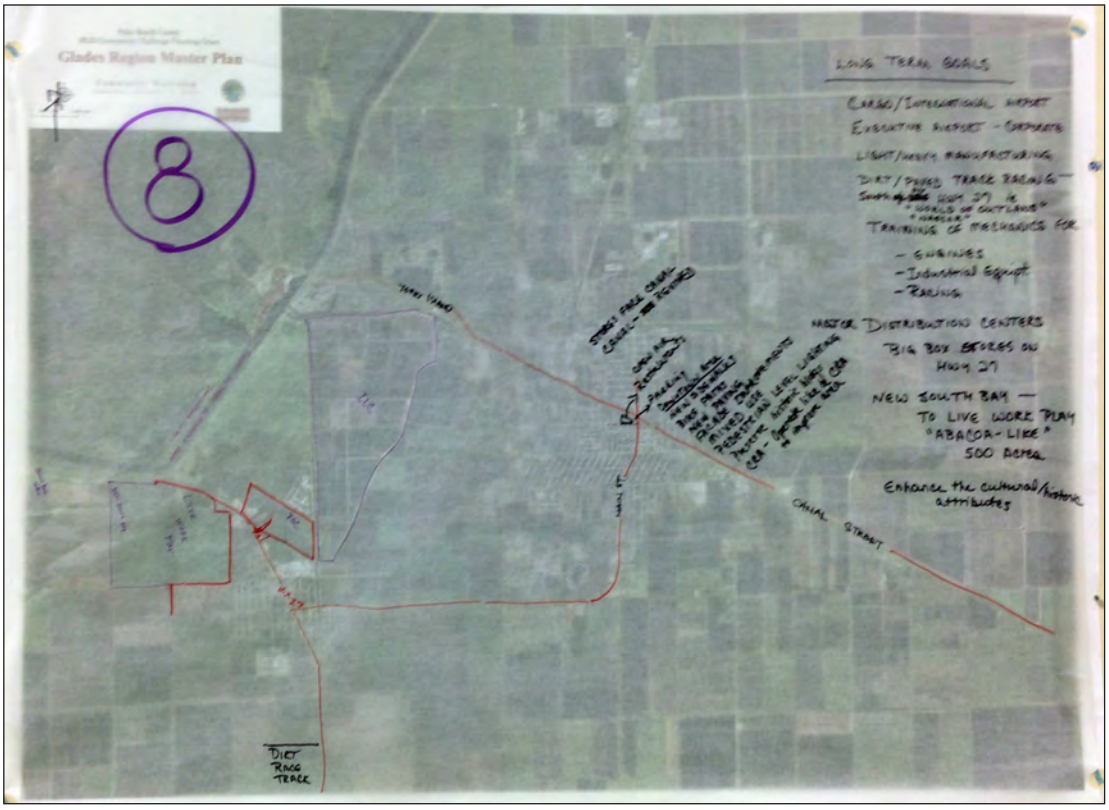
Citizens' maps developed during the Belle Glade/South Bay Workshop.

Citizens' maps developed during the Belle Glade/South Bay Workshop.





Citizens' maps developed during the Belle Glade/South Bay Workshop.



Citizens' map developed during the Belle Glade/South Bay Workshop.

4.0 Key Issues, Analyses and Results - Belle Glade / South Bay

Many ideas and issues were discussed and presented during the Saturday workshop. Key items that were presented repeatedly are listed below.

- Include the Community In Every Aspect of Improving the Glades Region
- Change Belle Glade – For the Betterment of the Community
- Clean Up Trash – Remove or Redevelop Broken Buildings
- More Community Gardens, Police in the Neighborhoods, and a Green Market
- Maintain Historic Belle Glade – Loading Ramp is Very Important to African American Community – Enhance Cultural Elements of the Glades
- Need to Improve Sidewalks, Include Shade Trees and Better Lighting on Main Street (more street lights throughout)
- Need Roadway Improvements (especially neighborhood streets)
- We Must Strengthen the Weakest Link which is the Inner City to Thrive
- Must Diversify Economy – Include Local Participation with ILC Hiring
- The Youth are the Ultimate Stakeholders of Our Community – Listen to the Youth and Work Towards Immediate Improvements

After the Saturday workshop the TCRPC team set up a mobile office at Palm Beach State College for the following six days. The mobile office was open to the public from 9:00 am until 5:00 pm each day and many members of the community visited the office to provide further input. The key function of the mobile office was to provide an on-site location for the team to work and give members of the public and agency partners a central location to continue the dialogue and information exchange. Perhaps most importantly, the on-site office provided a unique opportunity for the project team to engage daily with the community. This interaction helped to build connections between the team and the community and was intended to increase the sense of authorship the participant felt toward the process.

During the week, the team developed the following key areas of analysis to assist in the overall GRMP effort:

- Development of Study Area Base Maps; Qualitative Assessment of the Built Environment; Infill Housing Prototypes; Marketing and Promotional Images; and Emerging Economies.
- Development of Study Area Base Maps
- Using high-resolution aerial photographs and cross-referencing with Palm Beach County Property Appraiser data, the GRMP team developed base maps of all of the Glades communities. These maps were developed in AutoCad and illustrate existing blocks, lots, building footprints, and significant landmarks including canals and parks.

The team used these maps to build the existing condition assessment diagrams.

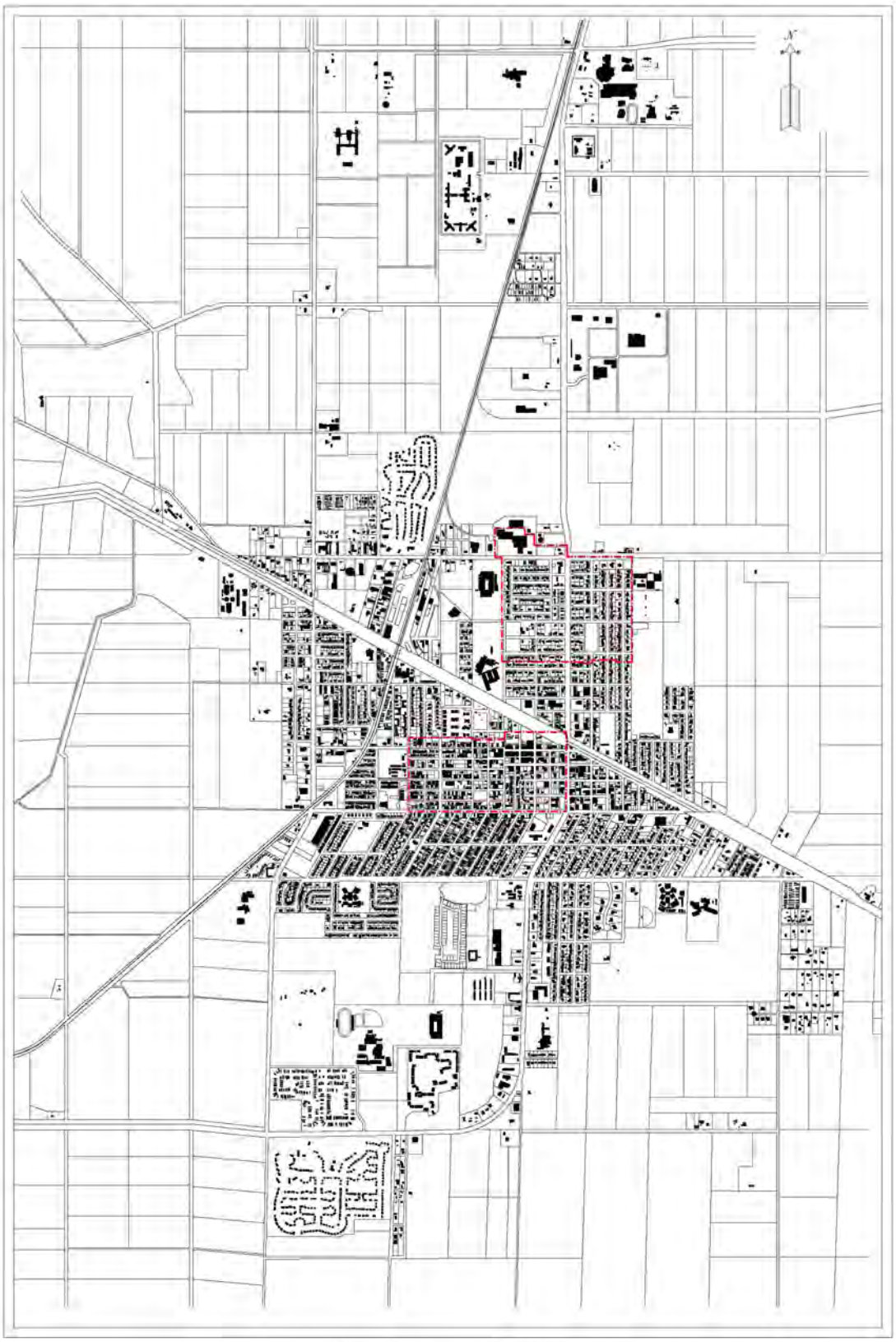
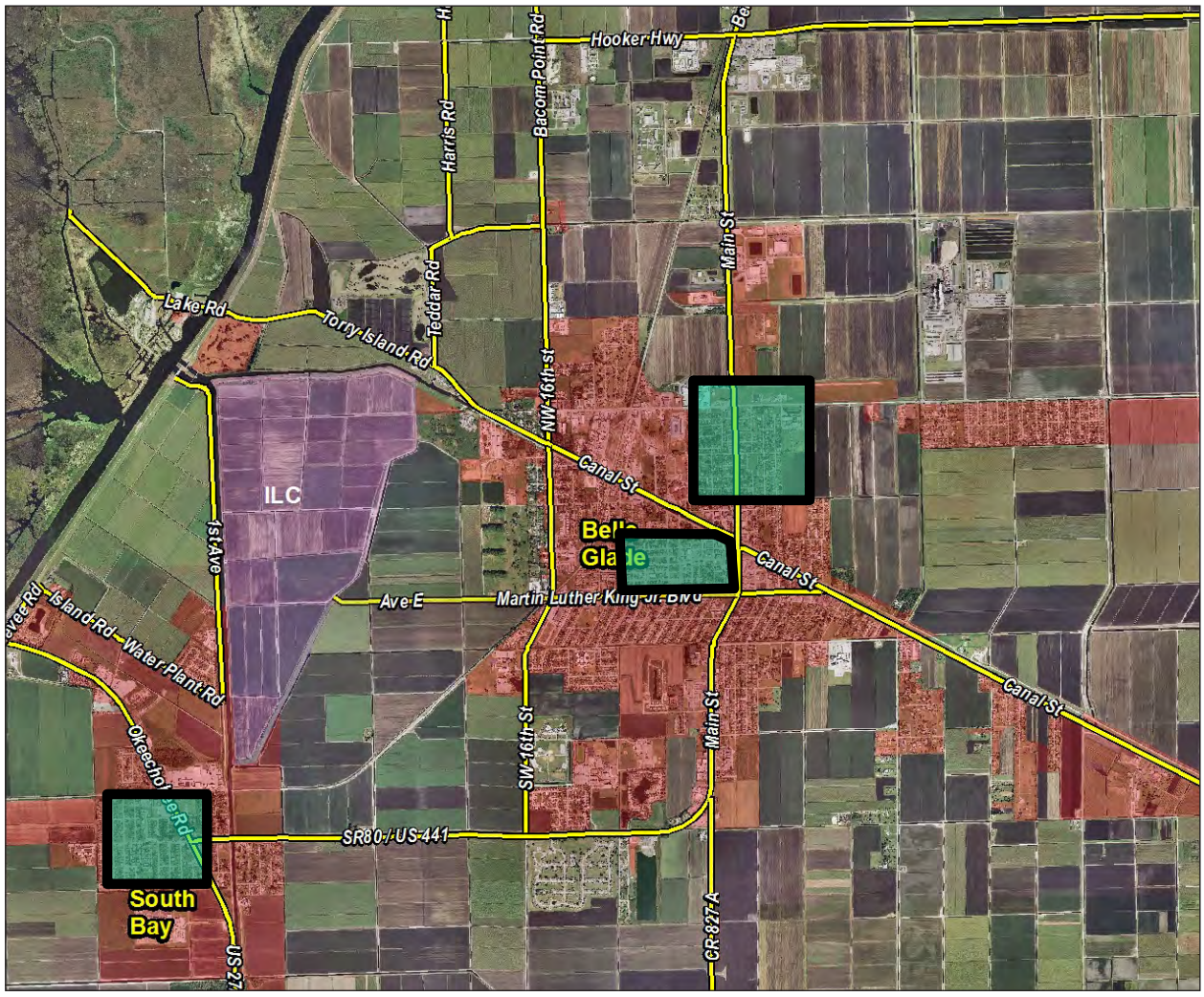

BELLE GLADE
Site Map N.T.S.

Figure 1
Belle Glade/South Bay Analyzed Areas



This aerial image is of Belle Glade and South Bay. The areas within the green boxes depict the areas where the detailed building condition, roadway and sidewalk infrastructure analysis was conducted. The following pages illustrate that analysis.

Qualitative Assessment of the Built Environment

The team conducted a windshield survey of the detailed areas of South Bay and Belle Glade. The surveys identified housing, roadway, sidewalk, and other general conditions. To document the building conditions, the team developed a three-tier ranking system based upon the following criteria:

TYPE A
Building in GOOD physical condition

- Building envelope adequately protects interior
- Exterior may need some improved maintenance, cleaning, etc.

TYPE B
Building in need of MINOR repairs

- Exterior may need paint; Vegetation may be overgrown; May require site work, planting, paving, etc.
- May be missing a window or two; Appearance may need general improvement

TYPE C
Building in need of MAJOR repairs

- Roof may be compromised; Foundations may have settled and may be separating from structural wall; Walls may have structural cracks; Missing doors or windows, exposing interior to elements
- Substantial repairs and/or alterations required to bring building up to code

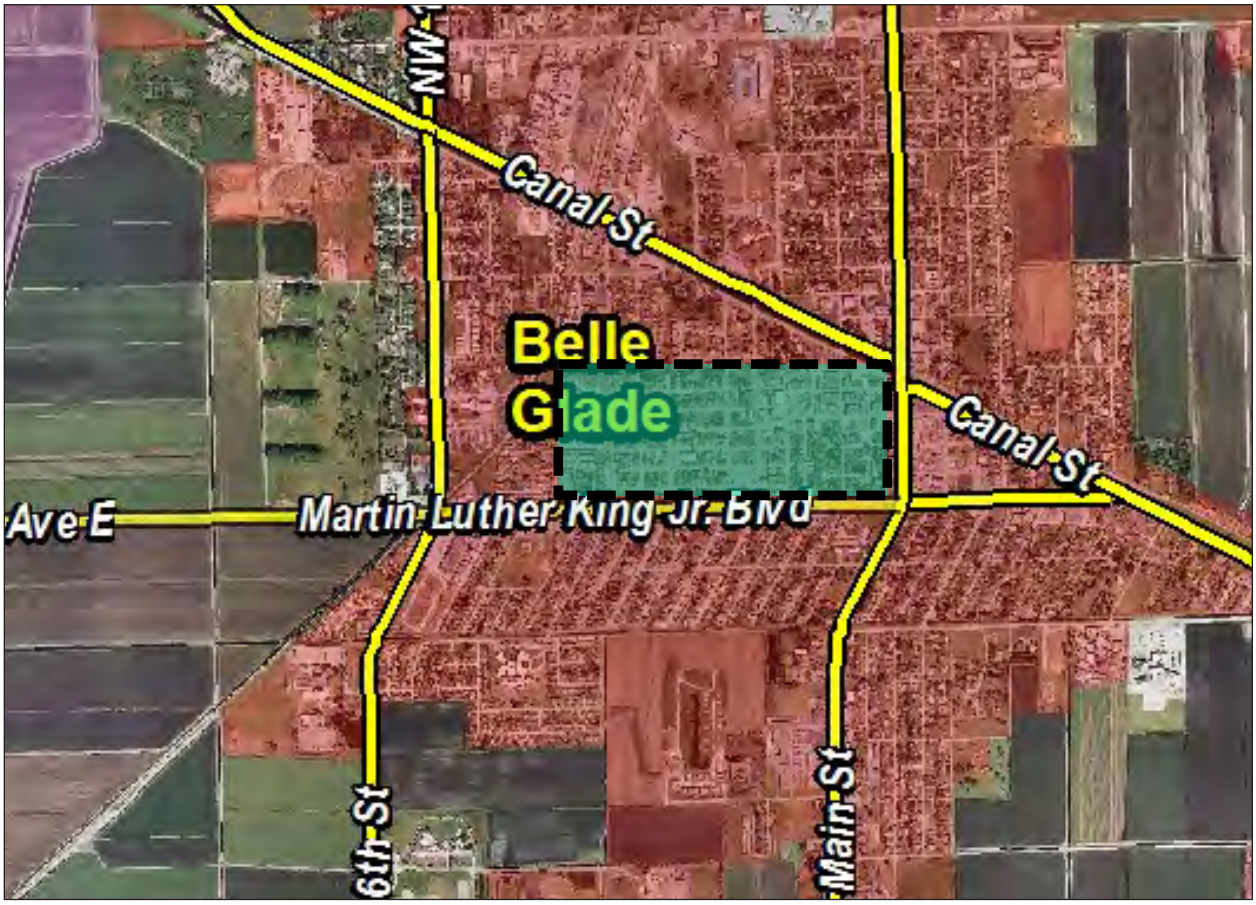
Using this criteria, the team ranked the existing building fabric within a detailed area and mapped the results.

Type A building type example.

Type B building type example.

Type C building type example.

Figure 2
SW Belle Glade
Avenue A to Avenue E (MLK); Main Street to 10th Street

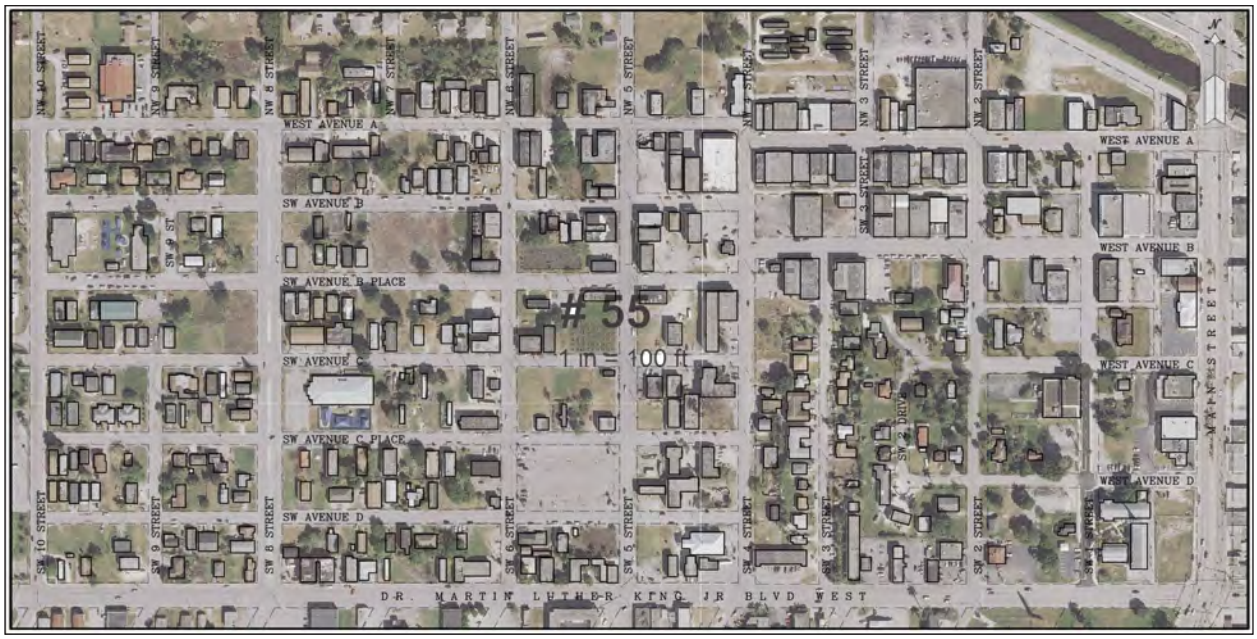


The detailed analysis area of south-west Belle Glade is represented above. The area is bounded by Main Street to the east, Avenue A to the north, NW 10 Street to the west, and Martin Luther King Boulevard to the south.

Figure 3
SW Belle Glade
Existing Conditions

Above is a detailed aerial of the south-west Belle Glade analysis area.

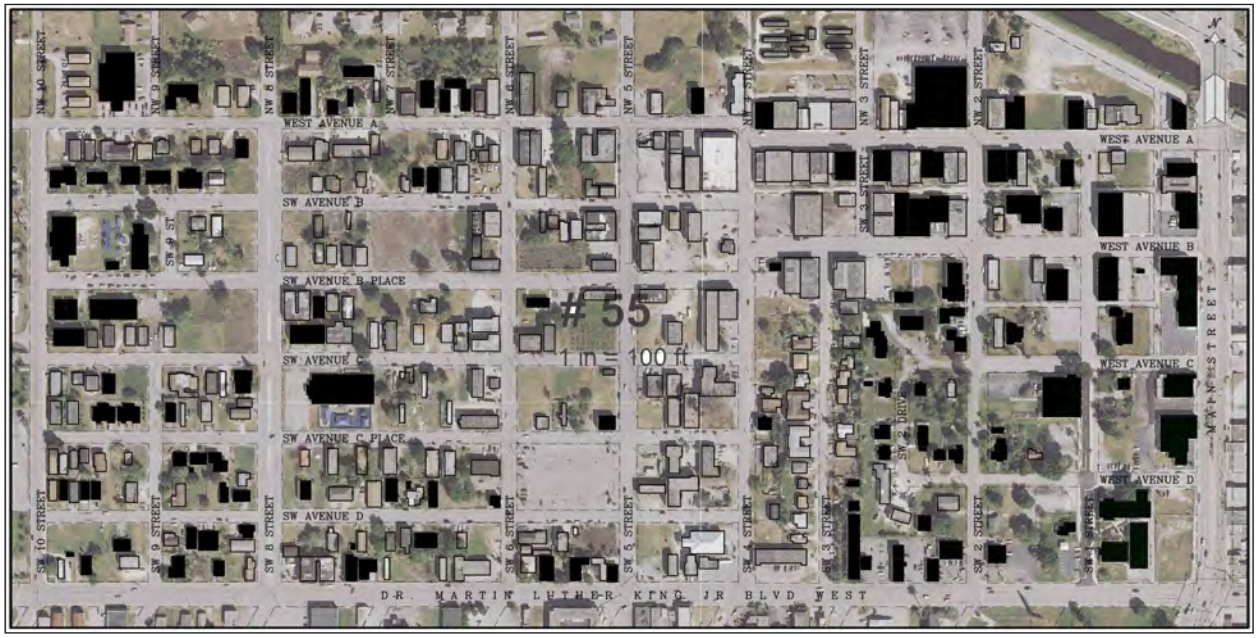
Figure 4
SW Belle Glade
Existing Conditions with Building Footprints



Using the detailed aerial image from above, the TCRPC team developed base drawings that drew in every street and building.

Figure 5
SW Belle Glade
Building Assessment Type "A"

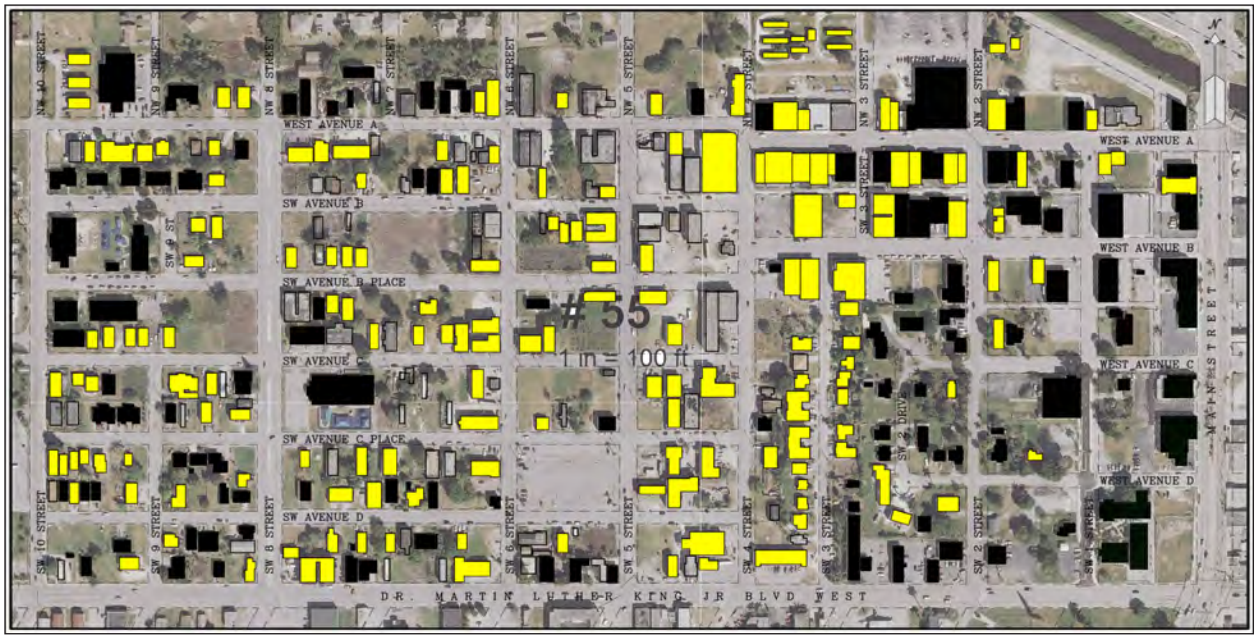
The buildings illustrated above are examples of Type A buildings.



The buildings that are colored in black represent the Type A buildings within the south-west Belle Glade analysis area. These buildings are in typically good condition as assessed from the street.

Figure 6
SW Belle Glade
Building Assessment Type "B"

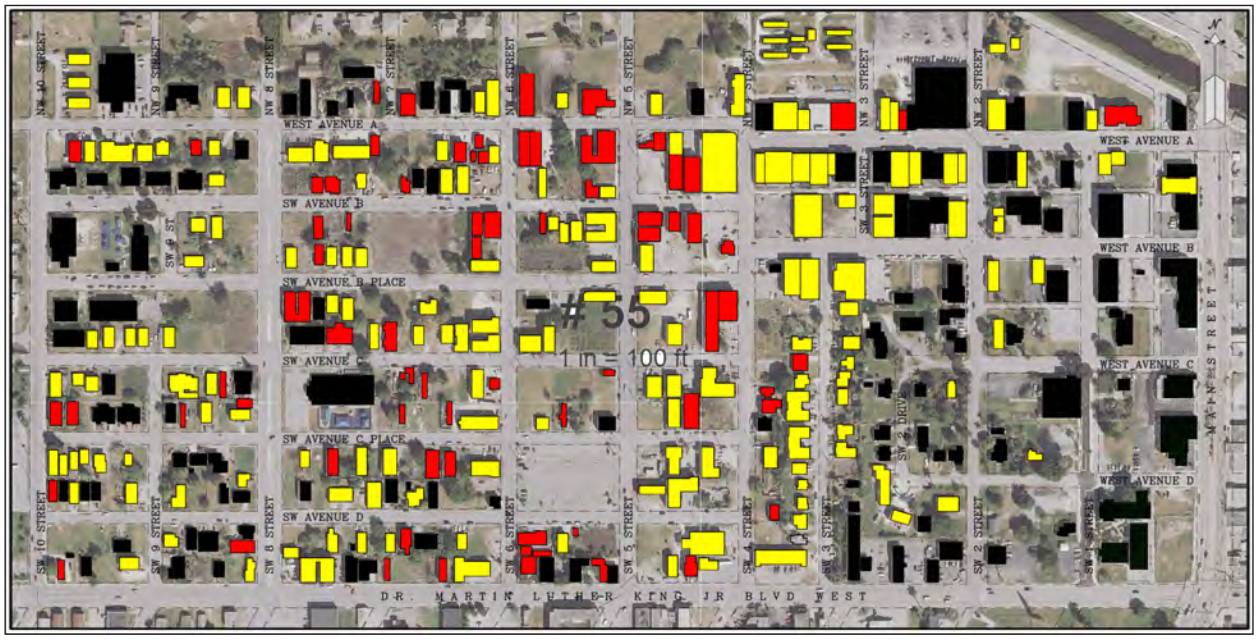
The buildings illustrated above are examples of Type B buildings.



The buildings that are colored in yellow represent the Type B buildings within the south-west Belle Glade analysis area.

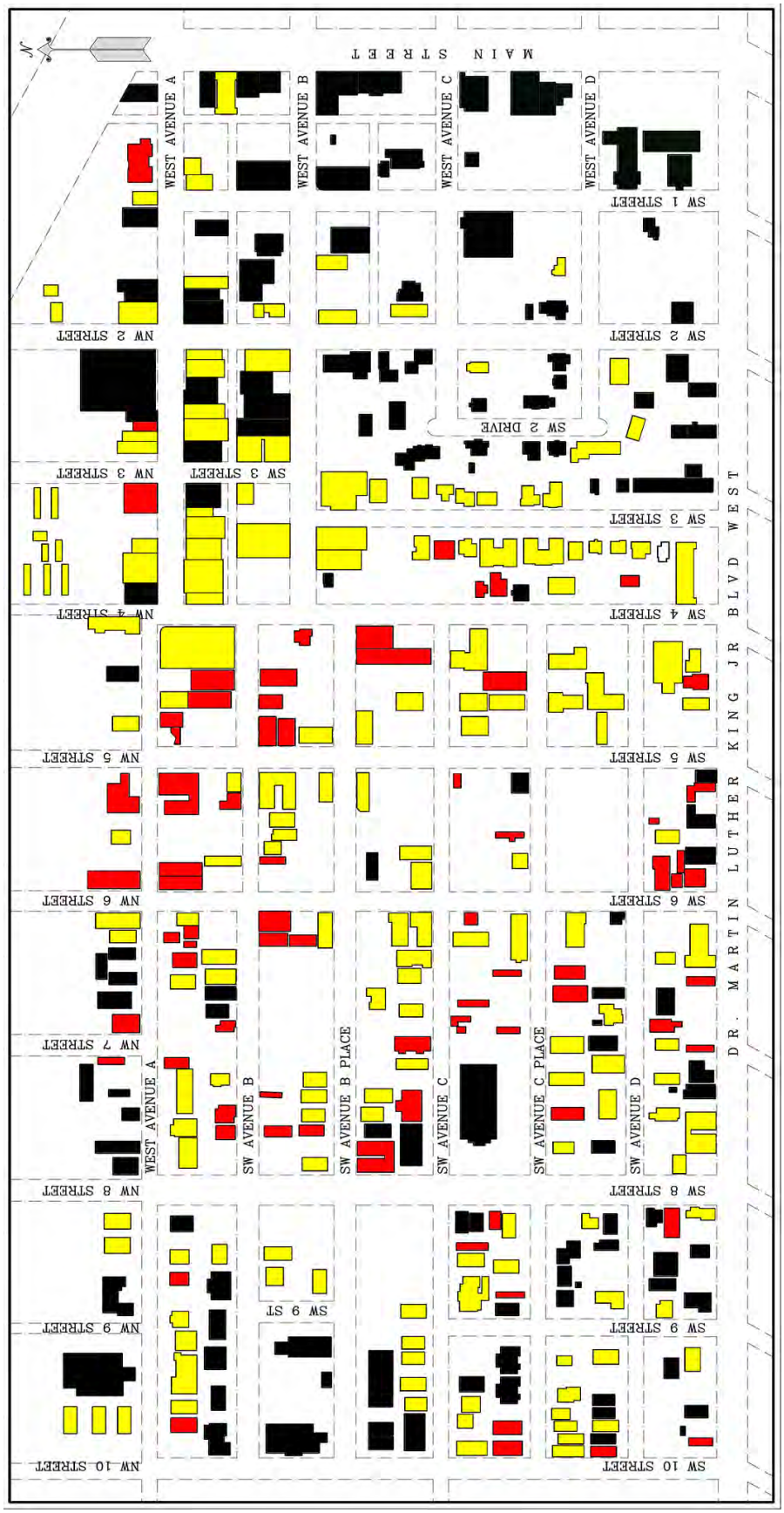
Figure 7
SW Belle Glade
Building Assessment Type "C"

The buildings illustrated above are examples of Type C buildings.



The buildings that are colored in red represent the Type C buildings within the south-west Belle Glade analysis area. As assessed from the street, these buildings are in obvious need of significant improvement and rehabilitation.

Figure 8
SW Belle Glade
Building Assessment Type "A" + "B" + "C" Buildings



The drawing above is a composite of the Type A, Type B, and Type C buildings within the south-west Belle Glade analysis area. Note that the majority of buildings are Type A or B suggesting that attention should be focused on the Type C buildings.

The team also mapped streets in need of improvement, missing sidewalks, and prominent community features (including community gardens and corner stores).

Figure 9
SW Belle Glade
Needed Roadway Improvements

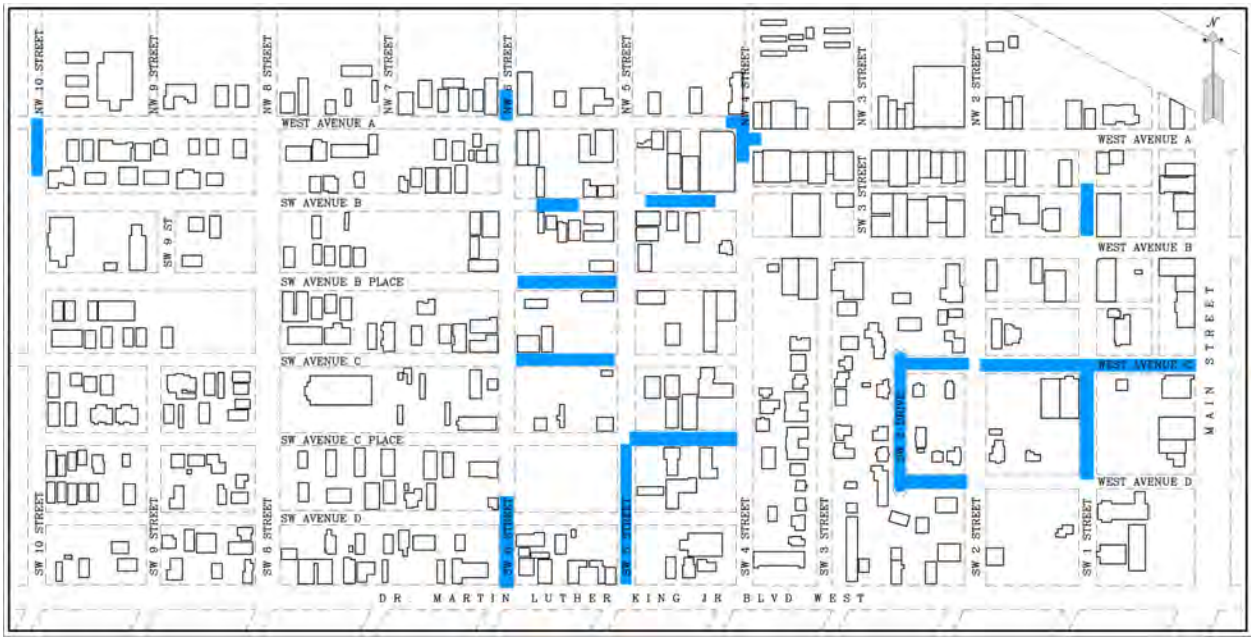
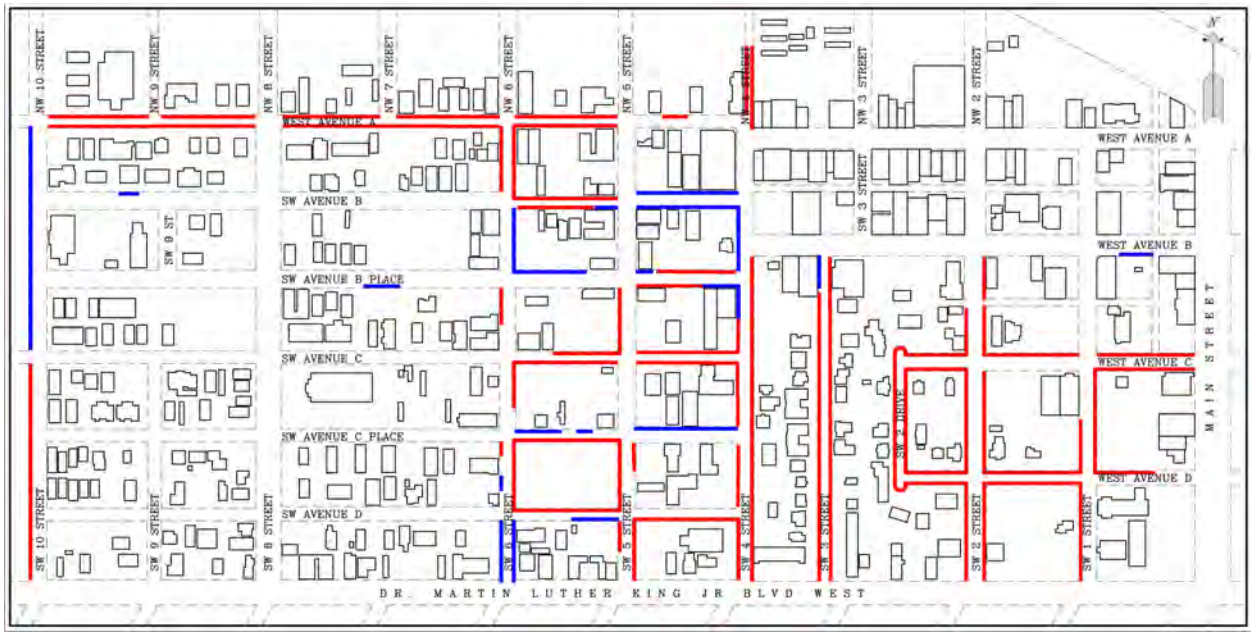


Figure 10
SW Belle Glade
Sidewalk Improvements



The two drawings above represent needed roadway and sidewalk improvements. The red lines illustrate missing sidewalks whereas the thin blue lines identify sidewalks that need improvements.

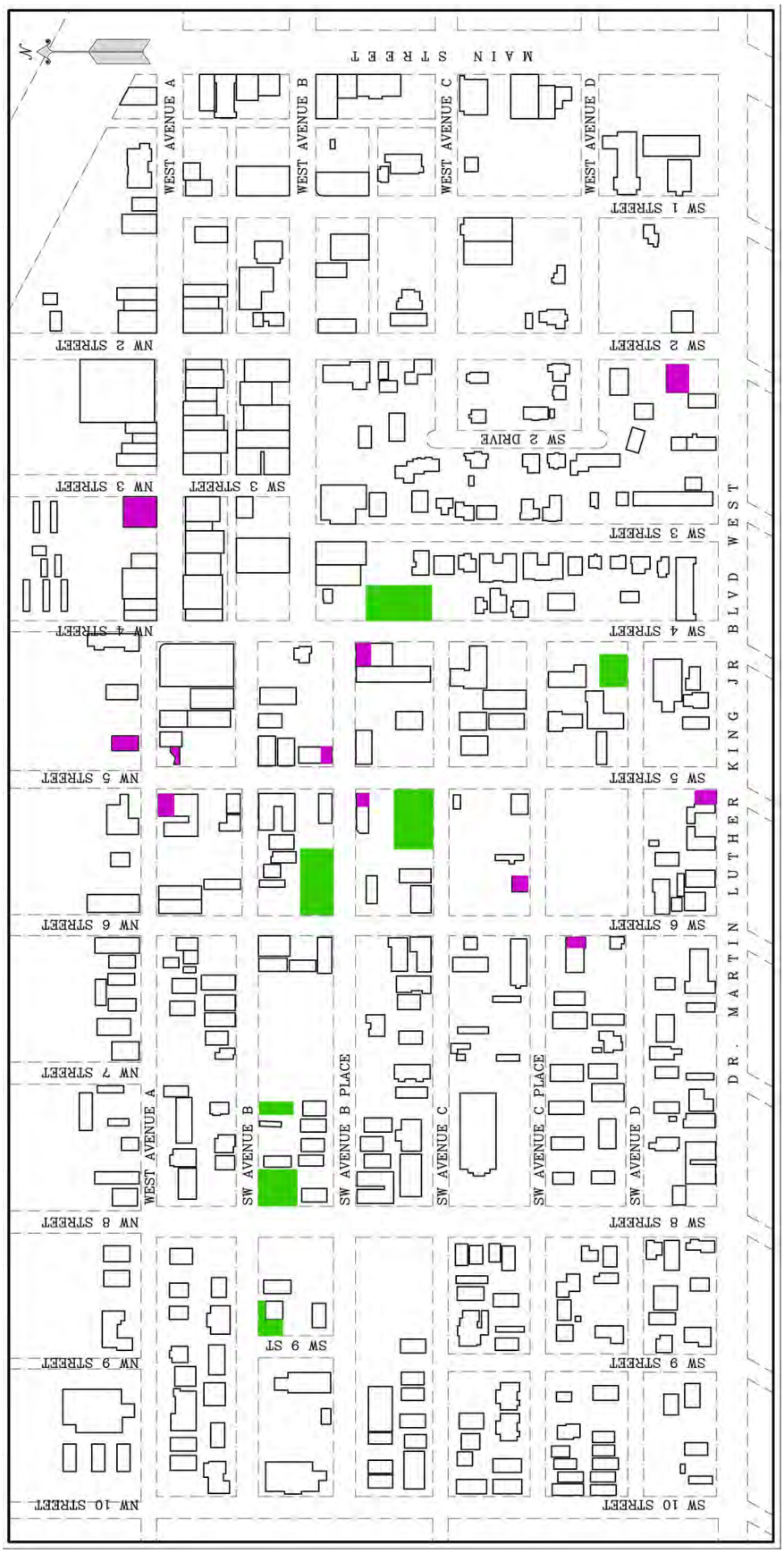


Figure 11
SW Belle Glade
Community Gardens - Corner Stores

This map illustrates local amenities within the south-west Belle Glade analysis area. The purple building footprints represent community markets or corner stores and the green lots illustrate existing community gardens. One idea presented by the public was creating a stronger connection between the community garden produce and corner store offerings.

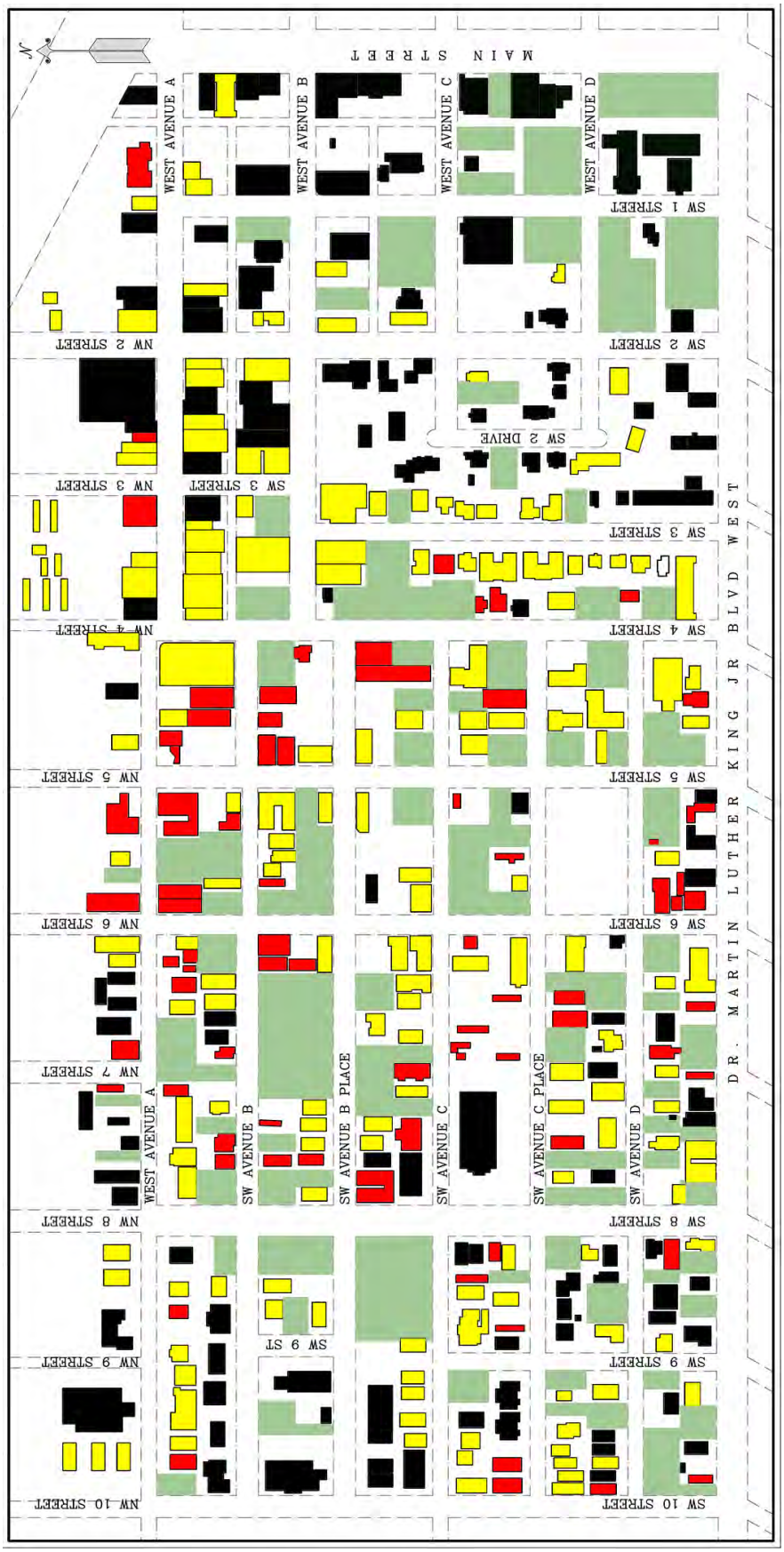


Figure 12
SW Belle Glade
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels

The drawing above illustrates the buildings and vacant parcels within the south-west Belle Glade analysis area. The light green areas are vacant lots which represent opportunities for infill housing.

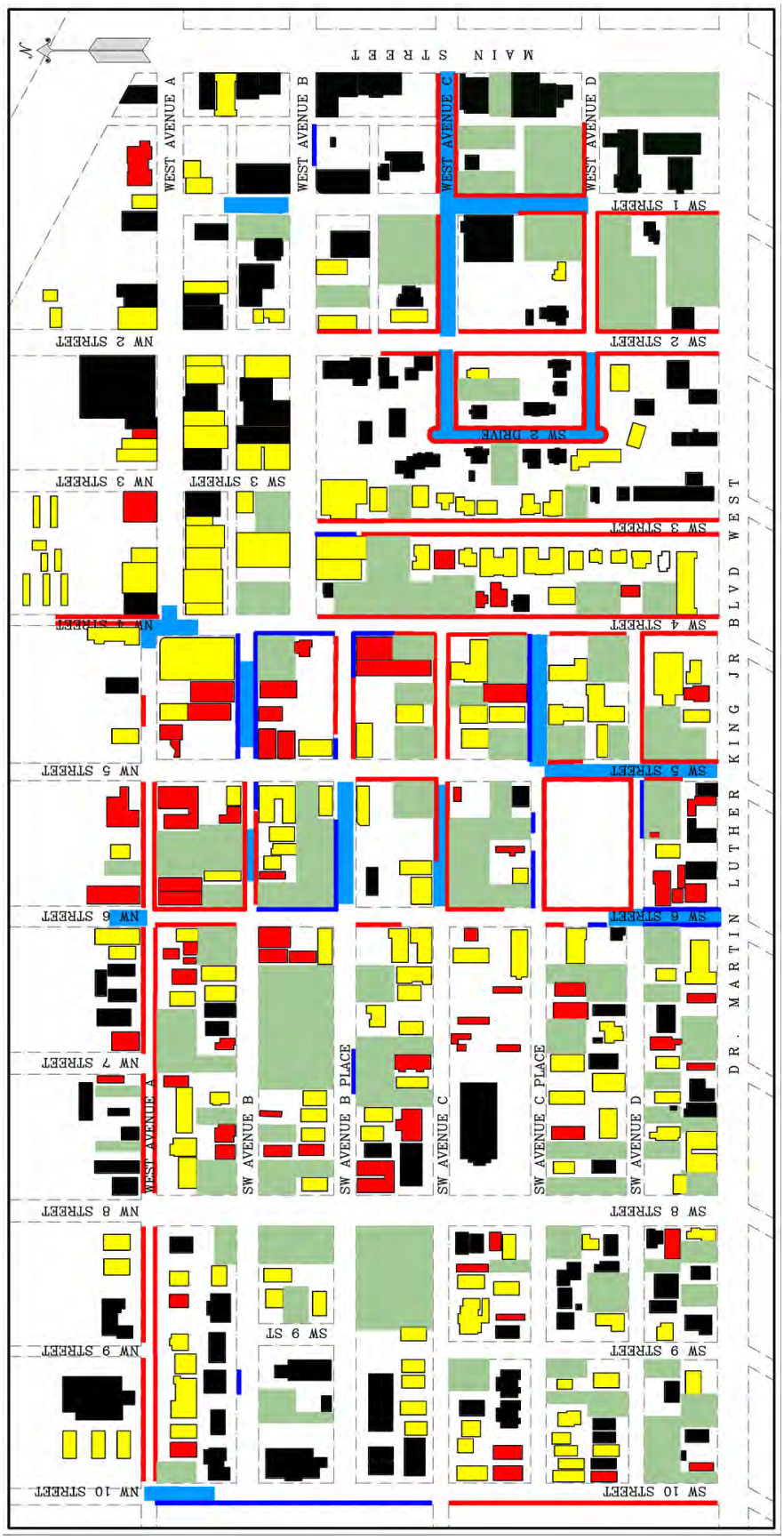
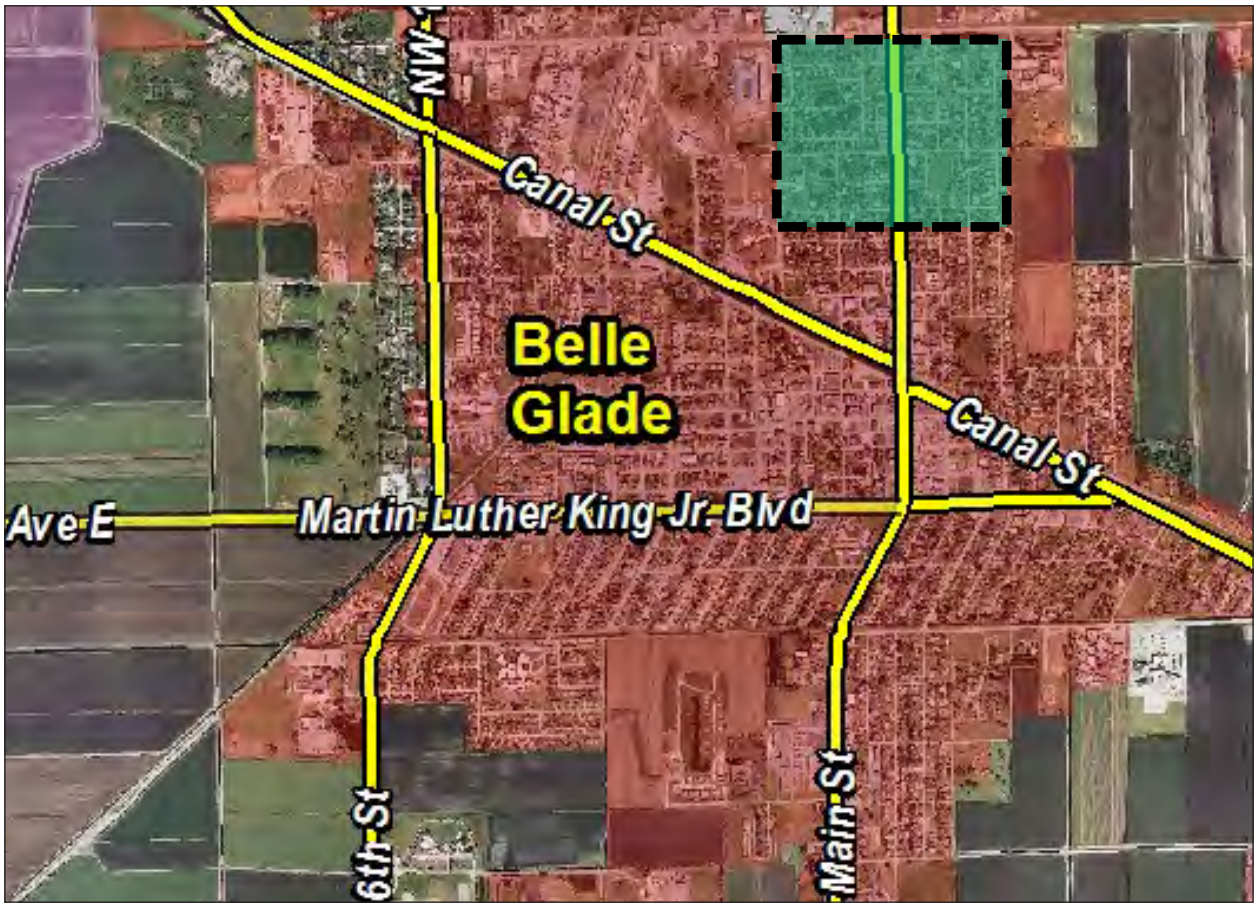


Figure 13
SW Belle Glade
All Analyses

This drawing is a composite of all the analytical diagrams developed for the south-west Belle Glade analysis area.

Figure 14
NE Belle Glade
Avenue L to Avenue F; NW 2nd Street to NE 3rd Street



The detailed analysis area of north-east Belle Glade is represented above. The area is bounded by Airport Road to the north, NE 3rd Street to the east, NE Avenue F to the south, and NW 4th Street to the west.

Figure 15
NE Belle Glade
Existing Conditions

Above is a detailed aerial of the north-east Belle Glade analysis area.

Figure 16
NE Belle Glade
Existing Conditions with Building Footprints

Using the detailed aerial image from above, the TCRPC team developed base drawings that drew in every street and building.

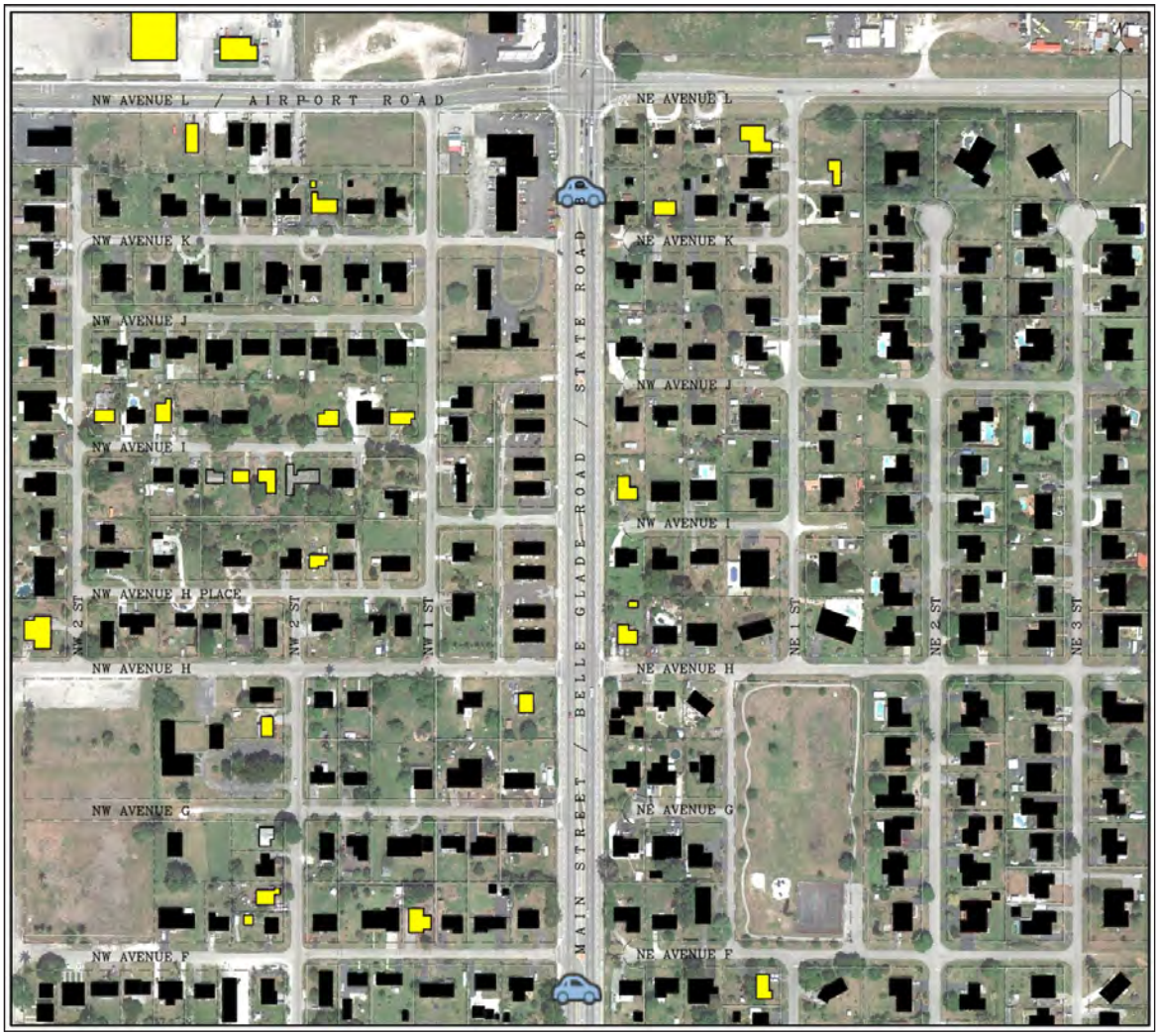
Figure 17
NE Belle Glade
Building Assessment Type "A"

The buildings illustrated above are examples of Type A buildings.

The buildings that are colored in black represent the Type A buildings within the north-east Belle Glade analysis area. These buildings are in typically good condition as assessed from the street.

Figure 18
NE Belle Glade
Building Assessment Type "B"

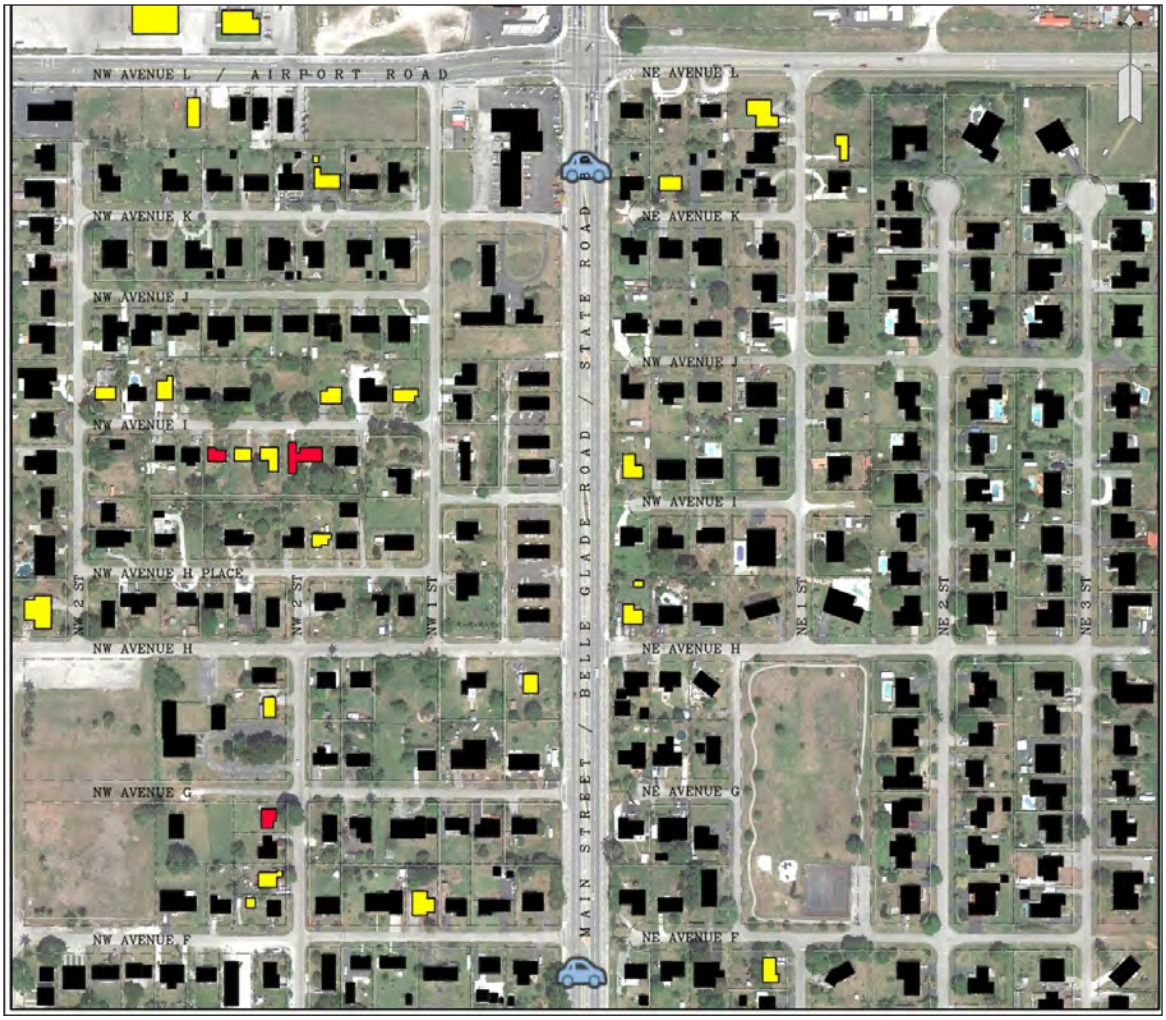
The buildings illustrated above are examples of Type B buildings.



The buildings that are colored in yellow represent the Type B buildings within the north-east Belle Glade analysis area.

Figure 19
NE Belle Glade
Building Assessment Type "C"

The building illustrated above is an example of Type C buildings.



The buildings that are colored in red represent the Type C buildings within the north-east Belle Glade analysis area. As assessed from the street, these buildings are in obvious need of significant improvement and rehabilitation.

Figure 20
NE Belle Glade
Building Assessment Type "A" + "B" + "C" Buildings

The drawing above is a composite of the Type A, Type B, and Type C buildings within the north-east Belle Glade analysis area. Note that the majority of buildings are Type A representing a strong building fabric in this neighborhood. There are also very few Type C buildings in this area.

Figure 21
NE Belle Glade
Needed Roadway Improvements

This drawing illustrates the roadways in need of improvement within the north-east Belle Glade analysis area.

Figure 22
NE Belle Glade
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels

This map is a composite of the A, B, and C type buildings as well as vacant parcels within the analysis area.

Figure 23
NE Belle Glade
All Analyses

The drawing above illustrates all of the analytical diagrams developed for the north-east Belle Glade analysis area.

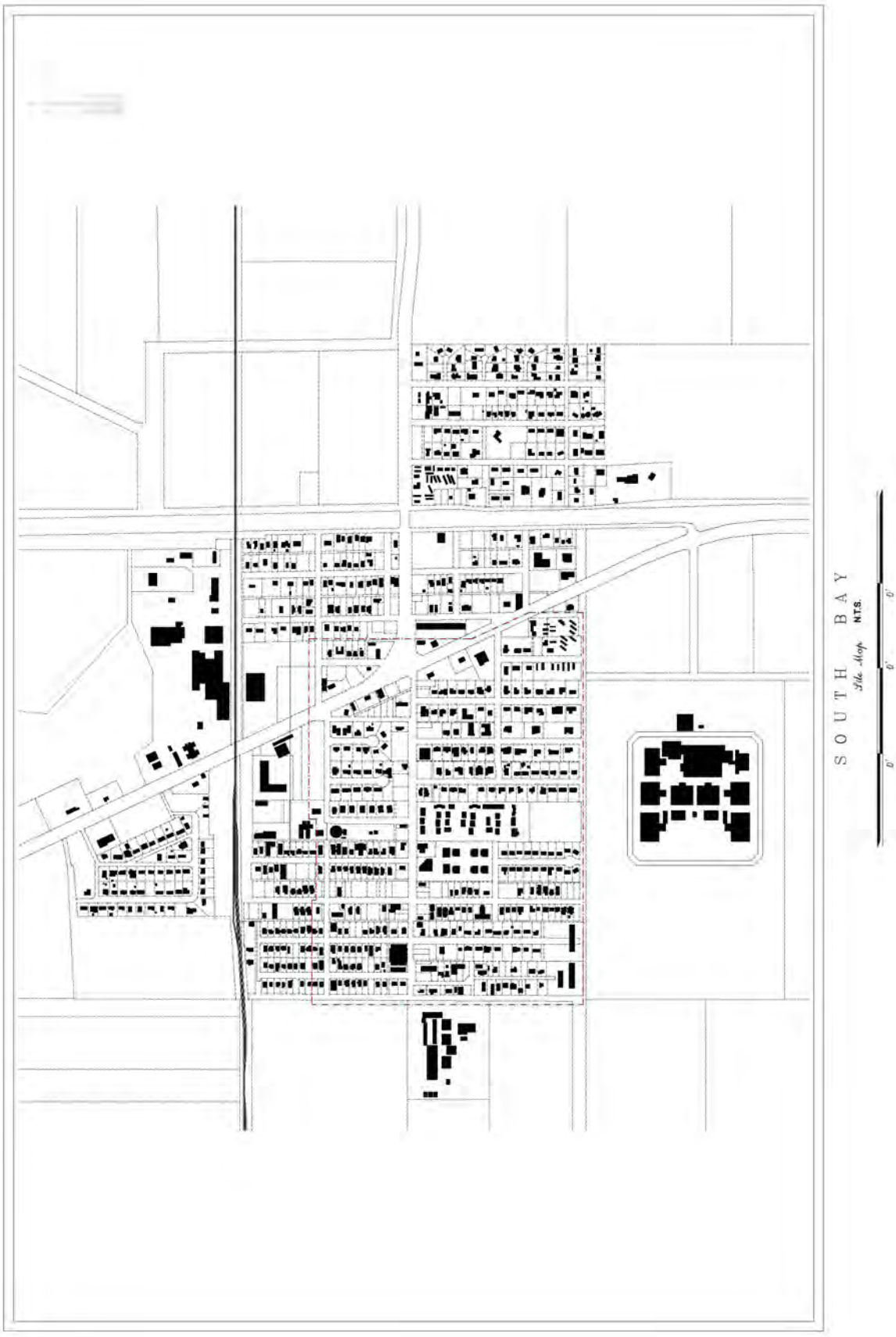
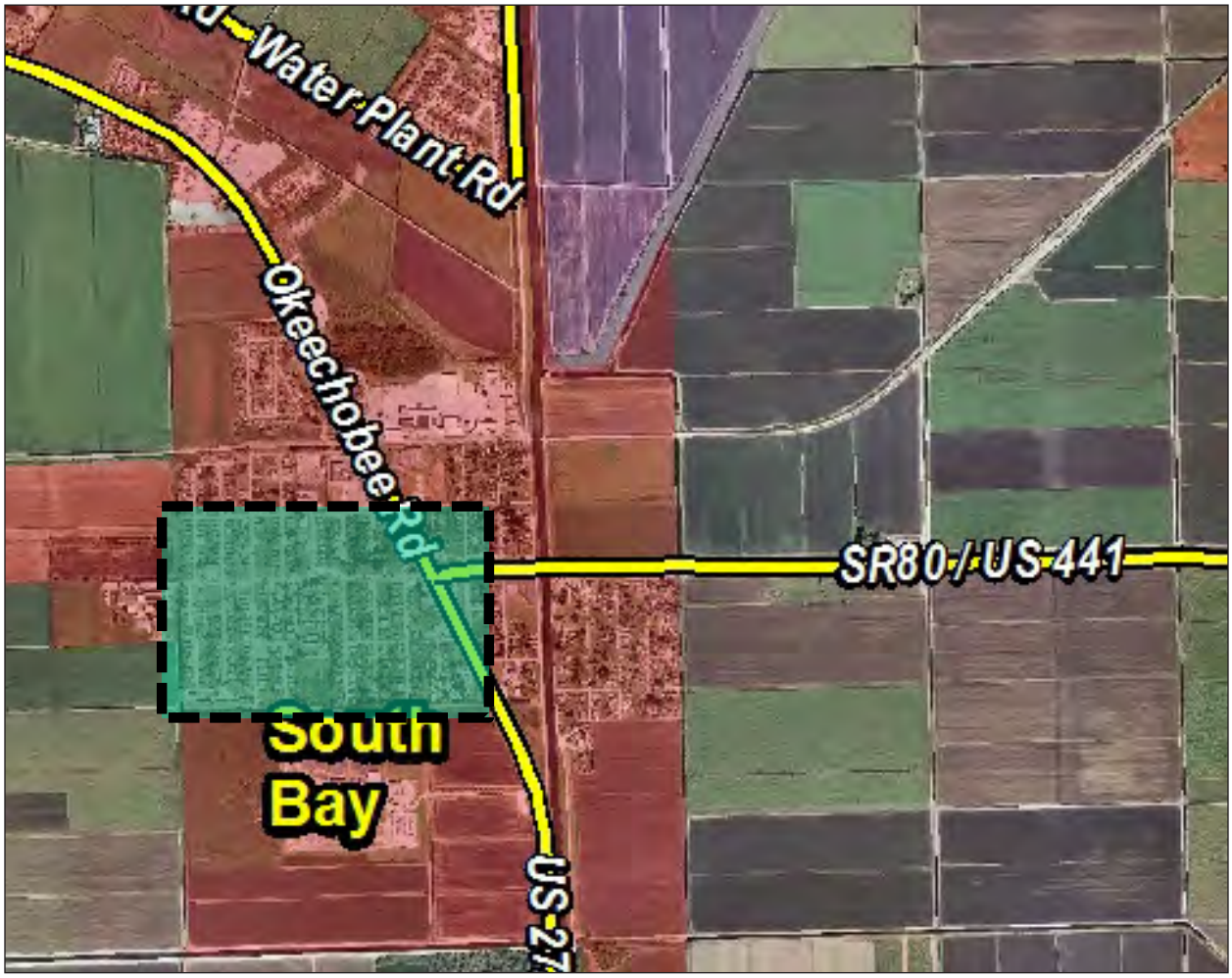

SOUTH BAY
Site Map
NTS.

Figure 24
South Bay
SW 12th Ave to SR 80/US 27; NW 1st Street to SW 3rd Street



The detailed analysis area of South Bay is represented above. The area is bounded by NW 1st Street to the north, SR 80 to the east, SW 3rd Street to the south, and SW 12th Avenue to the west.

Figure 25
South Bay
Existing Conditions

Above is a detailed aerial of the South Bay analysis area.

Figure 26
South Bay
Existing Conditions with Building Footprints

Using the detailed aerial image from above, the TCRPC team developed base drawings that drew in every street and building.

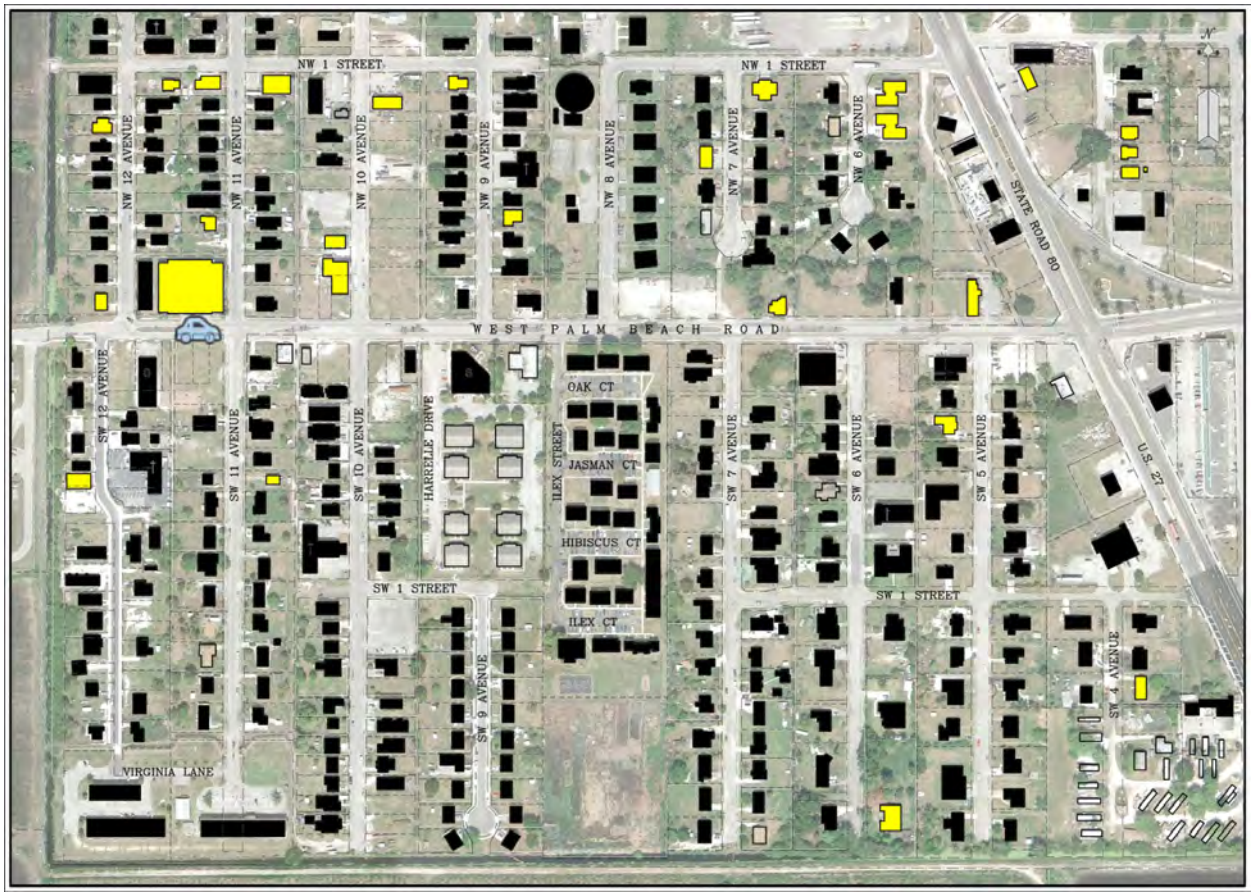
Figure 27
South Bay
Building Assessment Type "A"

The buildings illustrated above are examples of Type A buildings.

The buildings that are colored in black represent the Type A buildings within the South Bay analysis area. These buildings are in typically good condition as assessed from the street.

Figure 28
South Bay
Building Assessment Type "B"

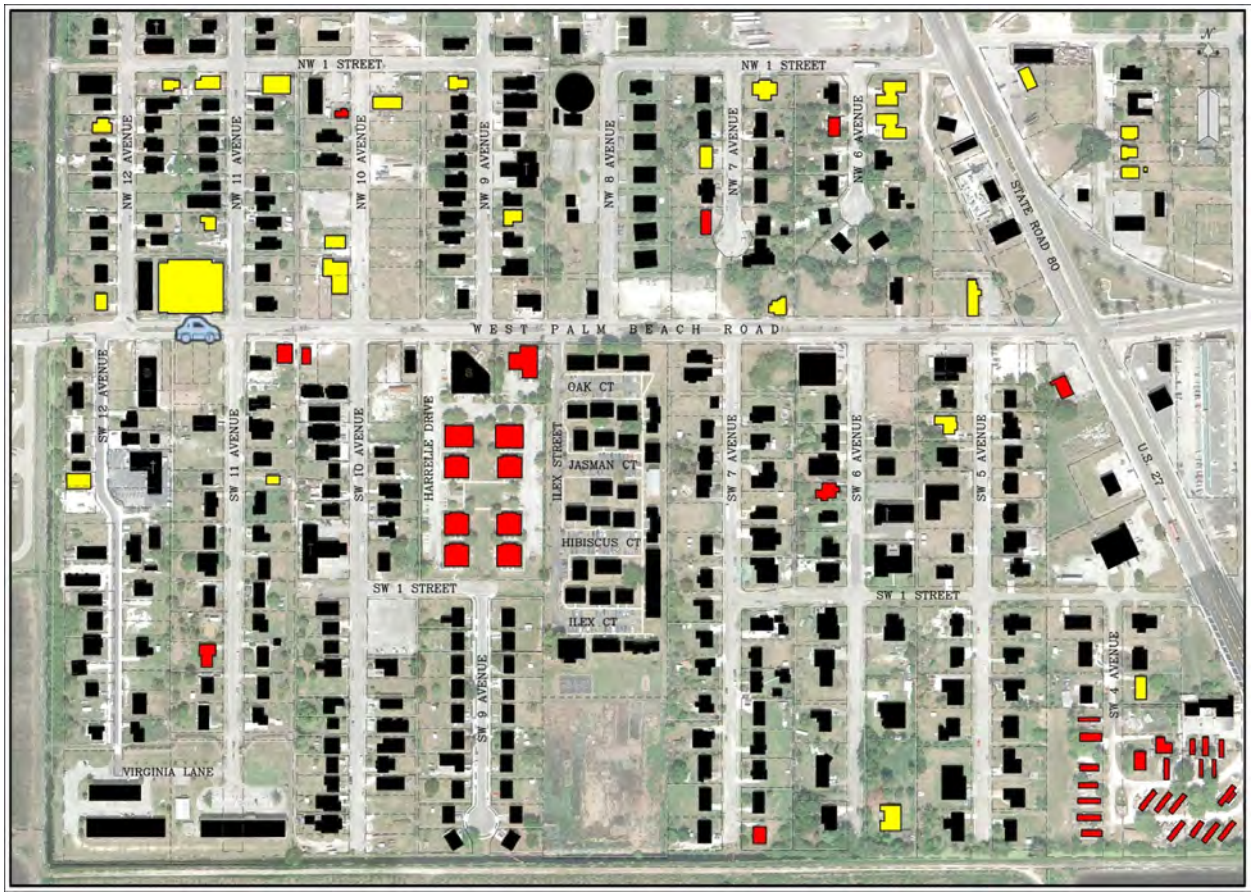
The buildings illustrated above are examples of Type B buildings.



The buildings that are colored in yellow represent the Type B buildings within the South Bay analysis area.

Figure 29
South Bay
Building Assessment Type "C"

The buildings illustrated above are examples of Type C buildings.



The buildings that are colored in red represent the Type C buildings within the South Bay analysis area. As assessed from the street, these buildings are in obvious need of significant improvement and rehabilitation.

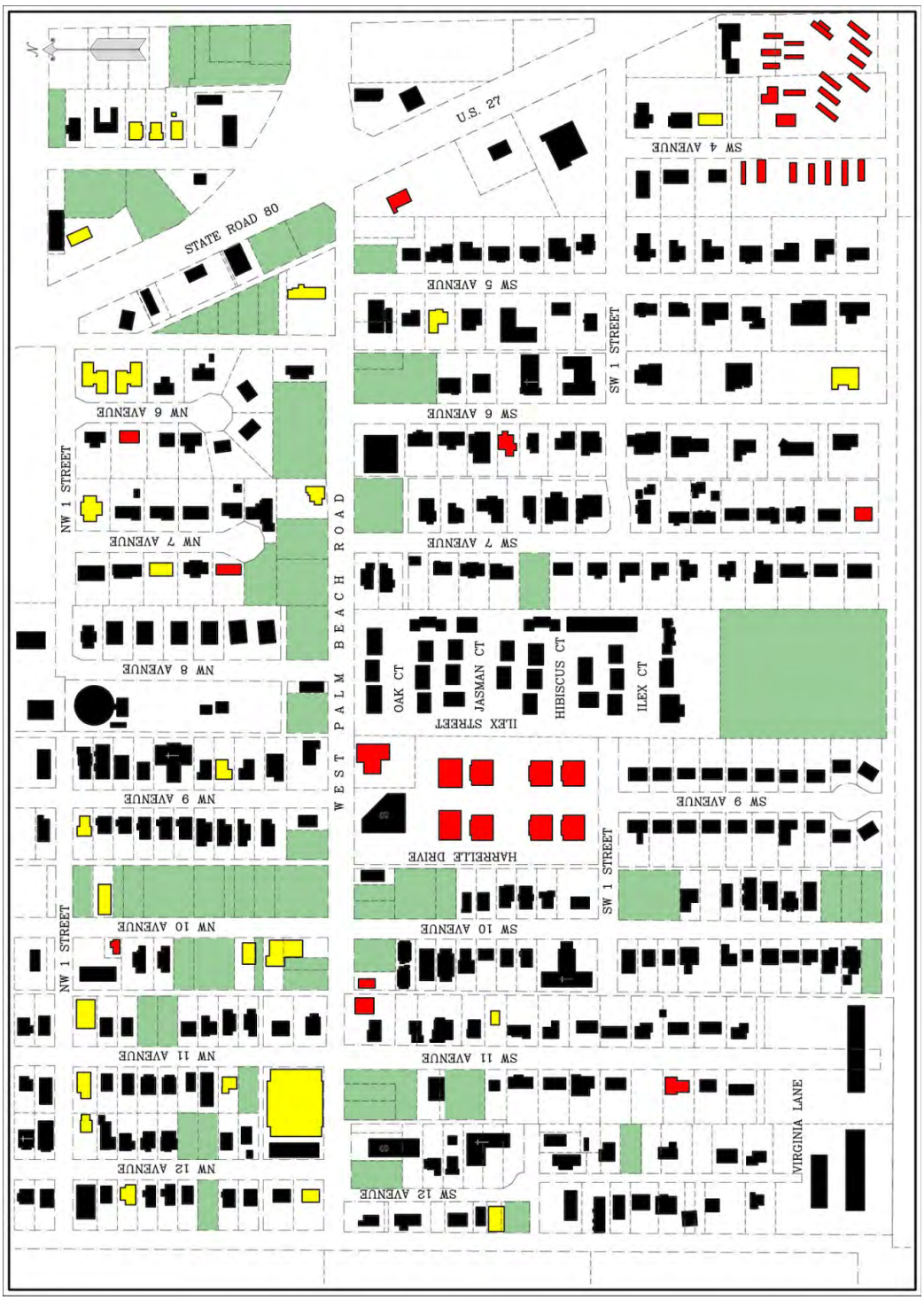


Figure 30
South Bay
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels

The drawing above is a composite of the Type A, Type B, and Type C buildings within the South Bay analysis area. This drawing also depicts the vacant parcels. Note the significant amount of vacant land in the community. There are also very few Type C buildings in the South Bay analysis area.

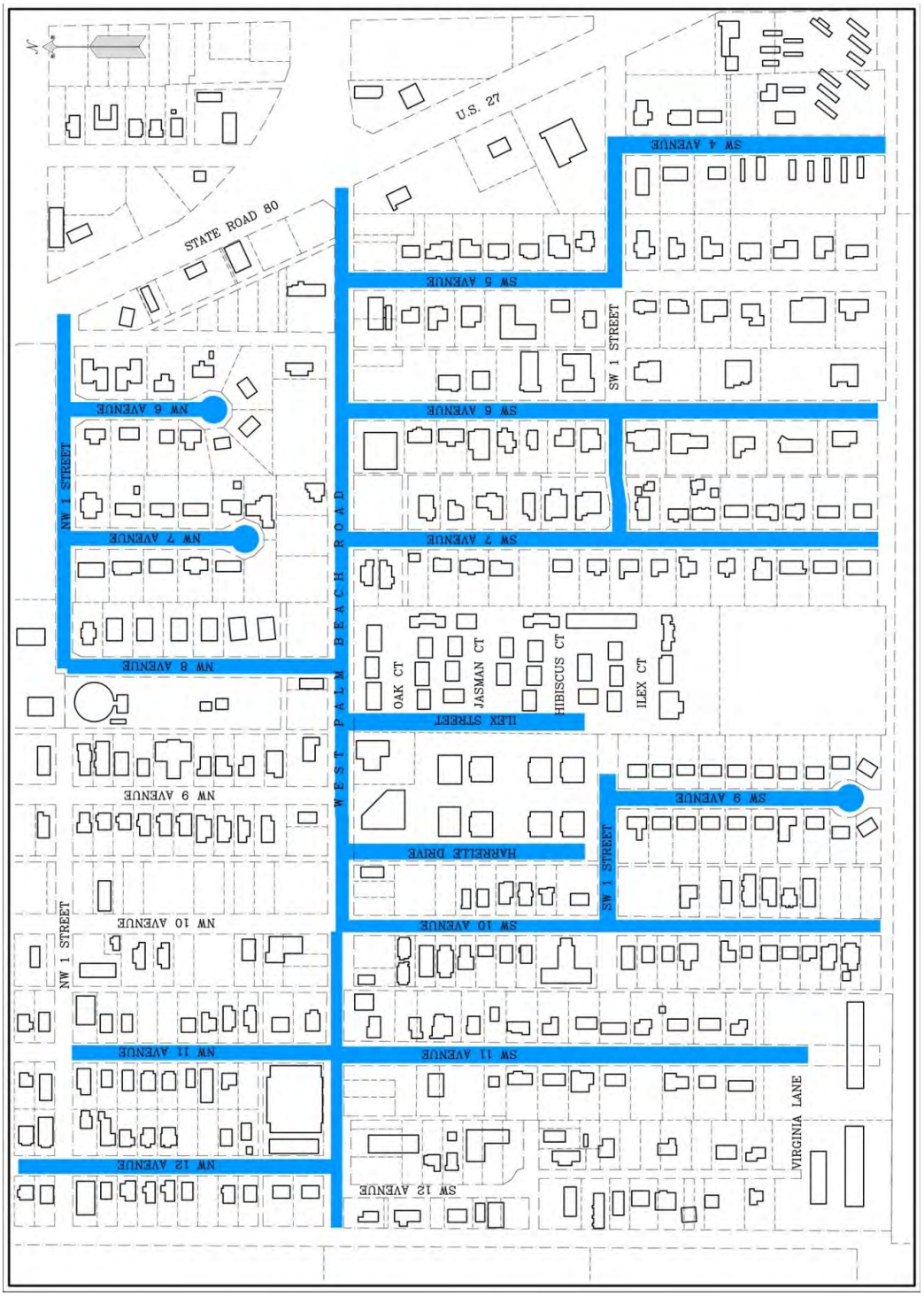
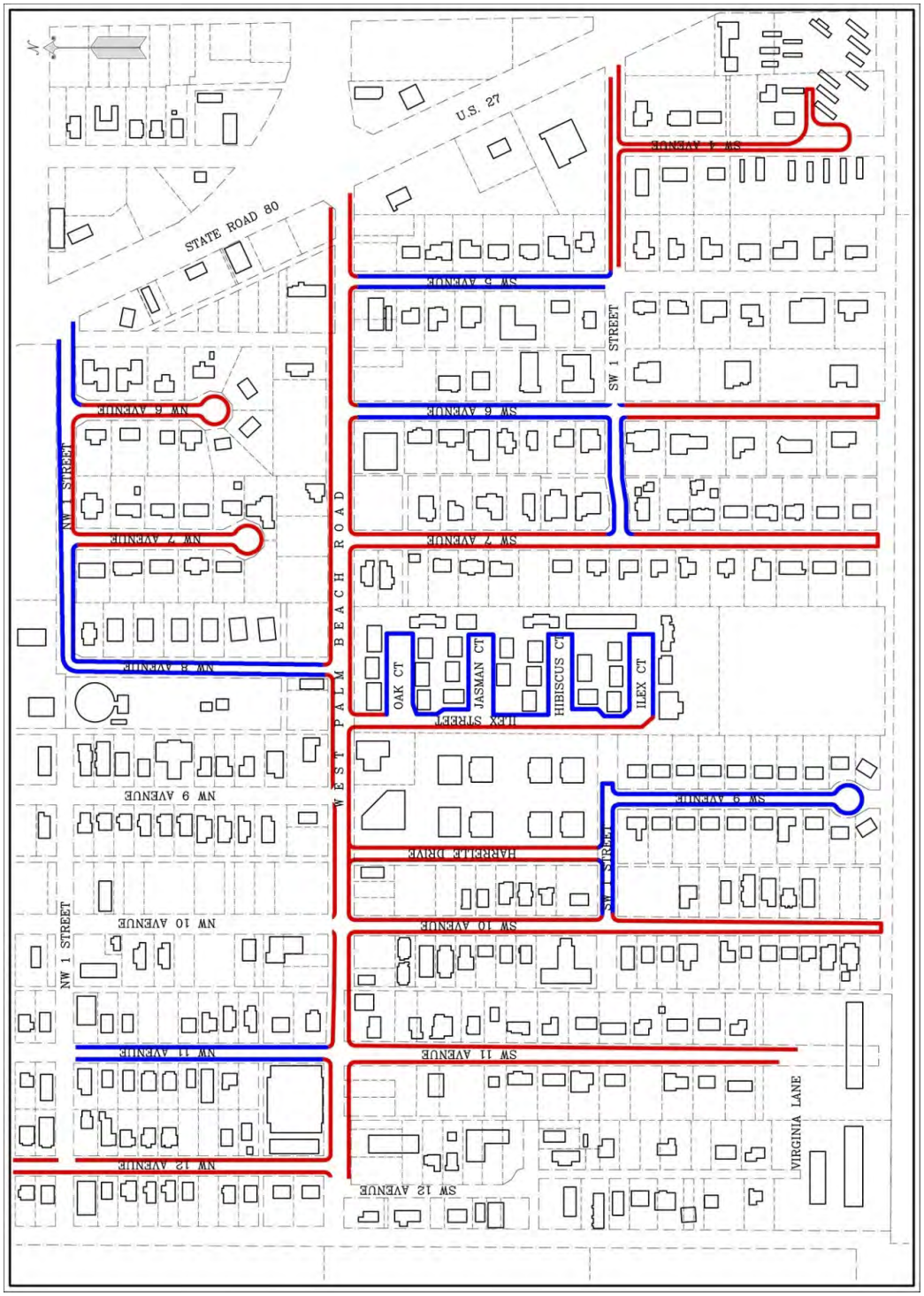


Figure 31
South Bay
Needed Roadway Improvements

This drawing illustrates the roadways in need of improvement within the South Bay analysis area. There are a significant amount of roadway improvements needed in South Bay, far more than Belle Glade. In some cases the roadways that are in need of reconstruction are also transit routes.

Figure 32
South Bay
Sidewalk Improvements - Missing Sidewalks/Replacements



This map identifies where sidewalks need replacement (red) or need repair (blue).

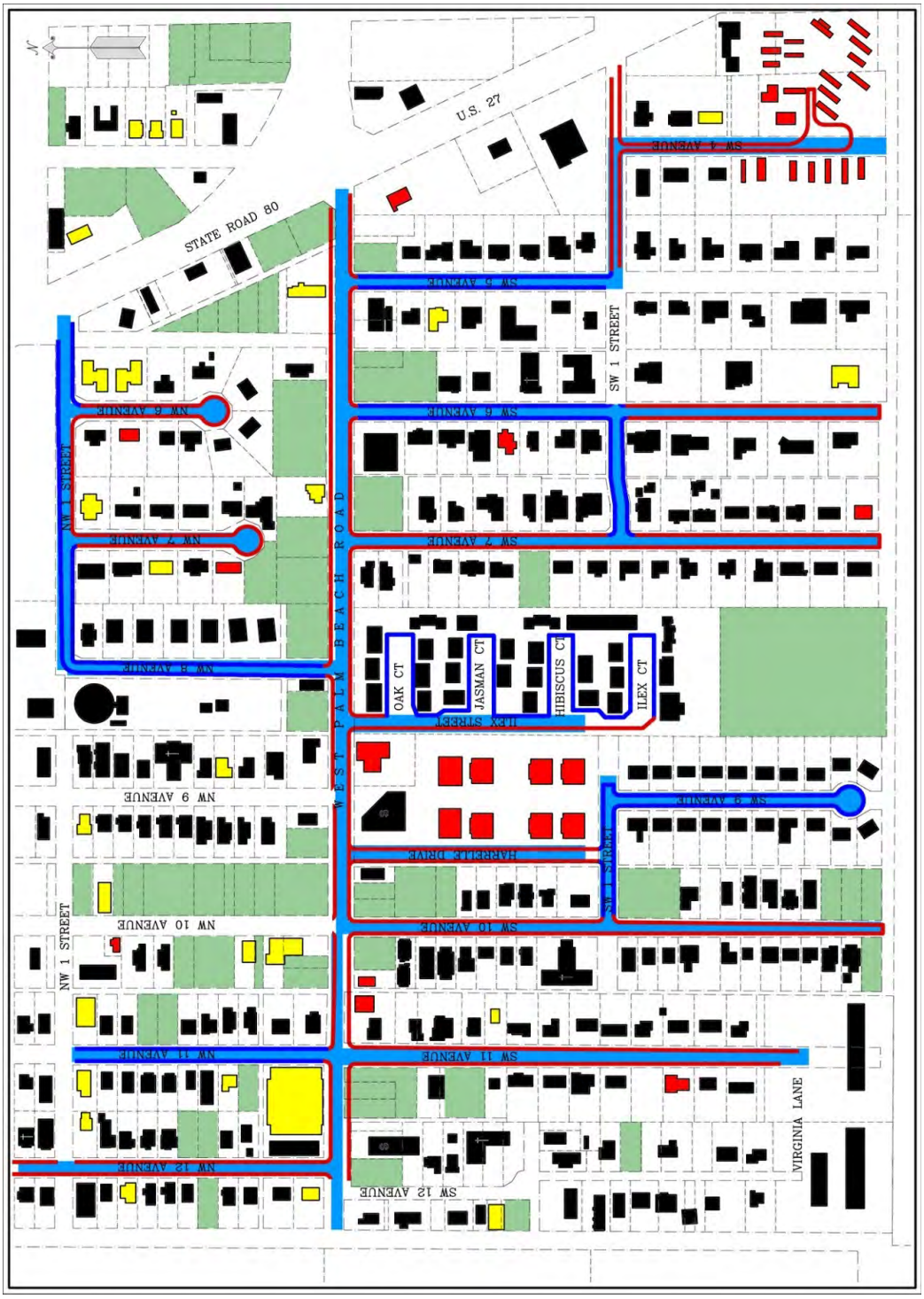


Figure 33
South Bay
All Analyses

The drawing above illustrates a composite of all the analytical diagrams developed for the South Bay analysis area.

Figure 34
Belle Glade/ South Bay
Community Resources

Glades Region Master Plan

Community Resources

Belle Glade and South Bay

Shopping Centers / Food Markets

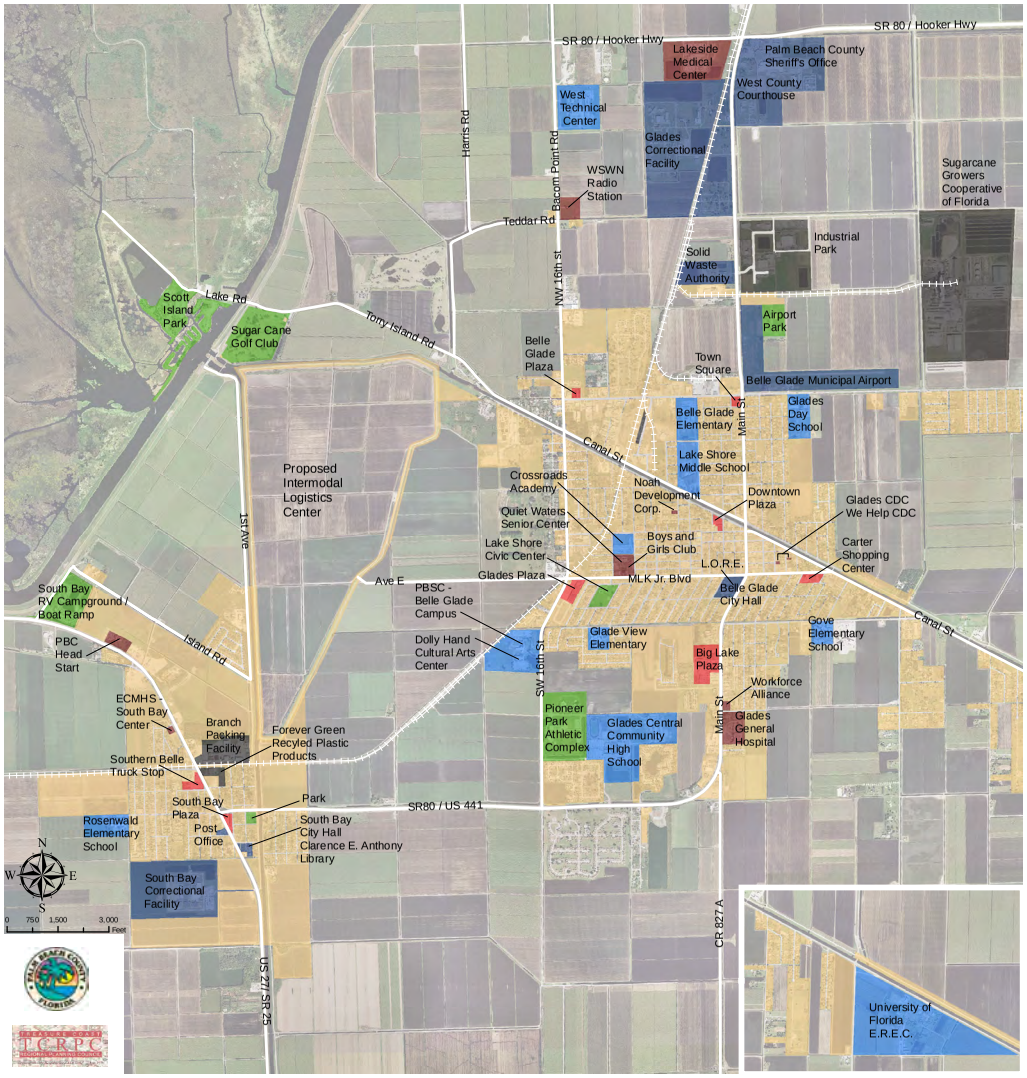
Belle Glade Plaza
Big Lake Plaza
Carter Shopping Center
Downtown Plaza
Glades Plaza
South Bay Plaza
The Southern Belle Truck Stop
Town Square

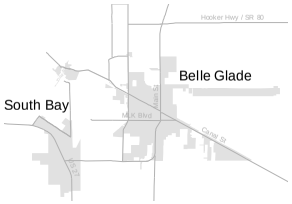
Social Services and Healthcare Facilities

Boys and Girls Club of the Glades
East Coast Migrant Head Start (ECMHS) - South Bay Center
Glades Community Development Corporation (CDC)
Glades General Hospital
Lakeside Medical Center
Lake Okeechobee Regional Economic Alliance of Palm Beach County (L.O.R.E.)
Palm Beach County Head Start
Quiet Waters Senior Center
We Help Community Development Corporation (CDC)
Worforce Alliance Career Center
WSWN Radio Station

Parks and Recreational Facilities

Airport Park
Lake Shore Civic Center
Pioneer Park Athletic Complex
Scott Island Park / Marina / Campground
South Bay RV Campground / Boat Ramp
Sugar Cane Golf Club





Educational Facilities

Belle Glade Elementary School
Crossroads Academy
Glade View Elementary
Glades Central Community High School
Glades Day School
Gove Elementary School
Lake Shore Middle School
Palm Beach State College - Belle Glade Campus and Dolly Hand Cultural Arts Center
Rosenwald Elementary School
University of Florida Everglades Research and Education Center (E.R.E.C.)
West Technical Education Center

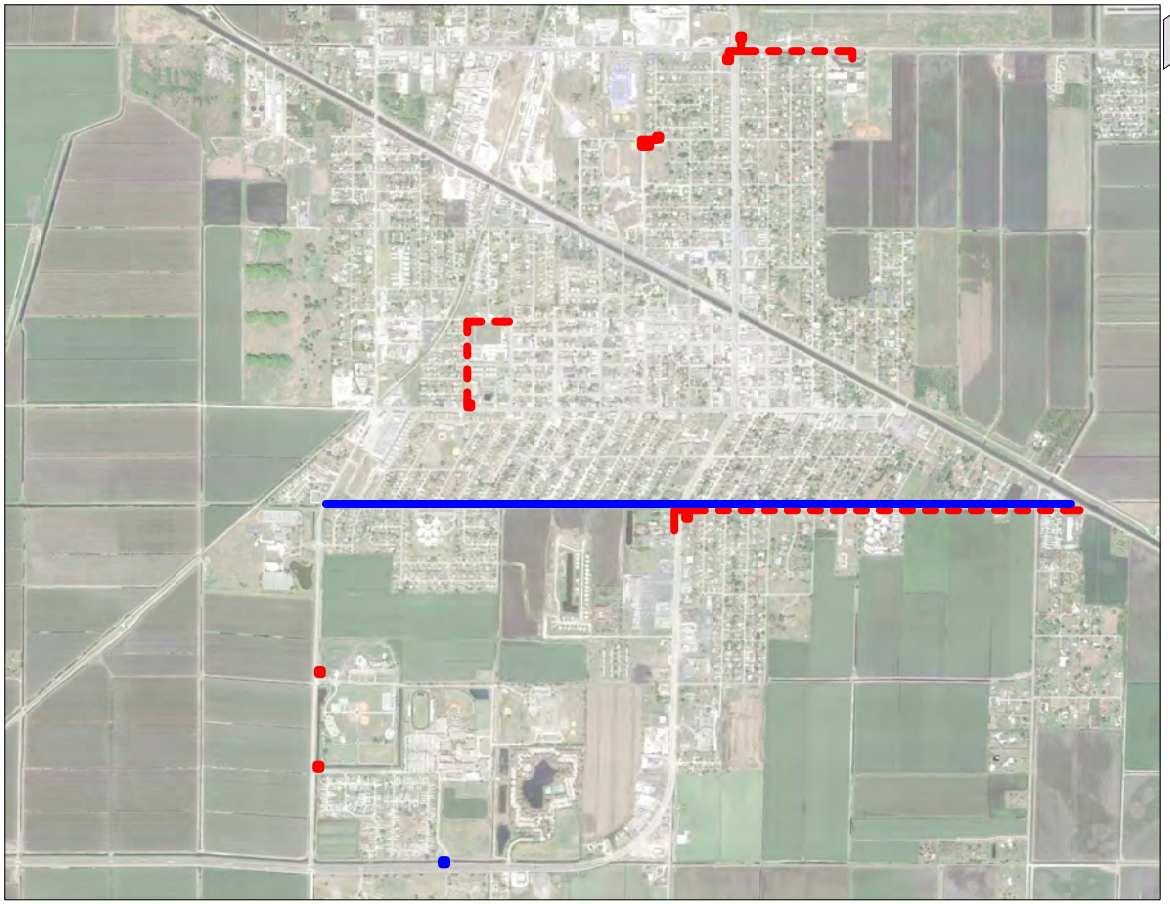
Government Services

Belle Glade City Hall / Fire Station / Library / Museum
Belle Glade Municipal Airport
Glades Correctional Facility
Palm Beach County Sheriff's Office
South Bay Post Office
Solid Waste Authority
South Bay City Hall and Clarence E. Anthony Library
South Bay Correctional Facility
West County Courthouse

Manufacturing and Production

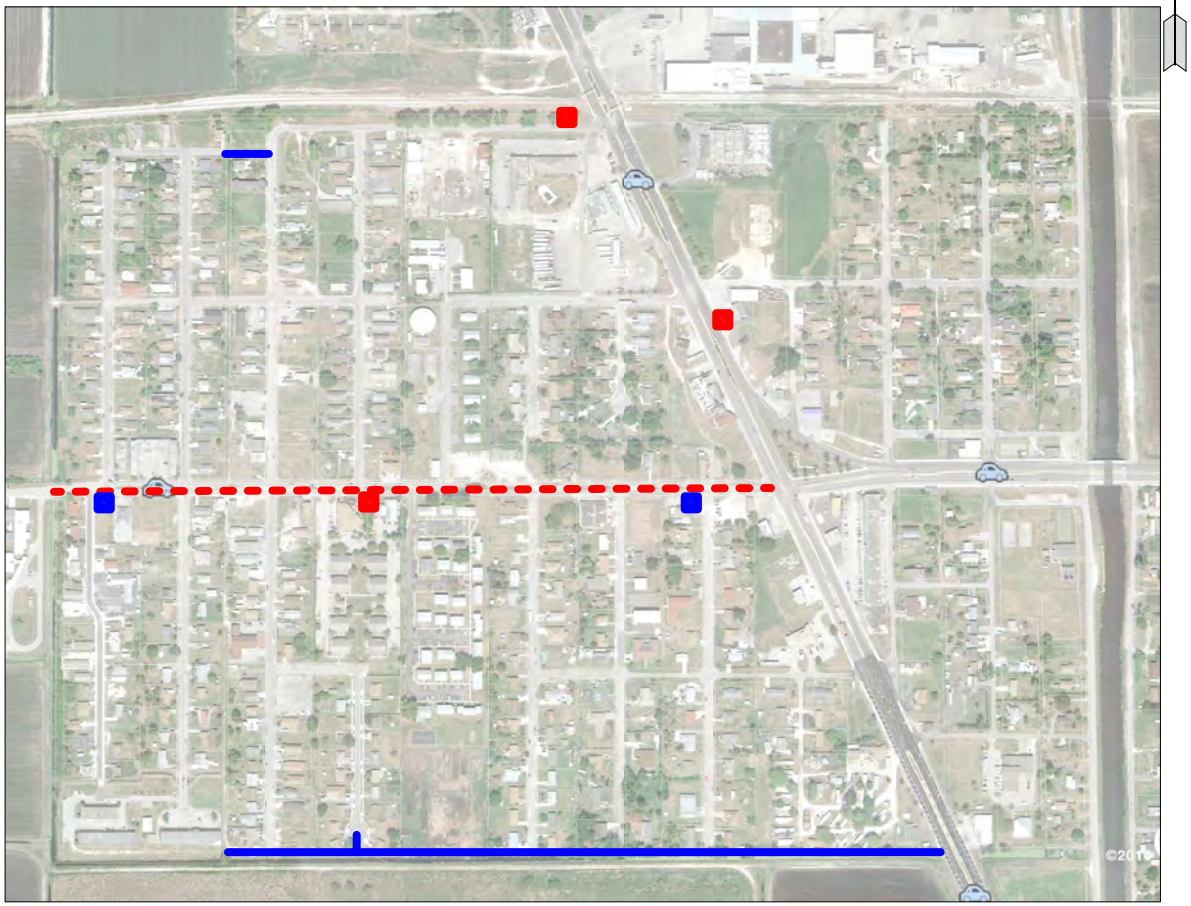
Branch Produce Packing Facility
Forever Green Recycled Plastic Products
Industrial Park
Sugar Cane Growers Cooperative of Florida

Figure 35
Belle Glade
Enhanced Pedestrian Connections



The TCRPC team identified areas of critical sidewalk need from neighborhoods to schools. The drawing above illustrates these connections in Belle Glade. The red dashed lines are missing sidewalk links and the blue line represents a multi-purpose path proposed along the canal north of SW Avenue G.

Figure 36
South Bay
Enhanced Pedestrian Connections



POTENTIAL NEW STOP
IMPROVED STOP
POTENTIAL NEW CONNECTION
IMPROVED CONNECTION

S O U T H B A Y
Transportation Analysis

The TCRPC team identified areas of critical sidewalk need from neighborhoods to schools. The drawing above illustrates these connections in South Bay. The red dashed lines are missing sidewalk links and the blue line represents a multi-purpose path proposed along the canal north of SW 3rd Street.

As the maps developed by the team identified the footprints of all existing buildings, the vacant parcels could be mapped easily as well. The vacant parcel maps are important as they represent potential areas for infill housing opportunities.

Infill Housing Prototypes

Based upon the typical lot sizes within the neighborhoods, the team developed a series of prototypical infill housing models that are configured for different densities.

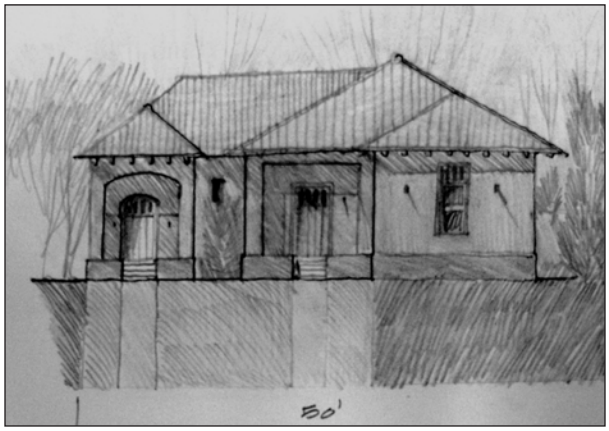
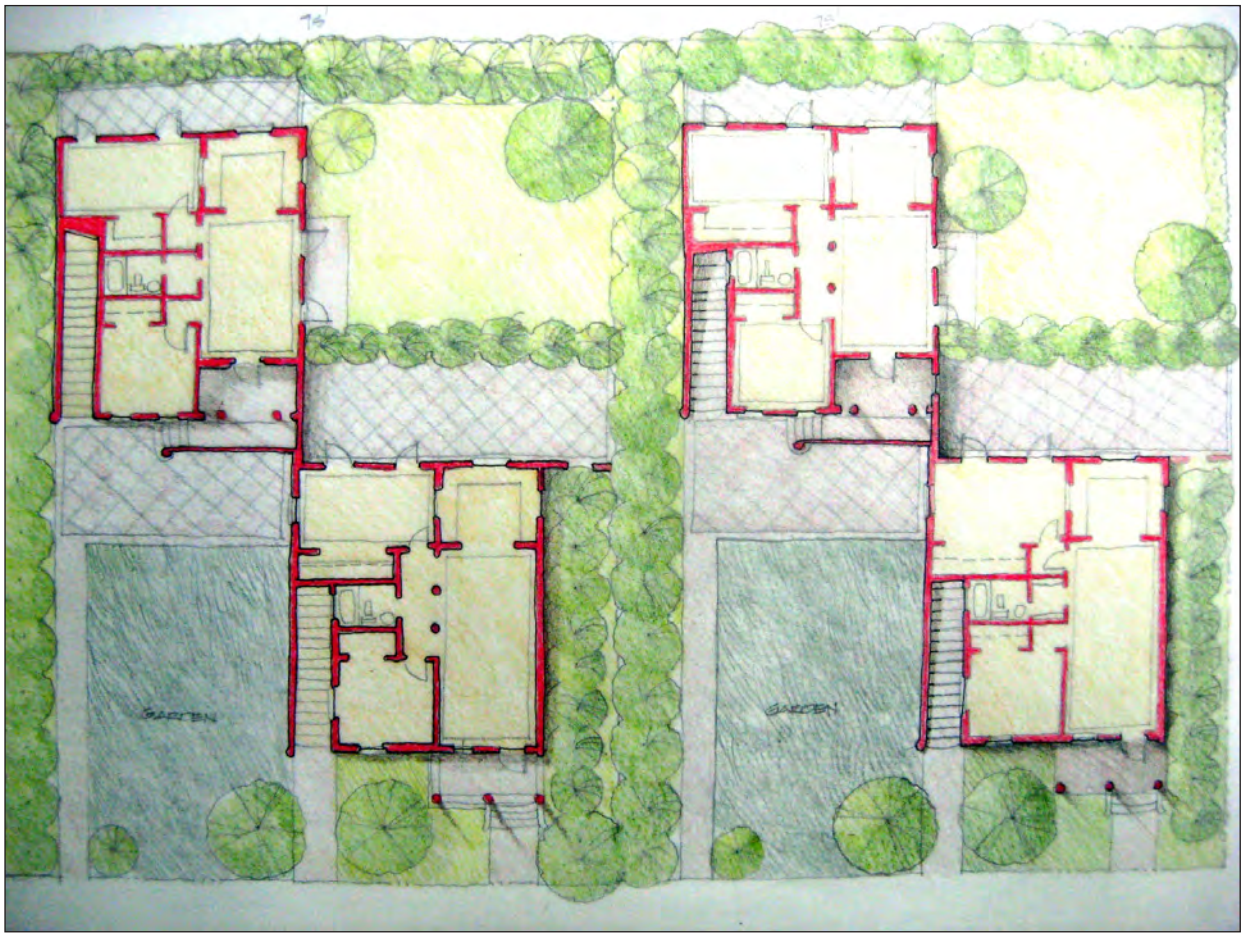


Figure 37
Infill Housing
4-Plexes on 75' Lots



The TCRPC team developed a series of infill housing types that would fit on a number of different lot sizes and conditions found throughout the Glades communities. The floor plans illustrated above are for four-plex type units to fit on 75' wide lots.

Figure 38
Infill Housing
6-Plexes on 75' Lots

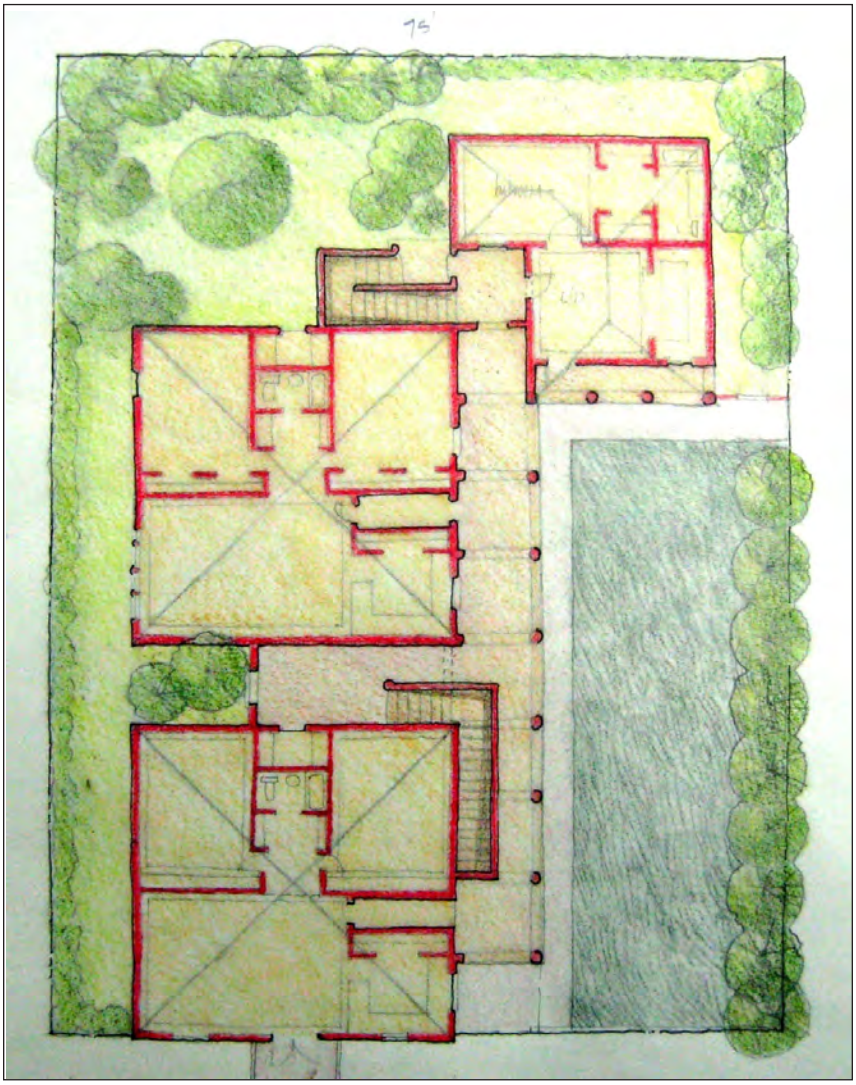


Figure 39
Infill Housing
Duplexes on 50' Lots

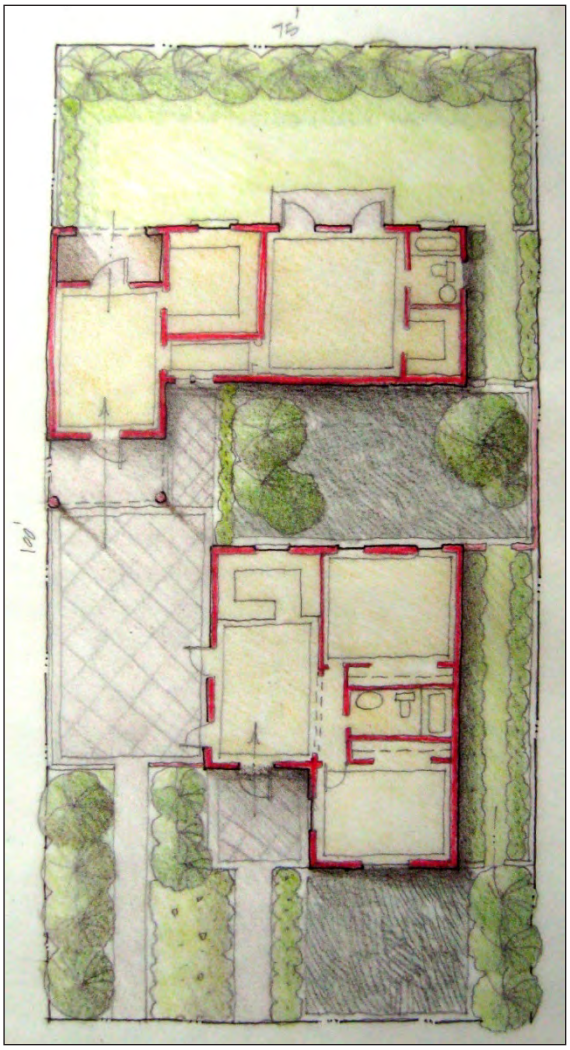


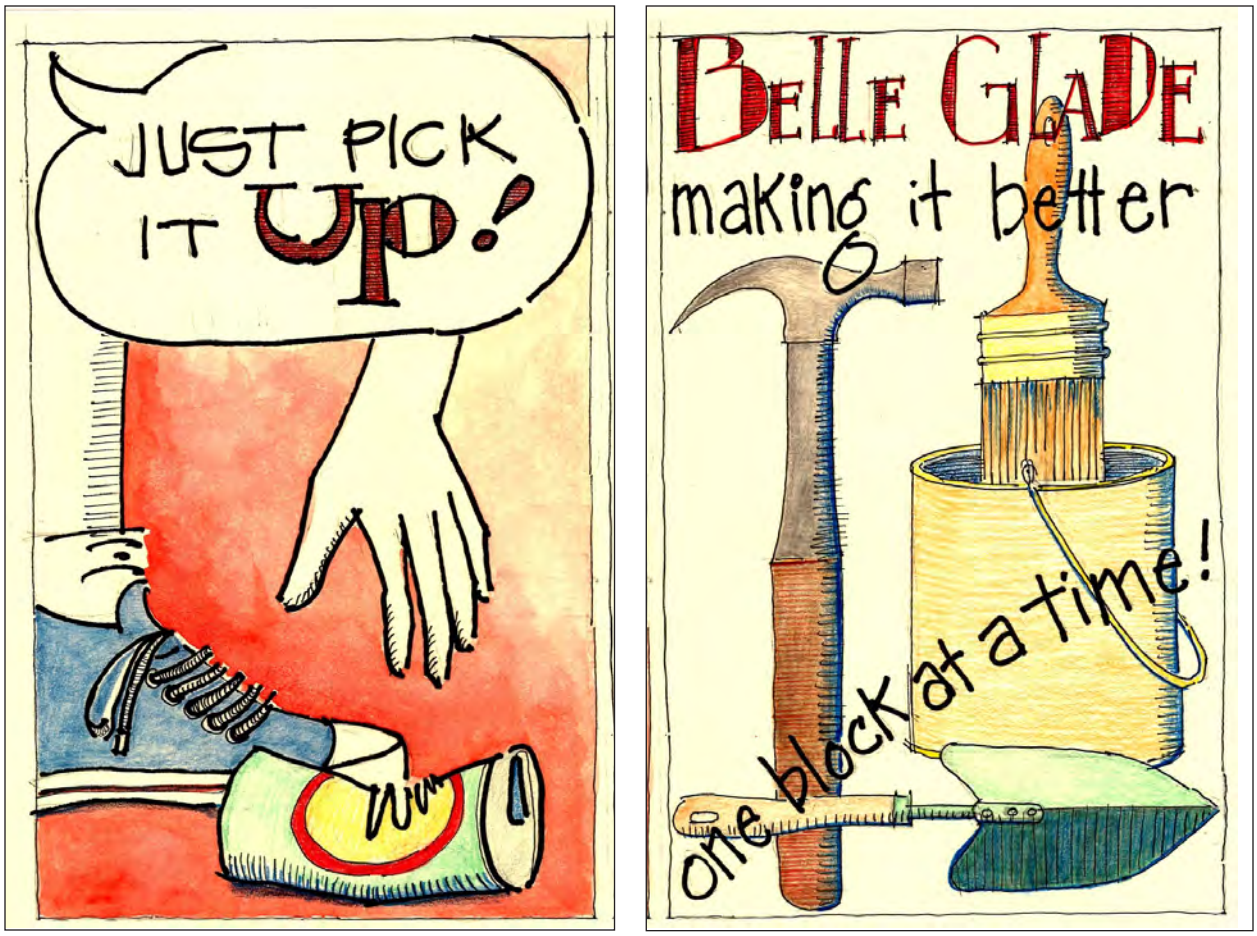
Figure 40
Infill Housing
Street Presence

In addition to developing floor plans, the TCRPC team created building elevations to illustrate the character and scale of the proposals. The image above depicts the character of a few infill houses combined on a single street.

Marketing and Promotional Images

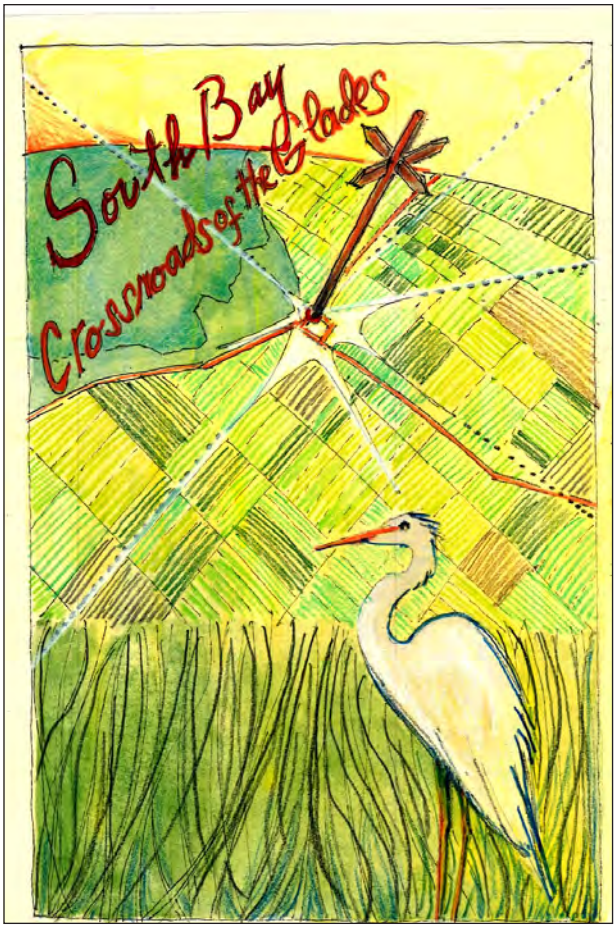
During the pre-workshop interview process it became clear that the Glades communities have suffered from challenges of image and perception for quite some time. In addition to the issues of poverty, joblessness, and crime, the Glades communities are isolated. The isolation can fuel the perception that there are few positive characteristics to the communities. Nothing could be further from the truth. The Glades communities have a tremendous amount to offer and the team tried to convey some of those characteristics with visual aids. The thought is that these images could provide the impetus for better exposure of all the positive aspects of the Glades.

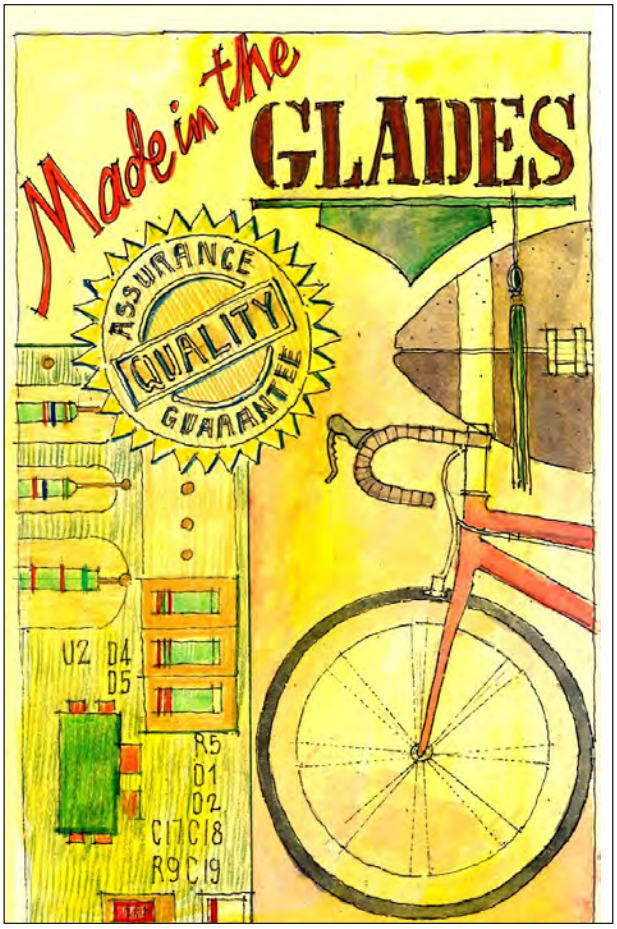
Figures 41 & 42
Changing Perceptions
A Step Towards Marketing Materials



These marketing images convey the spirit of improving the Glades communities through litter control and rehabilitation of the physical environment. The smallest efforts can make a big difference, “one block at a time”.

Figures 43 & 44
Changing Perceptions
A Step Towards Marketing Materials



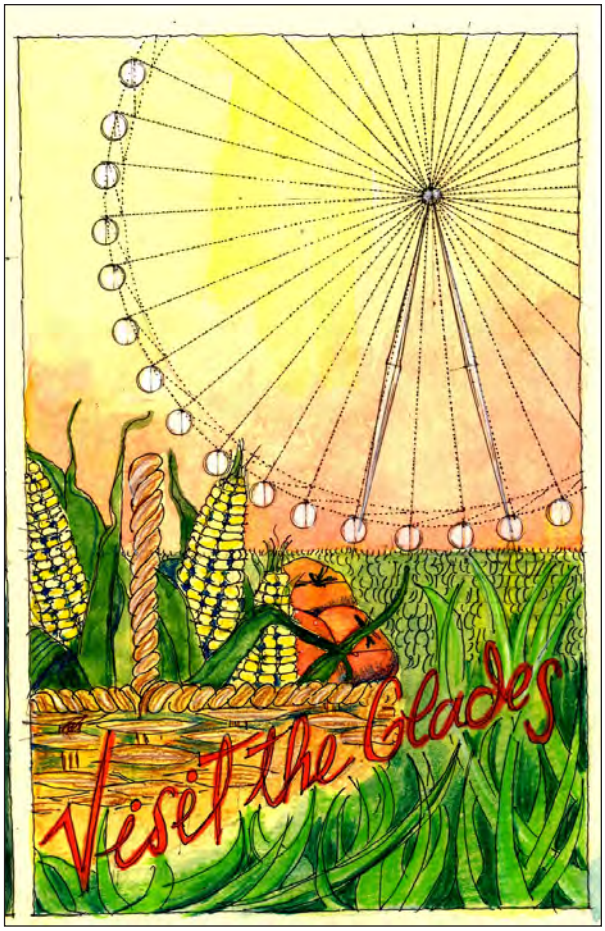


These images depict the powerful geography of South Bay as the “Crossroads of the Glades” and the amazing production potential of the Glades communities. The Glades communities have a long tradition of producing world-class athletes however, many don’t realize the advancements being made in education, technical training, and the potential for economic growth. These characteristics need to be broadcasted as well.

Figures 45 & 46
Changing Perceptions
A Step Towards Marketing Materials

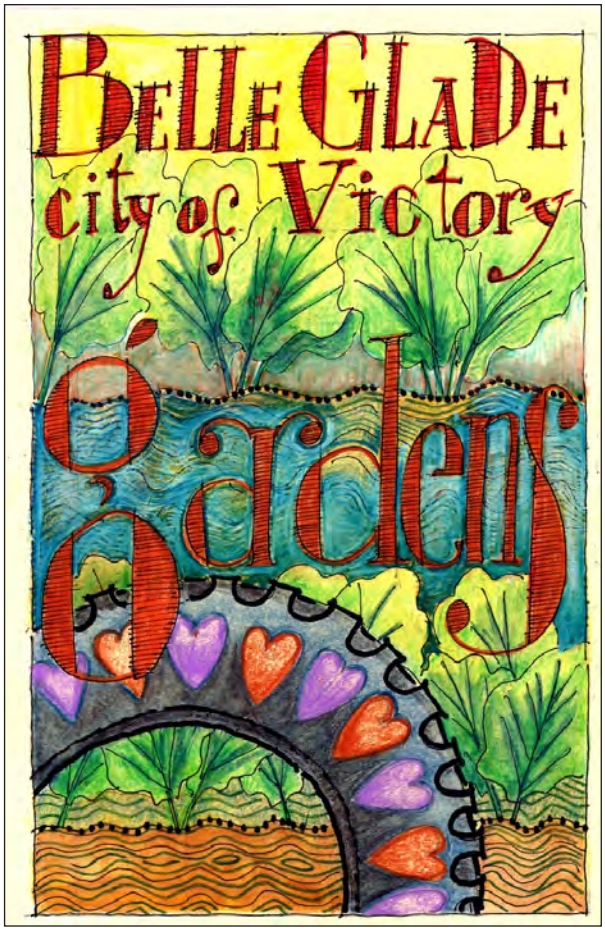
Lake Okeechobee is known for its world-class fresh-water fishing. In fact, there are all types of outdoor activities available in the Glades.

Figures 47 & 48
Changing Perceptions
A Step Towards Marketing Materials



The Lake Okeechobee Scenic Trail is already a destination for bicyclists who train with long-distance rides. Palm Beach County has an extensive network of existing and proposed trail systems. Coordinating the variety of bicyclists could be an economic opportunity for the Glades communities. As part of the "Visit the Glades" campaign, there was discussion of potentially developing a large ferris wheel where SR 80 approaches Main Street in Belle Glade. While not your typical economic development proposal, developing a ferris wheel in the Glades would provide a physical icon for the community, a long-distance view terminus that would be seen for miles, and afford a view of the Glades communities and Lake Okeechobee never before seen by the public. The ferris wheel ride could become a frequent destination for families on the east coast of Palm Beach County.

Figures 49 & 50
Changing Perceptions
A Step Towards Marketing Materials



One idea that came from the public was the potential of turning the marketing images (the black and white line drawings) into coloring books for kids in the Glades communities' schools. The chance to change some of the perceptions is even more important where the children of the Glades are concerned.

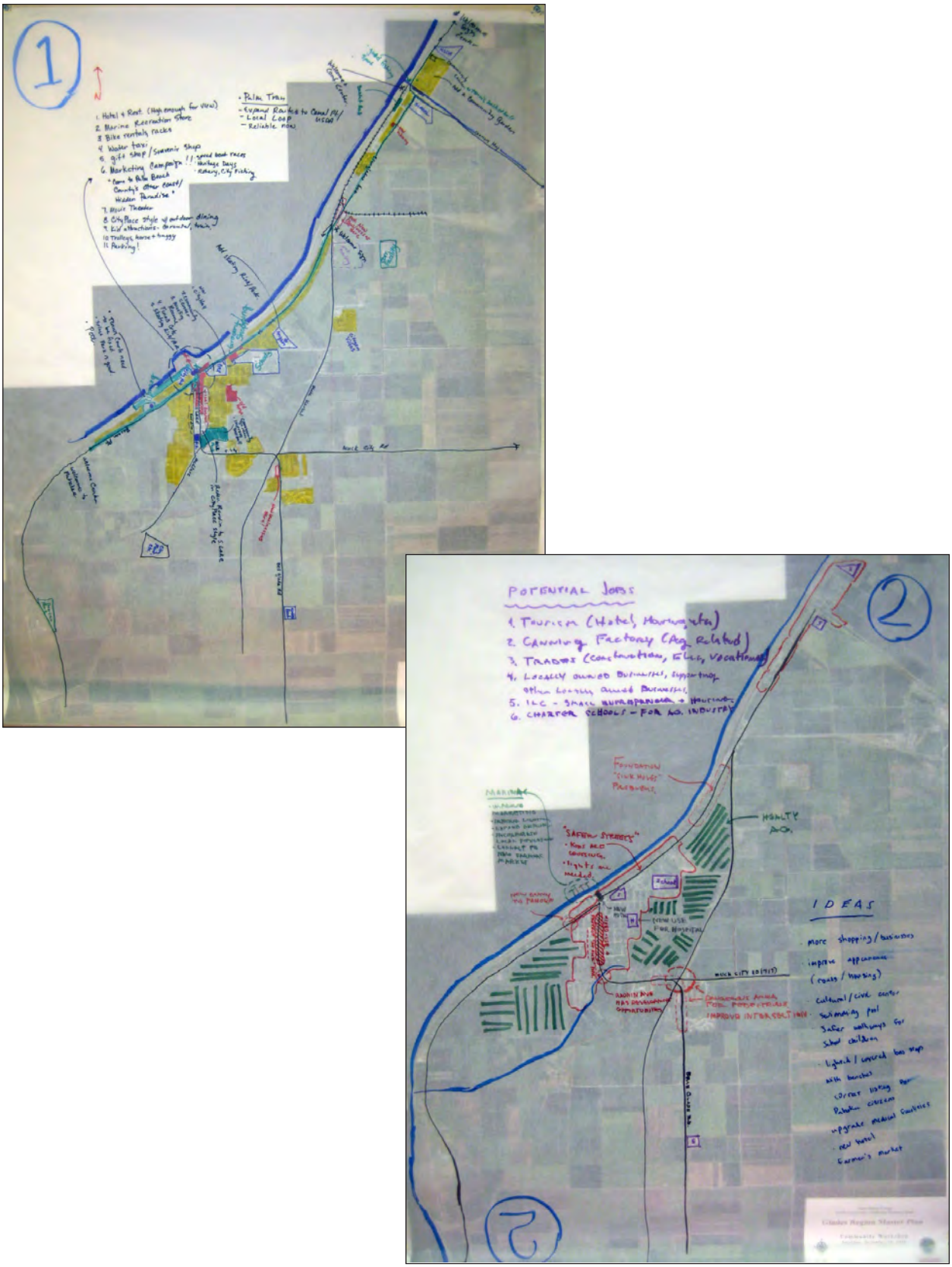
5.0 Existing Conditions and Issues - Pahokee Canal Point

Pahokee/Canal Point Workshop

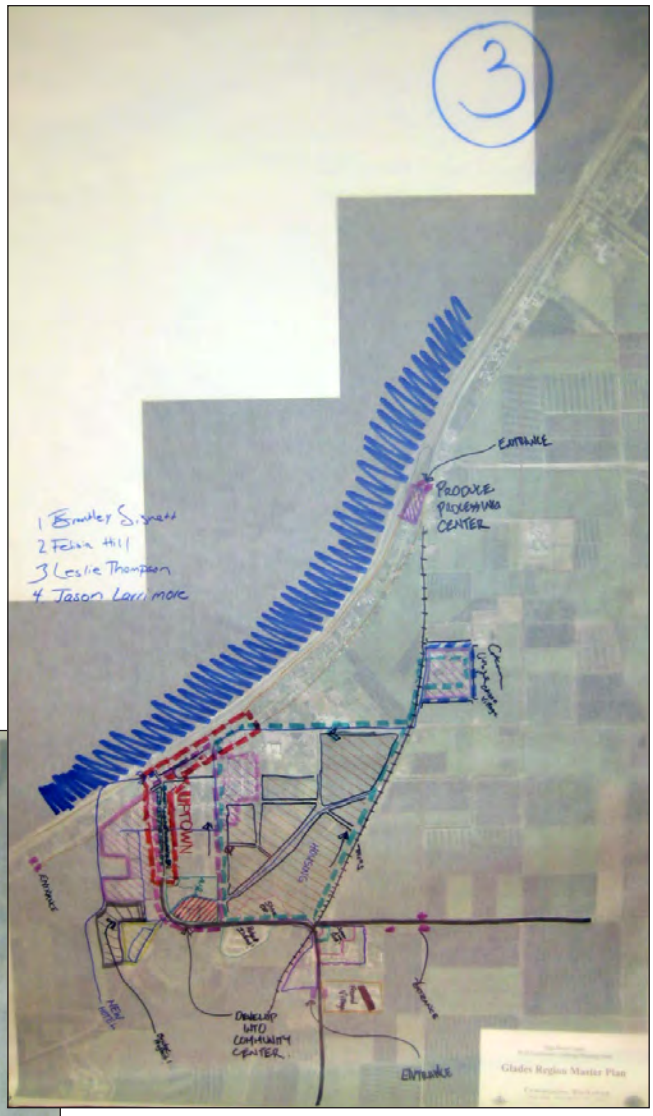
On November 16, 2013, the second week-long public workshop kicked-off at the old Pahokee High School gymnasium. Nearly 70 participants spent about five hours providing their input, sharing ideas and concerns with neighbors, and presenting their ideas to their peers and the TCRPC team. After an opening Power Point presentation by TCRPC that provided an overview of the project scope, work done to date, and expectations of the workshop itself, the participants worked at tables developing their ideas. Lunch and refreshments were provided. After lunch, a representative of each of the table groups presented their ideas back to the overall group. This process provided an excellent opportunity for the community to hear from their own friends and neighbors about ways to improve the Glades area. This input gained is critical for the project team as it serves as the basis for future recommendations.

The Pahokee/Canal Point participants developed seven plans which are included in the following pages.

Citizens working at the table sessions and presenting their ideas during the Pahokee/Canal Point Workshop.

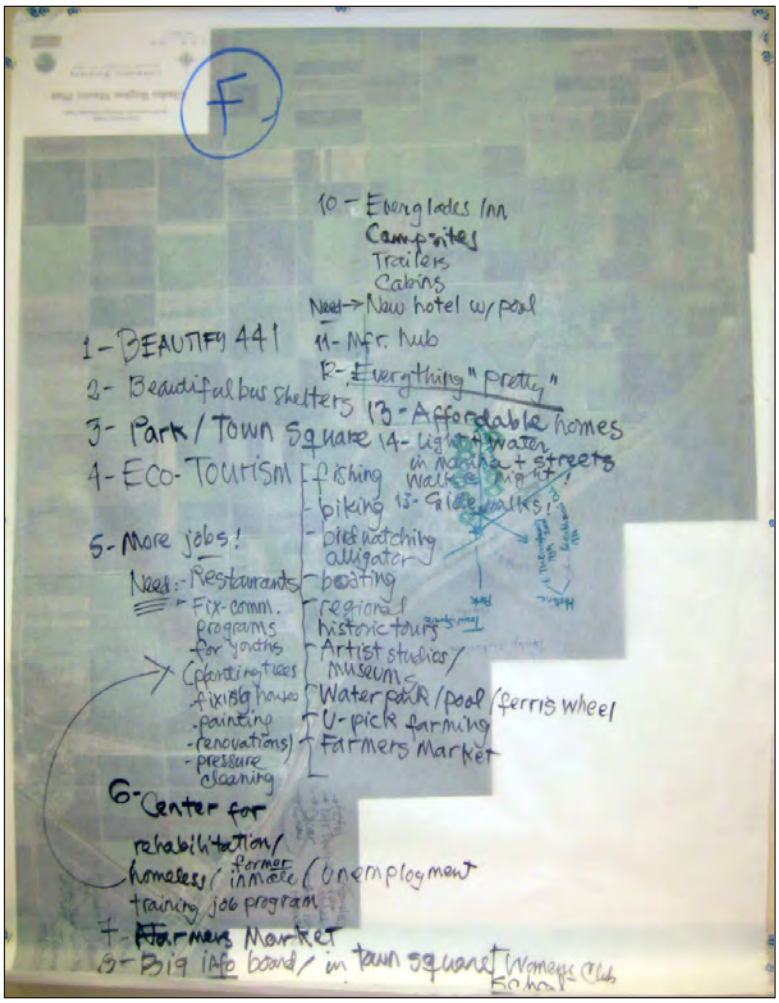


Citizens' maps developed during the Pahokee/ Canal Point Workshop.



Citizens' maps developed during the Pahokee/ Canal Point Workshop.

Citizens' maps developed during the Pahokee/ Canal Point Workshop.



Citizens' maps developed during the Pahokee/Canal Point Workshop.

6.0 Key Issues, Analyses and Results - Pahokee / Canal Point

Many ideas and issues were discussed and presented during the Saturday workshop. Key items that were presented repeatedly are listed below.

- Jobs and Employment Opportunities
- The community needs an enhanced marketing campaign starting with the logo, "The County's Other Coast" – all entries should look as good as Bacom Point Road.
- Need new restaurants and development – should really consider a hotel near the marina and downtown – create a CityPlace-type of environment with outdoor shops and places to eat.
- Develop a trolley system to connect neighborhoods, parks, and downtown. Expand upon existing businesses and activities.
- Need to coordinate training with jobs (ala West Tech). We need to create our own labor force.
- A Farmer's Market would be great.
- Desperately need better sidewalks and lighting along 441 near Padgett Island, Fremd Village, the Housing Authority properties, and the Track Store all the way into town. Very dangerous now and separates communities.
- A community pool is needed. Bus stops and shelters need to be upgraded with lighting. There have been some improvements in this area however, more lights and improved shelters are needed.
- We must promote what we have – promote our strengths rather than focusing on our weaknesses.
- It would be great if the Glades had its own TV channel – a way to promote the many good things that are happening out here. All people outside hear is bad news. We need positive press.
- Pahokee Plaza should recruit new businesses.
- Need greenery (street trees, medians, bulb-outs, etc)
- We should have a Quarter Bus like Belle Glade (a local circulator that augments Palm Tran and only costs a quarter). It could also connect to Belle Glade – just saw a woman walking in the rain with her small child – that is not necessary and is sad.
- Empower and engage the youth – utilize the extraordinary human resources within Pahokee and the Glades region.

After the Saturday workshop the TCRPC team set up a mobile office at old Pahokee High School gymnasium for the following six days. The mobile office was open to the public from 9:00 am until 5:00 pm each day and many members of the community visited the office to provide further input. The key function of the mobile office is to provide an on-site location for the team to work and give members of the public and agency partners a

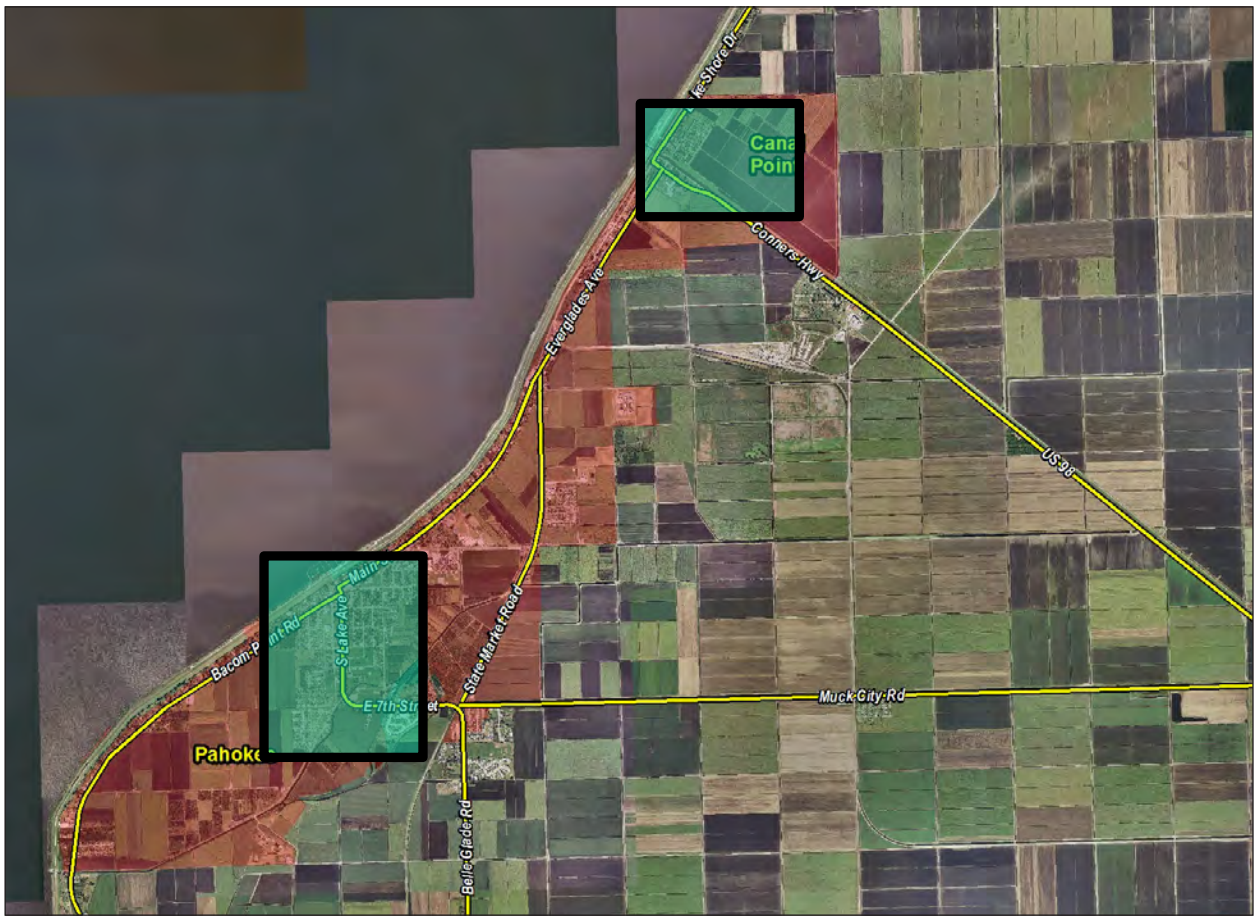
central location to continue the dialogue and information exchange. Perhaps most importantly, the on-site office provided a unique opportunity for the project team to engage daily with the community. This interaction helped build connections between the team and the community and served to increase the sense of authorship the participants feel toward the process.

During the week, the team developed the following key areas of analysis to assist in the overall GRMP effort:

- Development of Study Area Base Maps; Qualitative Assessment of the Built Environment; Infill Housing Prototypes; Marketing and Promotional Images; and Emerging Economies.
- Development of Study Area Base Maps
- Using high-resolution aerial photographs and cross-referencing with Palm Beach County Property Appraiser data, the GRMP team developed base maps of all of the Glades communities. These maps were developed in AutoCad and illustrate existing blocks, lots, building footprints, and significant landmarks including canals and parks.

The team used these maps to build the existing condition assessment diagrams.

Figure 51
Pahokee/Canal Point Analyzed Areas



The detailed analysis areas of Pahokee and Canal Point are represented above.

Qualitative Assessment of the Built Environment

The team conducted a windshield survey of the detailed areas of Canal Point and Pahokee. The surveys identified housing, roadway, sidewalk, and other general conditions. To document the building conditions, the team developed a three-tier ranking system based upon the following criteria:

TYPE A
Building in GOOD physical condition

- Building envelope adequately protects interior
- Exterior may need some improved maintenance, cleaning, etc.

Type A building type example.

TYPE B
Building in need of MINOR repairs

- Exterior may need paint; Vegetation may be overgrown; May require site work, planting, paving, etc.
- May be missing a window or two; Appearance may need general improvement

Type B building type example.

TYPE C
Building in need of MAJOR repairs

- Roof may be compromised; Foundations may have settled and may be separating from structural wall; Walls may have structural cracks; Missing doors or windows, exposing interior to elements
- Substantial repairs and/or alterations required to bring building up to code

Type C building type example.

Using this criteria, the team ranked the existing building fabric within a detailed area and mapped the results.

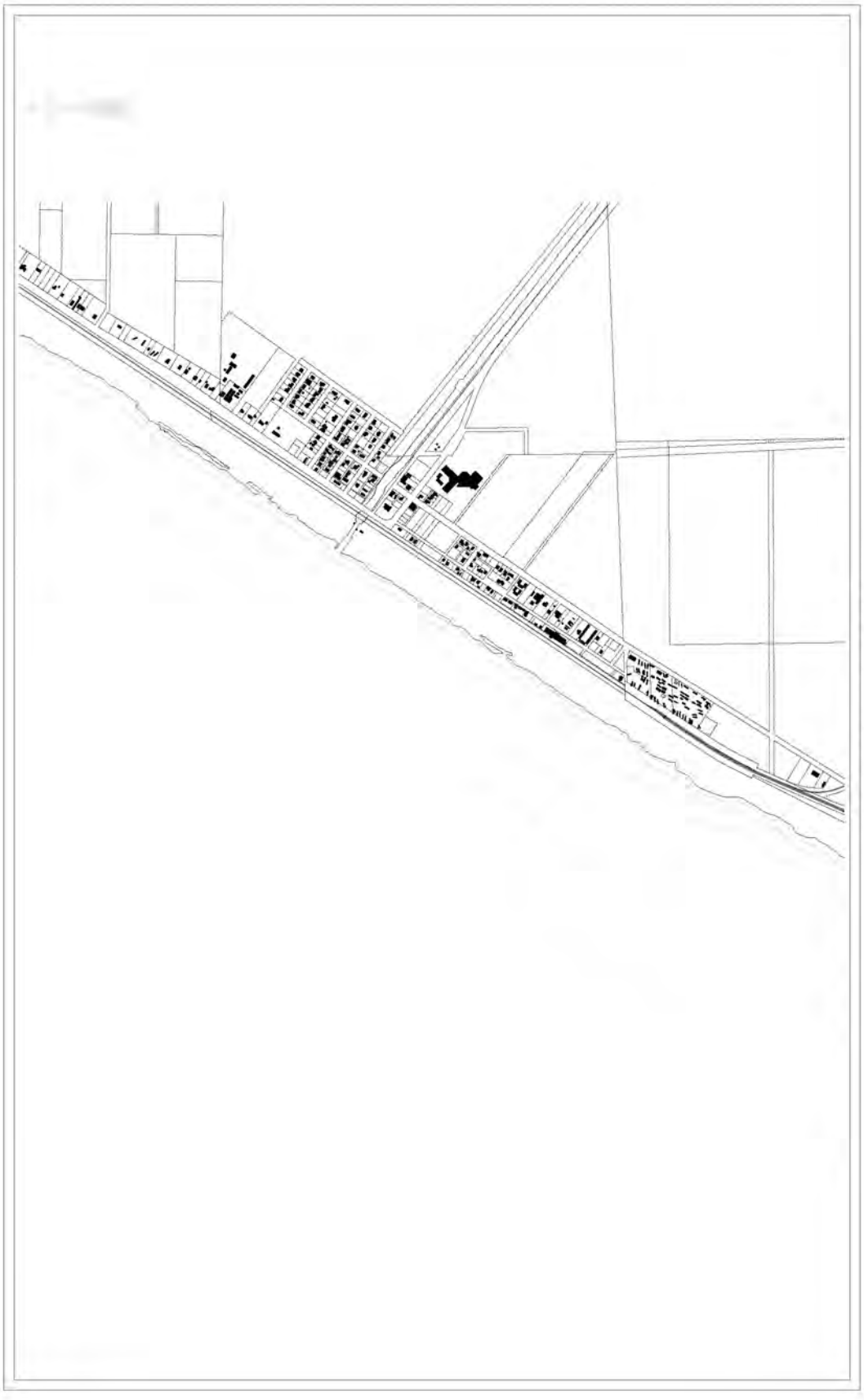
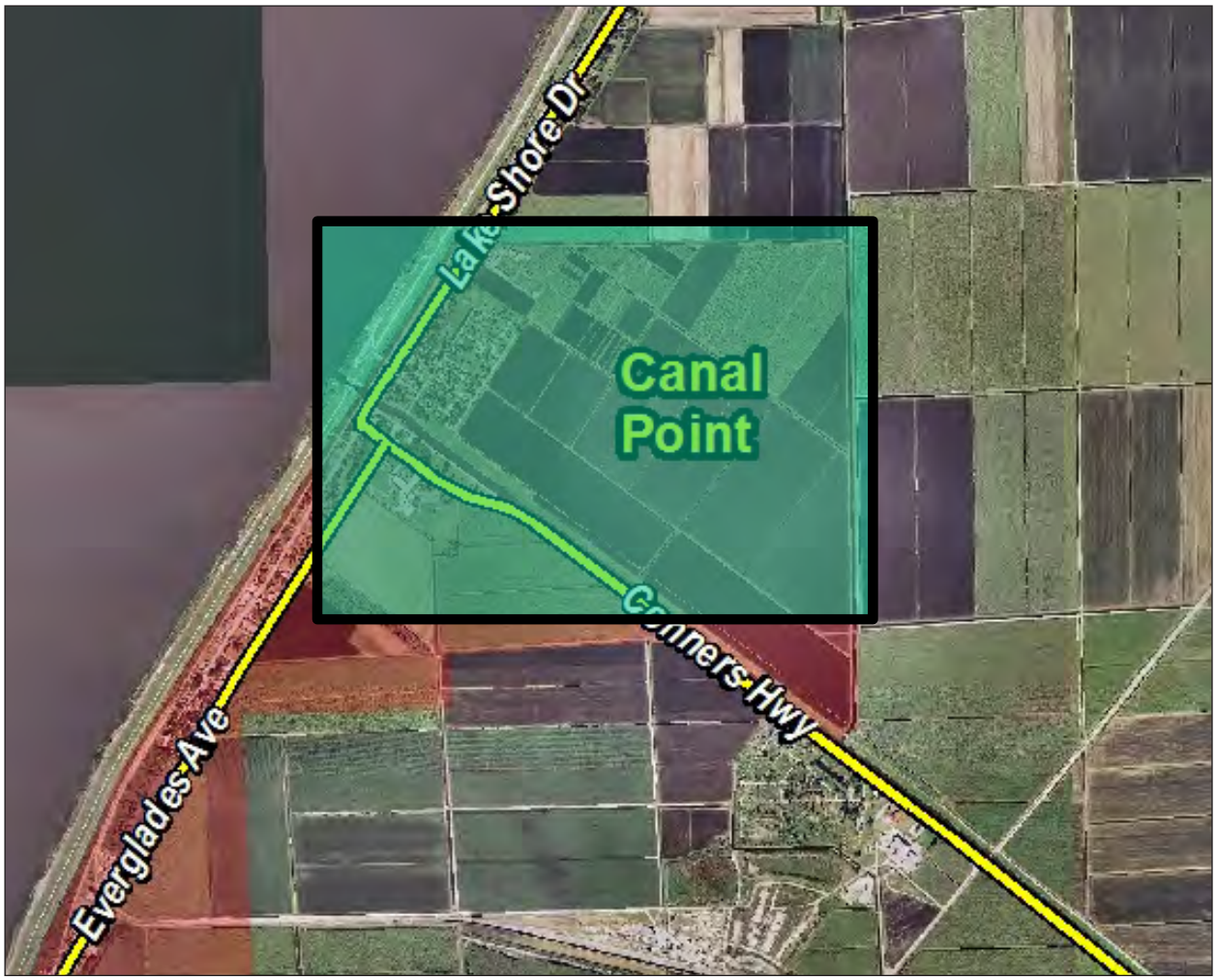

CANAL POINT
N.T.S.

Figure 52
Canal Point
5th Street - West Main



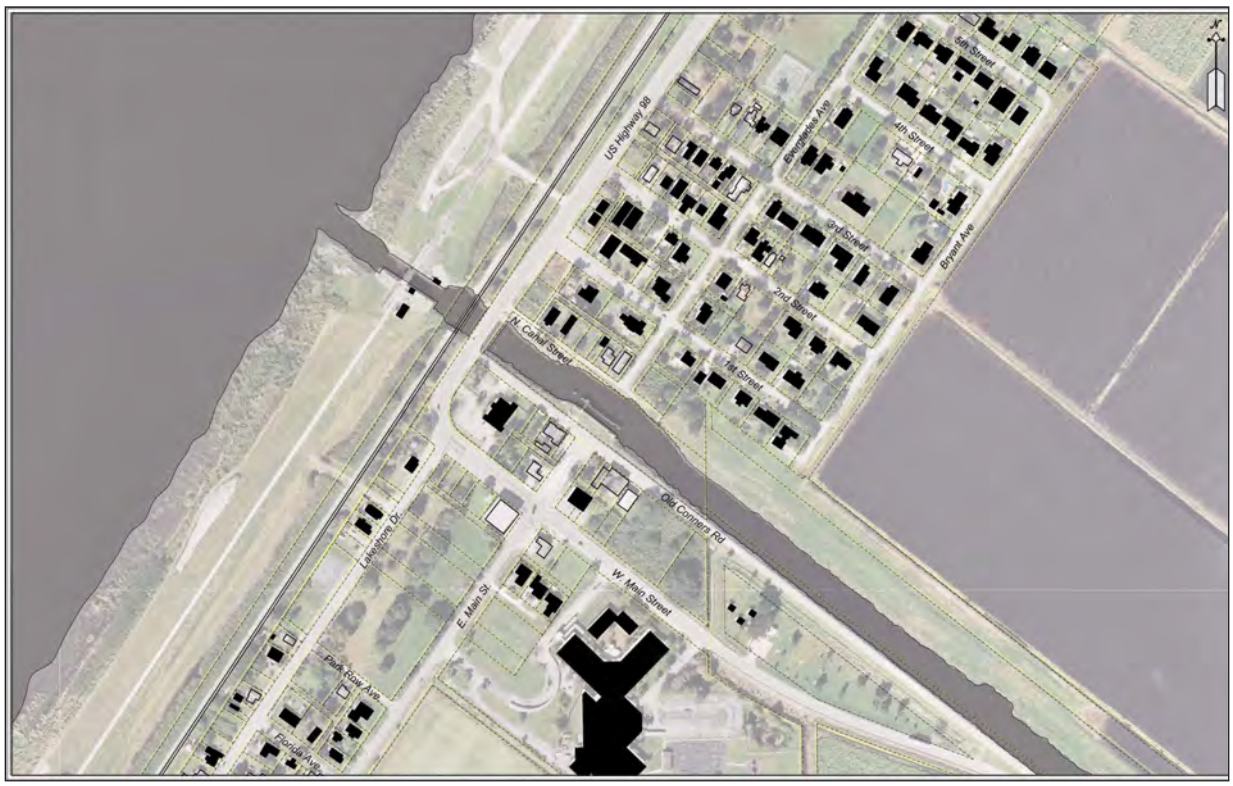
The image above depicts the detailed analysis area for Canal Point.

Figure 53
Canal Point
Existing Conditions

The aerial image above depicts the detailed analysis area for Canal Point. Note the West Palm Beach Canal that separates north and south Canal Point in becomes the C-51 Canal that ultimately connects to the Lake Worth Lagoon in West Palm Beach.

Figure 54
Canal Point
Building Assessment Type "A"

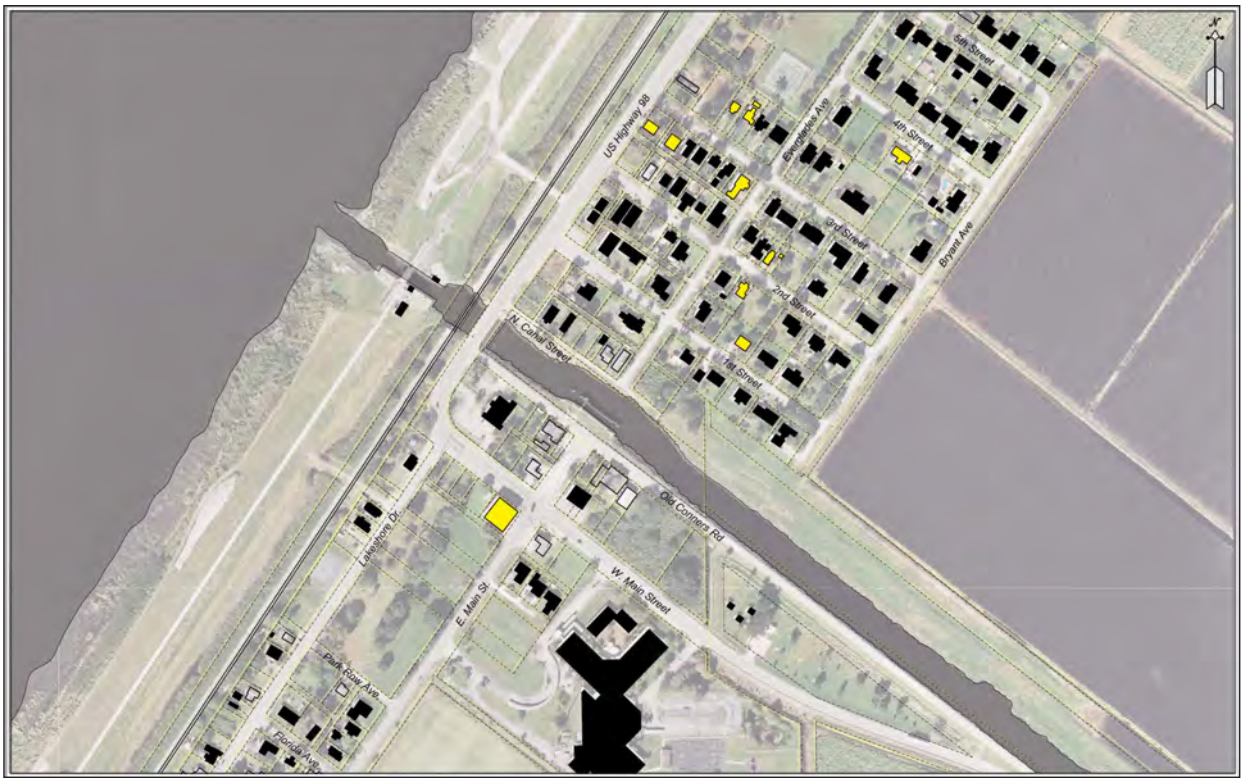
The building illustrated above is an example of Type A buildings.



The black building footprints in the diagram above represent the Type A buildings. The Canal Point Baptist Church, shown above, is a fine example of local historic architecture and is a Type A building.

Figure 55
Canal Point
Building Assessment Type "B"

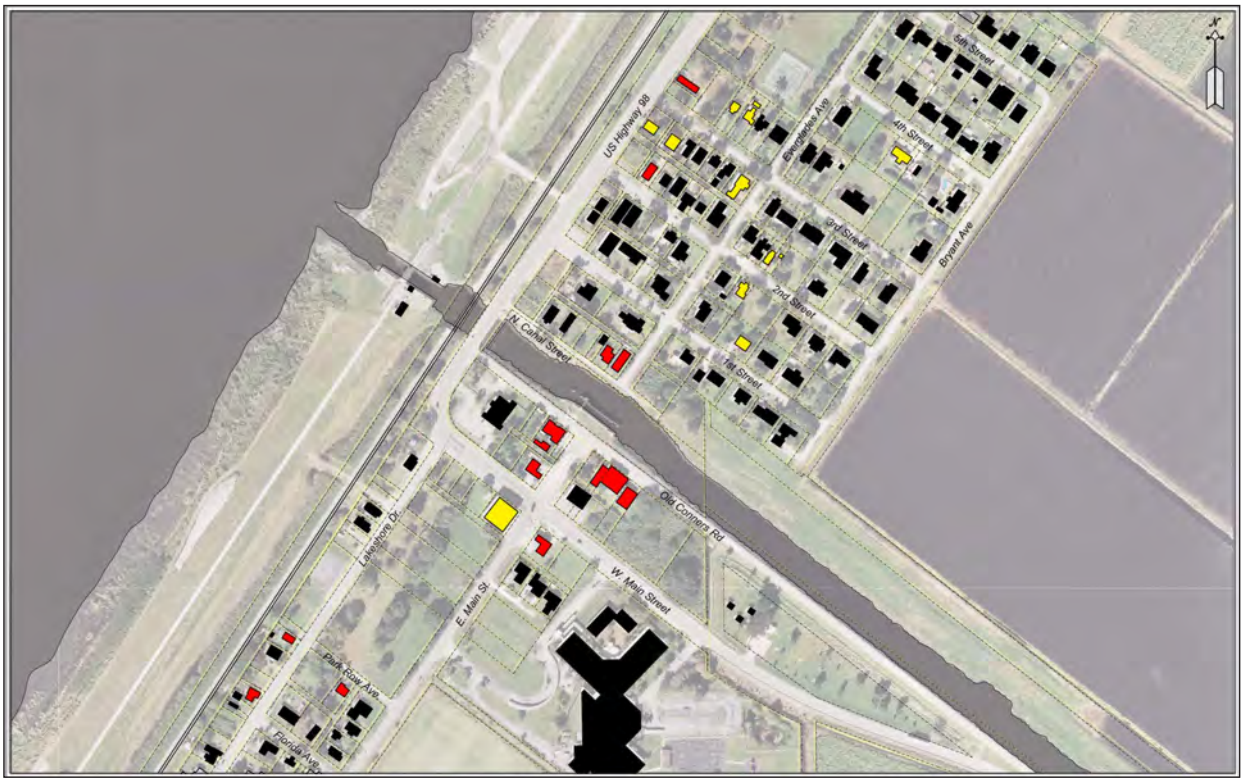
The building illustrated above is an example of Type B buildings.



The image above illustrates the Type B buildings in yellow. Note the large building to the south is commercial.

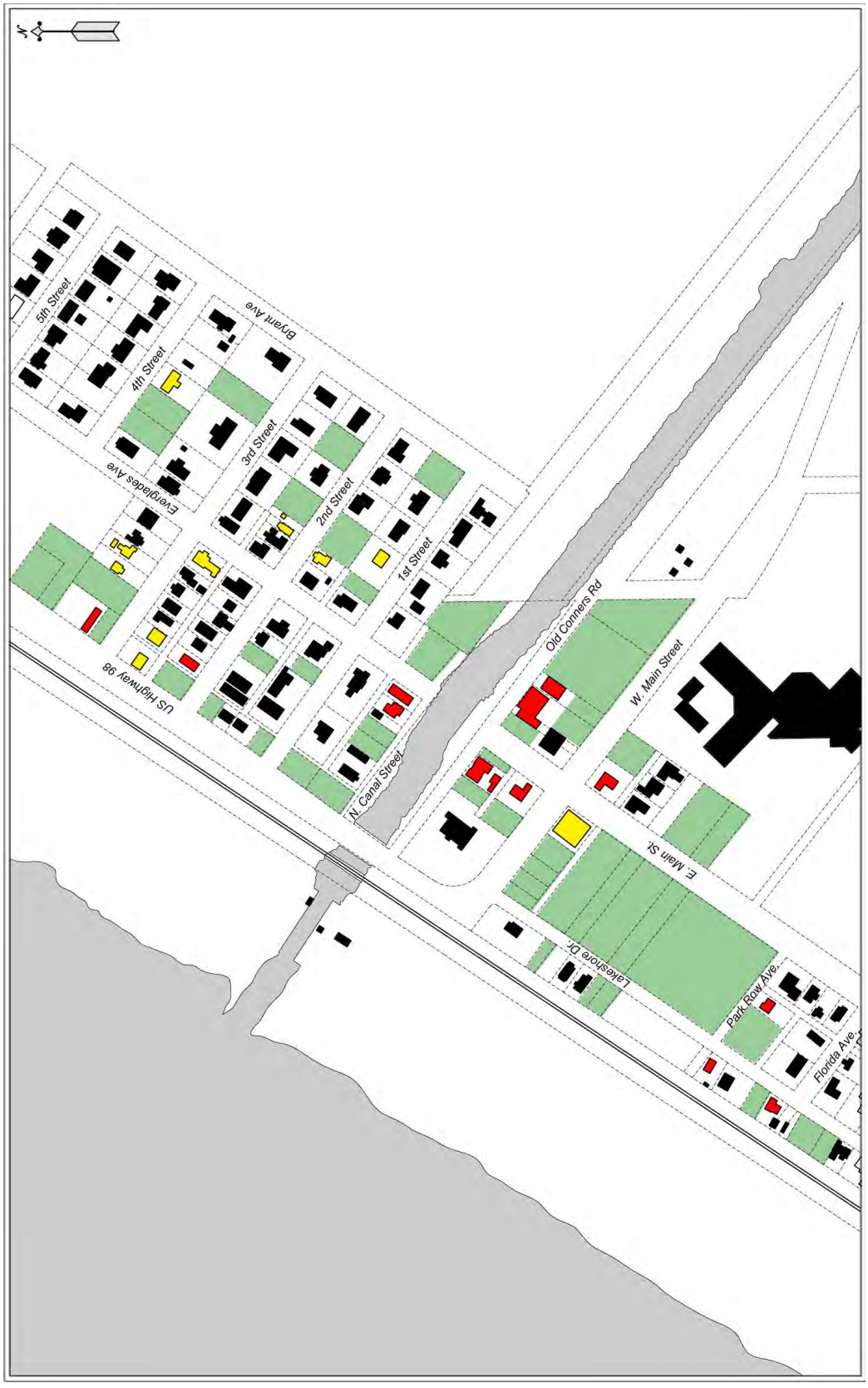
Figure 56
Canal Point
Building Assessment Type "C"

The building illustrated above is an example of Type C buildings.



The red building footprints illustrated above are the Type C buildings in Canal Point. There is a cluster of these buildings that are commercial, in need of repair, south of the canal at the end of Main Street. Very few of the neighborhood structures match the Type C description.

Figure 57
Canal Point
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels



The diagram above is a composite of the A, B, and C buildings as well as the vacant parcels in green. For as small a community as Canal Point is, there are a surprising number of vacant parcels that could provide infill housing opportunities.

Figure 58
Canal Point
Needed Roadway Improvements

The few Canal Point roadways in need of significant repair are illustrated above in blue.

Figure 59
Canal Point
Building Assessment Sidewalks

The Canal Point community does not have an existing sidewalk network. The image above illustrates the missing sidewalks throughout Canal Point. There are sidewalks along SR 98/Main Street and the blue line represents an existing sidewalk that needs repair.

Figure 60
Canal Point
Sidewalks, Roads & Transit

The image above is a composite of the sidewalk, roadway, and transit analysis for Canal Point. The dotted lines represent the existing Palm Tran transit routes. It is important to note where there are needed roadway or sidewalk improvements along transit routes as those deficiencies, if they are not addressed, may over time impact the transit service.

Figure 61
Canal Point
All Analyses

This composite diagram includes all of the Canal Point analyses into one drawing.

P A H O K E E

Figure 62
Pahokee
3 Sections - North, Middle & South

The area identified above is the detailed analysis boundaries conducted for Pahokee. This total area is broken into three subsets – North, Middle, and South.

Figure 63
Pahokee
Building Assessment 3 Sections - North, Middle & South

The three areas identified above are the detailed analysis areas for Pahokee. The subsets are identified as North, Middle, and South. The black and white base drawing above was developed by the TCRPC team and illustrates all of the roadways, lots, building footprints, and special physical features.

Figure 64
Pahokee North Existing Conditions
East Main – East Second/ Bacom Point – N Elm Avenue

The aerial image above identifies the Pahokee North analysis area. Note the Pahokee Marina, downtown Pahokee, and Main Street.

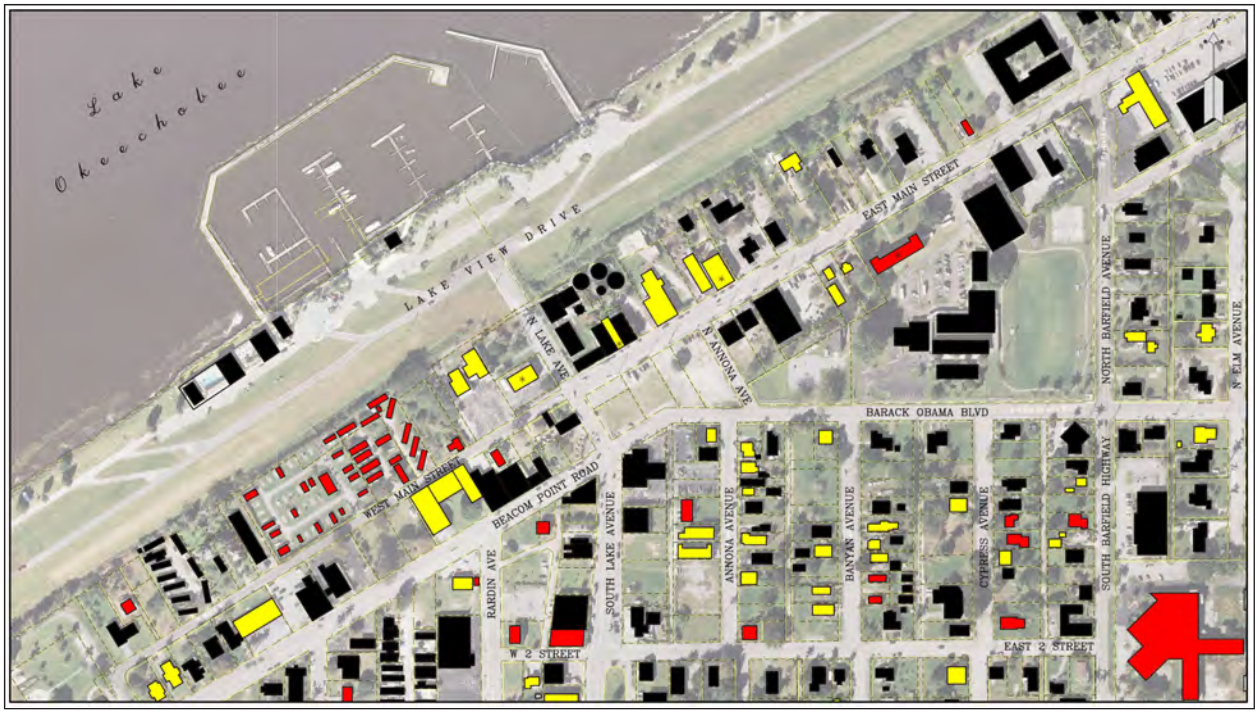
Figure 65
Pahokee North
Building Assessment Type "A"

The buildings in black are the Type A buildings in the north section of Pahokee.

Figure 66
Pahokee North
Building Assessment Type "B"

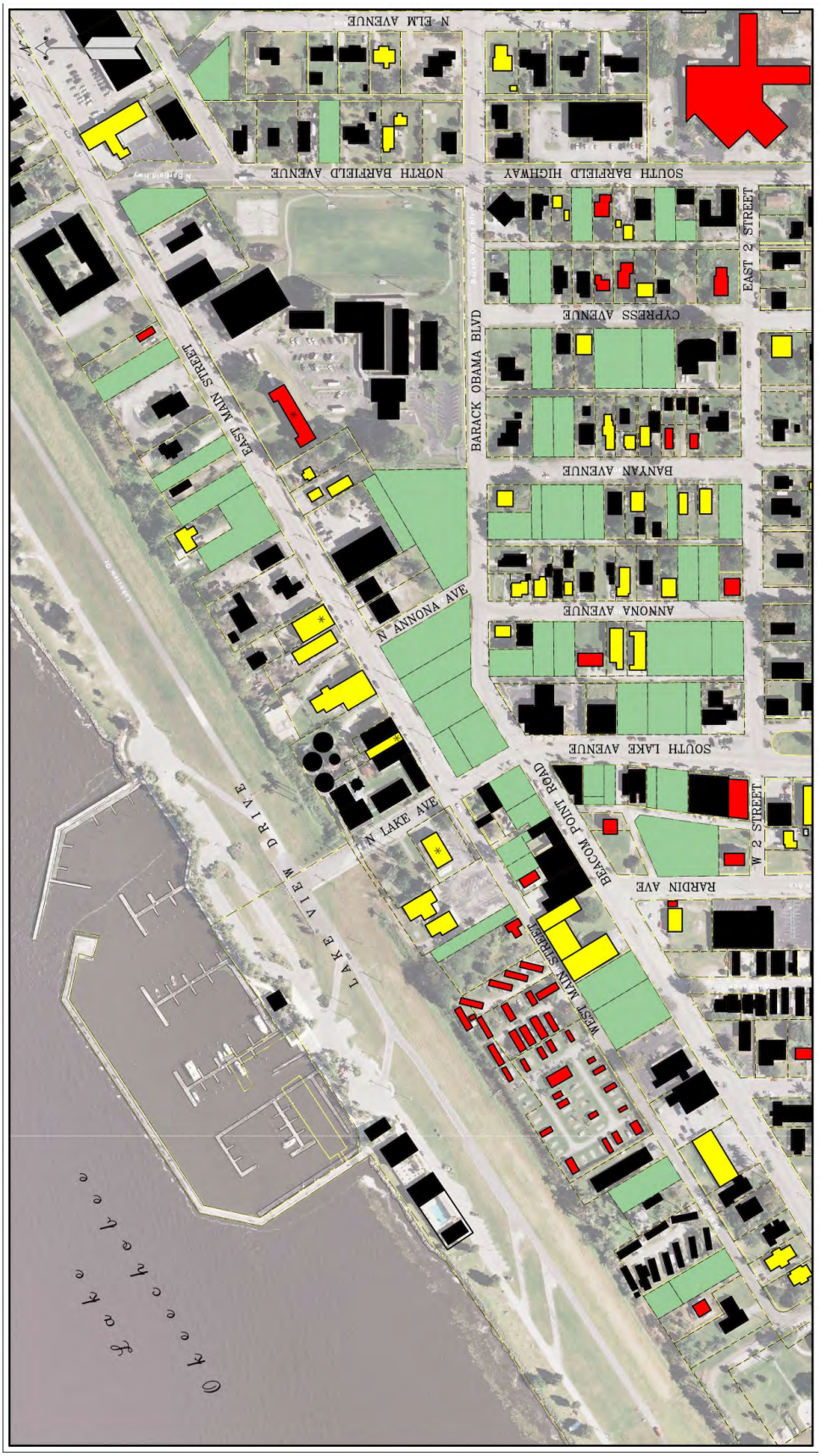
The diagram above identifies the Type B buildings in yellow.

Figure 67
Pahokee North
Building Assessment Type "C"



This diagram identifies the Type A, B, and C buildings. The C buildings are colored in red. The cluster of red building footprints opposite the dike from the marina are mobile homes that will ultimately be replaced over time.

Figure 68
Pahokee North
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels



This composite drawing identifies the building assessment types as well as the vacant parcels. There is a significant amount of vacant land in the downtown area of Pahokee. These empty parcels represent infill housing and redevelopment opportunities and are essential to completing streets and neighborhood improvements in Pahokee.

Figure 69
Pahokee North
Needed Roadway Improvements

The map above illustrates the local roadway network improvements needed in the Pahokee North detailed analysis area. There are a significant number of local streets in Pahokee that need improvements.

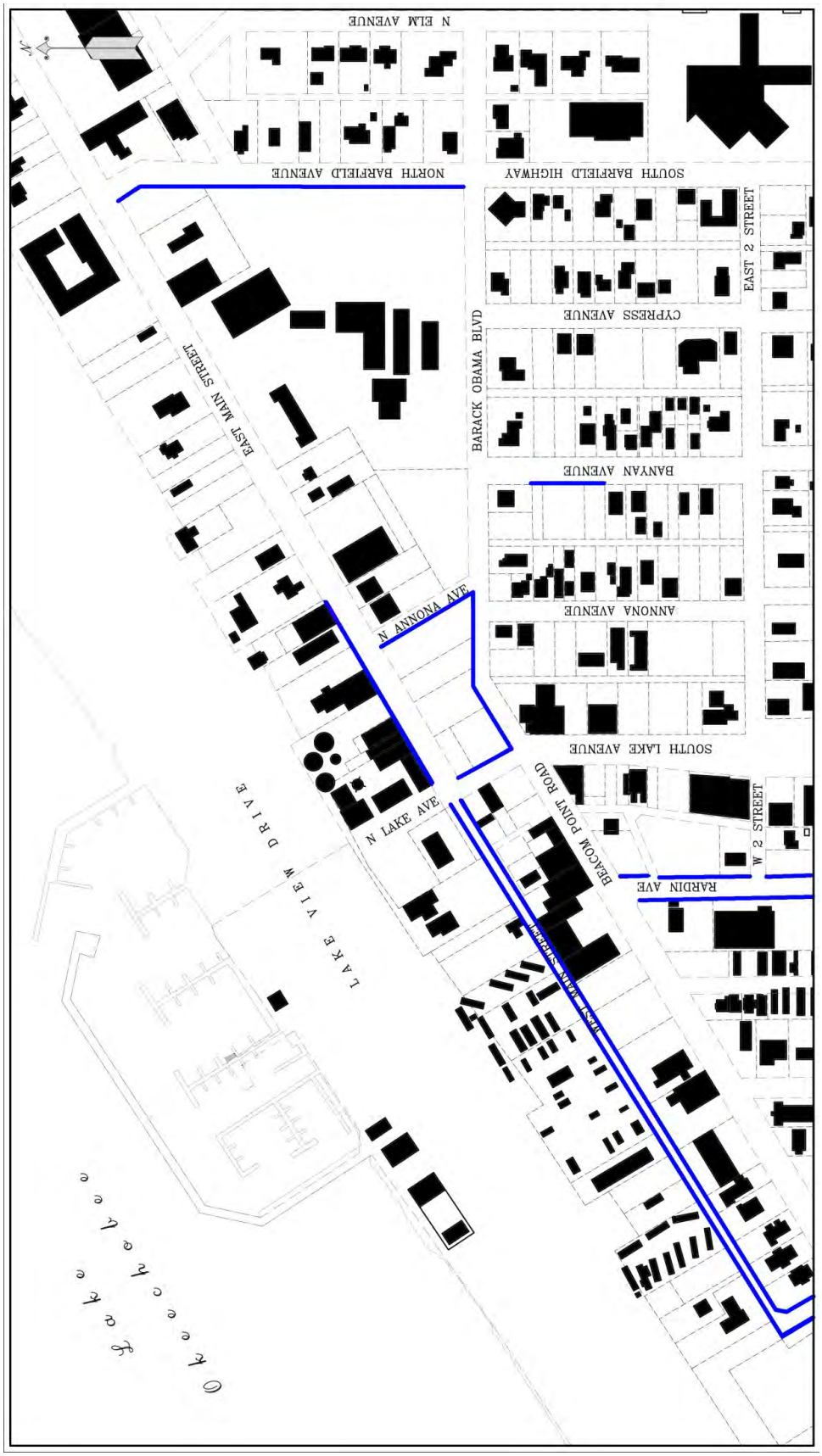


Figure 70
Pahokee North
Building Assessment Sidewalks

The diagram above illustrates areas where sidewalk improvements are needed.

Figure 71
Pahokee North
Building Assessment Sidewalks, Roads & Transit

The dotted lines illustrated above represent the existing Palm Tran bus routes in the Pahokee North analysis area. Where the transit routes co-incide with needed roadway improvements should be considered priority action items.

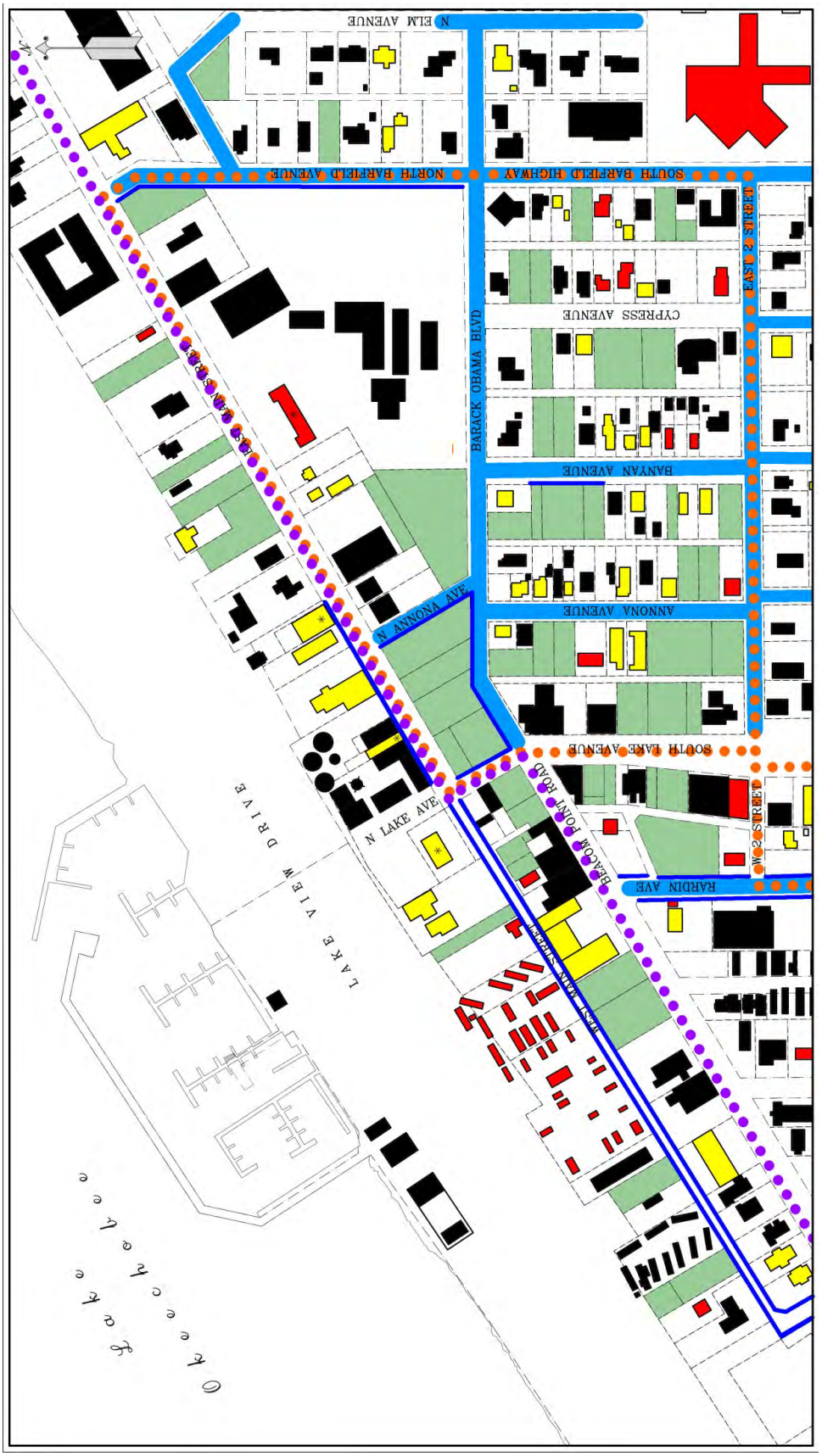
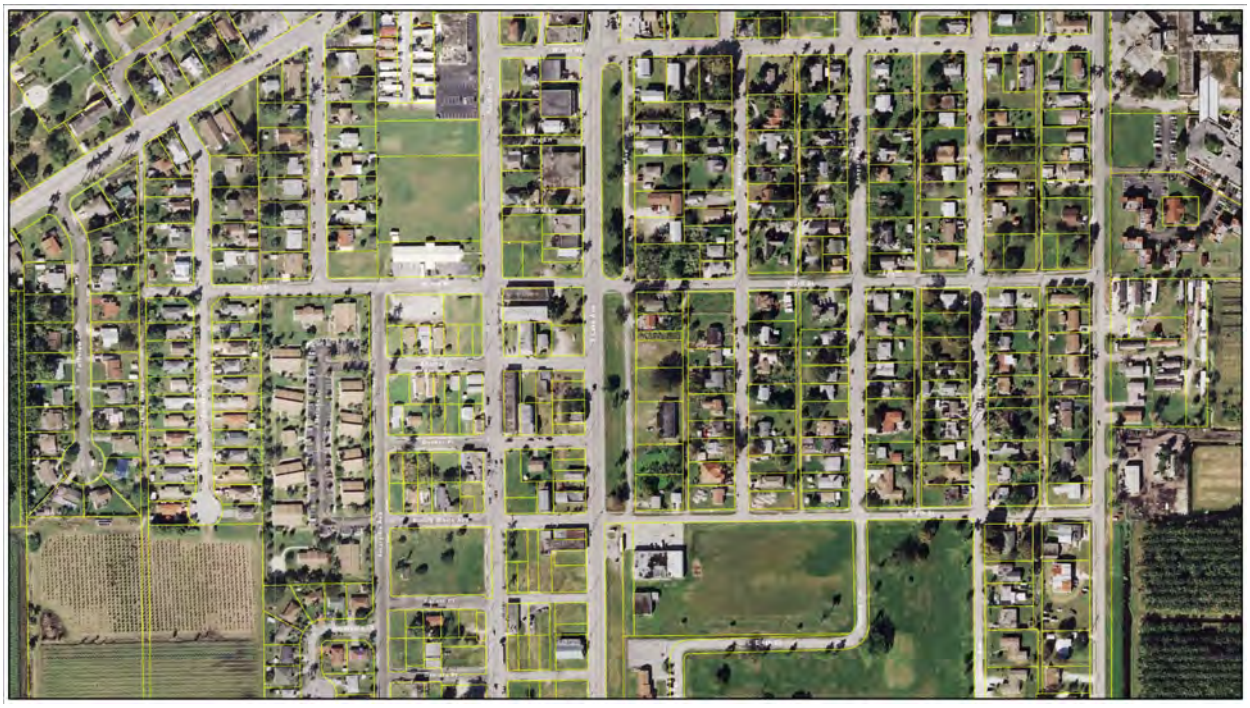


Figure 72
Pahokee North
All Analyses

The diagram above is a composite of all the analysis for the Pahokee North area.

Figure 73
Pahokee Middle Existing Conditions
East Second – Daniels Place / Bacom Point – Banyan Avenue



The aerial image above identifies the Pahokee Middle analysis area. Note that portions of Bacom Point Road are visible as the diagonal road to the left of the image.

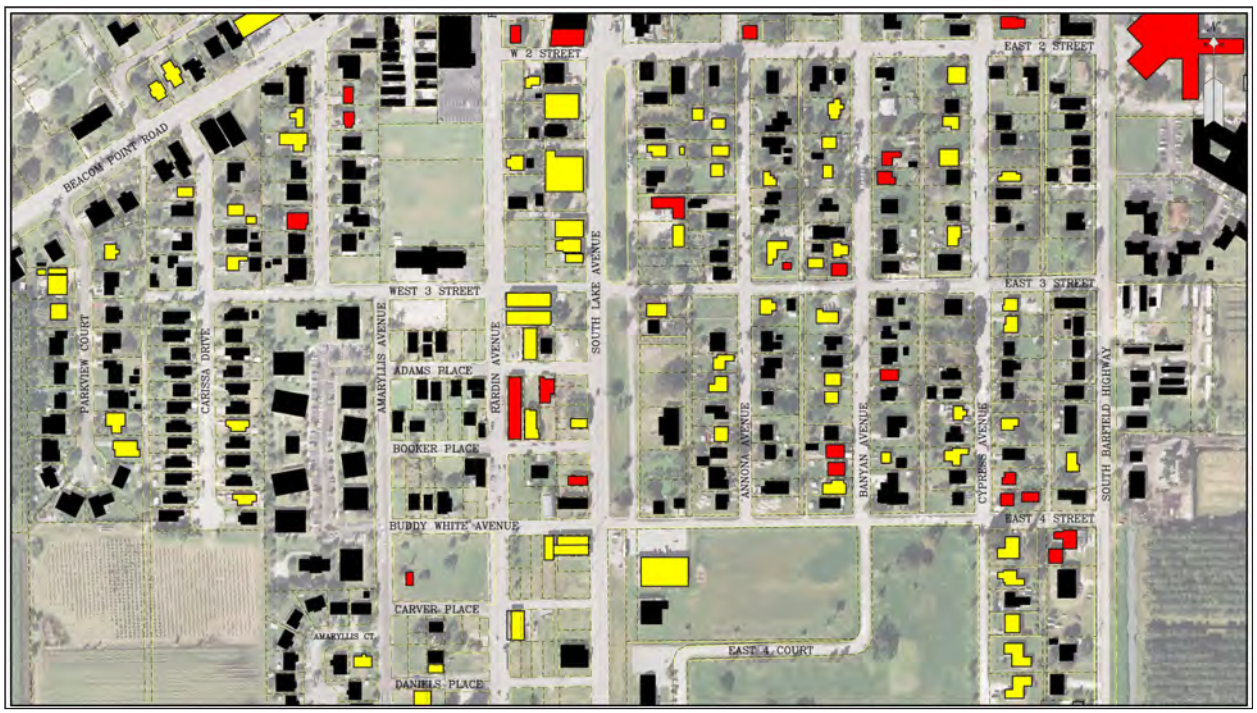
Figure 74
Pahokee Middle
Building Assessment Type "A"

The buildings in black are the Type A buildings in the Pahokee Middle section of the analysis areas.

Figure 75
Pahokee Middle
Building Assessment Type "B"

The diagram above identifies the Type B buildings in yellow. There are a number of commercial and mixed-use buildings along South Lake Avenue that are in need of repair.

Figure 76
Pahokee Middle
Building Assessment Type "C"



This diagram identifies the Type A, B, and C buildings. The C buildings are colored in red. The larger building footprint in the upper right hand corner of the image is the old Pahokee hospital.

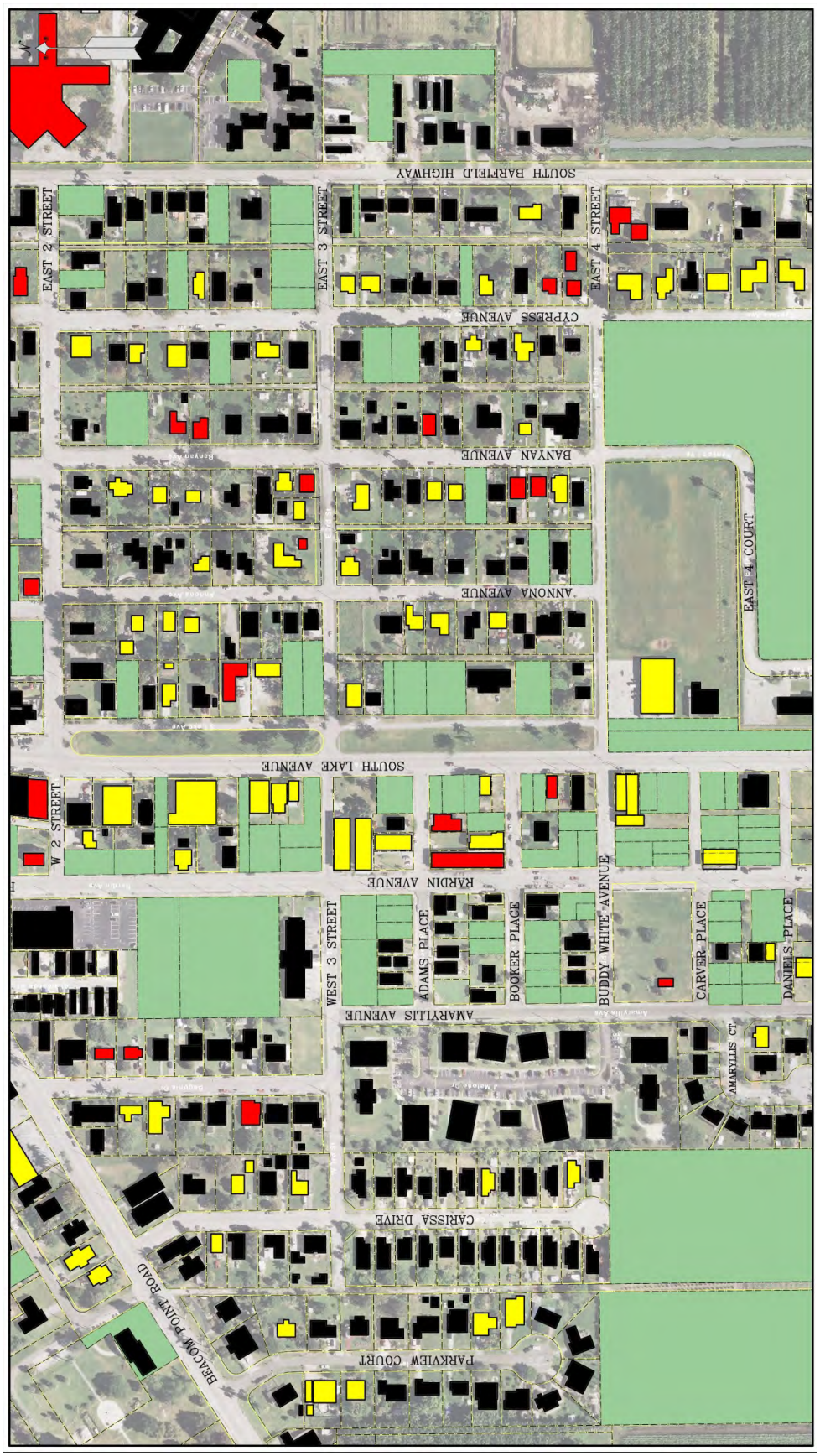


Figure 77
Pahokee Middle
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels

This composite drawing identifies the building assessment types as well as the vacant parcels. There is a significant amount of vacant land in the Pahokee Middle analysis section. Note the vacant parcels along Rardin and South Lake Avenues.

Figure 78
Pahokee Middle
Needed Roadway Improvements

The map above illustrates the local roadway network improvements needed in the Pahokee Middle detailed analysis area. There are a significant number of local streets in Pahokee that need improvements.

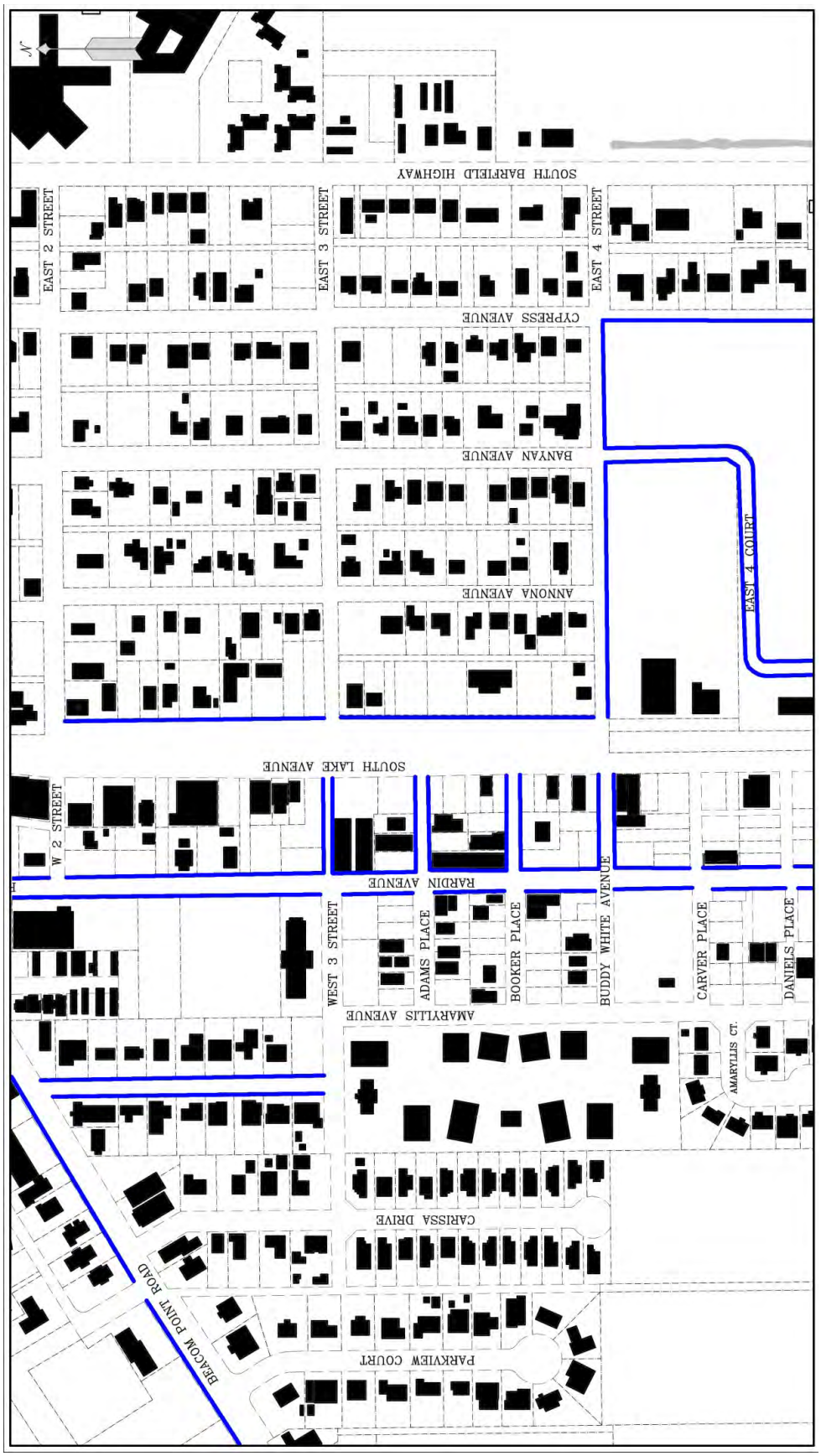
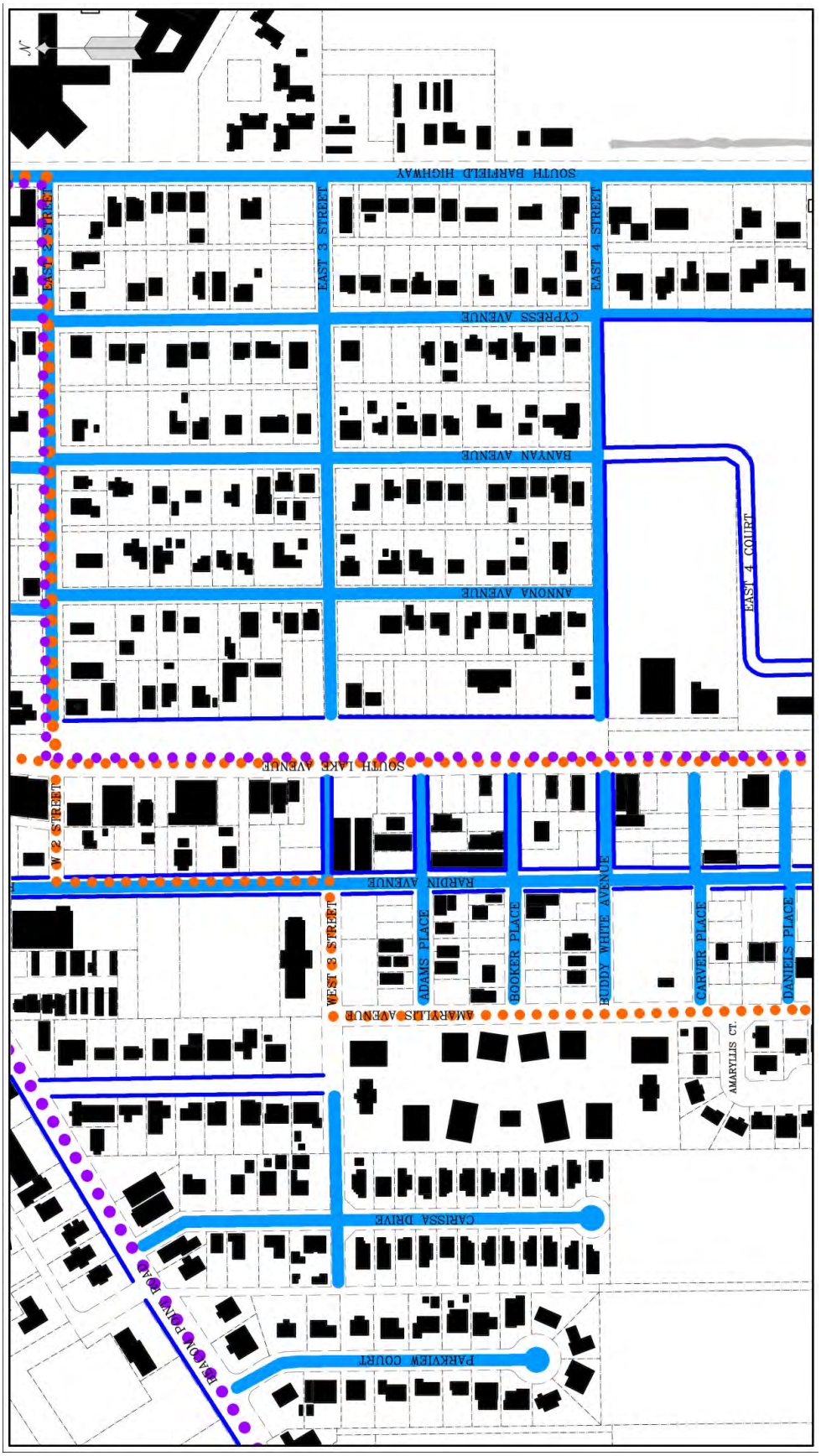


Figure 79
Pahokee Middle
Building Assessment Sidewalks

The diagram above illustrates areas where sidewalk improvements are needed.

Figure 80
Pahokee Middle
Building Assessment Sidewalks, Roads & Transit



The dotted lines illustrated above represent the existing Palm Tran bus routes in the Pahokee Middle analysis area. Where the transit routes coincide with needed roadway improvements should be considered priority action items.

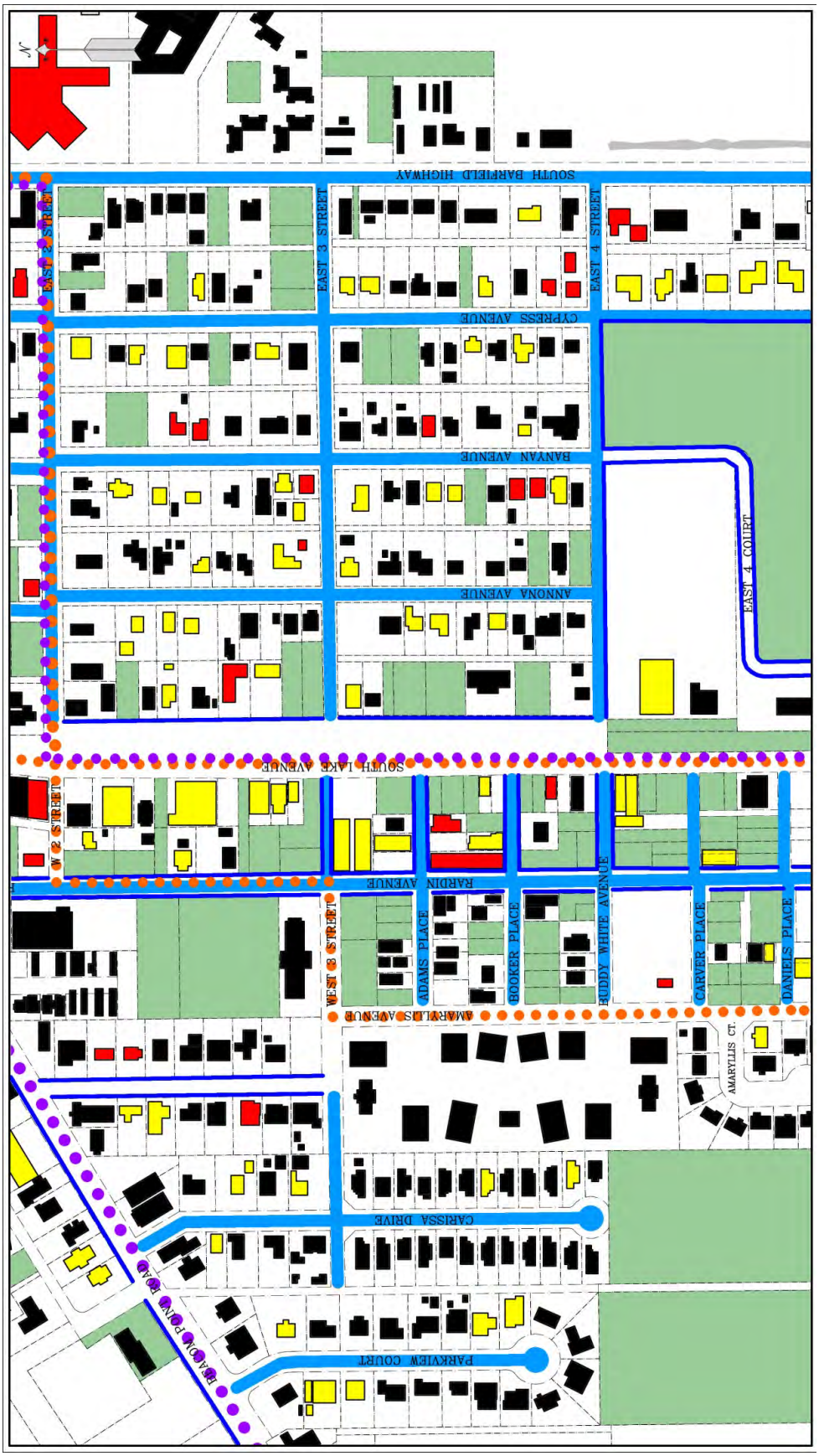


Figure 81
Pahokee Middle
All Analyses

The diagram above is a composite of all the analysis for the Pahokee Middle area.

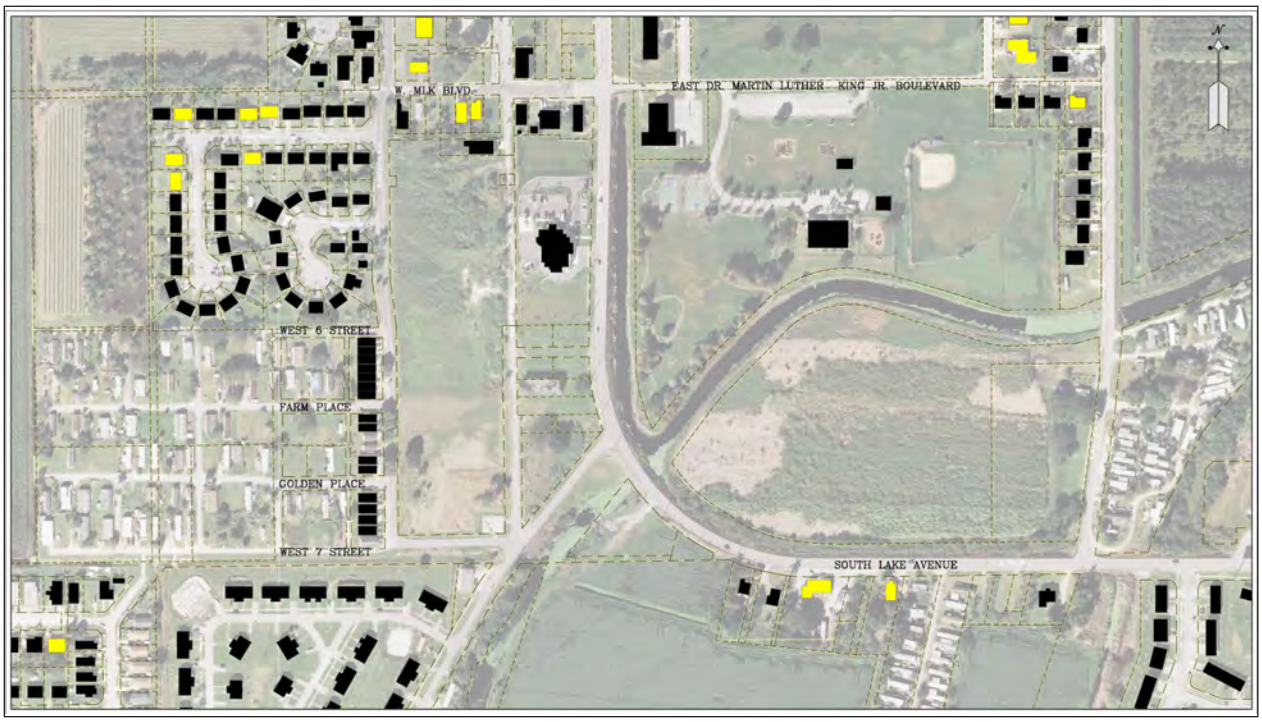
Figure 82
Pahokee South Existing Conditions
East MLK – South Lake Avenue / Palm Blvd – South Barfield Highway

The aerial image above identifies the Pahokee South analysis area. Note that South Lake Avenue/SR 441 is in the center of the image and curves eastbound.

Figure 83
Pahokee South
Building Assessment Type "A"

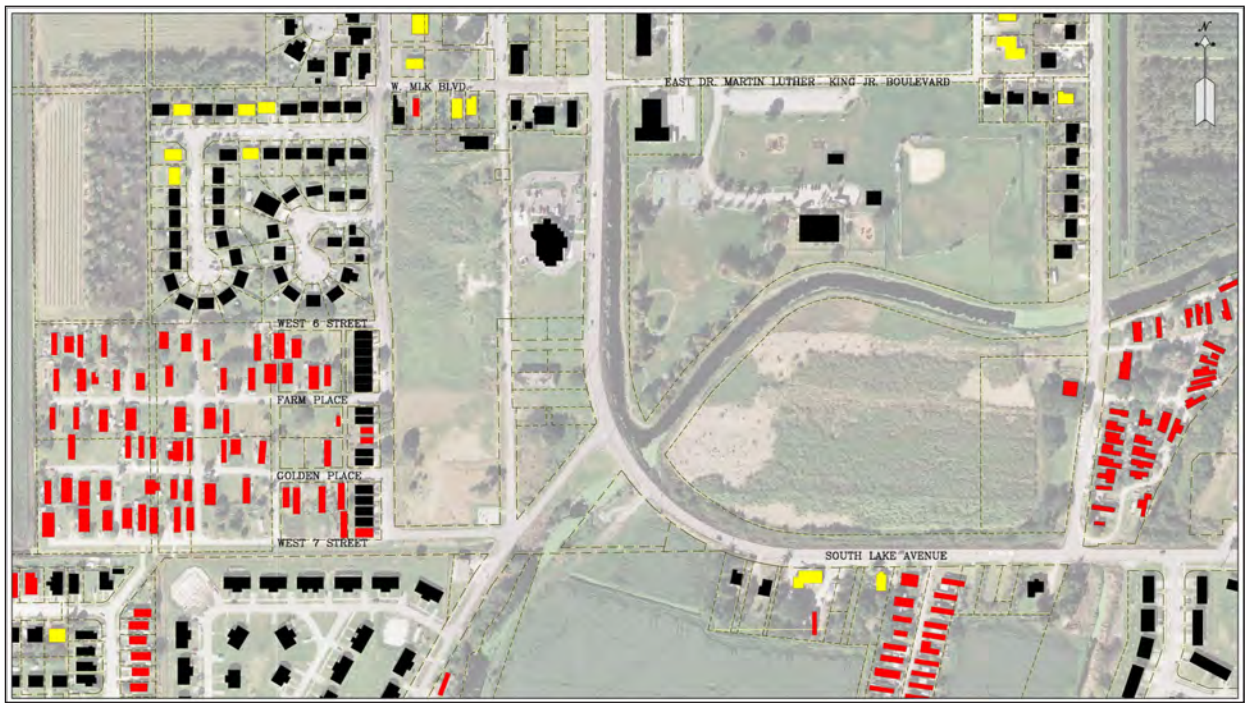
The buildings in black are the Type A buildings in the Pahokee South section of the analysis areas.

Figure 84
Pahokee South
Building Assessment Type "B"



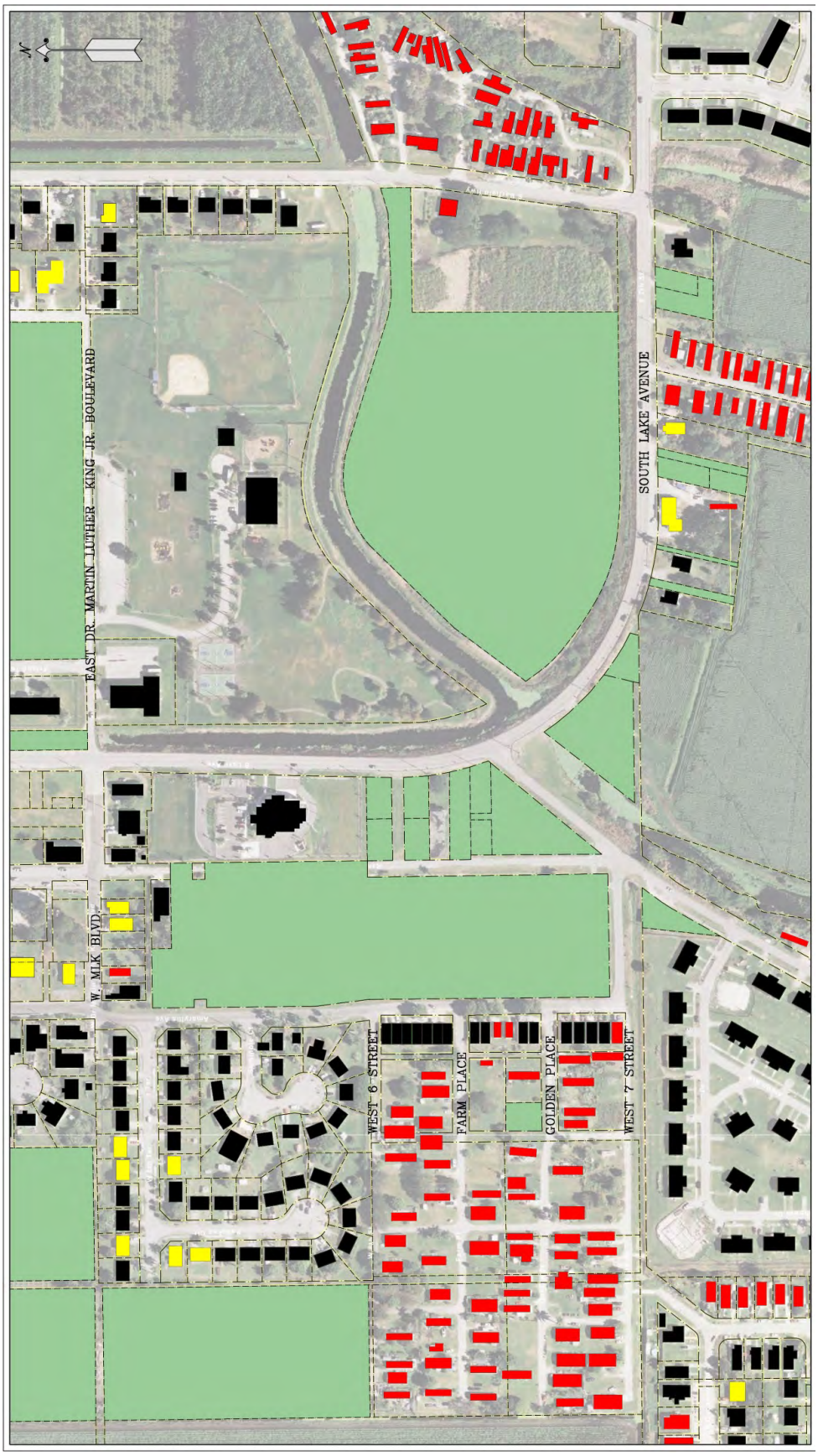
The diagram above identifies the Type B buildings in yellow. There are a few buildings meeting the Type B conditions in this area.

Figure 85
Pahokee South
Building Assessment Type "C"



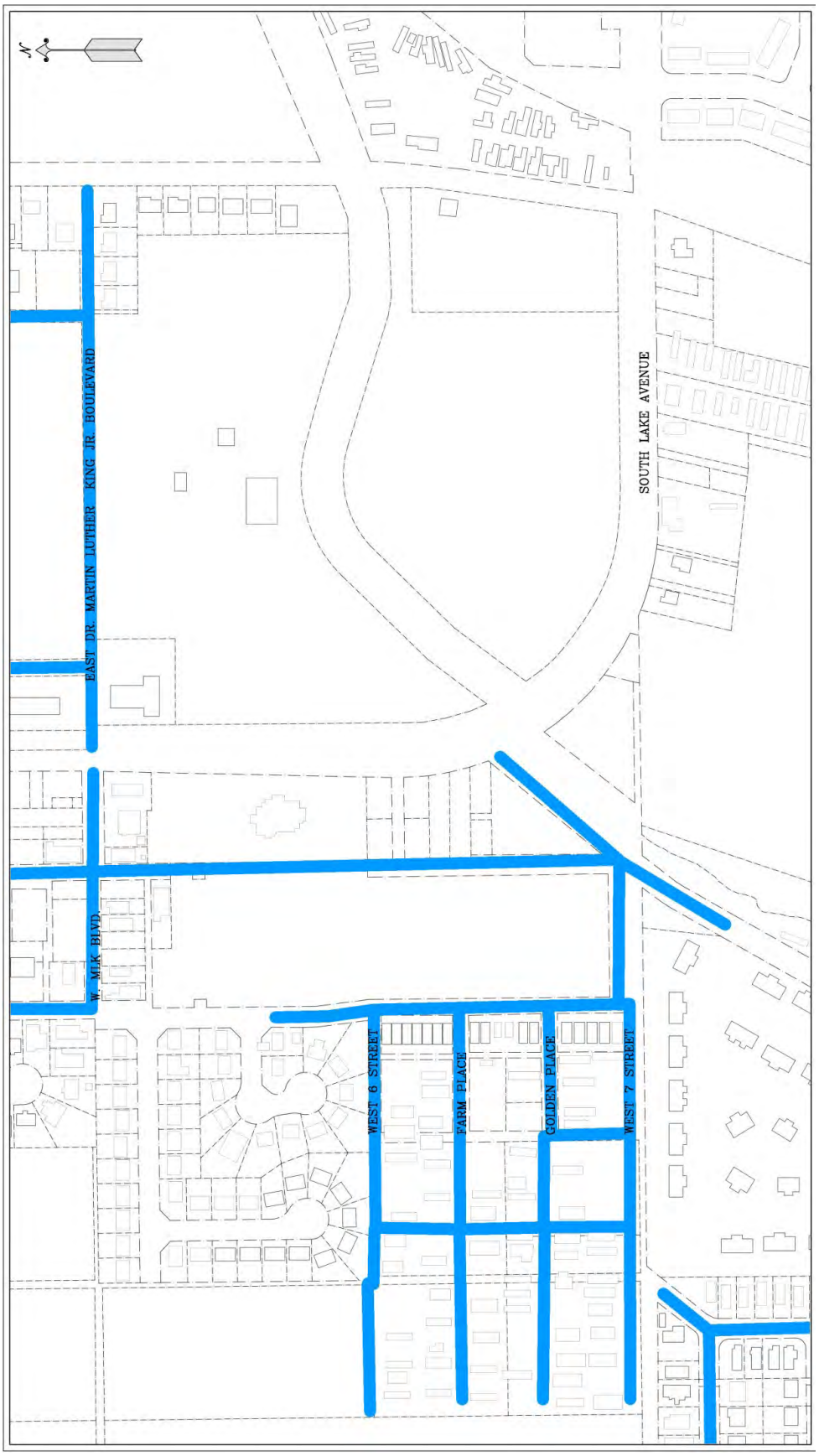
This diagram identifies the Type A, B, and C buildings. The C buildings are colored in red. There are a number of mobile homes in the Pahokee South analysis area fitting the Type C building assessment descriptions.

Figure 86
Pahokee South
Building Assessment Type "A" + "B" + "C" Buildings - Vacant Parcels



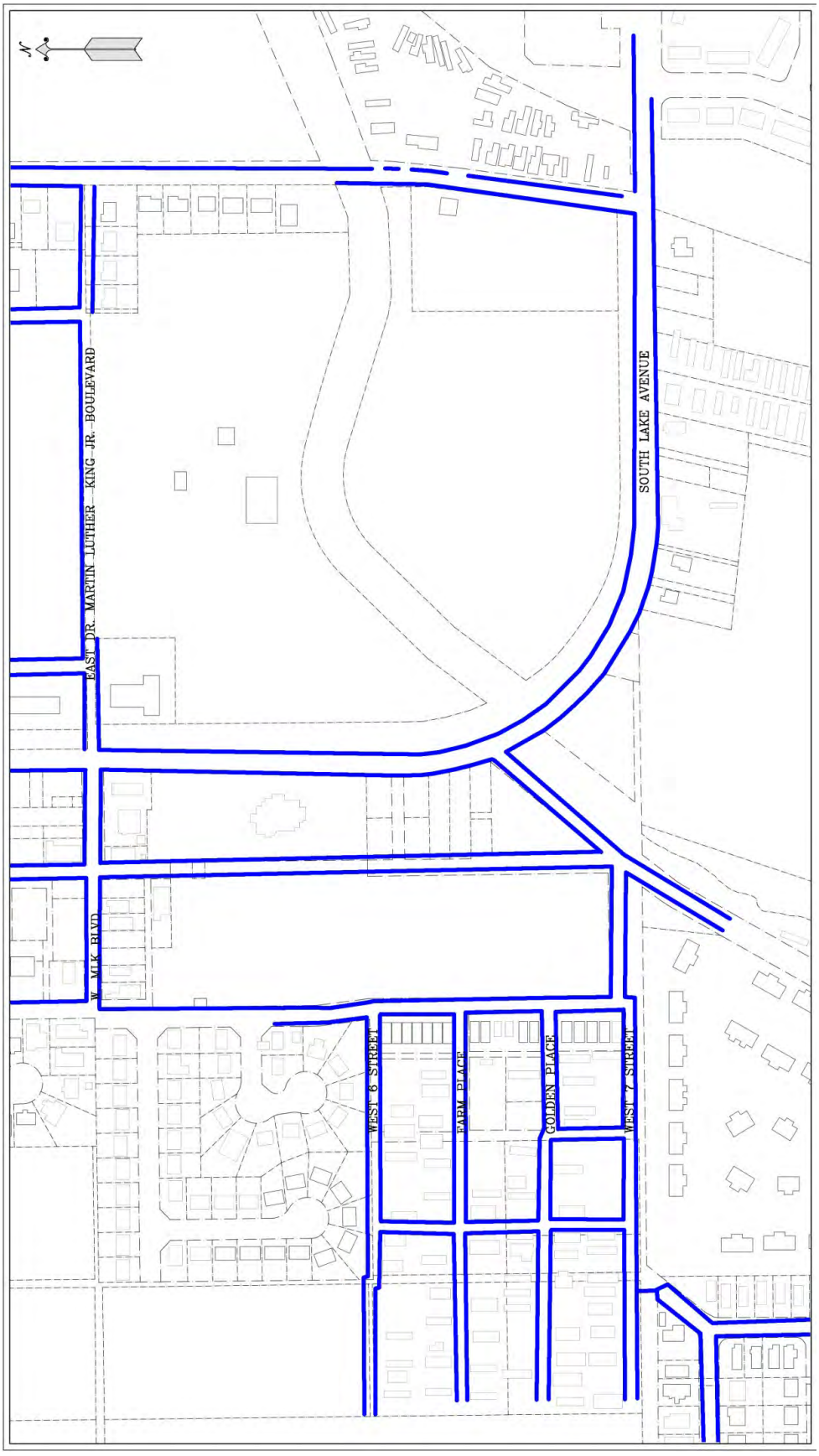
This composite drawing identifies the building assessment types as well as the vacant parcels. There is a significant amount of vacant land in the Pahokee South analysis section. Note the vacant parcels along South Lake Avenue.

Figure 87
Pahokee South
Needed Roadway Improvements



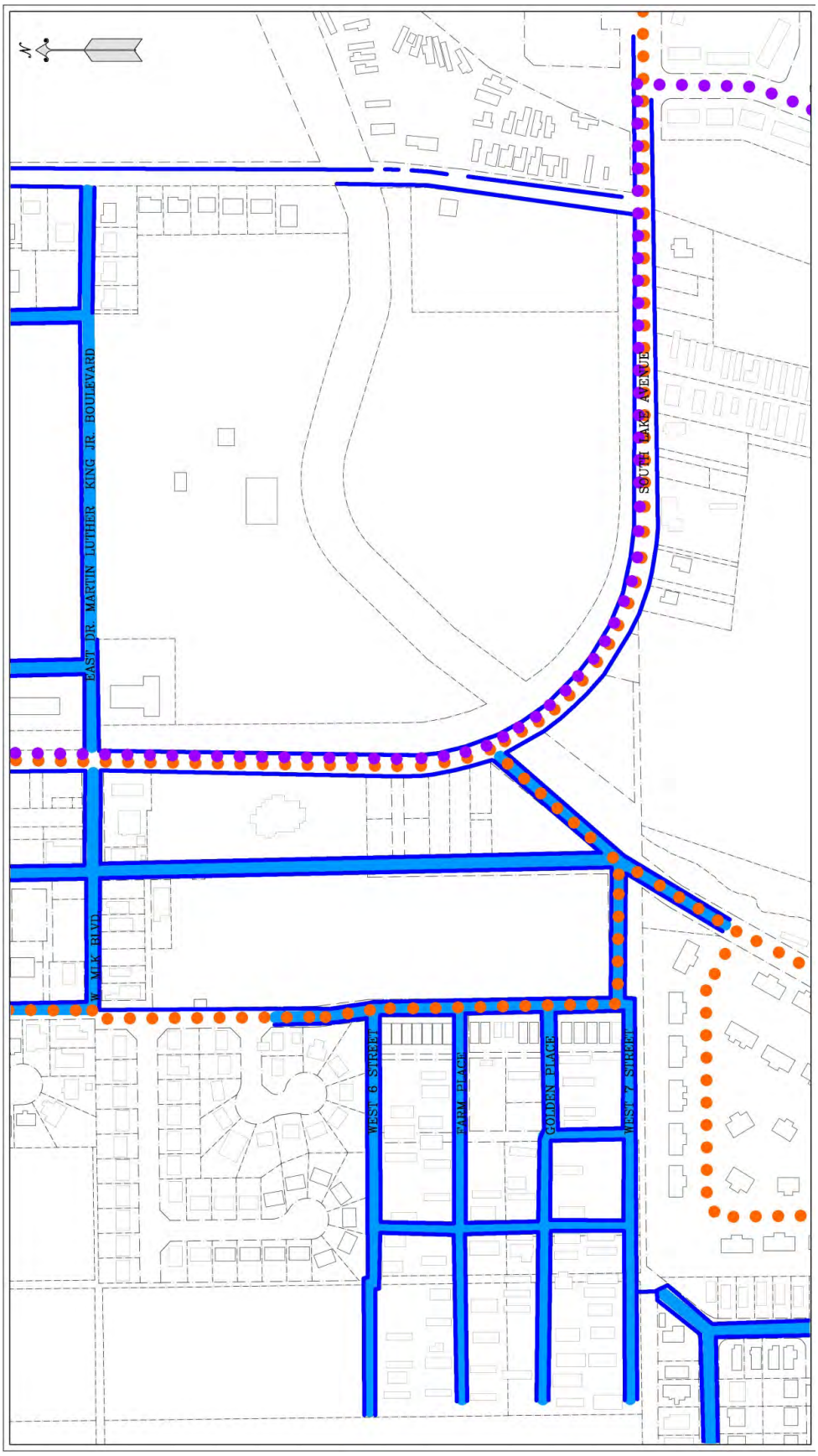
The map above illustrates the local roadway network improvements needed in the Pahokee South detailed analysis area. There are a significant number of local streets in Pahokee that need improvements.

Figure 88
Pahokee South
Building Assessment Sidewalks



The diagram above illustrates areas where sidewalk improvements are needed. The South Lake Avenue/SR 441 corridor, which is a significant transit route in the Glades, is in need of sidewalk improvements.

Figure 89
Pahokee South
Building Assessment Sidewalks, Roads & Transit



The dotted lines illustrated above represent the existing Palm Tran bus routes in the Pahokee South analysis area. Where the transit routes coincide with needed roadway improvements should be considered priority action items.

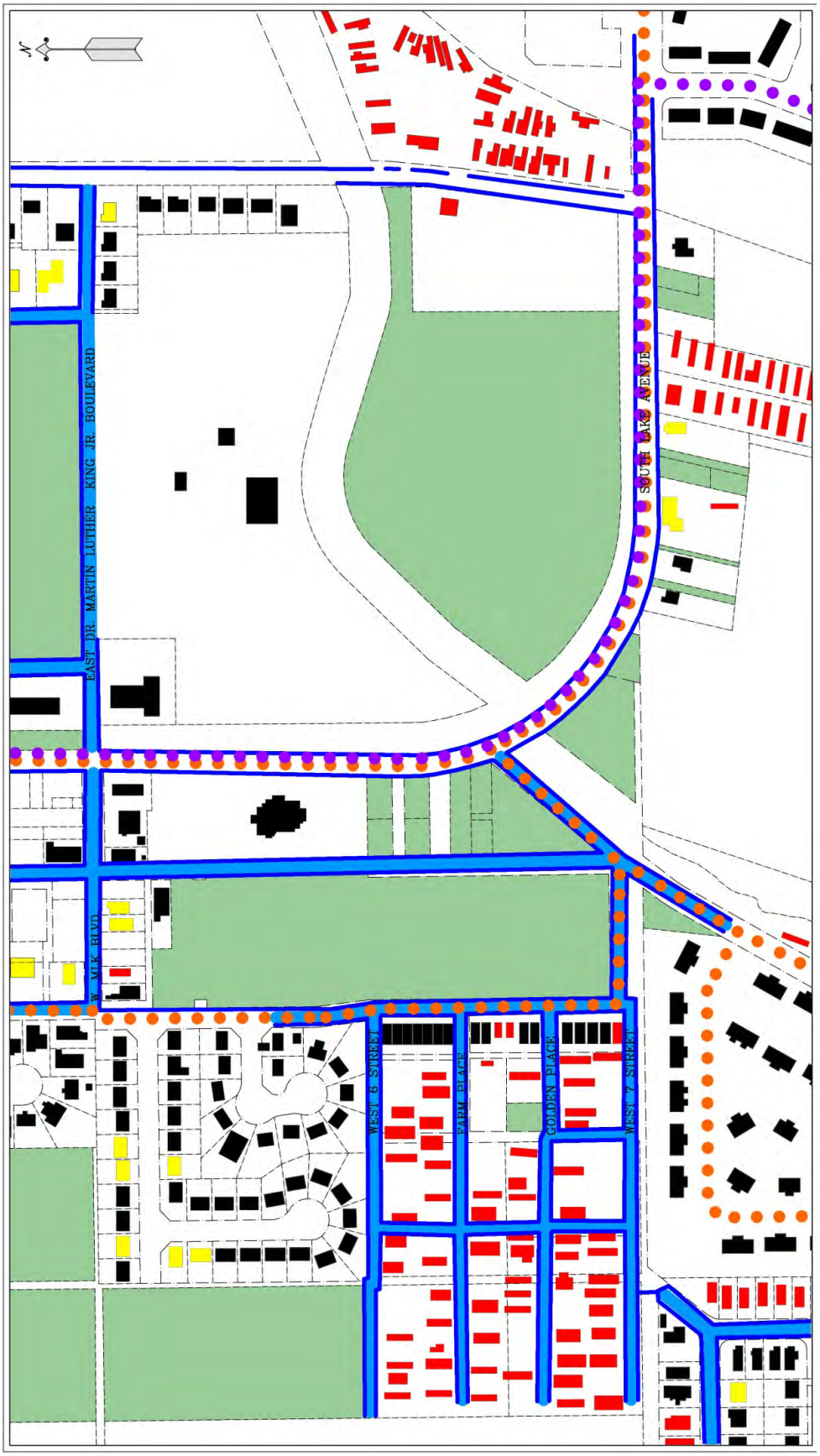


Figure 90
Pahokee South
All Analyses

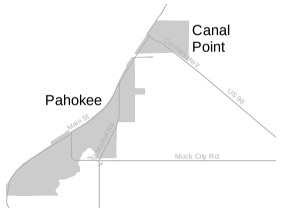
The diagram above is a composite of all the analysis for the Pahokee South area.

Figure 91
Pahokee/ Canal Point
Community Resources

Glades Region Master Plan

Community Resources

Pahokee and Canal Point



Shopping Centers / Food Markets

Family Dollar / Save-a-Lot Plaza
Thriftway Supermarket

Social Services and Healthcare Facilities

Canal Point Community Center
Glades Area Pantries Community Center
Pahokee Medical Plaza

Parks and Recreational Facilities

Anquan Boldin Stadium
Chess Park
Duncan Padgett Park
Martin Luther King Jr Memorial Park
Pahokee Marina and RV Resort
Triangle Park

Educational Facilities

Everglades Preparatory Academy
Glades Academy
Kathryn E. Cunningham Elementary School
Pahokee Elementary / Middle / High School

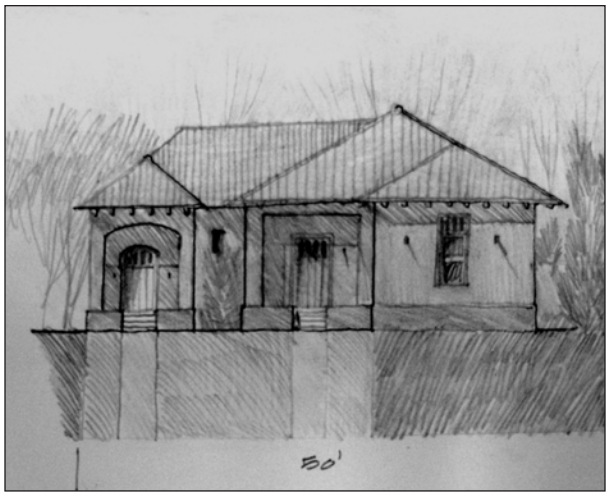
Government Services

Pahokee City Hall / Fire Station / Chamber of Commerce
Palm Beach County Glades Airport
Palm Beach County Library
Sago Palm Work Camp (Correctional Facility)
USDA Agricultural Research Service

Manufacturing and Production

Sun Corn Produce Packing Facility

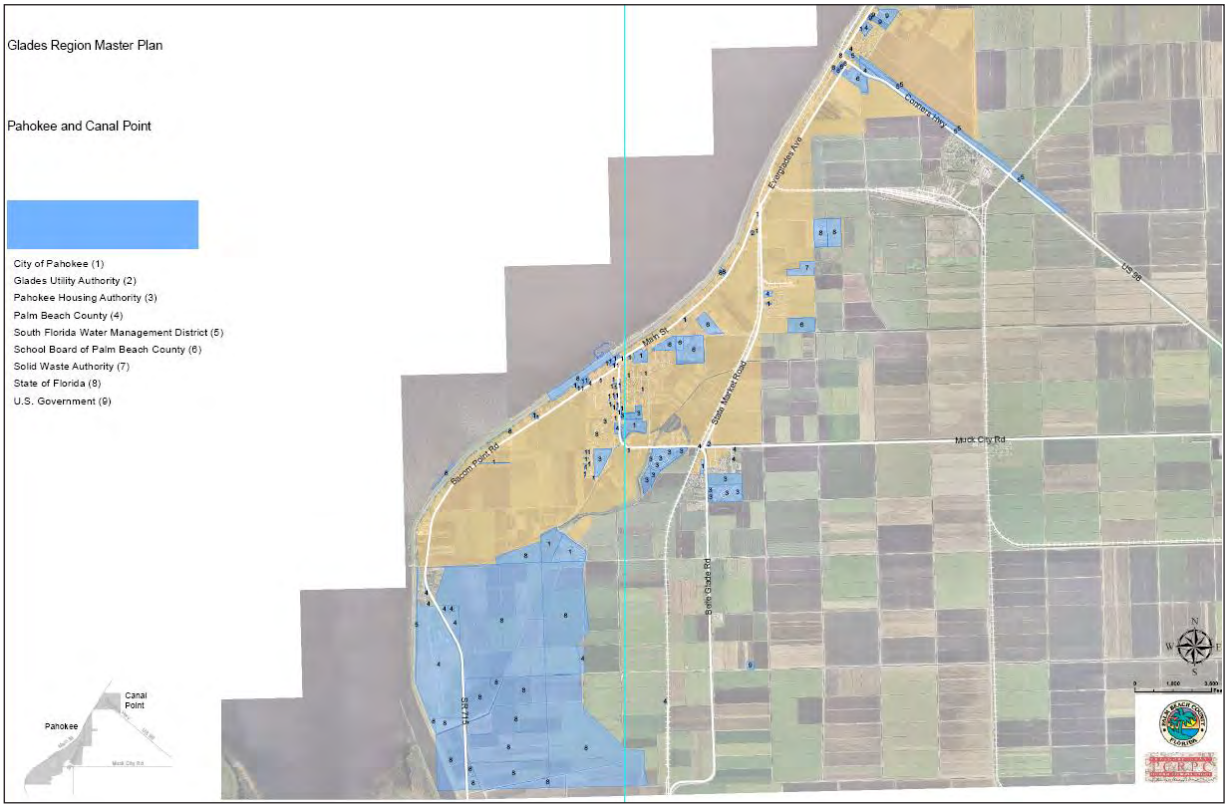
As the maps developed by the team identified the footprints of all existing buildings, the vacant parcels could be mapped easily as well. The vacant parcel maps are important as they represent potential areas for infill housing opportunities.



Infill Housing Prototypes

Based upon the typical lot sizes within the neighborhoods, the team developed a series of prototypical infill housing models that are configured for different densities.

Figure 92
Infill Housing Opportunities
Ownership Patterns



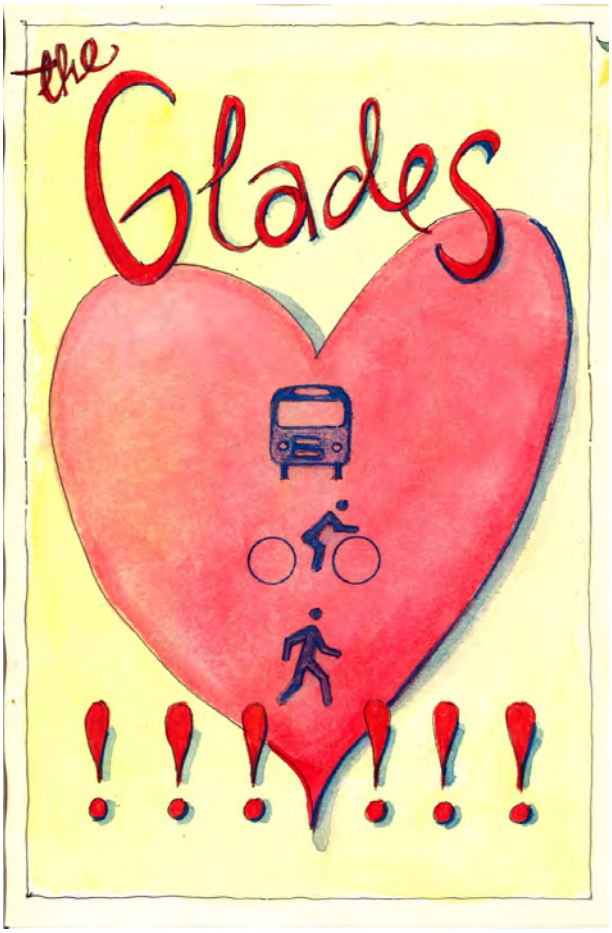
Figures 93 & 94
Infill Housing
Street Elevations

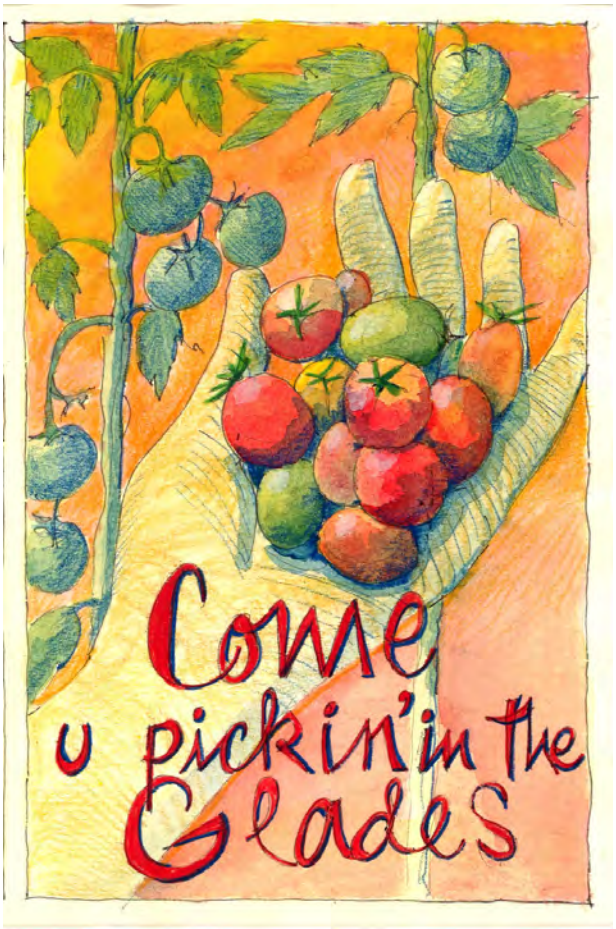
In addition to developing floor plans, the TCRPC team created building elevations to illustrate the character and scale of the infill housing proposals. The images above depict the character of a few infill houses. Please refer to the Infill Housing section for the Belle Glade/South Bay workshop earlier in this chaper for full floor plans and other details.

Marketing and Promotional Images

During the pre-workshop interview process it became clear that the Glades communities have suffered from challenges of image and perception for quite some time. In addition to the issues of poverty, joblessness, and crime, the Glades communities are isolated. The isolation can fuel the perception that there are few positive characteristics to the communities. Nothing could be further from the truth. The Glades communities have a tremendous amount to offer and the team tried to convey some of those characteristics with visual aids. The thought is that these images could provide the impetus for better exposure of all the positive aspects of the Glades.

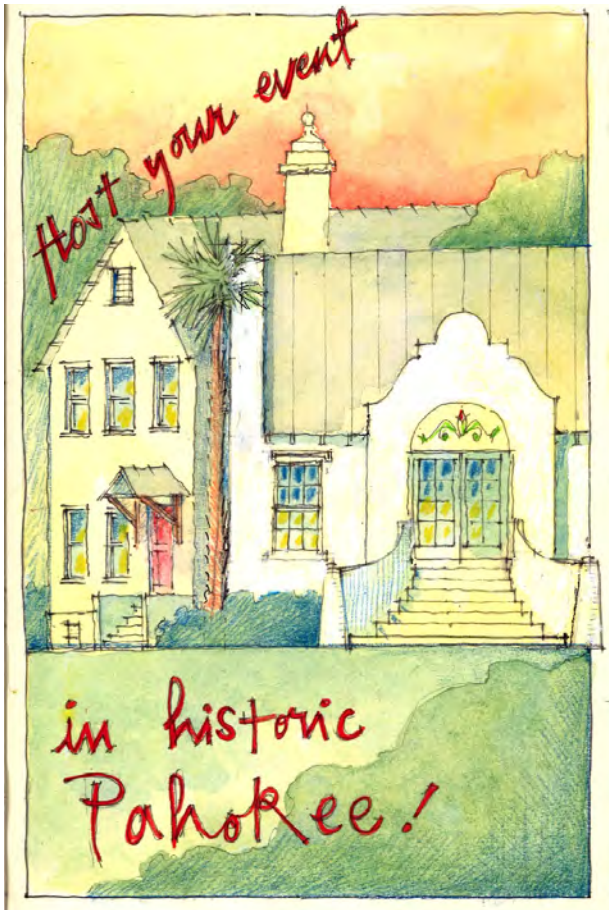
Figures 95 & 96
Changing Perceptions
A Step Towards Marketing Materials

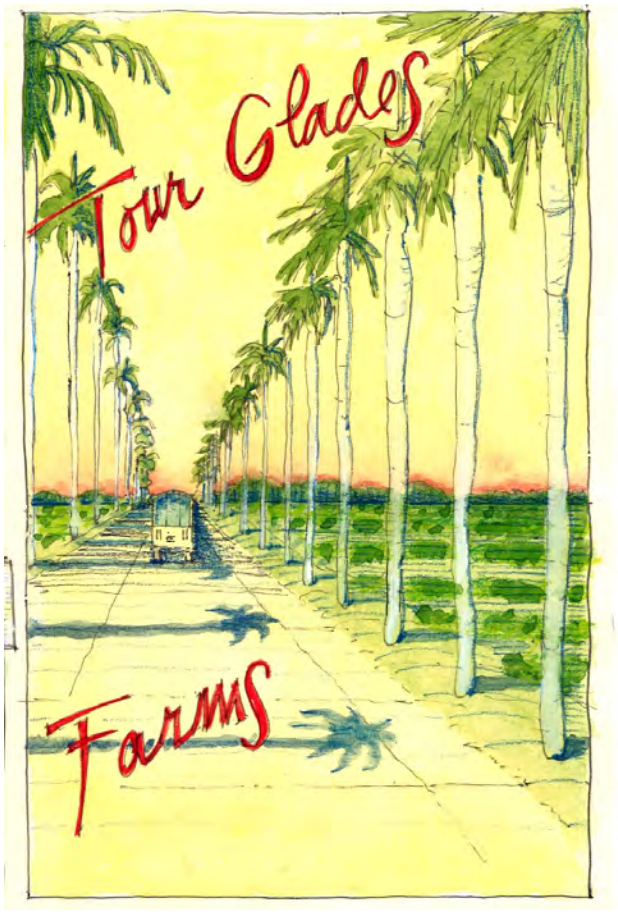




The development of marketing images that are Glades-specific was continued during the Pahokee/Canal Point workshop and week-long office. The image to the left depicts the goal of multi-modal transportation choices that are desired in the Glades communities. The image to the right illustrates the agricultural roots and unique offerings of the Glades.

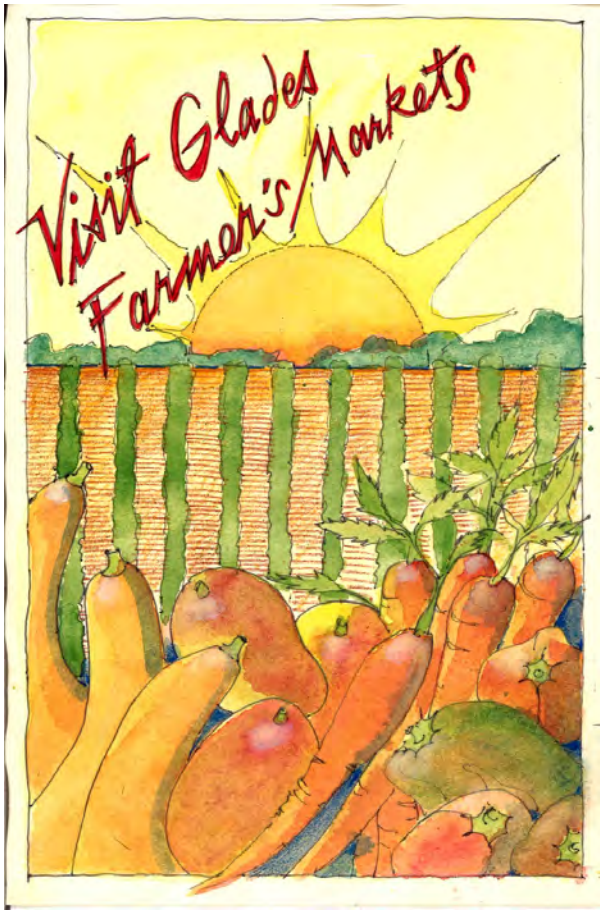
Figures 97 & 98
Changing Perceptions
A Step Towards Marketing Materials

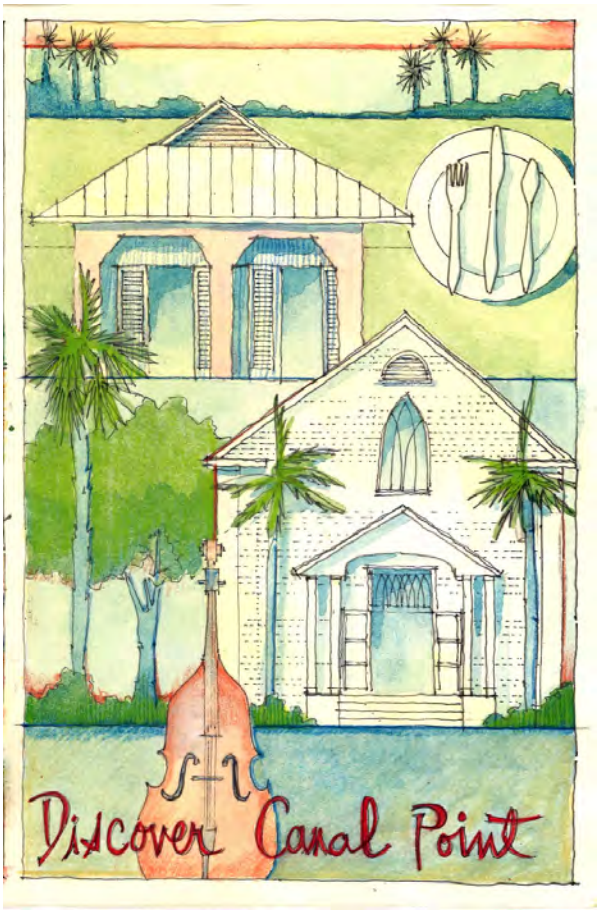




These images portray some of the characteristics unique to Pahokee and Canal Point. The image to the left celebrates the historic architectural heritage of Pahokee while the image to the right depicts the entry to Pahokee along Bacom Point Road.

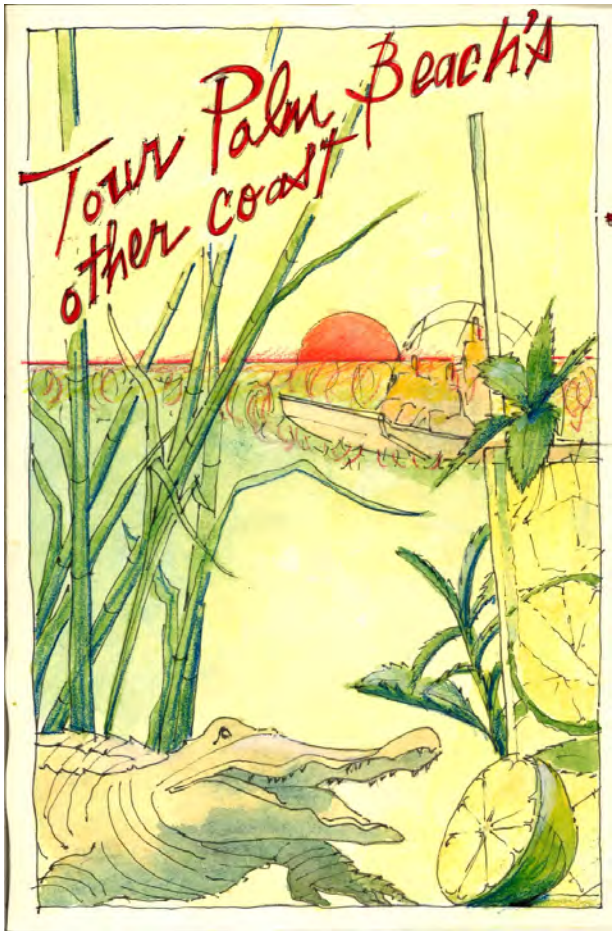
Figures 99 & 100
Changing Perceptions
A Step Towards Marketing Materials





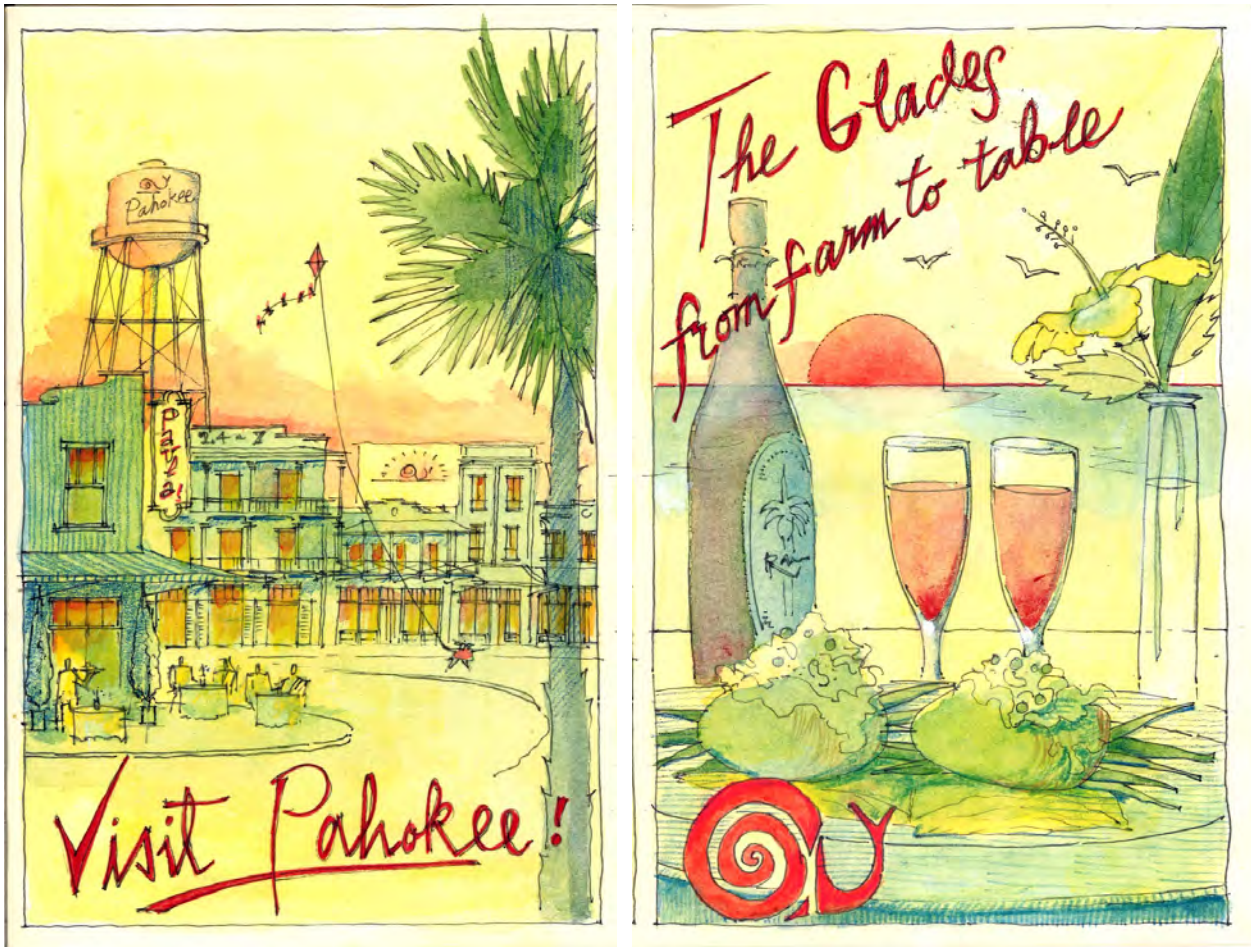
"Visit Glades Farmer's Markets" is a call to establish an outlet for all the Glades has to offer. Discovering Canal Point could include the Lake, the architecture, the culture, and the food of the Glades.

Figures 101 & 102
Changing Perceptions
A Step Towards Marketing Materials



Often referred to as “Palm Beach’s other coast”, the Glades communities along Lake Okeechobee offer one of the most unique experiences in the United States. Harnessing the unique characteristics of the Glades communities and providing the infrastructure to avail those assets to the general public is one of the challenges that must be addressed. The historic elements of the Glades communities plays perfectly into the opportunities that exist.

Figures 103 & 104
Changing Perceptions
A Step Towards Marketing Materials



The two images above represent a positive message for Pahokee and the Glades communities in general. The redevelopment and restoration of downtown Pahokee as the center of that community and from "Farm to Table", a celebration of all the Glades has to offer, are two messages that must be marketed.

One idea that came from the public was the potential of turning the marketing images (the black and white line drawings) into coloring books for kids in the Glades communities' schools. The chance to change some of the perceptions is even more important where the children of the Glades are concerned.

Emerging Economies

Working with the economists the team explored existing and potential future economic strategies to further support the local Glades economies. There are many activities occurring already in the Glades communities that have the potential to provide additional revenues however, many of those activities lack the needed infrastructure to support business growth. As an example, the Glades communities see thousands of visitors every year as motorcyclists, long-distance bicycle trainers, photographers, and general site seers. The Glades is known nationwide for its fresh water fishing and airboating.

Food Challenges in the Glades Region

In the midst of bountiful agriculture and food production, the Glades Region experiences food challenges and hunger. The Glades is mostly rural with a population of just over 30,000. Poverty and long-term unemployment are huge structural challenges in the region. The Glades is a USDA Champion Community with some of the highest unemployment and poverty levels in the county. The communities of Belle Glade, Pahokee and South Bay are designated by the State of Florida as a Rural Area of Critical Economic Concern (RACEC), encompassed within the South Central Rural Area of Critical Economic Concern. Agriculture and food production are major economic drivers in Palm Beach County generating estimated total sales (in 2012-2013) of $1.22 billion with an economic impact of $2.25 billion. The agricultural industry is the legacy industry of the Glades Region of western Palm Beach County. The western section of Palm Beach County encompasses some 421,000 acres of organic soils dedicated to sugar cane primarily and other major crops such as sweet corn, lettuce, radishes, celery, green beans, sod and rice. In the midst of this plentiful bounty it is ironic that the Glades Region is designated a "Food Desert" by the U.S. Department of Agriculture (USDA). USDA defines a food desert as a census tract with a substantial share of residents who live in low-income areas that have low levels of access to a grocery store or healthy, affordable food retail outlet.

In fact, the Glades Initiative, one of the predominant social service providers in the Region, whose mission – …"is to improve the coordination and effectiveness of the health and human service delivery system in the Glades area of Palm Beach County…" has recognized that food security in the Glades Region is a vitally important issue. So much so that it has developed a Strategic Plan for Food Security in the Glades Area. The food program involves numerous community partners working together to help address hunger and food security in the Region. The Glades Initiative's food program helps provide food to an average of 5,000 individuals per month.

Other community leaders have raised awareness of the Region's food challenges by initiating community gardens as described below.

Pahokee Community Garden

Vincent Smith and Brandin Hawthorne, two former Pahokee football standouts came up with a plan to develop a community garden for the City's residents.

The two young men received assistance from the Pahokee Housing Authority (PHA) and the Pahokee Deliverance Christian Center (PDCC) and began their project in August of 2013.

The two friends planted an assortment of sunflower seeds, plantains and sugar cane in the garden which is located in a lot between the PHA and PDCC facilities. The friends received the lot from Mr. William Hickman Jr., pastor at PDCC and their former football coach. Urban GreenWorks provided the plants for the community garden and helped the two friends implement their green project.

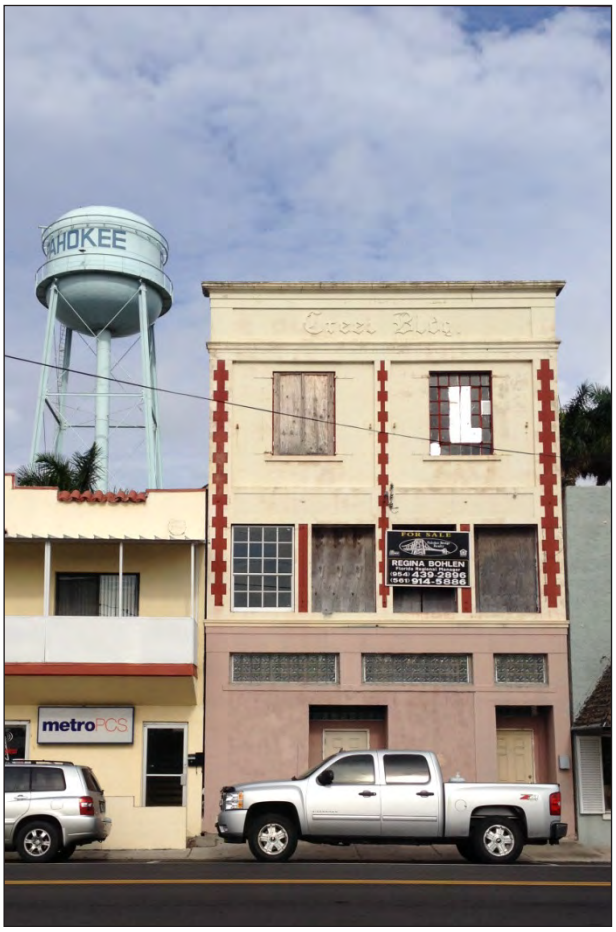
Non-Ag Economies

Tap into European Dollars

Source: Palm Beach County Tourist Development Council

Photography

Architectural Heritage



Regional Greenways and Trails Masterplan

The seven southeastern Florida counties together, from Monroe to Indian River County, are included in a Regional Greenways and Trails Masterplan that is being facilitated by the TCRPC. The plan identifies existing and proposed facilities of all types – unpaved greenways corridors suitable for hiking and equestrians, stabilized off-road trails, paved corridors suitable for all users, and paddling trails. The plan has been developed through a broad multi-agency, multi-disciplinary process, including Metropolitan/Transportation Planning Organizations (MPOs, TPOs), local governments, agencies, stakeholder groups, business and property owners, and residents. The plan differentiates those trails identified by the state Department of Environmental Protection as "Opportunity Corridors" as well as locally-identified opportunities. Further distinctions are noted with regards to facility type and status (noting whether facilities are in a completed form, planned and funded, or planned without funding). The Regional Greenways and Trails Master Plan is scheduled to be completed towards the end of 2014 and is designed for implementation by the MPO/TPOs in the region as well as local governments.

Identified on the map series are existing and proposed facilities within the Glades region including:

- Lake Okeechobee Scenic Trail, PB27 (Existing Facility)
- Central PBC Greenway Corridor, PB9 (Conceptual Facility)
- The Sugar Trail Corridor, PB48 (Conceptual Facility)
- Everglades Rim Trail, PB18 (Conceptual Facility)

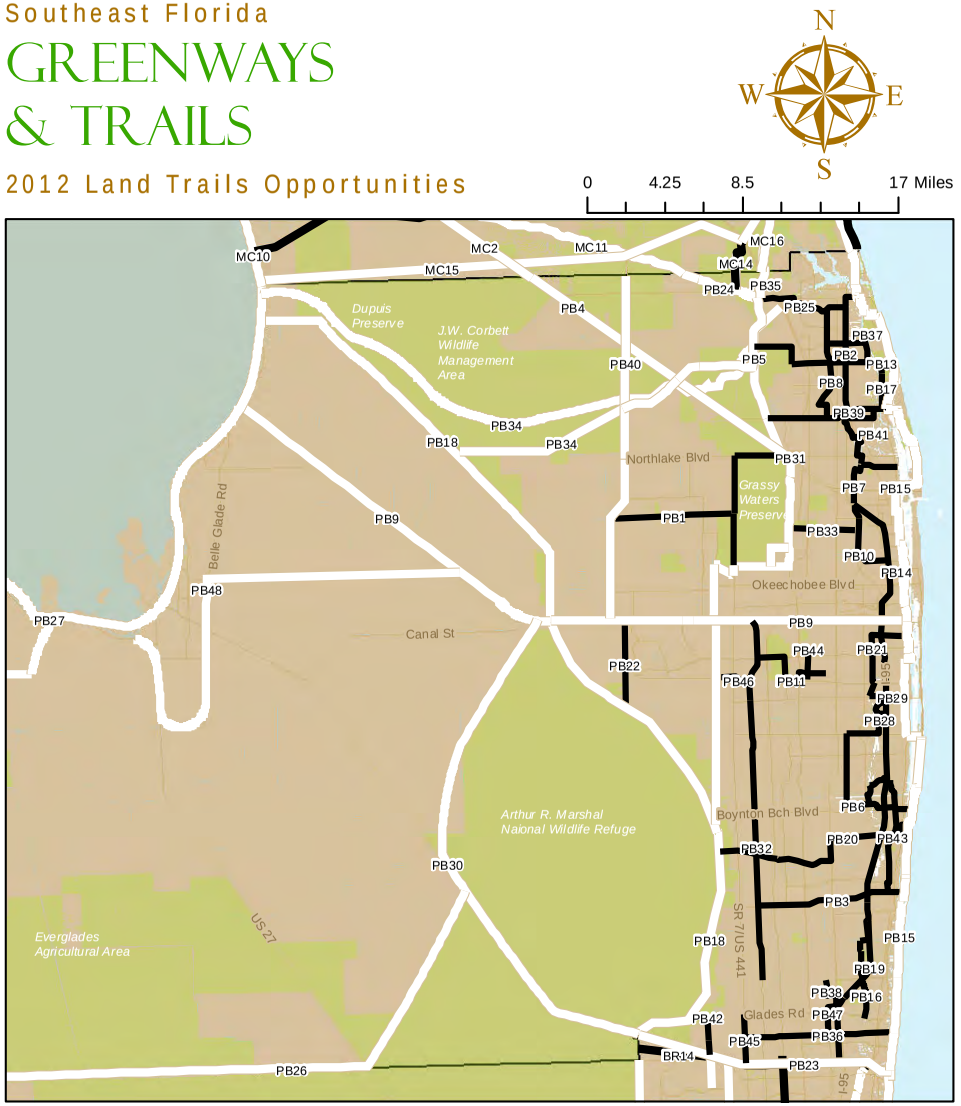
Southeast Florida

GREENWAYS & TRAILS

2012 Land Trails Opportunities

DRAFT

Rev 3/2014



This information was compiled from state and local agencies including Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Trail Association, St. Johns River Water Management District, Southwest Florida Water Management District, South Florida Water Management District, Indian River County, St. Lucie County, Martin County, Palm Beach County, Broward County, Miami-Dade County and Monroe County

FGTS Plan

Facilities identified in the Florida Greenways and Trail System (FGTS) Plan 2012 Land Trails Opportunity Map

Other Plans

Additional facilities identified by local governments and/or other planning agencies

Palm Beach County

Acreage Catchment Connector, PB1

Alternate A1A Corridor, PB2

Atlantic Ave Area Corridor, PB3

Beeline Highway Corridor, PB4

Bluegill Trail, PB5

Boynton Lawrence Corridor, PB6

Boynton TriRail Connect, PB6

C 17 to Lake Park Corridor, PB7

Central Blvd Corridor, PB8

Central PBC Greenway Corridor, PB9

Congress P B Lakes, PB10

Cresthaven to Lyons, PB11

CSX Trail County Line, PB12

Donald Ross to Lox Slough, PB13

Downtown WPB, PB14

East Coast Greenway, PB15

El Rio Trail Delray TriRail, PB16

El Rio Trail, PB16

Ellison Wilson, PB17

Everglades Rim Trail, PB18

FDOT SFRTA RR Corridor, PB19

Flavor Pict Boynton Corridor, PB20

Florida Mango to West Palm, PB21

Flying Cow Corridor, PB22

Hillsboro Canal Corridor, PB23

Historic Jupiter-to-Indiantown Trail, PB24

Jupiter Corridor, PB25

Lake Okeechobee-to-Loxahatchee, PB26

Lake Okeechobee Scenic Trail, PB27

Lake Osbourne Corridor, PB28

LakeWorth Corridor, PB29

Loxahatchee NWR West Corridor, PB30

Loxahatchee Slough / Owhawee Trail, PB31

Lyons Road Corridor, PB32

M_Canal Corridor, PB33

Ocean-to-Lake Trail Corridor, PB34

Ocean to Lake Hiking Trail, PB35

Palmetto Park Corridor, PB36

Palmwood FredSmall, PB37

Patch Reef Trail, PB38

PGA Gardens Corridor, PB39

Pratt & Whitney Trail, PB40

RCA Corridor, PB41

Riverside Drive Corridor, PB42

Seacrest Corridor, PB43

Sherwood Forest, PB44

SR7 Corridor, PB45

Stribling Connector, PB46

T-Rex CSX Patch Reef, PB47

The Sugar Trail Corridor, PB48

Southeast Florida

GREENWAYS & TRAILS

Multi-use and Hiking

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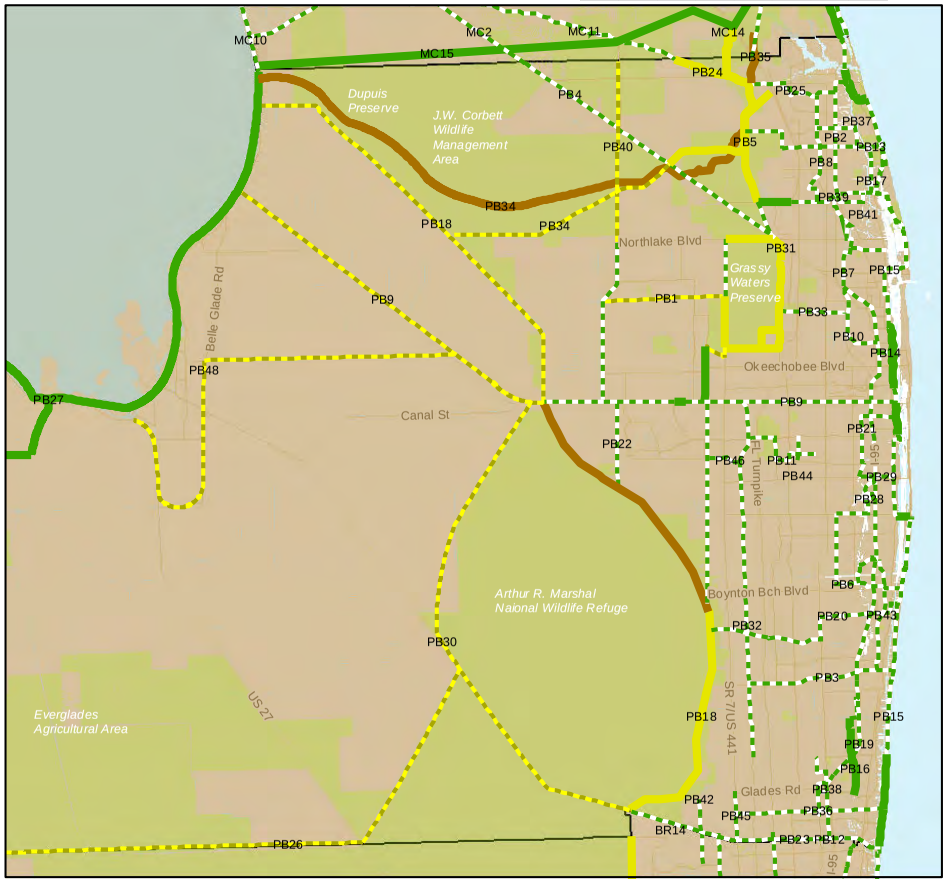

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Existing Facilities

- Multi-use, Paved — *Bicycle and pedestrian access*
- Multi-use, Unpaved — *Bicycle and pedestrian access*
- Hiking, Unpaved — *Pedestrian access only*

Proposed Facilities

- Multi-Use, Paved — *Bicycle and pedestrian access*
- Multi-use, Unpaved — *Bicycle and pedestrian access*
- Hiking, Unpaved — *Pedestrian access only*

Palm Beach County

Acreage Catchment Connector, PB1

Alternate A1A Corridor, PB2

Atlantic Ave Area Corridor, PB3

Beeline Highway Corridor, PB4

Bluegill Trail, PB5

Boynton Lawrence Corridor, PB6

Boynton TriRail Connect, PB6

C 17 to Lake Park Corridor, PB7

Central Blvd Corridor, PB8

Central PBC Greenway Corridor, PB9

Congress P B Lakes, PB10

Cresthaven to Lyons, PB11

CSX Trail County Line, PB12

Donald Ross to Lox Slough, PB13

Downtown WPB, PB14

East Coast Greenway, PB15

El Rio Trail Delray TriRail, PB16

El Rio Trail, PB16

Ellison Wilson, PB17

Everglades Rim Trail, PB18

FDOT SFRTA RR Corridor, PB19

Flavor Pict Boynton Corridor, PB20

Florida Mango to West Palm, PB21

Flying Cow Corridor, PB22

Hillsboro Canal Corridor, PB23

Historic Jupiter-to-Indiantown Trail, PB24

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Lake Okeechobee Scenic Trail, PB27

Lake Osbourne Corridor, PB28

LakeWorth Corridor, PB29

Loxahatchee NWR West Corridor, PB30

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Riverside Drive Corridor, PB42

Seacrest Corridor, PB43

Sherwood Forest, PB44

SR7 Corridor, PB45

Stribling Connector, PB46

T-Rex CSX Patch Reef, PB47

The Sugar Trail Corridor, PB48

DRAFT
Rev 3/2014
Final Form
Existing facility in final stage of development
Need Improvements
Existing facility in various stages of planning, development and/or accessibility
Conceptual
Proposed facility in conceptual planning phase
Palm Beach County
Historic Jupiter-to-Indiantown Trail, PB24
Jupiter Corridor, PB25
Lake Okeechobee-to-Loxahatchee, PB26
Lake Okeechobee Scenic Trail, PB27
Lake Osbourne Corridor, PB28
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Florida Mango to West Palm, PB21
Flying Cow Corridor, PB22
Hillsboro Canal Corridor, PB23
Southeast Florida
GREENWAYS & TRAILS
Development Status
N
W
E
S
0
4.25
8.5
17 Miles
SR 7/US 441
Okeechobee Blvd
Boynton Bch Blvd
Glades Rd
Northlake Blvd
Belle Glade Rd
Canal St
US 27
I-95
Grassy Waters Preserve
Arthur R. Marshal National Wildlife Refuge
J.W. Corbett Wildlife Management Area
Dupuis Preserve
Everglades Agricultural Area
This information was compiled from state and local agencies including Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Trail Association, St. Johns River Water Management District, Southwest Florida Water Management District, South Florida Water Management District, Indian River County, St. Lucie County, Martin County, Palm Beach County, Broward County, Miami-Dade County and Monroe County
TCRPC
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Metropolitan Transportation Organization
planning

7.0 Conclusions and Recommendations

Throughout the public outreach and input process, the TCRPC team formulated a series of observations and potential recommendations to address the many issues brought forward by the community. Over the years, many planning studies and analyses have been conducted in the Glades area producing numerous strategies and recommendations for economic and community improvements. Since the beginning of the Glades Region Master Plan effort, a lingering question has remained, "how will this effort be different?"

From its inception, the basic structure and program of the GRMP has been multi-disciplinary, comprehensive, and inclusive. Palm Beach County, in managing the overall GRMP effort, has put great emphasis and effort into assuring all elements of the plan are focused, discreet to their particular objectives, yet maintain connected to the other areas of the plan. There are four distinct characteristics of the GRMP that separate the effort from previous plans and studies:

A. A Multi-Disciplinary and Comprehensive Plan

The GRMP includes detailed infrastructure and engineering analyses necessary to begin near-term implementation of physical improvements. While the Community Challenge Planning Grant funding cannot pay for physical implementation, the infrastructure master plans are developing the work needed for implementation. The study is comprehensive in its breadth of disciplines (water, sewer, drainage, transit, housing and community planning, and economic strategies). The study is also comprehensive in that it includes the tri-cities, Canal Point, and unincorporated areas of Palm Beach County.

B. An Inclusive Plan

The Glades Region Master Plan has been developed with a continuous connection to the local community, agencies, and business interests. Dozens of public presentations, weeks of public workshops in the community, and an established base of community leaders guiding the process, have made this the most complete public planning effort in the Glades' history.

C. A Tangible Plan

While broad and comprehensive, a hallmark of the GRMP is its specificity. There are real, defined projects that can be quantified and therefore implemented throughout all disciplines of the plan. Specifically to the TCRPC effort, great detail is provided to which buildings, which roadways, which sidewalks, and which areas need improvements. Each community will be able to use this data to implement improvements at their own pace and priority.

D. An Enduring Plan

Palm Beach County, with the Glades communities and business partners have established a unique infrastructure for the sharing and dissemination of information. For the GRMP to reach fruition, the partnerships and networks established need to be maintained and nurtured. If the team that has been built can remain intact, the plan will endure.

Key recommendations for implementing the Glades Region Master Plan are identified below.

1. Local Assistance to Help Implement the Plan

Key local organizations such as the Lake Okeechobee Regional Economic Alliance, the Glades Guardians, Glades Technical Advisory Committee, Glades Career Readiness Roundtable and other local community leaders have played a vital role in engaging the community. These organizations can play a vital role in helping monitor and implement the GRMP.

2. Interface Between DES and OCR

Throughout the GRMP process, TCRPC engaged frequently with the Glades Technical Advisory Committee (GTAC). This group of residents and key community stakeholders is organized through the Office of Community Revitalization (OCR) at Palm Beach County. With the GTAC, OCR also helped establish the Glades Guardians, a small but very involved and well-connected group of citizens who work on specific projects and areas of importance in the community. OCR plays an important outreach and community improvement role in the Glades. TCRPC recommends that OCR and GTAC play a greater role in the GRMP implementation process.

3. Adoption of Plan by Local Governments

The GRMP team has been cautious to not dictate to the local communities what to do, but rather, provide data and analysis of positive and negative conditions and offer some solutions. TCRPC recommends that each of the tri-cities, Belle Glade, South Bay, and Pahokee adopt all or parts of the GRMP plan. By taking formal action, the local governments will send a few key messages: a) the city recognizes and approves of the effort and direction of the GRMP; b) the formal action sends a message to the private sector of the direction the city is going in terms of development expectations; c) the formal action gives staff direction into areas of priority that will require study and resources.

4. Transit Routes and Roadway Improvements

Part of the TCRPC analysis pinpointed and quantified an obvious problem in parts of the Glades communities, the roadway conditions. Many of the local streets, especially in South Bay and Pahokee, are in desperate need of reconditioning. In addition, the TCRPC analyses overlaid existing transit routes on the roadway maps to identify where the routes and poor roadway conditions align. Transit is essential in the Glades areas. The County, Palm Tran, and the Palm Beach Metropolitan Planning Organization (MPO) should seek funding to implement improvements to the local streets that serve as transit routes.

5. Distribution of Resources

In line with the transit route/roadway improvement discussion above, the limited resources available to make improvements in the Glades should go to the areas of greatest need. One of the benefits of TCRPC doing the lot-by-lot analysis of housing, sidewalk, and roadway conditions is that there can be a regional assessment of the greatest needs. As an example, South Bay needs a great deal of roadway work; however, the housing stock has relatively few needs. This approach to the allocation of improvement dollars

will require great cooperation between the cities and will help ensure a collaborative spirit going forward.

6. Local Visioning Processes

Each of the tri-cities could benefit from a local visioning process. The City Managers of South Bay and Pahokee asked for this specific assistance during the workshops. Providing measurable, well-illustrated vision plans for each of the communities will help them to articulate what they want to look like in the future. Where should parking lots go, where should buildings go, what are some of the special entry features desired, does a hotel fit in the area we desire it to go? These are some of the questions that could be illustrated through localized vision efforts.

7. Land Development Regulations Audit

Each of the tri-cities needs an assessment of their Land Development Regulations to identify conflicts and areas that need to be streamlined. The planning and development process can be confusing and overly technical. TCRPC recommends that the local governments consider developing a much-simplified development code that is easy to understand and regulate. However, the County should be cautious about applying additional parts of the County's Land Unified Development Code in the Glades. The County's code can be very complex and may only complicate matters in these smaller communities. In addition, land development regulations that are tailored specifically to a community can be sure to implement a community vision as described above.

8. West Tech

The re-opening of West Tech training center, as part of the efforts of the Glades Educational Roundtable group, has been extremely well-received. Every effort must be made to maintain that progress and expand the access and opportunities to job training at West Tech.

9. Branding – BDB-Tourist Development Council

Providing a more positive image of the Glades communities has been a constant theme throughout the GRMP process. As illustrated earlier in this chapter, the TCRPC team began developing marketing images and topics that should be carried forward in a larger marketing campaign. The Business Development Board of Palm Beach County, Inc. has presented its own efforts, through various media, to better market the Glades to the business community. Working together with the County, the Palm Beach County School District, and local governments and agencies need to emphasize the positive attributes of the Glades communities.

10. Schools and coloring books

During one of the presentations in the Glades, a comment was made that the marketing materials and posters developed by TCRPC would make great coloring books for kids in local elementary schools. This idea, while nice and thoughtful, actually has the potential to provide the children in Glades schools a source of community pride. To have a book made for you, representing the wonderful aspects of your own community, is something that does not often exist. If desired, TCRPC will work with the County and the School

District to move this idea forward.

11. Address Critical Infrastructure Needs

All stakeholders committed to the long-term economic sustainability of the Glades communities should work together to support the implementation of all infrastructure, roadway, transportation, and transit recommendations identified in the Glades Region Master Plan. Work with the Treasure Coast Regional Planning Council and other state and local partners to seek federal funding (EDA, EPA, USDA and others) for key infrastructure projects that will support regional competitiveness, innovation and high-wage job growth in the Glades Region.

APPENDIX C

Glades Region Water Master Plan –
Carollo Engineers, September 20144

GLADES REGION
WATER MASTER PLAN
Project No. WUD 12-068

Final
September 2014

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PBC WUD Document
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In Accordance with:
FS Chapter 281.301
FS Chapter 119.071(3)(b)
FS Chapter 153

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Engineers...Working Wonders With Water®

Palm Beach County Water Utilities Department

GLADES REGION WATER MASTER PLAN

FINAL

September 2014

The undersigned has approved this document for and on behalf of Carollo Engineers, Inc.

Laura Baumberger P.E.
P.E. #65401

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FS Chapter 119.071(3) (b)
FS Chapter 153

PALM BEACH COUNTY

WATER MASTER PLAN

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EXECUTIVE SUMMARY

INTRODUCTION AND SCOPE

Palm Beach County Water Utilities Department (PBCWUD) operates the Glades Region potable water system serving the cities of South Bay, Belle Glade, and Pahokee in western Palm Beach County. In 2012, the County received a Community Challenge Planning Grant from the U.S. Department of Housing and Urban Development (HUD) to develop a comprehensive Glades Region Master Plan. Carollo Engineers, Inc. (Carollo) was retained to assist the County develop a Water Master Plan for the region. The Glades Region Water Master Plan (WMP) will become part of the comprehensive Glades Region Master Plan.

The WMP includes development of raw and finished water demand projections for the Glades Region; development and calibration of a hydraulic water distribution system model; analysis of water treatment plant and finished water storage capacity; and development of a Capital Improvements Plan (CIP) through 2035.

PLANNING FRAMEWORK

The WMP documents planning information that serves as the framework for distribution system modeling and master planning analyses. Factors including population growth, water demand projections, peaking factors, and diurnal curves were evaluated and incorporated into the water model.

Demand projections were calculated based on Palm Beach County Planning Department population projections and a per capita water demand factor. The per capita finished water demand factor was calculated using served population and historical average finished water demand excluding bulk water sales. This factor varied from 129 to 139 gallons per capita per day (gpcd) between 2008 and 2012 with an average value of 136 gpcd. A conservative per capita demand factor of 140 gpcd was selected to calculate projected water demands for future years. The County projects that the per capita demand factor will decrease in the future as a result of metering and pipeline improvement projects that will be completed in the Glades Region. The County will revisit this WMP every five years and will continue to adjust the per capita demand factor accordingly. Peaking factors were calculated and used for developing maximum daily and peak hour demand projections.

It is estimated that 33,663 residents currently are served by PBCWUD in the Glades Region, with an average annual finished water demand of 5.30 mgd. Based on the selected peaking factors, the maximum day and peak hour finished water demands could be expected to reach 7.18 mgd and 12.92 mgd, respectively, in 2013. Since the three cities have different peak hour behaviors, the peak hour demand factor is not expected to be the same among the three cities. Based on historical usage data, the City of Belle Glade demand is about 59 percent (7.61 mgd) of the peak hour flow, the City of South Bay demand is 22.5 percent (2.90 mgd), and the City of Pahokee demands the remaining 18.5 percent (2.41 mgd). For 2035, the Glades Region population is projected to be 53,163 residents, with anticipated annual average finished water demand projection of 8.04 mgd, maximum day demand of 11.02 mgd, and peak hour demand of 20.06 mgd.

A summary of projected Glades Region service area population and finished average annual water demand is shown in Figure ES.1.

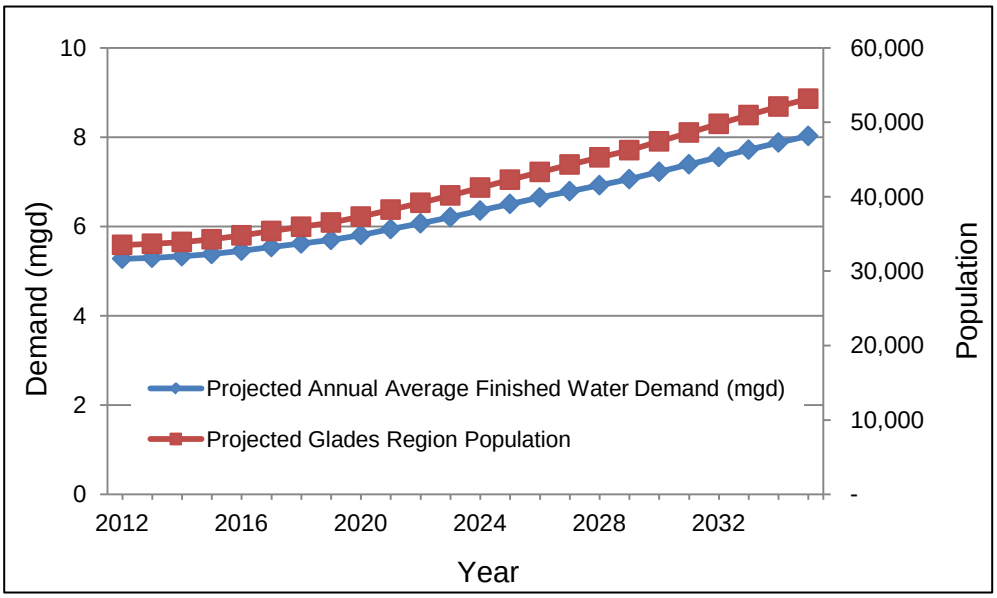


Figure ES.1 Projected Glades Region Service Area Population and Water Demand

Criteria of measurement for evaluating the performance and design of the water distribution system included pressure, velocity, and headloss guidelines, as well as criteria for fire flow availability at fire hydrants and emergency storage. Comparison of the system's capabilities against these criteria provides the mechanism for identifying existing or future deficiencies and needs and serves as a guide for capital improvement projects and budget planning. The performance criteria are based on applicable regulations such as the Florida Administrative Code (FAC) and 10 State Standards, the County's Uniform Policies and Procedures (UPAP) Manual, commonly accepted engineering standards, and input from PBCWUD staff.

EXISTING WATER SYSTEM ASSETS

PBCWUD currently operates one raw water wellfield in the Glades Region, with a total annual raw water allocation of 3,443 million gallons (MG), which would be equivalent to a daily average of 10.7 mgd. This WUP is scheduled to expire in October 2025.

Groundwater is pumped to WTP No. 11, which is a reverse osmosis WTP with a total permitted capacity of 10 mgd. The plant has produced a daily average of 6.41 mgd of finished water since start-up, which, at 80 percent permeate recovery and the current raw water blend proportion, translates into the use of approximately 8 mgd of raw water (well below the consumptive use permit). At the same permitted recovery, if the plant were required to produce its permitted capacity, the current consumptive use permit would limit the plant production.

The comparison of maximum day demand projections, WTP capacity, and permitted raw water quantity in Figure ES.2 shows that both additional raw and finished water will be required before year 2030. A WTP capacity expansion and other projects to meet 2035 demands were analyzed and evaluated for incorporation into the CIP, which is discussed later in the Executive Summary.

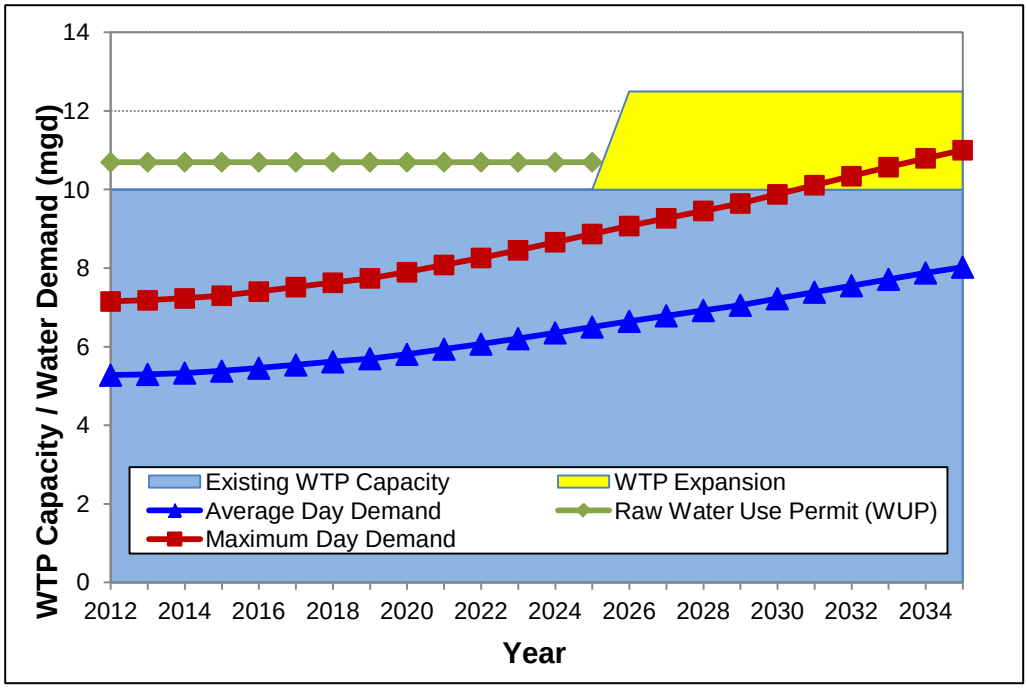


Figure ES.2 Comparison of Maximum Day Demand Projections with WTP Capacity

The water distribution system is comprised of 203 linear miles of pipe, three repump facilities, and several elevated and ground storage tanks that provide a total 5.5 MG of finished water storage. The service area encompasses 44 square miles.

WATER MODEL DEVELOPMENT

A hydraulic model of the water distribution system was created using InfoWater v8.1. The model was developed from available pipeline, pump station, and storage tank data. An extensive pre-calibration quality control process was undertaken to verify pipe material and diameter, system connectivity, tank sizes, high service and repump stations pump curves. Model calibration was performed using one historical day supported by SCADA data to reproduce the behavior of the existing network. The model network provided results that reflected field conditions with some discrepancies. Recommendations to minimize calibration discrepancies for future modeling efforts are addressed in the WMP. Modeling evaluations included multiple scenarios of annual average demand, maximum day demand, peak hour demand, and fire flow conditions. Steady state and extended period simulations provided the appropriate level of knowledge to allow for complete system evaluation.

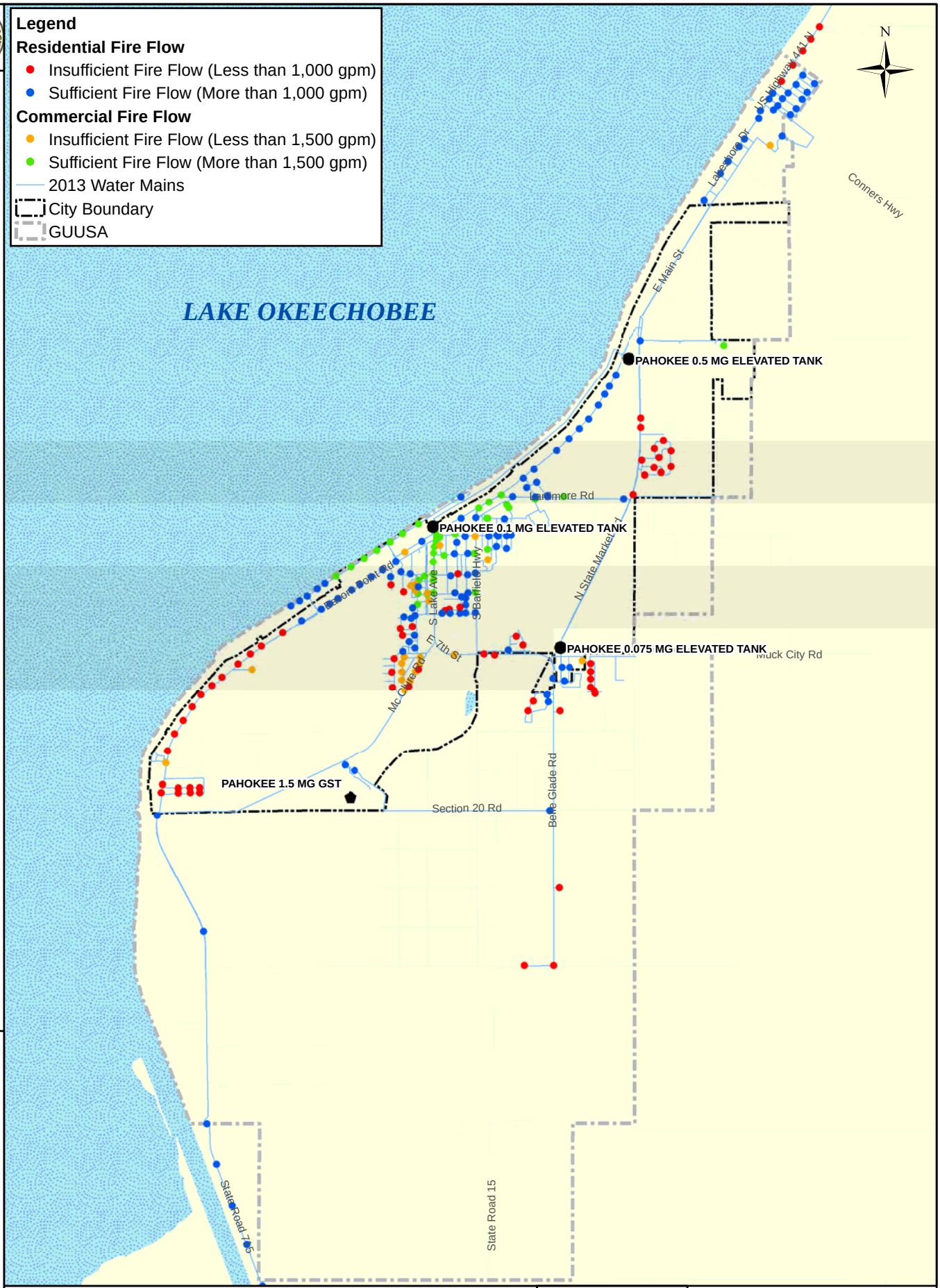
MODELING RESULTS FOR THE EXISTING SYSTEM (2013)

An evaluation of the water distribution system was carried out to determine if the existing infrastructure satisfies the selected performance criteria, to determine the level of redundancy in the distribution network and vulnerability of principal transmission water mains, and to identify necessary corrective actions.

The existing system has sufficient capacity to meet current water demands at peak hour, maximum day, and average day demand conditions while meeting the performance criteria, with two exceptions. Exceptions include:

1. Failure to meet the minimum specified pressure criterion (50 psi) in the City of Pahokee. Distribution system pressure less than the 50 psi are observed in the City of Pahokee during all demand conditions due to the elevation of the 0.5 MG EVT, which sets a low hydraulic grade.
2. Several portions of the service area cannot meet the 1,000 gpm and 1,500 gpm available fire flow performance criteria specified for residential and commercial areas, respectively. Approximately 36 percent of fire hydrants fail to supply adequate fire flow according to model results. These results are shown in Figure ES.3. Field investigations by PBCWUD should be completed to determine the actual fire flow availability.

Palm Beach County Water Utilities Department
Glades Region Water Master Plan



2013 Fire Flow Sufficiency during Maximum Day Demand Condition

Figure ES.3
Page A

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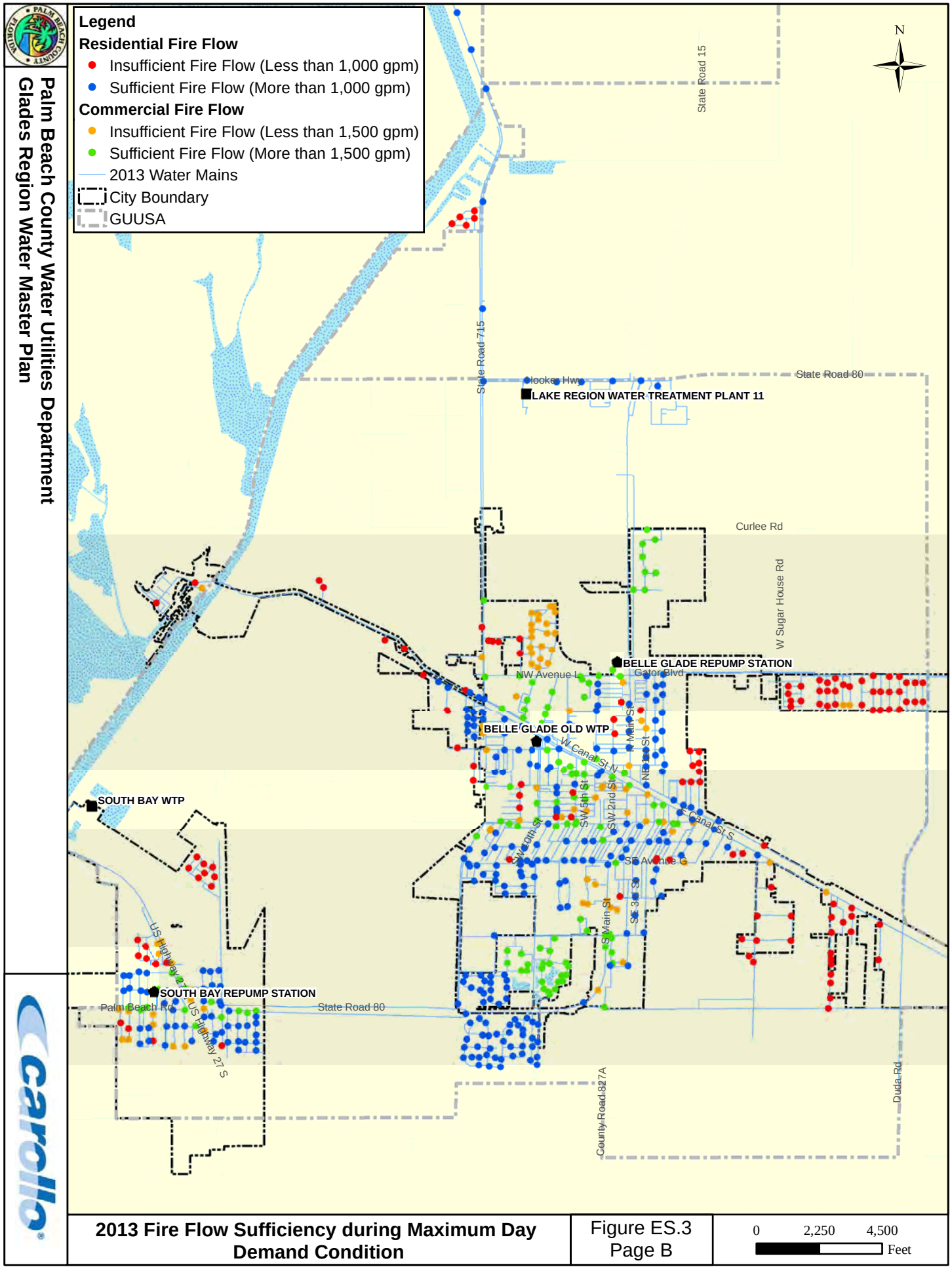
Palm Beach County Water Utilities Department
Glades Region Water Master Plan



2013 Fire Flow Sufficiency during Maximum Day Demand Condition

Figure ES.3
Page B

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A redundancy analysis of the existing distribution system modeled under peak hour demand conditions indicates that the system has a low degree of redundancy because it heavily relies upon the 30-inch line that connects WTP No. 11 with the distribution system. This case is common in many distribution systems. The 16-inch pipeline serving the City of Pahokee located along State Road 715 is also critical. Rupture of this pipe causes the system to be unable to meet demand in the City of Pahokee after exhausting water available in storage tanks.

Evaluations of water age under average demand conditions conclude that retention time is higher than desired in the City of South Bay and in the northern portion of the City of Pahokee, potentially generating water quality issues. High water age in the City of South Bay occurs due to the large volume of water storage at the South Bay Repump Station and low tank turnover. High water age in the City of Pahokee occurs because of a relatively low water demand and the remoteness of the Canal Point area. Detailed explanations of the causes and a set of strategies to decrease water age are outlined in the WMP.

MODELING RESULTS FOR FUTURE SCENARIOS

Future planning scenarios were modeled with the goal of progressively improving network performance throughout the planning period. The first future planning year, 2015, was modeled with a small number of on-going pipeline capital improvement projects. The 2025 and 2035 scenarios reflect a series infrastructure improvement projects that were analyzed and selected to allow the system to meet the County's selected performance criteria.

Model simulations that include pipeline projects outlined in the CIP show that 2025 and 2035 system conditions will shown substantial improvement in distribution system performance, including higher and more balanced distribution system pressure, improved fire flow availability, and a moderate decrease in water age. The completed future scenarios developed under this WMP show a system that would be compliant with nearly all the performance criteria during all demand conditions at the built-out phase. Although overall system vulnerability (redundancy) improves after simulated completion of the proposed projects, transmission between the three cities will remain vulnerable due to the geographical separation without redundant connections, which is typical of regional systems.

WTP AND STORAGE CAPACITY

The WTP and finished water storage capacity of the system were evaluated to determine if demands of the projected population are met through 2035. The WTP capacity was compared with the projected maximum day demands through 2035. Based on maximum day demand projections, the existing WTP capacity will not be exceeded until early 2030. However, the reserve capacity by 2030 is projected to be as low as 1 percent. It is recommended to maintain approximately 10 percent reserve capacity in the system. Therefore, design of an expansion at WTP No. 11 is recommended to begin by 2026. An additional 2.5 mgd of treatment capacity through construction of a fifth RO membrane train and associated blending bypass at the existing WTP is recommended. Additional raw water allocation will be necessary to accommodate the WTP expansion.

Finished water storage capacity is used for operational equalization, fire reserve, and emergency needs. The existing storage capacity of 5.5 MG is sufficient to meet the storage requirements through 2035 for both the minimum PBCWUD fire reserve requirement and the more conservative AIA fire storage reserve recommendations.

CAPITAL IMPROVEMENTS PLAN (CIP)

The CIP outlined in this WMP describes recommended improvements based on the estimated age and condition of pipelines, results of the hydraulic model evaluation for current and future scenarios, and pipe and WTP improvements already proposed by PBCWUD. The CIP will assist PBCWUD in planning and budgeting for water system improvements through 2035. Capital improvement projects were classified into three groups: WTP No. 11 projects, Storage and Pump Station Improvement Projects, and Distribution System Projects. Table E.1 summarizes the projects under the three categories, along with their costs and estimated year for design and construction.

WTP Projects: A number of improvements at WTP No. 11 have been identified by PBCWUD and are included in the short-term CIP. The majority of these projects are slated for completion in FY 2014 or FY 2015. These projects include new wells PW-9 and PW-10, degassifier cleaning station, replacement of the variable frequency drives (VFDs) for two of the membrane feed pumps, and a new 5 MG storage tank. Project expenditures during FY 2014 are estimated to total approximately $6.7 M. Four additional projects totaling $2.28 M are programmed for FY 2016 and FY 2017: a new clearwell, odor scrubber improvements, replacement of the degassifer packing, and addition of a roof structure over the transfer and high service pumps

and generator. A future WTP expansion to 12.5 mgd with an estimated cost of $2.5 M is included towards the end of the planning period.

Storage and Pump Station Improvement Projects: Storage and pump station improvement projects at remote facilities are included to improve hydraulic conditions, enhance system performance, and supply the forecasted water demand by 2035 based on model results. With the exception of the installation of a booster pump at the 0.5 MG Pahokee tank in the near-term to increase minimum pressures and improve fire flow availability, project needs identified as part of the WMP hydraulic modeling for storage and pumping are long-term. Such projects include replacing pumps at the South Bay Repump Station and the construction of a 1.5 MG ground storage tank and booster pump station in the City of Pahokee. PBCWUD intends to install a rechlorination station along with at the booster pump station at the Pahokee 0.5 MG tank. PBCWUD also identified three additional projects they will complete in the near-term: a booster station at State Market Road, security improvements at the South Bay Repump Station, and tank and electrical improvements at the South Bay WTP.

The near-term booster and rechlorination station at the Pahokee 0.5 MG tank is estimated to cost $830,000 and is slated for FY 2015. The long-term storage and pump station improvements in the cities of Pahokee and South Bay total $2.12 M, which were allocated in FY 2028-2032.

Distribution System Projects: Proposed improvements to the water distribution system aim to improve hydraulic conditions while supplying forecasted water demands. Projects in this group include projects proposed by PBCWUD and pipe replacements and new pipes based on modeling results. Pipeline improvements are programmed into the CIP based on their relative priority and improvement seen in the system. Figure ES.4 illustrates the location of the proposed pipeline projects throughout the Glades Region.

Table ES.1 summarizes the recommended Glades Region water system CIP, which includes all projects that will help to improve and maintain reliable water service to customers through 2035. Improvements at and expansion of WTP No. 11 accounts for 24 percent of this total estimated cost (about $12.8 M), storage and pump station improvement projects account for about 6 percent (about $3.2 M), and distribution system projects account for 70 percent ($37.3 M).

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Proposed Infrastructure Improvements

Figure ES.4
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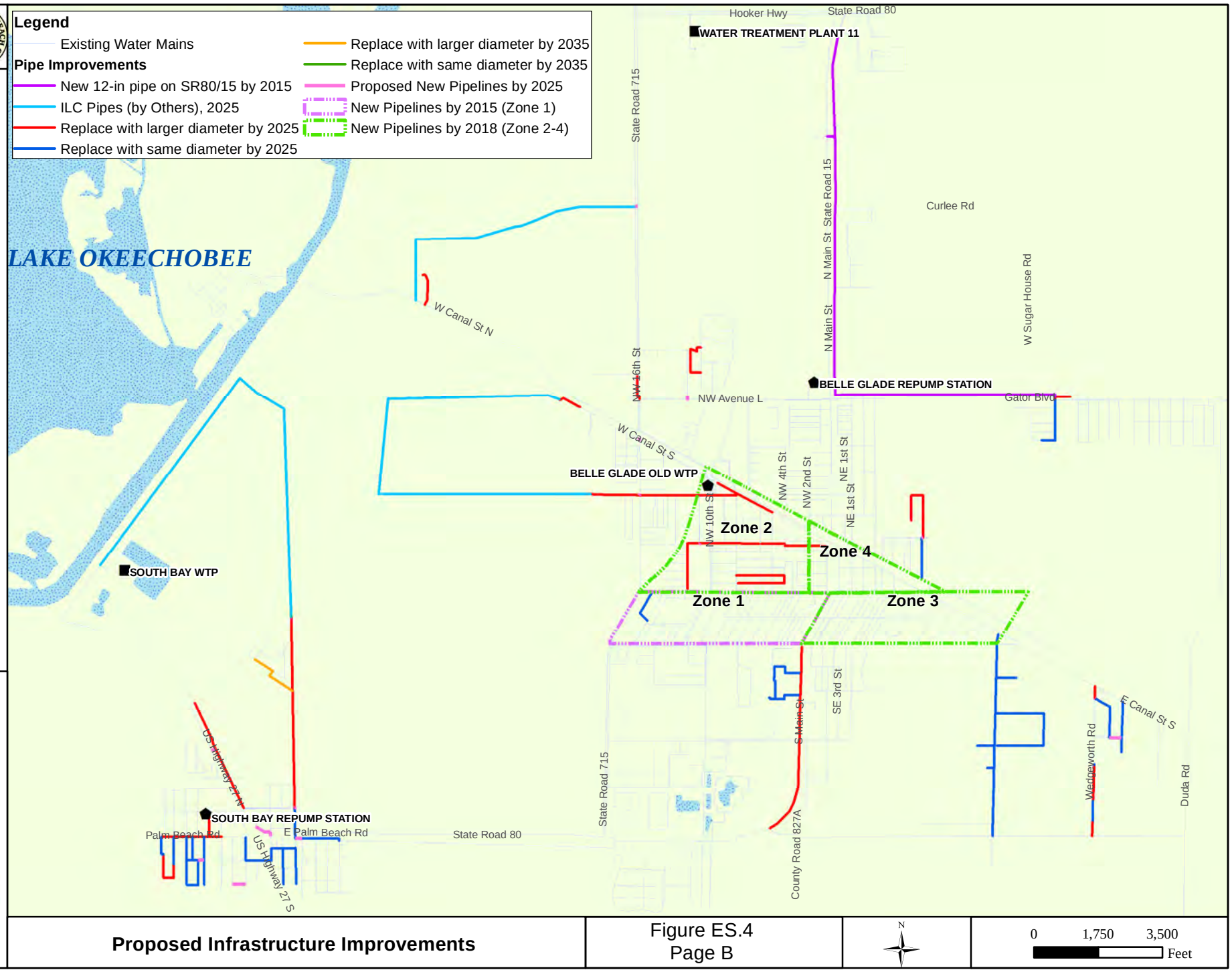


Palm Beach County Water Utilities Department

Glades Region Water Master Plan

carollo

Proposed Infrastructure Improvements

Figure ES.4
Page B

Table ES.1 Glades Region Water Master Plan Water Capital Improvements Plan

Capital Improvement	CIP Schedule in 5-Year Increments				Total Estimated Cost
	FY 2013 to FY 2017	FY 2018 to FY 2022	FY 2023 to FY 2027	FY 2028 to FY 2032	
WATER TREATMENT PLANT No. 11 PROJECTS					
WTP No. 11					
Wells PW-9 & PW-10/Raw Water Main[1,2]	$3,043,000				$3,043,000
RO Skid Energy Recovery System[1,2]	$943,000				$943,000
Degassifier Cleaning Station[2]	$590,000				$590,000
Clearwell[2]	$1,200,000				$1,200,000
Replace VFDs for Membrane Feed Pumps 1 and 4[2]	$400,000				$400,000
5 MG Ground Storage Tank[1]	$3,025,000				$3,025,000
Odor Scrubber Improvements[2]	$700,000				$700,000
Roof over Transfer/High Service Pumps and Generator[2]	$300,000				$300,000
Replace Degassifier Packing[2]	$80,000				$80,000
WTP No. 11 Expansion - Fifth RO Skid			$2,520,000		$2,520,000
Total WTP No. 11	**$10,281,000**	**$0**	**$2,520,000**	**$0**	**$12,800,000**

Capital Improvement	CIP Schedule in 5-Year Increments				Total Estimated Cost
	FY 2013 to FY 2017	FY 2018 to FY 2022	FY 2023 to FY 2027	FY 2028 to FY 2032	
STORAGE AND PUMP STATION IMPROVEMENT PROJECTS					
Storage and Pumping Improvements					
Booster Pump Station & Rechlorination Station at Pahokee 0.5 MG EVT	$830,000				$830,000
Booster Station at State Market Road[2]	$75,000				
Security Improvements at South Bay Repump Station[2]	$50,000				
Tank and Electrical Improvements at South Bay WTP[2]	$150,000				
1.5 MG Ground Storage Tank and Booster Pump Station in Pahokee				$1,880,000	$1,880,000
Increase Pump Capacity at South Bay Repump Station				$240,000	$240,000
Total Storage & Pump Station	**$1,105,000**	**$0**	**$0**	**$2,120,000**	**$3,225,000**
DISTRIBUTION SYSTEM PROJECTS					
Distribution System Projects Proposed by PBCWUD					
SR 15 and Gator Blvd 12-inch and 16-inch Water Main Extension[1]	$3,056,000				$3,056,000
12-inch Water Main along South Main Street, SE Ave K to SE Ave G[2]	$200,000				$200,000
12-inch Water Main along SW Avenue J from Canal Street to Main Street[2]	$280,000				$280,000

Capital Improvement	CIP Schedule in 5-Year Increments				Total Estimated Cost
	FY 2013 to FY 2017	FY 2018 to FY 2022	FY 2023 to FY 2027	FY 2028 to FY 2032	
Pahokee Services Relocation[2]	$60,000				$60,000
12-inch Water Main along E. Main Street from SR 15 to S. State Market Road[2]	$2,500,000				$2,500,000
Pipeline Improvements in SW Section of Belle Glade - Zone 1[1]	$3,321,000				$3,321,000
Pipeline Improvements in SW Section of Belle Glade - Zone 2	$3,000,000				$3,000,000
Pipeline Improvements in SW Section of Belle Glade - Zone 3	$2,000,000				$2,000,000
Pipeline Improvements in SW Section of Belle Glade - Zone 4	$2,000,000				$2,000,000
Distribution System Projects Based on Modeling Results					
Pipeline Replacement	$17,783,000	$988,000		1,310,000	$20,081,000
New Pipelines	$721,000	$84,000			$805,000
Total Distribution	**$34,921,000**	**$1,072,000**	**$0**	**$1,310,000**	**$37,303,147**
TOTAL CAPITAL IMPROVEMENTS PLAN	**$46,307,000**	**$1,072,000**	**$2,520,000**	**$3,430,000**	**$53,329,000**

Notes:

1) Projects in progress (design or construction) or are complete.
2) Projects identified by PBCWUD but not evaluated as part of this WMP.

Chapter 1
INTRODUCTION

1.1 BACKGROUND

Palm Beach County Water Utilities Department (PBCWUD) operates a potable water system serving the cities of South Bay, Belle Glade, and Pahokee and unincorporated areas in western Palm Beach County. In 2012, the County received a Community Challenge Planning Grant from the U.S. Department of Housing and Urban Development (HUD) to develop a comprehensive Glades Region Master Plan. PBCWUD requested that Carollo develop a Water Master Plan for the Glades Region. The Glades Region Water Master Plan (WMP) will become part of the comprehensive Glades Region Master Plan.

The WMP includes development of updated water demand projections for the Glades Region, results of hydraulic distribution system modeling, and development of a Capital Improvements Plan (CIP) through 2035. The primary goal of the WMP is to document and evaluate the existing water system and provide recommendations for future infrastructure improvements to meet the County's level of service goals while maintaining a sustainable water supply throughout the Glades service area.

The WMP project included development of a hydraulic distribution system model, model calibration, and modeling scenario analyses through 2035. The WMP also includes an assessment of the water treatment plant (WTP) capacity and recommendations for future expansion, evaluation of storage volume and location, and analysis of repump stations throughout the region.

The WMP is based on existing system conditions and modeling results obtained in 2013 completed as a part of this project. The model and WMP should be updated on a regular basis to address changes in system conditions, water demand patterns, and future regulations.

1.2 PROJECT SCOPE AND OBJECTIVES

Carollo was retained to assist the County in updating their water distribution system model and to develop a WMP to serve the County's Glades Region water needs through 2035. Major scope elements included data collection, development of water demand projections and peaking factors, updating the water model, calibration exercises, evaluation of the distribution system under current and anticipated future

water demands, analysis of WTP and finished water storage capacity, and development of a CIP for the water system through 2035. The complete scope of work is included in Appendix A.

A primary goal of the WMP project was to develop a thorough and accurate water model that can be used to make capital planning and operational decisions in the water distribution system. Results of the modeling analyses were used to develop CIPs for both near- and long-term projects. CIPs resulting from the WMP evaluations will provide PBCWUD staff with project descriptions, justification, and necessary timing to meet the County's water demand and level of service through 2035.

Specific objectives of the Water Master Plan are to:

1. Develop a water distribution system model that includes the WTP tank and all pumps; remote storage and pumping facilities in the cities of Belle Glade, South Bay, and Pahokee; new allocation of water demands based on December 2012 population projections developed by Palm Beach County; and peaking factors and diurnal curves based on SCADA data.
2. Perform a rigorous calibration exercise and quality review check of the model.
3. Document performance criteria used to evaluate the adequacy of the water distribution system infrastructure.
4. Evaluate the existing water network to identify areas that are not meeting the selected performance criteria and to assess potential improvements to resolve problems.
5. Compile an inventory of existing facilities including the wellfield, WTP, storage tanks, pump stations, and transmission system.
6. Conduct interviews with PBCWUD staff to identify and document specific problems in the distribution system, water supply weaknesses, and suggested future capital improvements projects.
7. Develop a CIP including cost estimates for recommended WTP, pump station, storage, and distribution system projects, along with suggested timing.
8. Compile the project data and analyses into a comprehensive Water Master Plan Report.

1.3 ACKNOWLEDGEMENTS

Carollo Engineers would like to thank PBCWUD staff involved in this project including Maurice Tobon, Jennifer Prettel, Ali Bayat, Juan Guevarez, Steve McGrew, James Stiles, Hector Rodriguez, Michael Turbeville, and others at PBCWUD that provided assistance in gathering information and participated in developing and calibrating the water model. PBCWUD staff members were instrumental in completing this project.

1.4 FACTORS AFFECTING WATER SUPPLY PLANNING

Water utilities in Florida are challenged with supplying potable water while sustaining natural resources in an area where traditional raw water sources, such as fresh groundwater aquifers, are stressed. While the Glades Region currently has adequate water supply and treatment capacities to meet anticipated water demand projections through approximately 2030, the County is projected to need to begin planning of additional water supply and treatment capacity sometime in the 2025 to 2027 timeframe. Water supply development can be defined as the “planning, design, construction, operation, and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use,” (Senate Bill 444, 2005). While the County will likely expand its current water supply source, the following sections describe several general factors to be considered for future water supply development.

1.4.1 Water Supply Legislation and Policy

Recent legislation has acknowledged that the need for potable water supply will continue to increase in the future and that there is a need to conserve water and develop alternative water supplies to sustain Florida’s growth and natural resources. Florida Statute (F.S.) 373 and Senate Bill 444 were enacted to impact policies to provide environmentally responsible means for developing future water supplies in Florida while managing and restoring natural watersheds in the state. These policies also provide direction for regional coordination and cooperation between water suppliers and stress the benefits of planning regionally when developing water supplies, such as increased reliability and cost-effectiveness. Some of the specific goals of Senate Bill 444 are to:

1. Promote the development of alternative water supplies and cooperation between water-related entities to prevent the undesirable effects of competition for limited supplies of water.

2. Establish funding criteria for monetary assistance for alternative water supply development.
3. Require local governments and other entities to select and incorporate alternative water supply projects into their future water supply plans.

The Florida Legislature passed Senate Bill 1740 in 2009 to ensure the Water Protection and Sustainability Trust Fund established as part of Senate Bill 444 is continued, and to re-create the program within the Florida Department of Environmental Protection (FDEP). However, no funds have been appropriated to the Water Protection and Sustainability Trust Fund since FY 2010 as a result of a declining revenue stream that supports this fund.

Senate Bill 550, effective July 1, 2010, reorganized various provisions of Chapter 373 addressing water supply policy, planning, production, and funding into a new Part VII. The intention of this bill was to reorganize the existing provisions without substantive modification to the existing law. The one notable change as a result of Senate Bill 550 includes the addition of conservation projects to the list of eligible projects for state and water management district funding.

Chapter 373.019, F.S. and Senate Bill 444 define alternative water supplies as “salt water; brackish surface and groundwater; surface water captured predominantly during wet-weather flows; sources made available through the addition of new storage capacity for surface or groundwater; water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; stormwater; and any other water supply source that is designated as nontraditional for a water supply planning region in the applicable regional water supply plan.” Senate Bill 550 expands the definition of alternative water supplies to include conservation.

PBCWUD currently utilizes an alternative water supply in the Glades Region, brackish groundwater.

1.4.2 Regional Water Supply Coordination

A goal of local water management districts is to restore the natural environmental systems, including timing and flows of waterways, in order to maintain the appropriate flow levels to support indigenous wildlife within the waterways and downstream water bodies. Surface water supply projects are being proposed to assist in preserving these hydrologic and biologic systems. In some instances, projects to restore natural systems provide an opportunity for potable water supply development.

The South Florida Water Management District (SFWMD) updates its *Regional Water Supply Plan* every five years. This plan emphasizes the use of alternative water sources and water conservation measures. The water management districts are provided with funds from the state to support the development of alternative water supplies by local governments, water supply authorities, and other water users. SFWMD employs various strategies to protect water resources, including minimum flows and levels, restricted allocation areas, prevention and recovery strategies, and reservations.

SFWMD water supply planning efforts are summarized in the "2013 Lower East Coast Water Supply Plan Update" (SFWMD, 2013). The 2013 Lower East Coast Water Supply Plan Update (LEC Update) was approved by the SFWMD Governing Board on September 12, 2013. The Lower East Coast planning area includes all of Miami-Dade, Broward, and Palm Beach counties; most of Monroe County; and eastern portions of Hendry and Collier counties.

Population in the Lower East Coast planning area is expected to demand an additional 166 million gallons per day (mgd) by 2030. To meet future demands, the 2013 LEC Update maintains the goal of previous plans of developing alternative water sources. There are 22 potable water supply projects and 23 reclaimed water projects that will decrease potable water demand described in the 2013 LEC Update. Regional project strategies are also provided for use by local governments. The 2013 LEC Update describes that demands for the Glades Region of Palm Beach County are met with reverse osmosis treatment of brackish groundwater.

1.4.3 Consumptive Use Permitting Regulations

Florida's water management districts, including SFWMD, are governed by water resources rules and regulations set forth by FDEP. PBCWUD has a consumptive use permit (CUP) from SFWMD that allows for raw water withdrawal from a wellfield located north of Belle Glade near the water treatment plant. In 2012, the FDEP Office of Water Policy began exploring changes in water resources rules, including those involving water use permitting, to address inconsistencies and streamline the permitting process throughout the State. FDEP found that while all water management districts have consumptive use permitting rules developed under the same Florida Statutes, implementation of the rules have varied between districts. FDEP's goals in changing permitting rules are to: 1) make permitting programs less confusing for applicants, 2) treat applicants equitably statewide, 3) provide consistent protection of the environment, 4) streamline the permitting process, and 5) incentivize behavior that protects water resources including conservation.

A Consumptive Use Permitting Consistency (CUPcon) effort was initiated by FDEP Office of Water Policy in 2011 to address different aspects of the permitting process. A number of policy documents related to CUPcon were developed by FDEP and provided to water management districts in 2011 outlining descriptions and rationale for a number of issues such as consumptive use permitting, conjunctive use, and conservation. These policy documents are available on the FDEP website.

FDEP held several rule development workshops throughout the State in 2012. The purpose of the workshops was to discuss CUPcon, proposed changes to Florida Administrative Code (FAC) Rule 62-40 (Water Resource Implementation Rule) and related consumptive use permitting rules, and potential implications on permittees. On December 28, 2012, FDEP published the notice of proposed rule for amendments to Chapter 62-40, FAC. On February 8, 2013 and March 19, 2013, FDEP published notices of change to a number of the proposed Chapter 62-40 Rules. The March 19, 2013 notice of change reflects the settlement of two rule challenges that were filed in February 2013. As part of this settlement, language related to reclaimed water supplementation of reuse systems was removed from the current rulemaking effort.

The water management districts held public workshops throughout August 2013 to receive comments on the revised rules. Written comments were accepted by FDEP through September 6, 2013.

In late 2013, all water management districts except for the St. Johns River WMD published notices of proposed rules to amend their consumptive use permitting rules. The St. Johns River WMD released their draft rules in January 2014. The districts plan to complete their rulemaking in 2014.

1.4.4 Population Shifts and Demand Forecasting

Water supply planning and projection of water demands are highly dependent on a number of factors typically outside of a utility's control such as weather patterns, the economy, and population shifts.

Because water planning is so closely tied to the economy and resulting population, the County consults the detailed planning efforts completed by the University of Florida Bureau of Economic and Business Research (BEBR). The Palm Beach County Department of Planning, Zoning, and Building regularly updates population projections for the County based on BEBR. Population and water demand

projections presented in Chapter 2 of this WMP are based on population projections provided by the Department of Planning, Zoning, and Building in December 2012.

1.4.5 Climate Change

The purpose of this section is to summarize climate change related impacts that are of importance to PBCWUD water planning efforts and to document actions already being taken. The content serves to identify the highest risk impacts relevant to PBCWUD (and the Glades Region service area) that need to be addressed in the near future to continue developing a reliable water supply.

1.4.5.1 Background

In 2009, the county commissions of southeast (SE) Florida (i.e., Miami-Dade, Broward, Palm Beach, and Monroe Counties) came together and recognized their vulnerability to climate change. These four counties represent approximately 5.6 million residents (which exceeds the population of 30 states) and 30 percent of Florida's population that account for one-third the total gross domestic product for the entire state of Florida. In January of 2010, the four counties joined efforts and formally approved the SE Florida Climate Change Compact (Compact) addressing climate issues beyond the borders of individual jurisdictions and providing a focus for setting local priorities regarding mitigating (reducing) greenhouse gas (GHG) emissions and adapting to the impacts of climate change, specifically sea level rise. In addition to the Compact, other state and federal legislation and initiatives are driving the need for more adaptive planning strategies, including:

- Executive Orders 07-126, 07-127, and 07-128 altogether supporting the quantification and reduction of GHG emissions of state government facilities and vehicle fleets and use of purchasing power of state government to promote energy efficiency and reduced emissions.
- Florida's Energy and Climate Change Action Plan
- U.S. Conference of Mayor's Climate Protection Agreement
- U.S. Environmental Protection Agency's (USEPA) Mandatory Greenhouse Gas Emissions Reporting Rule
- U.S. EPA's 2012 National Water Program Strategy: Response to Climate Change

1.4.5.2 Projected Impacts

While the Intergovernmental Panel on Climate Change (IPCC) is the leading international organization providing the average global perspective of projected

impacts due to climate change, there are regional (or "downscaled") efforts to model and project impacts at a more realistic scale for use in planning in SE Florida. Although there is large uncertainty about future emissions of GHGs and how and when the earth's climate will respond to higher concentrations of GHGs, various studies report that detectable changes are already under way.[1] The most likely outcomes are increases in atmospheric temperature and changes in precipitation, soil moisture, and sea level, which could have adverse effects on many ecological systems, as well as on human health, infrastructure, and the economy.

1.4.5.3 Actions Taken

In SE Florida, key scientists[2] developing the existing projections and other local scientists specializing in the impacts of climate change were invited to be participants in the Regional Climate Change Compact Technical Ad hoc Work Group (Work Group). Their objective was to work toward developing a unified sea level rise projection for the SE Florida region for use by the Compact counties and partners for planning purposes to aid in understanding potential vulnerabilities and to provide a basis for outlining adaptation strategies for the SE Florida region (SE FL Compact Ad hoc Group 2011).

The SE Florida Regional Climate Change Action Plan (Climate Action Plan) was drafted with a five-year planning horizon. The overall objective is to integrate adaptation to and mitigation of climate change into existing systems and to develop a plan that can be implemented through existing local and regional organizations. The focus is on finding regionally relevant methodologies for mapping sea-level rise impacts, assessing vulnerability of various sectors (including water supply,

[1] There are two main sources of uncertainty about future climate: First, no one knows what humans will do in the future. Will humans continue with "business as usual" and consume even greater amounts of fossil fuels for energy, or will we reduce our energy demand, increase efficiency, and turn to more sustainable and less carbon-intensive fuels? The answer is crucial to the future of atmospheric GHG concentrations, and therefore to the degree of future global warming. Second, we do not precisely know the "climate sensitivity," which is the atmospheric temperature response to a given change in the radiative forcing associated with a change in GHG concentrations. This is because the physics and chemistry of the atmosphere and ocean are not understood well enough to develop reliable models. Estimates range from 1.5° to 4° C warming with a "best-guess" of about 3° C for a doubling of CO_2 concentration in the atmosphere to about 540 ppmv. This is the crux of the "climate debate" over global warming: "What is the climate sensitivity?"

[2] Scientists including those associated with Florida Atlantic University, University of South Florida, USGS, U.S. ACE, Florida SeaGrant, the Compact Work Group, and others associated with The Integrative Collaborative on Climate and Energy at The Florida Center for Environmental Studies.

management, and infrastructure), and understanding the sources of regional GHG emissions for four counties. The Climate Action Plan calls for reduction in GHG emissions and adapting to regional and local impacts of a changing climate (specifically, sea level rise). The recommendations provided aim to protect the assets of the region's unique quality of life and economy, guide future investments, and foster livable, sustainable, and resilient communities.

1.4.5.4 Conclusion and Recommendations

While PBCWUD can support existing efforts driven by the SE Florida Compact by planning to monitor levels of GHGs emitted from its water facilities, it must also address impacts to future demand forecasting (i.e., projected changes in temperature and precipitation patterns), the need for water supply diversification under changing conditions, and potential for alternative funding sources for implementing adaptive measures. Next steps could include:

- Identify the sources and monitoring GHG emissions from the operation of treatment and pumping facilities and use the annual estimates as performance criteria for alternative evaluation.
- Perform a literature review of projected regional impacts to temperature and precipitation patterns, as they relate to demand forecasting (i.e., peaking factors and diurnal curves).
- Investigate alternative sources of funding for projects implementing new or retrofit equipment/infrastructure as part of an adaptive planning strategy.
- Continue working towards the PBCWUD goal of decreasing energy consumption by 10 percent per customer and finding alternative energy sources for 5 percent of its energy usage by 2020.

1.4.6 Distribution System Water Quality Considerations

Water quality is an important consideration for water treatment and supply. The County stated that they flush approximately 4 million gallons of water per month at Canal Point (in the northern portion of the Glades Region) at a cost of approximately $100,000 per year due to poor water quality. In the future, the County may evaluate a number of options to improve water quality and control nitrification, such as minimizing free ammonia, adding rechlorination facilities, decreasing potential thermal stratification in storage tanks using mixers, and/or converting to a free chlorine secondary residual.

In this WMP, water transmission options were evaluated for water age, which can serve as a surrogate for water quality. High water age locations generally correlate with poor water quality. Model evaluations were completed to identify improvements that can decrease water age; however, water quality considerations beyond this analysis was outside the scope of the WMP.

1.5 SUMMARY OF DRINKING WATER REGULATIONS

Water treatment and supply facilities must meet all state and federal water quality guidelines. The following section presents brief descriptions of the major current and future federal drinking water regulations that are relevant to PBCWUD. While water quality and compliance with drinking water regulations was not specifically addressed in this WMP, this section serves to provide information on potential changes to drinking water regulations that may impact the treatment facility and distribution system regulatory compliance and reporting requirements in the future.

Current and future treatment regulations relevant to PBCWUD are summarized in this section, including:

- Safe Drinking Water Act (SDWA) and National Primary and Secondary Drinking Water Standards
- Microbial and Disinfection Byproducts Rules
- Revised Total Coliform Rule (RTCR)
- Lead and Copper Rule
- Third Candidate Contaminant List (CCL3) and the Unregulated Contaminant Monitoring Rule 3 (UCMR3)
- Consumer Confidence Report updates
- Potential future regulations

1.5.1 SDWA and National Drinking Water Regulations

The SDWA of 1974 established primary drinking water regulations designed to ensure the distribution of safe drinking water. These regulations were the first to be implemented at all public water systems in the United States, covering both chemical and microbial contaminants. In 1986, Congress passed widespread amendments to the SDWA that have resulted in a three-fold increase in the number of contaminants regulated and establishment of National Primary Drinking Water Regulations (NPDWRs).

1.5.1.1 Primary and Secondary Drinking Water Regulations

The NPDWRs, established by the USEPA, are legally enforceable primary standards to protect the public from consuming water that contains contaminants that present a risk to human health. The current list comprises 83 contaminants, including turbidity, 7 microorganisms (two of which are indictors), 4 radionuclides, 16 inorganic contaminants, and 57 organic contaminants. Maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) have been set for 73 contaminants and 3 disinfectants. Ten other contaminants have treatment technique requirements.

USEPA has also published secondary standards, which are guidelines to help utilities provide aesthetically pleasing drinking water. The secondary standards set secondary maximum contaminant levels (SMCLs) for 15 compounds, including TDS. These compounds do not present a health risk at the SMCL. States are not required by the USEPA to enforce any of the secondary standards; however, each state may choose to regulate any or all of the secondary standards. Florida requires that utilities meet both the primary and secondary drinking water standards and has set enforceable limits for the secondary standards, including total dissolved solids (TDS). In Florida, failure to meet the fluoride secondary standard requires public notification pursuant to Rule 62-560.430, F.A.C. Community water systems (CWSs) may, in lieu of meeting the maximum contaminant level for iron or manganese, sequester iron or manganese using polyphosphates when the maximum concentration of iron plus manganese does not exceed 1.0 milligram per liter. Each CWS using polyphosphate to sequester iron or manganese shall certify annually in writing to FDEP that the amount of phosphate added does not exceed 10 milligrams per liter as PO_4. For the purpose of compliance with groundwater quality secondary standards, as referenced in Chapter 62-520, F.A.C., levels of ethylbenzene exceeding 30 micrograms per liter, toluene exceeding 40 micrograms per liter, or xylenes exceeding 20 micrograms per liter shall be considered equivalent to exceeding the drinking water secondary standard for odor.

TDS is comprised of inorganic salts (e.g., calcium, magnesium, potassium, sodium, carbonate, bicarbonate, chlorides, and sulfates) and small amounts of organic matter that are dissolved in water. USEPA has set the SMCL for TDS at 500 milligrams per liter (mg/L). Florida adopted the 500 mg/L SMCL for TDS as an enforceable standard that must be continually met (Rule 62-550.320, F.A.C.).

1.5.1.2 Summary of NPDWRS

Table 1.1 lists specific treatment requirements of existing regulations, including references to the specific rule. All contaminant maximum contaminant levels (MCLs) are the same under both Federal and State statues unless otherwise noted. National and Florida standards are the same unless otherwise noted. Table 1.2 lists the secondary requirements.

Table 1.1 Primary Drinking Water Regulations
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Contaminant	**EPA/Florida Limit**		**Notes**
	MCLG (mg/L)	**MCL or TT (mg/L)**	
Disinfection Byproducts			
Bromate	0	0.010	
Chlorite	0.8	1.0	
Total haloacetic acids (HAA5)	--[(1)]	0.060	LRAA[(2)]
Total trihalomethanes (TTHMs)	--[(1)]	0.080	LRAA[(2)]
Disinfectants	**MRDLG (mg/L)**	**MRDL (mg/L)**	
Chloramines (as Cl_2)	4	4.0	
Chlorine (as Cl_2)	4	4.0	
Chlorine dioxide (as Cl_2)	0.8	0.8	
Organic Contaminants	**MCLG (mg/L)**	**MCL or TT (mg/L)**	
Volatile Organic Chemicals (VOCs)			
Benzene	0	0.001	Federal standard is higher, 0.005
Carbon Tetrachloride	0	0.003	Federal standard is higher, 0.005
Chlorobenzene	0.1	0.1	No FDEP standard, Federal standard applies
o-Dichlorobenzene	0.6	0.6	
p-Dichlorobenzene	0.075	0.075	
1,2-Dichloroethane	0	0.003	Federal standard is higher, 0.005
1,1-Dichloroethylene	0.007	0.007	

Table 1.1 Primary Drinking Water Regulations Glades Region Water Master Plan Palm Beach County Water Utilities Department			
Contaminant	**EPA/Florida Limit**		**Notes**
	MCLG (mg/L)	**MCL or TT (mg/L)**	
cis-1,2-Dichloroethylene	0.07	0.07	
trans-1,2-Dichloroethylene	0.1	0.1	
Dichloromethane	0	0.005	
1,2-Dichloropropane	0	0.005	
Ethylbenzene	0.7	0.7	
Monochlorobenzene	0.1	0.1	
Styrene	0.1	0.1	
Tetrachloroethylene (PCE)	0	0.003	Federal standard is higher, 0.005
Toluene	1	1	
1,2,4-Trichlorobenzene	0.07	0.07	
1,1,1-Trichloroethane	0.20	0.2	
1,1,2-Trichloroethane	0.003	0.005	
Trichloroethylene (TCE)	0	0.003	Federal standard is higher, 0.005
Vinyl Chloride	0	0.001	Federal standard is higher, 0.002
Xylenes (Total)	10	10	
Synthetic Organic Compounds (SOCs)			
2,3,7,8-TCDD (Dioxin)	0	$3x10^{-8}$	
2,4,5-TP (Silvex)	0.05	0.05	
2,4-D	0.07	0.07	
Acrylamide	0	TT(3)	
Alachlor	0	0.002	
Atrazine	0.003	0.003	
Benzopyrene (PAH)	0	0.0002	
Carbofuran	0.04	0.04	
Chlordane	0	0.002	
Dalapon	0.2	0.2	

Table 1.1 Primary Drinking Water Regulations Glades Region Water Master Plan Palm Beach County Water Utilities Department			
Contaminant	**EPA/Florida Limit**		**Notes**
	MCLG (mg/L)	**MCL or TT (mg/L)**	
1.2-Dibromo-3-chloropropane (DBCP)	0	0.0002	
Di(2-ethylhexyl) adipate	0.4	0.4	
Di(2-ethylhexyl) phthalate (DEHP)	0	0.006	
Dinoseb	0.007	0.007	
Diquat	0.02	0.02	
Endothall	0.1	0.1	
Endrin	0.002	0.002	
Epichlorohydrin	0	TT(3)	
Ethylene dibromide	0	2×10^{-5}	Federal standard is higher, 5×10^{-5}
Glyphosate	0.7	0.7	
Heptachlor	0	0.0004	
Heptachlor epoxide	0	0.0002	
Hexachlorobenzene	0	0.001	
Hexachlorocyclopentadiene	0.05	0.05	
Lindane	0.0002	0.0002	
Methoxychlor	0.04	0.04	
Oxyamyl	0.2	0.2	
Pentachlorophenol	0	0.001	
Picloram	0.5	0.5	
Polychlorinated biphenyls (PCBs)	0	0.0005	
Simazine	0.004	0.004	
Toxaphene	0	0.003	
Inorganic Chemicals (IOCs)			
Antimony	0.006	0.006	
Arsenic	0	0.010	
Asbestos (fibers >10 µm)	7 (MFL)	7 (million fiber/liter)	

Table 1.1 Primary Drinking Water Regulations Glades Region Water Master Plan Palm Beach County Water Utilities Department			
Contaminant	**EPA/Florida Limit**		**Notes**
	MCLG (mg/L)	**MCL or TT (mg/L)**	
Barium	2	2	
Beryllium	0.004	0.004	
Cadmium	0.005	0.005	
Chromium (total)	0.1	0.1	
Copper	1.3	TT, Action Level = 1.3	Lead & Copper Rule
Cyanide	0.2	0.2	
Fluoride	4.0	4.0	Secondary standard is 2.0 mg/L
Lead	0	TT, Action Level = 0.015	Lead & Copper Rule
Mercury	0.002	0.002	
Nickel	--	0.1	Florida standard, no national standard
Nitrate (as N)	10	10	
Nitrite (as N)	1	1	
Selenium	0.05	0.05	
Thallium	0.0005	0.002	
Radiological Contaminants			
Combined Radium (226 & 228)	0	5 pCi/L	
Gross Alpha particles	0	15 pCi/L	Excludes radon and uranium
Beta particles and photon emitters	0	4 mrem/year	
Uranium	0	30 µg/L	Not listed by FDEP, national standard applies

Table 1.1	**Primary Drinking Water Regulations Glades Region Water Master Plan Palm Beach County Water Utilities Department**		
Contaminant	**EPA/Florida Limit**		**Notes**
	MCLG (mg/L)	**MCL or TT (mg/L)**	

Notes:

(1) Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:
TTHMs: bromodichloromethane (0); bromoform (0); dibromochloromethane (0.06 mg/L); chloroform (0.07 mg/L).
HAA5: dichloroacetic acid (0); trichloroacetic acid (0.02 mg/L); monochloroacetic acid (0.07 mg/L). Bromoacetic acid and dibromoacetic acid are regulated with this group but have no MCLGs.

(2) Levels based on locational running annual average (LRAA) of four quarterly sample events.

(3) Each water system must certify, in writing, to the state when acrylamide and epichlorohydrin are used to treat water, the combination (or product) of dose and monomer level does not exceed 0.05% doses at 1 mg/L and 0.01% dosed at 20 mg/L, respectively.

(4) MLCG = Maximum Contaminant Level Goal
MCL = Maximum Contaminant Level
TT = Treatment Technique
MRDLG = Maximum Residual Disinfectant Level Goal
MRDL = Maximum Residual Disinfectant Level

Table 1.2	**Secondary Drinking Water Regulations Glades Region Water Master Plan Palm Beach County Water Utilities Department**
Contaminant	**MCL (mg/L)**
Aluminum	0.2
Chloride	250
Copper	1
Fluoride	2.0
Iron	0.3
Manganese	0.05
Silver	0.1
Sulfate	250
Zinc	5
Color	15 color units
Odor	3 (threshold odor number)
pH	6.5 – 8.5
TDS	500
Foaming agents	0.5

1.5.2 Microbial and Disinfection Byproduct Rules

Since the promulgation of the SDWA in 1974, several rules have focused on public health protection by limiting the presence of microorganisms in drinking water. The 1996 amendments to the SDWA required the USEPA to develop additional rules to balance risks between microbial pathogens and DBPs. These rules are briefly summarized in this section.

1.5.2.1 Stage 1 Disinfectants/Disinfection By-Products Rule

Stage 1 of the Disinfectants/Disinfection By-Products Rule (Stage 1 D/DBP Rule) was finalized on December 16, 1998 and became effective for public water systems serving more than 10,000 people on January 1, 2002.

1.5.2.2 Stage 2 Disinfectants and Disinfection By-Product Rule

The rule establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three chemical disinfectants - chlorine, chloramines, and chlorine dioxide (see Table 1.1). It also establishes maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for total trihalomethanes, haloacetic acids, chlorite, and bromate.

The EPA promulgated Stage 2 D/DBPR on January 4, 2006, simultaneously with the LT2ESWTR, to address risks from microbial pathogens and DBPs. The Stage 2 D/DBPR applies to water systems that add and/or deliver water that is treated with a primary or residual disinfectant other than ultraviolet light. The key provisions of the Stage 2 D/DBPR consist of an Initial Distribution System Evaluation (IDSE) and a change in compliance calculation for TTHMs and HAA5 from a running annual average to a locational running annual average (LRAA). LRAAs are intended to strengthen public health protection by eliminating the potential for groups of customers to receive elevated levels of DBPs on a consistent basis.

1.5.3 Revised Total Coliform Rule

The USEPA revised the 1989 Total Coliform Rule (TCR). The new Revised Total Coliform Rule (RTCR) was published in the Federal Register on February 13, 2013. The TCR was revised to reduce implementation burden and used advances in scientific understanding to improve public health protection against waterborne pathogens in the public drinking water distribution systems. The RTCR impacts all water systems, and represents a major shift in the regulatory framework from lots of public notification to “find and fix” based on total coliform triggers.

Under the TCR, the MCLG for total and fecal coliforms is zero, and an MCL based on the percentage of positive samples collected during a compliance period—for the PBCWUD Glades Region, 40 samples per month must be collected and no more than 5.0 percent can be total coliform positive. If a system has greater than 5 percent total coliform-positive (TC-positive) samples in a month, then this is considered a monthly MCL violation, which needs to be reported to the FDEP and to the public in a specific timeframe. All TC-positive samples must be analyzed for the presence of *Escherichia coli* (*E. coli*) or fecal coliform. If two consecutive samples are TC-positive and one is also fecal coliform- or *E. coli*-positive, then this is defined as an acute violation of the MCL; the system must notify the FDEP and the public using mandatory language developed by the USEPA and collect repeat samples.

Secondary disinfection is required under the TCR in accordance with the following:

- A minimum disinfectant residual of 0.2 mg/L free chlorine or 0.5 mg/L chloramines measured as total chlorine must be present throughout the distribution system continually.
- A sample with heterotrophic plate counts (HPCs) less than 500 cfu/100 mL is assumed to carry the required minimum residual.

The RTCR retains the basic monitoring requirements of the TCR and changes some of the assessments and corrective actions. The RTCR will: 1) require public water systems that are vulnerable to microbial contamination to identify and fix problems; and 2) establish criteria for public water systems to qualify for and stay on reduced monitoring. The second requirement is intended to reduce water system burden and provide incentives for better system operation. Pertinent differences between the current and revised rules is provided in Table 1.3.

Table 1.3 Comparison of the TCR and RTCR Provisions
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

TCR	RTCR
- CL for Total Coliform (TC) including fecal coliform/*E. coli.*	- Treatment technique (TT) based on TC and E*. coli* and an MCL for *E. coli.*
- Acute violation based on fecal coliform and *E. coli.*	- Acute violation based on *E. coli* only.
- No assessment or corrective action required.	- Assessment and corrective action required based on monitoring results.
- PN required for monthly TC and acute *E. coli* violations.	- PN required for failure to assess/correct and for acute *E. coli* violations.

Table 1.3 Comparison of the TCR and RTCR Provisions Glades Region Water Master Plan Palm Beach County Water Utilities Department	
TCR	**RTCR**
- Acute violation = Any fecal coliform-positive repeat sample or *E. coli*-positive repeat sample, or any TC-positive repeat sample following a fecal coliform-positive or *E. coli*-positive routine sample, constitutes a violation of the MCL for TC.	- A system is in compliance with the MCL for *E. coli* unless any of these conditions occur: (1) The system has an *E. coli*-positive repeat sample following a TC-positive routine sample. (2) The system has a TC-positive repeat sample following an *E. coli*-positive routine sample. (3) The system fails to take all required repeat samples following an *E. coli*-positive routine sample. (4) The system fails to test for *E. coli* when any repeat sample tests positive for TC.
- Systems must collect samples that are representative of water throughout the distribution system according to a written sample siting plan. - Plans are subject to State review and revision.	- Systems must develop a written sample siting plan that identifies sampling sites and a sample collection schedule that are representative of water throughout the distribution system, no later than March 31, 2016. - Sites may include a customer's premise, dedicated sampling station or other designated compliance sampling station. - Routine, repeat, and Ground Water Rule sampling sites must be reflected in the plan. - Plans are subject to State review and revision.

1.5.4 Lead and Copper Rule

The Lead and Copper Rule requires public water systems serving greater than 10,000 people to sample household taps for lead and copper and conduct distribution system sampling for certain water quality parameters (pH, alkalinity, calcium, etc.). Lead and copper samples must be collected from 100 "worst case" home sites (Tier 1) and water quality parameters must be collected from 25 sites in the distribution system.

The USEPA has established the following action levels for lead and copper for the 90th percentile of home tap samples:

- Lead: 0.015 mg/L
- Copper: 1.3 mg/L

If the lead and copper concentrations in the 90th percentile of home tap samples is greater than these values, then the utility must conduct a public education program.

The goal of the lead and copper regulation is for utilities to optimize their corrosion control treatment. Under this regulation, there are two ways in which a utility is considered to have "optimized" their corrosion control:

- Demonstrate to regulatory agency that it has performed corrosion control steps "equivalent" to those required by USEPA.
- If the difference between the highest level of lead in the source water and the 90th percentile tap samples is less than the practical quantitation level (PQL) for lead (0.05 mg/L).

The Final Lead and Copper Rule (LCR) Short-Term Revisions and Clarifications (also known as the Lead and Copper Rule Minor Revisions, or LCRMR) was promulgated on October 10, 2007. The compliance date for all of the provisions of this Rule was April 7, 2008. The LCRMR does not change the action levels for lead or copper, nor does it affect the rules basic requirements. The modified rule requires the following:

1. Consumer Awareness. All utilities must now provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings who consume water from the taps that are part of the utility's sampling program.

2. Lead Service Line Replacement. Some utilities must reconsider previously "tested-out" lines when resuming lead service line replacement programs. This provision applies to systems that had: 1) Initiated a lead service line replacement program; 2) Complied with the lead action level for two consecutive monitoring periods and discontinued the lead service line replacement program; and 3) Were subsequently re-triggered into lead service line replacement. All previously "tested-out" lines would then have to be tested again or added back into the sampling pool and considered for replacement.

3. Public Education. The new rule changes the content of the message to be provided to consumers, changes how the materials are delivered to consumers, and the timeframe in which materials must be delivered. Also, there are changes to the delivery requirements which include additional organizations that systems must partner with to disseminate the message to at-risk populations as well as changes in the ways information is disseminated to ensure water systems reach consumers when there is an action level exceedance. The new rule also requires educational statements about lead in drinking water to be included in all consumer confidence reports.

1.5.5 Third Candidate Contaminant List and the Unregulated Contaminant Monitoring Rule 3

The EPA uses the Contaminant Candidate List (CCL) to prioritize research and data collection efforts for future regulations. Contaminants on the list are known or anticipated to occur in public water systems, but are currently unregulated. The most recent version of the CCL, CCL3, was published on October 8, 2009. This list includes 104 chemicals or chemical groups and 12 microbiological contaminants. In June 2011, EPA held a stakeholder meeting to discuss the health effects and occurrence data for the subset of contaminants from the CCL3 that were being investigated further for the third regulatory determination (Reg-Det 3). It appears likely that EPA will make positive regulatory determinations for nitrosamines, strontium, and chlorate unless funding/budgeting issues impede the process.

In developing this list, EPA employed a new classification process based on National Drinking Water Advisory Council (NDWAC) recommendations. The process began with the identification of 7,500 potential chemical and microbial contaminants in the "CCL 3 Universe." This list was narrowed to almost 600 potential contaminants on the preliminary CCL (PCCL) based on potential to occur in public water systems and the potential for public health concern. The PCCL was then pared down to a final list. EPA uses this list of unregulated contaminants to prioritize research and data collection efforts to help determine whether specific contaminants should be regulated. In this round, more occurrence data is needed (as opposed to gaps in health effects data). CCL4 is expected in 2014.

The primary source of occurrence data to identify emerging contaminants is collected via the Unregulated Contaminant Monitoring Rule (UCMR). The data are used to support regulatory decision making about the contaminants. The EPA identified and published unregulated contaminants for the first direct implementation of UCMR (UCMR 1) in 1999, which required some public water systems to monitor for unregulated contaminants from 2001 to 2005. The most recent implementation of this rule (UCMR 3) was published in the Federal Register on May 2, 2012. Two contaminants, sec-butylbenzene and n-propylbenzene, were removed to make room for Cr-VI and total chromium on the final list of 30 contaminants (28 chemicals and 2 viruses). Large water systems (serving >100,000 people) were required to provide location and inventory information to EPA by October 1, 2012 in preparation for 12 months of UCMR3 monitoring beginning on January 1, 2013.

1.5.6 Consumer Confidence Report Rule

On January 3, 2013, USEPA announced a new interpretation of the Consumer Confidence Report (CCR) Rule. According to the agency, community water systems will now be considered in compliance with federal CCR delivery requirements if they publish their report on a public website, notify customers of the report's availability (e.g., a notice printed on water bills), and provide a direct URL to the online report. Utilities only have to mail hard copies to customers who request them; any water system that prefers to continue distributing all CCRs by postal mail or other hard-copy means may continue to do so. Water systems can start using electronic communication of CCRs in 2013.

1.5.7 Potential Future Regulations

The USEPA is considering completing a number of new drinking water regulations by the end of 2016. These include a ruling on perchlorate, Long-Term Lead and Copper Rule Revisions (LT-LCR), and a new MCL for carcinogenic volatile organic compounds (cVOCs). Other scheduled regulatory actions include the Third Regulatory Determination (Reg-Det 3), Reg Det 3 Regulations (if EPA makes positive determination to regulate), and the Third 6-Year Review. Anticipated future Federal drinking water regulations are summarized in Table 1.4 below. The dates are tentative unless otherwise noted.

Table 1.4 Calendar of Anticipated Future Regulatory Action
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Regulatory Action	Proposal Date	Final Date
New "Lead-Free" Definition	-	Jan. 4, 2014
CCL4	2014	2015
Reg-Det 3	2014	2015
Reg-Det 3 Determinations	2016/2017	2018/2019
LT-LCR	2015	2017
cVOCs	2014	2016
Third 6-Year Review	2016	2017
Reg Det 3 Regulations (if EPA makes positive determination to regulate)	2016/2017	2018/2019

1.5.7.1 Third Regulatory Determination

The SDWA requires EPA to make regulatory determinations (whether or not to promulgate a new regulation) on at least five contaminants every five years. In Reg-

Det 1 and Reg-Det 2, EPA decided not to regulate 20 contaminants under consideration. It was determined that a new national regulation would not provide a "meaningful opportunity for risk reduction" as required by the SDWA. EPA can make "off-cycle" determinations, such as the positive determination to consider a new perchlorate MCL in 2011.

The most likely candidates for positive regulatory action in Reg-Det 3 or off-cycle action include nitrosamines, chlorate, and strontium. In June 2011, EPA presented occurrence data for 32 chemicals from the CCL3 list - five nitrosamines, chlorate and three metals; TCP, MTBE, PFOS, PFOA are also under consideration.

Negative determinations are also likely for up to nine compounds including 1,3-dinitrobenzene, nitrobenzene, RDX, Dimethoate, Disulfoton, Diuron, molinate, terbufos, and terbufos Sulfone. These had zero or near-zero detections in UCMR1 & 2, which indicates these are likely not prevalent enough that a new national regulation would not provide a meaningful opportunity for risk reduction. Another eight acetanilides and their degradates could be added.

The preliminary Reg-Det 3 list is expected to be published in 2014 with a final determination following in 2015.

1.5.7.2 Fourth Candidate Contaminant List

EPA is likely to propose the Fourth Candidate Contaminant List (CCL4) in 2014 in order to publish the final CCL4 in 2015. Sixty-nine nominations for CCL4 were received. Eight contaminants out of the 69 were nominated by more than one organization or individual: aldicarb, bisphenol A, carbaryl, chlorpyrifos, manganese, microcystin-LR, PFOA, and *Toxoplasma gondii*.

1.5.7.3 Perchlorate

Perchlorate is both a naturally occurring and synthetic chemical and used to manufacture fireworks, explosives, flares, and rocket propellant. On February 18, 2005, EPA established an RfD of 0.0007 mg/kg-day, which corresponds to a drinking water equivalent level (DWEL) of 24.5 µg/L. In 2011, EPA reversed its initial determination (in 2008) not to regulate perchlorate.

The perchlorate MCLG has several complex scientific issues on such issues as iodide deficiency, how much of a change in iodide levels is significant based on EPA's PBPK model, and EPA's "life-stages" analysis. This last issue could be precedent-setting for other future regulations based on the increased amount of water consumed per body weight for infants and toddlers as compared to adults. It

is unclear when an MCL will be proposed. It is anticipated that this will not occur before late 2014, with final promulgation twelve to eighteen months later.

1.5.7.4 Lead and Copper Rule Revisions

EPA first promulgated the Lead and Copper Rule (LCR) to control lead and copper levels in drinking water in 1991. The LCR was revised in 2000 and 2007. The LCR sets an action level (AL) of 0.015 mg/L for lead and 1.3 mg/L for copper. The AL is exceeded if the concentration in more than 10 percent of tap water samples collected during any monitoring period is greater than the action level. If the 90th percentile value for tap water samples is above the action level, it does not signal a violation, but may trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and/or lead service line replacement. In 2011, the Centers for Disease Control and Prevention (CDC) lowered the recommended blood lead level for children to ≥ 10 µg/dL.

EPA is currently developing a proposal to modify the current Lead and Copper Rule to address a number of long-term issues and new health research data such as that from the CDC. Requirements under consideration for modification include:

- Modifying partial lead service line replacement (LSLR) requirements; issues include control versus ownership and potentially supplying filters to households with partial LSLR.
- Optimizing corrosion control and water quality parameters.
- Changing sample site selection criteria; EPA is considering shifting the focus on sampling to homes, schools, and day care centers with lead service lines as opposed to the homes with lead service lines or lead solder.
- Changes in the sampling protocol; systems with LSLs may have to collect LSL water sample and the flushing interval could depend on LSL length.
- Changes in tap sampling and sampling protocols. EPA is considering sampling for water in the lead service line, i.e., the compliance sample would capture water from the lead service line rather than the current “first flush” sampling.

Sample site selection is one issue that could affect all systems. Revising all of the LCR sampling plans and getting primacy agency approval for these revisions would be a significant effort for both systems and states. One potential outcome of these revisions is that the range of allowable water quality parameters may be tightened. A public meeting of the National Drinking Water Advisory Council (NDWC) Lead

and Copper Rule Working Group (LCRWG) was held on May 29 and 30, 2014. During this meeting, the LCRWG and the EPA discussed the Lead and Copper Rule sample site selection criteria. Revisions to the Lead and Copper Rule are anticipated no earlier than early 2014 with final promulgation two years later.

A new definition of “lead free” has also been issued and became effective on January 4, 2014. The new definition of “lead-free” is <0.25% lead, and any new meters, pipe fittings, etc., that are installed will have to meet this new definition as well as any parts that are used in repairs.

1.5.7.5 Carcinogenic Volatile Organic Compounds

EPA has announced that Carcinogenic Volatile Organic Compounds (cVOCs) would be the first group to be regulated as part of the agency’s 2010 Drinking Water Strategy to regulate contaminants as groups. In its fact sheet, EPA listed eight currently regulated cVOCs that would likely be included in this regulation, as well as eight unregulated cVOCs that could also be potentially be included. It is not known yet how many or which of these eight unregulated cVOCs will ultimately be included in this regulation. EPA is still in the process of collecting occurrence and treatment data in order to determine what cVOCs might be included in this regulation. Potential co-occurrence, as well as common treatment, will likely be factored into consideration of what cVOCs will be selected.

This group regulation also links with EPA’s efforts to revise the MCLs for trichloroethylene (TCE) and tetrachloroethylene (PCE) as part of its second Six-Year Review of existing drinking water regulations (74 FR 15500). In this notice, EPA presented its analysis of the potential impacts of lowering both of these MCLs from the current standard of 5 ng/L to 1 ng/L and 0.5 ng/L, which at this point, should be considered regulatory “targets” that USEPA is seriously considering.

This regulation will primarily be a concern for groundwater systems. EPA anticipates proposing this regulation in 2014; the final rule would likely be published two years after the proposal.

1.5.7.6 Nitrosamines

Nitrosamines meet the first two of the three SDWA criteria for regulating a new contaminant: 1) nitrodimethylamine (NDMA) and other nitrosamines are carcinogens, and 2) UCMR2 data shows that NDMA and other nitrosamines occur frequently enough to warrant considering regulatory action. There is still significant debate as to whether or not this suite of chemicals meets the third criterion, whether their regulation would provide a meaningful opportunity for risk reduction. Current

regulatory discussions have focused around regulating nitrosamines as a group; NDMA would almost certainly be included.

The contribution of drinking water to the typical person's nitrosamine exposure is small (<0.1%) compared to exposure from foods and from what is produced inside the body (endogenous exposure). Whether or not nitrosamines are regulated will depend largely upon how EPA evaluates whether regulation would provide a "meaningful opportunity for risk reduction." EPA has adopted a new "life-stages" approach to risk assessment, which focuses more on at risk populations, like infants and toddlers, who drink more water per body weight.

More than half of the systems that would be impacted by a nitrosamine rule are chloraminated systems. There are many potential treatment options, but many conflict with other regulations. Also, new treatment research at pilot- or full-scale is needed before the risk assessment (which includes a cost component) can be completed. More information on this topic is anticipated to become available over the next few years as Reg-Det 3 moves forward.

1.5.7.7 Third Six-Year Review

EPA is due to propose the Third Six-Year (SY3) Review of existing drinking water regulations in 2016, with finalization in 2017. The SDWA requires EPA to review its drinking water regulations every six years in light of advances in the fields of heath effects, analytical methodologies, treatment, and occurrence data to determine whether any revisions are needed. In a separate, related effort, in August 2011 EPA issued a plan to review of all of its regulations to comply with Executive Order 13563.

Besides the LT-LCR Revisions previously discussed, EPA also listed chemicals that could also be revisited such as fluoride, revision of total chromium to address hexavalent chromium, arsenic, nitrate, manganese, and radionuclides.

1.5.7.8 Hexavalent Chromium

Total chromium was regulated in 1991 at 100 µg/L. EPA has been working over the past several years to develop a draft risk assessment for hexavalent chromium (Cr-6), which is now due in late 2013 with a final risk assessment due in late 2014 or early 2015. This assessment was extended from its initial 2012 completion date to incorporate the latest health effects research. Total and Cr-6 monitoring are also included in UCMR3. Laboratory and water quality experts expect UCMR3 to report widespread occurrence all be it at low concentrations, most frequently at levels less than 1 µg/L. Once the final risk assessment is published EPA will move forward with

determining whether or not to promulgate a Cr-6 MCL. This could be part of the Third Six-Year Review decision or could be done off-cycle.

At a state level, on August 23, 2013, California proposed the first U.S. MCL for Cr-6 at 10 µg/L. The regulations package for the MCL submitted to the Office of Administrative Law (OAL) for review was approved by OAL on May 28, 2014. The 0.010-milligram per liter MCL (equivalent to 10 micrograms per liter, µg/L) becomes effective on July 1, 2014. The data used in developing this standard are older animal studies using Cr-6 doses several orders of magnitude higher than that found in drinking water. The new Cr-6 toxicity data being developed to inform the EPA IRIS report has not been included.

1.5.7.9 The Radon Rule

The Radon Rule, which will establish an MCL for radon, was proposed on November 2, 1999. The proposed MCL is 300 PCi/L. The proposed standard will apply only to community water systems that use ground water or mixed ground and surface water. No significant additional action has taken place on this potential rule.

1.5.7.10Toxic Organic Chemicals

Whether toxic organic chemicals (TOrCs) like pharmaceutical and personal care products (PPCPs) and endocrine-disrupting compounds (EDCs) in the environment pose a significant exposure risk to humans or wildlife is still not well understood and the subject of much investigation and debate. Research on these compounds began in the 1990s and the magnitude of the issue is still not fully defined. The use and subsequent release of antibiotics and natural/synthetic steroids to the environment has generated controversy to date regarding pharmaceuticals as pollutants. However, a plethora of other drug classes, bioactive metabolites, and transformation products, as well as PPCPs have yet to be examined. Certain physiologically active compounds (for example, caffeine, aspirin, and sex steroids) have been known for over 20 years to enter the environment by a variety of routes, primarily via treated and untreated sewage effluents.

The EPA is studying the effect of PPCPs and has not proposed any regulations as of yet, but as more information emerges over the next five to ten years, the EPA may regulate these products. A significant portion of on-going research concerns where and how TOrCs should be treated. Options include drug take-back programs (to keep them out of the water), treatment at wastewater treatment plants, and treatment at drinking water plants. Research suggests that advanced oxidation processes, such as ultraviolet irradiation with peroxide (UV/H_2O_2), are effective at

removing many PPCPs. Initial UCMR3 data indicates that endocrine disrupting compounds are largely absent in drinking water sources at even very low levels.

1.5.7.11Emerging Disinfection By-products

A number of potential significant disinfection by-products continue to be the subject of on-going research For example, both iodo-substituted HAAs and THMs have been shown to form under certain conditions when drinking water is chloraminated. Bromate has been the subject of scrutiny as well. No regulations have been proposed as of yet, but as more information emerges, the EPA may regulate some of these emerging DBPs.

1.6 SUMMARY OF REPORT CHAPTERS

A summary of the content of each report chapter is provided below.

Chapter 1 – Introduction: Provides a description of the project scope and objectives and a discussion of factors affecting the Glades Region water planning efforts including water supply planning efforts, regulations, and climate change.

Chapter 2 – Planning Framework: Documents planning information that serves as the basis for distribution system modeling and master planning analyses, including regional population growth, finished water demand projections, peaking factors, diurnal curves, and criteria against which to evaluate distribution system performance.

Chapter 3 – Water System Assets: Contains an inventory and description of the Glades Region water system assets including wellfields, the water treatment plant (WTP), water storage tanks, pump stations, and transmission mains.

Chapter 4 – Water Model Development: Describes the water model development, including data inputs and calibration methodology and results.

Chapter 5 – Existing System Evaluation: Summarizes modeling evaluations and results for the existing distribution system, including identification of existing water system deficiencies.

Chapter 6 – Future Water System Analysis: Summarizes modeling evaluations and results for projected water demands in 2015, 2025, and 2035, including identification of anticipated water system deficiencies and recommendations for future infrastructure improvements.

Chapter 7 – WTP and Storage Capacity: Compares existing WTP and storage capacities with regulatory requirements and anticipated water demand projections to identify the necessary timing for additional WTP and storage capacity.

Chapter 8 – Capital Improvement Plan: Summarizes recommended projects for the water system and documents the cost estimating methodology used to develop the near-term and long-term CIP.

Chapter 9 – Summary and Recommendations: Provides a summary of the modeling and master planning analyses and recommendations.

Chapter 10 – References: Documents references of all sources of information used in compiling the WMP.

Chapter 2
PLANNING FRAMEWORK

2.1 INTRODUCTION

The purpose of Chapter 2 is to present the planning information that serves as the foundation of the distribution system modeling and master planning analyses. Chapter 2 documents anticipated population growth in the Glades Region and develops demand projections, peaking factors, and diurnal curves that are used in the hydraulic model. Chapter 2 provides the basis for all Glades Region WMP project tasks.

Chapter 2 is divided into the following sections:

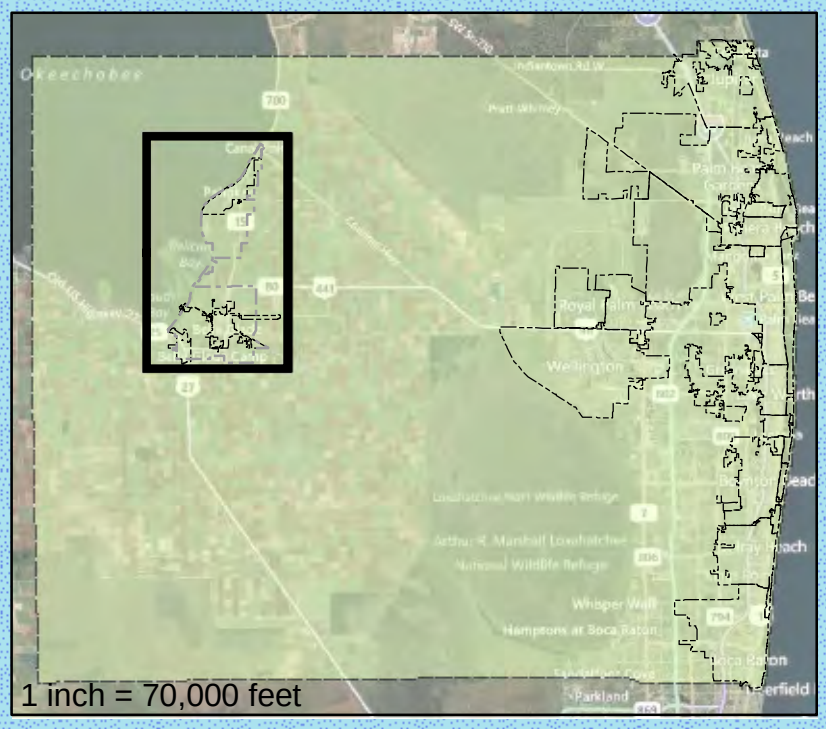
- Section 2.1 – Introduction: Provides an overview of the project and the intent of Chapter 2, which is to outline planning data and information for modeling and master planning purposes.
- Section 2.2 – Background: Presents an overview of the Glades Region water distribution system, water service area, and WMP project drivers.
- Section 2.3 – Population and Finished Water Demand Projection Methodology: Discusses the method used to develop population and finished water demand projections used in the WMP scenarios.
- Section 2.4 – Peaking Factors: Provides an analysis of historical water use data and selected peaking factors for modeling and master planning purposes.
- Section 2.5 – Finished Water Demand Projections: Discusses finished water demand projections that will be used as the basis for modeling scenarios.
- Section 2.6 – Performance Criteria: Defines criteria, or standards of measurement, for evaluating the performance and design of the water system.

2.2 BACKGROUND

PBCWUD manages two separate potable water distribution systems. The eastern system serves the urban areas on the eastern side of the County, and the western system serves the cities of Belle Glade, South Bay, and Pahokee and some small surrounding unincorporated areas. These three cities are located in Palm Beach County on the southeastern shore of Lake Okeechobee as shown in Figure 2.1. This area is collectively known as the “Glades Region.”

Palm Beach County Water Utilities Department

Glades Region Water Master Plan



LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT-11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Legend

Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30

Glades Region Facilities

- Water Treatment Plant
- Elevated Storage Tank
- Ground Storage Tank
- Master Water Meter
- City Boundary
- GUUSA
- PBC Boundary

Old US Highway 441 N

Lakeshore Dr

Conners Hwy

E Main St

Larrimore Rd

S Lake Ave

S Barfield Hwy

N State Market

Muck City Rd

Mc Clure Rd

Belle Glade Rd

Section 20 Rd

State Road 15

Hooker Hwy

State Road 80

W Sugar House Rd

Curlee Rd

Gator Blvd

N Main St

E Canal St S

SW 10th St

SE Avenue G

S Main St

N US Highway 27

US Highway 27

SW 1st St

County Road 827A

Duda Rd

County Road 880

Glades Region Water System	Figure 2.1	N	0 2,750 5,500 Feet

The service area in the Glades Region encompasses approximately 44 square miles, which includes the Glades Unincorporated Urban Service Area (GUUSA) and a few rural industrial and agricultural customers.

Based on data provided by the Palm Beach County Planning Department, the total population of the Glades Region in 2012 was 33,518. The City of Belle Glade is the largest community and accounts for approximately 51 percent of the total regional population, followed by unincorporated county areas having 18 percent, Pahokee with 17 percent, and South Bay with 14 percent. The population served by private wells in 2012 was 679, which accounts for approximately 2 percent of the population in the region.

2.2.1 Historical Water Use

Billing records for the last three fiscal years, 2010 through 2012, indicate that non-residential usage has steadily increased while residential single-family demand has decreased. Based on the usage for fiscal year 2012, major users of potable water in the Glades Region are non-residential customers, which include institutional, industrial, and commercial users. Overall, residential users account for 45 percent of the average metered demand during the fiscal year of 2012, as summarized in Figure 2.2. The total potable water sales in fiscal year 2012 were approximately:

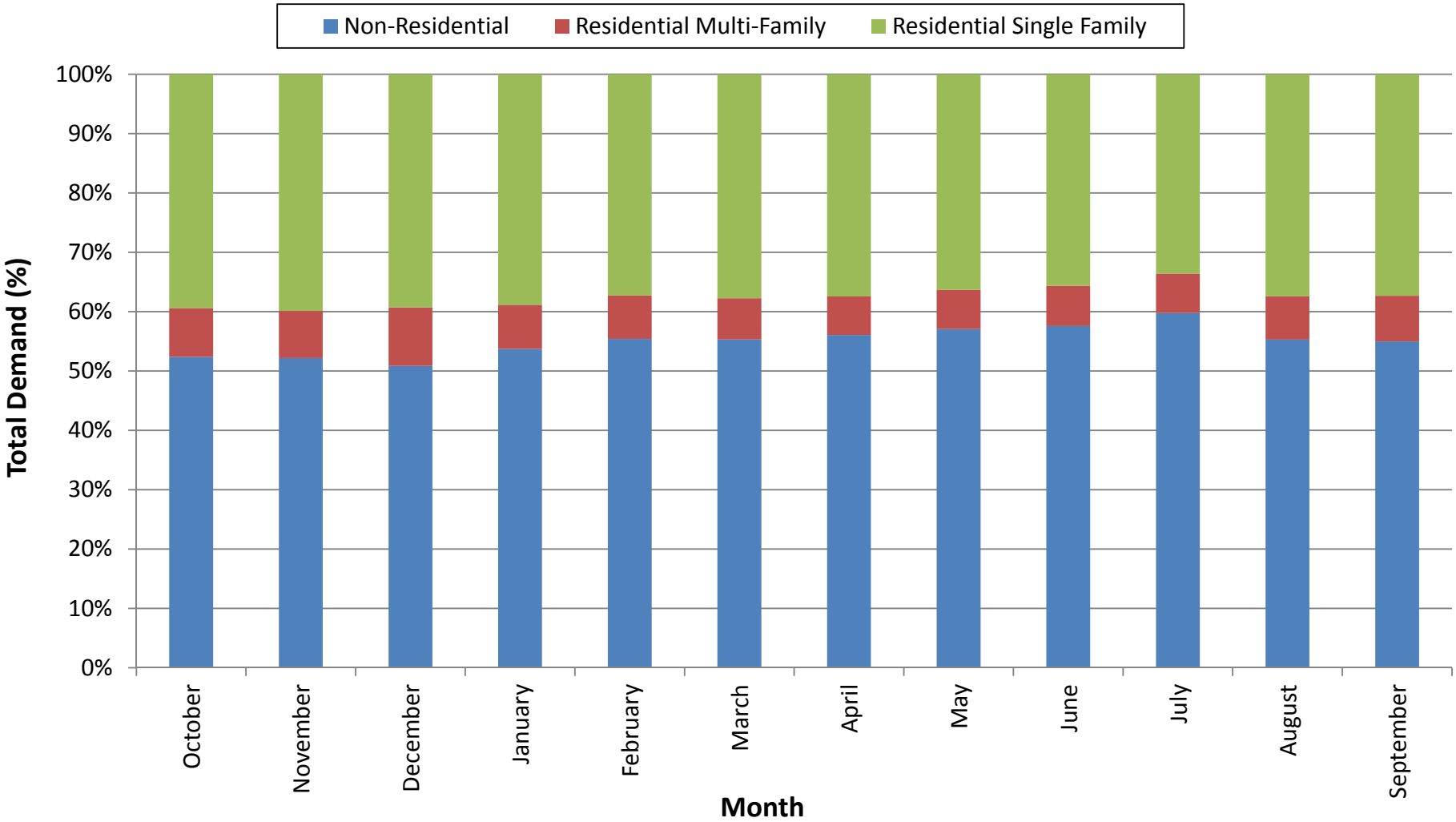
- 55 percent non-residential,
- 37 percent residential single-family, and
- 7 percent residential multi-family.

As indicated in Figure 2.3, the Glades Region has experienced an increase in the annual average water demand over the last three years. This is mainly attributed to the increase in non-residential demand.

Based on a comparison of potable water sales and finished water production in the last three fiscal years, the Glades Region has an average of 46 percent non-revenue water. Non-revenue water includes uses such as flushing to maintain water quality, usage at water and wastewater facilities, unbilled water due to inaccurate meters, and water loss.

2.2.2 Water System Overview

The Glades Region currently has one water treatment plant (WTP No. 11) located north of the City of Belle Glade. This facility has one high service pump station and a 3 million gallon (MG) ground storage tank.

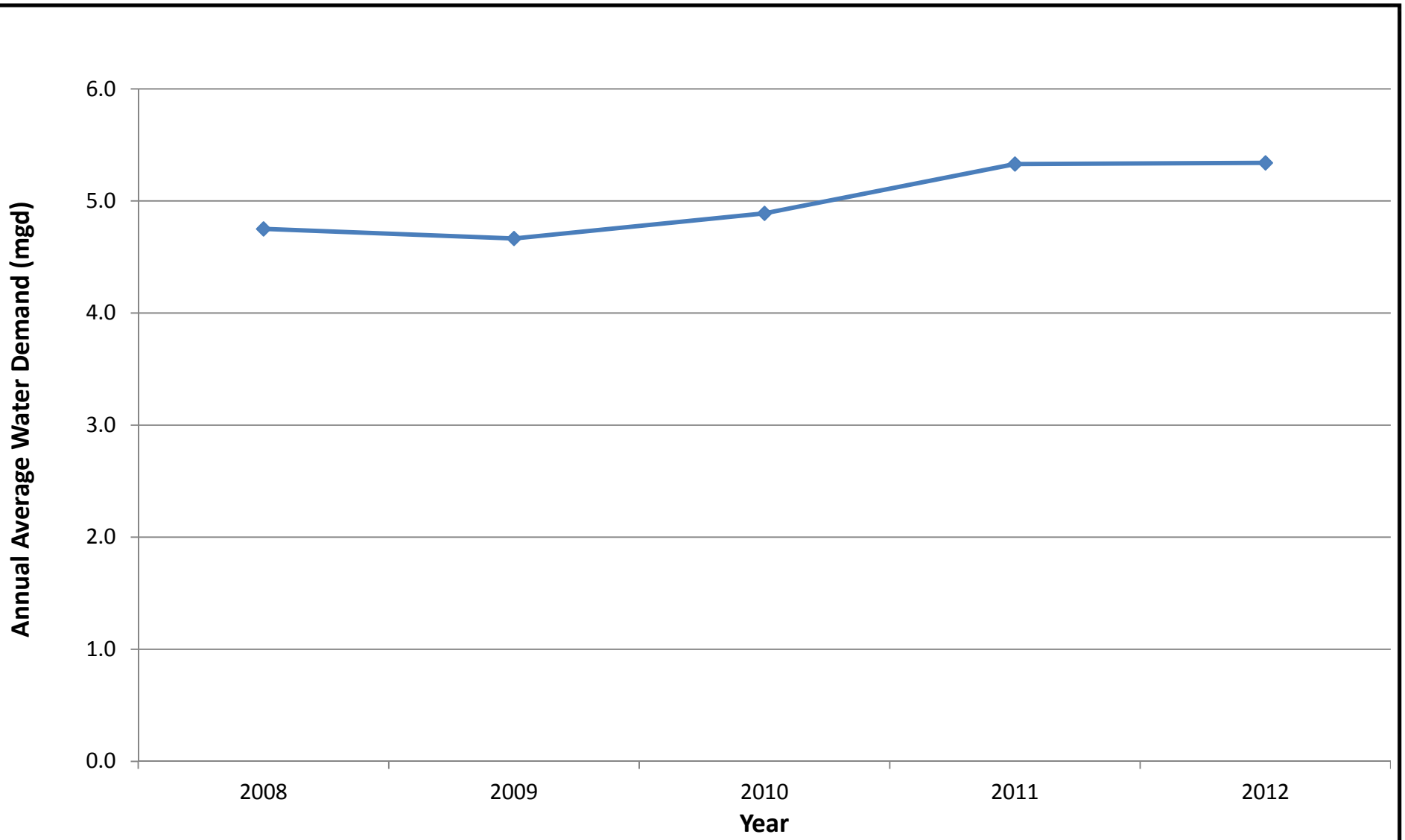


WATER USE BY CLASS
FISCAL YEAR 2012

FIGURE 2.2

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



ANNUAL AVERAGE FINISHED WATER DEMAND

FIGURE 2.3

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

The Glades Region also relies on repump stations and storage tanks located in Belle Glade, South Bay, and Pahokee to maintain adequate storage and pressure in the distribution system.

The facilities existing in the City of Belle Glade include WTP No. 11 and the Belle Glade Repump Station. The Belle Glade Old Water Treatment Plant had been used as a booster pumping facility until it was decommissioned in late 2012. The Repump Station serves as a booster pump station with an above ground storage tank with a capacity of 1 MG.

The City of South Bay has one booster pump station with a 1-MG above ground storage tank. The City of South Bay previously had a water treatment plant located near the southeastern shore of Lake Okeechobee, but this facility was taken offline in 2008.

The City of Pahokee has three elevated storage tanks with a total capacity of 0.675 MG. One of these elevated tanks (0.075 MG) is no longer in service. Figure 2.1 shows these tanks and the other water distribution system infrastructure in the Glades Region.

Table 2.1 summarizes the pipelines size and length by city. For unincorporated areas, the existing pipelines were assigned to the city in closest proximity. Belle Glade contains 62 percent of the distribution pipe length in the system followed by Pahokee with 29 percent. In total, the water distribution system is comprised of approximately 203 miles of pipe.

Table 2.1 Total Pipe Length by City
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Diameter	Total Length (miles)				Total Percentage
	Belle Glade	South Bay	Pahokee	Total	
6" or less	69	13	30	112	55%
8" to 12"	46	5	23	74	37%
16" to 24"	9	1	5	15	7%
30"	2	0	0	2	1%
Total Length (miles)	**126**	**19**	**58**	**203**	

A primary objective of the Glades Region WMP is to develop a comprehensive water model to aid in water infrastructure planning. Water model results were

analyzed to develop capital improvement plans (CIPs) outlining the infrastructure necessary to serve customers in the Glades Region through 2035.

2.3 POPULATION AND FINISHED WATER DEMAND PROJECTION METHODOLOGY

This section describes the methodology used to develop population and finished water demand projections for the Glades Region. Information from the Palm Beach County Planning Department was used to determine population projections. These projections were assigned to traffic analysis zones (TAZs).

2.3.1 TAZ Population Estimates

The finished water demand projections are based on County population projections by TAZ. These projections are multiplied by a per capita water demand factor. Only the TAZs within the GUUSA were included in this analysis.

The Palm Beach County Planning Department provides an annual breakdown of housing units by TAZ, occupancy ratios, and persons per household. Population estimates are calculated by multiplying these data for each TAZ. The resulting population projection by year is included in Appendix B.

The population data for 2008 to 2012 was obtained using historical residential units multiplied by occupancy and population per household rate. The same methodology was used to forecast future annual population in the region, using residential units projected by the County's Planning Department to allocate future population by TAZ.

While near-term growth in the region is expected to be minor, the population growth rate is expected to increase after 2020 due to economic and infrastructure development in the region. Table 2.2 summarizes the projected population through 2035.

Table 2.2 Glades Region Population Projections Glades Region Water Master Plan Palm Beach County Water Utilities Department					
Year	**Total**	**Belle Glade**	**South Bay**	**Pahokee**	**Unincorporated County**
2012	33,517	17,055	4,705	5,690	6,067
2013	33,664	17,144	4,705	5,735	6,080
2014	33,909	17,254	4,710	5,806	6,139
2015	34,265	17,475	4,717	5,869	6,204
2016	34,798	17,691	4,827	5,935	6,345
2017	35,382	17,901	4,939	5,995	6,547
2018	35,949	18,107	5,051	6,058	6,733
2019	36,520	18,305	5,165	6,115	6,935
2020	37,314	18,518	5,280	6,176	7,340
2021	38,255	18,765	5,395	6,230	7,865
2022	39,173	19,006	5,511	6,292	8,364
2023	40,161	19,242	5,627	6,343	8,949
2024	41,217	19,472	5,743	6,405	9,597
2025	42,278	19,698	5,859	6,453	10,268
2026	43,316	19,918	5,974	6,512	10,912
2027	44,318	20,091	6,089	6,558	11,580
2028	45,278	20,240	6,203	6,614	12,221
2029	46,244	20,385	6,316	6,657	12,886
2030	47,427	20,525	6,428	6,710	13,764
2031	48,616	20,661	6,538	6,750	14,667
2032	49,784	20,792	6,647	6,801	15,544
2033	50,958	20,918	6,754	6,838	16,448
2034	52,107	21,042	6,859	6,879	17,327
2035	53,162	21,160	6,962	6,914	18,126

2.3.2 Per Capita Finished Water Demand Analysis

Population data for 2008 to 2012 was used to determine the per capita finished water demand.

The total finished water demand was obtained from historical daily water production from WTP No. 11 for the period of July 1, 2008 to December 31, 2012.

To calculate the per capita demand factor, bulk usage was subtracted from the finished water volume since and was accounted for separately. The per capita finished water demand factor was calculated using served population and average finished water demand excluding the bulk usage. This factor varied from 129 to 139 gpcd between 2008 and 2012 with an average value of 136 gpcd. A conservative per capita demand factor of 140 gpcd was selected to calculate the projected water demand. Calculations for the per capita finished water demand factor are included in Table 2.3.

Table 2.3 Per Capita Finished Water Demand Factor
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Parameter	Year				
	2008(1)	**2009**	**2010**	**2011**	**2012**
Glades Region Population	34,192	34,219	34,262	34,274	34,274
Total Finished Water (MG)	874	1,703	1,785	1,945	1,954
Average Daily Finished Water (mgd)	4.75	4.67	4.89	5.33	5.34
Bulk User Demand (mgd)			0.47	0.58	0.58
Average Daily Demand Excluding Bulk (mgd)	4.75	4.67	4.42	4.75	4.76
Per Capita Demand (gpcd)	139	136	129	139	139
Average gpcd	136				
Selected gpcd for Demand Projections	**140**				

Notes:
(1) 2008 total finished water data range is for July through December.

Finished water demand projections were calculated by multiplying the population projections listed in Table 2.2 by the 140 gpcd factor, plus the addition of bulk user demand. Finished water demand projections are presented in Section 2.5.

2.3.3 Consideration of Bulk Users and Residents Using Private Wells

Non-residential users account for 49 percent of the total finished water purchased, as indicated in the billing records for the last three fiscal years. The largest non-residential users include the correctional institution and commercial facilities listed in Table 2.4, which consume approximately 10 percent of the total annual water produced. Over the last three years, these four large users purchased approximately 0.56 mgd on an average annual basis. Based on feedback from PBCWUD staff, it is assumed that the demands for these users will remain constant in the future. The Glades Correctional Institution will be relocated to the City of South Bay; therefore, future demands from this user were reallocated to the new location.

An additional demand of 0.59 mgd is added to the demand projection calculated based on the population and per capita demand factor analysis to account for large users. The large user A Duda and Sons has shown a steady water consumption increase over the last three years; therefore, fiscal year 2012 annual average demand of 0.11 mgd is applied in the model for this user as indicated in Table 2.4. The average demand for the last three years is entered in the model for the other three large users. Modeling scenarios include the base bulk user demand of 0.59 mgd.

Table 2.4 Bulk User Demands
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Annual Average (mgd)				
Bulk User	**FY 2010**	**FY 2011**	**FY 2012**	**Average**	**Modeled Demand**
Geo Group Inc.	0.22	0.24	0.23	0.23	0.23
Glades Correctional Institution	0.13	0.16	0.15	0.15	0.15
Glass Ratner Rcvr For Belle Glade	0.07	0.11	0.12	0.10	0.10
A Duda And Sons	0.07	0.08	0.11	0.08	0.11
Total	**0.48**	**0.59**	**0.60**	**0.56**	**0.59**

As previously noted, approximately 2 percent of the population within the Glades Region is not connected to the potable water distribution system and instead use private water wells. It is assumed that these customers will not convert to the water distribution system; therefore, the total population is not adjusted in future scenarios to reflect customer conversion from wells.

2.4 PEAKING FACTORS

The following sections summarize the water system peaking factors used in the modeling and master planning analyses. Description and illustration of the data analysis compiled to develop the monthly, daily, and hourly peaking factors for the water system and WTP are provided. Data analysis omits information of the finished water production recorded during the months of April, May, and June 2008 due start-up activities at WTP No. 11.

2.4.1 Monthly Peaking Factors

Historical water production data since July 2008 was analyzed to determine average monthly peaking factors in the water system, which illustrate general trends in water use throughout the year. The monthly peaking factors for the past five years are shown in Table 2.5, as well as the 5-year minimum, maximum, and average for each month. The highest monthly peaking factor normally ranges from 1.03 to 1.16 times the average demand. The lowest monthly peaking factor varies within the range of 0.79 to 1.06 of the average monthly demand.

Table 2.5 Historical Monthly Peaking Factors, 2008-2012
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

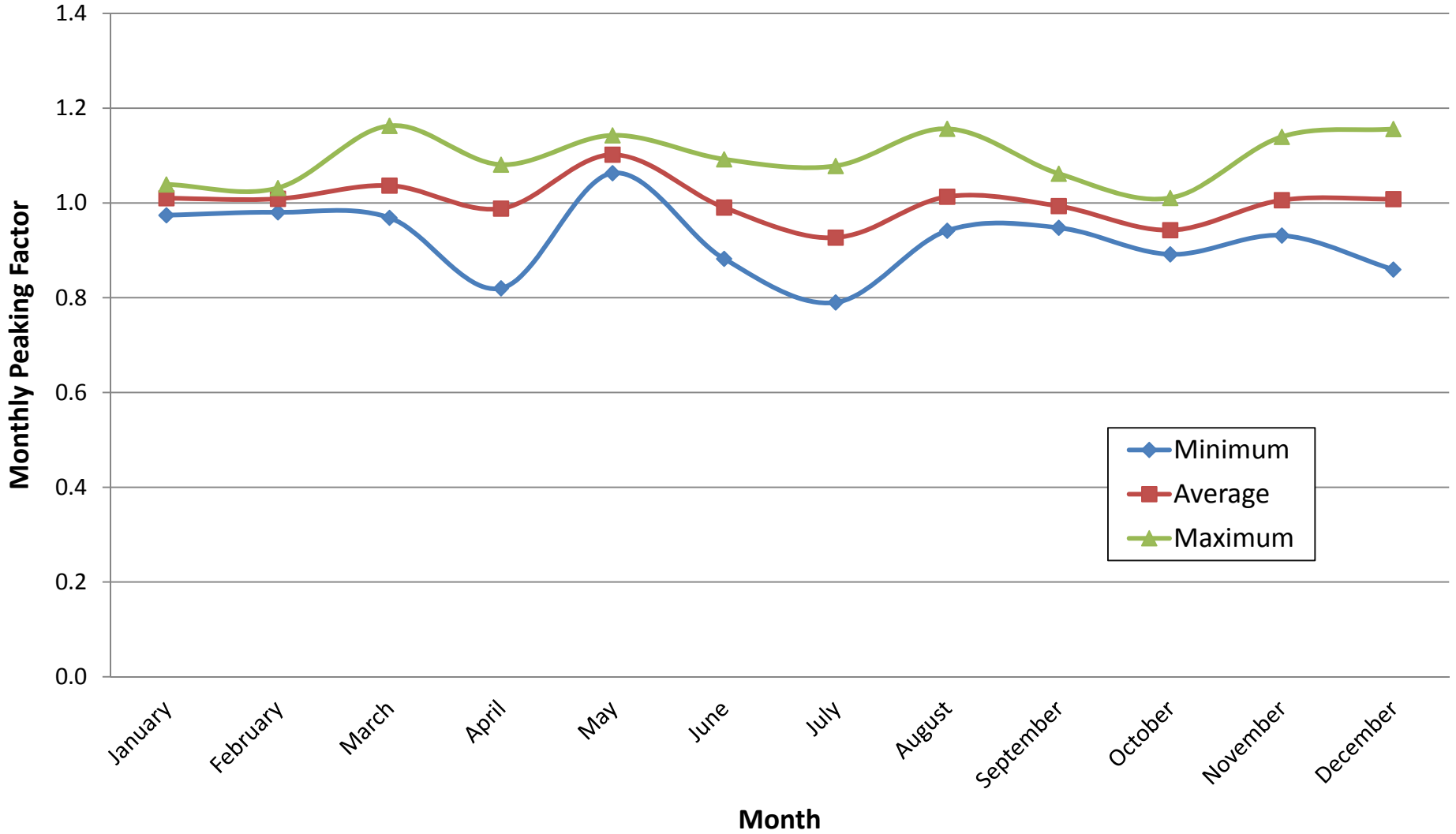
Month	Year					Average	Min.	Max.
	2008	2009	2010	2011	2012			
January		0.97	1.02	1.04	1.01	1.01	0.97	1.04
February		1.02	1.01	1.03	0.98	1.01	0.98	1.03
March		1.16	0.97	1.01	1.00	1.04	0.97	1.16
April		0.82	0.97	1.08	1.08	0.99	0.82	1.08
May		1.11	1.14	1.06	1.09	1.10	1.06	1.14
June		0.88	0.95	1.03	1.09	0.99	0.88	1.09
July	1.08	0.79	0.84	0.91	1.02	0.93	0.79	1.08
August	0.98	1.16	0.98	0.94	1.01	1.01	0.94	1.16
September	1.06	1.02	0.98	0.95	0.95	0.99	0.95	1.06
October	0.89	1.01	0.96	0.95	0.90	0.94	0.89	1.01
November	1.14	0.97	1.00	0.98	0.93	1.01	0.93	1.14
December	0.86	1.07	1.16	1.01	0.95	1.01	0.86	1.16

Monthly variations in the water demand from July 2008 to December 2012 indicate that the demand in general does not correlate to dry or wet seasons. Irrigation does

not appear to influence water demand patterns. Instead it indicates that water usage is mainly driven by residential indoor usage and facilities in the area such as the prison and other correctional institutes.

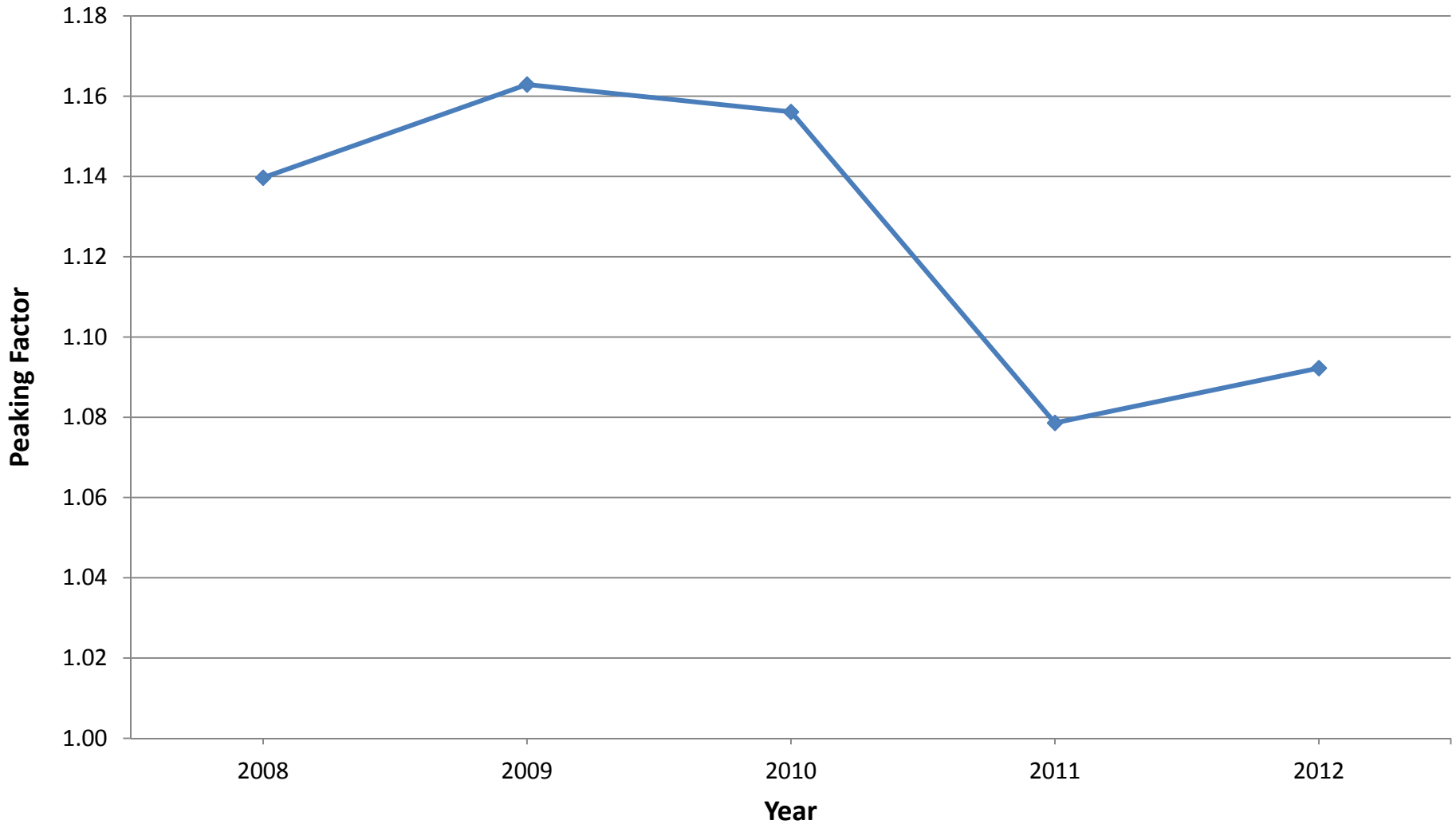
The typical seasonal finished water demand pattern is illustrated by the average monthly peaking factors shown in Figure 2.4. Figure 2.4 also illustrates the maximum and minimum monthly peaking factors that have occurred in each month since WTP No. 11 has been in service.

Figure 2.5 shows the annual maximum month peaking factor from July 2008 to December 2012. Maximum month demand is defined as the average daily demand during the highest demand month throughout a year. As indicated in Table 2.5, the months of March, May, August, November, and December show the highest maximum monthly peaking factor, ranging between 1.14 and 1.16.



HISTORICAL MONTHLY PEAKING FACTORS, 2008-2012

FIGURE 2.4
PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN



MAXIMUM MONTH PEAKING FACTORS, 2008-2012

FIGURE 2.5
PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

2.4.2 Maximum Day Peaking Factors

Finished water data production from July 2008 to December 2012 was used to calculate the maximum day peaking factor. Data prior to July 2008 was not included due to WTP No. 11 transitioning into service. Table 2.6 summarizes the annual average demand, maximum day demand, and maximum day peaking factor by year. Average annual demand and maximum day demand show a pattern that is somewhat inversely proportional; while the average demand increases, the maximum demand day decreases, as shown in Figure 2.6. This trend indicates that although water consumption is increasing in the region, maximum demand days will have a lower peaking factor than seen in the past.

An average maximum day peaking factor of 1.36 was observed during the period of record. As shown in Figure 2.7, a downward trend in the maximum day peaking factor has occurred since 2009. While the maxium day peaking factor has decreased, a peaking factor of previous magnitude may be seen again. Therefore, a maximum day peaking factor of 1.40 was selected for predicting future maximum day demands.

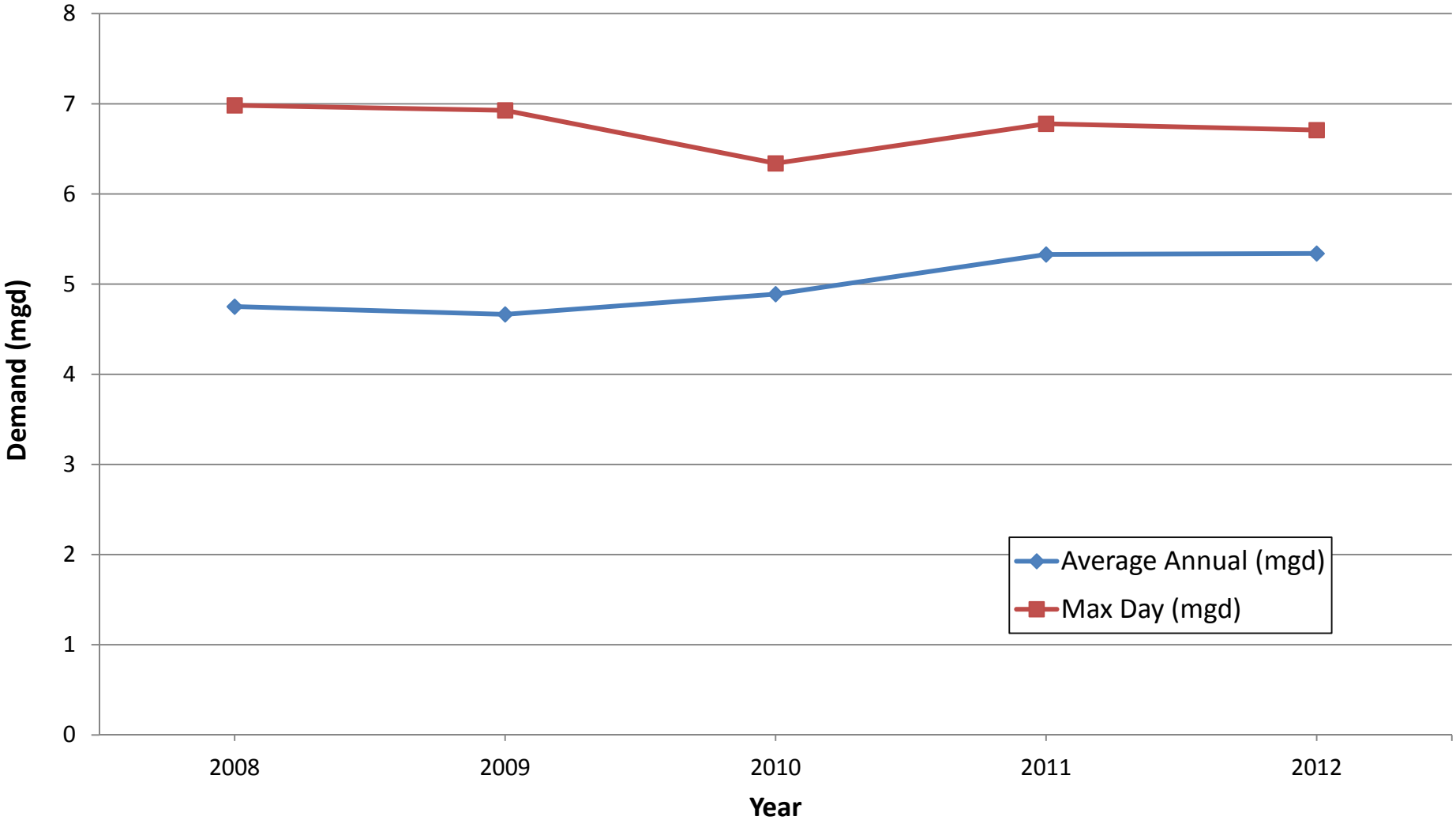
Table 2.6 Maximum Day Peaking Factors, 2008-2012
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Year	Average Annual (mgd)	Max Day (mgd)	Max Day PF
2008[(1)]	4.75	6.98	1.47
2009	4.67	6.93	1.49
2010	4.89	6.34	1.30
2011	5.33	6.78	1.27
2012	5.34	6.71	1.26
Average	**5.00**	**6.75**	**1.36**
Average from 2009 to 2012	**4.96**	**6.68**	**1.33**
Maximum from 2009 to 2012	**5.33**	**6.93**	**1.49**

Notes:
(1) 2008 data range is for July through December.

2.4.3 Diurnal Curves and Peak Hour Factors for Each City

Diurnal curves were developed for one complete year (January 2011 to December 2011) using hourly data recorded by the supervisory control and automated data acquisition (SCADA) system.

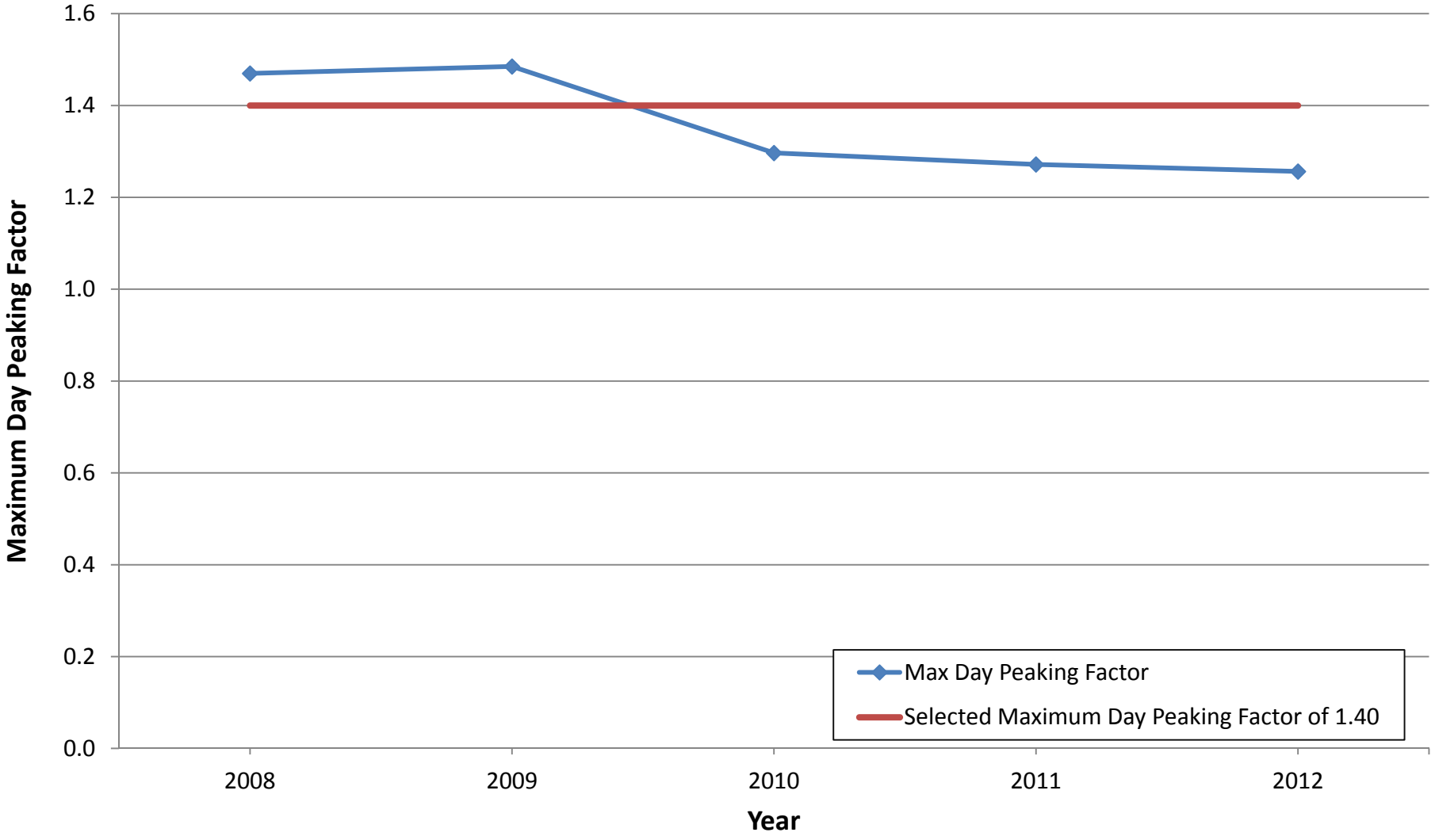


AVERAGE ANNUAL AND MAXIMUM DAY DEMAND, 2008-2012

FIGURE 2.6

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



MAXIMUM DAY PEAKING FACTORS, 2008-2012

FIGURE 2.7
PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

Annual average diurnal curves were developed for each city. Diurnal curves were developed to establish the demand pattern of each city independently using flow data and water level fluctuations at each tank. The average diurnal demand curves for each city are assigned to locations within the corresponding city in the model. Nodes within the unincorporated area were assigned the diurnal curve of the nearest city, as indicated in Appendix B

Evaluation of the total demand at each hour time step in the historical data was used to develop the peak hour peaking factor for each city using the 99th percentile of all hourly demand values divided by the average annual demand for 2011. This methodology allows for removal of outlier records caused by inconsistencies in the SCADA data such as zero meter flow readings and/or dramatic tank level changes. Table 2.7 summarizes the 99th percentile of all hourly peaking factors.

Table 2.7 Summary of Peak Hour Peaking Factors by City
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Parameter	Belle Glade	South Bay	Pahokee
2011 Annual Average Demand (mgd)	3.53	0.63	1.15
99th Percentile Hourly Peaking Factor	1.76	2.87	1.56

As shown in Table 2.7, South Bay has the highest hourly peaking factor among the three cities. Close inspection of the hourly demands for the three cities show that South Bay and Pahokee had hourly demands that exceeded 2 mgd at times. Belle Glade occasionally exceeded 9 mgd. These large demands occur for a short duration and are suspected to be attributed to large bulk users such as correctional institutions, some of which have their own on-site storage tanks, which can be filled quickly causing demand spikes. These occasional high hourly demands cause high peak hour factors, which are compounded by the low annual average demand, especially in the City of South Bay.

2.4.3.1 Belle Glade Diurnal Demand Curve

Hourly average demand for the City of Belle Glade was calculated by deducting the tank level fluctuations at the Belle Glade Repump Station and Belle Glade Old WTP facilities and total metered consumption for Pahokee and South Bay from the total finished potable water production at WTP No. 11. The Belle Glade diurnal demand curve shown in Figure 2.8 illustrates the average hourly water consumption fluctuation in this city. The pattern identifies a constant water demand of at least 1.08 times the average for a period of approximately 13 hours from 9:00 a.m. to 10:00 p.m. During this period, the maximum peaking factor seen is 1.11, occurring

at 3:00 p.m. The lowest peaking factor of 0.77 is observed at 3:00 a.m. The Belle Glade diurnal demand curve is applied to all junctions in the model except for Junction ID J4177, representing bulk user A Duda & Sons, which was assigned a unique diurnal curve to represent water usage from only 4 a.m. to 4 p.m.

2.4.3.2 South Bay Diurnal Demand Curve

The diurnal demand curve for the City of South Bay was developed using the master meter flow and South Bay Repump Station tank level data which is provided by SCADA, and is recorded hourly. Figure 2.8 illustrates three distinct demand peaks that occur at 9:00 a.m., 2:00 p.m., and 7:00 p.m. The less pronounced peaks of 1.2 and 1.25 times the average occur at 9:00 a.m. and 2:00 p.m., respectively. The highest peak of 1.3 times the average is observed at 7:00 p.m., which is followed by a water demand decrease. The minimum flow is reached at 5:00 a.m. and corresponds to 0.57 times the average.

2.4.3.3 Pahokee Diurnal Demand Curve

The demand for Pahokee was established using the master meter flow and water level variations at the three tanks in Pahokee. As observed in Figure 2.8, the diurnal demand curve for Pahokee shows a constant flow rate between 12:00 p.m. and 9:00 p.m., when the flow ratio is 1.12 times the average. The maximum observed peaking factor of 1.13 is observed twice at 3:00 and 7:00 p.m. At 2:00 a.m., the minimum demand experienced in this system is approximately 76 percent of the average hourly flow.

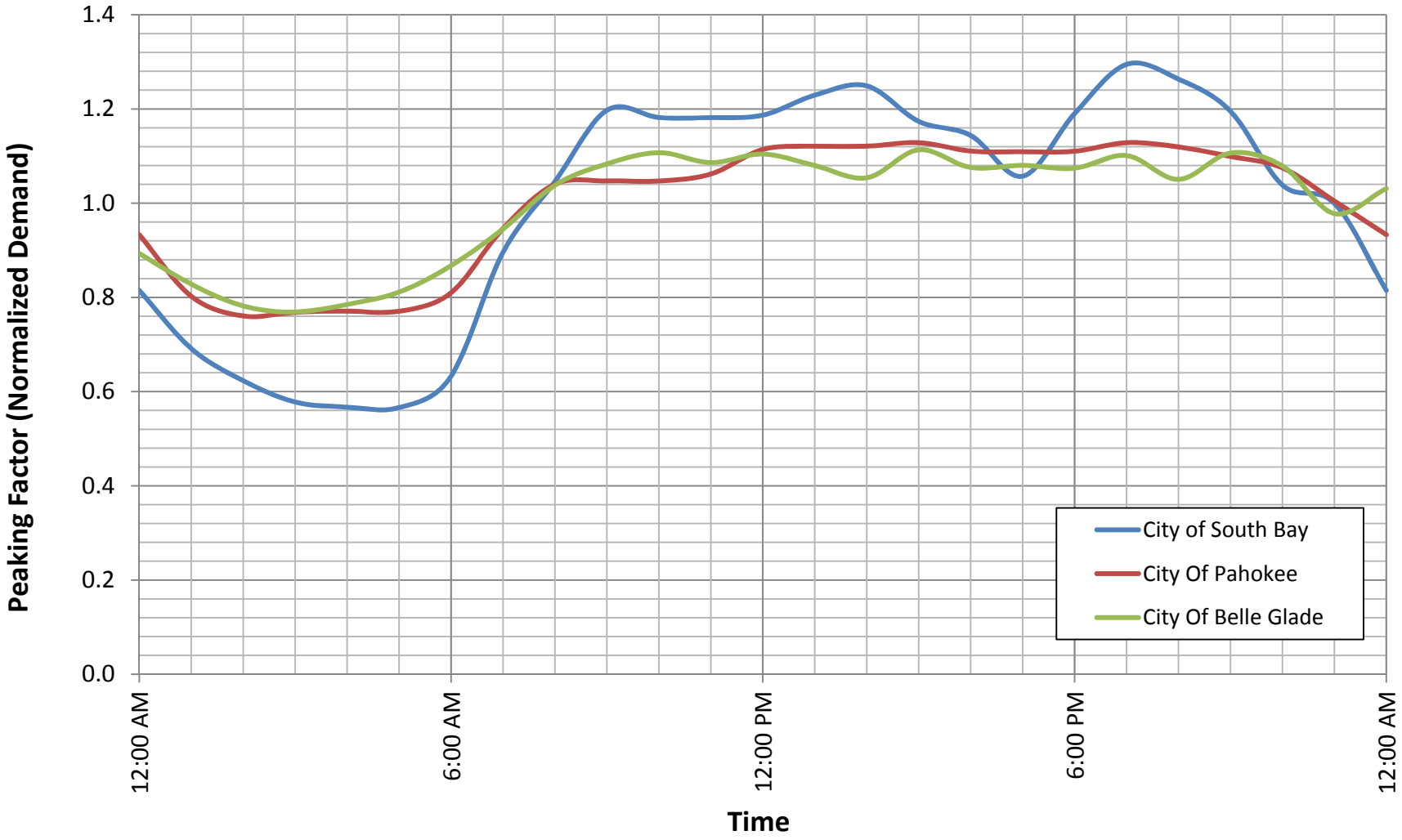
2.4.4 Summary of Peaking Factors

Finished water demand peaking factors included in the model were selected based on the analyses presented in Sections 2.2 through 2.4. Table 2.8 summarizes the finished water demand peaking factors that were used in developing the WMP.

Table 2.8 Finished Water Demand Peaking Factors by City
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Demand Condition	Belle Glade	South Bay	Pahokee
Annual Average	1.0	1.0	1.0
Maximum Day	1.4	1.4	1.4
Diurnal Peak (within a day)	1.76	2.87	1.56
Peak Hour(1)	2.46	4.02	2.18

Notes:
(1) Peak hour demand factor is equal to the product of the maximum day and diurnal peak.



ANNUAL AVERAGE DIURNAL CURVES
JANUARY 2011 TO DECEMBER 2011

FIGURE 2.8

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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2.5 FINISHED WATER DEMAND PROJECTIONS

Annual average, maximum day, and peak hour finished water demand projections were developed for years 2013, 2015, 2025, and 2035 which correspond to roughly 2-year, 12-year, and 22-year planning periods. The demand projections are used in the model and were developed using TAZs population projections and estimated bulk users water consumption established in Section 2.3. The following sections provide demand projection results for each finished water usage demand condition.

2.5.1 Average Annual Demand Projections

Average daily demand projections are used to determine the demand on an annual average basis. The average annual demand is calculated using the population projections and per capita demand factor of 140 gpcd plus the addition of bulk user demands. The average daily demand for 2013 is calculated at 5.30 mgd and can be expected to increase to approximately 8.04 mgd by 2035.

2.5.2 Maximum Day Demand Projections

Maximum day demands are utilized for sizing treatment facilities and evaluating storage capacity. Historical daily finished water production data from 2008 to 2012 was evaluated to select an overall maximum day peaking factor of 1.40, as discussed in Section 2.4.2.

Maximum day demands were estimated by applying the 1.40 peaking factor to projected annual average day demands, excluding bulk user demands to which the peaking factor is not applied since bulk user demands typically do not follow the same usage patterns as other customers. The maximum day demand projected for the year of 2035 is estimated at 11.02 mgd.

2.5.3 Peak Hour Demand Projections

Modeling analyses consider peak hour demands to determine the ability of the pump stations and distribution system to meet peak demand conditions. For modeling purposes, the peak hour demand factor was calculated by applying the maximum day peaking factor of 1.40 by the peak hour diurnal factor for each city as shown in Table 2.7. This peaking factor is applied to annual average demands in the model in a steady-state scenario to simulate the highest anticipated demand condition (peak hour) in the distribution system for each city. The 2025 and 2035 peak hour demand for the unincorporated TAZs containing the Inland Logistics Center (ILC) was calculated using the peak hour factor for the City of Belle Glade.

The range of peak hour demands for each city based on the evaluated methodologies is provided in Table 2.9.

2.5.4 Summary of Selected WMP Finished Water Demand Projections

Table 2.9 summarizes the finished water demand projections that were used for the WMP analyses. The annual average demand includes the estimated bulk usage consumption of 0.59 mgd as described in Section 2.3.3. These demands are also illustrated in Figure 2.9.

Table 2.9 Finished Water Demands Projections
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

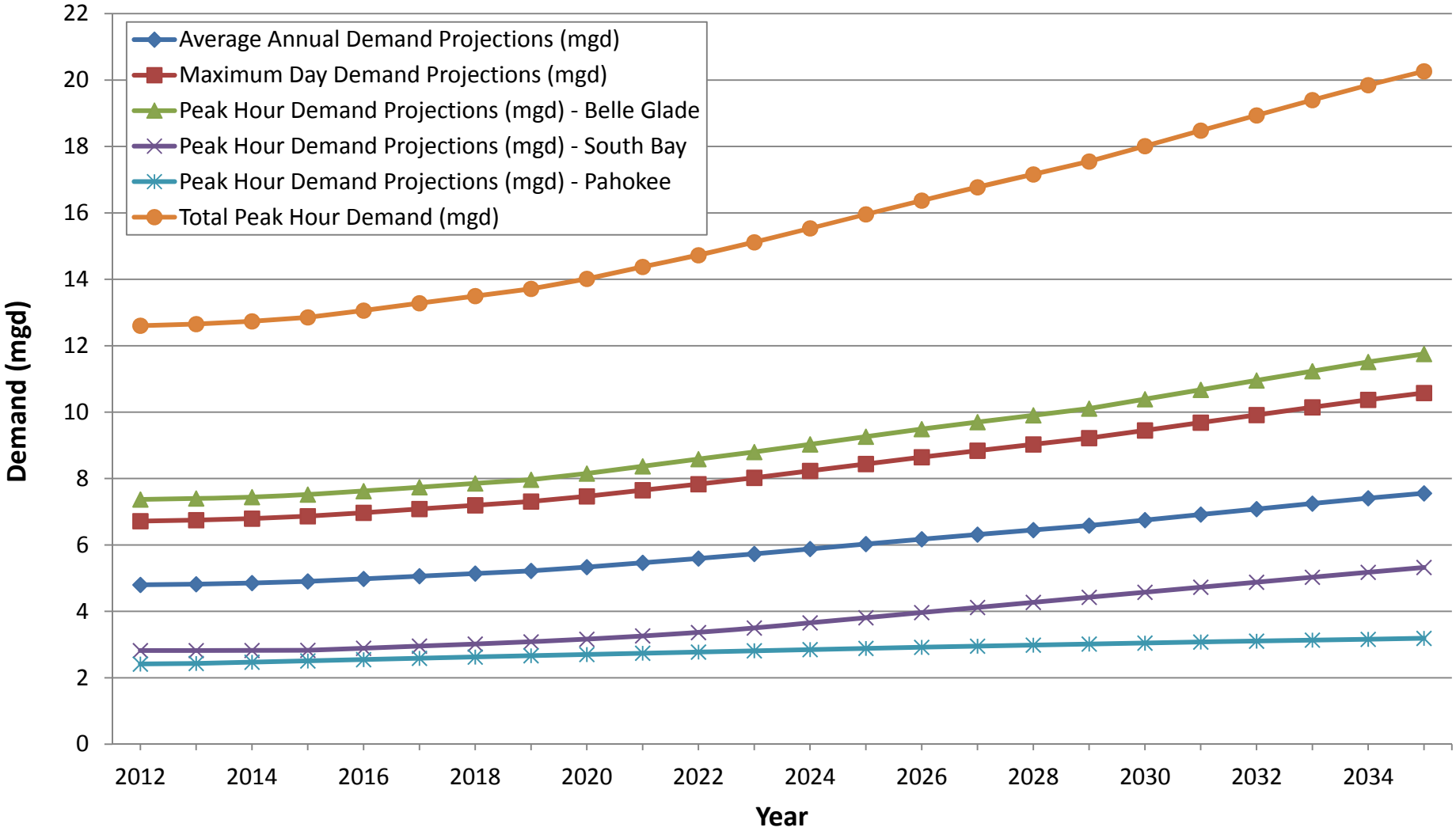
Year	Glades Region Population	Annual Average (mgd)	Max Day (mgd)	Peak Hour (mgd)[1]			
				Belle Glade	South Bay	Pahokee	Total
2013	33,663	5.30	7.18	*7.61*	*2.90*	*2.41*	12.92
2015	34,266	5.39	7.32	*7.60*	*3.05*	*2.49*	13.15
2025	42,278	6.51	8.89	*9.34*	*3.89*	*2.86*	16.10
2035	53,163	8.04	11.02	*11.84*	*5.06*	*3.16*	20.06

Notes:
(1) Peak hour flow is determined using the area assigned to each city, as shown in Appendix B.

2.6 PERFORMANCE CRITERIA

The purpose of this section is to define criteria, or standards of measurement, for evaluating the performance and design of the water system. Comparison of the system's capabilities against these performance and design criteria provides the mechanism for identifying existing or future deficiencies and needs, and serves as a guide for capital improvement projects, including budget planning. The performance criteria are based on applicable regulations such as the Florida Administrative Code (FAC), 10 State Standards, the County's Uniform Policies and Procedures (UPAP) Manual, commonly accepted engineering standards, and input from PBCWUD staff.

The following sections discuss the performance criteria that were used to evaluate the water distribution system. The findings of these evaluations and the associated recommended improvements to the system that result are discussed in Chapters 5 and 6.



WATER DEMAND PROJECTIONS FOR HYDRAULIC MODELING AND WMP EVALUATIONS

FIGURE 2.9

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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2.6.1 Background

As new infrastructure is planned and analyzed with the hydraulic model, standards of measurement accepted by PBCWUD are necessary to evaluate the adequacy of the infrastructure. These standards of measurement are the performance criteria described in this section.

Performance criteria covers the following areas:

- Water system reliability to provide a level of assurance that the infrastructure in the distribution system can deliver water even when some facilities or pipelines may not be in service.
- System operational requirements to provide a level of assurance that water can be delivered reliably under fire flow, high demand, or other extreme or unusual operating conditions.

System operational requirements refer to the level of service provided by a utility to the customer. Levels of service include many parameters such as facility capacity, maximum and minimum pressures, maximum flow velocities, and provisions for emergency conditions. Adequate pressure is usually defined in terms of a minimum pressure under certain demand conditions, such as peak hour or fire flow. Adequate fire protection refers to providing adequate flow to meet firefighting demand. The water system is considered adequate when system demand conditions are met while meeting system performance criteria such as system pressure, pipeline velocity, and pipeline headloss.

2.6.2 Transmission and Distribution Mains

Distributing water to the consumer requires a system capable of meeting instantaneous demands that vary with the time of day and season of year. Transmission and distribution mains must be able to meet instantaneous peak demands. Therefore, they are sized for the greater of the following two demand conditions: maximum day demand plus fire flow or peak hour demand.

The following pressure criteria are used to assess the adequacy of the water distribution system under these two demand conditions:

- Peak Hour Demand: Pressures must be greater than 50 pounds per square inch (psi) and less than 80 psi.

- Maximum Day Demand plus Fire Flow: A minimum of 20 psi at the point of the maximum fire draft.

In addition to the pressure criteria in the distribution system listed above, pipelines must meet the following velocity and headloss criteria:

Velocity:

- Velocity less than or equal to 7 feet per second (fps) under maximum day demand conditions.
- Velocity less than 8 fps under peak hour demand conditions.
- Velocity less than 10 fps under fire flow conditions.

Headloss:

- Under maximum day demand conditions: Headloss less than 5.5 feet per 1,000 feet for pipes 24 inches in diameter or larger.
- Under peak hour demand conditions: Headloss less than 7.5 feet per 1,000 feet for pipes 24 inches in diameter or larger.
- Headloss less than 10 feet per 1,000 feet for pipes with diameter less than 24 inches for both peak hour and maximum day demand conditions.

2.6.3 Fire Flow

Fire flow requirements are usually defined by local fire departments, insurance requirements, or local ordinances. Minimum required fire flow rates and flow durations are specified in the Florida Building Code for building areas according to construction type. It is assumed that a major fire will not occur in the peak hour since the chance of this happening is minimal. It is slightly more likely that a fire will occur at the same time as the maximum day demand. Consequently, this demand condition will be used for modeling fire flow events.

Fire flow requirements are specified in the National Fire Prevention Association (NFPA) Fire Code, Florida 2012 Edition, Section 18.4.5, “Fire Flow Requirements for Buildings,” and by the Palm Beach County Fire Department. The fire flow requirement for residential land use is 1,000 gpm plus domestic demand at a residual pressure of 20 psi, and the selected criterion for commercial areas is 1,500 gpm at a residual pressure no less than 20 psi. To assess the adequacy of the water system with respect to the maximum day demand plus fire allowance, fire

flows of 1,000 and 1,500 gpm were added to junctions located in residential and commercial areas, respectively, in the model.

2.6.4 Storage Facilities

The principal function of storage is to provide reserve supply for: 1) operational equalization, 2) fire reserve, and 3) emergency needs. Because production facilities are typically designed to operate at a steady rate over an extended period of time, storage tanks serve to accommodate fluctuating demands. Operational storage is directly related to the amount of water necessary to meet peak demands. The intent of operational storage is to provide the difference in quantity between the peak demands and the system's reliable available supply. The volume of water allocated for emergency use can be selected based on the historical record of emergencies experienced; the amount of time that is expected to occur before a hypothetical emergency can be corrected; and the amount of treatment, storage, and pumping capacity redundancy in the system.

Factors included in designing storage tank capacity are daily demand fluctuations, fire demand, and emergency reserve storage. Storage facilities should be designed and operated to meet these conditions, while achieving turnover to minimize water quality degradation.

2.6.4.1 Storage for Diurnal Demand Fluctuations (Operational Storage)

Operational storage is the amount of desirable stored water in a system to regulate fluctuations in demand so that extreme variations will not be imposed on the sources of supply. With operational storage, system pressures are improved and stabilized to better serve customers throughout the service area. Operational storage is commonly estimated between 25 and 50 percent of the maximum day demand.

According to FAC Rule 62-555.320(19), the total useful finished water storage capacity (excluding any storage capacity for fire protection) must at least equal 25 percent of a system's maximum day water demand. A volume less than described is acceptable if the system can demonstrate that the total useful finished water storage capacity (excluding any storage capacity for fire protection) is sufficient for 1) operational equalization, and 2) meeting the water system's peak hour demand for four consecutive hours.

For operational storage volume planning, a value of 25 percent of maximum day demand is used for evaluations.

2.6.4.2 Storage for Fire Demand

Fire storage is the amount of water required when the capacity of the production facilities is insufficient to meet the necessary maximum day demand plus fire flow demands for a particular duration of time. The fire flow duration for determining storage was based on an assumed 4-hour fire duration at the commercial fire flow rate of 1,500 gpm, which results in a fire storage reserve of 0.36 MG.

In the past, population also has been used to estimate recommended fire storage. Fire demand rates and storage volumes are determined using criteria established by the American Insurance Association (AIA) according to the following equation:

$$G = 1,020\sqrt{P}\left(1 - 0.01\sqrt{P}\right)$$

Where:

G = fire demand rate, gal/min

P = population in thousands

In contrast to the minimum requirement of 0.36 MG for fire storage reserve, this equation is based on population, which increases over time. While this equation was used frequently in the past to size fire storage, many utilities are moving away from this approach since the international building code revised its fire flow requirements to include sprinkler systems. However, it can be used for comparison purposes and to provide a conservative guideline. Table 2.10 compares the County's 0.36 MG requirement with calculations for determining fire protection storage over time based on AIA guidelines using the 4-hour fire duration.

Table 2.10 Required Fire Flow and Fire Reserve Storage
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Planning Year	Population	Fire Flow[(1)] (gal/min)	Duration (hr)	AIA Fire Reserve Storage[(1)] (MG)	Minimum Fire Reserve Storage[(2)] (MG)
2013	33,663	5,575	4	1.34	0.36
2015	34,266	5,621	4	1.35	0.36
2025	42,278	6,201	4	1.49	0.36
2035	53,163	6,895	4	1.65	0.36

Notes:
(1) Recommended fire storage based on American Insurance Association guidelines.
(2) Minimum fire storage requirement based on a 4-hour fire and a commercial area minimum fire flow of 1,500 gpm.

As shown in Table 2.10, the County's minimum requirement is less than the storage reserve recommended by AIA. Although the WMP and model analyses are based on the County's minimum requirement of 0.36 MG, an evaluation in Chapter 7 is geared towards presenting alternatives in which the Region can also meet the higher, more conservative storage volumes recommended by AIA.

2.6.4.3 Storage for Emergency Reserve

Emergency storage capacity is an additional volume of water that is held in storage tanks to meet various emergency conditions, such as facility outages, pipeline failures, pump failures, or natural disasters such hurricanes. The amount of emergency storage that a utility should plan for is largely based on professional judgment and is influenced by a number of factors such as power outage history, line break frequency, and overall supply redundancy.

Typical emergency storage for a system with a single pump station should be equivalent of two hours of the peak system demand (Qasim, et. al, 2000). Systems with more than one source theoretically would need less emergency storage; however, to maintain a conservative volume of storage, this criterion will be used for WMP purposes. During the past year, a two-hour duration of the peak demand flow rate was approximately equal to 10 percent of the maximum day demand. Therefore, required storage volumes will include a volume of 10 percent of maximum day demand for emergency reserve.

2.6.5 Pump Stations

Usually pumping stations are the most critical components in a distribution system with respect to meeting reliability and redundancy criteria because these facilities are subject to disruptions such as power outages, mechanical failures, and line breaks. Pump stations should be designed based on the firm capacity that can be consistently provided with the largest pump out of service. The capacity of a pump station combined with the useful storage capacity should be sufficient to meet the pump station's service area peak hour water demand for at least four consecutive hours.

2.6.6 Performance Criteria Summary

Table 2.11 summarizes the selected performance criteria for the WMP. The model was used to determine if the existing pipe velocities and system pressures satisfy the selected performance criteria under each demand condition. Fire flow criteria was evaluated at junctions representing each existing fire hydrant.

Table 2.11 Water System Performance Criteria Summary Glades Region Water Master Plan Palm Beach County Water Utilities Department	
Description/Demand Condition	**Criteria**
System Pressure Criteria:	
Average Annual, Max Day, and Peak Hour	≥ 50 psi and ≤ 80 psi
Fire Flow Condition	≥ 20 psi at flowing hydrant
Pipeline Headloss Criteria:	
Maximum Day	
Pipe Diameter < 24”	10 ft per 1,000 ft
Pipe Diameter ≥ 24”	5.5 ft per 1,000 ft
Peak Hour	
Pipe Diameter < 24”	10 ft per 1,000 ft
Pipe Diameter ≥ 24”	7.5 ft per 1,000 ft
Pipeline Velocity Criteria:	
Average Annual and Maximum Day	≤ 7 fps
Peak Hour	≤ 8 fps
Fire Flow Condition	≤ 10 fps
Fire Flow Criteria:	
Hydrants in Residential Areas	1,000 gpm
Hydrants in Commercial Areas	1,500 gpm
Storage Criteria:	
Operational	25% of maximum day demand
Fire	0.36 MG based on 4-hour fire duration with 1,500 gpm fire flow
Emergency	10% of maximum day demand
Repump Station Criteria:	
Storage	Volume equal to peak hour demand for 4 consecutive hours
Firm Capacity	Capacity with largest pump out of service

Chapter 3
EXISTING WATER SYSTEM ASSETS

3.1 INTRODUCTION

This chapter provides an inventory and description of major water system assets in the Glades Region including wellfields, the water treatment plant (WTP), storage tanks, and pump stations. Information regarding each asset was documented using current permits and history available from former operation by GUA. The primary objectives of Chapter 3 are to:

- Summarize the existing water infrastructure relative to water treatment, production, and distribution.
- Assess the current WTP capacity. An analysis of the ability to meet future demands based on the existing WTP capacity is presented in Chapter 7.

The following sections of Chapter 3 include:

- Section 3.2 - Water System Overview: Summarizes the water system including location, extension of service area, population, and major components.
- Section 3.3 - Wellfield: Describes the raw water supply, the reported raw water used, and the raw-to-finished water ratio.
- Section 3.4 - Water Treatment Plant: Presents a description of existing treatment processes at WTP No. 11, and current and projected capacity analyses.
- Section 3.5: Storage and Pumping Facilities: Describes the storage and repumping facilities located in the cities of Belle Glade, Pahokee, and South Bay, and explains their role in the transmission system.
- Section 3.6: Transmission System and Interconnects: Presents an overall pipeline inventory including interconnections between the three major cities of the Region.

3.2 WATER SYSTEM OVERVIEW

The County currently operates one water treatment plant, WTP No. 11 (formerly referred to as the Lake Region Plant), which serves the 44 square mile Glades Region service area. Figure 3.1 illustrates the Region's existing water supply network, wellfields, and the WTP.

Customers in the Glades Region include users from the cities of Belle Glade, Pahokee, and South Bay and few rural users that are located between the three urban centers. The approximate population served by the Glades Region water system in 2012 was 33,518. The current population served is estimated at 33,663.

3.3 WELLFIELD

SFWMD Water Use Permit (WUP) No. 50-06857-W provides a total annual raw water allocation of 3,443 million gallons (MG) from the Upper Floridan Aquifer. The raw water is extracted from a wellfield located near WTP No. 11 along State Road 715 north of Hooker Highway. The maximum monthly allocation shall not exceed 321.2 MG, which is equivalent to a daily average of 10.7 mgd. The past 5-year monthly average raw water usage at WTP No. 11 was 192.3 MG (6.41 mgd). This WUP is scheduled to expire in October 2025.

The wellfield consists of eight on-site wells. Seven wells were initially constructed and operated under Department of Health (DOH) permit modification No. 246527-014-WC, with an expiration date of April 2016. The eighth well was constructed after one of the first seven wells was found less likely to produce the expected water quality at all times. PBCWUD is in the process of constructing two more wells (PW-9 and PW-10) and will continue to evaluate the need for additional wells in the future. In May 2013, one of the wells (PW-5) was converted to a standby facility.

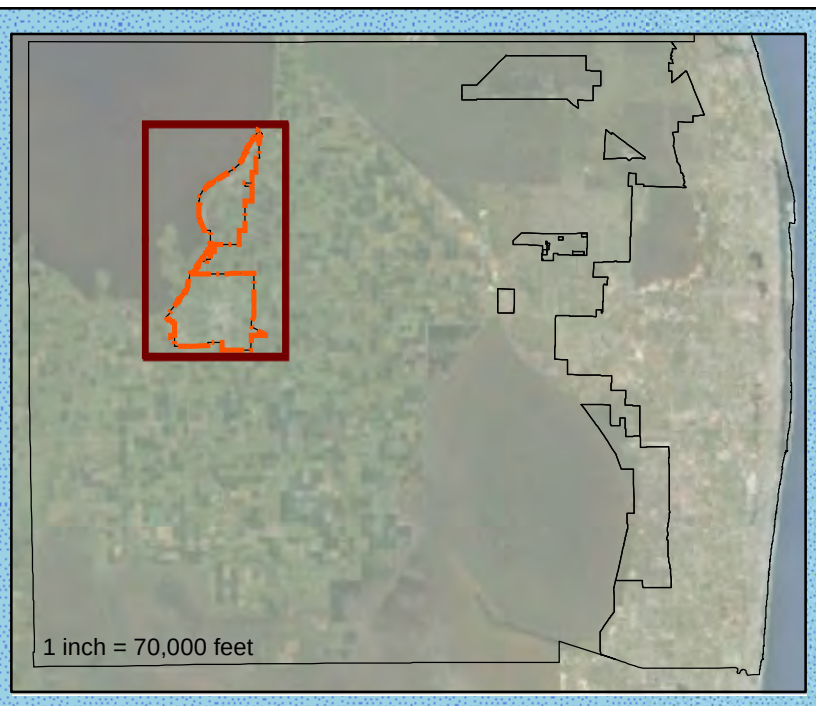
Each of the existing well pumps originally had a design capacity of 1,460 gpm. Recently, PBCWUD downgraded the well pumps from 150 hp to 60 hp to increase sustainability, which resulted in a decreased capacity of 900 gpm per well, which corresponds to a firm capacity of 9.072 mgd (allowing for one spare or out of service). After completion of PW-9 and PW-10, the wellfield will have a firm capacity of 7,200 gpm (10.37 mgd) with one well out of service.

Historical records show that the average raw water use since plant start up is 6.41 mgd, with a maximum month quantity of 9.2 mgd pumped in May 2010.

The raw water main consists of approximately 3,670 linear feet of 30-inch, 1,835 linear feet of 24-inch, 810 linear feet of 20-inch, 1,880 linear feet of 16-inch, and 990 linear feet of 12-inch HDPE pipe. This raw water main was initially permitted under DOH certification No. 264357-002-DS.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan



LAKE OKEECHOBEE

City of Pahokee

City of South Bay

City of Belle Glade

PAHOKEE 0.5 MG ELEVATED TANK
DSPK08

PAHOKEE 0.1 MG ELEVATED TANK
DSPK09

PAHOKEE 0.075 MG ELEVATED TANK
DSPK07

PAHOKEE 1.5 MG GST

PAHOKEE MASTER METER
DSPK04

TP-2

TP-1

PW-6

PW-5

PW-4

PW-3

MASTER METER WTP 11
DSBG01

LAKE REGION WATER TREATMENT PLANT 11
DSXX01

BELLE GLADE REPUMP STATION
DSBG10

BELLE GLADE OLD WTP
DSBG11

BELLE GLADE PIONEER PARK MASTER METER
DSBG05

SOUTH BAY WTP
DSSB13

SOUTH BAY REPUMP STATION
DSSB12

SOUTH BAY MASTER METER
DSSB06

Legend

Water Pipe Diameter (in)

- 2 - 12
- 16 - 20
- 24 - 30

Glades Region Facilities

- Elevated Storage Tank
- Ground Storage Tank
- Water Treatment Plant
- Wholesale Water Meter
- Raw Water Well
- City Boundary
- Glades Unincorporated Urban Service Area

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
Larrimore Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Belle Glade Rd
Section 20 Rd
State Road 15
Hooker Hwy
State Road 80
Curlee Rd
Sugar House Rd
NW Avenue L
Gator Blvd
N Main St
W Canal St S
E Canal St N
SW 5th St
SW 10th St
SE Avenue G
E 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway
SW 1st St
State Road 80
County Road 827A
County Road 880
Duda Rd

Carollo

Glades Region Water System Assets

Figure 3.1

N

0 2,750 5,500 Feet

3.4 WATER TREATMENT PLANT

PBCWUD operates WTP No. 11 to serve the combined needs of the cities of Belle Glade, Pahokee, and South Bay, as well as some unincorporated areas. The facility was initially permitted under Florida DOH permit No. 246527-001-WC in November 2005. The latest recorded permit extension/modification issued for the plant (246527-016-WC) will expire in January 2017.

The facility is located at 39700 Hooker Highway in Belle Glade, in Control Property No. 00-37-43-19-00-000-3050. It has a land use designation of INST (Institutional and Public Facility), and a zoning designation of PO (Public Ownership). An aerial photograph of WTP No. 11 is provided in Figure 3.2. WTP No. 11 was placed into service in April 2008.

3.4.1 Historical Production

Figure 3.3 illustrates historical finished water production at WTP No. 11. Figure 3.4 compares this trend versus the projected system-wide demands provided in Chapter 2. The average annual daily finished water production at WTP No. 11 has varied from 4.7 to 5.3 mgd over the past five years (see Figure 3.3), and the maximum day production ranged from 6.3 to 7.0 mgd over the same period. The raw to finished water ratio has ranged from 1.19 to 1.41 over the operating life of the plant, but has been stabilizing to an average of 1.21 during the last two years.

3.4.2 Process Description

This section summarizes design information for WTP No. 11. These summaries were developed from information documented from regulatory permit information.

WTP No. 11 uses a low pressure reverse osmosis (LPRO) process. Concentrate disposal is accomplished utilizing a deep well injection system, located on the site and permitted separately from the WTP. Finished water is stored in one 3.0 MG on-site ground storage tank.

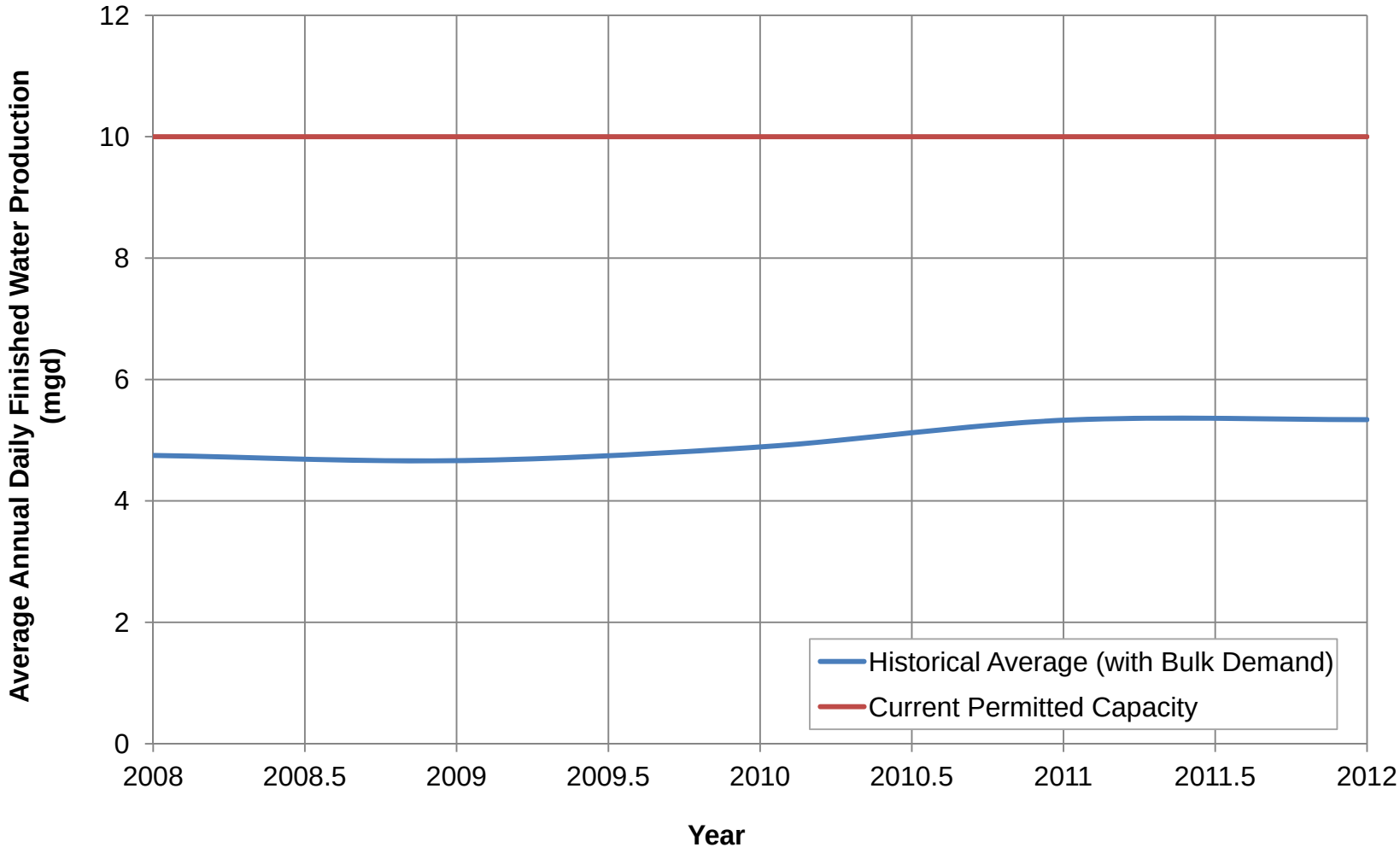
Figure 3.5 shows a process flow schematic of WTP No. 11. Table 3.1 presents a summary of key process design criteria for WTP No. 11. Since WTP No. 11 is relatively new, and because the treatment technology employed is considered a state-of-the-art process, only the overall capacity documentation and asset description identified in Table 3.1 were performed as part of this project. No condition assessments were included as part of this WMP effort.

AERIAL PHOTOGRAPH OF WTP NO. 11

FIGURE 3.2

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

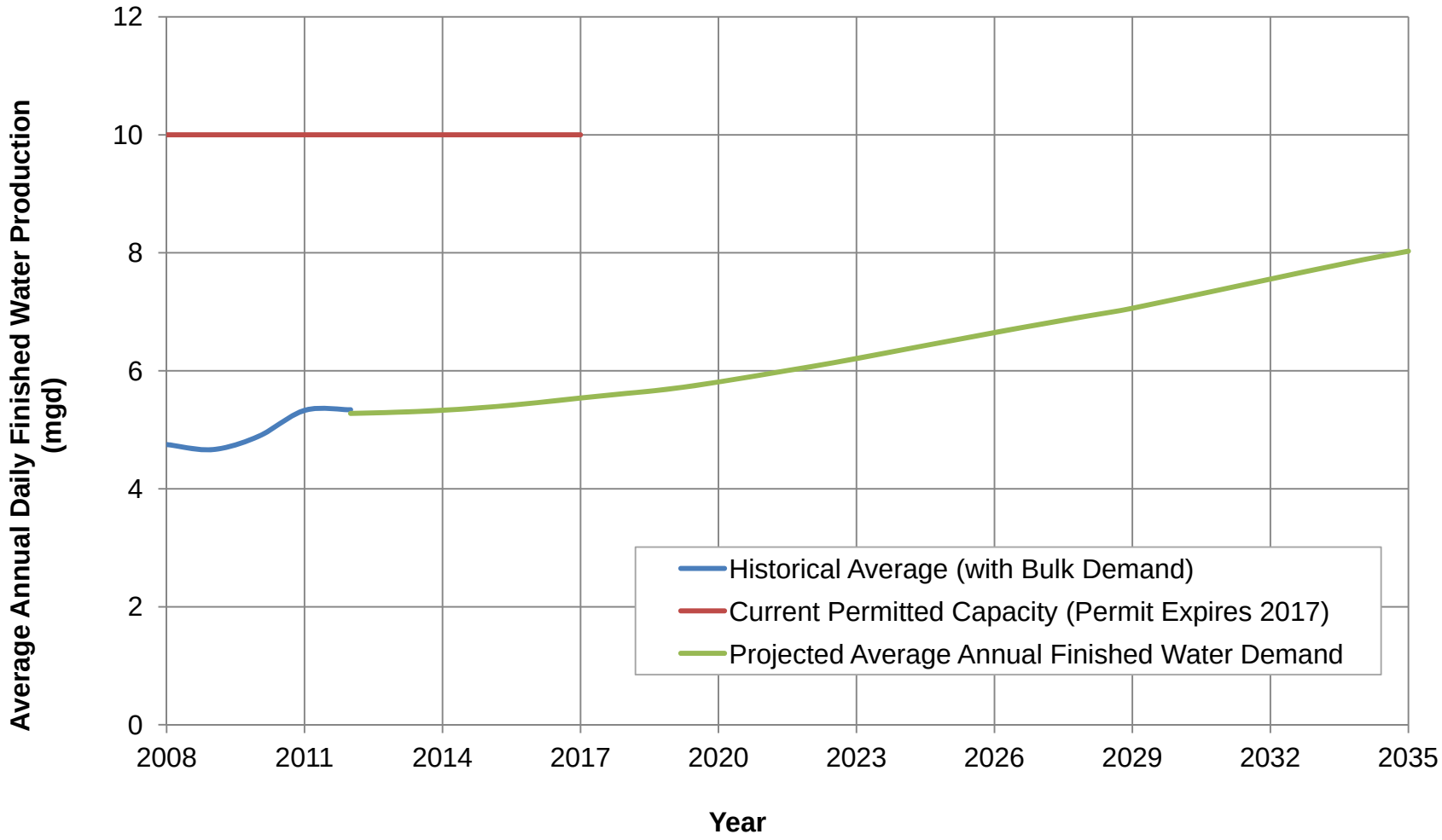
carollo



HISTORICAL ANNUAL FINISHED WATER PRODUCTION AT WTP No. 11

FIGURE 3.3

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

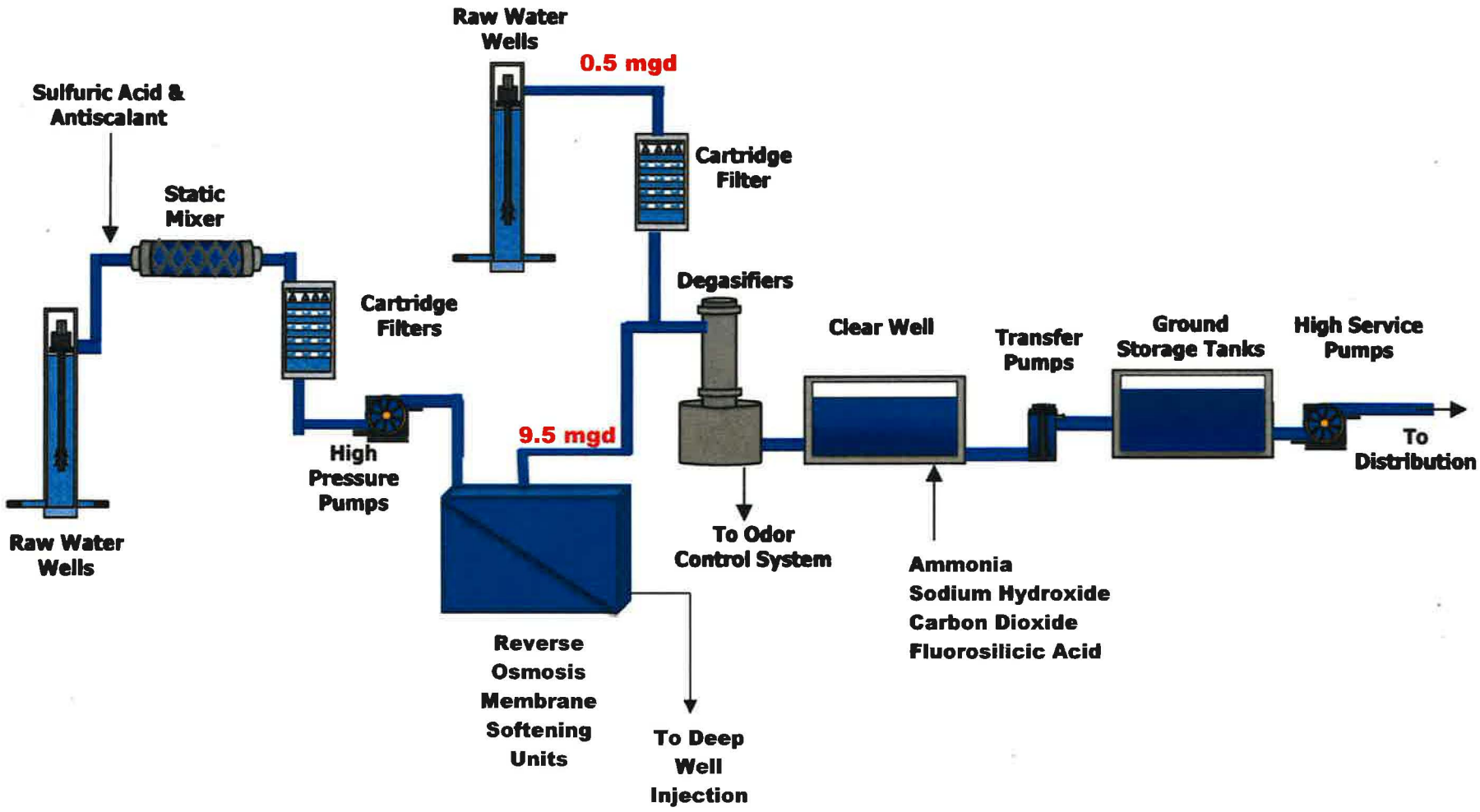


CURRENT AND PROJECTED AVERAGE ANNUAL FINISHED WATER PRODUCTION

FIGURE 3.4

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

carollo



WTP NO. 11 PROCESS FLOW SCHEMATIC

FIGURE 3.5

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

carollo

Table 3.1 Summary of WTP No. 11 Permitted and Operating Process Parameters Glades Region Water Master Plan Palm Beach County Water Utilities Department	
Parameter	**Value or Description**
Permitted and Operating Capacity	
Permitted Membrane Softening Capacity	9.5 mgd
Permitted Raw Water Bypass Capacity[1]	0.5 mgd
Total Production Permitted Capacity	10.0 mgd
Average Daily Production for the Past 5 Years	6.41 mgd
Average Raw/Total Finished Water Ratio of Past 5 Years	1.28
Raw Water Supply	
Raw Water Source	Upper Floridan Aquifer groundwater
Raw Water Supply	Network of 8 wells
Pretreatment	
Main Trains Cartridge Filters	
Number / Description of Cartridge Filters	Four / 5-micron
Element Number / Description	116 40-inch elements
Element Rated Capacity	2.99 gpm per 10-inch length
Raw Water Bypass Stream Cartridge Filters	
Number / Description of Cartridge Filters	One / 5-micron
Element Number / Description	176 40-inch elements
Element Rated Capacity	4.83 gpm per 10-inch length
Chemical Pretreatment	Scale inhibitor and sulfuric acid
Reverse Osmosis Membrane System	
Number of Trains	4
Rated Capacity	2.375 mgd each train, 9.5 mgd total
Skids Configuration	40 x 20 array
Design Flux (recalculated after array modification in 2012)	14.16 gpd/sf
Recovery Rate	80%
Membrane Feed Pumps Rated Point	2,100 gpm at 280 psi with VFDs
Membrane Cleaning System	Two 5,000-gal tanks One cleaning pump, 800 gpm at 35 psi
Degasification and Odor Control	
Degasifier Type	Packed tower
Number of Degasifiers and Diameter	Two 12-feet diameter
Degasifiers Design Loading Rate	30.7 gpm/sf
Degasifiers Blowers	Two active 40-HP, 13,900 cfm each One standby with equal rating
Number of Odor Control Scrubbers / Diameter	One 12-feet diameter
Scrubber Design Loading Rate	27,800 cfm
Scrubber Recirculation Pumps	One active, rated for 550 gpm One standby with equal rating
Disinfection and Post Treatment	
Clearwells	One
Clearwell Volume	91,436 gal
Minimum Chlorine Contact Time	15 minutes

Table 3.1 Summary of WTP No. 11 Permitted and Operating Process Parameters Glades Region Water Master Plan Palm Beach County Water Utilities Department	
Parameter	**Value or Description**
Post Treatment Chemicals	Ammonia Sodium hydroxide Carbon dioxide Fluorosilicic acid
Chemical Storage and Feed Systems	
Sodium hypochlorite for disinfection and odor control – liquid delivery: • Storage tanks • Metering pumps	 Two 10,000-gal Two active, one standby, rated for 210 gph
Ammonia for secondary disinfection: • Storage tank • Ammoniators	 1,000 gal One active, one standby, rated for 150 ppd
Sulfuric acid for pH adjustment during pretreatment: • Storage tanks • Metering pumps	 Two 12,500-gal One active, one standby, rated for 38 gph
Scale inhibitor system: • Storage tank • Metering pumps	 One 250 gal One active, one standby, rated for 2.6 gph
Sodium hydroxide system: • Storage tanks • Metering pumps for odor control • Metering pumps for pH adjustment	 Two 9,000-gal One active, one standby, rated for 21 gph One active, one standby, rated for 16.5 gph
Carbon dioxide for post treatment pH adjustment: • Refrigerated storage tank • Carrier pumps	 One 52,00-lb One active, one standby, rated for 70 gph
Fluorosilicic acid system for fluoridation: • Storage tank • Day tank • Metering pumps	 One 4,000 gal One 100 gal One active, one standby, rated for 1.7 gph
Transfer Pumps, Storage, and High Service Pumps	
Transfer Pumps	Two active rated for 3,475 gpm at 40 feet One standby with equal rating
Ground Storage Tank	One 3-MG
High Service Pumps	Three active rated for 2,315 at 200 feet One standby with equal rating All with VFDs
Electrical Equipment	
Emergency Generator	One 2,000-kW
Miscellaneous	Automatic controls and instrumentation

Notes:
(1) While permitted, the raw water bypass and blending is currently not in use.

3.5 STORAGE AND PUMPING FACILITIES

Tables 3.2 and 3.3 provide a summary of the characteristics of tanks and pump stations in the Glades Region.

Table 3.2 Storage Tank Physical and Operational Characteristics
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Location	Description	Capacity (MG)	Dimensions (1) (ft)	Bottom Elevation of Tank (ft)	Operational Tank Levels	
					Min. WSL(2) (ft)	Max. WSL(3) (ft)
WTP No. 11	GST	3	120	10.92	5	35.5
Belle Glade Old WTP (4)	GST #1	0.75	106 x 83.5	18.5	1	12
	GST #2	0.75	82 x 100			
Belle Glade Repump Station	GST	1	95	14.07	5	18.33
South Bay Repump Station	GST	1	90	13.4	3	21
Pahokee Old WTP	EST	0.1	26	106.85	5	25
Pahokee Offsite	EST	0.5	49.5	93.57	5	38
	EST	0.075	25	106.78	5	25.5

Notes:
(1) Indicates diameter unless length x width dimensions are provided.
(2) Minimum water service level (WSL) denotes the minimum pool height above the bottom elevation of the tank at which the tank is operated.
(3) Maximum WSL is the maximum water depth above the bottom elevation of the tank to which the tank is filled.
(4) The Belle Glade Old WTP Pump Station was decommissioned after model calibration.

Table 3.3 High Service Pumps
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Location	Total Number of Pumps	Total Capacity (mgd)	Total Capacity (gpm)	Horsepower
WTP No. 11	4	13.3	2,310	168
Belle Glade Old WTP[1]	4	12.1	2,100	110
Belle Glade Repump Station	3	6.9	1,600	851
South Bay Repump Station	2	Unknown		

Notes:
(1) The Belle Glade Old WTP Pump Station was decommissioned after model calibration.

3.5.1 Belle Glade Storage and Repump Station

The Belle Glade storage tank and repump station are remote facilities that provide additional storage and pumping capacity in the central part of the service area. This facility is located at 1155 North Main Street in Belle Glade. The facility contains a 1.0 MG ground storage tank and three booster pumps, each rated for 1,600 gpm at 161 feet of head.

3.5.2 Belle Glade Old WTP Repump Station

As stated in Chapter 2, the storage and pumping facilities of the Belle Glade Old WTP were used after the plant was decommissioned in 2008, but recently all the assets at this location were disconnected from the system.

3.5.3 South Bay Storage and Repump Station

The South Bay Repump Station is located at 101 NW 8th Avenue in South Bay. This repump station includes a 1.0 MG ground storage tank and two horizontal split-case centrifugal pumps. The County plans to replace these pumps by 2014.

3.5.4 Pahokee Elevated Storage Tanks

Three elevated storage tanks with total capacity of 0.675 MG are located in the Pahokee area (see Figure 3.1). The tank at the northernmost end of the City of Pahokee is located at 2466 East Main Street and is the largest of the three with a capacity of 0.5 MG. The second largest tank (0.1 MG) is located near Lake Okeechobee, at 180 North Lake Avenue, at the site of the Pahokee Old WTP. The third and smallest tank (0.075 MG) is located in the periphery of the City, at 100 State Market Road.

3.6 WATER TRANSMISSION SYSTEM AND INTERCONNECTS

The following sections summarize water transmission system assets and interconnects with other potable water systems.

3.6.1 Transmission System

Water transmission assets of the former GUA historically were not interconnected between the three cities of Belle Glade, Pahokee, and South Bay. In August 2006, a finished water transmission main to provide connection from WTP No. 11 (under construction at that time) to service points in the distribution systems of Belle Glade, South Bay, and Pahokee was permitted under DOH permit No. 246527-003-DS.

The construction consisted of approximately 12,911 linear feet of 30-inch, 3,293 linear feet of 24-inch, and 64,261 linear feet of 16-inch HDPE water main. In addition to the pipelines, one master meter for South Bay, three master meters for Belle Glade, and one master meter for Pahokee were installed.

On November of 2012, 7,000 linear feet of 8-inch pipe that had been taken out of service was reconditioned and put back in service to serve the city of South Bay in combination with the new HDPE pipeline (16-inch). The City of Pahokee is served via five miles of 16-inch transmission pipeline that extends from the 30-inch transmission line from WTP No. 11. The resulting interconnected system is shown in Figure 3.1.

Water distribution system pipelines consist of a total of 203 miles, of which 41 percent are cast iron and 30 percent are PVC. Table 3.4 summarizes current pipe materials and lengths. This table is based on PBCWUD's geographic information system (GIS) records.

Table 3.4 Summary of Water Distribution System Pipelines
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Material	Total (Miles)	%
Asbestos Cement	0.2	<1%
Cast Iron	83.7	41%
Ductile Iron	47.0	23%
Galvanized Iron	0.10	<1%
HDPE	4.90	2%
PVC	62.5	31%
Steel	2.0	2%
Total	**203**	

3.6.2 Water System Interconnects with Other Utilities

The Glades Region transmission system is not currently connected to any other potable water system. There are no backup water supplies during emergencies, except for the storage provided by tanks throughout the service area. Chapter 7 provides an inventory and assessment of the ability to supply storage capacity over the duration of this WMP planning period.

Chapter 4
WATER MODEL DEVELOPMENT

4.1 INTRODUCTION

The purpose of Chapter 4 is to provide a description of the water distribution system model and to document the calibration process and results, including all model elements and calibration data. A hydraulic model of the Glades Region water distribution system was created using InfoWater v8.1. The model was developed from available pipeline, pump station, and storage tank data.

Chapter 4 is divided into the following sections:

- Section 4.1 - Introduction: Provides the intent of Chapter 4, which is to document the development of the water distribution model, model calibration efforts, and calibration results.
- Section 4.2 - Existing Water System: Describes the water system, including physical characteristics and operational parameters input into the model.
- Section 4.3 - Water Model Development: Presents a description of the facilities and boundary conditions applied in the model.
- Section 4.4 - Water Model Calibration: Describes the calibration process, results, and statistical analysis.
- Section 4.5 - Summary and Recommendations: Provides suggestions to improve the water model accuracy.

4.2 EXISTING WATER SYSTEM

The Glades Region water system provides potable water service to approximately 33,500 residents within its service area. Figure 4.1 illustrates the water service area and the existing water distribution system.

4.2.1 Water Treatment Plant No. 11

WTP No. 11 is a 10 million gallon per day (mgd) reverse osmosis facility. Raw water is withdrawn from the Upper Floridian Aquifer via eight wells. Descriptions of the water source, water system assets, and treatment processes at WTP No. 11 are included in Chapter 3.

Finished water is distributed to the system using four high service pumps that discharge into a 30-inch water main. This 30-inch pipeline transports potable water to the main pipelines feeding the cities of Pahokee, South Bay, and Belle Glade. A 16-inch water main also ties into the 30-inch main pipeline at WTP No. 11. This 16-inch pipe feeds the commercial and institutional facilities to the east of State Road 80 and areas south to the City of Belle Glade.

4.2.2 Water Distribution System

As described in Chapter 3, WTP No. 11 supplies potable water to a total area of approximately 44 square miles, which encompasses the cities of Belle Glade, South Bay, and Pahokee as shown in Figure 4.1. The 30-inch pipeline from WTP No. 11 reduces to a 24-inch pipeline before connecting to the Belle Glade Old WTP (described further in Section 4.2.3), where 12- and 16-inch pipelines provide potable water to the cities of Belle Glade and South Bay, respectively. In November 2012, 7,000 linear feet of 8-inch pipe were reconditioned and put back in service to serve the city of South Bay in combination with the existing 16-inch pipeline. The City of Pahokee is served via five miles of 16-inch transmission pipeline that connects to the 30-inch transmission line from WTP No. 11.

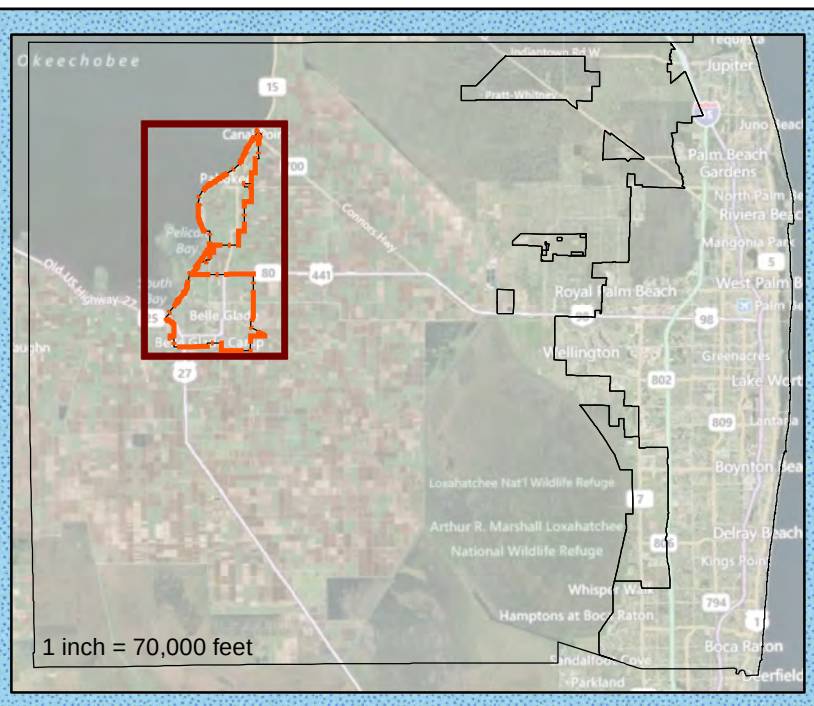
Table 4.1 provides information on water system assets including pipe materials, respective lengths, and percentage of the total pipe length that was included in the model to reflect most recent PBCWUD water utility GIS shapefiles.

Table 4.1 Summary of Water Distribution Pipeline Materials and Length
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Material	Diameter 2-8 Inches (LF)	Diameter 10-16 Inches (LF)	Diameter 20-30 Inches (LF)	Total (LF)	Total (Miles)	%
Asbestos Cement	1,127	-	-	1,127	0.20	<1%
Cast Iron	395,223	46,871	-	442,094	83.7	41%
Ductile Iron	140,127	94,908	12,932	247,968	47.0	23%
Galvanized Iron	520	-	-	520	0.10	<1%
HDPE	276	22,465	3,287	26,028	4.9	2%
PVC	291,109	37,815	1,046	329,971	62.5	31%
Steel	26,161	-	-	26,161	5.0	2%
Total	**854,544**	**202,059**	**17,265**	**1,073,869**	**203**	

Palm Beach County Water Utilities Department

Glades Region Water Master Plan



City of Pahokee

LAKE OKEECHOBEE

Legend

Water Pipe Diameter (in)

- 2 - 12
- 16 - 20
- 24 - 30

Glades Region Facilities

- Elevated Storage Tank
- Ground Storage Tank
- Water Treatment Plant
- Wholesale Water Meter
- Raw Water Well
- City Boundary
- Glades Unincorporated Urban Service Area

PAHOKEE 0.5 MG ELEVATED TANK
DSPK08

PAHOKEE 0.1 MG ELEVATED TANK
DSPK09

PAHOKEE 0.075 MG ELEVATED TANK
DSPK07

PAHOKEE MASTER METER
DSPK04

TP-2

TP-1

PW-6

PW-5

PW-4

PW-3

MASTER METER WTP 11
DSBG01

LAKE REGION WATER TREATMENT PLANT 11
DSXX01

BELLE GLADE REPUMP STATION
DSBG10

BELLE GLADE OLD WTP
DSBG11

BELLE GLADE PIONEER PARK MASTER METER
DSBG05

SOUTH BAY WTP
DSSB13

SOUTH BAY REPUMP STATION
DSSB12

SOUTH BAY MASTER METER
DSSB06

City of South Bay

City of Belle Glade

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

Larrimore Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Belle Glade Rd

Section 29 Rd

State Road 15

Hooker Hwy

State Road 80

Curlee Rd

Sugar House Rd

NW Avenue L

Gator Blvd

N Main St

SW 5th St

E Canal St N

SW 10th St

SE Avenue G

SE 3rd St

S Main St

E Canal St S

N US Highway 27

US Highway 27

SW 1st St

State Road 80

County Road 827A

County Road 880

Duda Rd

Glades Region Water Distribution System and Facilities

Figure 4.1

N

0 2,750 5,500 Feet

4.2.3 Remote Storage and Pumping Facilities

Storage is provided for equalization, fire flow requirements, and emergencies. At the time of model calibration, there were six remote storage tanks in service throughout the service area. As shown in Figure 4.1, the model includes three remote elevated storage tanks (ESTs) located in the City of Pahokee, one repump station with an above ground storage tank (GST) located in South Bay, and two repump stations with above ground storage tanks in Belle Glade. The Belle Glade Old WTP and Pahokee Old WTP are no longer in service. Only the pumping and/or storage facilities were in operation at these facilities at the time of calibration. (The Belle Glade Old WTP pump station went offline after calibration of the model.)

The total capacity of the Glades Region distribution system storage tanks, including the storage tank at WTP No. 11, was 7.2 MG during calibration of the model. Tables 3.2 and 3.3 in Chapter 3 summarize the characteristics of these tanks and high service pumps at each location. For the purposes of model simulations, the two Belle Glade Old WTP existing rectangular tanks (actual approximate dimensions shown in Table 3.2) were converted into a single circular tank, with an equivalent diameter of 147.34 feet. Chapter 7 presents the post-calibration (current) and system storage capacity.

4.3 WATER MODEL DEVELOPMENT

The water distribution system model was developed using the network analysis software program InfoWater v8.1. The model information was incorporated using pipeline GIS data provided by PBCWUD, which was updated based on discussions with County staff. An extensive quality control process was undertaken to verify pipe material and diameter, system connectivity, tank sizes, and high service pump curves.

4.3.1 Background

The physical facilities in a water distribution system are represented in a mathematical form so that the modeling software can calculate the hydraulics occurring within the network. To do this, all physical facilities are represented as either point entities (nodes) or line entities (pipes). Line entities include pipes in the network and point entities include tanks, reservoirs, pumps, valves, and junctions. Junctions represent locations where pipes intersect and where demands are taken from the system. Reservoirs can model treatment plants or wells; in this model, a reservoir represents WTP No. 11. Tanks represent system storage, and pumps

transfer water to the distribution system at adequate pressures. Valves can control flow and pressure in the system, and for this reason, flow control, pressure sustaining, and pressure reducing valves are used in the model to control parameters and assist in the calibration process.

Physical characteristics of the water distribution system used in the computer model include ground elevation; tank and reservoir elevations; physical and operational pump characteristics; tank dimensions and operational parameters; and pipe diameter, length, and roughness. Operational characteristics input into the model include water demands and diurnal curves, pump on/off and speed controls, initial tank levels, and valve control settings.

The following sections describe how existing facilities are simulated in the water model, topology, and diagnostic checks that were performed to improve accuracy, water demand allocation, and scenario management.

4.3.2 Model Elements

The following sections describe the water model elements.

4.3.2.1 Pipelines

Pipeline data was obtained from the GIS shapefile and imported directly into the model. The applicable physical characteristics of the pipes, such as diameter, length, and material were included in the shapefile data.

The pipe configuration was revised and updated using field visit notes, as-built records, and input from PBCWUD staff. Updates to the pipe configuration system included changes at WTP No. 11, Belle Glade Old WTP, and Belle Glade and South Bay Repump Stations, as well as piping connectivity in the distribution system. The total number of pipes in the hydraulic model is 3,347.

4.3.2.2 Junctions

Junctions, or nodes, are locations where flow leaves the network as system demand. Junctions with a demand of zero denote locations where flow moves between pipes and flow is neither exiting nor entering the network. Junctions also represent the beginning and ending of each pipe or pipe segment in the model network. Each junction is assigned a unique identification number, elevation, demand value, and demand pattern. The Glades Region model has 3,010 junctions.

Junction elevations in the current model were assigned using the InfoWater Elevation Extractor tool using raster elevation data. For modeling purposes, junction elevations are assumed to be located at the ground surface and not buried in order to generate results that simulate pressure at ground level. Even though elevation differences in the Glades Region can be considered negligible, elevations were added to junctions (as well as to the base of tanks) in order to most accurately reflect distribution system pressure at grade level. The average elevation throughout the service area is 13 feet above mean sea level.

Demands were assigned to the junctions in the calibration scenario based on monthly billing data for November 2012. Water usage and water loss demands were allocated in the model as described in Section 4.3.4. Additionally, each junction in the model is assigned a demand pattern, which is a diurnal curve that reflects fluctuations of water usage throughout the day. The diurnal curves applied to the model in the Base scenario were presented in Chapter 2, and developed as an average over one complete year (January 2011 to December 2011) using hourly demands. Diurnal demand patterns assigned to each city for the calibration scenario are described in Section 4.4.2.

4.3.2.3 Water Treatment Plant No. 11

The facilities at WTP No. 11 are represented in the model by a constant head reservoir, flow control valve (FCV), tank, and high service pumps. The total WTP production is simulated using a constant head reservoir for the purpose of providing an unlimited water supply as a source. The FCV regulates flow from the source (reservoir) to the tank by adjusting its setting to a predefined flow rate. The model currently has a constant FCV setting that is set at the average water production rate.

4.3.2.4 Tanks

InfoWater has the capacity to model cylindrical or variable area tanks. For this model, above ground cylindrical tanks are modeled using data provided by PBCWUD staff and the SCADA system. Characteristics such as level and diameter were manually entered into InfoWater. Table 4.2 summarizes the physical characteristics and geometry of the tank at each remote storage facility and WTP No. 11. To reduce model analysis time and simplify the network, one equivalent cylindrical tank was used to represent the combined volume of the existing rectangular tanks at the Belle Glade Old WTP. The Belle Glade Old WTP tank and pump station facility was only included in the model for calibration purposes. This

pump station was not included in post-calibration scenarios due to decommissioning soon after calibration was completed.

4.3.2.5 Pump Stations

The Belle Glade Old WTP, the Belle Glade Repump Station, and South Bay Repump Station are all remote storage facilities with booster pump stations. Pumps at these remote storage facilities as well as at WTP No. 11 are included in the model. The pump station located at the Belle Glade Old WTP was deleted from the model in post-calibration scenarios due to its decommissioning thereafter. Operational characteristics such as pump curves and controls were obtained from County staff and manually added to each pump in the model.

Table 4.2 summarizes the pump curves entered in the model for each facility. Only the four high service pumps at WTP No. 11 have variable frequency drives (VFDs). Pump characteristics for the South Bay Repump Station entered in the model were assumed based on information provided by County staff (total power input of 40 horsepower), since the actual pump curve was not available. Pumps speeds recorded by the SCADA system were entered in the calibration scenario to simulate the changes in pump speed at WTP No. 11. The pump curve at the Belle Glade Old WTP was modified during the calibration process to obtain a better match between flow and pressure leaving this facility.

Table 4.2 Pump Curve Data Points in Water Model
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

WTP No. 11	**Flow (gpm)**	0	1,000	2,000	2,300	3,000	3,500
	TDH (ft)	267	260	241	230	205	179
Belle Glade Old WTP	**Flow (gpm)**	500	800	1,200	1,600	2,100	
	TDH (ft)	247	240	225	200	148	
Belle Glade Old WTP Modified	**Flow (gpm)**	40	64	96	128	168	
	TDH (ft)	247	240	225	200	148	
Belle Glade Repump Station	**Flow (gpm)**	640	960	1,280	1,600	1,920	
	TDH (ft)	219	207	187	161	128	

4.3.3 Topology and Diagnostic Checks

Elements in the network must be logically connected in the model so that flow can be routed through the distribution system. InfoWater tools were used to perform a number of diagnostic checks to identify errors in the data network. These tests included a review of the system connectivity and identification of disconnected nodes or pipes, missing attributes, and parallel pipes. After completing topology and diagnostic checks, PBCWUD staff reviewed the pipe network for accuracy of connections and pipe configuration. Changes were made in the database for pipes not yet or not shown accurately in the County's GIS database.

4.3.4 Water Demand Allocation

Water consumption is assigned to junctions in the model network to represent the amount of water that must be supplied by the distribution system. The following sections describe the water demand allocation methods for the calibration, 2013, and future model scenarios.

4.3.4.1 Demand Allocation for Calibration

The total water demand for the calibration day was determined using billing records. Each address from the billing records was mapped as a point in GIS using the geocoding tool. The feature point indicating the location of each billing record and containing the water demand for the month of November was joined based on proximity to the closest junction in the model. Each billing record was then assigned with the closest junction ID. The Meter-Junction Allocation method in the InfoWater Allocator tool was used to assign water usage to the correct junction in the model from the GIS feature point. This method allows the allocation of demands from the GIS feature point by specifying which field possesses the junction ID.

The water demand allocated using the Allocator tool for the calibration scenario was 1,831 gpm, corresponding with November 2012 billing data. Of this, 1,727.5 gpm was applied in the Demand 1 field of the model. InfoWater allows the use of up to ten different demand fields, each of which can be assigned a different diurnal pattern. The demands located in the Demand 1 field are varied throughout the day using diurnal demand curves calculated from SCADA data. The remaining 103.61 gpm was applied in the Demand 3 field at Junction ID J2264 (located in Canal Point) to represent a hydrant flushing demand. The hydrant flushing demand was applied in a separate demand field to allow a fixed diurnal curve assignment since the automatic flushing is set at a constant rate and therefore does not fluctuate throughout the day.

Water loss demand was added to each junction in the model in the Demand 2 field. Water loss was determined by comparing the November billing records with the SCADA recorded flow at the master meters located at Pahokee (DSPK04), South Bay (DSSB06), and Lake Region WTP No. 11 (DSXX01). The total water loss of 1,671.5 gpm was assigned to junctions based on the calculated water loss by city as summarized in Table 4.3. The water loss within each city was distributed equally to all nodes since the location of the water loss is unknown.

Table 4.3 November 2012 Water Loss Demand by City
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

City	November 2012 Billing Records (mgd)	November 2012 SCADA Data - Master Meter Average (mgd)	Calculated Water Loss[1] (mgd)	Water Loss Percentage
Pahokee	0.39	0.97	0.58	60%
South Bay	0.50	0.71	0.21	30%
Belle Glade	1.74	3.38	1.64	49%
Total	2.63	5.06	2.43	48%

Notes:
(1) Water loss figures are based on the difference between the average November usage from the billing data and the plant production data for the calibration day.

4.3.4.2 Demand Allocation for Years 2013, 2015, 2025, and 2035

Water demands through 2035 were estimated using the population growth projections and projected per capita water usage described in Chapter 2. Population data for years 2013, 2015, 2025, and 2035 was evaluated for the 20 TAZs falling within the GUUSA as shown in Figure 4.2. Water demand by TAZ was calculated by multiplying the projected population of each TAZ by a demand factor of 140 gpcd. Chapter 2 provides a description of the methodology used to calculate the 140-gpcd demand factor.

Two methods were used to allocate 2013 and future scenario water demands in the model. The first method, used for assigning demand for 2013 and 2015, assumes the same water consumption pattern (location of demands) as the calibration scenario. Demands allocated using billing data during calibration were increased proportionally to achieve the total demand shown in Table 4.4 for the 2013 and 2015 scenarios.

The second water demand allocation method integrates the water consumption pattern from calibration and the total forecasted population by TAZ to determine the

demand allocation for the years of 2025 and 2035. Water demand allocation for the 2025 and 2035 scenarios was calculated at each junction as the ratio of the water demand from Demand 1 under the calibration scenario and the total calculated demand at each TAZ. It must be noted that both methods provide the same total water demand but differences are observed when the water demands are classified by city or TAZ.

The typical bulk users' demand (discussed in Chapter 2) is assumed to remain constant at an average of 0.59 mgd through 2035. This demand was manually applied in the Demand 3 field in the model to the node that is closest to each bulk user. Table 4.4 summarizes the water demands for each year of the WMP analysis.

Table 4.4 Modeled Average Annual Water Demand Projections
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

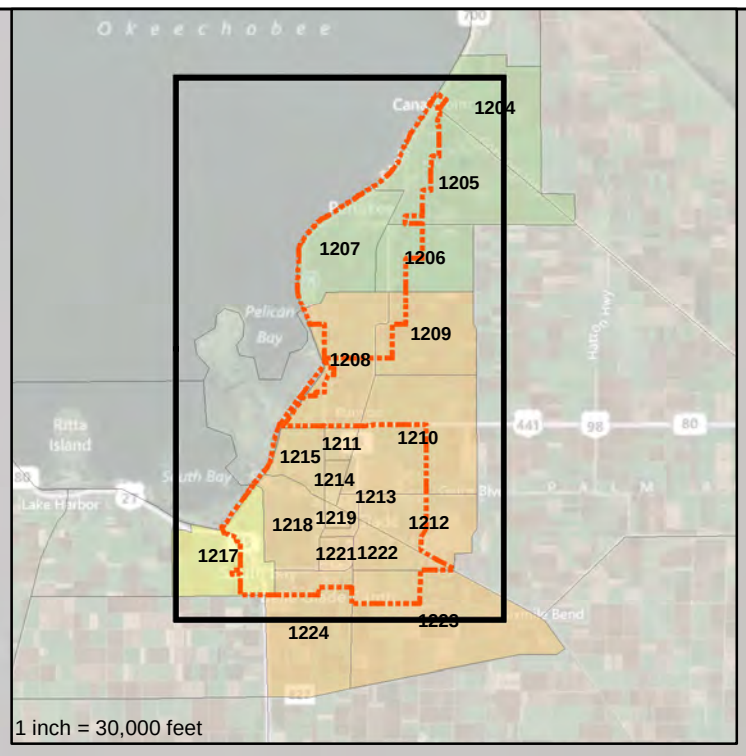
	2013	2015	2025	2035
Glades Region Demand (gpm)	3,273	3,395	4,118	5,176
Glades Region Demand (mgd)	4.71	4.81	5.93	7.45
Bulk Users Demand (mgd)	0.585	0.585	0.585	0.585
Total Demand (mgd)	**5.30**	**5.39**	**6.51**	**8.04**

4.3.5 Scenario Management

Different conditions in the water system can be simulated in the modeled network by creating separate scenarios depicting existing or future parameters. These differentiating parameters such as various demand conditions, different pipe diameters and materials, modified operating controls, or alternate pipe configuration are entered in InfoWater as data sets, which are assigned to scenarios that can be modeled and evaluated accordingly.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan



Legend

- City Boundary
- Glades Unincorporated Urban Service Area
- Watermain

TAZ

- Other
- Belle Glade
- Pahokee
- South Bay

1204

1205

CITY OF PAHOKEE

1207

1206

1208

1209

1210

1211

1215

1214

1213

1219

CITY OF BELLE GLADE

1218

1220

1212

1217

1221

1222

CITY OF SOUTH BAY

1224

1223

carollo

GUUSA Boundary and TAZ for Demand Allocation Analysis

Figure 4.2

N

0 2,750 5,500 Feet

4.3.5.1 Scenarios and Data Sets

The creation of scenarios allows the modeling of a specific situation through the assignment of particular conditions, data sets, and facilities to the network. Different scenarios are linked through inheritance relationships (where parent scenarios provide baseline functionality to child scenarios), represented in InfoWater as a directory tree. All scenarios are children of the Base scenario until the inherited set of data is changed and customized through the creation of additional data sets. Successively, parent scenarios can be cloned into child scenarios that inherit the same set of data from their parent, which can be customized to evaluate different situations in the model.

The years of 2013, 2015, 2025, and 2035 provide the parent scenarios in model. The parent scenarios are assigned with the annual average demand projections for each year, which are shown in Table 4.4. These demands were inherited by each child and then modified using a new data set to reflect the appropriate demand condition (such as maximum day or peak hour). Child scenarios under each parent include the maximum day, peak hour, and fire flow demand for the corresponding year. Each scenario is assigned with its corresponding diurnal demand curve (average annual or maximum day curve). Actual diurnal demand curves were calculated for the calibration day scenario using the same methodology explained in Chapter 2.

4.3.5.2 Steady State and Extended Period Simulations

Steady state (SS) simulations perform an evaluation of a distribution system in an equilibrium state where changes over time are ignored. SS models are frequently used for hydraulic analysis of fire flow scenarios because infrastructure is sized for peak or design flows. In contrast, extended period simulations (EPS) perform a series of steady state balances at specified time intervals, usually hourly. The EPS provides a greater view of conditions happening during system evaluation for the specified time period. EPS is used to resolve reservoir storage concerns, conduct water quality modeling, and to solve operational problems. These types of simulations require diurnal demand patterns and time-based operational parameters for tanks, pumps, and valves.

For the purpose of the WMP, EPS analysis is used for calculating water age and evaluating maximum day demand conditions. Average diurnal demand curves for each city were applied to EPS model scenarios. SS analysis is used for evaluating peak hour conditions and fire flow requirements.

4.4 WATER MODEL CALIBRATION

Hydraulic water model calibration involves the adjustment of model parameters until simulated results are within reasonable agreement with data collected on the field such as pressures and flow rates. The main objective of calibration is that results provided by the model operate in resemblance to reality.

4.4.1 Objectives and Background

The main objective of the calibration process is to simulate the hydraulics of the water distribution system as accurately as possible. It is imperative that results provided by the model bear a close resemblance to observed conditions in the distribution system. The calibration process consists of adjusting parameters in the model network until the simulated results match actual observed data to some acceptable level.

4.4.2 Calibration Data and Scenario Setup

Field data collection and its accuracy are very important since this data is used as a point of reference in the calibration process. SCADA data and pressure tests were the two sources of the field information collected for the purpose of calibration of the hydraulic water model. The calibration scenario was developed to simulate distribution system conditions observed on November 21, 2012.

Between November 19 and November 24, 2012, field activities were coordinated to collect pressure readings at four locations in the Glades Region as shown in Figure 4.3. Only Loggers #3 and #4 collected valuable data that was used in the calibration for comparison with simulated model results. Pressure, flow, and tank levels in the distribution system are monitored by the PBCWUD SCADA system at the locations listed in Table 4.5. This data was provided for the week of November 19 to November 26, 2012. This information was used in the calibration process to compare the model pressure and flow results to SCADA readings on the calibration day.

After inspection of all SCADA data, two data points were eliminated from the calibration process. These included the pressure at the South Bay Old WTP (DSSB13) and flow data at the Belle Glade Repump Station (DSBG10). It was apparent that instrumentation was not functioning properly due to unrealistic recorded values. Data discrepancy at these facilities may warrant a field investigation or calibration of recording devices.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Water Pipe Diameter (in)

- Less than 6
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30

Glades Region Facilities

- Elevated Storage Tank
- Ground Storage Tank
- Water Treatment Plant
- Wholesale Water Meter
- City Boundary
- Glades Unincorporated Urban Service Area

LAKE OKEECHOBEE

Logger # 1

PAHOKEE 0.5 MG ELEVATED TANK

City of Pahokee

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

Muck City Rd

Conners Hwy

PAHOKEE MASTER METER

State Road 15

MASTER METER WTP 11

LAKE REGION WATER TREATMENT PLANT 11

State Road 80

Logger # 2

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

Logger # 4

Gator Blvd

W Sugar House Rd

Curlee Rd

City of South Bay

City of Belle Glade

SOUTH BAY WTP

N US Highway 27

BELLE GLADE PIONEER PARK MASTER METER

Logger # 3

SOUTH BAY REPUMP STATION

SOUTH BAY MASTER METER

County Road 827A

County Road 880

Duda Rd

DIP PVC CIP HDPE

N

0 2,750 5,500 Feet

Glades Region Water Distribution System

Figure 4.3

Since water demand was the highest on November 21, 2012 during the testing period, this day was chosen as the calibration day. Table 4.5 summarizes the information collected at each location. All information presented in Table 4.5 was obtained from the PBCWUD SCADA system except for data collected in the field using Pressure Loggers #3 and #4 The Field Test Plan used to collect data for calibration is included in Appendix C.

The initial tank levels listed in Table 4.6 were entered into the model for the calibration scenario. The initial levels were obtained from SCADA data for the calibration day.

Table 4.5 SCADA and Field Test Data for Calibration Day
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

City	Facility Name	SCADA Tag	Observed Parameters		
			Pressure	Flow	Level
Belle Glade	Lake Region WTP No. 11	DSXX01	X	X	X
	Belle Glade Old WTP	DSBG11	X[1]	X	X
	Belle Glade Repump Station	DSBG10	X		X
	Belle Glade WTP 11 Master Meter	DSBG01	X	X	
	Pioneer Park Master Meter	DSBG05	X	X	
	Pressure Logger #3	--	X		
	Pressure Logger #4	--	X		
South Bay	South Bay Repump Station	DSSB12	X		X
	South Bay Master Meter	DSSB06	X	X	
	South Bay WTP	DSSB13	X		
	Pressure Logger #2	--	X		
Pahokee	0.1 MG Elevated Storage Tank	DSPK09	X		X
	0.5 MG Elevated Storage Tank	DSPK08	X		X
	0.075 MG Elevated Storage Tank	DSPK07	X		X
	Pahokee Master Meter	DSPK04	X	X	
	Pressure Logger #1	--	X		

Notes:

(1) Two sets of pressure data are measured at this location: after the pump station (DSBG11_FV) and at the master meter (DSBG11_MM).

Table 4.6 Tank Characteristics During Calibration Day Glades Region Water Master Plan Palm Beach County Water Utilities Department		
Location	**Volume (MG)**	**Initial WSL (ft)[1]**
WTP No. 11	3.0	29.03
Belle Glade Old WTP	1.5	2.80
Belle Glade Repump Station	1.0	13.04
South Bay Repump Station	1.0	11.53
Pahokee WTP	0.1	19.31
Pahokee Offsite 1	0.5	34.96
Pahokee Offsite 2	0.075	13.96
Notes: (1) Initial WSL in feet refers to the initial water level above the bottom elevation of the tank.		

Diurnal demand curves for each city on the calibration day of November 21, 2012 were calculated using hourly data recorded by SCADA. Hourly average demand was calculated by deducting the tank level fluctuations from the flow meter data at each city. Chapter 2 describes the methodology used to obtain the hourly average demand at each city. Table 4.7 provides the final diurnal curves obtained for the calibration day, which were entered in the model and assigned to nodes within the corresponding city.

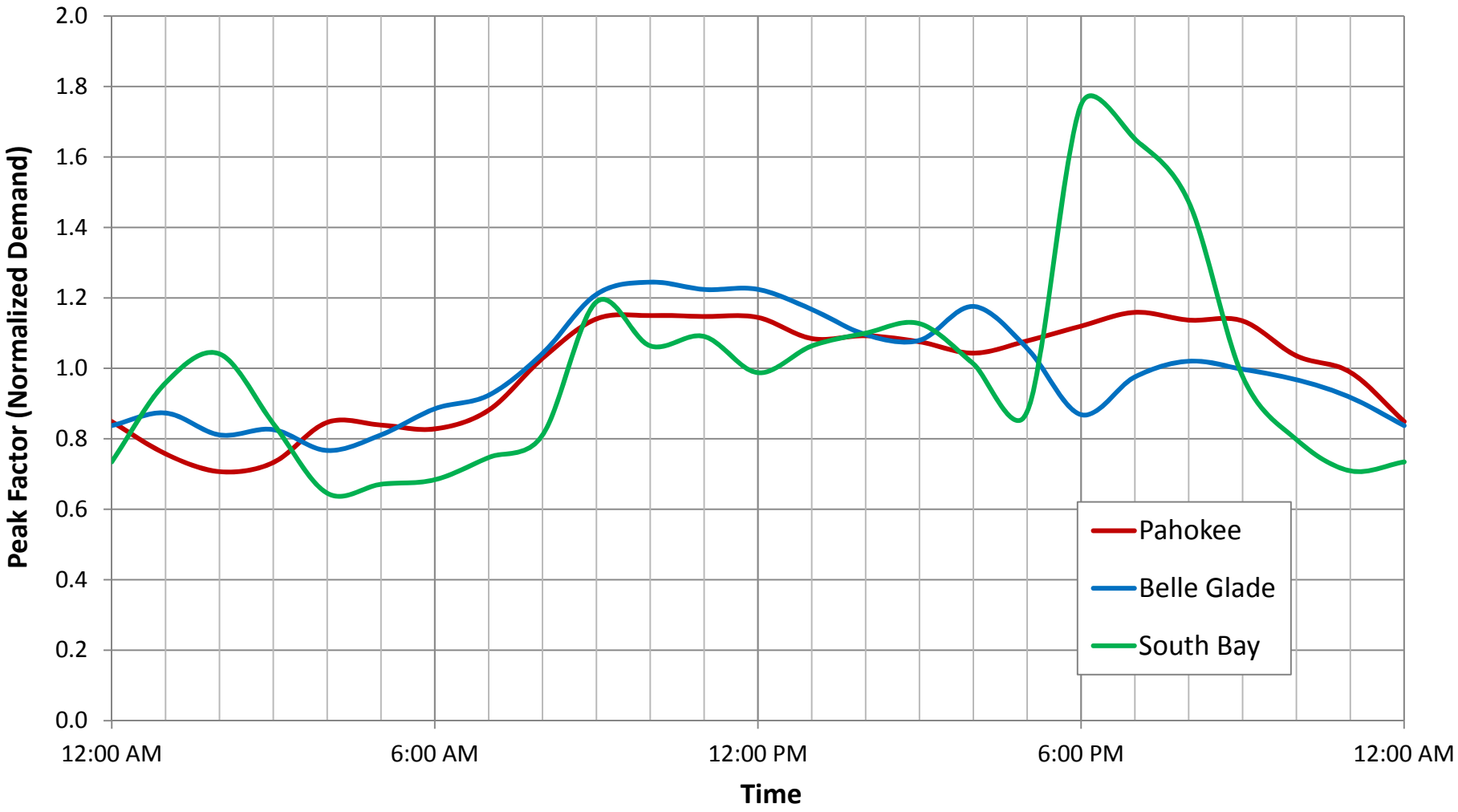
Table 4.7 Diurnal Demand Patterns for Calibration Scenario Glades Region Water Master Plan Palm Beach County Water Utilities Department			
Hour	**Hourly Peaking Factor**		
	Belle Glade	**South Bay**	**Pahokee**
12:00 AM	0.84	0.73	0.85
1:00 AM	0.87	0.96	0.76
2:00 AM	0.81	1.04	0.71
3:00 AM	0.83	0.84	0.73
4:00 AM	0.77	0.65	0.85
5:00 AM	0.81	0.67	0.84
6:00 AM	0.89	0.68	0.83
7:00 AM	0.92	0.75	0.88
8:00 AM	1.04	0.81	1.03
9:00 AM	1.21	1.19	1.14
10:00 AM	1.24	1.06	1.15
11:00 AM	1.22	1.09	1.15

Table 4.7 Diurnal Demand Patterns for Calibration Scenario Glades Region Water Master Plan Palm Beach County Water Utilities Department			
Hour	**Hourly Peaking Factor**		
	Belle Glade	**South Bay**	**Pahokee**
12:00 PM	1.22	0.99	1.14
1:00 PM	1.17	1.06	1.08
2:00 PM	1.10	1.10	1.09
3:00 PM	1.08	1.13	1.08
4:00 PM	1.18	1.01	1.04
5:00 PM	1.06	0.88	1.08
6:00 PM	0.87	1.75	1.12
7:00 PM	0.98	1.65	1.16
8:00 PM	1.02	1.47	1.14
9:00 PM	1.00	0.98	1.13
10:00 PM	0.97	0.80	1.04
11:00 PM	0.92	0.71	0.99
12:00 AM	0.84	0.73	0.85

Figure 4.4 illustrates the diurnal demand curves representing the average hourly water consumption on November 21, 2012 for the three cities.

South Bay: The diurnal curve for South Bay displays an hourly peak from 6:00 p.m. to 8:00 p.m., which is also greater than the average hourly peak in the region. Additionally, there are two less pronounced peaks of 1.19 and 1.13 times the average occurring at 9:00 a.m. and 3:00 p.m, respectively. These hourly peaks in South Bay are consistent with the annual average diurnal curve presented in Chapter 2, where the hourly peak occurs at 7:00 p.m. There is a peak of 1.04 times the average observed at 2:00 a.m. It is assumed that the high water consumption at such an early hour is due to large bulk users in the City of South Bay.

Belle Glade: The Belle Glade diurnal demand curve for the calibration day shows a similar pattern as the average diurnal demand curve shown in Chapter 2. In Figure 4.4, two distinctive high peaks of 1.24 and 1.18 times the average are observed at 10:00 a.m. and 4:00 p.m., respectively. It is also noted that the hourly peaking factor is always above average between the hours of 8:00 a.m. and 5:00 p.m., and the lowest peaking factor of 0.77 is observed at 4:00 a.m.



DIURNAL DEMAND CURVES DURING CALIBRATION DAY

FIGURE 4.4

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

Pahokee: The Pahokee diurnal demand curve shows that between the hours of 8:00 a.m. and 10:00 p.m. there is a sustained higher than average hourly demand, with the highest peak being 1.16 times the average at 7:00 p.m. The lowest peaking factor of 0.71 is observed at 2:00 a.m.

The total demand allocated for the calibration scenario was calculated using SCADA data and November billing records. The difference between these sets of data was added in the model as water loss throughout the system, which was assigned to the nodes in the model based on proximity to each city. Table 4.3 summarizes the total water loss in the system entered in the model for the calibration scenario, estimated at approximately 1,688 gpm.

4.4.3 Calibration Process

The calibration process requires the adjustment of different parameters in the model to achieve results that are close to observed pressures, flows, and tank levels during calibration day. The model includes one reservoir WTP No. 11, 13 pumps, 7 tanks, 4 valves, 3,010 nodes, and a total of 203 miles of pipe ranging from 2-inch to 30-inch in diameter.

Model elements were controlled to simulate operation of the system during the calibration day scenario. The following is a compilation of the actions taken during the calibration process:

- Total water usage from November billing records was applied to the calibration scenario using the InfoWater Allocator tool as described in Section 4.3.4.
- Total water loss from Table 4.3 was applied to each junction by editing the nodes' attributes at each city.
- The diurnal demand patterns for each city shown in Table 4.7 were applied to the calibration scenario.
- Pump curves from Table 4.2 were applied to each corresponding pump in the model. At the Belle Glade Old WTP, pump curve was modified and a minor loss coefficient of 100 was added at one pipe to better represent the observed SCADA data during calibration. Pumps at the South Bay Repump Station were set as Constant Power Input types with a total horsepower of 40.
- On the calibration day, to achieve observed pressures and flows at WTP No. 11, the two speed patterns for High Service Pumps 1 and 2 recorded by the SCADA system were decreased by 2 percent.

- One FCV was incorporated at WTP No. 11 to mimic the flow of water from the WTP into the storage tank. The FCV was set to the average flow at WTP No. 11 as recorded by SCADA on the calibration day.
- To simulate the existing pressure reducing valve (PRV) at the Pahokee Master Meter, one PRV was added in the model with a setting of 68.96 psi, which was the average pressure observed on the calibration day.
- Pressure sustaining valves (PSVs) were added before the tanks at the Belle Glade Old WTP and South Bay Repump Station to maintain upstream pressures in the system and prevent reverse flow.
- A control setting was added to the pipe located before the South Bay Repump Station tank to simulate the filling of the tank observed at this facility during calibration day.
- The pipe connecting the distribution system to the 0.075 MG elevated tank at Pahokee was closed to simulate actual tank levels on the calibration day. The level did not fluctuate so it was assumed this facility was offline on the calibration day.
- The InfoWater Calibrator tool was then used to determine the c-factors that provide the best fit with SCADA data.

The c-factors obtained from the Calibrator tool were applied to the calibration scenario and base pipe set. The results of the model were compared against the observed SCADA data to evaluate the accuracy of the results. Overall, comparisons of observed and simulated calibration results bear a close correlation at all locations with reliable data. Further information of calibration results is provided in Section 4.4.6. Model control settings for the calibration scenario are provided in Appendix D.

4.4.4 C-Factor Adjustment for Final Calibration

The InfoWater Calibrator tool employs a mathematical genetic algorithm (GA) to solve for unknown values; in this case, to determine the best suitable pipe roughness coefficient by limiting input conditions in the model such as demands and pressures observed in the field. GA refers to a type of optimization that attempts to find the best solution to a problem by mimicking the natural selection process in genetics (Walski *et al*, 2001). This powerful tool selects the most satisfactory set of roughness values that can be applied to the model, and the fitness function provides a measurable and comparable value, given a set of observed data, to determine if the results provided by the Calibrator can be applied to the model.

The Calibrator tool used in this step of the calibration process has the purpose of finding the best set of results to reach an adequate “level of fitness.” The fitness value provided by the Calibrator tool in the summary of results indicates how close the model is to matching the observed values initially set in the model. The fitness value obtained for this model calibration was 10.78 percent, where the best fitness value that can be obtained is zero.

Table 4.8 summarizes the parameters entered in the Calibrator tool, as well as the results obtained for each pipe group. In total, nine pipe groups were created based on pipe material, diameter, and as-built date. The ductile iron pipe was segregated in three groups where Pipe Groups 3 and 4 contain ductile iron pipes older than 10 years. Pipe Group 9 combines ductile iron pipes with diameters greater than 16-inch and those installed in the last 10 years. Initial estimates of c-factors for each pipe group were obtained from published tabular values based on pipe material type. The Calibrator Tool is given a range of c-factor values (from acceptable minimum to acceptable maximum) from which to determine the best fit for the corresponding pipe group.

Table 4.8 Calibrator Parameters and Results
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Material	Pipe Group	Diameter (in)		InitialC-Factor	C-Factor Range		Calibrator Result
		Min	Max		Min	Max	
Asbestos Cement	1	6		120	100	140	108
Cast Iron	2	2	24	80	50	100	80
Ductile Iron 1	3	2	12	110	50	125	57
Ductile Iron 2	4	12	16	110	90	125	90
Galvanized Iron	5	2		110	100	120	100
HDPE	6	6	24	130	120	150	120
PVC	7	2	24	130	100	140	140
Steel	8	2	6	100	90	110	110
Ductile Iron 3	9	16	30	130	120	130	120

4.4.5 Calibration Criteria and Expected Accuracy

The goal of modeling a water distribution system is to reproduce its behavior in the "real-world" as closely as feasible in terms of spatial and temporal characteristics. The collection of field data provides an opportunity to understand the operation of

the real system at a specified number of locations and times. Such efforts are consistent with the findings of the American Water Works Association Engineering Computer Applications Committee which indicate that "true model calibration is achieved by adjusting whatever parameter values need adjusting until a reasonable agreement is achieved between model-predicted behavior and actual field behavior" (AWWA Engineering Computer Applications Committee, 1999). Once a model is considered to be calibrated, it can then be used to, among other purposes, estimate hydraulic characteristics of the real-world system at locations where measured data are unavailable or unknown.

In the United States, definitive standards to assess the accuracy of model calibration have yet to be agreed upon or established. Calibration criteria have been suggested, such as the goal presented by Cesario and Davis (1984), to obtain a difference between measured and simulated values of ±5 psi to ±10 psi. However, calibration results are highly variable based on the quality and quantity of available field data and complexity of the distribution system. The primary outcome of calibration is to obtain confidence that the model is representing the distribution system accurately and that it is built upon good data.

These criteria were used as general guidelines and took into account the availability and accuracy of the data for the Glades Region water distribution system. A selected pressure difference (difference between measured and simulated pressure) of ±5 psi to ±10 psi was established as a calibration criterion from which to compare simulated and observed data.

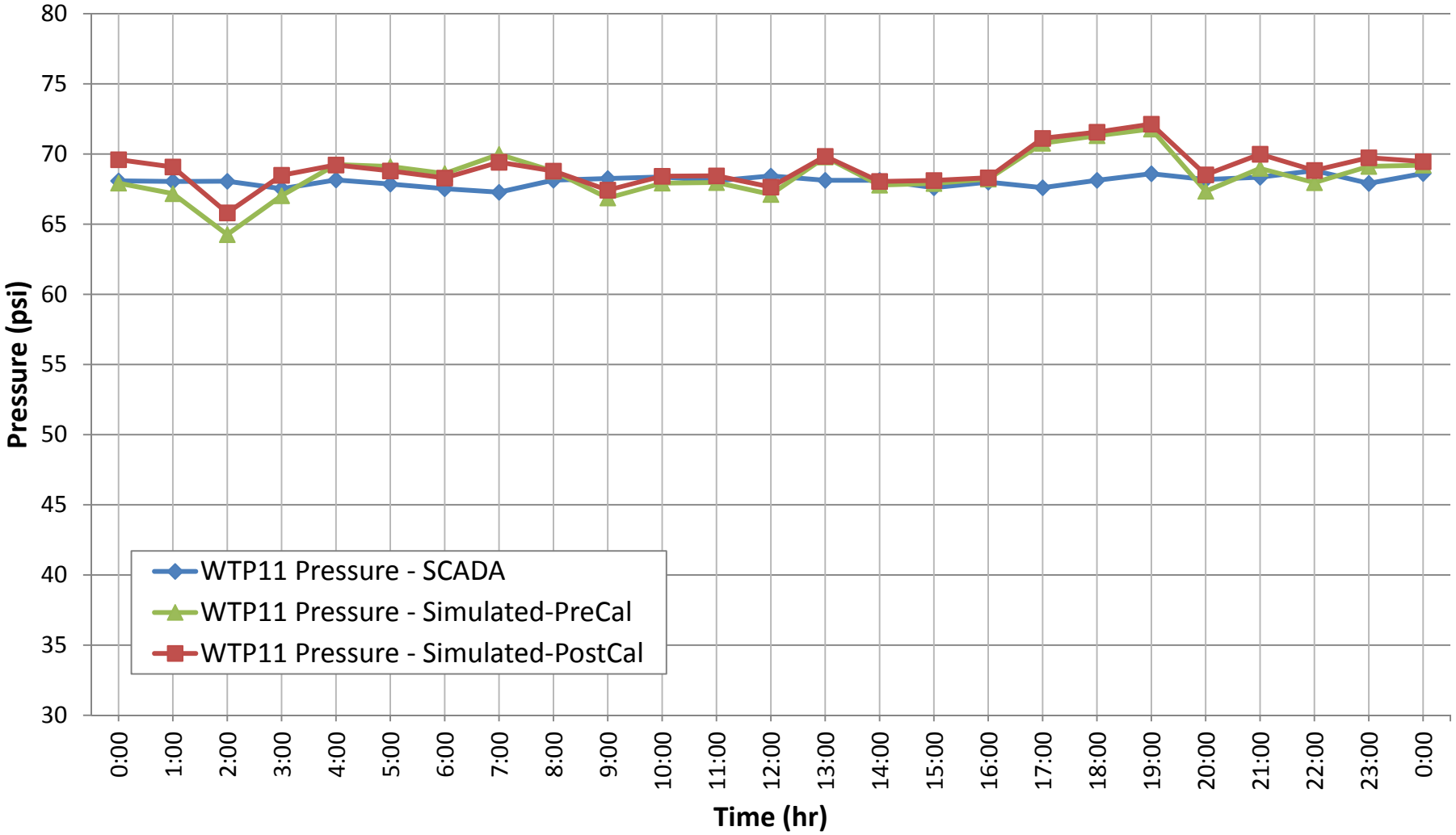
4.4.6 Calibration Results

Flow, pressure, and tank level data collected by the SCADA system and during fieldwork at selected locations were compared with simulated results from the model after completing all necessary steps to calibrate the network. Figures 4.5 through 4.12 illustrate some of the results obtained when comparing the observed data and modeled results. After examination of available observed data during calibration day, four sets of data were eliminated from the calibration results used for statistical analysis including flow measurements at Belle Glade Repump Station and the pressure readings at South Bay WTP and Pressure Loggers #1 and #2 due to unrealistic readings. In general, pressure, flow, and tank level comparison at all locations with reliable data show that simulated results after calibration bear a close resemblance to observed data. All calibration results are shown in Appendix E.

Evaluation of the absolute pressure difference between observed and modeled results at all time intervals for locations with reliable pressure readings indicate that

78 percent had less than a 5 psi difference and 95 percent had less than a 10 psi difference. Pressures with differences larger than 10 psi were mainly observed at Pressure Logger #3 and Pressure Logger #4. At WTP No. 11, the absolute pressure difference was an average of 3.3 psi, which indicates that 100 percent of all pressure differences are below 5 psi in this location. In contrast, pressure differences at Pressure Loggers #3 and #4 were the highest, where just 64 percent of the data had less than a 10 psi difference. During the hours of 7:00 a.m. and 9:00 p.m., there was a significant drop in pressure at these locations.

PBCWUD staff indicated that pressure differences recorded during those hours at these two specific locations might be due to greater than allocated water consumption by one large user (Duda & Sons) in the southeastern area of the City of Belle Glade. Further investigations should be completed for this user and other potential sources of large demand in this area to determine the volume and location of actual water usage. Water demands and diurnal curves can be modified in the model if additional information is obtained. By an average of 6 psi, simulated pressures higher than field data were seen at the 0.075 MG elevated storage tank in Pahokee, which might be caused by elevation differences between the pressure gauge at the tank and modeled node elevation.



NOVEMBER 21, 2012 CALIBRATION PRESSURE RESULTS AT WTP NO. 11

FIGURE 4.5

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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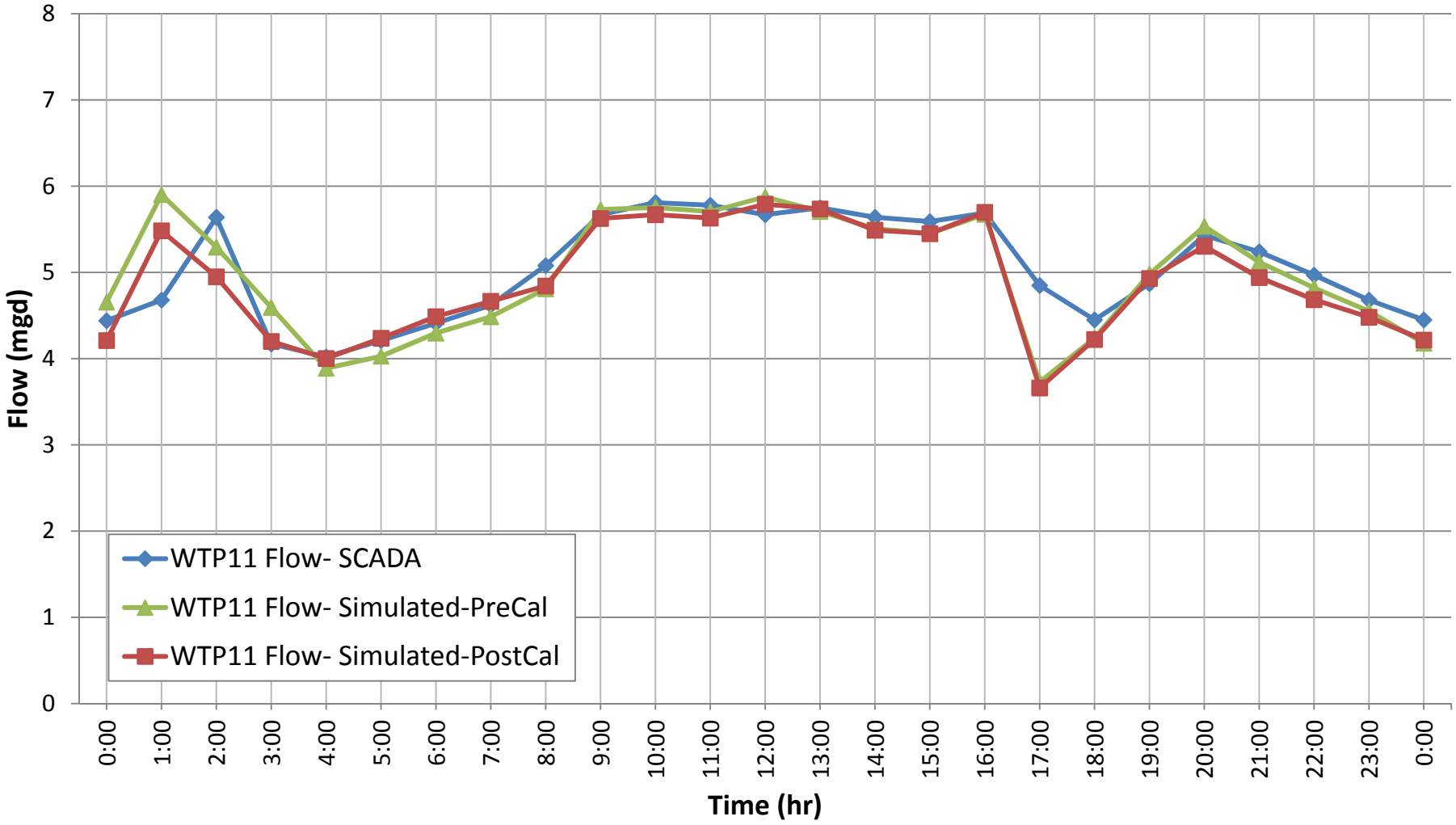
pw://Carollo/Documents/Client/FL/Palm Beach/8558E00/Deliverables/Master Plan Report/Fig 4.5.docx

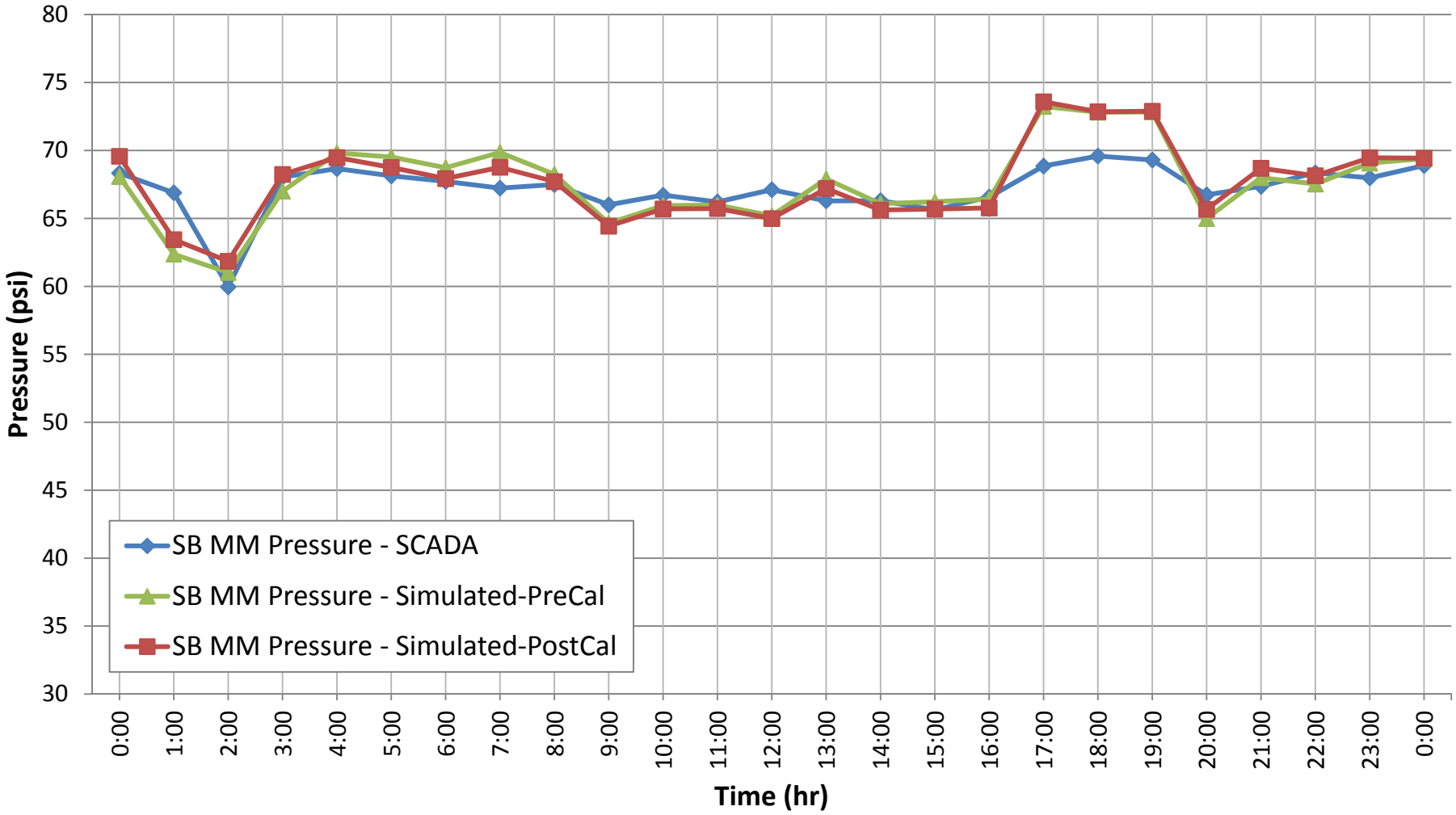


NOVEMBER 21, 2012 CALIBRATION FLOW RESULTS AT WTP NO. 11

FIGURE 4.6

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



NOVEMBER 21, 2012 CALIBRATION PRESSURE RESULTS AT SOUTH BAY MASTER METER

FIGURE 4.7

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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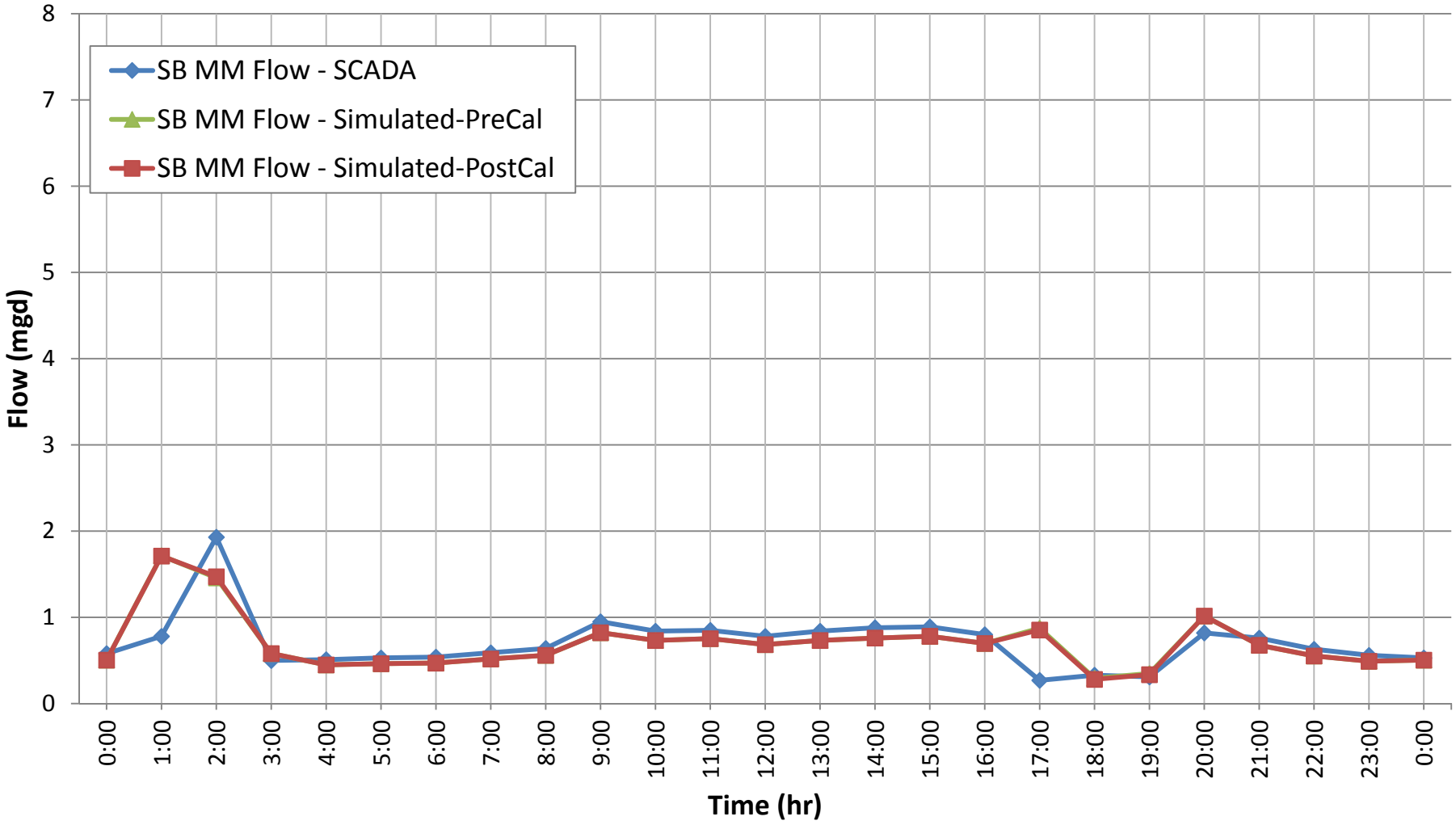

NOVEMBER 21, 2012 CALIBRATION FLOW RESULTS AT SOUTH BAY MASTER METER

FIGURE 4.8

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GLADES REGION WATER MASTER PLAN

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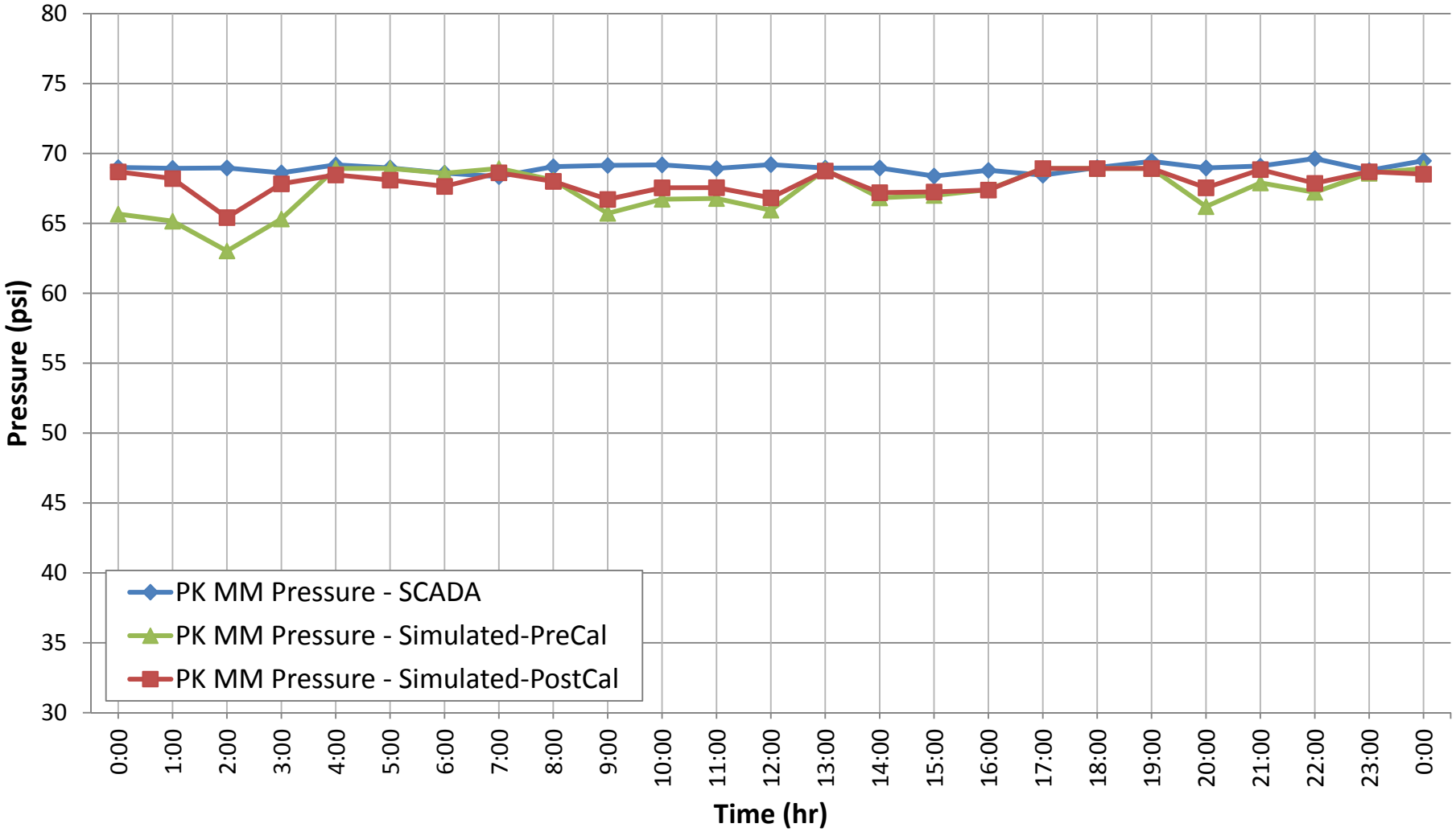

NOVEMBER 21, 2012 CALIBRATION PRESSURE RESULTS AT PAHOKEE MASTER METER

FIGURE 4.9

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GLADES REGION WATER MASTER PLAN

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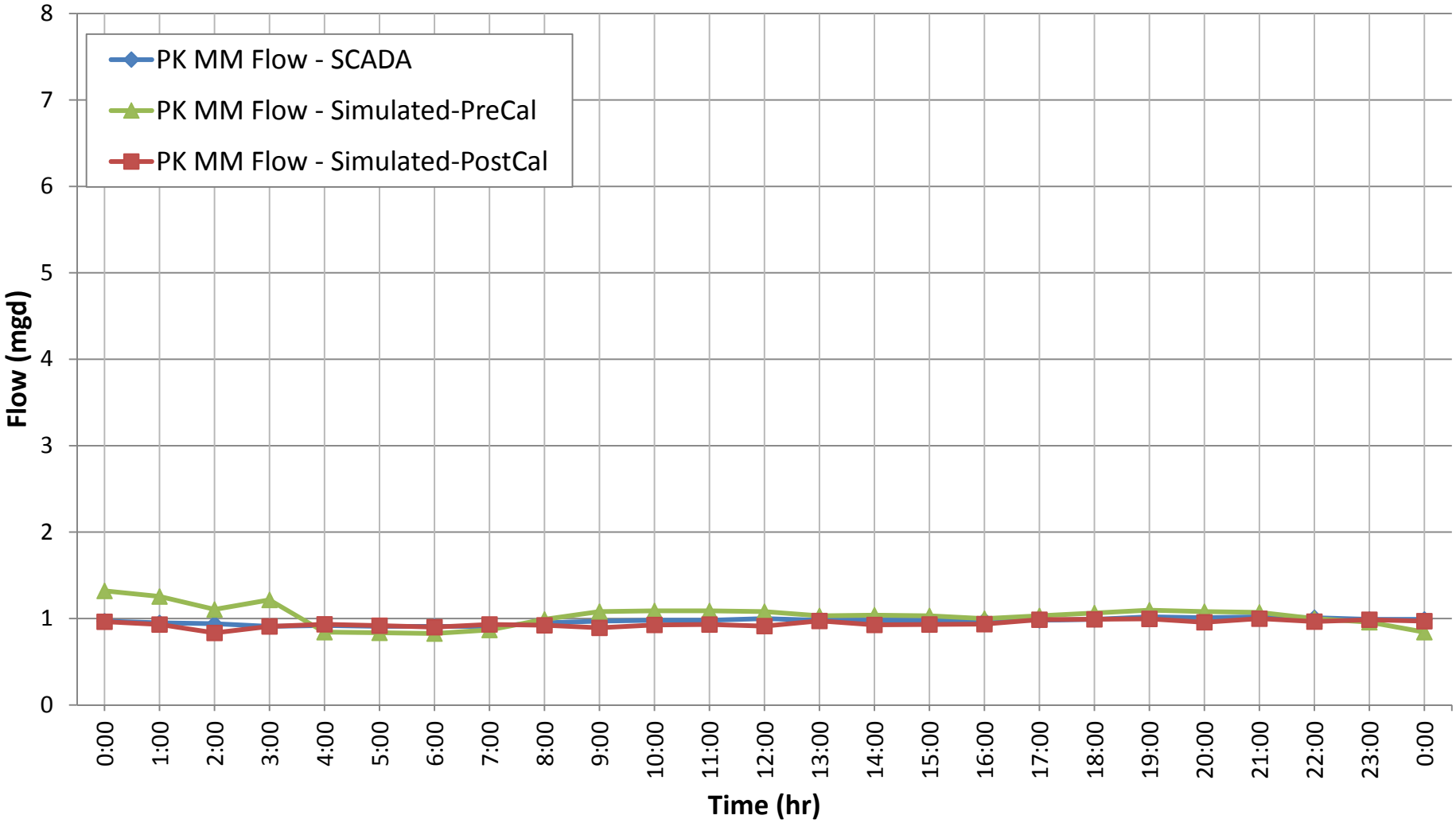
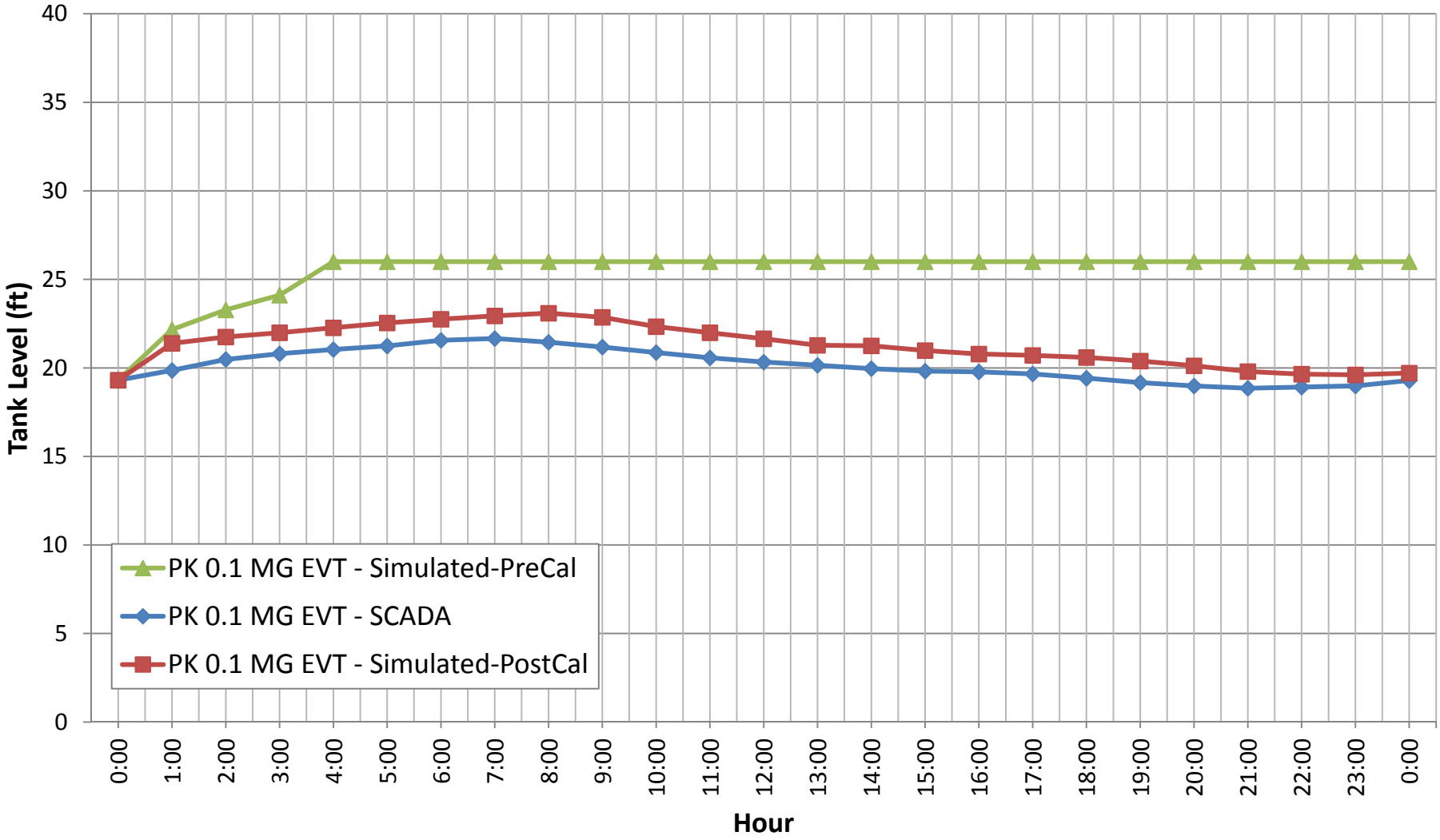


NOVEMBER 21, 2012 CALIBRATION FLOW RESULTS AT PAHOKEE MASTER METER

FIGURE 4.10

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

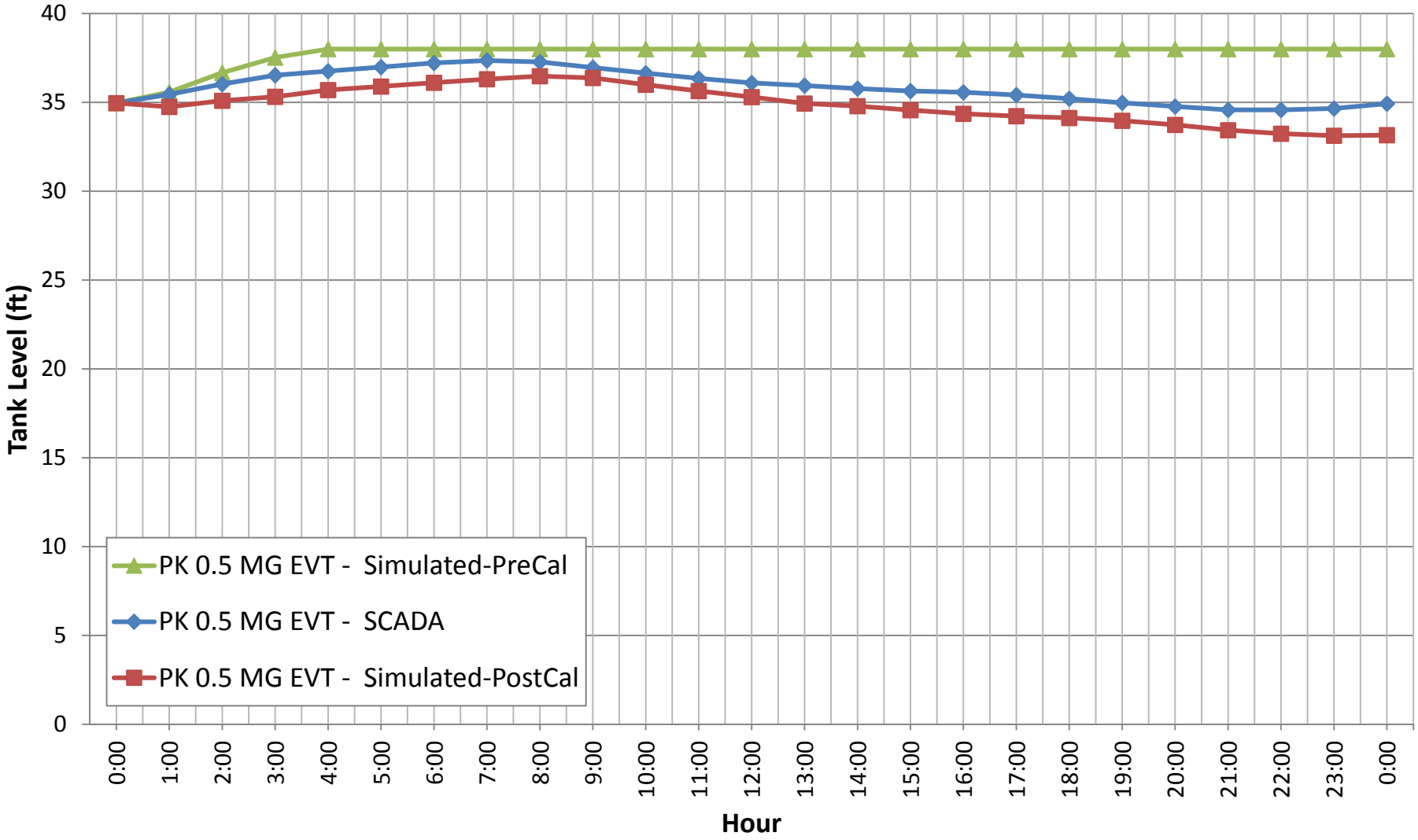


NOVEMBER 21, 2012 CALIBRATION RESULTS – TANK LEVEL AT PAHOKEE 0.1 MG ELEVATED STORAGE TANK

FIGURE 4.11

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



NOVEMBER 21, 2012 CALIBRATION RESULTS – TANK LEVEL AT PAHOKEE 0.5 MG ELEVATED STORAGE TANK

FIGURE 4.12

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

Flow correlation at all locations reflects an acceptable level of accuracy, except at the 16-inch master meter at WTP No. 11 (DSBG01), where the recorded and simulated average flows for the calibration day were 1.25 mgd and 0.44 mgd, respectively. Because of poor correlation of simulated versus observed data at this location, demand allocation, water loss conditions, valve status, and pipe diameter and configuration should be investigated on the eastern side of the City of Belle Glade where the 16-inch feeds potable water from WTP No. 11.

The simulated model results closely mirror actual tank level fluctuations during calibration day. Figures 4.11 and 4.12 compare observed and simulated data before and after calibration for two elevated storage tanks in Pahokee. As observed in the graphs, the pressures in the City of Pahokee were adjusted through the calibration of c-factors to match tanks operational conditions on the calibration day. In general, the results indicate reasonable agreement between field and modeled data.

Statistics methodologies are employed to assess the quality and reliability of the model calibration. Results of the statistical evaluation are presented in terms of pressures and flows due to the nature of the collected data at all locations for the purpose of this project. The calibration statistic used for the analyses, referred to as “mean absolute pressure and flow difference,” is defined as the mean of the absolute value of the difference between measured and simulated pressure and flow values, in psi and mgd, respectively, over a period of 24 hours. This statistic provides the average difference between observed and modeled data for all data points included in the calibration analysis. At WTP No. 11, the mean absolute pressure and flow differences are 1.2 psi and 0.2 mgd, respectively, which indicate a good correlation of simulated and observed data at this location. Results of the evaluation of the mean absolute pressure and flow differences are 2.7 psi and 0.3 mgd for all evaluated facilities located throughout the Glades Region, where observed data was recorded through SCADA system. The field data collected through pressure loggers during calibration day shows a total mean absolute pressure of 8.54 psi, which is indicative of the large absolute pressure differences observed at these two locations, especially at Pressure Logger #3.

Figure 4.13 presents a frequency diagram illustrating the percentage of absolute pressure differences between observed and simulated data for all facilities throughout the 24-hour interval period. Ninety percent of the data points were within an absolute pressure difference of 6.9 psi for the calibration scenario.

Figures 4.14 and 4.15 illustrate the correlation between the observed and simulated pressures and flows, respectively, for all locations where reliable data was collected

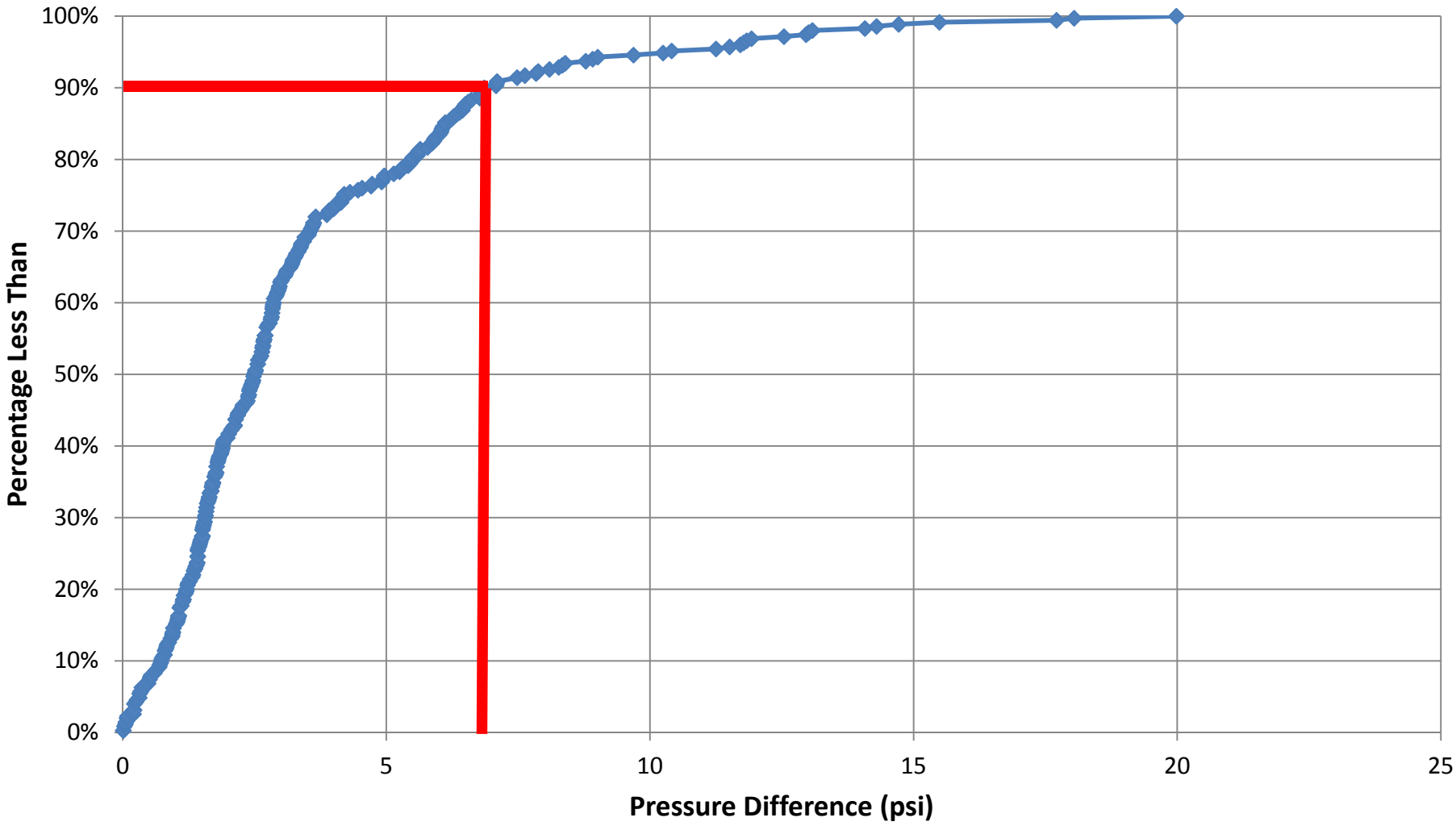
during the calibration day. As shown in Figure 4.14, pressure correlation is in general satisfactory; however, it is noted that simulated pressures are higher than observed for the Pahokee 0.075 MG tank, and Pressure Logger #3 and #4.

Figure 4.15 depicts the flow correlation for all five master meters. In general, flows present an acceptable relationship between simulated and actual data, except for the master meter flow data at the Belle Glade WTP No. 11 master meter (DSBG01). The simulated flow at this location is lower than the observed by an average of 65 percent. The Belle Glade Old WTP master meter data shows higher simulated than observed flows by an average of 17 percent at all time intervals.

4.4.7 Sensitivity Analysis

Sensitivity analysis is a technique that allows the visualization and quantification of the effects of parameters variation in the model. To decrease system uncertainty due to unknown data entered in the model, it is important to understand the effects on the model if the parameter value is varied. It is known that parameters with high potential sources of error and therefore greatest uncertainty are pipe roughness values, operational controls, system demands, and outdated pump curves.

In the Glades Region, the network accuracy of operational controls and pumps characteristics were considered to be a low source of error due to the recent installation of equipment at the Lake Region WTP No. 11. Pump curves at remote pump stations and their impact in the network are considered to be negligible with respect to the effects of the overall pressure and flow changes in the system.

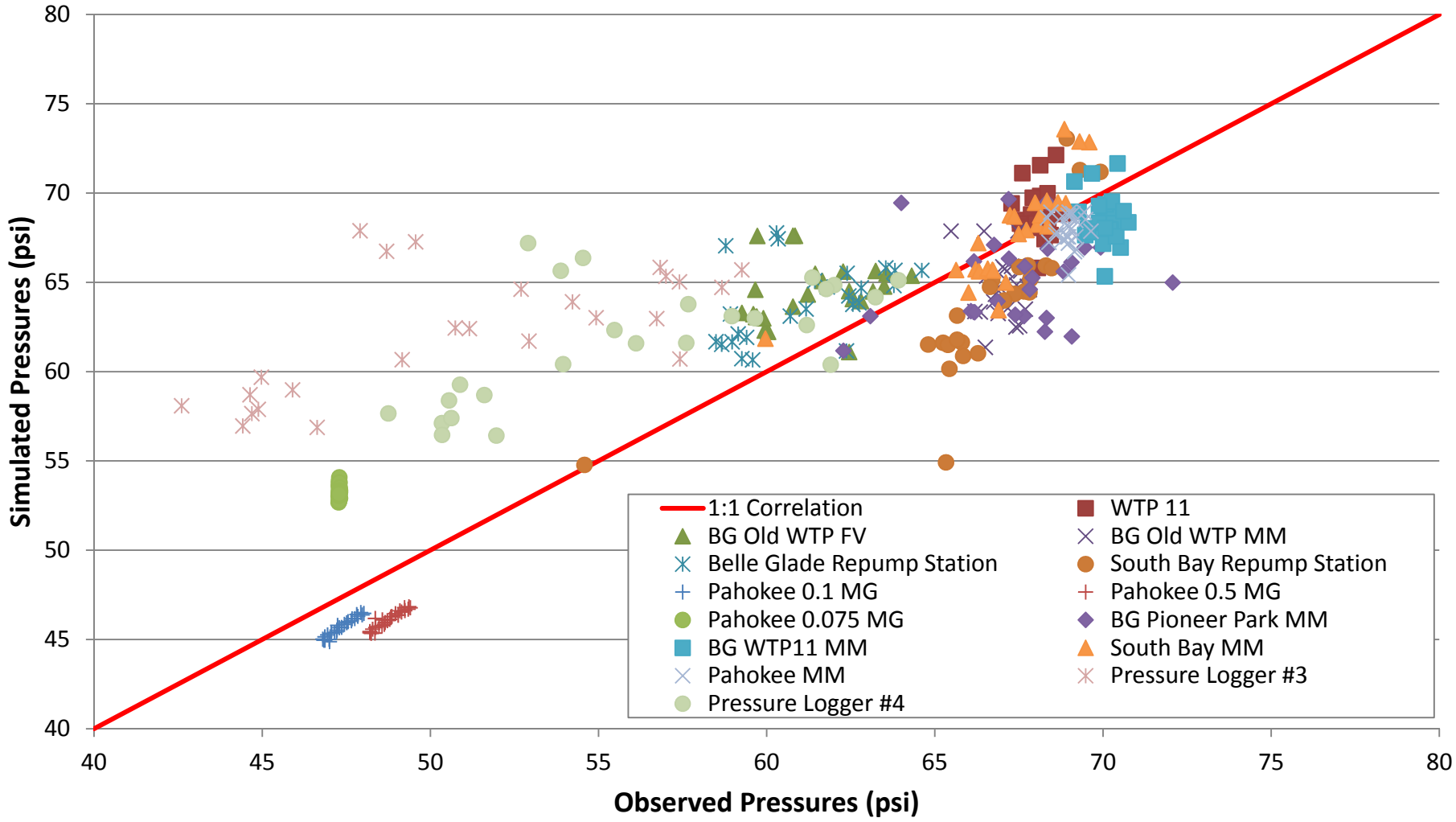


FREQUENCY ANALYSIS OF ABSOLUTE PRESSURE DIFFERENCE DURING CALIBRATION DAY

FIGURE 4.13

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

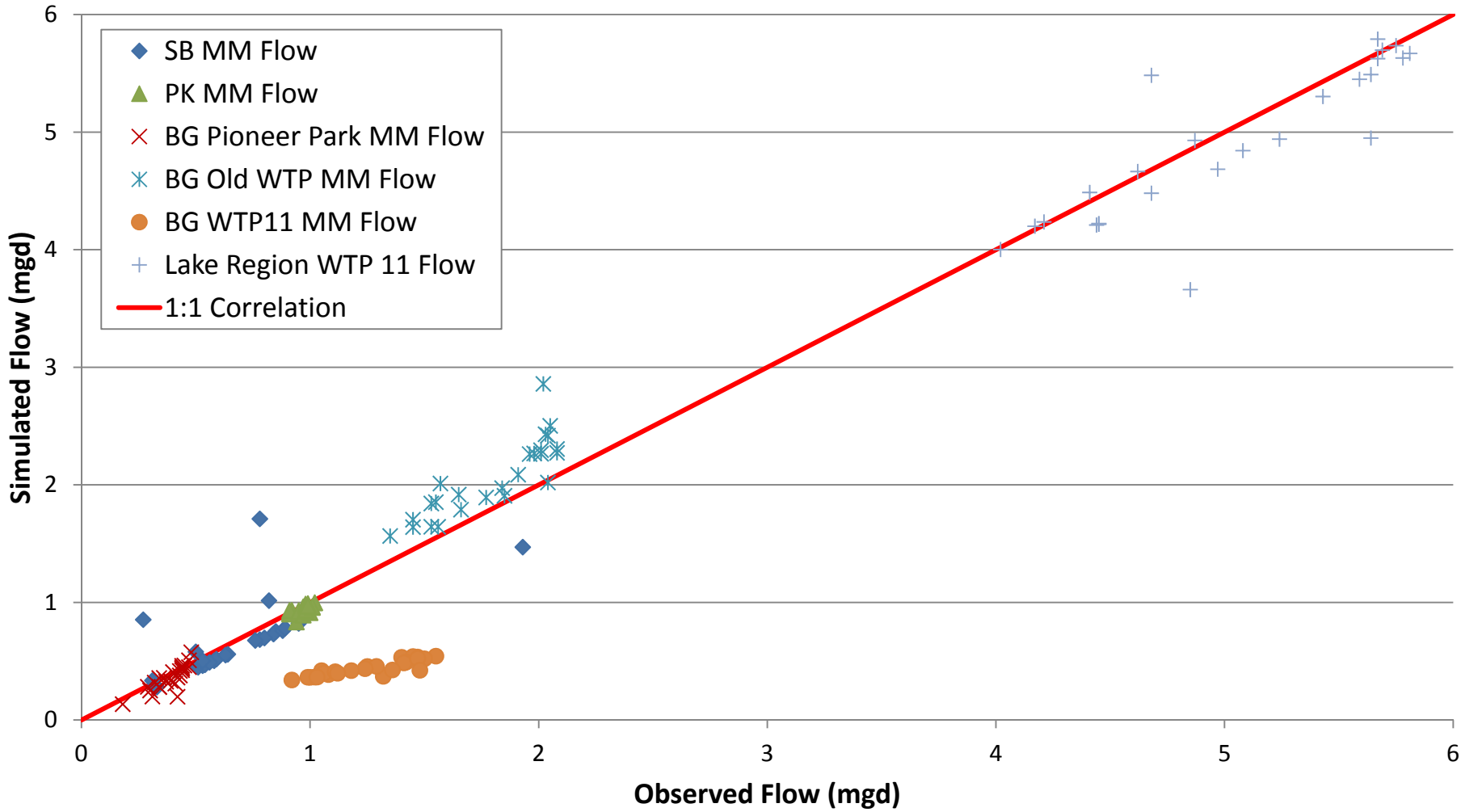


PRESSURE CORRELATON AT ALL LOCATIONS DURING CALIBRATION DAY

FIGURE 4.14

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



FLOW CORRELATON AT ALL LOCATIONS DURING CALIBRATION DAY

FIGURE 4.15

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

The source of highest potential error in the model is the distribution of water demand throughout the system, since the Glades Region experienced 48 percent water loss during the month of November 2012 based on the difference between WTP No. 11 production and the metered water usage. Water system demands were allocated using billed and master metered data, which were used to calculate the water loss in the system.

Water loss within each city cannot be identified and quantified at specific locations; however, allocation of the water loss demand was evaluated with two approaches. First, the total water loss for each city was distributed evenly to all nodes within the respective city. In the second approach, the water loss for each city was allocated proportionally to only those nodes that had a metered water usage from the billing records. This method follows the logic that more water is lost in the areas of higher water use. Modeling results for each method were compared with SCADA data. Little difference in results between the two methods was seen, implying that distribution of water loss is close to evenly balanced throughout each of the cities. Graphical results and statistical analysis presented in Chapter 4 are based on the first method of water loss allocation, which distributed water loss evenly throughout each city.

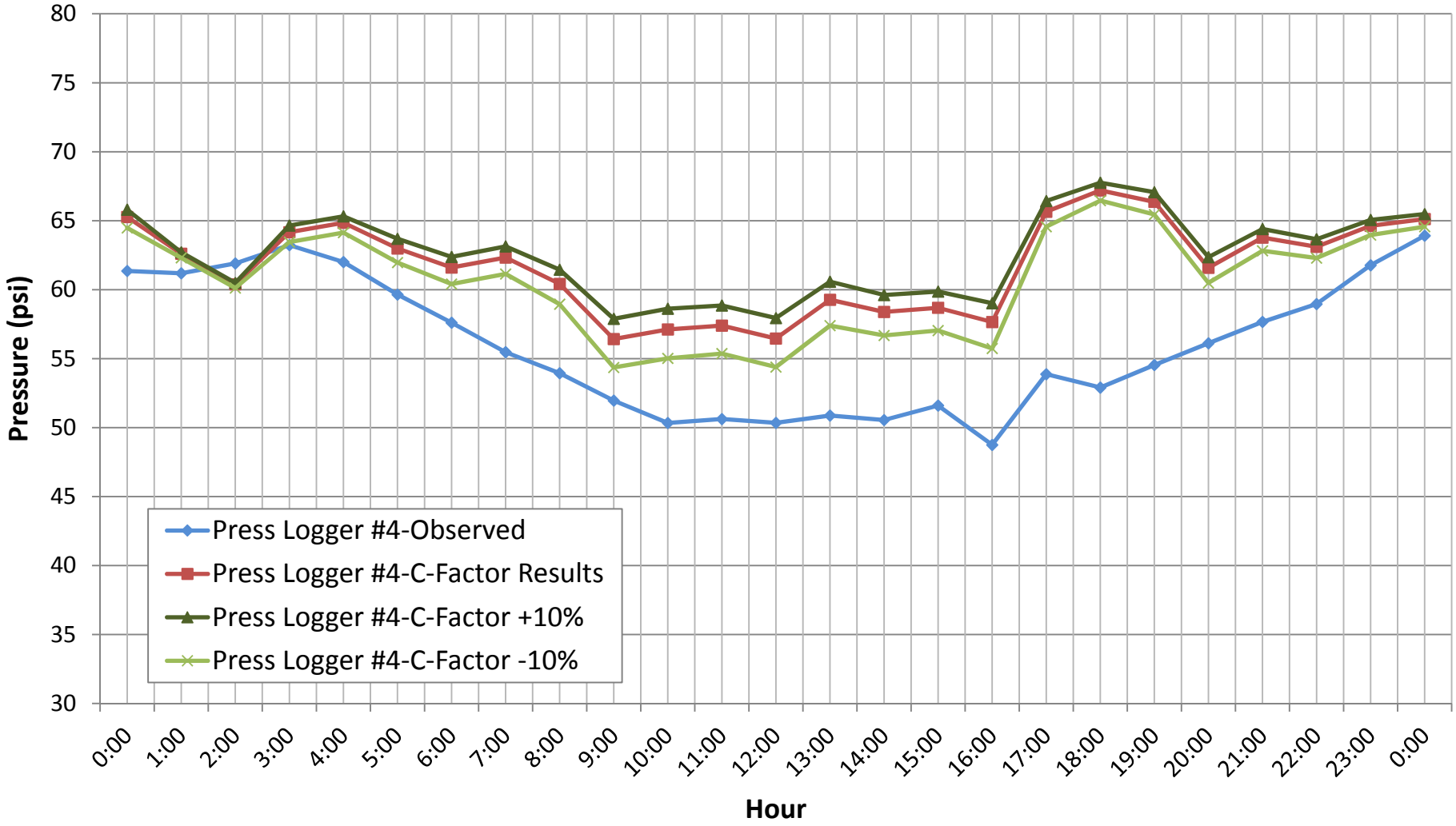
Another model parameter with potential uncertainty is pipe roughness (Hazen-Williams c-factor) values. The values chosen for this parameter cause higher or lower friction losses for water flowing through network pipes. By systematically changing the c-factor, a sensitivity simulation was conducted for each pipe material type based on the previous pipe grouping described in Section 4.4.4. Variations in pipe group c-factor ranges were evaluated in a sensitivity analysis. The sensitivity simulations identified in Table 4.9 were conducted on the calibration day scenario.

Table 4.9 C-Factors Used in Sensitivity Analysis Glades Region Water Master Plan Palm Beach County Water Utilities Department					
Material	**Pipe Group**	**Calibrator Result**	**C-Factor + 10%**	**C-Factor - 10%**	**Pipe Length (Miles)**
AC	1	108	119	97	0.3
CIP	2	80	88	72	93.3
DIP1	3	57	63	51	30.0
DIP2	4	90	99	81	0.6
GIP	5	100	110	90	0.1
HDPE	6	120	132	108	1.9
PVC	7	140	154	126	63.0
STEEL	8	110	121	99	5.0
DIP3	9	120	132	108	14.6

The calibration scenario was run using the range of c-factors listed in Table 4.9 to determine the extent of variation in results. Figures 4.16 and 4.17 illustrate the resulting pressures at two different locations using the various c-factors. The difference in modeled pressure between the +10 and -10 percent of c-factors varied from 0.37 to 3.60 psi at Pressure Logger #4 (throughout the 24-hour period), and from 0 to 2.77 psi at the 0.5 MG elevated storage tank. The sensitivity analysis results indicate that, for this distribution system, variation in c-factor has relatively little influence on system pressures in the Glades Region.

4.5 SUMMARY AND RECOMMENDATIONS

The water model was developed using data and physical characteristics of the network and boundary conditions of existing facilities. Physical characteristics such as diameters, materials, and configuration of pipes were reviewed by PBCWUD staff to accurately determine the existing pipeline connectivity in the region. Other characteristics pertaining to the model such as pump curves where provided by the County. Boundary conditions of the water distribution system, such as tank levels and pump status, were documented in the SCADA system and entered in the model to determine the operational scheme of the network. Allocation of demands and water loss were applied in the water model using actual billing records and total water volume recorded at master meters throughout the service area. The model was calibrated to simulate observed pressure and flow data collected by SCADA and field testing by modifying pipe c-factors.



CALIBRATION DAY - SENSITIVITY ANALYSIS AT PRESSURE LOGGER #4

FIGURE 4.16

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GLADES REGION WATER MASTER PLAN

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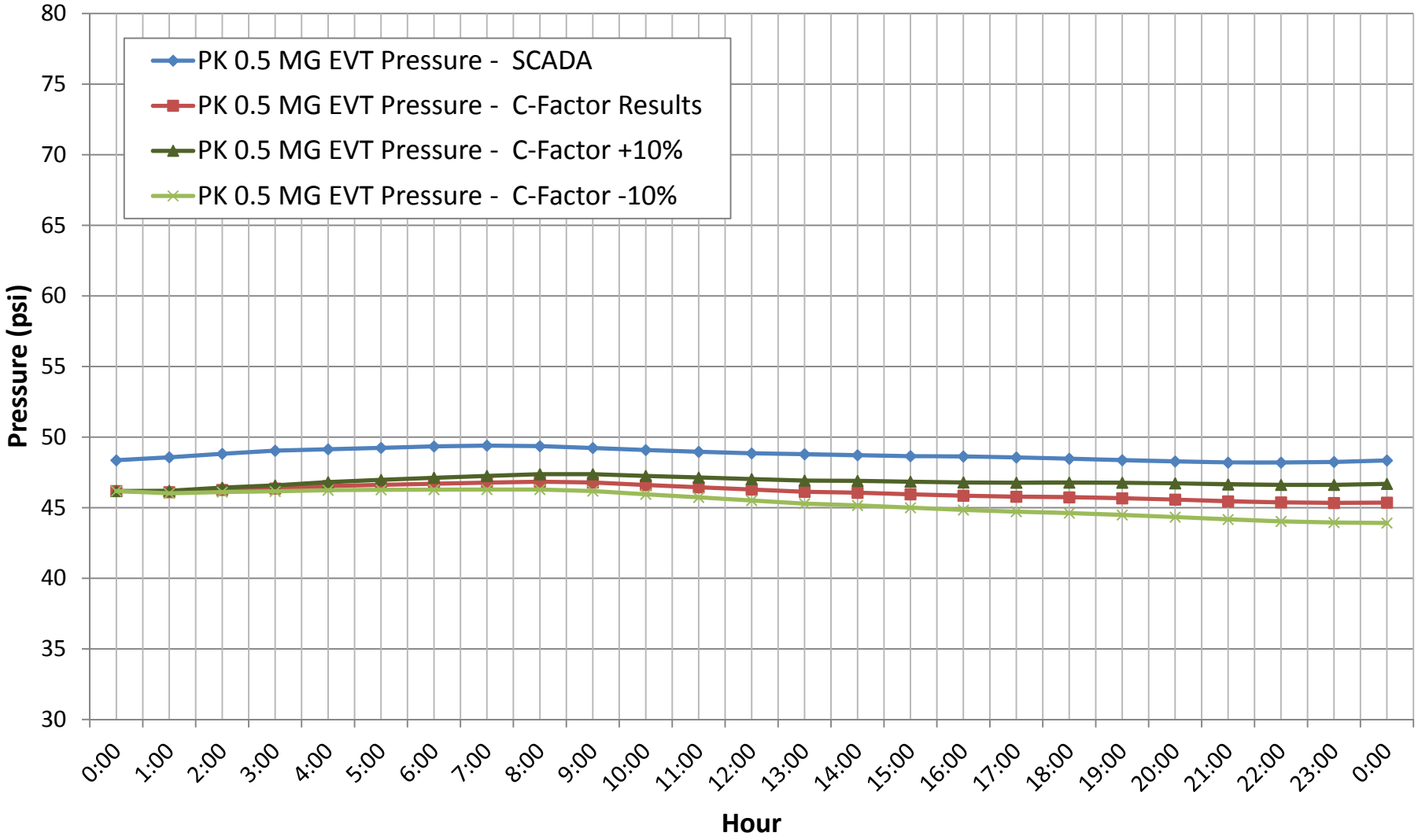

CALIBRATION DAY - SENSITIVITY ANALYSIS AT PAHOKEE 0.5 MG ELEVATED STORAGE TANK

FIGURE 4.17

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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It is concluded that the existing model is reasonably built and the assumptions are adequate based on the calibration results and subsequent sensitivity analysis. The differences that do exist between model results and observed data may be a result of the considerations discussed in the following sections.

4.5.1 Effect of Water Loss Demands

Water loss demands were obtained by comparing billing records and master meter flows recorded by the SCADA system. The calculated water loss was determined for each city and then equally applied equally at each node since the location of the water loss is unknown. Assignment of water losses in the network cannot be localized to specific locations due to the nature of the available information. For that reason, the effects of allocating water loss demand in the network instead of placing such demand at the actual source of water loss in the system could produce differences between actual and simulated results. Based on the calibration results, it is assumed that the differences are relatively minor since the total unaccounted water in the system was incorporated in the model as a demand and different methods of allocating the water loss yielded similar results.

4.5.2 Recommendations for Future Modeling Efforts

The recommendations listed below should be considered to increase the accuracy of the model results during future model updates:

- Continue to confirm the current pipe configuration and update missing information.
- Reconcile unknown pipe materials in the model.
- Revisit localized and overall water loss.
- Evaluate water demand and the diurnal demand curve for the large user Duda & Sons, located on the southeastern side of the City of Belle Glade.
- Water demand factors should be re-evaluated on an on-going basis to reflect current water use.

Chapter 5
EXISTING WATER DISTRIBUTION SYSTEM ANALYSIS

5.1 INTRODUCTION

The primary objective of the water distribution system evaluation is to verify that the existing infrastructure satisfies the performance criteria set forth in Chapter 2, to determine the level of redundancy in the distribution network and vulnerability of primary transmission water mains, and to identify necessary corrective actions. All evaluations and recommendations presented in this chapter are based on the current pipeline size, material, location, capacity, and other operational data provided by PBCWUD and as reflected in the model. Identification of infrastructure replacement needed due to age or condition is considered in the WMP to meet the established performance criteria. The existing (2013) water distribution system analysis is divided into six sections including the Introduction:

- Section 5.2 - Water System Analysis Assumptions: Informs the reader of all necessary background data and adjustments incorporated into the model, as well as key assumptions made for calculations and reporting of results.
- Section 5.3 – Existing Water Distribution System Performance: Describes the results of the model under 2013 average annual, maximum day, and peak hour demand conditions and documents available fire flow. Results such as system pressure, pipeline headloss and velocity, water age, and tank levels are presented. A series of maps are provided to aid the reader through the analyses.
- Section 5.4 – Distribution System Redundancy Analysis: Uses a modeling tool to simulate pipe breakages within the distribution network to assess the impact on customers and evaluate system redundancy.
- Section 5.5 – Strategies for Decreasing Water Age: Discusses different approaches that can be implemented to reduce water age.
- Section 5.6 - Summary of Existing System Analysis: Provides a summary of Chapter 5 including major results and recommendations.

5.2 WATER SYSTEM ANALYSIS ASSUMPTIONS

Analysis of the water system was based on the following assumptions:

Water demands were calculated based on historical finished water production data and Palm Beach County Planning Department population projections as presented in Chapter 2. Variation in demands allocated in the model could produce different results.

Water distribution pipes of less than 1-inch in diameter were not included in the model. The modeled pipe network is shown in Figure 4.1.

Existing water mains were digitized from the County's GIS database. As-built drawings, input from PBCWUD staff, SCADA data, and historical information were gathered to update the InfoWater model. The data was checked for reasonableness and consistency as described in Chapter 4.

Based on comments from PBCWUD staff, a secondary 8-inch pipe connecting the cities of Belle Glade and South Bay was reconditioned and put back in service in December 2012. Pipe P3132 was added in the model to represent this pipeline with a c-factor of 140.

Existing pump station and tank data including elevations, pump curves, tank diameters, and operating setpoints was incorporated into the model. This data was provided by PBCWUD.

Existing water mains are modeled using Hazen-Williams c-factors ranging from 57 to 140 correlating with pipe material. C-factors were selected during model calibration as described in Chapter 4.

Initial tank levels are set at approximately half full or at typical levels at midnight based on SCADA data. The Belle Glade Old WTP has been taken out of service; therefore, elements related to this facility have been inactivated in the model. The Belle Glade and South Bay Repump Stations and 0.5 MG EVT in Pahokee are the only operational remote facilities in the 2013 scenarios, unless otherwise noted in subsequent sections of this chapter. Appendix F provides information on facility operation for each model scenario. The 0.1 MG EVT tank in Pahokee does not improve system performance in 2013 (the same hydraulic results are obtained with and without this tank); therefore, it was not included in the 2013 model scenarios. However, this tank will be needed if the 12-inch pipeline along the Herbert Hoover Dike (HHD) is taken out of service, until a new pipeline is constructed along Bacom Point Road as discussed in Section 6.2.

Junctions between high service pumps discharge and suction pipelines are excluded from the pressure analyses because they are characterized by either very high or very low pressures.

Fire flow scenarios were assumed to occur during maximum day demands, but not at peak hour. Therefore, fire flows were added to the base maximum day demands for all fire flow evaluation scenarios.

Pressure control valve, flow control valve, tank controls, and pump settings for all scenarios are included in Appendix F. Variations in control settings may alter system results.

5.3 EXISTING WATER DISTRIBUTION SYSTEM PERFORMANCE

The following sections describe the existing distribution system performance under average annual, maximum day, peak hour, and fire flow conditions. A redundancy analysis of the existing distribution system was also completed to identify critical pipes in the network and to determine the impact of potential pipe breaks in the system. Water age in the distribution system is modeled under the average annual demand scenario.

Maps illustrating the parameters set forth by the selected performance criteria are presented for discussion purposes when the criteria are not met. This chapter provides explanations and descriptions of non-compliant areas of the system. Maps presented include pipe velocity and headloss, junction pressure and water age, and fire flow availability. Additional figures are located in Appendix G. Average annual demand and maximum day demand conditions are modeled using EPS scenarios. Peak hour and fire flow scenarios are modeled under steady-state conditions. For EPS simulations, most of the reported parameters are the minimum or maximum critical result.

For maximum day demand scenarios, the maximum velocity and maximum headloss in each pipe and minimum pressure for each node does not necessarily occur at the same time throughout the EPS period. Rather, it is the maximum velocity and headloss and minimum pressure achieved at any time during the 24-hour period.

Water quality issues are addressed through maps that show maximum water age obtained throughout a 120-hour average annual demand EPS scenario for all junctions that have a demand greater than zero. Areas with highest water age are discussed and linked to other parameters or results such as facilities operational settings, headloss, pressure, or velocity when applicable.

Fire flow scenarios are divided into commercial and residential scenarios since different types of land use have different required available fire flow (1,500 gpm for commercial areas and 1,000 gpm for residential areas) as specified in the NFPA 1, Fire Code, Florida 2012 Edition, Section 18.4.5, Fire Flow Requirements for Buildings. Maps showing available fire flow at nodes corresponding to fire hydrants in the distribution system are presented, as well as a summary map of commercial and residential hydrant locations that cannot currently meet required fire flows.

5.3.1 2013 Average Annual Demand Condition and Water Age

The existing system was evaluated under annual average demand conditions to illustrate typical operating parameters and to evaluate the impact of such parameters on customers, particularly in terms of water quality (simulated by age in this analysis). As described in Chapter 4, average annual scenarios are set up as extended period simulations of 120 consecutive hours, in which model output is obtained at every hour time step. Essentially, this results in a five-day simulation of water movement through the distribution system at average demand conditions with consistent daily hydraulic conditions, which is normally when water quality issues occur.

5.3.1.1 Hydraulic Conditions

While hydraulic conditions (i.e., pressure, velocity, and headloss) are not commonly stressed during average annual conditions due to lower water demands, these parameters were evaluated with the model to ensure the system is meeting the performance criteria described in Chapter 2.

Throughout the system, maximum pipe velocities were lower than 6.74 fps, which comply with criteria set for the Glades Region. Evaluation of maximum headloss per 1,000 feet in the system shows that only 0.02 percent of pipes experience a headloss higher than 10 ft/kft with a maximum of 14.62 ft/kft. A total of three non-compliant pipes were identified. These pipes are located in Belle Glade at Pioneer Park Master Meter (8-inch pipe), the South Bay Repump Station tank (12-inch feed line), and at WTP No. 11 (discharge header), respectively.

The average minimum pressure throughout the distribution system is 55 psi. Minimum pressures lower than 50 psi are observed for 50 percent of the nodes in the City of Pahokee along U.S. Route 441 and Bacom Point Road, the downtown area, and Canal Point. In the City of South Bay, two locations along NW 1st Avenue violate minimum pressure criteria, which can be attributed to a high elevation. In

total, 86 percent of the nodes meet the performance criteria of 50 psi as shown in Figure G.1.

All remote storage and repump stations are able to pump required flows and maintain normal tank levels under existing average annual demand conditions. The City of Pahokee does not meet minimum pressure requirements due to existing elevated tanks controlling the pressure gradient in the area. This trend at the City of Pahokee will remain as long as the elevated tanks remain in service. Aside from the few pipelines mentioned above that exceed the headloss per 1,000 feet criterion, the water distribution system meets the selected performance criteria during the average day demand analysis at the Cities of Belle Glade and South Bay.

5.3.1.2 Water Age

The age of water at any location in the network is the time of travel to the location or "retention time." Water age is a function primarily of water demand, system operation, and system design. As water demand increases, the amount of time any given gallon of water resides in the distribution system decreases. Demand is related to land use patterns, types of commercial-industrial activity present in a community, weather (i.e., irrigation), and water use habits of the community (i.e., conservation practices, reuse practices). Low water quality or no water mixing (stagnant areas) are usually accompanied by low finished water demand. Water age varies as a result of these factors.

Areas with atypical water age and/or no change in water age throughout the simulation period are identified as areas of concern. The Water Industry Database (AWWA and AwwaRF, 1992) indicates an average distribution system retention time of 1.3 days and a maximum retention time of 3.0 days, based on a survey of more than 800 U.S. utilities. The literature cites examples of distribution systems with both "short" (i.e., less than 3 days) and "long" (i.e., greater than 3 days) water age (EPA, 2002). The Glades Region has areas of both "short" and "long" water age.

Figure 5.1 illustrates the maximum water age throughout the distribution system under average annual demand conditions during a five-day simulation. Areas with the highest water age (water that has achieved more than 96 hours of travel time within the system) are observed in red and account for two percent of the all model nodes with a demand greater than zero. These areas are observed in scattered areas throughout each city where high water age is mainly due to a combination of dead-end pipes and low water demand.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Water Age (hrs)

- 13.1 - 24
- 24.1 - 48
- 48.1 - 72
- 72.1 - 96
- 96.1 - 120

2013 Water Mains

GUUSA

City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Ln

E 7th St

Mc Cuire Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue I

Gator Blvd

Duda Rd

N US Highway 27

US Highway 27

SW 1st St

State Road 80

County Road 827A

County Road 880

E Canal St S

Maximum Water Age during 2013 Annual Average Demand Condition

Figure 5.1

N

0 2,750 5,500 Feet

The water age throughout the Glades Region and at each city is summarized in Table 5.1. Water age results are based on 2013 annual average demands with the South Bay Repump Station and the 0.5 MG EVT in Pahokee operational. While the Belle Glade Repump Station is typically online, the 2013 average annual scenario was modeled without this storage tank in operation in order to compare water age with and without this storage tank. This facility was turned on for the 2015 average annual scenario resulting in a slight increase in water age in Belle Glade, as discussed in Section 6.3.1 of Chapter 6.

Table 5.1 Water Age for 120-Hour EPS during 2013 Annual Average Scenario
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Water Age	Percentage of System Nodes by City				Comments
	Belle Glade	Pahokee	South Bay	Combined Glades Region	
Water Age > 96 hours	1%	5%	5%	2%	Highest water age (potentially degraded water quality)
72 Hours < Water Age ≤ 96 Hours	1%	7%	58%	10%	Long water age
48 Hours < Water Age ≤ 72 Hours	4%	49%	18%	14%	Intermediate water age
24 Hours < Water Age ≤ 48 Hours	47%	39%	19%	42%	Short water age (good water quality)
Water Age ≤ 24 Hours	48%	1%	0%	33%	Shortest water age (best water quality)
Average Water Age (hours)	28	53	72	38	Average water age is calculated using nodes with demands greater than zero

Initial tank levels in the model are similar to historical SCADA data. Additional adjustments to the model (i.e., pump control settings, lower initial tank level) could produce greater turnover in tanks, which would lead to a decrease in water age.

During the simulation, the 0.5 MG EVT came to approximate equilibrium whereas the storage tank at South Bay maintained a decreasing water level throughout the simulation. Storage tank turnover is difficult to improve in Pahokee for the existing scenario due to the set pressure gradient of the elevated tanks. The tanks are

operated at a high level (close to full) in order to keep the water pressure as high as possible.

As summarized in Table 5.1, good water quality (water age less than 48 hours) is achieved in 74 percent of the overall Glades Region system. Water age less than 48 hours is observed at 95 and 40 percent of model nodes in the cities of Belle Glade and Pahokee, respectively. Areas with intermediate water quality (water age between 48 and 72 hours) are shown as yellow in Figure 5.1. Half of all Pahokee system nodes fall into this category with only 14 percent for the entire Glades Region. Areas of poor water quality (water age between 72 and 96 hours) were observed mainly in the City of South Bay where 58 percent of system nodes fell into this category. The total average retention time at the City of South Bay is 72 hours.

Degraded water (water age greater than 96 hours) accounted for two percent of the nodes and were generally observed at dead-end pipes and peripheries of the cities of Pahokee and South Bay. In general, good water quality was observed in Belle Glade due to its proximity to WTP No. 11, while poor water quality was observed in South Bay due to long retention time in the storage tank. The 2013 annual average data results show a distinctive pattern of increased water age at the cities of South Bay and Pahokee due to the operation of storage tanks.

Additional adjustments to the model, such as operation at lower levels (resulting in a smaller storage volume), would lead to a decrease in water age in the system. Potential strategies to decrease water age in the distribution system are discussed in Section 5.5.

5.3.2 2013 Maximum Day Demand Condition

The existing system was evaluated with a 24-hour EPS scenario at maximum day demand conditions. Operational conditions similar to the 2013 annual average settings were used for the 2013 maximum day scenario. Appendix F presents a summary of facilities in operation and controls used in the maximum day demand scenario. The distribution system performance criteria for this demand condition were:

- Headloss less than 5.5 feet per 1,000 feet in pipes 24 inch and greater,
- Headloss less than 10 feet per 1,000 feet in pipes less than 24 inches,
- Velocity equal or less than 7 fps, and
- System pressure greater than or equal to 50 psi.

Figure 5.2 illustrates the maximum headloss per 1,000 feet during maximum day demand conditions and indicates the pipes that do not meet the performance criteria (only 0.7 percent of pipes in the network). Areas with headloss in excess of the established criteria are only pipes less than 24 inches. These pipelines include:

- 8-inch pipe connecting to Pioneer Park Master Meter in Belle Glade.
- 2-inch line located on NE 7th Street between NE Ave B and E Ave A in Belle Glade.
- Area northeast of Belle Glade Old WTP on W Canal Street S.
- 12-inch pipe segment connecting South Bay Repump Station with pipelines on NW 8th Ave.
- 4-inch pipeline connecting 6 and 8-inch lines on NW 17th St and State Road 715, respectively, in Belle Glade.
- Short segment of 6-inch line on SE 1st Ave connecting two 8-inch lines in South Bay.
- Segments on State Road 80 south of James Wheeler Way in the City of Belle Glade.
- 4-inch segment on McClure Road immediately north of Rim Canal Road in the City of Pahokee
- 6-inch pipe located on W Lake Road between NW 7th Street and Hillsboro Street in the City of Belle Glade.

Figure G.2 illustrates the maximum pipe velocities experienced during the maximum day demand condition. The maximum velocity and headloss in each pipe do not necessarily occur at the same time throughout the 24-hour period or at the same location. The maximum velocities in Belle Glade, South Bay, and Pahokee were 4.6, 3.6, and 1.6 fps, respectively.

All nodes in the cities of Belle Glade and South Bay maintain pressures greater than 50 psi, meeting the minimum pressure criterion, with the exception of the area located at the dead end on the east side of Gator Boulevard/Airport Road in Belle Glade, which has a pressure of 48 psi. In contrast, 50 percent of the nodes in the City of Pahokee have minimum pressures lower than 50 psi, which are mainly observed along U.S. Route 441 and in the western and northern part of the city. Pressures in the City of Pahokee are a result of the water elevation in the existing elevated tanks. During the 2013 maximum day demand scenario, the average elevation in the 0.5 MG EVT is 131 feet.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe Diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/kft

Pipe diameter 24" and above

- Less than 5.5 ft/kft
- Above 5.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Carlmore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue L
Main St
Gator Blvd
E Canal St N
SW 10th St
SW 5th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Pipelines Exceeding Headloss Criteria during 2013 Maximum Day Demand Condition

Figure 5.2

N

0 2,750 5,500 Feet

Figure 5.3 illustrates minimum pressures during maximum day demand conditions. System wide, about 86 percent of the nodes meet the minimum pressure criterion during 2013 maximum day demand.

Tanks currently in operation were evaluated under maximum day demand conditions. The tank level and percent full of each tank during the maximum day EPS scenario are illustrated in Figure 5.4. This figure shows that the tanks are able to provide adequate storage during maximum day demand conditions. Finished water storage requirements for all planning periods are discussed in Chapter 7.

5.3.3 2013 Peak Hour Demand Condition

A steady-state scenario was performed to evaluate the peak hour demand condition. Peak hour is the highest demand one-hour period, which represents the highest potential demand in the distribution system. For this scenario, the Belle Glade Repump Station and South Bay Repump Station are operational in order to provide additional pumping capacity during peak hour demand. Given that the peak hour demand is almost instantaneous in nature, it is modeled using a steady-state simulation.

Criteria used to evaluate this scenario include the following:

- Headloss less than 7.5 feet per 1,000 feet in pipes 24-inch and greater,
- Headloss less than 10 feet per 1,000 feet in pipes less than 24 inches,
- Velocity equal or less than 8 fps, and
- System pressure greater than or equal to 50 psi.

Figure 5.5 illustrates system pressure the under peak hour demand condition. Figure 5.6 illustrates the pipelines in which the headloss criteria are exceeded. Figure G.3 identifies pipe velocities in the system under the peak hour demand condition. All the pipes meet the velocity criteria during the peak hour scenario.

Pressure varies from 38.8 to 77.6 psi throughout the system during the peak hour scenario. Pressures below 40 psi are attributed to high node elevations (35 feet) of two nodes located along Lakeview Drive in the City of Pahokee. Average pressures of 59, 63, 64, and 49 psi occur in the Glades Region, Belle Glade, South Bay, and Pahokee, respectively.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 41.6 - 50
- 50.1 - 60
- 60.1 - 77.7
- 2013 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr

US Highway 441 N

Conners Hwy

E Main St

Lardmore Rd

S Lake Ave

Bacom Point Rd

S Barfield Hwy

N State Market Ln

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Bell Glade Rd

State Road 15

Hooker Hwy

State Road 715

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue E

Gator Blvd

N US Highway 27

US Highway 27

SW 1st St

E Canal St S

County Road 827A

Duda Rd

County Road 880

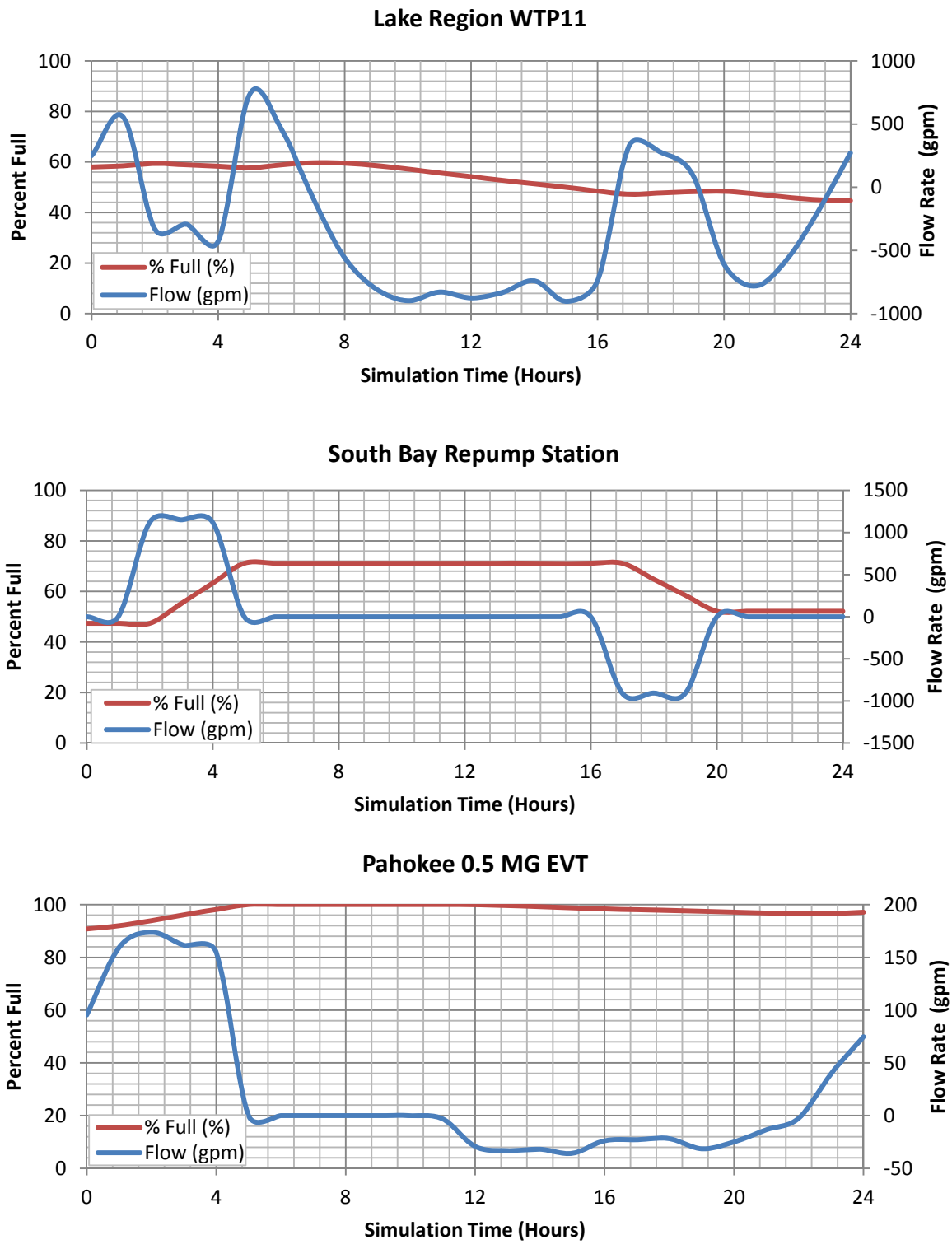
carollo

Minimum Pressure During 2013 Maximum Day Scenario

Figure 5.3

N

0 2,750 5,500 Feet



TANK PERCENT FULL AND FLOW RATE IN/OUT DURING 2013 MAXIMUM DAY CONDITION

FIGURE 5.4

PALM BEACH COUNTY UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 38.8 - 40
- 40.1 - 50
- 50.1 - 60
- 60.1 - 77.6
- 2013 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr

US Highway 441 N

Conners Hwy

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Ln

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Bell Glade Rd

State Road 15

Hooker Hwy

State Road 715

State Road 80

Curlee Rd

N Sugar House Rd

Gator Blvd

N US Highway 27

US Highway 27

E Canal St S

County Road 827A

Duda Rd

County Road 880

Pressures During 2013 Peak Hour Demand

Figure 5.5

N

0 2,750 5,500 Feet

carollo

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/kft

Pipe diameter 24" and above

- Less than 7.5 ft/kft
- Above 7.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr

US Highway 441 N

Conners Hwy

E Main St

Canimore Rd

Bacom Point Rd

S Barfield Hwy

N State Market Ln

E 7th St

Muck City Rd

Section 20 Rd

Bell Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue L

NW Main St

SW Main St

SE 3rd St

E Canal St

Gator Blvd

N US Highway 27

US Highway 27

SW 1st St

County Road 827A

Duda Rd

County Road 880

Pipelines Exceeding Headloss Criteria under 2013 Peak Hour Demand Condition

Figure 5.6

N

0 2,750 5,500 Feet

Pressure in the City of South Bay complies with the minimum pressure criteria. Pressures below 50 psi are mainly observed on the west and north sides of the City of Pahokee, along U.S. Route 441, East Main Street, and Canal Point due to the pressure gradient established by the 0.5 MG EVT. Pressures in the upper 40 psi are observed on Gator Boulevard/Airport Road east of NE 3rd Street in the City of Belle Glade. About 25 percent of the nodes in the Glades Region system are below the pressure criterion, with the majority of those located in the City of Pahokee and the rest in the eastern portion of the City of Belle Glade.

Pipes with high headloss in the existing peak hour scenario include some of the noncompliant pipes in the 2013 maximum day scenario, and an additional 0.6 miles of pipe in the City of South Bay as shown in Figure 5.6. In South Bay, the 12-inch pipe connecting the South Bay Repump Station to the pipelines on NW 8th Ave and the 6-inch lines on NW 1st Street and Dr. Martin Luther King Jr. Blvd. experience high headloss. Additionally in South Bay, the stretch of 6-inch pipe on State Road 80 between NW 1st Street and NW 4th Street in the north side of the city shows high headloss. High headloss observed in the 8-inch pipe located on the southeast corner of Gator Boulevard/Airport Road and State Road 80 cause the low pressure results observed in this area.

5.3.4 2013 Fire Flow Analysis

A steady-state fire flow analysis was completed to determine available fire flow at existing fire hydrants. The hydrant GIS layer was used to differentiate the location of fire hydrants from regular junctions. Out of the 848 fire hydrants in the GIS layer, 21 were private and 8 do not have a close junction in the model. Therefore, a total of 820 fire hydrants were included in the fire flow analysis.

The parcel GIS layer containing property usage information was used to differentiate commercial and residential fire hydrants. Table 5.2 identifies the list of property uses classified as commercial or residential used to categorize the 820 fire hydrants. All fire hydrants within a radius of 50 feet of an identified commercial parcel were categorized as commercial fire hydrants. A total of 251 nodes are identified as commercial fire hydrants in the model.

Table 5.2 Property Use Classification to Categorize Residential and Commercial Fire Hydrants Glades Region Water Master Plan Palm Beach County Water Utilities Department	
Commercial Type Parcel	**Residential Type Parcel**
Airport/Marina	Centrally Assessed
Auto Sales	City Inc Nonmuni
Clb/Ldg/Un Hall	Crop Soil Class 1
College	Crop Soil Class 3
Department Store	Districts
Federal	Equestrian
Financial	Golf Course
Forest/Pk/Rec	Gragsoil Class 1
Hospital	Leasehold Int
Insurance	Misc Residence Sfr
Light Mfg	Mobile Home
Motel	Mort/Cemetery
Multifamily	Multifamily < 10 Units
Night Clubs	Multifamily < 10 Units-Comm Zoning
Non Ag	Multifamily < 10 Units-Ind Zoning
Office Multistory	Municipal
Office One Story	Orchard Groves
Open Storage	Orn/Misc Agri
Orphng/Non-Prof	Pkg Lt / Mh Pk
Packing	R/W - Buffer
Prof Offices	Religious
Prv Hospital	River/Lakes
Prv Schl/Coll	Single Family
Pub Cty School	Single Family-Comm Zoning
Restaurant	Single Family-Ind Zoning
Restaurant, Drive In	Store/Office/Residential
Retirement	Vacant
Retirement Income Restricted	
Sani/ Rest Home	

Table 5.2 Property Use Classification to Categorize Residential and Commercial Fire Hydrants Glades Region Water Master Plan Palm Beach County Water Utilities Department	
Commercial Type Parcel	**Residential Type Parcel**
Service Shops	
Service Station	
Shopping Center Cmmity	
State	
Stores	
Supermarket/Drug Store	
Thtr/Aud/Clbhs	
Utility	
Vacant Commercial	
Vacant Industrial	
Vacant Instit	
Wareh/Dist Term	

Fire flow demands were simulated using the maximum day water demand plus the minimum fire flow rate required at each junction identified to represent a fire hydrant. The minimum fire flow at commercial and residential fire hydrants is 1,500 and 1,000 gpm, respectively with a residual pressure of 20 psi. The results of this analysis are shown in Figure 5.7.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Residential Fire Flow

- Insufficient Fire Flow (Less than 1,000 gpm)
- Sufficient Fire Flow (More than 1,000 gpm)

Commercial Fire Flow

- Insufficient Fire Flow (Less than 1,500 gpm)
- Sufficient Fire Flow (More than 1,500 gpm)
- 2013 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Lakemore Rd

Belle Glade Palm Rd

S Lake Ave

Seaboard Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

NW Avenue L

Main St

Gator Blvd

Canal St N

E Canal St N

SW 5th St

SW 10th St

E Avenue G

SW 3rd St

S Main St

E Canal St S

N US Highway 27

US Highway 27

SW 1st St

County Road 827A

Duda Rd

County Road 880

2013 Fire Flow Sufficiency during Maximum Day Demand Condition

Figure 5.7

N

0 2,750 5,500 Feet

After comparing available fire flow with the required fire flow at each hydrant, hydrants not meeting the fire flow criteria were identified. These fire hydrants were generally found in clustered groups. The number of non-compliant fire hydrants is summarized in Table 5.3. Approximately 34 and 41 percent of the residential and commercial fire hydrant nodes, respectively, did not meet the fire flow criteria. The majority of fire hydrants failing (173 fire hydrants) are located in the City of Belle Glade, followed by the City of Pahokee and South Bay (91 and 34, respectively). In general, more than a third of all fire hydrants in the region do not comply with the fire flow requirements.

Non-compliant residential fire hydrants are mainly located in clusters on the peripheries of the cities where minimum pressures of 20 psi or available fire flow (1,000 gpm) cannot be achieved. Other non-compliant residential fire hydrants were located on pipes with diameters less than 6 inches, such as along Bacom Point Road between SW 15th Street and Lemon Avenue, McClure Road in Pahokee, and W Lake Road and Tabit Road in Belle Glade.

The majority of commercial fire hydrants are centrally located in each city. Most failing commercial hydrants are due to pipe connections less than 6-inch in diameter. The City of South Bay has the highest percentage of non-compliant commercial fire hydrants at 53 percent. Increase of pipe diameter and redundancy in the system are recommended to improve fire flow availability at problematic areas.

Table 5.3 Percentage of Non-Compliant Fire Hydrants
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Combined Glades Region	Belle Glade	South Bay	Pahokee
Residential Fire Hydrants	34%	33%	27%	39%
Commercial Fire Hydrants	41%	40%	53%	39%
Total	36%	35%	35%	39%

The non-compliant fire hydrants identified in Figure 5.7 should be field tested to verify model results. At hydrants where deficiencies are verified in the field, additional evaluations of the distribution system should occur to determine alternatives for increasing fire flow. Recommended improvements to increase fire flow are discussed in Chapter 6.

5.4 DISTRIBUTION SYSTEM REDUNDANCY ANALYSIS

An analysis of distribution system vulnerability was completed to determine the reliability and redundancy of the network in the event of pipe breaks or closed valves. In this analysis, InfoWater's Protector Water Security Planning Module was used to simulate the consequence of pipe breaks on the ability of the system to meet peak hour demands while maintaining a minimum pressure of 20 psi. The Protector tool presents results in terms of the outcome after a single pipe breakage for each individual pipe in the system. Outcomes are divided in three categories:

- "Cannot supply demand" if the pipe breaks,
- Can still supply demands "with warnings" if the pipe breaks; however, the minimum specified pressure of 20 psi cannot be maintained in the system, and
- A "pass" status indicating that all demands and minimum pressures of 20 psi are satisfied if the pipe breaks, although pressures may be lower than the 50 psi performance criterion.

In addition to this categorization, results include the maximum pressure violation that would occur at the critical junction for each individual pipe break simulation. This methodology does not prioritize in terms of the magnitude of the demand deficiency.

Evaluation of the vulnerability of the system was performed for all pipes except dead-end pipes. Upstream nodes of pumps were also excluded from the analysis. Table 5.4 summarizes the total linear feet of pipe by diameter that was not evaluated (dead-end pipes), passing, or failing the vulnerability evaluation. During the redundancy analysis, ruptured pipes unable to supply water demand (causing a system disconnection) or maintain pressures greater than 20 psi in the network are classified as "fail." About 15 percent of the lines are dead-end pipes and therefore not evaluated during the vulnerability analysis. In total, 147 miles of pipes were given a "pass" status during the vulnerability evaluation indicating that the network can maintain its hydraulic reliability, satisfy water demands during the peak hour conditions, and maintain minimum pressures of 20 psi if breakage occurs. The "passing" pipes account for 73 percent of all the pipes in the system as shown in blue in Figure 5.8.

In total, 12 percent of all pipes in the network are classified as "fail" indicating that the pipe rupture causes a system disconnection and it is unable to supply water demand or maintain minimum specified pressures of 20 psi. Figure 5.8 provides an overview of the location of the failing pipes due to inability to supply demand in red

and minimum pressure violation in orange. Approximately 4 and 9 percent of the pipes in the network failed due to pressure violation and inability to supply demand, respectively.

It is noted that some of the pipes failing are large in diameter and act as main distribution lines in the region. For example, if breakage occurs anywhere along the 30-inch distribution line exiting WTP No. 11, the system would experience a hydraulic failure either due to inability to supply demand or maintain minimum pressure of 20 psi. As indicated in Figure 5.8, the 24-inch line connecting with the 30-inch line at the intersection of NW 16th St and W Canal St N also fails, indicating that these pipes lack redundancy in the system, and a rupture on any of them would cause a hydraulic failure in the system.

The next most critical pipe observed in the network was 1.2 miles of the 16-inch line serving the City of Pahokee located along State Road 715. Rupture of this pipe causes the network to be unable to meet demand in Pahokee after exhausting water available in storage tanks.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Vulnerability Results 2013

- Non-Evaluated Pipe
- Pass
- Fail - with warnings
- Fail - Cannot supply demand
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Belle Glade Rd

Section 20 Rd

State Road 15

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

NW Avenue L

N Main St

SW 5th St

SE Avenue G

SE 3rd St

S Main St

Duda Rd

Gator Blvd

E Canal St S

County Road 880

County Road 827A

N US Highway 27

Palm Beach Rd

State Road 80

Vulnerability Analysis during 2013 Peak Hour Demand Condition

Figure 5.8

N

0 2,750 5,500 Feet

The majority of failing pipes in the network are 6, 8, and 12-inch pipes, accounting for 75 percent of total pipes failing. Figure 5.8 shows two locations, Torry Island on the western side of Belle Glade and Villa Lago Homes in South Bay (located at intersection of Island Road and NW 1st Ave), where single 6-inch lines provide water with no redundancy. Other areas of concern are neighborhoods in the eastern area of Belle Glade on Gator Boulevard/Airport Road and Canal Point in Pahokee. These two areas are fed by single 8-inch and 12-inch pipes, respectively, which would cause a system disconnection due to pressures below 20 psi if rupture occurred.

Table 5.4 2013 Vulnerability Analysis Results
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Diameter	Pipes Failing (LF)		Total Fail (LF)	Total Pass (LF)	Pipes Not Evaluated (LF)	Total (LF)
	Cannot Supply Demand	Minimum Pressure Violation				
2	*5,217*		5,217	33,957	37,502	76,676
2.5				275		275
3				1,524	10	1,534
4	*1,116*		1,116	23,827	12,106	37,050
6	*51,290*	*793*	52,083	340,770	66,280	459,133
8	*14,506*	*15,502*	30,008	203,745	28,269	262,022
10	*2,622*		2,622	11,819	282	14,723
12	*9,140*	*5,908*	15,048	88,824	8,579	112,452
14				34		34
16	*6,384*	*35*	6,419	71,273	173	77,864
18		*12*	12	58		70
20		*18*	18	821	359	1,199
24	*32*	*3,230*	3,262	284	282	3,828
30	*50*	*13,820*	13,870			13,870
Total	*90,358*	*39,319*	129,676	777,211	153,842	1,060,730

The Glades Region is served by the 30-inch line originating at WTP No. 11 and routed along NW 16th Street where it reduces to a 16-inch to the north and a 24-inch to the south. The region relies heavily on this 30-inch line to supply the majority of its peak hour demand to all three cities, which indicates a low degree of redundancy

in the water distribution network. The 2013 vulnerability evaluation shows that damage to this main pipeline, including the 16-inch line serving Pahokee and the 24-inch line serving Belle Glade and South Bay, causes hydraulic failure of essentially the whole system.

5.5 STRATEGIES FOR DECREASING WATER AGE

Water age is significantly high at the cities of Pahokee and South Bay due to the design of the distribution system network, large volume of water storage, and set pressure gradient in Pahokee. Close inspection of the water age results for the 2013 annual average scenario show that operation of the South Bay tank was the main cause of high water age in this city. Model results indicate that the maximum water retention time at the South Bay tank was 77 hours and steadily increased throughout the five-day duration of the scenario except when fresh water entered the tank.

Large transmission piping is valuable for meeting peak demands and providing an overall well connected distribution system; however, these large transmission mains also result in a large volume of “storage” in the distribution system that can lead to high water age. Flushing large transmission mains is not a viable method to remove stagnant water due to the high volume of flushing water that would be necessary; nevertheless, this can be an effective strategy for smaller distribution mains and dead-end pipes.

While model results for the 2013 annual average scenario provides a good relative indication of water age throughout the system, model adjustments may produce different water age results. Since there are a number of potential operating scenarios, PBCWUD should use the model to work with distribution system operators and develop an overall best management approach to water age in the water distribution system.

Several other strategies can be evaluated to identify means to decrease water age in the system. The costs of these strategies can range from almost nothing to major expenditures. Closing valves, changing operating methods, and reducing storage volumes may not involve any additional costs. Changing pump controls or installing control valves may involve capital costs that are relatively small. Eliminating dead-ends is usually the most expensive method of reducing water age because it requires installation of new pipes, but the water quality benefits may justify the costs. Multiple supply sources may be more expensive than a single source due to

economies of scale, but water quality in the distribution system should be part of the decision-making process for new sources.

Case studies have demonstrated the following methods of reducing water age can be effective to varying degrees depending on system configuration:

1. Flush at optimal locations and flow rates
2. Bleed water at high water age boundaries
3. Increase tank turnover
4. Control variable speed pumps to ensure tank turnover
5. Use control valves to change flow directions
6. Consider closing valves to change circulation patterns
7. Change operating methods to increase low flow rates
8. Reduce storage volume in low demand zones
9. Eliminate dead-ends

A number of these strategies are further discussed in subsequent sections. It is recommended that PBCWUD consider these strategies with distribution system staff and evaluate them with the model.

5.5.1 Increasing Tank Turnover and/or Decreasing Storage Volume

Increasing tank turnover is an effective method of reducing water age. Tanks can store water for long periods of time, which can affect water age in large parts of a distribution system. For the purpose of this discussion, turnover refers to how much of a tank's volume is replaced with fresh water during each draining and filling cycle. Usually water levels fluctuate in the upper part of a tank due to diurnal demand variation, and the lower portion is reserved for fires.

A case study investigated the impact of varying tank turnover on water age predictions in a water storage tank. The water age varied from 91 hours at 10 percent turnover to 28 hours at 75 percent turnover. This utility normally operated pumps to maintain tank levels within 10 feet of the overflow, which corresponded to only a 25 percent turnover, which resulted in a water age of 58 hours at the point of entry to the distribution system

The model was used to determine the impact of increasing tank turnover in the South Bay tank. Results show that water age at the tank was reduced from 90 to 77 hours when tank turnover was increased from 19 to 21 percent. Overall, water age

at the City of South Bay does not improve significantly (below 77 hours) unless the tank turnover percentage increases to at least 32 percent by maintaining the tank at its minimum water level of 3 feet. Increasing tank turnover in Pahokee is difficult due to the elevation of the storage tanks.

Reducing storage volume is another effective method of reducing water age. Many utilities reserve more storage than needed for fires, and this unnecessarily increases water age.

5.5.2 Changing Pump Controls and/or Operating Methods

Changing controls for variable speed pumps is a method of increasing tank turnover and thus decreasing water age. Operators often control variable speed pumps based on pressure: the pump speed increases or decreases as needed to maintain a constant set-point pressure. In a case study, using this control method for a large variable speed pump at a water plant produced a wide range of flows from the plant but only a 10 percent turnover in a 1 MG tank, resulting in a predicted water age of 175 hours. Changing the control method to maintain a constant flow from the plant increased tank turnover to 45 percent and decreased the predicted water age to 62 hours. An alternative method reduced water age to 47 hours by controlling the pump speed based on the tank level: the pump operated at 78 percent of full speed until the tank water level fell just below half full, and then the pump speed increased to 94 percent of full speed until the tank filled. This control method ensured tank turnover and reduced water age, while maintaining sufficient storage for fires and without causing excessive pressures at the water plant.

5.5.3 Using Control Valves and/or Closing Valves

Using control valves can reduce water age by changing flow directions. A case study involved a distribution system with a 1 MG ground storage tank in the middle of a large trunk main loop. The hydraulic model predicted a water age exceeding 200 hours for conventional tank operation, which involved pumping and filling using both legs of the loop. The model showed that two control valves could reduce water age by filling the tank only from the west leg of the loop and pumping only to the east leg. The control valves consisted of two butterfly valves remotely controlled by the plant operators. Using the control valves reduced the predicted water age in the tank to 80 hours, a decrease of 60 percent.

Closing valves can be a viable method of reducing water age in some distribution systems. The closed valves reroute flows and increase velocities in pipes that otherwise would have low flow or flow reversals. A case study involved an

annexation area in a distribution system extremity where it was difficult to maintain residual disinfectant concentrations. The hydraulic model identified two valves that reduced water age if closed. One closed valve was on a 24-inch pipe between the water plant and an elevated tank, and the other was on a parallel 16-inch pipe west of the annexation area. Closing these valves forced water from the plant to flow through the problem area on the way to the tank. Comparing model predictions with and without the closed valve showed significantly reduced water age, in some locations from more than 100 hours with the valves open to less than 60 hours with the valves closed. This method of reducing water age requires careful analysis to ensure that the closed valves do not compromise fire protection. Small bypass lines may be needed to maintain some flow if any dead-ends are created by the closed valves. PBCWUD could use its model to evaluate the potential for closing valves to redirect flow.

5.5.4 Eliminating Dead-Ends

Eliminating dead-ends is a method of reducing water age by installing new pipes. A case study involved a school served off a dead-end pipe where measured disinfectant concentrations were very low. The predicted water age at the school was 176 hours. A hydraulic model showed that installing two sections of new pipe increased flows in the pipe serving the school, reducing the predicted water age to 52 hours. Since the Glades Region has a large number of dead-end pipes, additional looping may be a viable solution to decrease water age (and improve fire flow availability) in some areas.

5.6 SUMMARY OF EXISTING SYSTEM ANALYSIS

The existing system has sufficient capacity to meet the current water demands at peak hour, maximum day, and average day demand conditions using the existing infrastructure and can meet the performance criteria set forth in Chapter 2, except for minimum pressure in the City of Pahokee. Due to the elevation of the 0.5 MG EVT, violation of the 50 psi pressure criterion was observed in the City of Pahokee during all demand conditions.

Of the 820 fire hydrants evaluated, a total of 297 failed to comply with the fire flow criteria. On average, 36 percent of fire hydrants fail to supply adequate fire flow. The available fire flow at the failing hydrants should be field verified by PBCWUD staff. Recommended projects to improve fire flow availability are presented in Chapter 6.

The water distribution network has a low degree of redundancy in the system because it heavily relies upon a single 30-inch line, connecting WTP No. 11 to the distribution system, to provide water demand to all three cities. The 16-inch pipeline serving the City of Pahokee located along State Road 715 is also critical. Rupture of this pipe causes the system to be unable to meet demand in Pahokee after exhausting water available in storage tanks.

Water age is considerably high in the City of South Bay due to the large volume of water storage at the South Bay Repump Station and low tank turnover. The City of Pahokee provides acceptable water age except at the north end of the city (Canal Point) where water age is above 72 hours due to low water demand and remoteness of the area. Scattered locations throughout the City of Belle Glade experience high water age, usually observed at dead-end pipes. Strategies PBCWUD may consider to decrease water age in its distribution system include reducing storage volume, eliminating dead-end pipelines, using control valves and/or closing valves in the distribution system, and/or changing distribution system operating methods. Chlorination booster stations could be installed in the cities of South Bay and Pahokee to maintain chlorine residual at areas of high water age.

Chapter 6
FUTURE WATER DISTRIBUTION SYSTEM

6.1 INTRODUCTION

An evaluation of the future water distribution system using the calibrated model was completed in order to assess the performance of the distribution system under increased demands and to determine necessary improvements to be programmed into the CIP. The analyses in this chapter focus on evaluating the capacity and hydraulic performance (pressure, velocity) of the distribution network for planning years 2015, 2025, and 2035. Water age and system redundancy are also evaluated under future demand conditions.

Chapter 6 includes the following sections:

- Section 6.2 – Future Water Distribution System Analysis Assumptions: Informs the reader of changes incorporated into the model for future scenarios, as well as key assumptions made for calculations and reporting of results.
- Section 6.3 – 2015 Water Distribution System Performance: Describes the results of the model under 2015 average annual, maximum day, and peak hour demand conditions and documents available fire flow. Results such as system pressure, pipeline headloss and velocity, and water age are presented in maps.
- Section 6.4 – 2025 Water Distribution System Performance: Provides model results for 2025 under average annual, maximum day, and peak hour demand conditions, and documents improvements in available fire flow.
- Section 6.5 – 2035 Water Distribution System Performance: Provides model results at the end of the planning period (in 2035).
- Section 6.6 – Future Distribution System Redundancy Analysis: An evaluation of the redundancy in the system in 2035 is performed and compared to the redundancy analysis completed for 2013 in Chapter 5. The objective of this section is to identify any pipes that may become critical to system operation in the future.
- Section 6.7 – Tank Turnover and Associated Considerations: Presents a comparative evaluation of 2013 versus 2035 storage fluctuations and associated water age/quality considerations under EPS scenarios.

- Section 6.8 – Water Age Improvement throughout the Master Planning Period: Presents overall improvements in water quality from 2013 to 2035 due to the reduction of water travel time within the distribution system under average annual demand conditions.

- Section 6.9 - Future Distribution System Infrastructure Recommendations: Provides a summary of recommended pipe improvements throughout the planning period.

6.2 FUTURE WATER DISTRIBUTION SYSTEM ANALYSIS ASSUMPTIONS

Analysis of the future water system is based on the assumptions stated in Section 5.2 of Chapter 5, as well as the following additional assumptions:

1. Water demands were calculated based on historical finished water production data and Palm Beach County Planning Department population projections, as discussed in Chapter 2. Water demand was allocated for the 2015, 2025, and 2035 scenarios as explained in Section 4.3.

2. All on-going and proposed pipe improvements outlined in Section 6.9 were incorporated in the model for future scenarios. Pipe improvements were selected to increase the ability of the distribution system to handle forecasted demands while meeting the performance criteria described in Chapter 2. All recommended pipe improvements are summarized and discussed in Section 6.9. Model results discussed throughout this chapter were obtained by simulating the pipeline improvements outlined in Section 6.9. Model results and system performance will vary if the changes are made to the proposed projects, or if projects are not completed.

3. Per the request of the U.S. Army Corps of Engineers (USACE), 1.5 miles of 12-inch pipe running along the Herbert Hoover Dike (HHD) connecting the 0.1 MG and 0.5 MG elevated tanks in the City of Pahokee must be removed by the year 2015. To simulate this condition, Pipe IDs P2185 and P2186 were inactivated in the model for all future (2015, 2025, and 2035) scenarios.

4. New model elements such as pipes, junctions, fire hydrants, storage tanks, valves, and pumps were added to the model to serve new areas and meet forecasted demands. Infrastructure for the future Inland Logistics Center (ILC) will be constructed and paid for by developers; however, the model incorporates the ILC forecasted demands for the 2025 and 2035 scenarios to determine the ability to meet water demands and fire flow in these areas. The

intent of the Water Master Plan is to determine if the existing backbone transmission system is sufficient to serve projected increases in future water demand, and if not, to identify necessary pipeline improvements or additions.

5. Larger pumps will be needed at the South Bay Repump Station by 2035; therefore, new pump curves were added to the model at the estimated best efficiency point of 925 gpm at 148 feet of head for the 2035 scenarios.

6. Some performance improvements reflected in the results shown are based on adjustments to model controls and settings. The system reaction to these settings should be confirmed with field testing.

7. Data for pump stations and tanks including pump curves, tank diameters, and operating setpoints were incorporated into the model based upon existing conditions and necessary variations to obtain improved results. Control settings for future model scenarios are provided in Appendix F.

Maps illustrating the parameters set forth by the selected performance criteria are presented throughout Chapter 6 when the criteria are not met. Additional maps are located in Appendix G. For all planning years (2015, 2025, and 2035), average annual demand and maximum day demand conditions are modeled using EPS scenarios. For maximum day demand scenarios, the maximum velocity and maximum headloss in each pipe and minimum pressure for each node does not necessarily occur at the same time throughout the EPS period. Rather, it is the maximum velocity and headloss and minimum pressure achieved at any time during the 24-hour period.

Water quality issues are addressed through maps that show maximum water age obtained throughout a 120-hour average annual demand EPS scenario for all junctions that have a demand greater than zero. Areas with highest water age are discussed and linked to other parameters or results such as facilities operational settings, headloss, pressure, or velocity when applicable.

Peak hour and fire flow scenarios are modeled under steady-state conditions. Fire flow scenarios are divided into commercial and residential hydrants since different types of land use have different required available fire flow (1,500 gpm for commercial areas and 1,000 gpm for residential areas) as specified in the NFPA 1, Fire Code, and Florida 2012 Edition, Section 18.4.5, Fire Flow Requirements for Buildings. Maps showing available fire flow at nodes corresponding to fire hydrants in the distribution system are presented, as well as a summary map of commercial and residential hydrant locations that cannot currently meet required fire flows.

6.3 2015 WATER DISTRIBUTION SYSTEM PERFORMANCE

This section summarizes the anticipated performance of the distribution system under projected 2015 water demand conditions. Pipe improvement projects expected to be complete by 2015 have been incorporated into these scenarios. These projects are described in detail in Section 6.9.

6.3.1 2015 Average Annual Demand Condition and Water Age

The distribution system was evaluated under 2015 annual average demand conditions to illustrate typical operating conditions that will be observed in about two years. Model results indicate that the system is able to meet pipeline velocity and headloss criteria during 2015 annual average demand conditions.

The minimum pressure in the distribution system varies from 40.34 to 67.5 psi. The majority of nodes experiencing pressures below 50 psi are located in the City of Pahokee. The City of Pahokee does not meet minimum pressure requirements due to existing elevated tanks that set the pressure gradient in the area. This trend at the City of Pahokee will remain as long as the elevated tanks remain in service. Minimum pressure results during the 120-hour EPS are illustrated in Figure G.4.

Figure 6.1 illustrates the maximum water age throughout the distribution system under average annual demand conditions during a five-day simulation. These results resemble the water age map for the 2013 scenario (Figure 5.1), but areas with the highest water age (water that has achieved 72 or more hours of travel time within the system) have been slightly reduced in size.

Since water age is primarily a function of water demand, water age typically decreases over time as water demands increase. However, due to changes in the transmission system and storage facilities between 2013 and 2015, the average water age in some areas of the cities of Belle Glade and Pahokee is expected to increase slightly between 2013 and 2015.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Water Age (hrs)

- 19.1 - 24
- 24.1 - 48
- 48.1 - 72
- 72.1 - 96
- 96.1 - 120
- 2015 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
Scarfield Hwy
N State Market Rd
E 7th St
Muck City Rd
Mc Clure Rd
Bell Glade Rd
Section 20 Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue I
Gator Blvd
N US Highway 27
US Highway 27
SW 1st St
E Canal St S
County Road 827A
Duda Rd
County Road 880

Junction Maximum Water Age during 2015 Annual Average Demand Scenario

Figure 6.1

N

0 2,750 5,500 Feet

The increase is due to two changes in model settings:

1. While the Belle Glade Repump Station is typically online, the 2013 average annual scenario was modeled without this storage tank in operation in order to compare system performance and water age with and without this storage tank. This facility was turned on for the 2015 average annual scenario, and this additional storage volume increases the average retention time in the system. Having this storage tank online increases the average water age in Belle Glade from 28 to 33 hours.
2. As discussed in Section 6.2, the USACE is requesting that 1.5 miles of 12-inch pipe be removed along the HHD in the City of Pahokee by 2015. With this pipe in service, the 0.1 MG tank in downtown Pahokee does not improve fire flow availability; therefore, the County can operate the distribution system without this tank online. Therefore, the 0.1 MG tank is offline for 2013 model scenarios. In 2015 (or when the pipeline along the HHD is removed), the 0.1 MG tank must be placed back in service in order to provide adequate fire protection downtown. The 0.1 MG is online for all 2015 scenarios. This additional storage volume causes an increase in water age along East Main Street extending to Canal Point. On average, the water age increased by 10 hours compared to the 2013 scenario, but the retention time can still be considered “short” (i.e., less than 3 days).

Table 6.1 summarizes the water age results in the distribution system for 2015 during the 120-hour EPS. Degraded water quality (water age greater than 96 hours) accounted for two percent of the nodes and were generally observed at dead-end pipes and peripheries of the cities of Pahokee and South Bay. In general, short water age was observed in Belle Glade due to its proximity to WTP No. 11, while long water age was observed in the majority of the City of South Bay due to high retention time in the storage tank.

Table 6.1 Water Age for 120-Hour EPS during 2015 Annual Average Scenario Glades Region Water Master Plan Palm Beach County Water Utilities Department					
Water Age	**Percentage of System Nodes by City**				**Comments**
	Belle Glade	**Pahokee**	**South Bay**	**Combined Glades Region**	
Water Age > 96 Hours	-	5%	5%	2%	Highest water age (potentially degraded water quality)
72 Hours < Water Age ≤ 96 Hours	-	10%	63%	11%	Long water age
48 Hours < Water Age ≤ 72 Hours	8%	54%	9%	16%	Intermediate water age
24 Hours < Water Age ≤ 48 Hours	85%	31%	23%	66%	Short water age (good water quality)
Water Age ≤ 24 Hours	7%	0%	0%	5%	Shortest water age (best water quality)
Average Water Age (hours)	33	58	72	43	Average water age is calculated using nodes with demands greater than zero

6.3.2 2015 Maximum Day Demand Condition

The distribution system was evaluated under the 2015 maximum day demand condition. Figure 6.2 illustrates the maximum headloss per 1,000 feet and shows the location of pipes that do not meet the performance criteria. Less pipes exceed the headloss performance criteria in 2015 (0.4 percent of pipes in the network) than in 2013 (0.7 percent of pipes) due to pipeline improvements made in the City of Belle Glade. Figure G.5 illustrates the maximum pipe velocities experienced during the 2015 maximum day demand condition. All pipes meet the velocity criteria.

Figure 6.3 illustrates the minimum pressures obtained during 2015 maximum month demand conditions. All nodes in the cities of Belle Glade and South Bay maintain pressures greater than 50 psi, meeting the minimum pressure criterion. Minimum pressures increase by more than 10 psi in the eastern portion of the City of Belle Glade as compared to 2013 results due to pipe improvements that will be completed on Belle Glade Road. Approximately 58 percent of the nodes in the City of Pahokee have a pressure greater than 50 psi. As noted in Chapter 5, pressures below 50 psi are expected in the City of Pahokee due to the water elevation in the existing elevated tanks.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe Diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/kft

Pipe Diameter 24" and above

- Less than 5.5 ft/kft
- Above 5.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Carlimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
Ft Th St
Mc Clure Rd
Muck City Rd
Belle Glade Rd
Section 20 Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue L
Main St
Gator Blvd
E Canal St N
SW 10th St
SW 5th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Maximum Headloss during 2015 Maximum Day Scenario

Figure 6.2

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 40.4 - 50
- 50.1 - 60
- 60.1 - 77

2015 Water Mains

City Boundary

GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr

US Highway 441 N

Conners Hwy

E Main St

Lardmore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Ln

E 7th St

Muck City Rd

Mc Cleve Rd

Section 20 Rd

Bell Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue I

Gator Blvd

NW 1st St

NW 3rd St

E Canal St S

N US Highway 27

US Highway 27

SW 1st St

State Road 80

County Road 827A

Duda Rd

County Road 880

Minimum Pressure during 2015 Maximum Day Scenario

Figure 6.3

N

0 2,750 5,500 Feet

carollo

6.3.3 2015 Peak Hour Demand Condition

The distribution system was modeled under the 2015 peak hour demand condition using a steady-state scenario to evaluate the highest anticipated demand in the system. Pipeline velocity during the 2015 peak hour scenario is shown in Figure G.6. All pipes have a velocity less than the 8 fps performance criterion.

Pipelines that exceed the headloss criteria are indicated in Figure 6.4. Approximately 0.7 percent of pipelines exceed the criteria, and most are the same pipelines that exceeded the headloss criteria at 2015 maximum day demand conditions. Aside from the few short pipeline segments shown in Figure 6.4 that exceed headloss criteria, the infrastructure modeled for the 2015 peak hour scenario meets the established performance criteria for velocity and headloss.

Figure 6.5 illustrates the system pressure the under peak hour demand condition. Pressure in the cities of South Bay and Belle Glade is greater than the 50 psi pressure criterion, except for one location on the eastern side of the City of Belle Glade. The Belle Glade neighborhood located on Gator Boulevard between W. Sugar House Road and Duda Road experiences a pressure increase of approximately 15 psi when compared with the 2013 pressure due to the 12-inch pipe replacement project along Belle Glade Road. In the City of Pahokee, approximately 75 percent of the nodes experience pressures below 50 psi. The average pressure in the City of Pahokee is 49 psi in this scenario.

6.3.4 2015 Fire Flow Analysis

A steady-state fire flow analysis at maximum day demand was completed to evaluate available fire flow at fire hydrants in 2015. It is assumed that the location, number, and type (residential or commercial) of fire hydrants will not change between 2013 and 2015. Fire flow demands were simulated using the maximum day water demand plus the minimum fire flow rate required at each junction identified to represent a fire hydrant. The minimum fire flow at commercial and residential fire hydrants is 1,500 and 1,000 gpm, respectively with a residual pressure of 20 psi. The results of this analysis are shown in Figure 6.6.

Figure 6.6 shows the location of the fire hydrants that are not anticipated to meet the required fire flow in 2015. A total of 164 residential and 103 commercial fire hydrants failed to supply required fire flow of 1,000 and 1,500 gpm, respectively. This amounts to approximately 33 percent of all fire hydrants failing to meet the required fire flow.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe diameter less than 24"

- Less than 10ft/kft
- Above 10ft/kft

Pipe diameter 24" and above

- Less than 7.5ft/kft
- Above 7.5ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Muck City Rd
McClure Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue L
Main St
Gator Blvd
E Canal St N
SW 10th St
SW 9th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Headloss during 2015 Peak Hour Demand Scenario

Figure 6.4

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 38.2 - 40
- 40.1 - 50
- 50.1 - 60
- 60.1 - 77
- 2015 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr

US Highway 441 N

Conners Hwy

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Ln

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Bell Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

Gator Blvd

N US Highway 27

US Highway 27

E Canal St S

County Road 827A

Duda Rd

County Road 880

carollo

Pressures during 2015 Peak Hour Demand Condition

Figure 6.5

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Residential Fire Flow

- Insufficient Fire Flow (LessThan 1,000 gpm)
- Sufficient Fire Flow (MoreThan 1,000 gpm)

Commercial Fire Flow

- Insufficient Fire Flow (LessThan 1,500 gpm)
- Sufficient Fire Flow (MoreThan 1,500 gpm)
- 2015 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lake Shore Dr

E Main St

Lakemore Rd

Canal Point Rd

Lake Ave

S Bethel Hwy

N State Market Rd

E 7th St

Muck City Rd

Mc Cuen Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

Gator Blvd

NW Avenue I

NW 1st St

E Canal St N

SW 5th St

SW 3rd St

E Avenue G

S Main St

E Canal St S

N US Highway 27

US Highway 27

Sweet St

County Road 827A

Dudo Rd

County Road 880

carollo

2015 Fire Flow Sufficiency during Maximum Day Demand Condition

Figure 6.6

N

0 2,750 5,500 Feet

As shown in Figure 6.6, clusters of fire hydrants not complying with fire flow requirements are observed in the same locations as compared to the 2013 fire flow results (Figure 5.7), with the exception of the neighborhood located in the eastern portion of the City of Belle Glade on Gator Boulevard. The 12-inch pipe replacement project along Belle Glade Road improves available fire flow in this area.

Similar to 2013 results, the non-compliant residential fire hydrants are mainly located in clusters on the peripheries of the cities where minimum pressures of 20 psi or available fire flow (1,000 gpm) cannot be achieved. Other non-compliant residential fire hydrants were located on pipes with diameters less than 6 inches, such as along Bacom Point Road between SW 15th Street and Lemon Avenue, McClure Road in Pahokee, and W Lake Road and Tabit Road in Belle Glade.

As shown in Table 6.2, the City of Pahokee has the largest percentage of non-compliant fire hydrants at 42 percent. The long-term plan in the City of Pahokee is to decommission the existing elevated tanks and construct a new 1.5 MG ground storage tank with booster pump station in order to increase the pressure gradient and available fire flow throughout this city. In the interim period, a booster pump could be installed at the 0.5 MG tank to increase pressure and available fire flow. This pump was not modeled for 2015 scenarios since it cannot be installed by that time; however, it is included in the CIP in Chapter 8 as an interim solution to improve pressure and fire flow until pipeline improvements and the new GST are constructed.

Table 6.2 Percentage of Non-Compliant Fire Hydrants during 2015 Fire Flow Scenario
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Combined Glades Region	Belle Glade	South Bay	Pahokee
Residential Fire Hydrants	29%	22%	27%	43%
Commercial Fire Hydrants	41%	38%	57%	40%
Total	33%	27%	36%	42%

6.4 2025 WATER DISTRIBUTION SYSTEM PERFORMANCE

This section summarizes the anticipated performance of the distribution system under projected 2025 water demand conditions. The pipeline improvement projects outlined in Section 6.9 are expected to be complete by 2025; therefore, these projects were incorporated into all 2025 scenarios. Model results and system performance will vary if the pipeline projects are not completed.

6.4.1 2025 Average Annual Demand Condition and Water Age

The distribution system was evaluated under 2025 annual average demand conditions to illustrate typical operating conditions that will be observed around 2025. Model results indicate that all pipelines meet velocity and headloss criteria during 2025 annual average demand conditions.

The minimum pressure in the distribution system varies from 40.3 to 72.4 psi. All model nodes experiencing pressures below the 50 psi pressure criterion are located in the City of Pahokee. As discussed previously, the City of Pahokee does not meet minimum pressure requirements due to existing elevated tanks that set the pressure gradient in the area. This trend at the City of Pahokee will remain as long as the elevated tanks remain in service. Minimum pressure results during the 120-hour EPS are illustrated in Figure G.7.

Figure 6.7 illustrates the maximum water age throughout the distribution system under 2025 average annual demand conditions. In general, water age improves significantly when compared with the 2013 and 2015 water age results, especially in the City of South Bay. This is due to a combination of increased water demand and pipeline improvement projects that will be completed prior to 2025.

Table 6.3 summarizes the anticipated water age throughout the distribution system in 2025. Degraded water quality (water age greater than 96 hours) accounts for only one percent of all model nodes (down from two percent in 2015). Similar to 2013 conditions, short water age is observed in the City of Belle Glade due to its proximity to WTP No. 11.

Water age improves substantially in the City of South Bay between 2013 and 2025. The average water age decreases from 72 hours in 2013 to 59 hours in 2025. In addition, the percentage of model nodes with a water age of greater than 72 decreases from 63 percent in 2013 to 30 percent in 2025.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Water Age (hrs)

- 16 - 24
- 24.1 - 48
- 48.1 - 72
- 72.1 - 96
- 96.1 - 120
- 2025 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Main St

Seaboard Ave

N State Market St

NW 7th St

Mc Cuire Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue E

Gator Blvd

Duda Rd

E Canal St

SW Avenue G

SW 1st St

US Highway 27

N US Highway 27

SW 1st St

County Road 827A

County Road 880

Maximum Water Age during 2025 Annual Average Demand Scenario

Figure 6.7

N

0 2,750 5,500 Feet

The City of Pahokee also experiences lower water age in the downtown area as compared to 2013 conditions. However, water age in the northern area (Canal Point) shows an increase in retention time (average 83 hours) due to an upsized pipeline diameter needed to improve fire flow that will be constructed before 2020.

Table 6.3 Water Age for 120-Hour EPS during 2025 Annual Average Scenario
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Water Age	Percentage of System Nodes by City				Comments
	Belle Glade	Pahokee	South Bay	Combined Glades Region	
Water Age > 96 Hours	1%	4%	2%	1%	Highest water age (potentially degraded water quality)
72 Hours < Water Age ≤ 96 Hours	1%	21%	28%	8%	Long water age
48 Hours < Water Age ≤ 72 Hours	4%	6%	38%	9%	Intermediate water age
24 Hours < Water Age ≤ 48 Hours	60%	65%	33%	57%	Short water age (good water quality)
Water Age ≤ 24 Hours	35%	4%	0%	24%	Shortest water age (best water quality)
Average Water Age (hours)	30	47	59	37	Average water age is calculated using nodes with demands greater than zero

6.4.2 2025 Maximum Day Demand Condition

The distribution system was evaluated under 2025 maximum day demands. Pipes exceeding the maximum headloss criteria are shown in Figure 6.8 (only 0.02 percent of the system). Pipe improvements to be constructed by 2025 improve hydraulic conditions and reduce the number of pipes violating the headloss criteria. Pipelines exceeding the headloss criteria in 2025 include two segments of 6-inch pipe in the City of Belle Glade. Figure G.8 illustrates the maximum pipeline velocities during 2025 maximum day scenario. All pipes meet the velocity criteria.

Minimum pressures throughout the distribution system in 2025 are shown in Figure 6.9. Overall, 94 percent of modeled locations meet the minimum pressure criterion of 50 psi during the 2025 maximum day demand scenario. All nodes in the cities of Belle Glade and South Bay maintain pressures greater than 50 psi. Comparison with 2013 pressure results (Figure 5.3) shows a substantial pressure increase in the City of Pahokee along S. Lake Avenue as a result of pipe improvements in the City of Pahokee that will be completed by 2025.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe Diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/kft

Pipe Diameter 24" and above

- Less than 5.5 ft/kft
- Above 5.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Carlimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue L
Main St
Gator Blvd
SW 10th St
SW 5th St
E Canal St N
Ave G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Pipelines Exceeding Headloss Criteria during 2025 Maximum Day Demand Scenario

Figure 6.8

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend
Minimum Pressure (psi)
- 42.7 - 50
- 50.1 - 60
- 60.1 - 76.8
- 2025 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
LAKE REGION WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Lardmore Rd
Beacon Palm Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Muck City Rd
Mc Clure Rd
Section 20 Rd
Bell Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue I
Gator Blvd
NW 1st St
NW 3rd St
NW Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Minimum Pressure during 2025 Maximum Day Demand Scenario

Figure 6.9

N

0 2,750 5,500 Feet

Some locations that continue to violate the established minimum pressure criterion are observed along Lake Okeechobee. These pressure issues are expected in the City of Pahokee due to the water elevation in the existing elevated tanks and will remain until the tanks are replaced.

6.4.3 2025 Peak Hour Demand Condition

The distribution system was modeled under the 2025 peak hour demand condition using a steady-state scenario to evaluate the highest anticipated instantaneous demand in the system. More than 99 percent of pipelines meet the headloss performance criteria during the 2025 peak hour demand condition. Pipes failing headloss criteria include the 8-inch pipeline at the Pioneer Park Master Meter and a few short-length pipes with diameters less than 6 inches. Pipeline headloss is illustrated in Figure G.9. Pipeline velocity during the 2025 peak hour scenario is shown in Figure G.10. All pipes have a velocity less than the 8 fps performance criterion.

The range of distribution system pressures during the 2025 peak hour demand is shown in Figure 6.10. About 85 percent of nodes comply with the pressure criterion. The pressure criterion is met throughout the cities of Belle Glade and South Bay, which experience peak hour pressures of 64 and 61 psi, respectively. Areas with pressure less than 50 psi include areas along S. Lake Avenue, E. Main Street, and Canal Point in the City of Pahokee. About 54 percent of nodes fail to meet the minimum pressure criteria in the City of Pahokee.

Comparison of Figure 6.10 with Figures 5.5 and 6.5 (2013 and 2015 conditions, respectively) shows substantial pressure improvement in the neighborhood located on the east side of the City of Belle Glade on Airport Road/Gator Boulevard. In addition, pressures in the range of 55 to 60 psi extend into southern and central areas of the City of Pahokee, where pressures were less than 50 psi in 2013 scenarios. This indicates that proposed pipe improvements simulated with the model improve hydraulic conditions. Section 6.9 describes proposed infrastructure changes for the 2025 scenarios.

6.4.4 2025 Fire Flow Analysis

Similar to 2013 and 2015, a steady-state fire flow analysis was completed to evaluate available fire flow at fire hydrants in 2025. It was assumed that the location, number, and type (residential or commercial) of fire hydrants will not change between 2013 and 2025, aside from three addition nodes added to the model to represent the ILC forecasted demands.

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Pressure (psi)
- 40.5 - 50
- 50.1 - 60
- 60.1 - 76.9

2025 Water Mains
City Boundary
GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
LAKE REGION WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
Seafield Hwy
N State Market Rd
E 7th St
Mc Cuffs Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
NW Avenue A
Gator Blvd
N US Highway 27
US Highway 27
E Canal St S
County Road 827A
Duda Rd
County Road 880

System Pressure during 2025 Peak Hour Demand Scenario

Figure 6.10

N

0 2,750 5,500 Feet

These additional nodes were classified as commercial fire hydrants, bringing the total number of fire hydrants evaluated for the 2025 scenario to 823 (254 commercial and 569 residential).

Figure 6.11 illustrates the location of fire hydrants and fire flow results. Table 6.4 summarizes the percentage of non-compliant fire hydrants in each city and for the combined Glades Region.

A significant reduction in the number of non-compliant fire hydrants is achieved by 2025 due to pipe improvements proposed specifically to improve fire flow availability. Comparison with the 2013 fire flow results (Figure 5.7) illustrates this improvement. Based on model results, the number of non-compliant fire hydrants drops from 36 percent in 2013 to 9 percent in 2025.

Table 6.4 Percentage of Non-Compliant Fire Hydrants during 2025 Fire Flow
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Combined Glades Region	Belle Glade	South Bay	Pahokee
Residential Fire Hydrants	8%	6%	0%	14%
Commercial Fire Hydrants	12%	14%	3%	11%
Total	9%	9%	1%	14%

While fire flow availability will improve substantially by 2025, areas with fire hydrants not able to meet fire flow will remain in 2025. The largest number of non-compliant fire hydrants in 2025 is observed in the City of Belle Glade with 43, followed by Pahokee with 32. The only non-compliant node in the City of South Bay shown in Figure 6.11 is a commercial fire hydrant connected to a 6-inch line with a fire flow availability of 1,499 gpm, which is nearly at the required flow of 1,500 gpm.

Figure 6.11 shows that fire hydrants with insufficient fire flow are located in areas where pipe diameters are 6 inches or less in diameter and/or where the distribution system lacks redundancy or looping (usually at peripheries of the cities). Over time, these fire hydrants should be field tested to verify model results. At hydrants where deficiencies are verified in the field, additional evaluations of the distribution system should occur to determine alternatives for increasing fire flow in these areas.

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Residential Fire Flow
- Insufficient Fire Flow (Less than 1,000 gpm)
- Sufficient Fire Flow (Greater than 1,000 gpm)

Commercial Fire Flow
- Insufficient Fire Flow (Less than 1,500 gpm)
- Sufficient Fire Flow (Greater than 1,500 gpm)
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
LAKE REGION WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Conners Hwy
E Main St
N State Market Rd
Lakeshore Dr
Larimore Rd
Muck City Rd
Mc Cleod Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
State Road 80
Curlee Rd
NW Sugar House Rd
Gator Blvd
Dude Rd
NW Avenue I
NW Main St
SW 5th St
SW 2nd St
E Canal St
SW 6th St
SE Avenue G
SE 3rd St
SE Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
County Road 880

2025 Fire Flow Sufficiency during Maximum Day Demand Scenario

Figure 6.11

N

0 2,750 5,500 Feet

carollo

6.5 2035 WATER DISTRIBUTION SYSTEM PERFORMANCE

This section summarizes the anticipated performance of the distribution system under projected 2035 water demand conditions. Recommended pipe improvement projects expected to be complete by 2035 have been incorporated into these scenarios. These projects are described in detail in Section 6.9.

The 2035 scenario also reflects other assumed changes in infrastructure that are recommended in order to meet forecasted water demands while meeting the performance criteria. By 2035, the three existing elevated tanks in the City of Pahokee are replaced by a 1.5 MG ground storage tank and booster pump station. Other remote storage and pumping facilities in the cities of Belle Glade and South Bay remain operational.

6.5.1 2035 Average Annual Demand Condition and Water Age

The distribution system was evaluated under 2035 annual average demand conditions to illustrate typical operating conditions that will be observed around 2035. Model results indicate that all pipelines meet velocity and headloss criteria during 2035 annual average demand conditions.

Minimum pressures (shown in Figure G.11) show substantial improvement overall when compared with previous scenarios. Minimum pressures violating the 50 psi criterion are located mainly along Lake Okeechobee in the City of Pahokee. The majority of these nodes have a minimum pressure of around 49 psi (except two nodes with higher elevations having minimum pressures of around 43 psi). The minimum pressures (the minimum within the 120-hour EPS) are observed when the new 1.5 MG ground storage tank is filling during the early morning hours. Pressures in Pahokee exceed 50 psi when the tank is not filling.

The water age analysis for 2035 demonstrates an overall improvement in water age. Figure 6.12 illustrates the maximum water age throughout the distribution system under 2035 average annual demand conditions. Table 6.5 summarizes the anticipated water age throughout the distribution system in 2035. Overall, 91 percent of nodes have a water age less than 72 hours, with an average of 34 hours for the combined Glades Region.

Average water age in the cities of Belle Glade and South Bay decreased as compared to 2013 results, while the average water age in the City of Pahokee increased by 5 percent (from 53 to 56 hours). As shown in Figure 6.12, areas with

long and intermediate water age are located along McClure Road, E. 7th Street, N. State Market Road, E. Main Street, and Canal Point. The increase in water age is due to the new, larger 1.5 MG ground storage tank located on the southern side of the City of Pahokee. The increased storage volume in Pahokee will increase water age, unless this tank is operated at a low level. Assumed operational parameters for the new 1.5 MG tank are included in Appendix F.

Table 6.5 Water Age for 120-Hour EPS during 2035 Annual Average Scenario
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Water Age	Percentage of System Nodes by City				Comments
	Belle Glade	Pahokee	South Bay	Combined Glades Region	
Water Age > 96 Hours	1%	5%	1%	1%	Highest water age (potentially degraded water quality)
72 Hours < Water Age ≤ 96 Hours	0%	25%	21%	8%	Long water age
48 Hours < Water Age ≤ 72 Hours	1%	32%	23%	10%	Intermediate water age
24 Hours < Water Age ≤ 48 Hours	36%	34%	48%	37%	Short water age (good water quality)
Water Age ≤ 24 Hours	62%	5%	7%	44%	Shortest water age (best water quality)
Average Water Age (hours)	25	56	49	34	Average water age is calculated using nodes with demands greater than zero

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Water Age (hrs)

- 13.3 - 24
- 24.1 - 48
- 48.1 - 72
- 72.1 - 96
- 96.1 - 120
- 2035 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Belle Glade Rd

Section 20 Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

W Sugar House Rd

NW Avenue I

W Canal St

NW Canal St

E Canal St

SW Avenue G

E Avenue G

SW 1st St

State Road 80

N US Highway 27

US Highway 27

County Road 827A

Duda Rd

E Canal St S

County Road 880

Gator Blvd

carollo

Maximum Water Age during 2035 Annual Average Demand Scenario

Figure 6.12

N

0 2,750 5,500

Feet

6.5.2 2035 Maximum Day Demand Condition

The distribution system was evaluated for the 2035 maximum day demand condition. Pipes with results exceeding the maximum headloss criteria (about 0.07 percent of all pipes in the system) are shown in Figure 6.13. These pipelines include a few very short segments in the distributions system. Figure G.12 illustrates the maximum pipeline velocity during the 2035 maximum day scenario. All pipes in the system meet the velocity criterion.

Pressure throughout the distribution system is greater than 50 psi during the 2035 maximum day demand condition aside from a few nodes that drop to a pressure of 47 psi in the City of Pahokee due to high node elevations of over 31 feet. Figure 6.14 provides an overview of the minimum pressure results throughout the Glades Region. The average minimum pressures are 65, 55, and 56 in the cities of Belle Glade, South Bay, and Pahokee, respectively, concluding that the water distribution system will meet the minimum pressures criterion by 2035.

6.5.3 2035 Peak Hour Demand Condition

The distribution system was modeled under the 2025 peak hour demand condition using a steady-state scenario to evaluate the highest anticipated instantaneous demand in the system. More than 99.5 percent of pipelines meet the headloss performance criteria.

Figure 6.15 illustrates the location of pipelines not meeting the headloss criteria. Pipeline velocity is illustrated in Figure G.13. All pipelines have a velocity of less than the 8 fps criteria.

The range of system pressures during the 2035 peak hour demand is shown in Figure 6.16. Only one junction located in the City of South Bay experiences a pressure below 50 psi (49.9 psi) due to a high node elevation. The average pressure throughout the entire distribution system is 60 psi.

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/lft

Pipe Diameter 24" and above

- Less than 5.5 ft/kft
- Above 5.5 ft/lft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Carnimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

W Sugar House Rd

NW Avenue L

N Main St

W Canal St W

W Canal St S

E Canal St N

SW 5th St

SW 2nd St

SE Avenue G

SE 3rd St

S Main St

E Canal St S

Gator Blvd

N US Highway 27

US Highway 27

SW 1st St

State Road 80

County Road 827A

Dyde Rd

County Road 880

Pipelines Exceeding Headloss Criteria during 2035 Maximum Day Demand Scenario

Figure 6.13

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressures (psi)

- 47.3 - 50
- 50.1 - 60
- 60.1 - 78.6
- 2035 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

Main St

Larimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

Hooker Hwy

State Road 715

State Road 80

Curlee Rd

N Sugar House Rd

NW Avenue I

Gator Blvd

Duda Rd

N US Highway 27

US Highway 27

SW 1st St

E Canal St S

County Road 827A

County Road 880

Minimum Pressure during 2035 Maximum Day Demand Scenario

Figure 6.14

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Headloss per 1,000 feet

Pipe diameter less than 24"

- Less than 10 ft/kft
- Above 10 ft/kft

Pipe diameter 24" and above

- Less than 7.5 ft/kft
- Above 7.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larrimore Rd
Bacom Point Rd
S Lakeshore
S Barfield Hwy
N State Market Rd
Muck City Rd
Ft Th St
Mc Clure Rd
Section 20 Rd
Belle Glade Rd
State Road 15
Hooker Hwy
State Road 715
State Road 80
Curlee Rd
NW Sugar House Rd
Gator Blvd
NW Avenue L
N Main St
W Canal St N
E Canal St N
SW Avenue D
SW Main St
SE Avenue C
SE 3rd St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Pipelines Exceeding Headloss Criteria during 2035 Peak Hour Scenario

Figure 6.15

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Pressure (psi)

- 50
- 50.1 - 60
- 60.1 - 76.9
- 2035 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Lardmore Rd

Muck City Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

Gator Blvd

N US Highway 27

US Highway 27

SW 1st St

SE Avenue G

E Canal St S

County Road 827A

Duda Rd

County Road 880

Pressures during 2035 Peak Hour Demand Scenario

Figure 6.16

N

0 2,750 5,500 Feet

6.5.4 2035 Fire Flow Analysis

Similar to previous planning periods, a steady-state fire flow analysis was completed to evaluate available fire flow at fire hydrants in 2035. It was assumed that the location, number, and type (residential or commercial) of fire hydrants would not change between 2025 and 2035.

Figure 6.17 illustrates the location of fire hydrants and fire flow results. Failing hydrants are located at dead-end pipes or 6-inch lines that cannot deliver the entire required fire flow on top of maximum day demands.

Table 6.6 summarizes the percentage of non-compliant fire hydrants in each city and for the combined Glades Region. In total, 42 and 30 residential and commercial fire hydrants, respectively, fail to provide required available fire flow. The total number of non-compliant fire hydrants decreases from 76 to 72 when comparing the 2025 and 2035 results.

The most improved area is at the City of Pahokee, where the percentage of non-compliant fire hydrants decreases from 14 percent in 2025 to 8 percent in 2035. As observed in Figure 6.17, only three fire hydrants do not meet fire flow criteria in the Canal Point area, compared with seven failing hydrants in the same neighborhood in 2025.

The cities of Belle Glade and South Bay experience a slight increase in the total number of fire hydrants not meeting required available fire flow. This is due to an increase in base demand (maximum day demand) that decreases the amount of water available for fire flow.

Table 6.6 Percentage of Non-Compliant Fire Hydrants during 2035 Fire Flow
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Combined Glades Region	Belle Glade	South Bay	Pahokee
Residential Fire Hydrants	7%	9%	0%	8%
Commercial Fire Hydrants	12%	14%	6%	8%
Total	9%	11%	2%	8%

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Residential Fire Flow

- Insufficient Fire Flow (Less than 1,000 gpm)
- Sufficient Fire Flow (More than 1,000 gpm)

Commercial Fire Flow

- Insufficient Fire Flow (Less than 1,500 gpm)
- Sufficient Fire Flow (More than 1,500 gpm)
- 2035 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Lakemore Rd

Beaver Point Rd

S Lake Ave

Seaboard Hwy

N State Market Rd

Muck City Rd

E 7th St

Mc Clure Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

State Road 80

Curlee Rd

W Sugar House Rd

Gator Blvd

NW Avenue L

W Canal St N

W Canal St S

E Canal St N

E Canal St S

SW 5th St

SW 10th St

SE Avenue G

SE 3rd St

S Main St

N US Highway 27

US Highway 27

SW 1st St

County Road 827A

Duda Rd

County Road 880

2035 Fire Flow Sufficiency during Maximum Day Demand Scenario

Figure 6.17

N

0 2,750 5,500 Feet

6.6 FUTURE DISTRIBUTION SYSTEM REDUNDANCY ANALYSIS

An analysis of pipeline vulnerability in 2035 was performed and results compared to the same analysis presented for 2013 in Chapter 5. This evaluation assesses the change in redundancy that the system would experience from 2013 to 2035. The change in reliability of the system is expressed in terms of the difference in percentage of pipes that, if broken, would keep the system from supplying the entire peak demand. The data for the analysis is obtained using the InfoWater Protector tool.

The pressure in the system is intended to be maintained at 50 psi. In cases where this pressure criteria is violated due to a pipe failure (or a valve closing), a minimum of 20 psi must be met through the portion of the network that remains in service. As stated in Chapter 5, the methodology employed by the InfoWater Protector tool does not prioritize in terms of the magnitude of the demand not able to be met; therefore, the result is merely dependent on the pipe domain selected for the simulations.

All pipes in the network, except dead-ends, were evaluated individually to determine their vulnerability (lack of redundancy). Table 6.7 summarizes the total linear feet of pipe by diameter that passed (non-vulnerable pipe), failed (vulnerable pipe), or not evaluated during the vulnerability analysis. In total, 159 miles of pipe were classified as “pass” indicating that network can satisfy water demands and maintain hydraulic reliability if pipe breakage occurs. The passing pipes account for 77 percent of the pipes in the system and are shown in Figure 6.18.

About 10 percent of all pipes are classified as “vulnerable” denoting that pipe rupture causes a disconnection in the network and it is unable to supply water demand or maintain minimum pressure of 20 psi. Figure 6.18 provides an overview of the location of the failing pipes due to inability to supply demand in red and minimum pressure violation in orange. Approximately half of the vulnerable pipes fail due to inability to supply demand. The total length of vulnerable pipes decreased by about 12 percent as compared with the 2013 vulnerability results. Significant failing pipes observed in Figure 6.18 include:

- The 30-inch line originating at WTP No. 11 that extends south on State Road 715 (NW 16th Street) and reduces to a 24-inch line on W. Canal Street. This pipeline is also fails under the 2013 vulnerability results.

- The 16-inch line located on State Road 715 that feeds the City of Pahokee. A comparison with the 2013 vulnerability results show that the total length of vulnerable pipe increases due to a mix of inability to maintain pressure of 20 psi and supply water demand. In total, five miles of the 16-inch pipe is classified as “fail” during the 2035 vulnerability analysis.

Table 6.7 2035 Vulnerability Analysis Results
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Diameter	Pipes Failing (LF)		Total Fail (LF)	Total Pass (LF)	Pipes Not Evaluated (LF)	Total (LF)
	Cannot Supply Demand	Pressure Violation				
2	*3,001*		3,001	10,657	20,426	34,083
3				1,524	10	1,534
4	*134*		134	10,704	5,591	16,429
6	*28,289*	*799*	29,088	364,448	72,422	465,958
8	*10,223*	*4,878*	15,102	248,689	28,538	292,329
10	*3,523*	*6,128*	9,650	31,305	266	41,222
12	*5,212*	*5,254*	10,466	119,450	12,846	142,762
14				34		34
16	*6,394*	*22,375*	28,769	50,699	499	79,967
18		*12*	12	58		70
20		*18*	18	821	359	1,199
24	*32*	*3,230*	3,262	284	282	3,828
30	*50*	*13,820*	13,870			13,870
Total	*56,858*	*56,515*	113,373	838,673	141,240	1,093,286

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Vulnerability Results 2035

- Non-Evaluated Pipe
- Pass
- Fail - with Warnings
- Fail - Cannot supply demand
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 1.5 MG GST

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

E 7th St

Mc Clure Rd

Muck City Rd

Belle Glade Rd

Section 20 Rd

State Road 15

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

Gator Blvd

NW Avenue I

W Canal St N

E Canal St N

N Main St

SW 5th St

SW 10th St

SE Avenue G

SE 3rd St

S Main St

E Canal St S

County Road 827A

Duda Rd

County Road 880

N US Highway 27

US Highway 27

State Road 80

Vulnerability of the Distribution System during 2035 Peak Hour Scenario

Figure 6.18

N

0 2,750 5,500 Feet

Vulnerability results obtained for 2013 and 2035 are compared in Table 6.8. Although the total pipe length is greater by 6 miles in the 2035 scenario, system redundancy shows better results in 2035 suggesting that the network has gained some level of reliability.

Table 6.8 Comparison of 2013 and 2035 System Vulnerability Results
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

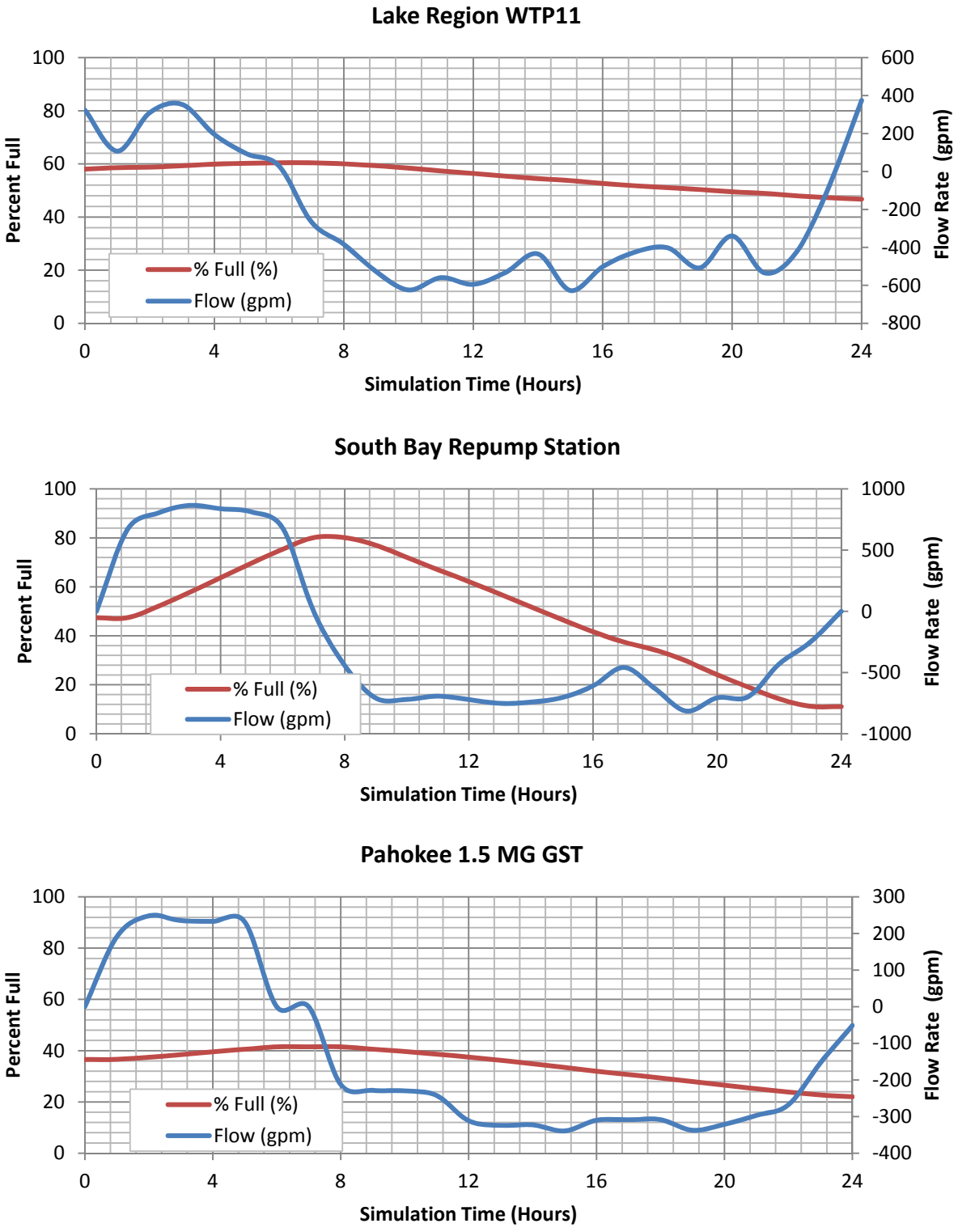
	2013	2035
Total Percent of Non-Vulnerable Pipes(1)	73.3	76.7
Total Percent of Vulnerable Pipes(2)	12.2	10.4
Percent of Pipes Unable to Supply Demand	*8.5*	*5.2*
Percent of Pipes Violating Minimum Pressure (20 psi)	*3.7*	*5.2*
Total Percent of Pipes Not Evaluated (dead-end pipes)	14.5	12.9

Notes:
(1) Non-Vulnerable Pipes: Pipes that, if broken, would not keep the system from supplying the entire peak hour demand.
(2) Vulnerable Pipes: Pipes that would prevent the system from supplying the peak hour demand.

6.7 TANK TURNOVER AND ASSOCIATED CONSIDERATIONS

The difference in water storage patterns between years 2013 and 2035 can be evaluated by comparing Figure 5.4 with Figure 6.19. Based on Figure 6.19, it is evident that more fluctuation in filling and emptying rates is necessary in 2035 than in 2013 in order for the tanks to supply the projected maximum day demand.

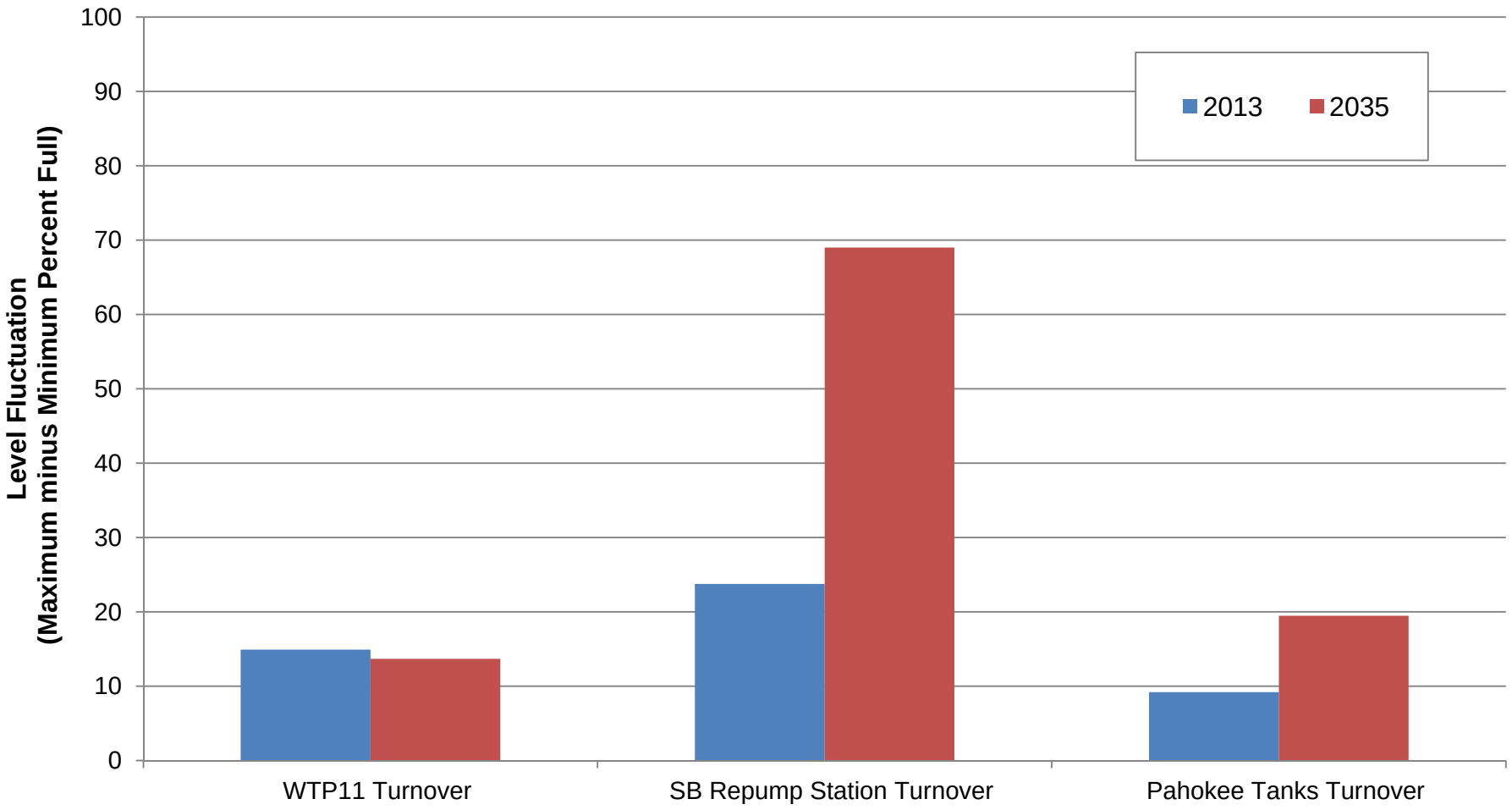
Data in Figure 6.19 was further analyzed to determine the difference in turnover of the tanks during a maximum day as compared to 2013. Figure 6.20 is the result of such analysis. Tank level fluctuation in terms of maximum percentage full throughout the day minus minimum percentage full throughout the day was graphed for each of the storage tanks. In the figures, the tanks in the City of Pahokee refer to the operational 0.5 MG elevated tank in 2013 and the 1.5 MG ground storage tank in 2035. A higher fluctuation in level is indicative of a higher tank turnover. As such, Figure 6.20 indicates that tanks in 2035 offer greater turnover than in 2013, based on assumed operating conditions in the model, except at WTP No. 11. Water age in the distribution system in 2035 demonstrates an improvement over 2013, in part due to higher demands and increased tank turnover, as discussed in the following section.



2035 TANK PERCENT FULL AND FLOW RATE DURING 24-HOUR EPS AT MAXIMUM DAY CONDITION

FIGURE 6.19

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN



TANK TURNOVER COMPARISON FOR YEARS 2013 AND 2035

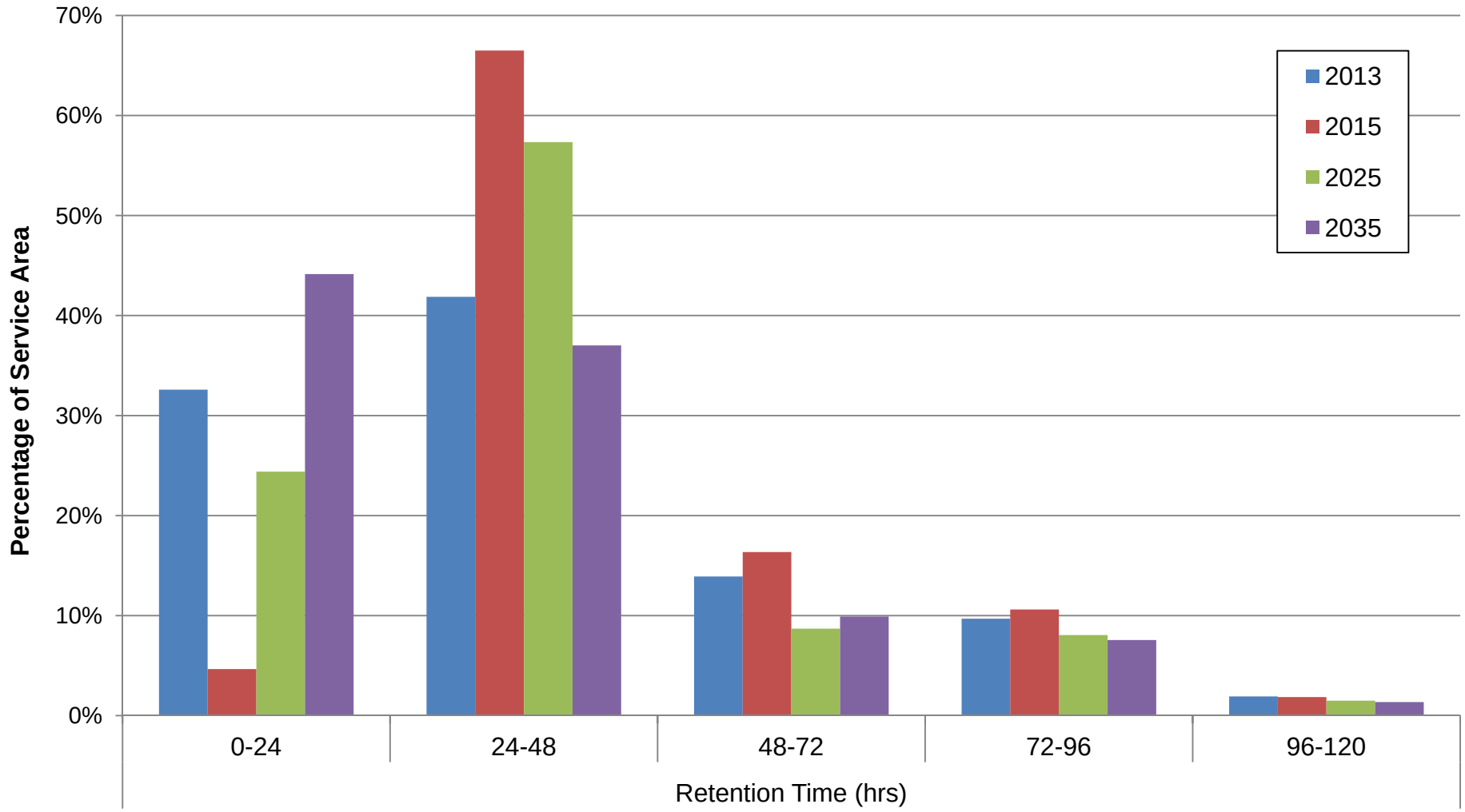
FIGURE 6.20

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

6.8 WATER AGE IMPROVEMENT THROUGHOUT THE MASTER PLANNING PERIOD

Overall improvements in water quality due to the reduction of the water travel time within the distribution system were evaluated at average annual demand conditions for each of the planning years. Because projected average annual finished water demand increases in the future and proposed pipe improvements are aimed to improve hydraulic conditions, the water age becomes shorter over time.

Overall water age improvement throughout the master planning period is shown in Figure 6.21. Water quality typically begins to deteriorate after the third day within pipes. This chart shows that areas with highest (greater than 96 hours) and high (between 72 and 96 hours) water age were slightly reduced in size, and that areas with best (0 to 24 hours) water age grew between 2013 and 2035. Although the size of areas with good and intermediate water age decreased in 2035 compared with 2013 results, in total, 91 percent of the nodes have a retention time lower than 72 hours during the 2035 scenario as compared to 88 percent for 2013. While water age will improve due to increased demands and proposed pipe and infrastructure improvements, several steps outlined in Section 5.5 also can be taken to decrease water age even further.



SIMULATED IMPROVEMENT OF WATER AGE BETWEEN 2013 AND 2035

FIGURE 6.21

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
GLADES REGION WATER MASTER PLAN

6.9 FUTURE DISTRIBUTION SYSTEM INFRASTRUCTURE RECOMMENDATIONS

The model was used to evaluate the distribution system in each planning year to select improvements needed to meet the projected demands while meeting the performance criteria described in Chapter 2. Results of model simulations indicate that water distribution system improvements are driven primarily by the need for: 1) additional or upsizing of transmission mains, 2) better and increased looping in older areas to decrease the number of dead-ends and short-circuiting, and 3) replacement of aging pipes that have high friction losses and limit hydraulic capacity.

Various combinations of pipeline projects were evaluated, and the lowest cost and/or most beneficial projects were selected with the aim of meeting the selected performance criteria. In addition to pipe improvements identified by hydraulic modeling, some on-going and future projects proposed by PBCWUD are included in the model:

- New 12-inch pipe on State Road 80, which is expected to be complete by 2015.
- Pipe replacement in Phase 1 of the Southwest (SW) Section of Belle Glade, which is expected to be complete by 2015.
- Pipe replacement in Phases 2 through 4 of the SW Section of Belle Glade, which are expected to be complete before 2025.

Pipeline improvements projects were selected based on model results. Many of the pipeline projects were sized in order to meet the required fire flow criteria. Because the model is not a perfect reflection of field conditions, field verification of available fire flow is recommended for fire hydrants that have been identified as not able to meet required fire flows before projects are initiated. Such investigations may result in the finding of simple solutions such as opening closed valves, replacement of short segments, or other corrective measures.

A total of 34 miles of new pipe were added in the model through 2035. Figure 6.22 illustrates the location of recommended pipeline replacements, new pipelines, and pipeline connections identified by implementation year. Model scenarios assume these pipelines are complete in the indicated year. ILC pipes will be constructed by others and therefore are not included in the Capital Improvement Plan in Chapter 8.

Figure 6.23 further illustrates the locations of new pipelines and short pipeline connections (where pipes are in close vicinity or crossing but not intersecting) to be completed between 2015 and 2025. These modifications improve pressure and fire flow results and were included in 2025 and 2035 model scenarios. Table 6.9 provides a summary of the proposed short new pipeline interconnections shown in Figures 6.22 and 6.23.

Table 6.9 New Short Pipeline Connections and Interconnections
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

ID	Description	Length (LF)
BG01	New 10-inch pipe connecting existing 6-inch and 30-inch pipelines	66
BG02	New 6-inch pipe connecting existing 6-inch and 12-inch pipelines	129
BG03	Connection of existing 8-inch and 6-inch crossing pipelines	-
BG04	Connection of existing 6-inch and 8-inch crossing pipelines	-
BG05	Connection of existing 6-inch crossing pipelines	-
BG06	New 6-inch pipe connecting existing 6-inch pipelines	50
BG07	Connection of existing 6-inch crossing pipelines	-
BG08	Connection of existing 6-inch crossing pipelines	-
BG09	Connection of existing 6-inch crossing pipelines	-
BG10	New 6-inch pipe connecting existing 6-inch pipelines	340
BG11	Connection of existing 12-inch and 16-inch crossing pipelines	-
BG12	Connection of existing 16-inch and 6-inch/8-inch crossing pipelines	-
SB01	New 6-inch pipe connecting existing 6-inch and 8-inch pipelines	111
SB02	Connection of existing 6-inch/8-inch/10-inch/16-inch crossing pipelines	-
SB03	New 6-inch pipe connecting existing 6-inch and 8-inch pipelines	571
SB04	New 8-inch pipe connection to improve redundancy	193
SB05	New 6-inch pipe connecting existing 6-inch pipelines	161
SB06	New 6-inch pipe connecting existing 6-inch pipelines	359
PK01	New 8-inch pipe connecting existing 6-inch and 12-inch pipelines	1145
PK02	Connection of existing 6-inch crossing pipelines	-
PK03	Connection of existing 6-inch and 12-inch crossing pipelines	-

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Pipe Improvements

- New 12-in pipe on SR80 by 2015
- ILC Pipes (by Others), 2025
- Replace with larger diameter by 2025
- Replace with same diameter by 2025
- Replace with larger diameter by 2035
- Replace with same diameter by 2035
- New Pipelines by 2015 (Phase 1)
- New Pipelines by 2018 (Phase 2-4)
- Proposed New Pipelines by 2025
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

PROPOSED PAHOKEE 1.5 MG GST

PK01

PK02

PK03

From 8 to 12

From 6 to 8

From 2 to 6

From 4 to 6

From 6 to 12

From 4 to 12

E Main St

Old Conners Hwy

Lakeshore Dr

E 1st St

E 7th St

N Barfield Hwy

S Barfield Hwy

S Lake Ave

N State Market Rd

Larrimore Rd

Muck City Rd

Bacom Point Rd

Rim Canal Rd

Section 20 Rd

Belle Glade Rd

State Road 715

State Road 15

State Road 80

Conners Hwy

CITY OF PAHOKEE

CITY OF BELLE GLADE

CITY OF SOUTH BAY

Gator Blvd

Duda Rd

1 in = 5 miles

carollo

Proposed Pipe Improvements and Future Infrastructure in the Glades Region

Figure 6.22
Page A

N

1 inch = 2,500 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Pipe Improvements

- New 12-in pipe on SR80 by 2015
- ILC Pipes (by Others), 2025
- Replace with larger diameter by 2025
- Replace with same diameter by 2025
- Replace with larger diameter by 2035
- Replace with same diameter by 2035
- New Pipelines by 2015 (Phase 1)
- New Pipelines by 2018 (Phase 2-4)
- Proposed New Pipelines by 2025
- GUUSA
- City Boundary

State Road 715

Hooker Hwy

State Road 15

State Road 80

WATER TREATMENT PLANT 11

Curlee Rd

BG01

W Sugar House Rd

From 4 to 6

From 6 to 8

BG02

NW Avenue L

BELLE GLADE REPUMP STATION

Gator Blvd

BG03

N Main St

NE 1st St

NW 4th St

NW 2nd St

From 6 to 8

BELLE GLADE OLD WTP

BG04

BG11

NW 5th St

BG07

BG06

From 4 to 8

BG12

Zone 2

BG05

Zone 4

From 2 to 6

E Canal St S

Zone 1

Zone 3

S Main St

SE 3rd St

From 6 to 8

BG08

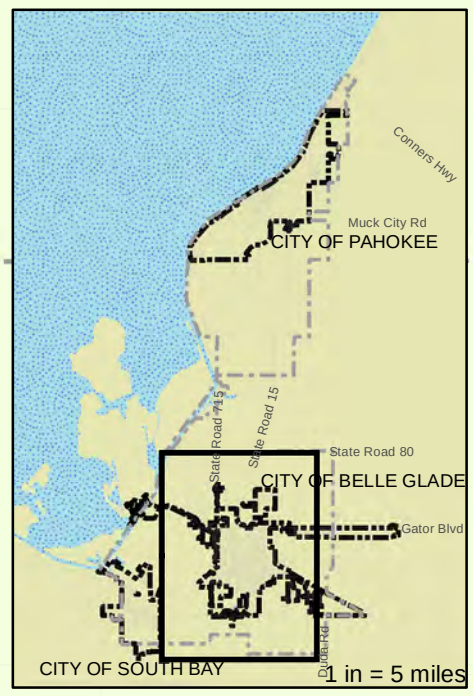
BG10

BG09

8

State Road 80

County Road 827A



1 in = 5 miles

Proposed Pipe Improvements and Future Infrastructure in the Glades Region

Figure 6.22
Page B

N

1 inch = 2,500 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Pipe Improvements

- New 12-in pipe on SR80 by 2015
- ILC Pipes (by Others), 2025
- Replace with larger diameter by 2025
- Replace with same diameter by 2025
- Replace with larger diameter by 2035
- Replace with same diameter by 2035
- New Pipelines by 2015 (Phase 1)
- New Pipelines by 2018 (Phase 2-4)
- Proposed New Pipelines by 2025
- GUUSA
- City Boundary

W Canal St N

SOUTH BAY WTP

N US Highway 27

From 6 to 8

From 6 to 10

US Highway 27 N

SB01

From 6 to 8

SOUTH BAY REPUMP STATION

SB02

6

SB03

SB04

8

State Road 80

Palm Beach Rd

From 6 to 12

6

6

8

6

SW 7th Ave

6

SW 1st St

From 4 to 6

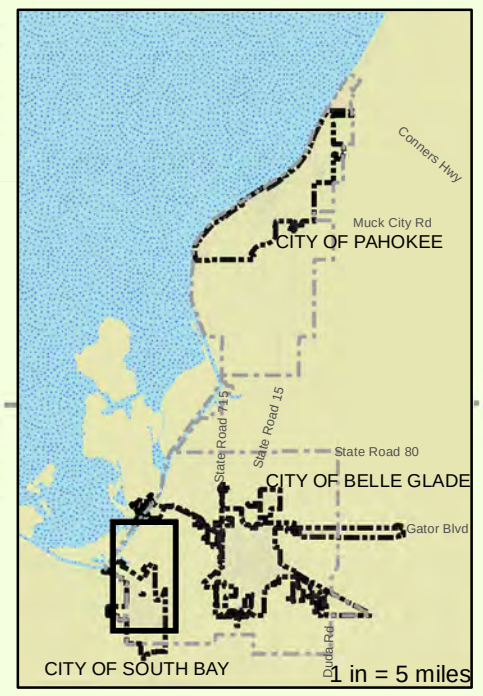
6

SB05

SB06

S US Highway 27

US Highway 27 S



Proposed Pipe Improvements and Future Infrastructure in the Glades Region

Figure 6.22
Page C

N

1 inch = 1,500 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

LAKE OKEECHOBEE

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

PK03

Larrimore Rd

N State Market Rd

PAHOKEE 0.075 MG ELEVATED TANK

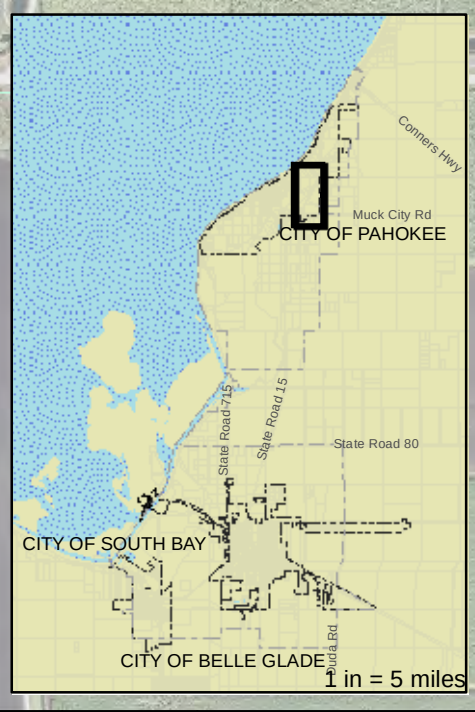
E 7th St

E 7th St

PK02

PK01

Belle Glade Rd



1 in = 5 miles

carollo

Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page A

N

1 inch = 600 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

State Road 715

NW 16th St

BG01

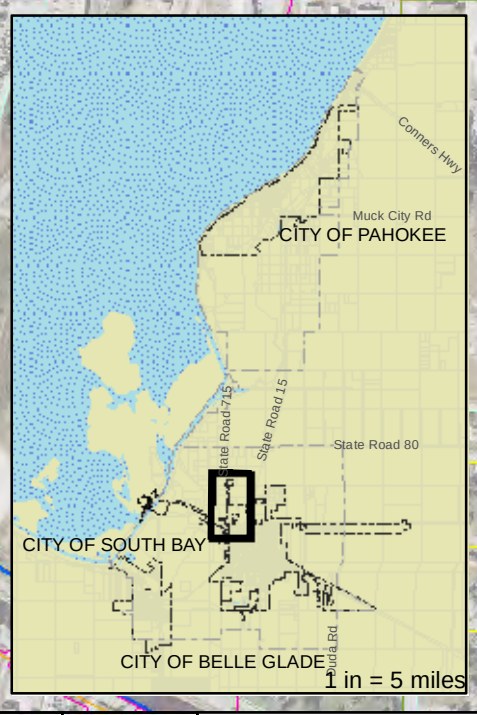
BG02

NW Avenue L

BG03

W Canal St S

W Canal St N



Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page B

N

1 inch = 600 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

W Canal St N

W Canal St S

BELLE GLADE OLD WTP

BG11

BG04

NW Avenue D

NW 16th St

NW 10th St

Phase 2

BG12

W Avenue A

SW 16th St

Conners Hwy

Muck City Rd

CITY OF PAHOKEE

State Road 715

State Road 15

State Road 80

CITY OF SOUTH BAY

CITY OF BELLE GLADE

1 in = 5 miles

carollo

Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page C

N

1 inch = 300 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

BG07

BG06

BG05

Phase 4

Phase 3

N Main St

NE 1st St

E Canal St N

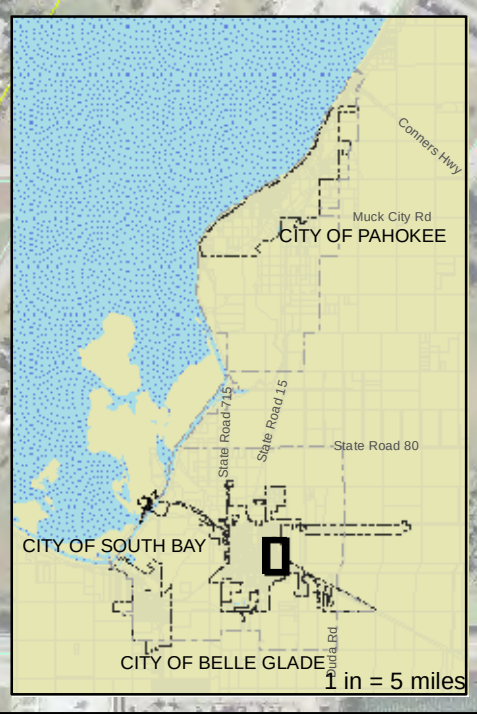
E Canal St S

S Main St

SE Martin Luther King Blvd

SE 3rd St

SE Avenue G



1 in = 5 miles

Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page D

N

1 inch = 300 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

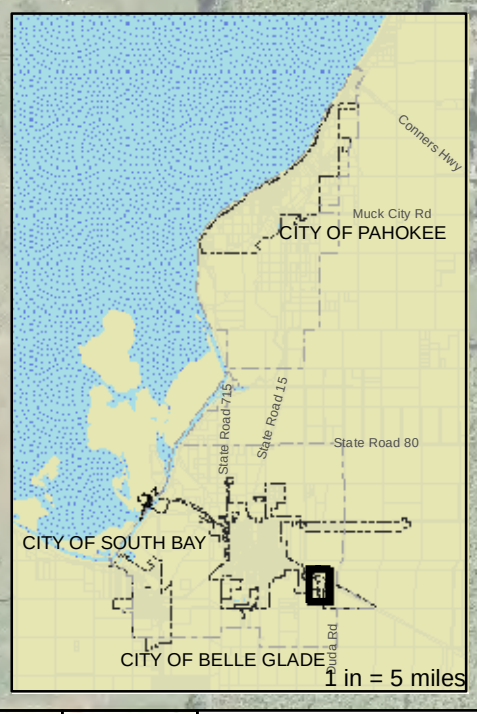
Wedgeworth Rd

E Canal St S

BG08

BG09

BG10



1 in = 5 miles

Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page E

N

1 inch = 300 feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Proposed New Pipelines by 2025

SB01

SB02

SB03

SB04

SB05

SB06

SOUTH BAY REPUMP STATION

US Highway 27 N

US Highway 27 S

Palm Beach Rd

E Palm Beach Rd

SW 7th Ave

SW 1st St

Conners Hwy

Muck City Rd

CITY OF PAHOKEE

State Road 715

State Road 15

State Road 80

CITY OF SOUTH BAY

CITY OF BELLE GLADE

Duda Rd

1 in = 5 miles

Detail of Proposed New Pipelines and Short Connections

Figure 6.23
Page F

N

1 inch = 400 feet

Table 6.10 provides a breakdown of pipelines by year, city, project type, and diameter. The 12-inch pipe on SR80 and the pipe replacement project in the SW Section of Belle Glade (Phases 1 through 4) are projects previously planned by PBCWUD. These projects will be completed by approximately 2018 and account for 27 percent of the total pipe length.

Approximately 79 percent of the pipe improvements are included in the period between 2016 and 2025. In general, 53, 15, and 32 percent of the total proposed length of pipe for improvements are located in the cities of Belle Glade, South Bay, and Pahokee, respectively. Figures G.14, G.15, and G.16 show the operational infrastructure and pipe diameters for each planning year.

Table 6.10 Sum of Length by Project Type, Year, City, and Diameter
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Project Type	2015	2025			2035		Total LF
	Belle Glade	Belle Glade	Pahokee	South Bay	Pahokee	South Bay	
New 12-inch Pipe on SR80	**16,741**						**16,741**
12- inch	16,741						16,741
New Pipes for the SW Section of BG Phase 1	**14,772**						**14,772**
6-inch	9,875						9,875
8-inch	4,897						4,897
New Pipes for the SW Section of BG Phase 2		**10,727**					**10,727**
6-inch		10,727					10,727
New Pipes for the SW Section of BG Phase 3		**5,435**					**5,435**
6-inch		5,435					5,435
New Pipes for the SW Section of BG Phase 4		**1,003**					**1,003**
6-inch		1,003					1,003
Pipe Replacement with Larger Diameter		**26,490**	**39,848**	**11,916**	**4,451**	**1,484**	**84,188**
6-inch		10,490	12,477	1,283			24,250
8-inch		13,837	7,264	4,473	2,124	583	28,281
10-inch			943	5,198		901	7,041
12-inch		2,163	19,164	879	2,327		24,532
16-inch				83			83
Pipe Replacement with Same Diameter		**19,834**	**10,147**	**12,072**	**859**		**42,911**

Table 6.10 Sum of Length by Project Type, Year, City, and Diameter Glades Region Water Master Plan Palm Beach County Water Utilities Department							
Project Type	**2015**	**2025**			**2035**		**Total LF**
	Belle Glade	**Belle Glade**	**Pahokee**	**South Bay**	**Pahokee**	**South Bay**	
6-inch		19,834	8,524	10,397			38,754
8-inch			1,422	1,675	859		3,956
10-inch			201				201
Other New Pipelines		**744**	**1,185**	**1,416**			**3,345**
6-inch		704	40	1,091			1,835
8-inch			1,145	304			1,450
12-inch		40		20			60
Total Linear Feet	**31,513**	**64,232**	**51,180**	**25,403**	**5,310**	**1,484**	**179,121**

Chapter 7

WATER TREATMENT PLANT AND STORAGE CAPACITY

7.1 INTRODUCTION

WTP No. 11 was constructed in 2005 to serve the cities of Belle Glade, Pahokee, and South Bay and the surrounding unincorporated areas. The treatment capacity of the facility and the system storage capacity were evaluated and compared with anticipated water demands and regulatory guidelines to identify necessary system expansions.

7.2 SUMMARY OF EXISTING WTP AND STORAGE CAPACITY

WTP No. 11 has a permitted treatment capacity of 10 mgd. A summary of the treatment unit processes and capacities is provided in Chapter 3.

The WTP storage tank volume along with the volume of the operable storage tanks in Belle Glade, South Bay, and Pahokee are summarized in Table 7.1.

Table 7.1 Existing Storage Tank Summary
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Storage Tanks	Current Operable Storage Capacity (MG)
WTP Storage Tanks	
WTP No. 11	3.0
Remote Storage Tanks	
Belle Glade Old WTP #1	Recently Decommissioned
Belle Glade Old WTP #2	Recently Decommissioned
Belle Glade Repump Station	1.0
South Bay Repump Station	1.0
Pahokee Old WTP	0.1
Pahokee Offsite #1	0.5
Pahokee Offsite #2	Out of Service
Subtotal Remote Storage Capacity	2.6
Total Storage Capacity	**5.6**

7.3 WATER TREATMENT PLANT CAPACITY

This section compares the existing WTP capacity with the projected maximum day water demands and regulatory requirements to determine the approximate timing of water treatment expansions.

7.3.1 Existing WTP Capacity

The existing WTP capacity of 10 mgd is presented in Figure 7.1 along with the projected average annual and maximum day water demands. Figure 7.2 shows the projected WTP reserve capacity through 2035. Based on maximum day demand projections, the existing WTP capacity will not be exceeded until 2030. However, the reserve capacity in 2030 is projected to be as low as 1 percent.

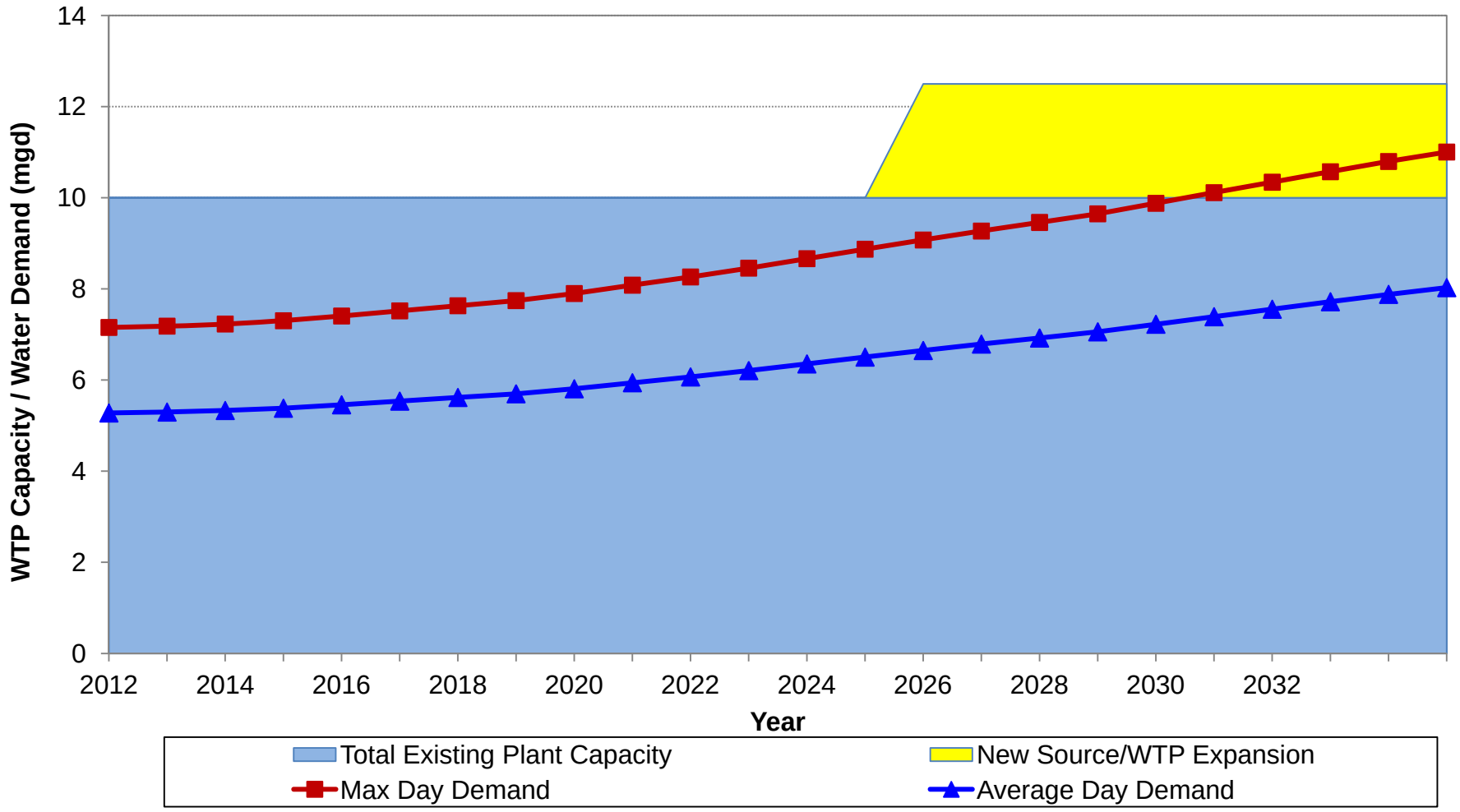
7.3.2 Reserve Capacity and Future WTP Capacity Needs

The maximum day reserve capacity at the WTP is projected to drop below 10 percent by approximately 2026. As indicated in Figure 7.2, a, 10 percent reserve capacity would allow for approximately five years for planning, design, and construction of an expansion before the reserve capacity is exhausted.

A reserve capacity of at least 10 percent above the projected maximum day water demands in 2035 could be attained by expanding WTP No. 11 to 12.5 mgd. The addition of a fifth RO membrane train and concurrent proportional increment of raw water blending by 2026 is recommended at this time. The County may also evaluate other WTP expansion options and/or an interconnect with the eastern County system in the future. Table 7.2 shows the proposed capacity increment summary. It is recommended that PBCWUD continue to monitor population and water use trends and update the demand projections and timing and scope of the WTP expansion accordingly.

Table 7.2 Proposed WTP No. 11 Expansion
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

	Permeate Production per train (mgd)	Number of Trains	Total Membrane Softening Capacity (mgd)	Raw Bypass Capacity (mgd)	Bypass/ Membrane Proportion	Total (mgd)
Current	2.375	4	9.5	0.5	0.053	10.0
Future (2026)	2.375	5	11.875	0.625	0.053	12.5

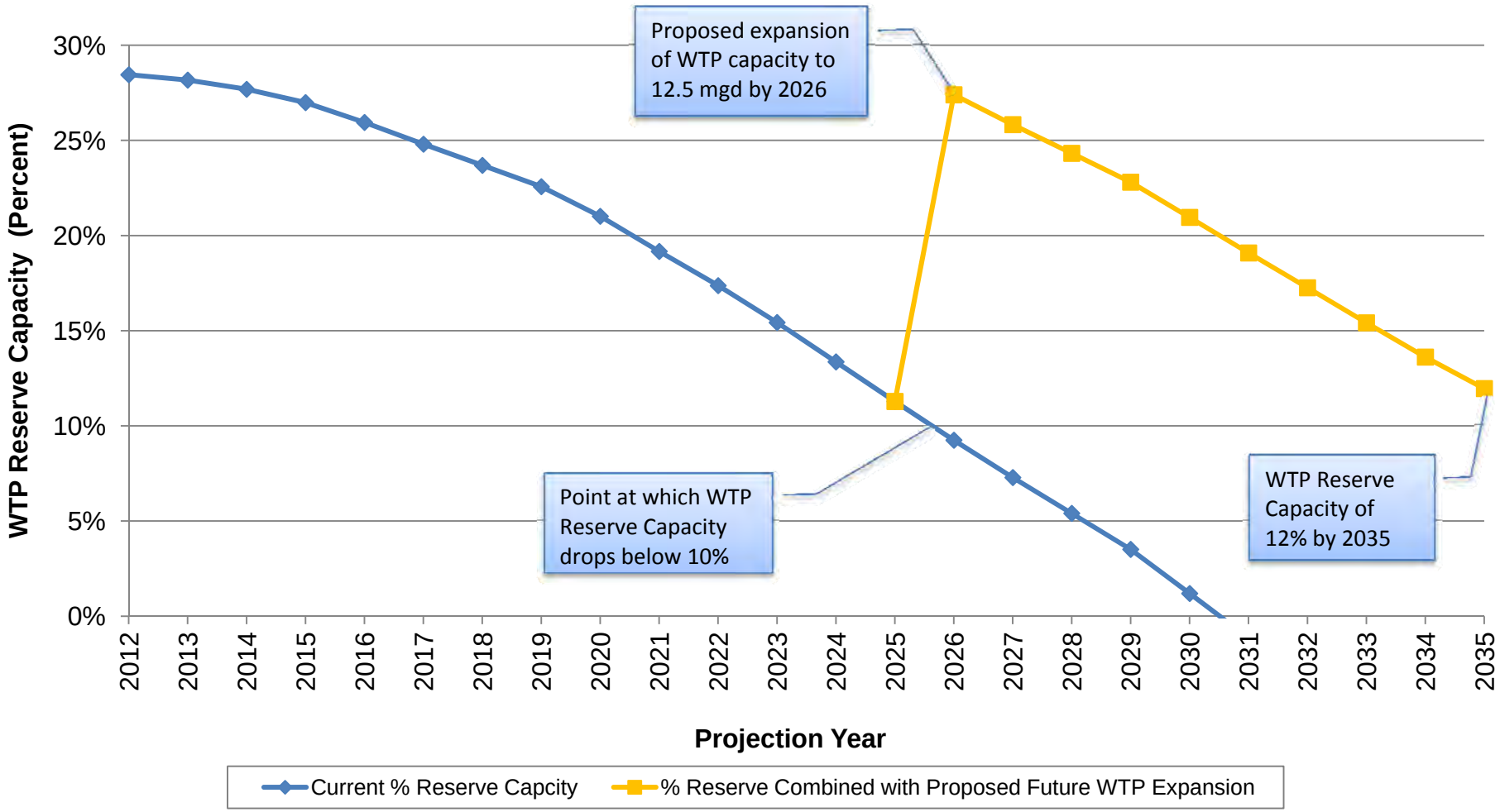


COMPARISON OF DEMAND PROJECTIONS WITH WTP CAPACITY

FIGURE 7.1

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN



PROJECTED WTP RESERVE CAPACITY AND FUTURE WTP NEEDS

FIGURE 7.2

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

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7.3.3 Existing and Future Raw Water Needs

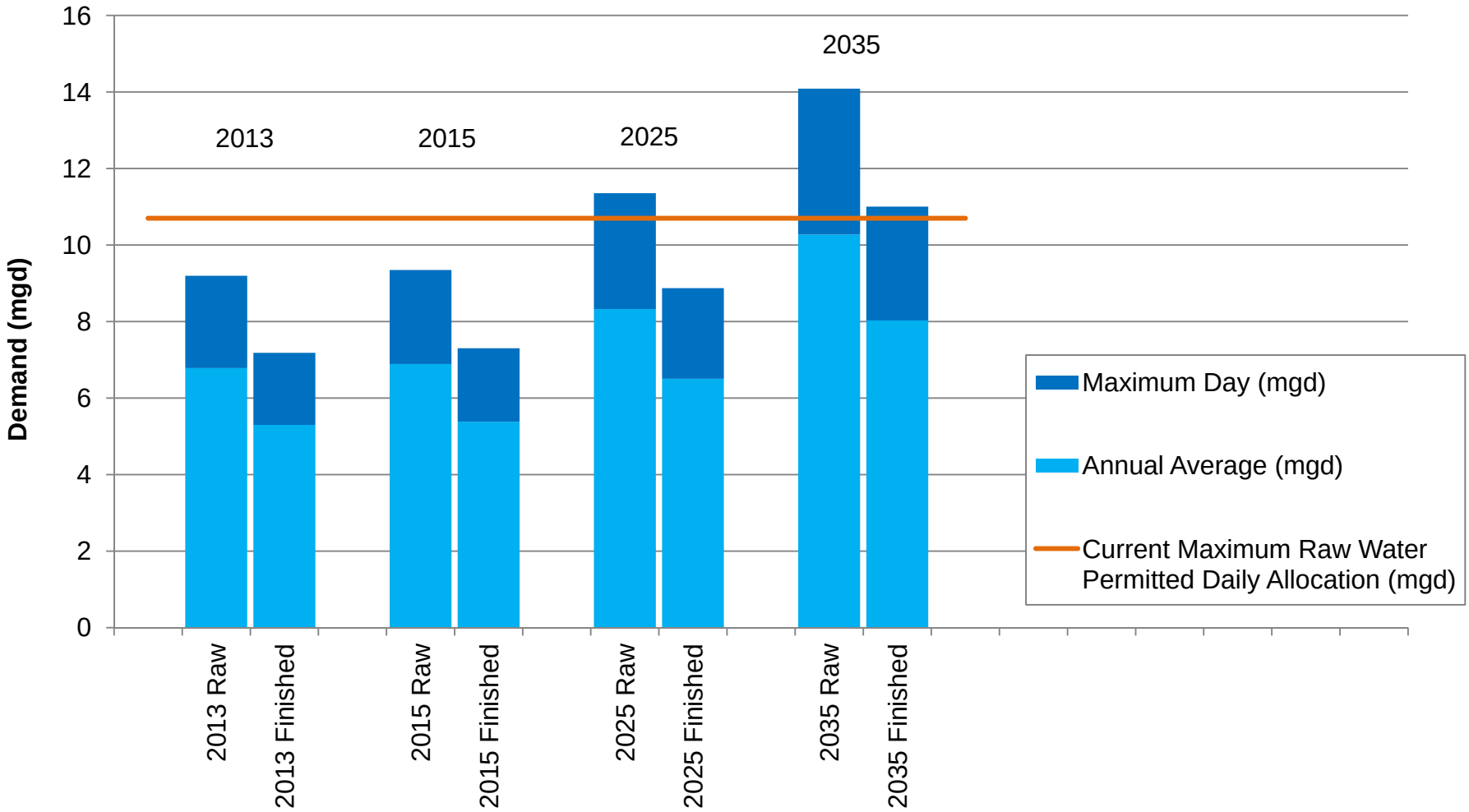
Existing finished water demands and raw water usage were analyzed to determine if the existing groundwater permit is sufficient under various demand conditions. Figure 7.3 illustrates the projected finished water demands and corresponding raw water requirements for both average annual and maximum day demand conditions, and compares them with the current raw water allocation. For example, the 2013 annual average finished water demand is 5.3 mgd. As described in Chapter 3, the average raw to finished water ratio of the last five years was 1.28, which yields an average raw water requirement of 6.8 mgd. This quantity is less than the 10.7 mgd allowed by the current WUP.

Figure 7.3 shows that the maximum day raw water demand by year 2025 exceeds the 10.7 mgd specified in the WUP. The annual average raw water requirement will be greater than the WUP allocation by 2035. A WUP increase will be necessary before 2025 and should be completed when planning begins for the WTP expansion.

While the existing WUP is sufficient to meet raw water requirements until approximately 2025, the existing wellfield capacity is less than the quantity permitted in the WUP. Currently, there are seven operational wells with a total capacity of 6,300 gpm (9.07 mgd). The firm capacity (one spare or well out of service) is 5,400 gpm (7.78 mgd). The existing wellfield will meet projected raw water needs through approximately 2015 with all wells in service. After completion of new wells PW-9 and PW-10, the wellfield will have a total capacity of 8,100 gpm (11.66 mgd), and a firm capacity of 7,200 gpm (10.37 mgd) with one well out of service. This will meet raw water needs through approximately 2025. At that time the County will need to construct additional wells in addition to obtaining a WUP increase.

7.4 WATER STORAGE REQUIREMENTS

The principle function of storage is to provide reserve supply of water for: 1) operational equalization, 2) fire reserve, and 3) emergency needs. Operational storage is directly related to the amount of water necessary to meet peak demands. The intent of operational storage is to provide the difference in quantity between the peak demands and the system’s reliable available supply.



COMPARISON OF RAW AND FINISHED WATER DEMAND PROJECTIONS

FIGURE 7.3

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

Recommended fire storage reserve volumes are established based on population and local fire codes or fire flow ordinances. The volume of water allocated for emergency use is determined based on the historical record of emergencies experienced, and on the amount of time that is expected to occur before a hypothetical emergency can be corrected.

Chapter 2 provides further discussion of operational, fire reserve, and emergency storage requirements and the selected criteria for evaluating the Glades Region storage volume. The sections below compare the existing storage volume with those criteria.

7.4.1 Operational Storage

Based on FAC rules, the total useful finished water storage capacity of a system must be at least equal to 25 percent of the maximum day water demand, excluding any capacity for fire protection. The maximum day demand in 2013 is approximately 7.18 mgd; therefore, the minimum operational storage volume for the system is 1.8 MG. The maximum day demand is projected to reach 11.0 mgd by 2035, resulting in a minimum operational storage volume of 2.75 MG.

7.4.2 Fire Reserve Storage

Fire reserve storage is the amount of water required when the capacity of the production facilities is insufficient to meet the necessary maximum day demand plus fire flow demand for a particular duration of time. The required fire storage capacity is obtained by multiplying the required fire flow rate by the desired fire duration. A 4-hour fire flow duration was used to determine the fire flow requirements for the Glades Region system. The required fire storage reserve assuming 4-hour fire duration at the commercial fire flow rate of 1,500 gpm is 0.36 MG.

As discussed in Chapter 2, an AIA equation based on population has been used to estimate the recommended fire storage in the past. While this equation was used frequently to size fire storage, many utilities are moving away from this approach since the international building code revised its fire flow requirements to include sprinkler systems. However, it can be used for comparison purposes, and to provide a conservative guideline for calculating storage for fire reserve.

Table 7.3 compares the 0.36 MG fire storage requirement with AIA guidelines using the 4-hour fire duration. The total AIA recommended storage for fire reserve is approximately 1.34 MG under current population conditions, and will be approximately 1.65 MG in the year 2035 as outlined in Chapter 2.

Table 7.3 Required Fire Flow and Fire Reserve Storage Glades Region Water Master Plan Palm Beach County Water Utilities Department					
Year	**Glades Region Population**	**AIA Fire Flow (gpm)**	**Duration (hr)**	**Storage For AIA Fire Reserve(1) (MG)**	**Minimum Fire Reserve(2) (MG)**
2013	33,663	5,575	4	1.34	0.36
2015	34,266	5,621	4	1.35	0.36
2025	42,278	6,201	4	1.49	0.36
2035	53,163	6,895	4	1.65	0.36

Notes:
(1) Recommended fire storage based on American Insurance Association guidelines.
(2) Minimum fire storage requirement based on a 4-hour fire and the County's commercial area fire flow rate of 1,500 gpm.

As identified in Table 7.3, the minimum requirement for the Glades Region is less than the storage reserve recommended by AIA. While the WMP and model analyses are based on the County's minimum fire storage requirement of 0.36 MG, the analysis in this chapter also presents the higher, more conservative storage volumes recommended by AIA.

7.4.3 Emergency Storage

Emergency storage is the volume recommended to meet demand during emergency situations such as pipeline failures, major trunk main failures, pump failures, electrical power outages, or natural disasters. PBCWUD selected an emergency storage criteria as 10 percent of the maximum day demand. Therefore, emergency storage in 2013 should equal 10 percent of 7.18 mgd, resulting in an emergency storage volume of 0.7 MG. By 2035, the emergency storage volume requirement will increase to 1.1 MG.

7.4.4 Total Required Storage and Surplus

The total current operable storage tank capacity in the water system is 5.6 MG. The minimum allowable operational storage capacity is equal to 25 percent of the maximum day water demand. The minimum fire reserve storage is 0.36 MG, and the AIA recommended fire storage capacity is 1.65 MG in the year 2035. The recommended emergency storage is equal to 10 percent of the maximum day demand.

Assuming a maximum day water demand of 11 mgd in 2035, the recommended minimum storage in 2035 is approximately 4.21 MG assuming the minimum fire reserve storage, and 5.5 MG assuming the AIA recommended fire storage. The existing storage capacity in the water system (5.6 MG) exceeds the storage requirements in 2035 for both scenarios. Table 7.4 summarizes the storage requirements and surplus available assuming the minimum fire reserve, while Table 7.5 summarizes the storage requirements and surplus assuming the AIA recommended fire reserve.

Table 7.4 Storage Capacity Summary (Using Minimum ISO Fire Reserve Rating)
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Year	Operational Storage	Storage For Fire Reserve	Emergency Reserve Storage	Total Minimum Required Storage	Total Existing Storage	Storage Surplus/ (Deficit)
	MG	MG	MG	MG	MG	MG
2013	1.80	0.36	0.72	2.87	5.60	2.73
2015	1.83	0.36	0.73	2.92	5.60	2.68
2025	2.22	0.36	0.89	3.46	5.60	2.14
2035	2.75	0.36	1.10	4.21	5.60	1.39

Table 7.5 Storage Capacity Summary (Using AIA Fire Reserve)
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

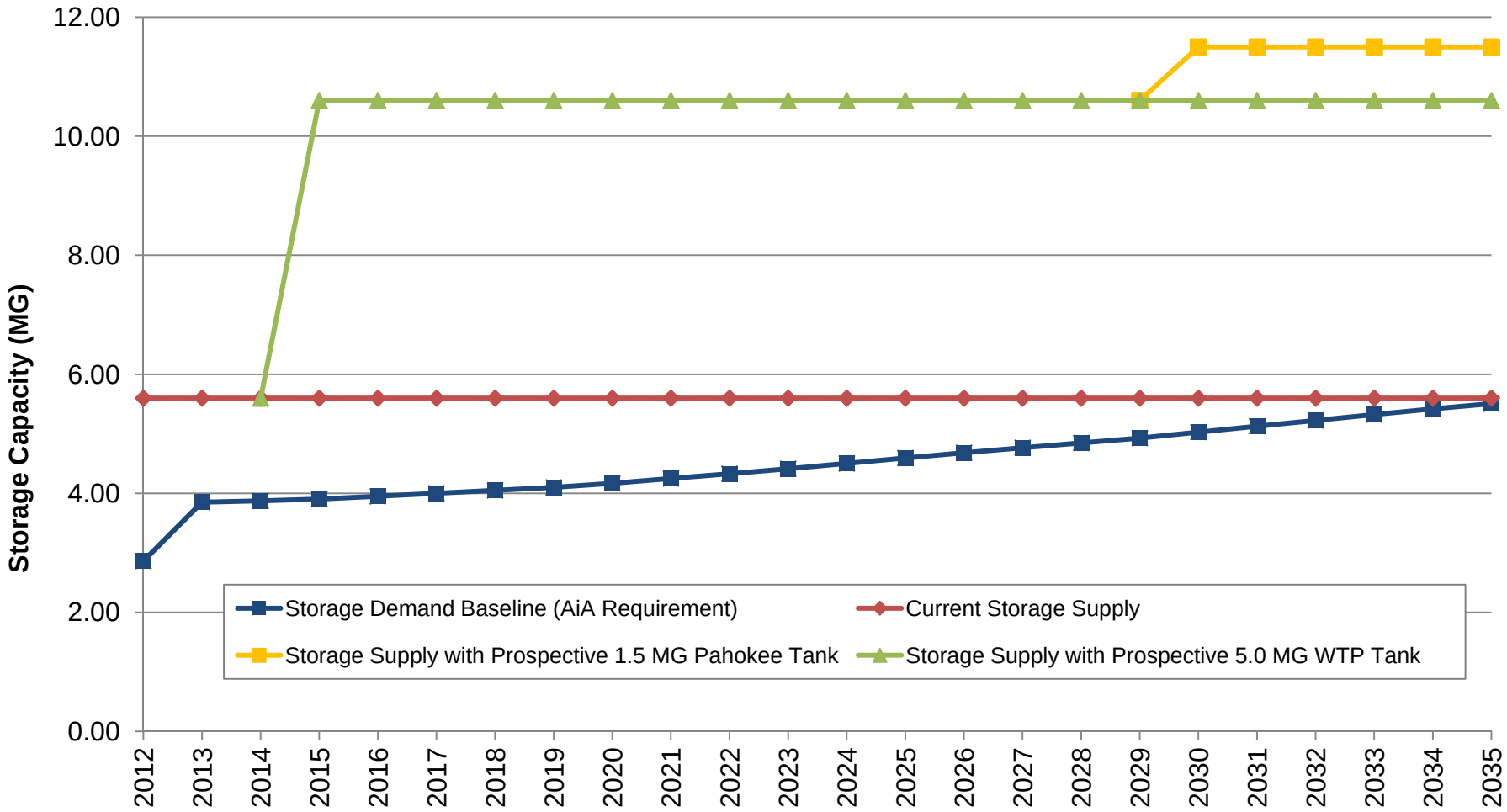
Year	Operational Storage	Storage For Fire Reserve	Emergency Reserve Storage	Total AIA Required Storage	Total Existing Storage Provided	Storage Surplus/ (Deficit)
	MG	MG	MG	MG	MG	MG
2013	1.80	1.34	0.72	3.85	5.60	1.75
2015	1.83	1.35	0.73	3.90	5.60	1.70
2025	2.22	1.49	0.89	4.59	5.60	1.01
2035	2.75	1.65	1.10	5.51	5.60	0.09

Both tables document that the system currently has a water storage surplus and will continue to have a surplus through 2035. Figure 7.4 presents the available storage volume and minimum storage requirement. In this figure, the difference between available storage (red line) and requirement (blue line) equals the surplus of the

existing storage tanks. A new 5 MG storage tank is scheduled to be constructed at WTP No. 11 by 2015, bringing the total available storage volume to 10.6 MG.

The County also plans to construct a 1.5 MG ground storage tank and booster pump station in the City of Pahokee sometime between 2025 and 2035. The new 1.5 MG tank would replace the existing 0.1 MG and 0.5 MG storage tanks currently in operation in Pahokee. In Figure 7.4, it is assumed that the new storage tank will come online in 2030. The addition of this tank would modify the available capacity in Figure 7.4 such that the surplus would be 6.47 MG when the tank is placed in service in 2030, and would be 6.0 MG in 2035. The orange line in Figure 7.4 represents the increased supply due to this capital improvement in Pahokee.

The analysis provided in this section is based on system-wide considerations. The system as a whole provides sufficient reserve storage. Evaluations for individual storage tank fluctuations and associated impacts on individual cities have been provided in Chapters 5 and 6. The capacity of the future storage tank in Pahokee was selected at 1.5 MG to meet the projected maximum day demand of that city in 2035.



COMPARISON OF STORAGE TANK CAPACITY AND REQUIREMENTS

FIGURE 7.4

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

7.5 SUMMARY

The WTP and water storage capacities were evaluated to determine the ability to meet projected water demands through 2035. WTP No. 11 has sufficient capacity to supply maximum day demands until approximately 2030. It is recommended to maintain approximately 10 percent reserve capacity in the system. Therefore, design of an expansion at WTP No. 11 is recommended to begin by 2026. An additional 2.5 mgd of treatment capacity through construction of a fifth RO membrane train and associated blending bypass at the existing WTP is recommended at this time. The County may also evaluate other WTP expansion options and/or an interconnect with the eastern County system in the future. Increased finished water demands also results in an increase in raw water demand. As shown in Figure 7.3, additional groundwater supply and the WUP need to be expanded by 2025.

The existing finished water storage volume of 5.6 MG is sufficient to meet storage requirements until 2035 for both the minimum fire reserve requirement and the more conservative AIA fire reserve recommendations. The system currently has a surplus storage volume of 1.75 MG. This existing storage surplus would be exhausted by year 2035 if no additional storage were provided. The County currently plans to construct a new 5 MG storage tank at WTP No. 11 in 2015, and a 1.5 MG ground storage tank is recommended in Pahokee sometime after 2025 to replace the existing 0.1 MG and 0.5 MG elevated tanks. The total storage with these two new tanks would be 11.5 MG, which is in excess of the projected required storage volume.

Chapter 8

CAPITAL IMPROVEMENTS PLAN

8.1 INTRODUCTION

This chapter presents a Capital Improvements Plan (CIP) that will assist PBCWUD in planning and budgeting for water system improvements through 2035. This CIP outlines recommended improvements to upgrade the water distribution system based on the estimated age and condition of water assets, results of the hydraulic model evaluation, and pipe and WTP improvements already proposed or in progress by PBCWUD. Improvement projects were classified into three groups: WTP No. 11 projects, Storage and Pump Station Improvement Projects, and Distribution System Projects. The last category includes pipe improvements currently in progress or completed and projects proposed by PBCWUD as well as pipe improvements that will allow the system to meet the selected performance criteria through 2035. Storage and Pumping Improvements are proposed to increase pressure in the system, replace aging storage tanks, and meet projected water demands.

Most improvement projects were programmed into the near-term (within five years) CIP, with a few proposed for the longer term (more than five years). Distribution system pipeline expansion projects due to growth or new developments such as the ILC project will be funded by developers and therefore are not included in the County's CIP. The majority of distribution system improvements through 2035 involve pipeline replacement due to hydraulic performance constraints and aging infrastructure.

8.2 WTP NO. 11 PROJECTS

Several improvements at WTP No. 11 were identified by PBCWUD and included in the short-term CIP. The majority of these projects are slated for completion in FY 2014 or FY 2015. These projects include new wells PW-9 and PW-10, degassifier cleaning station, replacement of the variable frequency drives (VFDs) for two of the membrane feed pumps, and a new 5 MG storage tank. Anticipated costs for project expenditures during FY 2014 and 2015 were provided by PBCWUD and are estimated to be $6.7 M. Projects programmed for FY 2016 and FY 2017 total $2.28 M and include: a new clearwell, oddor scrubber improvements, degassifier packing replacement, and roof installation over transfer and high service pumps and generator. In addition, a future WTP expansion is included in the CIP based on

WTP capacity evaluations presented in Chapter 7. The estimated cost of $2.5 M for the WTP expansion is reflected in the long-term CIP between fiscal years (FY) 2023 and 2027. The cost and timing of this project should continue to be evaluated and refined as additional project needs are developed.

8.3 STORAGE AND PUMP STATION IMPROVEMENT PROJECTS

Water storage additions at the WTP and at remote facilities are included in the CIP. Storage and pumping improvements at remote facilities are included to improve hydraulic conditions and enhance system performance in the near and long- term CIP based on projects identified by PBCWUD and water model results as described below.

In the near-term, three projects were identified by PBCWUD: a booster station at State Market Road, security improvements at South Bay Repump Station, and tank and electrical improvements at South Bay WTP. These three projects total $275,000 and are slated for FY 2014 and FY 2016.

A booster pump station and rechlorination station at the existing 0.5 MG tank in the City of Pahokee is programmed into the CIP for FY 2015 and is proposed to increase minimum pressures and improve fire flow availability. This booster pump station can be decommissioned once recommended pipeline improvements are constructed and the new 1.5 MG ground storage tank and booster pump station comes online by approximately 2030.

Improvement projects in the long-term include the 1.5 MG ground storage tank and booster pump station in Pahokee and pump replacement at South Bay repump station with a total of $2.12 M. The 1.5 MG ground storage tank and booster pump station is proposed in the City of Pahokee to improve water system performance and supply the forecasted water demand by 2035. The County plans to construct this tank and pump station sometime between 2025 and 2035 when the existing 0.5 MG elevated tank reaches the end of its useful life. For budgeting purposes, funds for the City of Pahokee storage tank and pump station are allocated between FY 2028 and FY 2032.To supply the forecasted water demand during the 2035 peak hour scenario, the South Bay Repump Station requires an increase in pump capacity. Two new pumps (one duty, one standby) are proposed at the South Bay Repump Station and are programmed into the CIP between FY 2028 and FY 2032.

8.4 DISTRIBUTION SYSTEM PROJECTS

Proposed improvements to the water distribution system will improve hydraulic conditions while supplying forecasted water demands. Projects discussed in this section include projects proposed by PBCWUD and pipeline replacements and new pipes based on modeling results. Table 6.10 in Chapter 6 summarizes recommended pipeline projects, which total 34 miles.

Figures 6.22 and 6.23 show the location of recommended pipe replacements and new pipelines. Diameters of the proposed pipes range between 6 and 16 inches. Approximately 51 percent of the recommended improvements consist of 6-inch pipelines (51 percent of total length). Pipeline improvements are programmed into the CIP based on their relative priority and improvement seen in the system.

The projects proposed by PBCWUD include water main extensions in Pahokee and Belle Glade, Pahokee services relocations, and phased pipeline improvements in the City of Belle Glade. The water main extension on State Road 15 and Gator Boulevard will connect the existing 10-inch pipeline located south of Hooker Highway with the 12-inch pipeline located along Airport Road/Gator Boulevard. It also provides an additional 12-inch pipeline to feed the existing Belle Glade Repump Station from the east and provides redundancy to the eastern area of the city on Airport Road/Glades Boulevard, allowing for the distribution system to meet the minimum 50-psi pressure criterion during peak hour demand conditions.

The phased pipeline replacement (Zones 1-4) project in the Southwest Section of Belle Glade was developed by PBCWUD along with a meter replacement program to decrease water loss and unmetered water in the area. The main objectives of improvements in these areas (identified in page B of Figure 6.22) are to improve hydraulic performance by increasing existing pipe diameters from 2-inch to 6-inch and to relocate water mains to the right of way for improved access.

Pipeline replacements and new lines are based on modeling results. Pipeline replacements are needed in some areas suspected to have pipelines with a low c-factor (based on pipe age and model calibration results). All proposed pipeline replacements were identified using modeling results; therefore, actual pipe conditions should be field verified, especially for proposed replacements that call for same pipe diameter as existing.

New pipelines include closing gaps between existing pipes and interconnection of crossing pipelines that currently overlap but do not interconnect. These account for only 2 percent of the total linear feet of pipe improvements. Closing gaps in the

water distribution system is necessary to improve pipe redundancy, meet fire flow requirements, and maintain adequate pressures in the system. Some new pipeline segments were proposed by PBCWUD staff and were then confirmed or adjusted based on modeling results. PBCWUD may elect to evaluate each of these segments individually to determine if replacement with a larger pipe is warranted. In many cases, these pipelines are short lengths of pipe with a small exceedance of the performance criteria, which may not significantly affect the system's overall ability to meet level of service.

New pipelines for the interconnection of crossing pipelines that overlap one each other but do not connect refer to the small pipe segments, valves, and other appurtenances necessary to interconnect the two lines. Description of such crossing lines is provided in Chapter 6.

8.5 COST ESTIMATING ACCURACY

The level of accuracy for cost estimates varies depending on the level of detail to which the project has been defined. Planning level estimates usually represent a Class 4 or Class 5 level of accuracy, while final plans and specifications present the highest level of accuracy, or Class 1. The American Association of Cost Engineers International developed the following guidelines for anticipated cost estimate accuracy based on the type of estimate:

Type of Cost Estimate	Anticipated Accuracy
Class 5 (Conceptual)	+100% to -50%
Class 4 (Planning Level)	+50% to -30%
Class 3 (Preliminary Design)	+30% to -15%
Class 2 (50 to 70% Design Completion)	+20% to -10%
Class 1 (Pre-Bid)	+15% to -5%

The cost estimates presented in the Glades Region WMP are considered Class 4 accuracy level unless otherwise noted.

8.6 COST ESTIMATING METHODOLOGY AND UNIT COSTS

Cost estimates were developed based on information obtained from previous studies and documents, experience on other similar projects, and budgetary cost quotes from vendors. Costs for WTP projects were provided directly by PBCWUD. Appendix H contains breakdowns of cost estimates not included in tables throughout this chapter.

Costs are presented in 2013 dollars unless otherwise noted, regardless of when the project is expected to be constructed. No price escalation for future years, taxes, or bid market allowance was included in the cost estimates.

The cost estimating methodology employed was different for each of the three major improvement groups (WTP No. 11 Projects, Storage and Pumping Improvement Projects, and Distribution System Projects). Moreover, due to the nature of projects within the Distribution System Projects group, two different methodologies were used to estimate pipeline costs. The following sections provide detailed information.

8.6.1 Cost Estimating Methodology for WTP No. 11 Projects

Cost estimates for near-term improvements at WTP No. 11 were developed by PBCWUD and are included in the CIP for FY 2013 and FY 2014. Details provided by PBCWUD are included in Appendix H. The long-term WTP expansion project cost estimates include a 20 percent contingency, 15 percent for engineering and CEI, and 10 percent for administration and legal fees. A breakdown of the preliminary cost estimate is provided in Appendix H. The cost of this project should continue to be evaluated and refined as project needs are determined.

8.6.2 Cost Estimating Methodology for Storage and Pumping Improvement Projects

Capital cost estimates developed for each storage and pump station project were based on major scope items, past experience, and vendor quotes. Cost estimates include total direct cost and indirect costs such as overall project contingency at 20 percent, 15 percent for engineering and CEI, and 10 percent for administration and legal fees. Appendix H shows the break down of direct and indirect costs.

8.6.3 Cost Estimating Methodology for Distribution System Projects

Cost estimates for most pipeline projects were based on a unit cost per foot of pipe, plus engineering, CEI, administration, and legal fees. A modification of this methodology was applied to projects involving interconnections between crossing pipelines, as described below.

1. Primary Methodology: Capital costs were estimated based on the costs of recent pipeline construction projects in Florida. Unit costs were estimated to be approximately $16 per inch diameter per foot of pipeline for pipes of all diameters. This unit cost for pipes assumes a residential area and includes the grouting and abandonment of existing lines and appurtenances such as valves, fittings, water services, hydrants, and pavement restoration. This unit

cost per linear feet of installed pipe includes contingency due to soil conditions and mobilization. In addition to capital costs, 15 percent of the construction cost was added for engineering and CEI, and 10 percent was added for administration and legal fees.

2. Modification for Short Pipeline Gaps and Interconnection of Crossing Pipes: Some pipeline improvements consist of small segments 1) to interconnect crossing pipelines that currently overlap, but are not connected, and 2) to close short gaps between pipelines. Estimated unit costs for these connections were calculated using the total length of the segment and the $16 per inch diameter per foot of pipe, plus a price adjustment for additional appurtenances such as fittings and valves necessary to connect the pipes as well as a unit price assumed for pavement restoration. This was necessary because some of the pipe segments are very short, and using the $16 per diameter per foot unit price would underestimate the cost of these improvements. The same factors for engineering, CEI, administration, and legal fees were added to the total construction costs. The total unit cost for interconnection of crossing pipelines is estimated at approximately $25,000 and $35,000 for 6-inch and 12-inch pipelines, respectively. Appendix H contains a breakdown of the unit cost per connection.

8.6.4 Land Acquisition

Acquisition of property, easements, and right-of-way may be required for some of the recommended projects. The capital costs presented in this chapter do not include pipeline corridor purchases or easement costs because it was assumed that public right-of-way would be utilized whenever possible. Land costs in the Glades Region are not easily determined, particularly in the master planning phase, and variables affecting properties can result in widely varying land prices. Since land acquisition costs are not included in the CIP cost estimates, the final capital costs may vary from the estimates presented in this chapter.

8.7 COST ESTIMATES FOR RECOMMENDED PROJECTS

The following sections outline cost estimates for the recommended projects. Table 8.1 summarizes and schedules capital and improvement projects in 5-year increments, with the costs estimated for the first five years further broken down by fiscal year. Cost estimate breakdowns are included in Appendix H.

8.7.1 Cost of WTP No. 11 Projects

Cost estimates for near-term WTP improvement projects and a long-term WTP expansion project have been added to the CIP schedule shown in Table 8.1. A total of $10.28 M in capital improvements has been assigned to the CIP through FY 2017. An expansion costing $2.5 M is proposed between FY 2023 and FY 2027. The cost of this project should continue to be evaluated as project needs are determined.

8.7.2 Cost of Storage and Pump Station Improvement Projects

A summary of storage and pump station improvements costs throughout the system is shown in Table 8.1. The total capital investment proposed at the cities of Pahokee and South Bay is $2.78 M and $0.44 M, respectively. These costs have been assigned to a planning year increment when they need to be online based on evaluations throughout this WMP. No pump station improvement projects have been proposed for the City of Belle Glade through 2035.

8.7.3 Cost of Distribution System Projects

A number of distribution system improvement projects were identified and scheduled into the proposed CIP in Table 8.1. Further cost breakdown for distribution system projects is provided in Table 8.2. Capital improvement projects proposed by PBCWUD total $16.4 M and investments on pipeline replacements and new water mains based on modeling results total $20.8 M. Pipeline improvements are programmed into the CIP based on their relative priority and improvement seen in the system.

8.8 SUMMARY OF CAPITAL IMPROVEMENTS PLAN

Table 8.1 outlines the recommended water system CIP, which includes projects to maintain reliable water service to its customers through 2035. The CIP identifies $53.32 M worth of water system projects to be completed by 2035. Improvements at and expansion of WTP No. 11 accounts for 24 percent of this total estimated cost (about $12.8 M), storage and pump station improvement projects account for about 6 percent (about $3.2 M), and distribution system projects account for 70 percent ($37.3 M).

Table 8.1 Capital Improvements Plan
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Capital Improvement	CIP Schedule in 5-Year Increments								Total Estimated Cost
	2013 - 2017					FY 2018 to FY 2022	FY 2023 to FY 2027	FY 2028 to FY 2032	
	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017				
WATER TREATMENT PLANT No. 11 PROJECTS									
WTP No. 11									
Site Study and Permit Modification	$5,000								$5,000
Wells 9 & 10	$3,700,000								$3,700,000
Well Pump Conversion	$162,000								$162,000
Floridan Aquifer Production Well #8	$413,000								$413,000
RO Skid Energy Recovery System	$731,000								$731,000
Degassifier Cleaning Station		$400,000							$400,000
5 MG Ground Storage Tank		$3,000,000							$3,000,000
WTP No. 11 Expansion - Fifth RO Skid							$2,520,000		$2,520,000
Total WTP No. 11	**$5,011,000**	**$3,400,000**	**$0**	**$0**	**$0**	**$0**	**$2,520,000**	**$0**	**$10,931,000**
STORAGE AND PUMP STATION IMPROVEMENT PROJECTS									
Storage and Pump Station Improvements									
Booster Pump Station at Pahokee 0.5 MG EVT			$270,000						$270,000
1.5 MG Ground Storage Tank and Booster Pump Station in Pahokee								$1,880,000	$1,880,000
Increase Pump Capacity at South Bay Repump Station								$240,000	$240,000
Total Storage and Pump Station Improvements	**$0**	**$0**	**$270,000**	**$0**	**$0**	**$0**	**$0**	**$2,120,000**	**$2,390,000**
DISTRIBUTION SYSTEM PROJECTS									
Distribution System Projects Under Design									
12-inch Pipeline on State Road 80 between Hooker Hwy and Airport Road	$4,018,000								$4,018,000
Distribution System Projects Proposed by PBCWUD									
Pipeline Improvements in SW Section of Belle Glade - Phase 1	$1,968,000								$1,968,000
Pipeline Improvements in SW Section of Belle Glade - Phase 2			$1,287,000						$1,287,000
Pipeline Improvements in SW Section of Belle Glade - Phase 3		$652,000							$652,000
Pipeline Improvements in SW Section of Belle Glade - Phase 4		$120,000							$120,000
Dstribution System Projects Based on Modeling Results									
Pipeline Replacement		$3,840,000	$3,555,000	$4,933,000	$5,455,000	$988,000		1,310,000	$20,081,000
New Pipelines		$337,000	$229,000	$101,000	$54,000	$84,000			$805,000
Total Distribution System Improvements	**$5,986,000**	**$4,949,000**	**$5,071,000**	**$5,034,000**	**$5,509,000**	**$1,072,000**	**$0**	**$1,310,000**	**$28,931,000**
TOTAL CAPITAL IMPROVEMENTS PLAN	**$10,997,000**	**$8,349,000**	**$5,341,000**	**$5,034,000**	**$5,509,000**	**$1,072,000**	**$2,520,000**	**$3,430,000**	**$42,252,000**

Table 8.2 Total Distribution System Improvements and Length of Pipe by City
Glades Region Water Master Plan
Palm Beach County Water Utilities Department

Project Type		Belle Glade	South Bay	Pahokee	Total
Projects Proposed by PBCWUD	SR 15 and Gator Blvd 12-inch and 16-inch Water Main Extension	$3,055,825			$3,055,825
	12-inch Water Main along South Main Street, SE Avenue K to SE Avenue G	$200,535			$200,535
	12-inch Water Main along SW Avenue J from Canal Street to Main Street	$280,000			$280,000
	Pahokee Services Relocation			$60,000	$60,000
	12-inch Water Main along E. Main Street from SR 15 to S. State Market Road	$2,500,000			$2,500,000
	New Pipes for the Southwest Section of Belle Glade – Zone 1	$3,320,787			$3,320,787
	New Pipes for the Southwest Section of Belle Glade – Zones 2-4	$7,000,000			$7,000,000
	SUBTOTAL COST	***$16,357,147***		***$60,000***	***$16,417,147***
Projects Based on Modeling Results	Replace Pipelines with Larger Diameter	$3,193,000	$1,936,000	$6,676,000	$11,805,000
	Replace Pipelines with Same Diameter	$1,904,000	$1,212,000	$1,142,000	$4,258,000
	New Pipelines	$56,000	$144,000	$147,000	$347,000
	New Interconnections between Existing Pipelines	$215,000	$35,000	$49,000	$299,000
	Total Construction Cost	*$5,368,000*	*$3,327,000*	*$8,014,000*	*$16,709,000*
	Engineering and CEI (15%)	$805,000	$499,000	$1,202,000	$2,506,000
	Administration and Legal Fees (10%)	$537,000	$333,000	$801,000	$1,671,000
	SUBTOTAL COST	***$6,710,000***	***$4,159,000***	***$10,017,000***	***$20,886,000***
TOTAL PIPELINE COST		**$23,127,147**	**$4,159,000**	**$10,017,000**	**$37,303,147**

Chapter 9
SUMMARY AND RECOMMENDATIONS

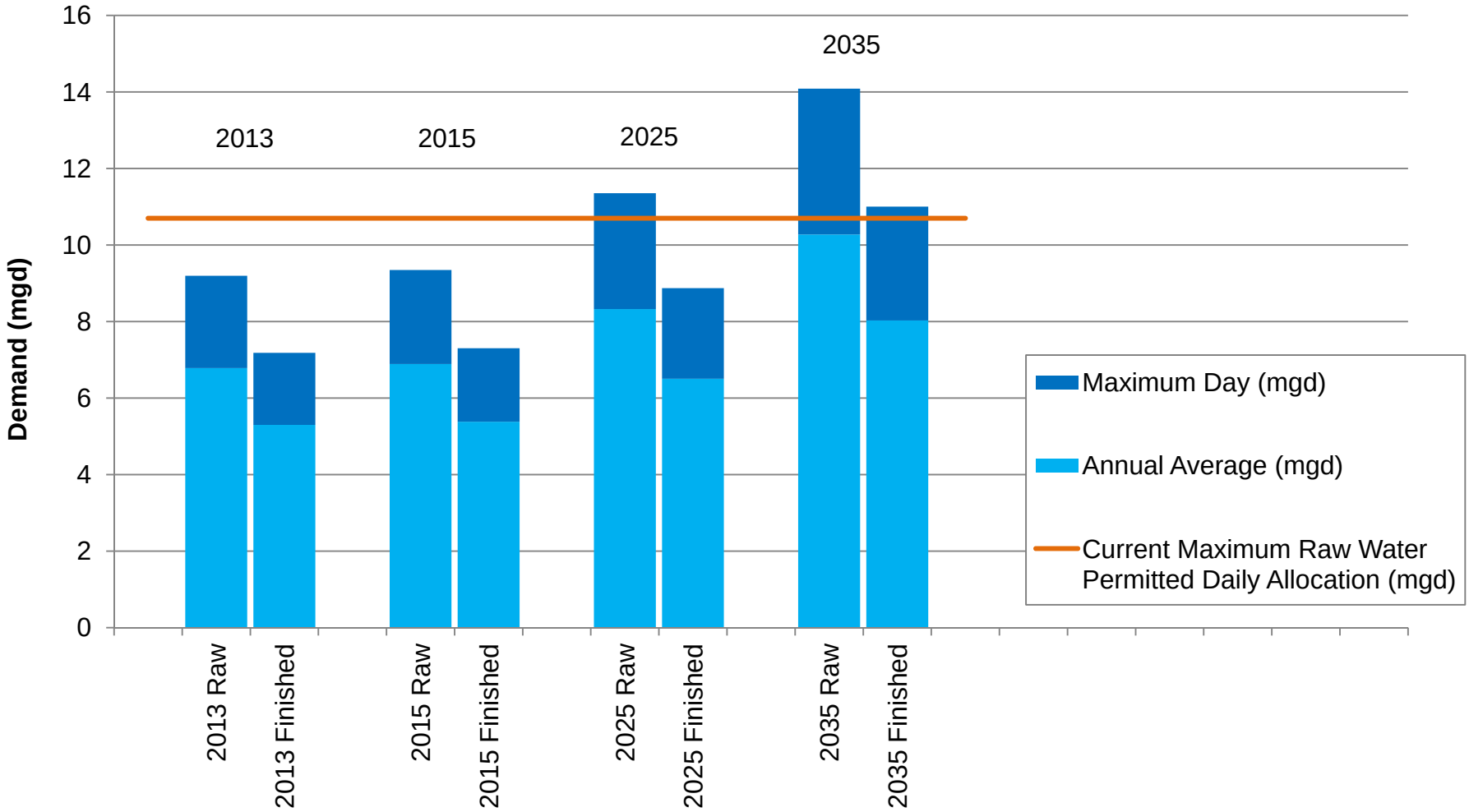
9.1 INTRODUCTION

This chapter provides a summary of the WMP and summarizes recommendations identified throughout the document. This chapter contains the following sections:

- Section 9.2 – Raw and Finished Water Demand Projections: Outlines projected raw water requirements and finished water demands for the master planning period through 2035.
- Section 9.3 – WTP Capacity to Meet Water Demands: Summarizes conclusions of the WTP capacity analyses (Chapters 3 and 7) and estimates the timing for future WTP capacity expansions to meet projected demands.
- Section 9.4 – Summary of Modeling Results: Compiles information and general observations documented throughout the modeling efforts that were completed as part of this project (Chapters 5 and 6), describes problem areas, and discusses potential corrective measures.
- Section 9.5 – Water System CIP: Summarizes major water system improvements through 2035 recommended to improve the water distribution system and maintain WTP, pump station, and storage facilities to meet projected water demands.
- Section 9.6 – Recommendations: Suggests strategies for updating the WMP, continuing reliable operation of the distribution system and WTP, and using the model for operational adjustments/enhancements in the distribution system.

9.2 RAW AND FINISHED WATER DEMAND PROJECTIONS

The WMP used information from the Palm Beach County Planning Department to estimate future population projections through 2035. A per capita water demand factor was multiplied by the projected population for each planning year to determine the total estimated finished water demand. Further details regarding finished water demand projections are provided in Chapter 2. Figure 9.1 summarizes the finished water average and maximum day demand projections and compares them with the raw water requirements, which were calculated using the historical ratio of raw water to finished water produced at WTP No. 11.



COMPARISON OF RAW AND FINISHED WATER DEMAND PROJECTIONS

FIGURE 9.1

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT

GLADES REGION WATER MASTER PLAN

A wellfield operating under SFWMD WUP No. 50-06857-W provides the Glades Region with a total annual raw water allocation of 3,443 MG, which is equivalent to a maximum daily allocation of 10.7 mgd. The WUP would be a limiting factor if WTP No. 11 were required to produce its rated capacity of 10 mgd (however, the plant's historical average production is only 6.41 mgd). The wellfield's current capacity is insufficient to meet the 2025 raw water needs as shown in Figure 9.1. This WUP is scheduled to expire in October 2025.

9.3 WTP CAPACITY TO MEET WATER DEMANDS

WTP No. 11 has sufficient treatment capacity to meet projected maximum day finished water demands through the beginning of 2030, after which maximum day demands will exceed the WTP capacity, as shown previously in Figure 7.1. It is recommended to maintain approximately 10 percent reserve treatment capacity in the system. Therefore, design of an expansion at WTP No. 11 is recommended to begin by 2026. An additional 2.5 mgd of treatment capacity through construction of a fifth RO membrane train and associated blending bypass at the existing WTP is recommended.

9.4 SUMMARY OF MODELING RESULTS

A hydraulic distribution system model was developed and calibrated as part of the WMP project. Data describing physical characteristics of the distribution system and existing facilities were used to develop the model. Pipeline diameter, material, and configuration was reviewed with PBCWUD staff to confirm pipeline connectivity and location accuracy. Water demands and water loss were incorporated into the model using billing records and total water volume recorded at master meters throughout the service area.

The calibrated model was found to be reasonably built for prediction of distribution system hydraulics, although calibration discrepancies did exist between model results and water system SCADA data. Differences observed may be attributed to effects of water loss demands being allocated throughout the network instead of at specific junction nodes where the actual loss occurs. Specific assignment of water losses to actual nodes with losses could not be performed due to the nature of the available information. In order to increase the accuracy of the model results, it is recommended to confirm pipe configurations in specific locations, reconcile unknown pipe materials, continue refinement of water demand allocation, and

evaluate diurnal water usage for the large user Duda & Sons. Additional discussion of these recommendations is included in Chapter 4.

The following sections summarize the modeling results, including areas that have a need for improvements and/or other corrective measures. Details are presented in Chapters 5 and 6.

9.4.1 2013 Distribution System General Observations

Modeling results for the 2013 planning period are included in Chapter 5. Analyses presented in this chapter indicate that the existing distribution system has sufficient capacity to meet the current water demands at peak hour, maximum day, and average day demand conditions while meeting the performance criteria set forth in Chapter 2, with two primary exceptions. Exceptions include:

1. Violation of the minimum specified pressure (50 psi) in the City of Pahokee. Distribution system pressures less than the 50 psi pressure criterion are observed in the City of Pahokee during all demand conditions due to the elevation of the 0.5 MG EVT, which sets a low hydraulic grade.
2. Many parts of the service area cannot meet the 1,000 gpm and 1,500 gpm available fire flow performance criteria specified for residential and commercial areas, respectively. Approximately 36 percent of fire hydrants fail to supply adequate fire flow according to model results. Field investigations by PBCWUD should be completed to determine the actual fire flow availability.

The water distribution network has a low degree of redundancy because it heavily relies upon a single 30-inch line, connecting WTP No. 11 to the distribution system, to provide water demand to all three cities. The 16-inch pipeline serving the City of Pahokee located along State Road 715 is also critical. Rupture of this pipe causes the system to be unable to meet demand in the City of Pahokee after exhausting water available in storage tanks.

Evaluations of water age under existing average demand conditions concluded that water age is considerably high in the City of South Bay due to the large volume for water storage used at the South Bay Repump Station and low tank turnover. The City of Pahokee has acceptable water age, except at the north end (known as Canal Point), where water age is above 72 hours due to low water demand and lack of looping to the rest of the distribution system. Scattered locations throughout the City of Belle Glade have high water age, usually at dead-end pipes. Detailed explanations of these causes and a set of strategies to decrease water age are outlined in Chapter 5.

Results of the model simulations indicate that water distribution system improvements will be driven primarily by the following needs:

- Additional or upsized transmission and distribution pipeline capacity,
- Improved and increased looping in older areas, which would decrease the number of dead ends and short-circuiting, and
- Replacement of old pipes to improve overall hydraulic performance (i.e., decrease headloss).

9.4.2 Areas of Concern

A summary of the areas of concern found in 2013 scenarios is provided below.

1. Areas with Insufficient Fire Flow Availability: Areas with insufficient fire flow availability exist in peripheral areas of the City of Pahokee, residential areas at the northern side of the City of South Bay, eastern residential areas in the City of Belle Glade, and scattered commercial areas.
2. Low Pressure in Pahokee and the Northeastern Residential Area of Belle Glade: Current minimum system pressures (ranging from 41.6 to 50 psi) during maximum day demand conditions occur in a large portion of the City of Pahokee. This is exacerbated during peak hour demand conditions, when model simulated pressures in the City of Pahokee fall to values as low as 38.8 psi. In addition, a small residential area in the northeast portion of the City of Belle Glade has peak hour pressures in the range of 40.1 to 50 psi.
3. System Vulnerability: The Glades Region is served by the 30-inch pipeline that originates at WTP No. 11 and extends along NW 16th Street in the City of Belle Glade, where it reduces to a 16-inch to the north and a 24-inch to the south. The region relies heavily on this 30-inch line to supply the majority of its peak hour demand to all three cities, which indicates a low degree of redundancy in the water distribution network. The 2013 vulnerability evaluation in Figure 5.8 shows that damage to this main pipeline, as well as the 16-inch line serving the City of Pahokee and the 24-inch line serving the cities of Belle Glade and South Bay, would cause hydraulic failure of essentially the entire distribution system.
4. Areas with High Water Age: The majority of the areas with impacts on water age are located throughout the City of South Bay and at the northern part of the City of Pahokee, namely the Canal Point area. This situation is repeated in the 2015 scenario for both affected areas.

5. Water Loss: Water loss figures based on the difference between billing data and plant production data show significant water loss and/or unmetered water in the distribution system. Aging water distribution infrastructure, inaccurate metering, challenging soil conditions that can cause pipe breaks, and other factors contribute to the high water loss.

9.4.3 Potential Corrective Measures

Potential corrective measures for the issues outlined in the previous section are discussed below. According to model simulated results, many of these issues are resolved in future (2025 and 2035) scenarios by constructing pipeline capital improvement projects throughout the distribution system. Improvement in hydraulic performance observed after simulating these pipeline projects is shown in maps throughout Chapter 6. Summary maps of recommended pipeline projects are shown by city in Figures 6.22 and 6.23. A description of each issue, potential corrective measures, and improvement after simulated pipeline projects is provided below.

1. Areas with Insufficient Fire Flow Availability: Field verification of fire flow is suggested for fire hydrants that have been identified as having insufficient fire flow availability. In some cases, when dead-end pipes are located close to a loop, connection with such loop can alleviate fire flow insufficiency. Fire flow deficiency will be improved through completion of pipeline replacement projects and new pipelines outlined in the CIP. After distribution system improvement projects are completed (simulated starting in 2015 scenarios), fire flow availability increases. Further improvement after additional capital improvement projects is observed in 2025 and 2035 scenarios. Figures 5.7, 6.6, 6.11, and 6.17 illustrate the series of consecutive changes in fire flow availability as projects outlined in the CIP are completed.

2. Increase Pressure at the City of Pahokee and Northeast Area of Belle Glade: The 2015 scenario simulations show that the low pressure condition in the City of Belle Glade will be resolved after an on-going pipeline improvement project in the area is completed.

   The addition of a booster pump station at the 0.5 MG tank at the northern end of the City of Pahokee will boost available fire flow and achieve higher distribution system pressures. A booster pump station is included in the CIP for FY 2015 to improve performance in the near-term. In addition, a new ground storage tank and repump station was also added to the CIP to be constructed sometime after 2025 when the existing 0.5 MG tank reaches the end of its useful life. The new tank and pump station was simulated in 2035 scenarios. This project will improve not only low pressures throughout the City

of Pahokee, but also fire flow availability and overall system redundancy and flexibility.

In the 2035 scenario, all low pressure conditions are resolved, and the pressure performance criteria are met throughout the region. Figures 5.3, 6.3, 6.9, and 6.14 illustrate the change in distribution system pressure during the maximum day demand condition as improvement projects outlined in the CIP are completed.

3. System Vulnerability/Reliability: While no projects were included in the CIP to specifically address system reliability, Figure 6.18 shows results obtained for system vulnerability during the final planning period of this WMP (year 2035). Although the total pipe length in the 2035 scenario is greater by 6 miles when compared to the 2013 scenario, a slightly better redundancy is attained during the 2035 scenario, suggesting that the network has gained some level of reliability through the completion of recommended pipeline and tank projects.

4. Areas with High Water Age: Figures 5.1, 6.1, 6.7, and 6.12 provide a graphical comparison of the sequential changes in water age throughout the planning periods. An overall simulated improvement in water age in the region is observed in this series of figures. For the City of South Bay, water age improves gradually through planning years 2025 and 2035 as water demand increases; however, this is not the case at Canal Point, where this condition remains challenging because of its remoteness with respect to the rest of the distribution system.

   It is recommended to implement strategies such as improvement of tank turnover (operating pump stations in such way that lower tank levels are sustained while still maintaining sufficient fire reserve); changing pump controls and/or operating methods; and eliminating dead-ends. Chlorination booster stations could be installed in the cities of South Bay and Pahokee to maintain chlorine residual at areas of high water age.

5. Water Loss: Prevention of water loss will be gradually accomplished through the on-going pipe replacement program in the Southwest Section of the City of Belle Glade, meter replacement, and other future distribution system improvement projects programmed into the CIP.

9.5 WATER SYSTEM CIP

The CIP for projects necessary to improve or expand the water system through 2035 including a WTP expansion, transmission and distribution system pipelines, pump stations, and storage facilities is documented in Chapter 8. Major projects in

the CIP include a new storage tank at the WTP, 34 miles of new pipelines, expansion of WTP No. 11, a booster pump station at the City of Pahokee 0.5 MG EVT, future replacement of pumps at the South Bay Repump Station, a new booster pump station and storage tank in Pahokee. Chapter 8 describes and breaks down the costs of the CIP and presents an implementation schedule of the projects, which total $42.25 M.

9.6 RECOMMENDATIONS

A number of recommendations were identified throughout the WMP project and this document. These include:

- Factors that may affect the County's water planning should continue to be monitored on an on-going basis. These factors could include modification to consumptive use permitting rules, regional planning efforts, climate change, and changes in drinking water regulations.
- PBCWUD should continue to update its water demand projections based on Palm Beach County Planning Department updates and monitor the per capita demand factor, which could change over time. The timing of the future WTP expansion project may shift based on changes in water demand projections.
- PBCWUD should continue to update its water distribution system model on a regular basis including allocation of updated demand projections, updated percentage of unaccounted-for water, and updating of model elements such as pipelines, pumps, and controls. Pump tests could be performed at the WTP high service pump station and repump stations on a regular basis to make sure accurate pump performance curves are incorporated into the model.
- Modeling identified several key areas where water quality is affected by water age longer than three days. These areas should continue to be monitored and operations adjusted as appropriate to optimize water quality in the service area. The County should continue to investigate opportunities to decrease or eliminate dead-ends.
- Fire hydrants in the three cities should be field tested to verify the model predictions. At hydrants where deficiencies are verified in the field, additional evaluations and pipeline projects outlined in Chapter 6 should be performed.
- The WTP expansion project outlined in Chapters 3 and 7, and included in the CIP, should be evaluated and implemented. A WTP expansion and increase in raw water supply are necessary for continued supply of maximum day flows through year 2035.

Chapter 10
REFERENCES

10.1 REFERENCES

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APPENDIX A– SCOPE OF WORK

EXHIBIT A

CONSULTANT SERVICE AUTHORIZATION NO. 7

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
ENGINEERING/PROFESSIONAL SERVICES

SCOPE OF WORK

INTRODUCTION

Palm Beach County (COUNTY) entered into an agreement entitled Contract for Engineering/ Professional Services - Palm Beach County Utilities Department Project No. WUD ***11-001*** (CONTRACT) with. Carollo Engineers (CONSULTANT) to provide engineering services for various general activities on (Reference Document R2011-0630). This Consultant Service Authorization will be performed under that CONTRACT.

BACKGROUND

The COUNTY recently received a Community Challenge Planning Grant from HUD to develop a comprehensive Glades Region Master Plan. The COUNTY Utilities Department has requested that the CONSULTANT develop a Water Master Plan for the Glades Region of the COUNTY, which is operated by the COUNTY's Utilities Department. The Glades Region Water Master Plan will become part of the comprehensive Glades Region Master Plan. The planning area is for the entire Glades Region consisting of 25,634 acres of which 74% is located in unincorporated Palm Beach County and 26% within the Tri-Cities. The CONSULTANT will update and calibrate the COUNTY's Lake Region water distribution system model and will develop a Water Master Plan for the Glades system. The project will include development of updated water demand projections for the Glades Region, hydraulic distribution system modeling, and development of a Capital Improvements Plan (CIP) through 2035.

SCOPE OF SERVICES

CONSULTANT shall perform the engineering Scope of Services as described herein.

GLADES REGION WATER MASTER PLAN

The CONSULTANT shall perform the following engineering services to develop the Glades Region Water Master Plan. This authorization includes hydraulic modeling and development of a Capital Improvements Plan and Water Master Plan Report. Because of the nature of this project, certain assumptions apply to this Scope of Services. To the extent possible, these assumptions are stated within this document and are reflected in the CONSULTANT fee.

The engineering services described herein have been based upon the understanding of the direction provided by COUNTY staff. Assumptions include:

- COUNTY staff will provide all previous reports, data, model, and information available to assist in the development of the Glades Region Water Master Plan.
- The COUNTY shall collect and compile all data necessary to complete the project and provide it to the CONSULTANT.
- The CONSULTANT shall be entitled to rely upon the accuracy of the data and information supplied by the COUNTY without independent review or evaluation.
- The COUNTY shall attend all workshops and review meetings to maintain the progress of the project according to the schedule.
- The COUNTY shall review Draft deliverables and provide comments to the CONSULTANT within a two-week period.
- The COUNTY shall provide GIS data requested by the CONSULTANT when available.
- The COUNTY shall provide the data and information requested to compute the water demand projections and peaking factors.
- The CONSULTANT will perform all necessary model development, calibration, and analyses. The complete model will be turned over to the COUNTY at the end of the project.
- The CONSULTANT will use InfoWater modeling software.
- The Glades Region Water Master Plan includes evaluation of infrastructure necessary for future growth and development only, and does not include replacement of pipes due to age or condition. It is understood that necessary renewal and replacement (R&R) projects were developed by the COUNTY under a separate project. The COUNTY will provide a list of R&R projects and cost estimates to include in the Glades Region Water Master Plan CIP.

Task 1 Project Management, Communication, and Meetings

The CONSULTANT's project manager will direct and coordinate the efforts of the project team members in order to deliver the project. Work under this task includes the following:

1.1 Project Management/Communication: The project manager will make staffing assignments, review work progress, and coordinate quality assurance and review procedures. The project manager will manage the budget, schedule, and invoicing.

1.2 Meetings and Workshops: The CONSULTANT will schedule progress meetings with COUNTY staff to keep staff informed of the project status, discuss upcoming tasks and deliverables, and to address issues relating to the project. It is estimated that the project will require a Kickoff Meeting and four (4) progress meetings. Regular communication will be achieved through email and phone correspondence between progress meetings. The progress meetings will be combined with deliverable review meetings when possible. The CONSULTANT will prepare meeting agendas and meeting notes to document discussions, decisions, and work progress. The CONSULTANT will not attend additional meetings such as countywide meetings to discuss the comprehensive Glades Region Master Plan unless they are substituted for one of the Water Master Plan progress meetings.

The CONSULTANT will participate in the following meetings:

- Project kick-off meeting
- Four (4) progress meetings

Task 1 Deliverables

The following deliverables shall be provided:

- Meeting agendas and notes

Task 2 Data Collection and Planning Framework

The COUNTY will collect all data necessary to complete the project and provide it to the CONSULTANT. The CONSULTANT will provide a data request list and format outlining how the data should be compiled. The CONSULTANT will review the data and available past reports to understand the County's Lake Region Water Treatment Plant (WTP) and distribution system. The CONSULTANT will use data and population projections provided by the County to develop updated water demand projections for the Glades Region. This task also includes a review of the performance criteria selected for the County's eastern distribution system and any potential adjustments needed for the Glades Region. This task serves as the basis of all future master planning tasks. Items included in this task are:

2.1 Water Data Review: The CONSULTANT will review past reports and data from COUNTY to develop a thorough understanding of the County's Lake Region system. Data requests may include past reports, customer billing records, major customer consumption, traffic analysis zone (TAZ) population projections, water production records, and peaking factor information. In addition, the following GIS data will be required: property parcels, street centerlines, service area boundaries, TAZ areas, land use, and zoning. The CONSULTANT will review the water system performance criteria selected as part of the County's Water Master Plan Update (eastern system) with COUNTY staff and discuss any potential changes that need to be made for the Lake Region.

2.2 Water Demand Projections: The CONSULTANT will evaluate historical water production and population data for the Lake Region to develop a per capita demand factor for the region. The County will review water sales data for any large or bulk customers and provide insight on any potential changes in future demand trends. As discuss in Task 3.2, the County will provide a spreadsheet of large water user demands that should be allocated separately in the model. The CONSULTANT will use population projections provided by the County's Planning Department (by TAZ) and the calculated per capita demand factor to develop annual average water demand projections for the Lake Region through 2035.

2.3 Peaking Factor Development: The CONSULTANT will analyze historical data to determine maximum month, maximum day, and peak hour demand factors for the Lake Region water system. One year of past SCADA data will be analyzed to develop average and maximum day diurnal curves for the Lake Region. Diurnal curves may be different in the Lake Region than in other areas of the COUNTY and are necessary for the extended period simulation modeling analyses.

2.4 Technical Memorandum No. 1: The CONSULTANT will develop Technical Memorandum (TM) No. 1 to present the planning and performance information that will be the foundation of the modeling studies. TM1 will include a summary of the population and water demand projection development. Peaking factors, diurnal curves, and performance criteria will be documented. COUNTY staff will be asked to provide comments on TM1. These comments will be incorporated into the Glades Region Water Master Plan.

Task 2 Deliverables

Ten (10) copies of TM1 and electronic pdf version.

Task 3 Water Model Development and Calibration

The CONSULTANT will update and calibrate the COUNTY's Lake Region water distribution system hydraulic model for the purpose of planning future infrastructure. The primary objective of the calibration task is to give the COUNTY confidence that the model is a reasonable representation of the water distribution system so that capital improvement decisions can be made based on model results.

The CONSULTANT will update the water system model. The County will provide all information necessary to complete the update. Some of these items have already been developed by the COUNTY, such as GIS data. The County will work with distribution system staff and/or staff at the Lake Region WTP to fill all data gaps in order to provide a complete set of necessary data to the CONSULTANT for developing the model, including:

- GIS Data: Water mains, hydrant locations, service area boundary, and pump station and tank data.
- Infrastructure Data: Elevations of facilities; storage tank size and height; pump number, size, and performance curves.
- Operational Information: SCADA data, infrastructure control schemes and setpoints, and location and use of control valves, if any.

Model creation and calibration will include the following tasks:

3.1 Water Model Development: The CONSULTANT will update the model using GIS data, as-built drawings, and other available information. Development of the model also includes establishing pipe connectivity and entering hydraulic infrastructure data for pumps and tanks, including control information. The CONSULTANT will discuss each pump and storage tank site with COUNTY staff to obtain an understanding of the system and to give guidance on how to incorporate pertinent data into the model. Model development also includes assigning node elevations, incorporating diurnal curves, allocating demands, and other data that is used by the model for calculations. It is assumed that the County will gather and provide all necessary data to the CONSULTANT for input into the model.

The CONSULTANT will provide a check of the model using GIS and InfoWater tools. This check will include pipe connectivity, topology checks such, and data entry of pump curves, tank dimensions, and diurnal curves.

3.2 Water Demand Allocation: The CONSULTANT will allocate water demands in the model based on the projections developed by TAZ as part of Task 2.2. The County will review bulk user consumption records and provide the CONSULTANT with a summary spreadsheet of large users with demands that should be allocated individually.

3.3 Calibration Plan and Data Compilation: The CONSULTANT will develop a calibration plan that identifies calibration scenario days (two days); necessary SCADA data including WTP flow, tank level, and WTP and remote pressure data; and necessary data that will need to be captured in the field during the calibration process. While the majority of the data necessary for model calibration can be obtained from the County's SCADA, the SCADA does not capture pump on/off or variable frequency drive (VFD) speed data. Therefore, the CONSULTANT will provide a plan with instructions for WTP staff to capture hourly pump speed data for up to a 48-hour period.

The calibration plan will include an approach to simulate two different demand conditions. One day will be selected from the project duration so that VFD speed can be captured. This day will be selected for as high of a demand condition as possible, such as in April or May, which are typically the highest demand months in the COUNTY. The second day will be selected from the past one-year period and will use available SCADA data only.

Data from the COUNTY's existing remote pressure nodes will be used to evaluate model results. Model calibration will not include capture of any additional pressure data in the field.

3.4 Water Model Calibration: Using data collected from SCADA and the field, the CONSULTANT will calibrate the Lake Region water model by comparing model results with field data. The model will be calibrated for extended period simulation (EPS) conditions for two 24-hour periods. Calibration will be conducted in a two-step process. The first calibration scenario will be developed using data captured during this project including manual readings of pump VFD speed. The InfoWater Calibrator tool will be used on this scenario. The second step will be to develop an additional calibration scenario for verification of the Calibrator results. The second day will be use available SCADA data only, and pump speeds will be estimated. Throughout the calibration process for both scenarios, the CONSULTANT will recommend modification of data parameters such as infrastructure, controls, demands, or friction factors until there is a reasonable correlation between the model and the test data.

3.5 Technical Memorandum No. 2: The CONSULTANT will prepare TM2 describing the model development and calibration. Maps showing pipe infrastructure data will be provided, along with tables of data describing infrastructure parameters such as storage tank sizes and elevations, pump design points and curves, and control information. TM2 will provide a location to document all data used in the model. TM2 will also include the calibration plan, model calibration results, and a discussion of additional investigations that may be needed to resolve anomalies that have been discovered during the model calibration process. The CONSULTANT will review the calibration results in a meeting with COUNTY staff. Staff will be asked to provide comments on TM2. These comments will be incorporated into the Glades Region Water Master Plan.

Task 3 Deliverables

Ten (10) copies of TM2 and electronic pdf version.

Task 4 Water System Evaluations and CIP

The CONSULTANT will conduct evaluations and develop scenarios for the COUNTY to meet the selected performance criteria and projected water demands in the 2012, 2015, 2020, and 2035 planning periods. These evaluations and scenarios will become the basis for the recommended projects in the Glades Region Water Master Plan. This task includes the following:

4.1 Evaluate Existing Water Distribution System: The CONSULTANT will evaluate the existing water distribution system to identify deficiencies, evaluate fire flow capabilities, and determine the adequacy of existing pumps and storage tanks. The CONSULTANT will also evaluate the redundancy in the system to identify any critical pipes that are crucial to system operation, as well as typical water age throughout the distribution system under average annual demand conditions.

4.2 Develop Master Plan for Future Water Infrastructure: The CONSULTANT will develop a master plan for future water infrastructure to meet the projected water demands. Recommendation of future infrastructure will include an alternatives analysis that will evaluate the benefits of various configurations and sizes of water distribution mains. The pipes will be sized and configured to maintain adequate pressure and fire flow availability. Future infrastructure will be designed to achieve system operation that maintains the performance criteria selected in Task 2.0.

Model scenarios will include steady-state peak hour analyses and fire flow evaluations for each time period being evaluated (2015, 2020, and 2035). Extended period simulation (EPS) scenarios will be developed for average day and maximum day demand conditions to evaluate storage fluctuations and water age/quality considerations at each time period. The CONSULTANT will also evaluate the redundancy in the system to identify any pipes that are currently or may become critical to system operation.

4.3 WTP and Storage Analysis: The CONSULTANT will compare the capacity of the Lake Region WTP with projected water demands and determine the timing when new sources or a WTP expansion is required. The CONSULTANT will also complete a storage volume assessment for each time period under evaluation (2015, 2020, and 2035) to determine the adequacy of finished water storage. The CONSULTANT will recommend sizes and locations of additional water storage tanks and/or booster pump stations if necessary.

4.4 Develop Water Capital Improvements Plan: The CONSULTANT will establish unit costs for water infrastructure (plant and distribution system) and will develop cost estimates of the recommended capital improvements projects for pipelines and/or WTP expansions. The costs will be based on Class 5 (conceptual level) cost estimates. The CONSULTANT will develop a CIP through 2035 with a detailed implementation schedule for the first five years. The COUNTY will provide R&R programmed projects and cost estimates to include in the CIP (R&R projects will be developed by the COUNTY in a separate project.) The Glades Region Water Master Plan includes evaluation of infrastructure necessary for future growth and development and does not include replacement of pipes due to age or condition.

Task 5 Glades Region Water Master Plan Report

The results of the project will be summarized in the Glades Region Water Master Plan Report. The Glades Region Water Master Plan Report will include the following sections:

- Standard Executive Summary.
- Introduction including background information, general purpose and scope, and description of factors affecting the Lake Region water planning efforts such as the comprehensive Glades Region Master Plan being completed by the County, permitting regulations, population shifts, and/or global warming.
- Summary of existing water facilities including treatment plant, wells, water distribution system, and storage facilities.
- Population estimates as provided in the COUNTY's TAZ data.
- Water demand projections including raw water, finished water, peaking factors and diurnal curves specific to the Lake Region.
- Description of the water transmission system including pumping, storage, and pipeline infrastructure.
- Model description and documentation including model elements, demand allocations, and calibration efforts.
- Model scenarios including 2012, 2015, 2020, and 2035 scenarios for both steady state and EPS evaluations.
- Capital improvements plan through 2035 including cost estimates and timing.

5.1 Draft Water Master Plan Report: The CONSULTANT will prepare a Draft Glades Region Water Master Plan that summarizes the analyses completed throughout the project. This document will include tables of existing system operational parameters, maps of existing and recommended future infrastructure, and breakdown of costs for the capital improvements plan. It is assumed that the organization and format of the Glades Region Water Master Plan will be similar to the County's eastern system Water Master Plan Update (project currently nearing completion). A similar format will provide efficiency in developing the Glades Region Water Master Plan. The CONSULTANT will review the results of the Glades Region Water Master Plan in a meeting with COUNTY staff. COUNTY staff will be asked to provide comments on the Draft Glades Region Water Master Plan. These comments will be incorporated into the Final Glades Region Water Master Plan.

5.2 Draft Report Review Meeting: The CONSULTANT will attend a meeting to discuss comments on the Draft Glades Region Water Master Plan. This meeting will be combined with one of the progress meetings described in Task 1.2.

5.3 Final Water Master Plan Report: Upon receipt of COUNTY comments, the document will be revised and a final version will be issued.

Task 5 Deliverables

Ten (10) copies of the Draft Glades Region Water Master Plan.

Minutes from Draft Report Review Meeting.

Ten (10) copies of the Final Glades Region Water Master Plan and electronic pdf version.

Items Not Included In Scope of Services

- Field verification or as-built/record drawing research to verify or confirm existing hydraulic model.
- Hydrant flow testing for determining C-factors. Typical values for friction C-factors can normally be used to achieve adequate modeling results. However, if throughout the course of the project it becomes evident that hydrant flow testing is necessary for calibration, additional project effort will be required (in addition to what is currently included).
- Evaluations, plans, and/or scheduling of repair and replacement (R&R) programs for water system assets. The COUNTY will provide existing R&R programs and schedules for all other water system assets to be documented in the Glades Region Water Master Plan.
- Additional services not otherwise provided for in this Scope of Services.

Compensation

Lump Sum - $186,000

M/WBE Participation

As prescribed under Section 7.5 of the CONTRACT, SBE participation is included in Attachment C under this Authorization. The attached Schedule 1 defines the SBE participation.

ATTACHMENT – A	Budget Summary
ATTACHMENT – B	Project Schedule
ATTACHMENT – C	SBE Schedules 1 & 2
ATTACHMENT – D	Location Map

APPENDIX B– GLADES REGION HOUSING UNIT AND POPULATION PROJECTIONS BY TAZ

Table B.1 Historical and Projected Residential Units by Traffic Analysis Zone

TAZ	JUR	City/Area	Grpqtr Pop	Occupancy Rate	Estimated Population per Household	Historical Residential Units												
						2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1200	00	Unincorporated County		83.3%	4.80	5	5	5	5	5	5	5	5	5	5	5	5	5
1202	00	Unincorporated County		81.2%	1.65	116	116	116	116	116	116	116	116	116	116	116	116	116
1202	04	Belle Glade		85.6%	3.09	5	5	95	95	95	95	95	95	95	95	95	95	95
1203	00	Unincorporated County		94.4%	3.47	16	16	16	16	17	17	18	18	18	18	18	18	18
1204	00	Unincorporated County		81.7%	2.52	122	122	122	123	124	124	124	124	124	124	124	124	124
1205	00	Unincorporated County		63.8%	2.45	115	115	116	116	116	116	117	117	117	117	117	117	117
1205	48	Pahokee	136	83.0%	3.20	450	455	464	470	478	480	482	485	486	486	487	487	487
1206	00	Unincorporated County		83.7%	3.01	430	430	430	430	430	430	430	430	430	430	430	430	430
1206	48	Pahokee		70.1%	3.34	66	66	66	66	66	66	66	66	66	66	66	66	66
1207	00	Unincorporated County		90.8%	3.02	229	229	229	229	229	229	229	229	229	229	229	229	229
1207	48	Pahokee	115	83.0%	3.20	1430	1434	1436	1443	1467	1490	1496	1498	1499	1500	1501	1502	1502
1208	00	Unincorporated County		88.6%	3.24	201	201	201	201	201	201	201	201	201	201	201	201	201
1209	00	Unincorporated County			2.48	0	0	0	0	0	0	0	0	0	0	0	0	0
1210	00	Unincorporated County	384	63.3%	2.61	60	60	60	60	60	60	60	60	60	60	60	60	60
1211	00	Unincorporated County	672		2.48	0	0	0	0	0	0	0	0	0	0	0	0	0
1212	00	Unincorporated County			2.48	1	1	1	1	1	1	1	1	1	1	1	1	1
1212	04	Belle Glade		96.6%	3.30	910	914	915	925	927	940	948	950	953	954	961	961	961
1213	04	Belle Glade		92.5%	2.97	254	254	254	254	254	254	254	254	255	255	256	256	256
1214	00	Unincorporated County		71.4%	3.84	36	36	36	36	36	37	37	37	37	37	37	37	37
1214	04	Belle Glade		97.3%	2.98	387	387	387	387	387	387	387	387	387	387	387	387	387
1215	00	Unincorporated TAZ around Inland Port		90.0%	2.11	29	29	29	29	29	29	29	29	29	29	29	29	29
1215	04	Belle Glade		100.0%	2.43	6	6	6	6	6	6	6	6	6	6	6	6	6
1217	00	Unincorporated TAZ around Inland Port		100.0%	3.15	12	12	12	12	12	12	12	12	12	12	12	12	12
1217	58	South Bay	1871	72.7%	3.40	1106	1109	1114	1118	1121	1128	1135	1142	1143	1145	1146	1146	1146
1218	00	Unincorporated TAZ around Inland Port		97.4%	3.12	78	78	78	78	78	78	78	78	78	78	78	78	78
1218	04	Belle Glade		87.5%	3.48	84	85	85	85	85	85	85	85	86	86	86	87	87
1218	58	South Bay			3.40	0	0	0	0	0	0	0	0	0	0	0	0	0
1219	04	Belle Glade	155	76.0%	2.84	1740	1740	1740	1740	1740	1752	1758	1760	1766	1771	1771	1771	1771
1220	04	Belle Glade		86.4%	2.79	1089	1089	1089	1113	1117	1119	1119	1119	1119	1119	1122	1123	1123
1221	00	Unincorporated County		100.0%	4.00	1	1	1	1	1	1	1	1	1	1	1	1	1
1221	04	Belle Glade		89.5%	3.21	941	941	941	941	942	944	944	955	958	960	961	961	961
1222	00	Unincorporated County		87.0%	2.55	22	22	22	22	22	22	22	23	23	23	23	23	23
1222	04	Belle Glade	7	95.0%	3.40	730	730	732	735	738	741	749	749	751	751	751	751	751
1223	00	Unincorporated County		54.2%	3.85	100	100	100	100	100	100	100	100	100	100	100	100	100
1224	00	Unincorporated County		98.5%	3.71	406	406	406	406	406	406	406	406	407	407	407	408	408
1224	04	Belle Glade				0	0	0	0	0	0	0	0	0	0	1	1	1
1225	00	Unincorporated County		83.3%	2.00	4	4	4	4	4	4	4	4	4	4	4	4	4
1226	00	Unincorporated County		58.8%	3.00	33	33	33	33	33	33	33	34	34	34	34	34	34
1228	00	Unincorporated County		36.4%	2.55	219	219	219	219	219	219	219	219	219	219	219	219	219
		Total	3340			11433	11450	11560	11615	11662	11727	11766	11795	11815	11826	11842	11846	11846

TAZ	JUR	City/Area	Projected Residential Units																							
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1200	00	Unincorporated County	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1202	00	Unincorporated County	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
1202	04	Belle Glade	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1203	00	Unincorporated County	19	19	19	20	20	20	20	21	21	21	21	22	22	22	22	23	23	23	24	24	25	25	25
1204	00	Unincorporated County	124	125	125	127	127	129	129	130	130	132	132	134	134	136	136	138	138	140	140	141	141	142	142
1205	00	Unincorporated County	120	122	124	127	129	131	134	136	138	141	143	146	148	151	154	156	159	162	164	167	170	172	175
1205	48	Pahokee	490	497	503	509	515	521	526	532	538	543	548	554	559	564	569	573	578	582	587	591	595	599	603
1206	00	Unincorporated County	432	450	470	490	510	529	548	567	585	602	619	636	652	667	681	695	708	721	733	744	756	768	780
1206	48	Pahokee	67	70	70	72	72	74	74	76	76	80	80	85	85	90	90	95	95	100	100	105	105	107	107
1207	00	Unincorporated County	230	230	232	232	240	240	250	250	260	260	270	270	280	280	290	290	300	300	310	310	320	320	330
1207	48	Pahokee	1514	1532	1550	1567	1584	1600	1616	1631	1646	1660	1674	1688	1701	1714	1726	1738	1749	1760	1771	1781	1791	1801	1810
1208	00	Unincorporated County	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201
1209	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1210	00	Unincorporated County	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
1211	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1212	00	Unincorporated County	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1212	04	Belle Glade	970	977	993	1007	1021	1035	1048	1060	1071	1082	1093	1102	1112	1120	1129	1136	1144	1150	1157	1163	1168	1174	1179
1213	04	Belle Glade	256	256	256	257	258	259	260	261	261	262	262	262	263	263	263	264	264	264	265	265	265	266	266
1214	00	Unincorporated County	37	37	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	0
1214	04	Belle Glade	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387
1215	00	Unincorporated TAZ around Inland Por	29	30	30	31	31	31	32	40	60	80	100	150	200	250	300	350	400	450	500	550	600	650	700
1215	04	Belle Glade	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
1217	00	Unincorporated TAZ around Inland Por	12	12	12	12	12	12	12	20	40	60	100	150	200	250	300	350	400	450	500	550	600	650	700
1217	58	South Bay	1146	1148	1151	1195	1240	1286	1332	1378	1425	1472	1519	1565	1612	1659	1705	1752	1797	1842	1887	1931	1974	2017	2059
1218	00	Unincorporated TAZ around Inland Por	78	79	79	80	82	83	84	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
1218	04	Belle Glade	90	90	91	91	92	92	93	100	120	140	160	180	200	220	226	226	226	226	226	226	226	226	226
1218	58	South Bay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1219	04	Belle Glade	1775	1780	1790	1800	1809	1817	1825	1832	1839	1845	1851	1857	1862	1867	1871	1876	1879	1883	1886	1889	1892	1895	1898
1220	04	Belle Glade	1128	1133	1142	1149	1157	1163	1169	1175	1180	1185	1189	1193	1196	1199	1202	1205	1207	1210	1212	1213	1215	1217	1218
1221	00	Unincorporated County	1	1	1	20	50	80	110	140	170	200	230	260	290	320	350	380	410	500	590	680	770	860	950
1221	04	Belle Glade	967	976	1000	1023	1047	1070	1093	1115	1137	1159	1181	1202	1222	1242	1262	1281	1300	1318	1336	1353	1370	1386	1401
1222	00	Unincorporated County	23	23	24	24	24	25	25	25	26	26	27	27	28	28	29	29	30	30	32	34	36	38	40
1222	04	Belle Glade	755	767	785	802	820	838	856	873	891	908	926	943	960	977	993	1010	1026	1043	1058	1074	1090	1105	1120
1223	00	Unincorporated County	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1224	00	Unincorporated County	408	409	409	410	410	411	411	450	470	490	510	530	550	570	590	610	630	650	670	690	710	730	750
1224	04	Belle Glade	1	3	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
1225	00	Unincorporated County	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1226	00	Unincorporated County	34	35	35	35	36	36	36	37	37	37	38	38	38	39	39	39	40	40	40	41	41	41	41
1228	00	Unincorporated County	219	219	220	220	222	222	223	223	224	224	225	225	226	226	227	227	228	228	230	230	231	231	232
		Total	11901	11995	12128	12325	12531	12728	12928	13196	13519	13833	14172	14542	14914	15278	15629	15967	16306	16697	17092	17477	17866	18243	18587

Table B.2 Population by Traffic Analysis Zone

TAZ	JUR	City/Area	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1200	00	Unincorporated County	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
1202	00	Unincorporated County	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156
1202	04	Belle Glade	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251
1203	00	Unincorporated County	59	59	59	59	59	62	62	62	66	66	66	66	69	69	69	69	72
1204	00	Unincorporated County	256	256	256	256	256	256	258	258	262	262	266	266	268	268	272	272	276
1205	00	Unincorporated County	183	183	183	183	183	187	191	194	198	201	205	208	212	216	220	224	227
1205	48	Pahokee	1427	1427	1430	1430	1430	1439	1456	1472	1488	1504	1519	1535	1550	1564	1579	1593	1607
1206	00	Unincorporated County	1082	1082	1082	1082	1082	1087	1132	1184	1233	1282	1331	1379	1425	1471	1515	1558	1599
1206	48	Pahokee	155	155	155	155	155	157	164	164	169	169	173	173	178	178	187	187	199
1207	00	Unincorporated County	628	628	628	628	628	631	631	636	636	658	658	686	686	713	713	740	740
1207	48	Pahokee	4098	4100	4103	4106	4106	4139	4186	4233	4278	4322	4365	4407	4448	4488	4526	4563	4599
1208	00	Unincorporated County	576	576	576	576	576	576	576	576	576	576	576	576	576	576	576	576	576
1209	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1210	00	Unincorporated County	483	483	483	483	483	483	483	483	483	483	483	483	483	483	483	483	483
1211	00	Unincorporated County	672	672	672	672	672	672	672	672	672	672	672	672	672	672	672	672	672
1212	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1212	04	Belle Glade	3037	3040	3062	3062	3062	3091	3114	3163	3210	3255	3297	3338	3377	3414	3449	3481	3513
1213	04	Belle Glade	700	700	703	703	703	703	702	705	707	709	713	714	716	717	719	720	721
1214	00	Unincorporated County	101	101	101	101	101	101	101	104	104	104	104	104	104	104	104	104	104
1214	04	Belle Glade	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123
1215	00	Unincorporated TAZ around Inland Por	55	55	55	55	55	55	57	57	58	59	59	60	76	114	152	190	285
1215	04	Belle Glade	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
1217	00	Unincorporated TAZ around Inland Por	38	38	38	38	38	38	38	38	38	38	38	38	63	126	189	315	473
1217	58	South Bay	4698	4703	4705	4705	4705	4705	4710	4717	4827	4939	5051	5165	5280	5395	5511	5627	5743
1218	00	Unincorporated TAZ around Inland Por	237	237	237	237	237	237	240	240	243	249	252	255	304	456	608	760	912
1218	04	Belle Glade	262	262	262	265	265	274	275	277	278	279	281	282	305	365	426	487	548
1218	58	South Bay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1219	04	Belle Glade	3969	3980	3980	3980	3980	3988	3999	4021	4042	4061	4079	4096	4112	4127	4140	4153	4165
1220	04	Belle Glade	2701	2701	2708	2711	2711	2723	2735	2755	2774	2792	2808	2823	2836	2848	2859	2870	2879
1221	00	Unincorporated County	4	4	4	4	4	4	4	4	80	200	320	440	560	680	800	920	1040
1221	04	Belle Glade	2754	2760	2763	2763	2763	2780	2805	2874	2942	3009	3076	3142	3206	3270	3333	3395	3455
1222	00	Unincorporated County	51	51	51	51	51	51	51	53	53	53	55	55	55	58	58	60	60
1222	04	Belle Glade	2434	2434	2434	2434	2434	2447	2486	2543	2601	2658	2715	2772	2829	2886	2942	2998	3054
1223	00	Unincorporated County	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208
1224	00	Unincorporated County	1490	1490	1490	1493	1493	1493	1497	1497	1501	1501	1504	1504	1647	1720	1793	1867	1940
1224	04	Belle Glade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1225	00	Unincorporated County	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
1226	00	Unincorporated County	60	60	60	60	60	60	62	62	62	64	64	64	65	65	65	67	67
1228	00	Unincorporated County	203	203	203	203	203	203	203	204	204	206	206	207	207	208	208	209	209
		Total Population	**34,192**	**34,219**	**34,262**	**34,274**	**34,274**	**34,422**	**34,669**	**35,027**	**35,563**	**36,149**	**36,717**	**37,289**	**38,088**	**39,030**	**39,948**	**40,939**	**41,998**

TAZ	JUR	City/Area	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1200	00	Unincorporated County	20	20	20	20	20	20	20	20	20	20	20
1202	00	Unincorporated County	156	156	156	156	156	156	156	156	156	156	156
1202	04	Belle Glade	251	251	251	251	251	251	251	251	251	251	251
1203	00	Unincorporated County	72	72	72	75	75	75	79	79	82	82	82
1204	00	Unincorporated County	276	280	280	284	284	289	289	291	291	293	293
1205	00	Unincorporated County	231	235	240	244	248	252	256	261	265	269	273
1205	48	Pahokee	1620	1634	1646	1659	1671	1684	1695	1707	1718	1729	1739
1206	00	Unincorporated County	1639	1678	1714	1749	1782	1814	1844	1872	1902	1932	1962
1206	48	Pahokee	199	211	211	223	223	234	234	246	246	251	251
1207	00	Unincorporated County	768	768	795	795	823	823	850	850	878	878	905
1207	48	Pahokee	4634	4668	4700	4732	4762	4792	4820	4848	4874	4900	4924
1208	00	Unincorporated County	576	576	576	576	576	576	576	576	576	576	576
1209	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0
1210	00	Unincorporated County	483	483	483	483	483	483	483	483	483	483	483
1211	00	Unincorporated County	672	672	672	672	672	672	672	672	672	672	672
1212	00	Unincorporated County	0	0	0	0	0	0	0	0	0	0	0
1212	04	Belle Glade	3542	3570	3596	3620	3644	3665	3686	3705	3723	3740	3755
1213	04	Belle Glade	722	723	724	725	725	726	728	728	728	731	731
1214	00	Unincorporated County	104	104	104	104	104	104	104	104	104	104	0
1214	04	Belle Glade	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123	1123
1215	00	Unincorporated TAZ around Inland Por	380	475	570	665	760	855	950	1045	1140	1235	1330
1215	04	Belle Glade	15	15	15	15	15	15	15	15	15	15	15
1217	00	Unincorporated TAZ around Inland Por	631	788	946	1104	1262	1419	1577	1735	1892	2050	2208
1217	58	South Bay	5859	5974	6089	6203	6316	6428	6538	6647	6754	6859	6962
1218	00	Unincorporated TAZ around Inland Por	1063	1215	1367	1519	1671	1823	1975	2127	2279	2431	2583
1218	04	Belle Glade	609	670	688	688	688	688	688	688	688	688	688
1218	58	South Bay	0	0	0	0	0	0	0	0	0	0	0
1219	04	Belle Glade	4176	4187	4196	4205	4214	4222	4229	4236	4242	4248	4253
1220	04	Belle Glade	2887	2895	2902	2909	2914	2920	2924	2929	2933	2936	2940
1221	00	Unincorporated County	1160	1280	1400	1520	1640	2000	2360	2720	3080	3440	3800
1221	04	Belle Glade	3514	3572	3629	3684	3737	3790	3840	3890	3938	3984	4029
1222	00	Unincorporated County	62	62	64	64	67	67	71	75	80	84	89
1222	04	Belle Glade	3109	3164	3218	3272	3324	3377	3428	3479	3529	3578	3626
1223	00	Unincorporated County	208	208	208	208	208	208	208	208	208	208	208
1224	00	Unincorporated County	2013	2086	2159	2233	2306	2379	2452	2526	2599	2672	2745
1224	04	Belle Glade	0	0	0	0	0	0	0	0	0	0	0
1225	00	Unincorporated County	7	7	7	7	7	7	7	7	7	7	7
1226	00	Unincorporated County	67	69	69	69	71	71	71	72	72	72	72
1228	00	Unincorporated County	210	210	210	210	211	211	213	213	214	214	215
		Total Population	**43,060**	**44,100**	**45,102**	**46,066**	**47,034**	**48,217**	**49,413**	**50,581**	**51,760**	**52,909**	**53,965**

APPENDIX C – FIELD TEST PLAN

FIELD TEST PLAN

PURPOSE

The purpose of the Field Test is to gather data needed to quantify the pressures experienced in various areas of the water distribution system. These pressures will be used during the calibration of the water model to maximize the accuracy of the analysis.

The County's Field Test Plan includes the following components:

- Identification of SCADA monitoring locations and parameters
- Identification of temporary pressure recorder locations
- Support required by Palm Beach County Staff

GENERAL

The County's water distribution system is shown in Figures 1 and 2. The figure shows all facilities in the Glades Region including Water Treatment Plant 11 (WTP11), storage tanks, water master meters and selected fire hydrants that will be included in the field test. Temporary pressure recorders will be placed in the field at locations identified in Figures 1 and 2. Field test data will be supplemented with daily SCADA data such as tank levels, pressures and water flow from existing facilities as shown in the Figures.

The pressure monitoring plan includes four (4) locations as shown on Table 1 and Figures 1 and 2. Carollo will provide the four pressure recorders. Pressure data measured by the pressure recorders will be used in combination with the SCADA information to calibrate the water model. The pressure recorders should be installed by Monday, November 19 and can be removed after Monday, November 26.

COUNTY STAFF RESPONSIBILITIES DURING FIELD TEST

During the field test, the County will be responsible for installing and uninstalling the pressure recorders, downloading the data collected from the pressure loggers, and verifying that the pressure recorders are functioning properly. In addition, the County will need to collect and provide SCADA data for all of the identified facilities during the field test. SCADA information should be collected and provided for each day of the field test in 1-hour increments for the following:

- Existing facilities summarized in Table 1.
- Fire hydrants with pressure loggers identified in Figures 1 and 2.

MASTER METER WTP 11
DSBG01
SCADA Data: PRESSURE AND FLOW

LAKE REGION WATER TREATMENT PLANT 11
DSXX01
SCADA Data: PRESSURE, FLOW, TANK LEVEL, PUMP SPEED (HSP1 & HSP2), PUMP STATUS (HSP3 & HSP4)
3 MG TANK AND FOUR PUMPS

Logger # 2
FHRR19W0001000

LAKE OKEECHOBEE

BELLE GLADE REPUMP STATION
DSBG10
SCADA Data: PRESSURE, FLOW, TANK LEVEL, AND PUMP SPEED
1 MG TANK AND THREE PUMPS

Logger # 4
FHMM20W0036000

BELLE GLADE OLD WTP
DSBG11
SCADA Data: PRESSURE, FLOW, TANK LEVEL, AND PUMP SPEED
TWO 0.75 MG GST AND FOUR PUMPS

SOUTH BAY WTP
DSSB13
SCADA Data: PRESSURE

Logger # 3
FHMM21W0022000

BELLE GLADE PIONEER PARK MASTER METER
DSBG05
SCADA Data: PRESSURE AND FLOW

SOUTH BAY REPUMP STATION
DSSB12
SCADA Data: PRESSURE,TANK LEVEL, AND PUMP STATUS

SOUTH BAY MASTER METER
DSSB06
SCADA Data: FLOW

Legend

- Pressure Loggers

GUA Facilities

- Elevated Storage Tank
- Ground Storage Tank
- Water Treatment Plant
- Wholesale Water Meter

Water Pipe Diameter (in)

- Less than 6
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Service Area
- City Boundary

0 1,350 2,700 Feet

N

Figure 1

Facilities and Pressure Loggers Location for Field Test Plan

Palm Beach County Water Utility Department
Glades Region Water Master Plan

carollo

Palm Beach County Water Utility Department
Glades Region Water Master Plan

Legend

- Pressure Loggers

GUA Facilities

- Elevated Storage Tank
- Ground Storage Tank
- Water Treatment Plant
- Wholesale Water Meter

Water Pipe Diameter (in)

- Less than 6
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- Service Area
- City Boundary

LAKE OKEECHOBEE

Logger # 1
FHLL07W0001000

PAHOKEE 0.5 MG ELEVATED TANK
DSPK08
SCADA Data: TANK LEVEL

PAHOKEE 0.1 MG ELEVATED TANK
DSPK09
SCADA Data: PRESSURE AND TANK LEVEL

PAHOKEE 0.075 MG ELEVATED TANK
DSPK07
SCADA Data: PRESSURE & TANK LEVEL

PAHOKEE MASTER METER
DSPK04
SCADA Data: PRESSURE AND FLOW

carollo

Facilities and Pressure Loggers Location for Field Test Plan

Figure 2

N

0 1,350 2,700 Feet

Table 1 Field Test Plan Requirements		
Pressure Logger Locations		
Pressure Logger	**Proposed Location (Hydrant No.)**	**Address/Intersection**
Logger 1	FHLL07W0001000	10349 Heritage Bay Blvd Canal Point, FL
Logger 2	FHRR19W001000	Illinois Ave Belle Glade, FL
Logger 3	FHMM21W0022000	940 Stillwell Road Belle Glade, FL
Logger 4	FHMM20W0036000	1109 NE 32nd Street Belle Glade, FL
Data Requirements		
Facilities	**SCADA Tag**	**SCADA Data Needed**
Lake Region Water Plant Master Meter	DSBG02	Pressure and Flow
Belle Glade Pioneer Park Master Meter	DSBG06	Pressure and Flow
Belle Glade Water Repump Station	DSBG11	Pressure, Flow and Tank Level
Belle Glade Old WTP	DSBG12	Pressure, Flow and Tank Level
Lake Region WTP No. 11	DSXX	Pressure, Flow, Tank Level and VFDs for HSP1 and HSP2
South Bay Master Meter	DSSB07	Pressure and Flow
South Bay Repump Station	DSSB13	Pressure and Tank Level
South Bay WTP	DSSB14	Pressure
Pahokee Master Meter	DSPK05	Pressure and Flow
Pahokee Elevated Tank (0.075MG)	DSPK08	Pressure and Tank Level
Pahokee Elevated Tank (0.5MG)	DSPK09	Tank Level
Pahokee WTP & Elevated STG Tank	DSPK10	Pressure and Tank Level

APPENDIX D – CALIBRATION SCENARIO CONTROL SETTINGS

Palm Beach County – Glades Region Water Master Plan
November 21st, 2012 - Calibration Scenario Control Settings

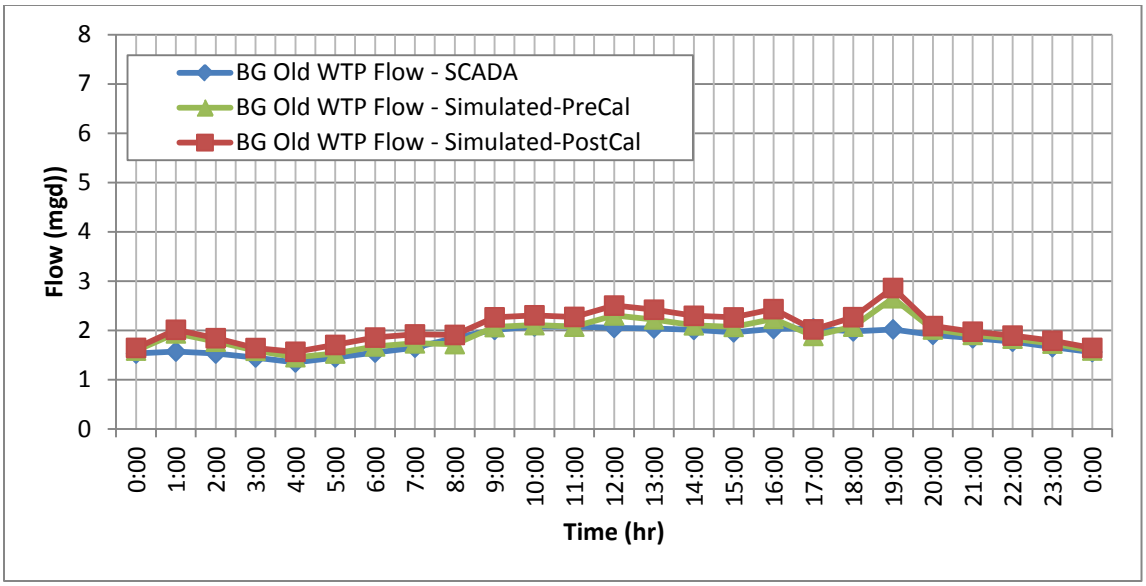
Pump Location	Pump	Pump ID (Char)	Status	Control Method	Control
Lake Region WTP 11	HSP 1	U7038	Open	By Pattern	PATN11
	HSP 2	U7040	Open	By Pattern	PATN13
Belle Glade Old WTP	HSP 1	U7050	Closed	By Clock Time	12:00
	HSP 1	U7050	Open	By Clock Time	8:00
South Bay Repump Station	HSP 1	U7064	Closed	By Clock Time	20:00
	HSP 1	U7064	Open	By Clock Time	17:00

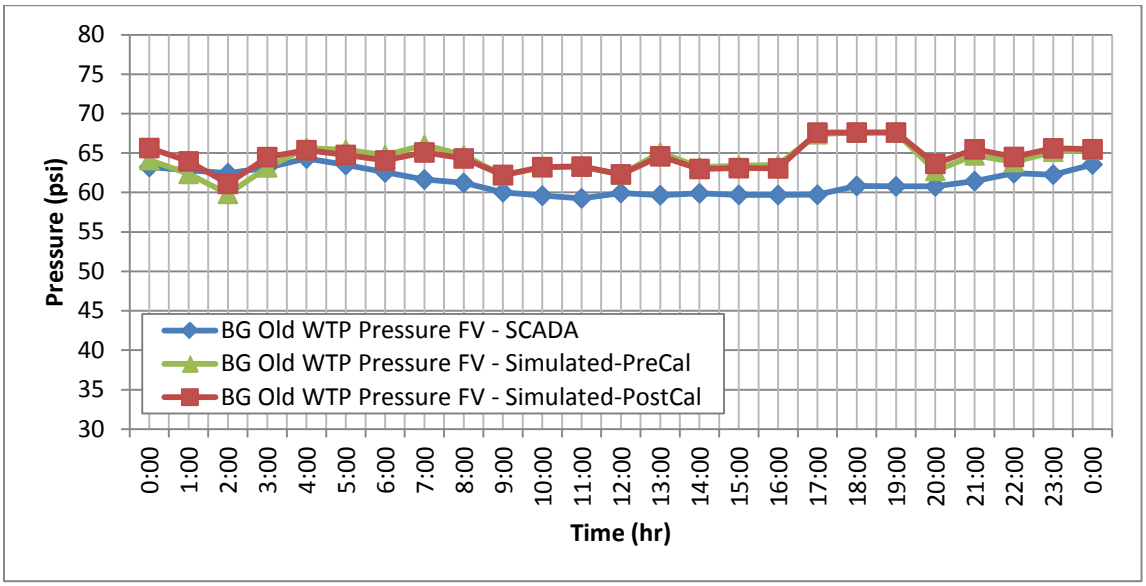
Valve Location	Valve Type	Valve ID	Status	Setting
Pahokee Master Meter	Pressure Reducer	V8020	Setting	68.93
Lake Region WTP 11	Flow Control	V8022	Setting	3495
Belle Glade Old WTP	Pressure Sustaining	V8032	Setting	67

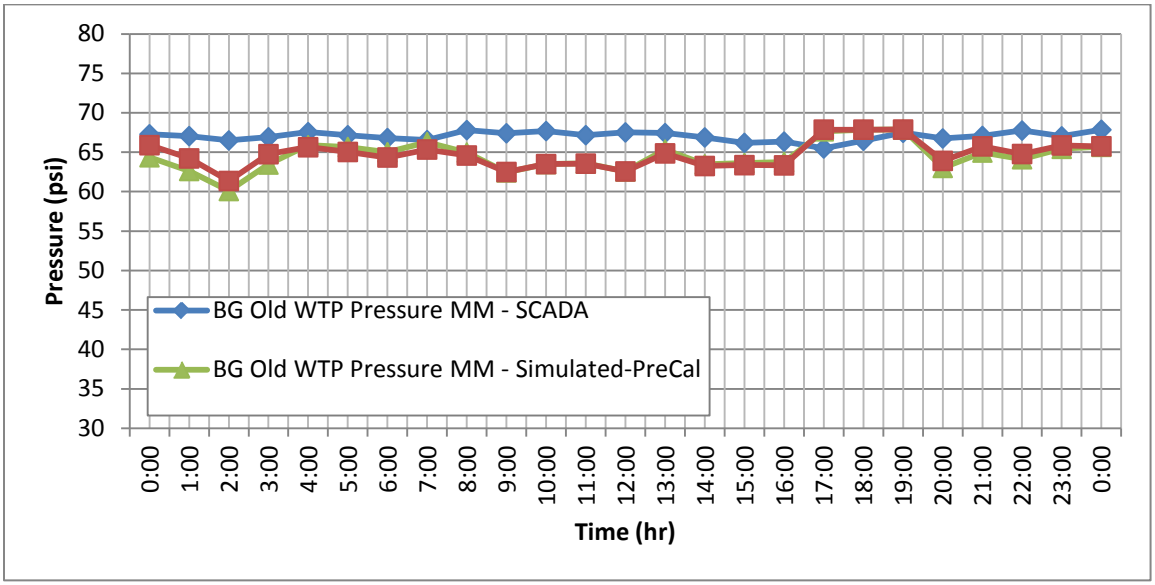
Pipe Location	Valve ID	Status	Control Method	Control
South Bay Repump Station	P3136	Open	By Pattern	PATN19

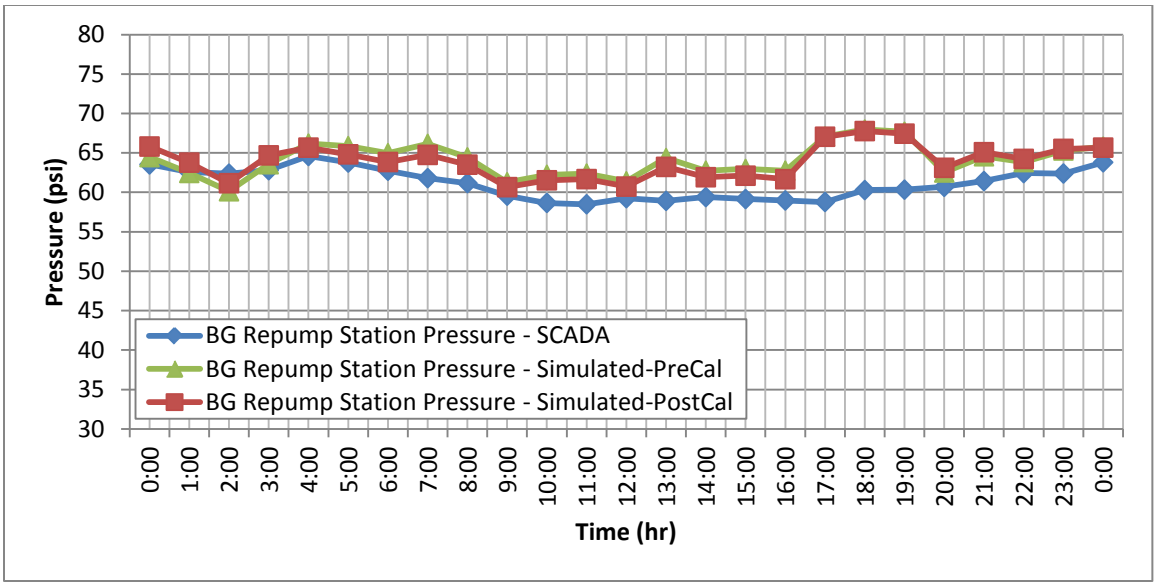
	WTP11 (DSXX01)		**South Bay Repump Station**
	PATN11	**PATN13**	**PATN19**
Time and Date	**Variable HSP1 speed feedback (F_CV)**	**Variable HSP2 speed feedback (F_CV)**	**P3136**
11/21/2012 0:00	0.74	0.74	0.00
11/21/2012 1:00	0.79	0.74	1.00
11/21/2012 2:00	0.73	0.74	1.00
11/21/2012 3:00	0.73	0.74	0.00
11/21/2012 4:00	0.73	0.74	0.00
11/21/2012 5:00	0.73	0.74	0.00
11/21/2012 6:00	0.73	0.74	0.00
11/21/2012 7:00	0.75	0.74	0.00
11/21/2012 8:00	0.75	0.74	0.00
11/21/2012 9:00	0.77	0.74	0.00
11/21/2012 10:00	0.78	0.74	0.00
11/21/2012 11:00	0.78	0.74	0.00
11/21/2012 12:00	0.78	0.74	0.00
11/21/2012 13:00	0.81	0.74	0.00
11/21/2012 14:00	0.78	0.74	0.00
11/21/2012 15:00	0.78	0.74	0.00
11/21/2012 16:00	0.79	0.74	0.00
11/21/2012 17:00	0.74	0.74	0.00
11/21/2012 18:00	0.77	0.74	0.00
11/21/2012 19:00	0.81	0.74	0.00
11/21/2012 20:00	0.77	0.74	0.00
11/21/2012 21:00	0.77	0.74	0.00
11/21/2012 22:00	0.75	0.74	0.00
11/21/2012 23:00	0.75	0.74	0.00
11/22/2012 0:00	0.75	0.74	0.00

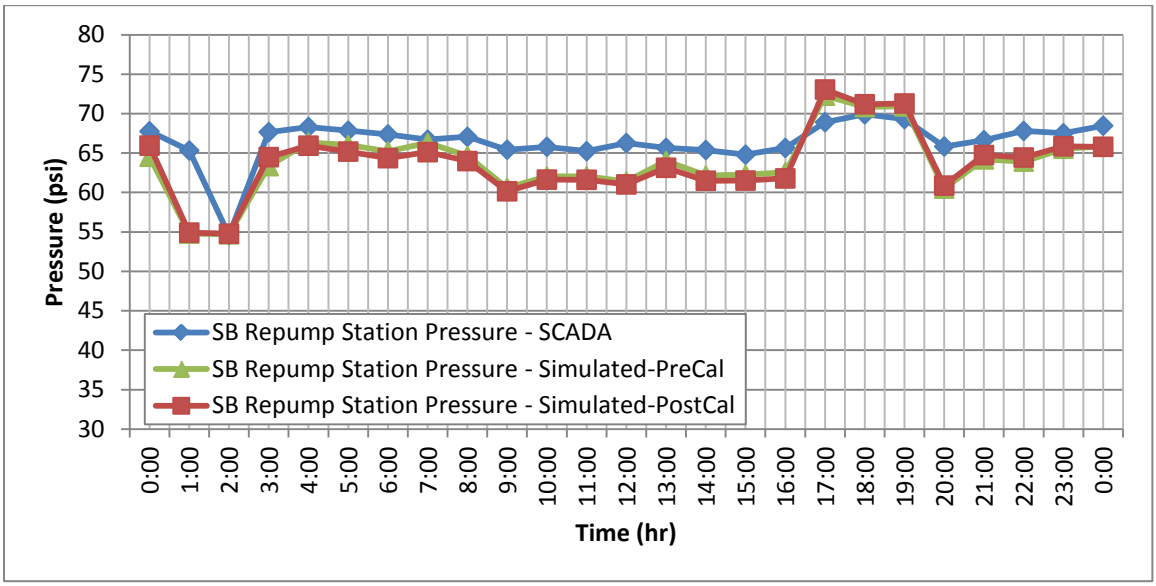
APPENDIX E – MODEL CALIBRATION RESULTS

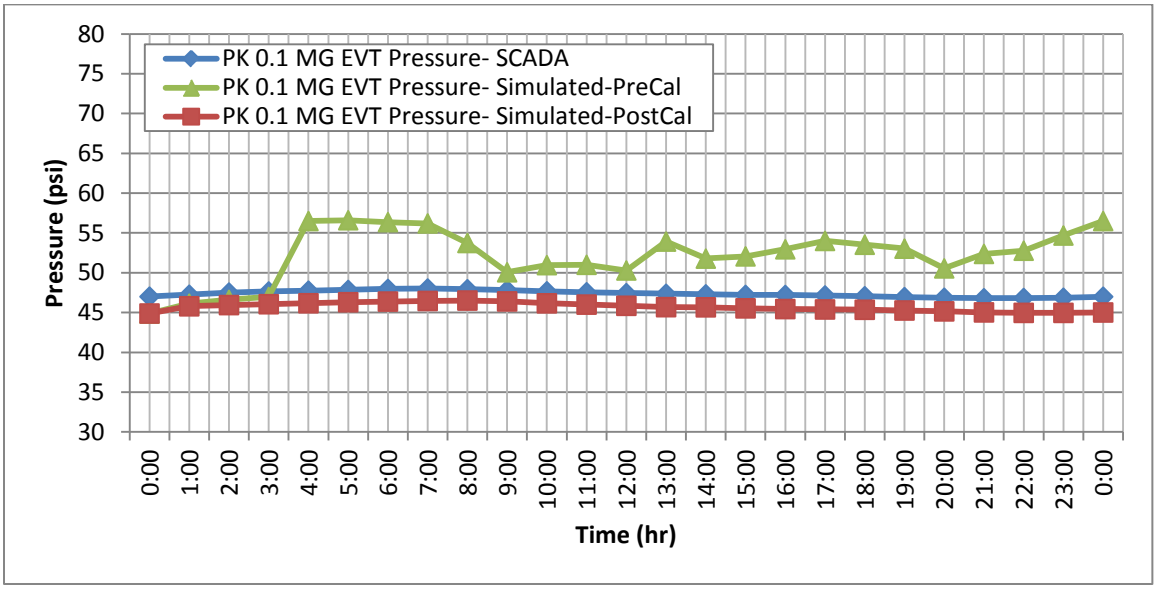

BG Old WTP Flow - SCADA
BG Old WTP Flow - Simulated-PreCal
BG Old WTP Flow - Simulated-PostCal
Flow (mgd)
Time (hr)

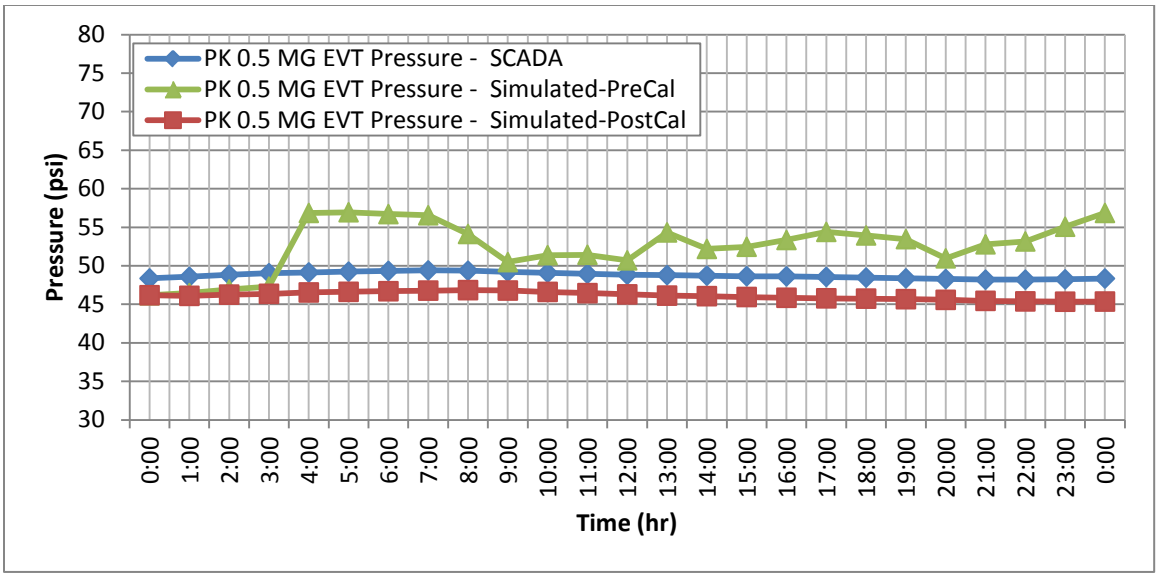

BG Old WTP Pressure FV - SCADA
BG Old WTP Pressure FV - Simulated-PreCal
BG Old WTP Pressure FV - Simulated-PostCal
Pressure (psi)
Time (hr)

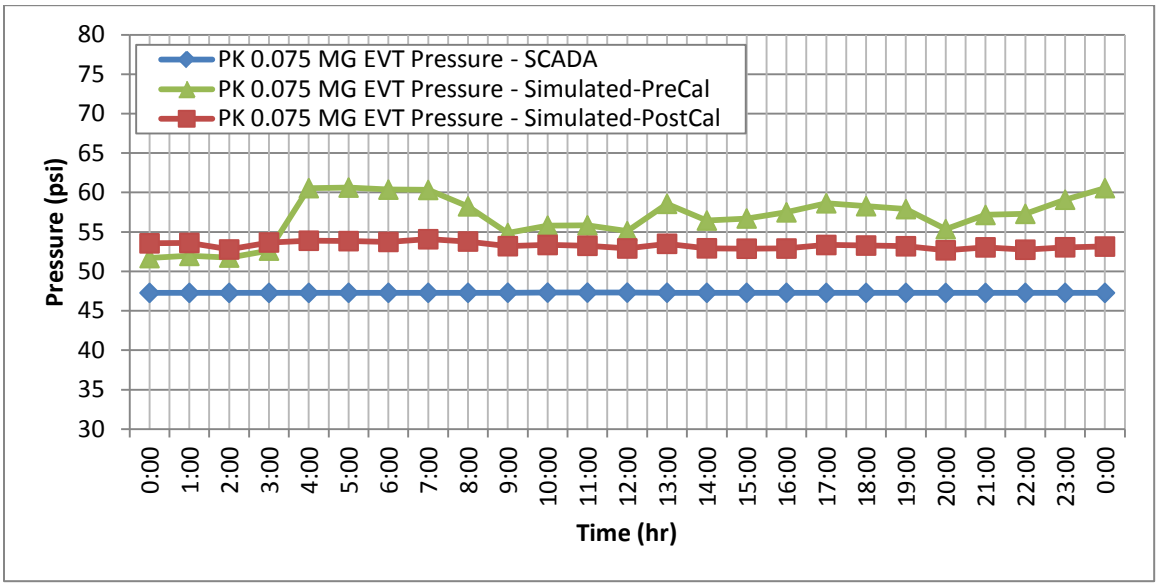

BG Old WTP Pressure MM - SCADA
BG Old WTP Pressure MM - Simulated-PreCal
Pressure (psi)
Time (hr)

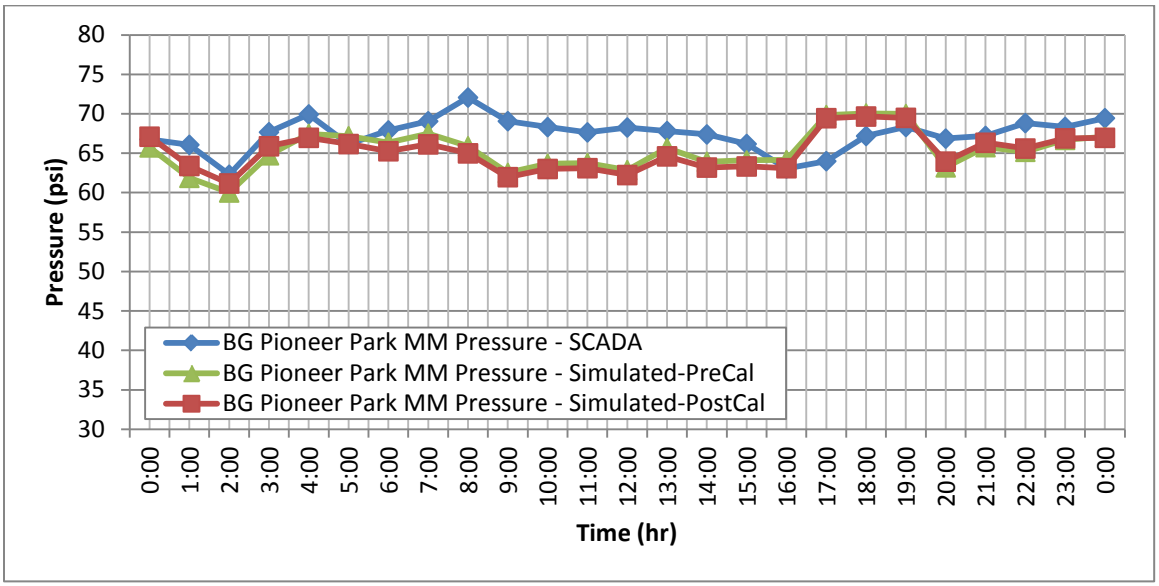

Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
BG Repump Station Pressure - SCADA
BG Repump Station Pressure - Simulated-PreCal
BG Repump Station Pressure - Simulated-PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)

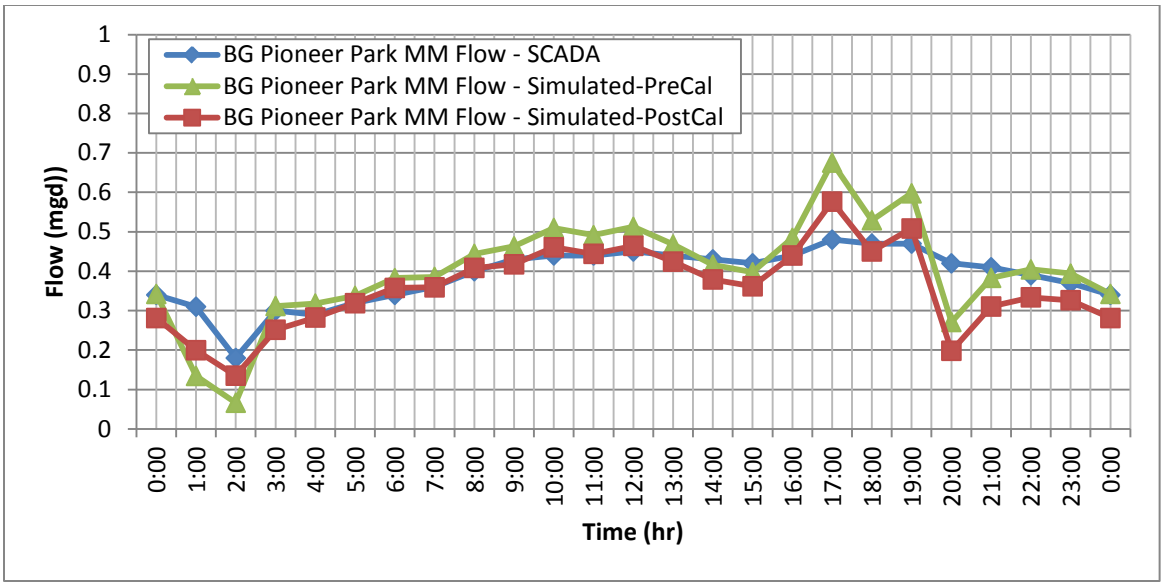

Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
SB Repump Station Pressure - SCADA
SB Repump Station Pressure - Simulated-PreCal
SB Repump Station Pressure - Simulated-PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)

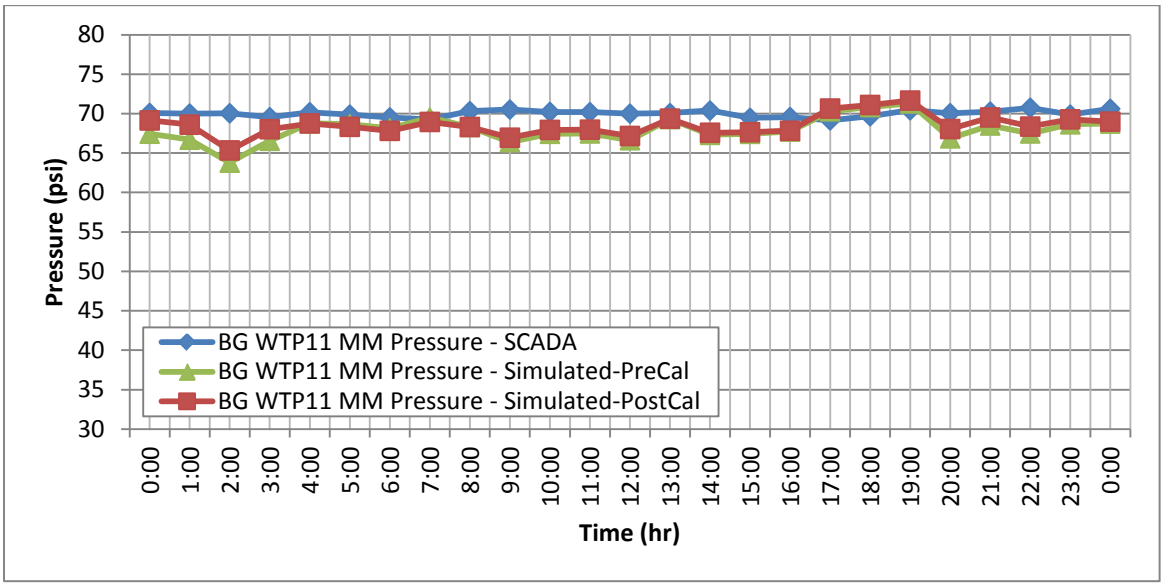

Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
PK 0.1 MG EVT Pressure- SCADA
PK 0.1 MG EVT Pressure- Simulated-PreCal
PK 0.1 MG EVT Pressure- Simulated-PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)

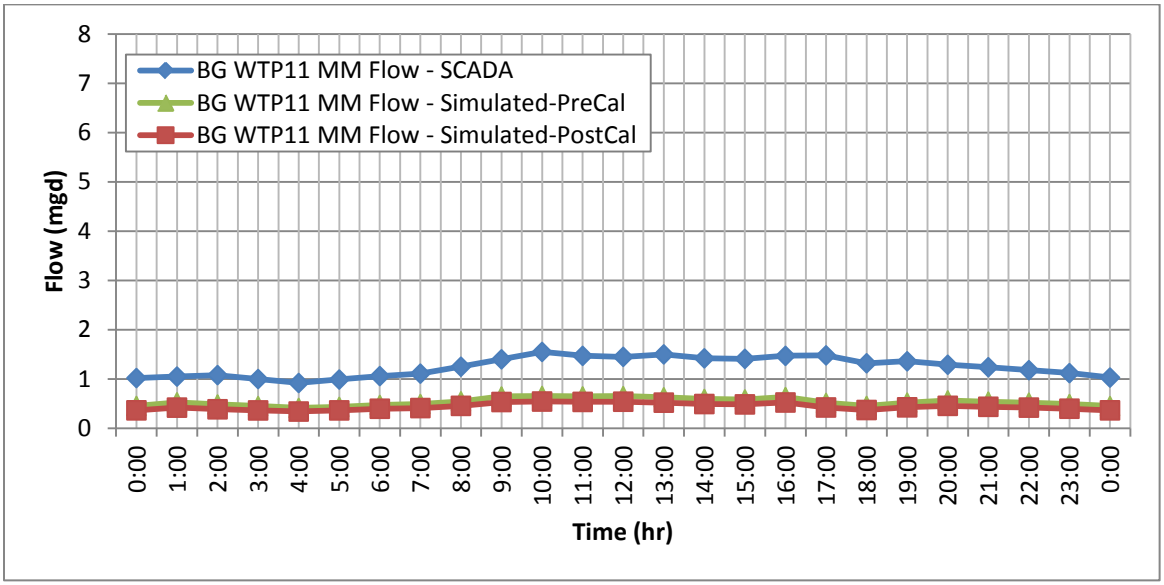

PK 0.5 MG EVT Pressure - SCADA
PK 0.5 MG EVT Pressure - Simulated-PreCal
PK 0.5 MG EVT Pressure - Simulated-PostCal
Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time (hr)

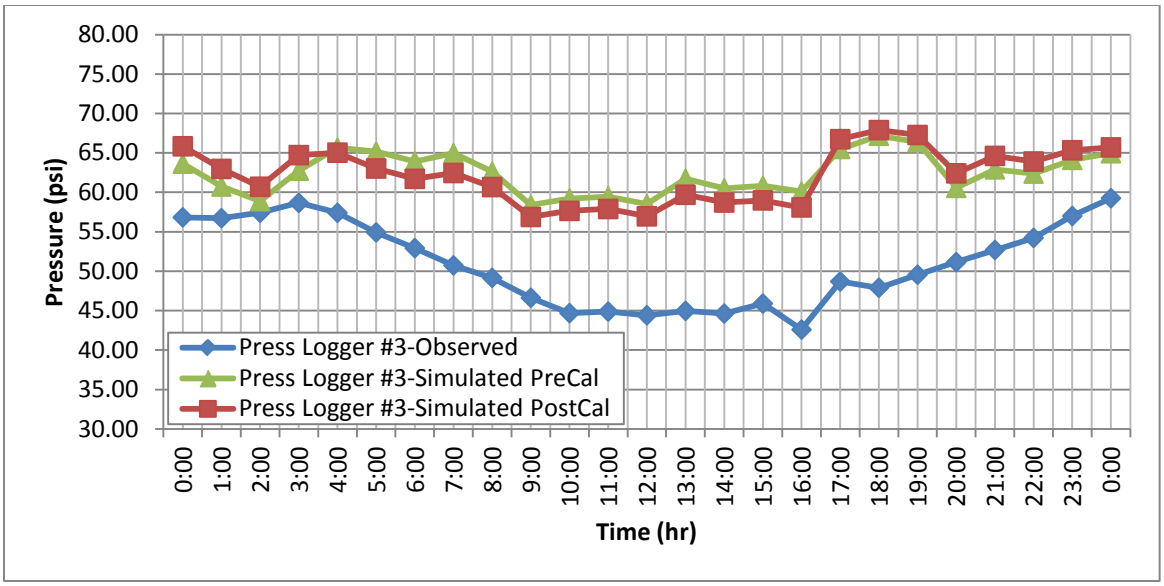

PK 0.075 MG EVT Pressure - SCADA
PK 0.075 MG EVT Pressure - Simulated-PreCal
PK 0.075 MG EVT Pressure - Simulated-PostCal
Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time (hr)

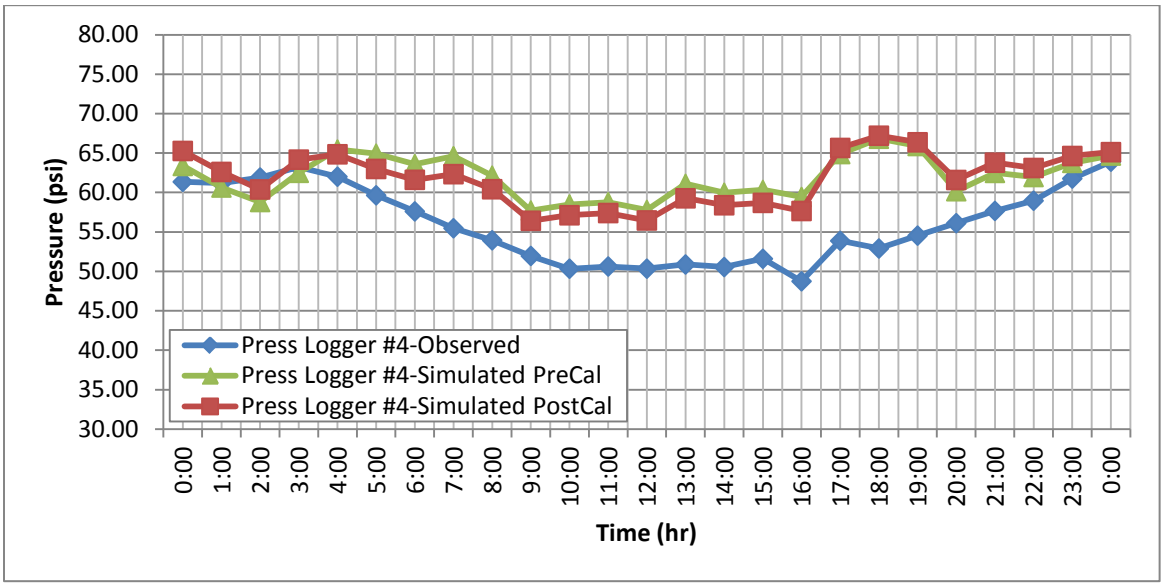

BG Pioneer Park MM Pressure - SCADA
BG Pioneer Park MM Pressure - Simulated-PreCal
BG Pioneer Park MM Pressure - Simulated-PostCal
Pressure (psi)
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time (hr)

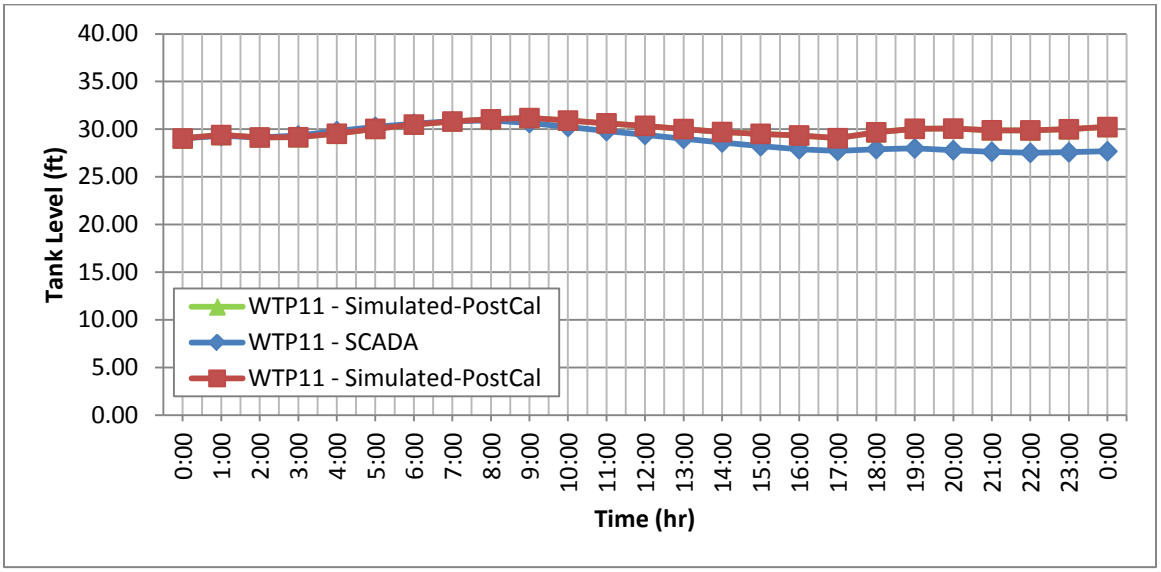

BG Pioneer Park MM Flow - SCADA
BG Pioneer Park MM Flow - Simulated-PreCal
BG Pioneer Park MM Flow - Simulated-PostCal
Flow (mgd))
Time (hr)

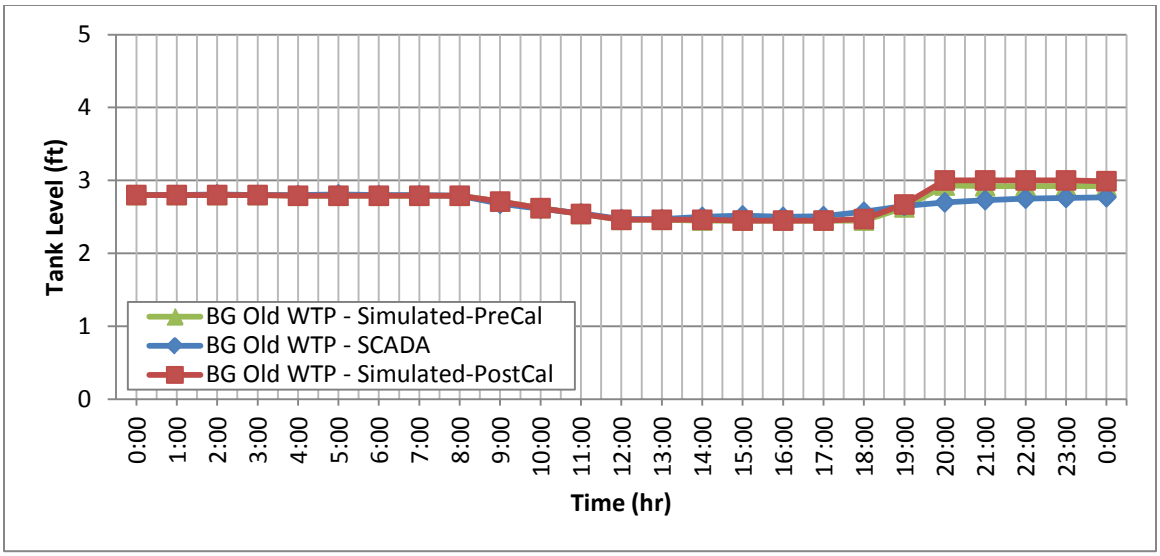

BG WTP11 MM Pressure - SCADA
BG WTP11 MM Pressure - Simulated-PreCal
BG WTP11 MM Pressure - Simulated-PostCal
Pressure (psi)
Time (hr)

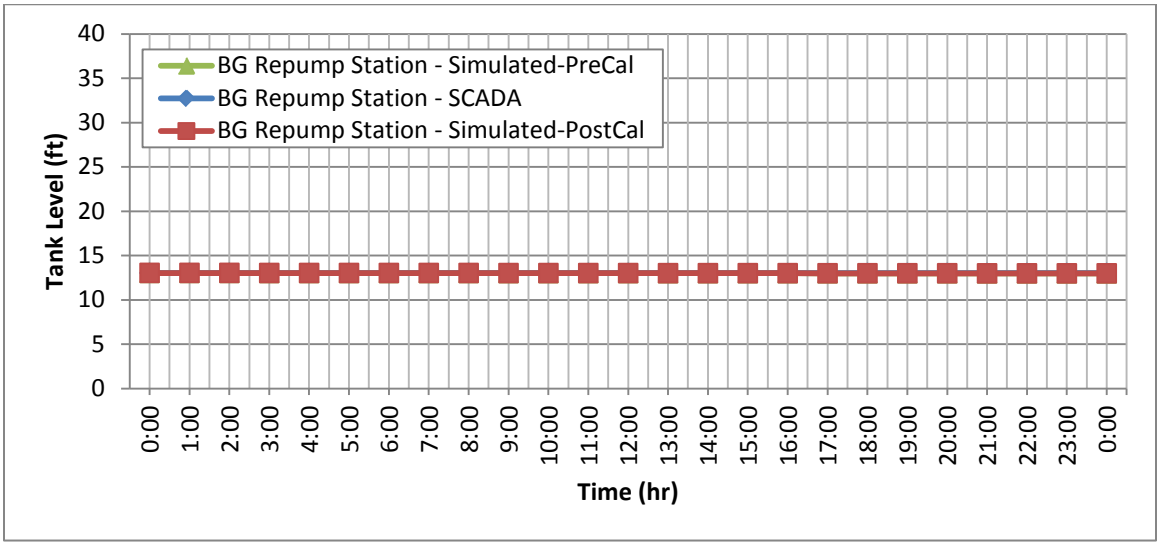

BG WTP11 MM Flow - SCADA
BG WTP11 MM Flow - Simulated-PreCal
BG WTP11 MM Flow - Simulated-PostCal
Flow (mgd)
Time (hr)

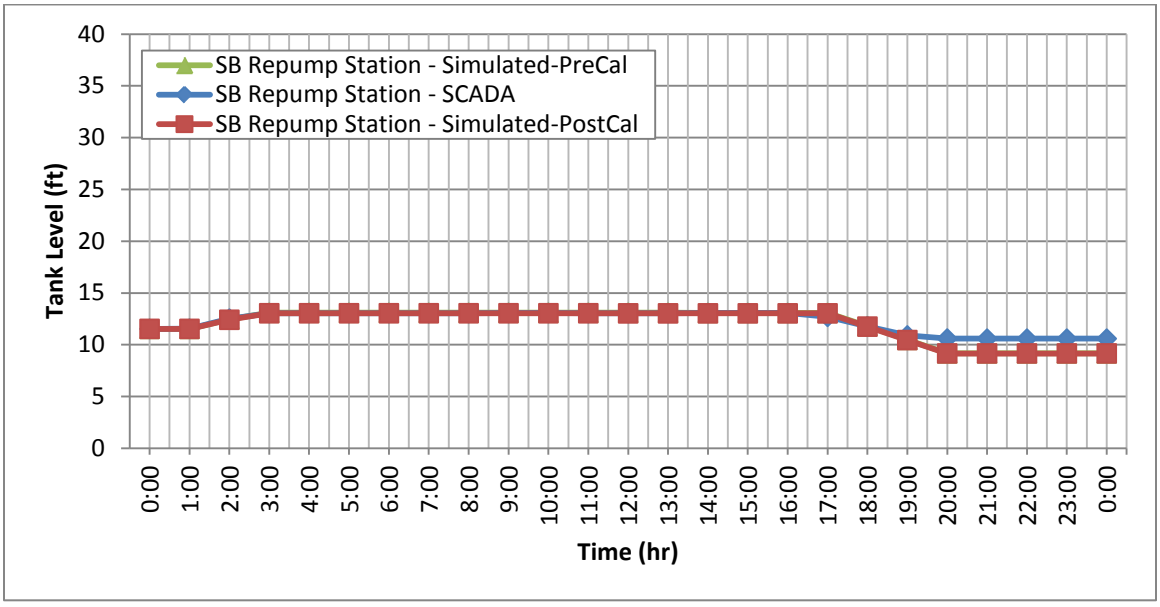

80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
Pressure (psi)
Press Logger #3-Observed
Press Logger #3-Simulated PreCal
Press Logger #3-Simulated PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)

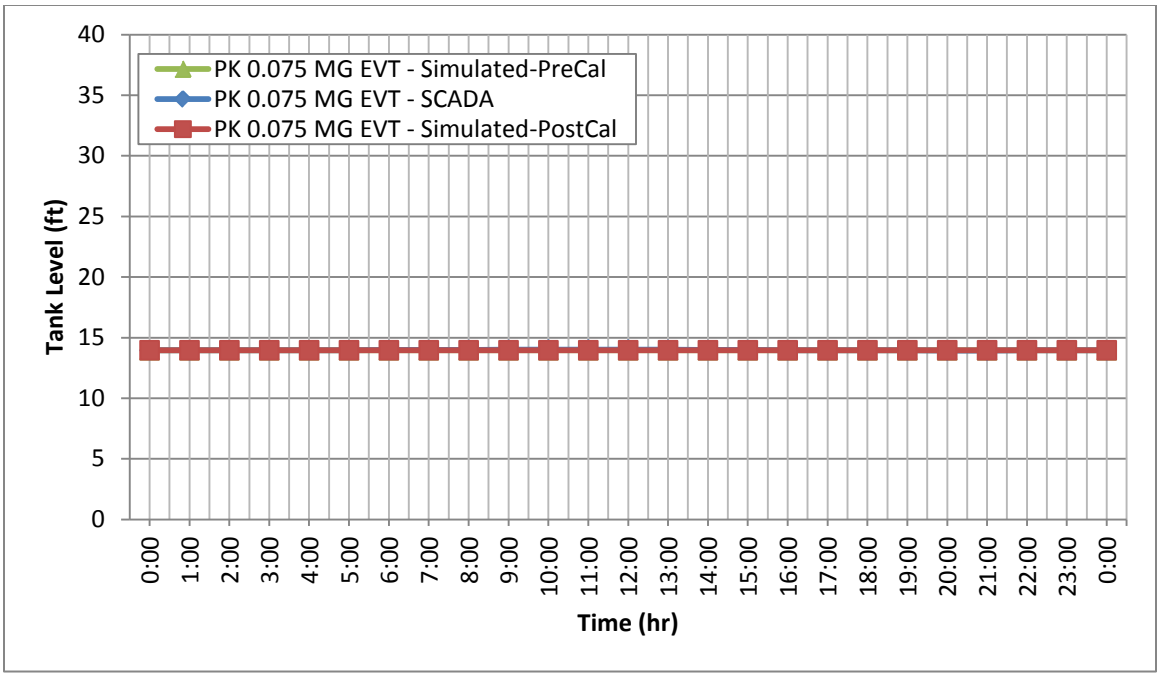

80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
Pressure (psi)
Press Logger #4-Observed
Press Logger #4-Simulated PreCal
Press Logger #4-Simulated PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)


40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Tank Level (ft)
WTP11 - Simulated-PostCal
WTP11 - SCADA
WTP11 - Simulated-PostCal
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time (hr)


Tank Level (ft)
Time (hr)
BG Old WTP - Simulated-PreCal
BG Old WTP - SCADA
BG Old WTP - Simulated-PostCal


Tank Level (ft)
Time (hr)
BG Repump Station - Simulated-PreCal
BG Repump Station - SCADA
BG Repump Station - Simulated-PostCal


Tank Level (ft)
Time (hr)
SB Repump Station - Simulated-PreCal
SB Repump Station - SCADA
SB Repump Station - Simulated-PostCal


PK 0.075 MG EVT - Simulated-PreCal
PK 0.075 MG EVT - SCADA
PK 0.075 MG EVT - Simulated-PostCal
Tank Level (ft)
40
35
30
25
20
15
10
5
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time (hr)

APPENDIX F– CONTROL SETTINGS FOR 2013, 2015, 2025, AND 2035 SCENARIOS

Table F.1
Glades Region Water Model
Water Infrastructure Control Settings for 2013, 2015, 2025, and 2035 Scenarios

Year	Scenario	WTP11	BG Old WTP	BG RS	SB RS	PK 0.5 MG EVT	PK 0.1 MG EVT	PK 0.075 MG EVT	PK 1.5 MG GST	FCV at WTP11
2013	**Annual Average Demand**	Pump U7038 with VSP set at 65 psi for downstream node and 1 parallel pump	Inactive	Inactive	Pump U7064 is on at 17 hours until tank level is 4.5 feet. Tank is filling from 1 a.m. to 5 a.m.	Active. PRV set at 62 psi.	Inactive	Inactive	NA	Set at 3600
	Maximum Day Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on between 17-20 hours. Tank is filling from 2 a.m. to 5 a.m.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 4700
	Peak Hour Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 70 psi for remote node J4130 and 1 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 1 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 4700
	Fire Flow	Pump U7038 with VSP set at 80 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 76 psi for remote node J4130 and 0 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 0 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 4700
2015	**Annual Average Demand**	Pump U7038 with VSP set at 65 psi for downstream node and 1 parallel pump	Inactive	Inactive	Pump U7064 is on at 17 hours until tank level is 4.5 feet. Tank is filling from 1 a.m. to 5 a.m.	Active. PRV set at 62 psi.	Inactive	Inactive	NA	Set at 4700
	Maximum Day Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on between 17-20 hours. Tank is filling from 2 a.m. to 5 a.m.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 4700
	Peak Hour Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 70 psi for remote node J4130 and 1 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 1 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 4700
	Fire Flow	Pump U7038 with VSP set at 80 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 76 psi for remote node J4130 and 0 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 0 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Active (Tank discharging)	Inactive	NA	Set at 6100
2025	**Annual Average Demand**	Pump U7038 with VSP set at 70 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on at 17 hours until tank level is 4.5 feet. Tank is filling from 1 a.m. to 5 a.m.	Active. PRV set at 58 psi.	Inactive	Inactive	NA	Set at 5000
	Maximum Day Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on at 17 hours until tank level is 4.5 feet. Tank is filling from 1 a.m. to 5 a.m.	Active. PRV set at 65 psi.	Inactive	Inactive	NA	Set at 6100
	Peak Hour Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 70 psi for remote node J4130 and 1 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 1 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 6100
	Fire Flow	Pump U7038 with VSP set at 80 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 76 psi for remote node J4130 and 0 parallel pump. Tank is not filling	Pump U7064 with VSP set at 70 psi for remote node J2751 and 0 parallel pump. Tank is not filling.	Active. PRV set at 69 psi.	Inactive	Inactive	NA	Set at 6100
2035	**Annual Average Demand**	Pump U7038 with VSP set at 70 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on at 16 hours until tank level is 4.5 feet. Tank is filling from 1 a.m. to 5 a.m.	Inactive. PRV set at 80 psi	Inactive	Inactive	Pump U7068 is on at 13 hours until tank level is 5 feet. Tank is filling from 1 a.m. to 5 a.m.	Set at 6100
	Maximum Day Demand	Pump U7038 with VSP set at 77 psi for downstream node and 2 parallel pump	Inactive	Inactive	Pump U7064 is on between 8-21 hours and VSP of 60 psi for remote node J2751 and 0 parallel pumps. Tank is filling from 1 a.m. to 7 a.m.	Inactive. PRV set at 80 psi	Inactive	Inactive	Pump U7068 with VSP set at 60 psi for remote node J3753 and 0 parallel pumps. Pump is on at 8 hours until tank level is 5.2 feet. Tank is filling from 1 a.m. to 6 a.m.	Set at 6100
	Peak Hour Demand	Pump U7038 with VSP set at 75 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 70 psi for remote node J4130 and 1 parallel pump. Tank is not filling	Pump U7064 with VSP set at 65 psi for remote node J2751 and 2 parallel pump. Tank is not filling.	Inactive. PRV set at 80 psi	Inactive	Inactive	Pump U7068 with VSP set at 65 psi for remote node J3753 and 1 parallel pump. Tank is not filling.	Set at 6100
	Fire Flow	Pump U7038 with VSP set at 80 psi for downstream node and 2 parallel pump	Inactive	Pump U7060 with VSP set at 76 psi for remote node J4130 and 0 parallel pump. Tank is not filling	Pump U7064 with VSP set at 65 psi for remote node J2751 and 0 parallel pump. Tank is not filling.	Inactive. PRV set at 80 psi	Inactive	Inactive	Pump U7068 with VSP set at 80 psi for remote node J3753 and 1 parallel pump. Tank is not filling.	Set at 7600

Tables F.2
Glades Region Water Model
General Control Settings Common to All Scenarios

PATNSET1 Header - Applied to All Scenarios	
ID (Char)	**Description (Char)**
PATN5	Pahokee-DC_Cal11/21/2012
PATN7	South Bay-DC_Cal11/21/2012
PATN9	Belle Glade-DC_Cal11/21/2012
PATN11	WTP11_HSP1-2 Pattern 2013 Max Day
PATN13	WTP11_HSP02 Pattern
PATN15	SouthBay_HSP01 Pattern
PATN17	Belle Glade-Old WTP. Pump
PATN19	SouthBayPumpStation. FillingTk
PATN25	WTP11-flow
PATN27	Belle Glade-Old WTP. FILLING
PATN33	WTP11_HSP01 Pattern
PATN41	Belle Glade-DC_Average
PATN43	South Bay-DC_Average
PATN45	Pahokee-DC_Average
PATN47	Duda & Sons Demand
PATN49	WTP11_HSP03 Pattern

PATNSET1 Detail - Applied to All Scenarios		
ID (Char)	**Sequence (Long)**	**Factor (Double)**
PATN5	0	0.85
PATN5	1	0.76
PATN5	2	0.71
PATN5	3	0.73
PATN5	4	0.85
PATN5	5	0.84
PATN5	6	0.83
PATN5	7	0.88
PATN5	8	1.03
PATN5	9	1.14
PATN5	10	1.15
PATN5	11	1.15
PATN5	12	1.14
PATN5	13	1.08
PATN5	14	1.09
PATN5	15	1.08
PATN5	16	1.04
PATN5	17	1.08
PATN5	18	1.12
PATN5	19	1.16
PATN5	20	1.14
PATN5	21	1.13
PATN5	22	1.04

PATN5	23	0.99
PATN5	24	0.85
PATN7	0	0.73
PATN7	1	0.96
PATN7	2	1.04
PATN7	3	0.84
PATN7	4	0.65
PATN7	5	0.67
PATN7	6	0.68
PATN7	7	0.75
PATN7	8	0.81
PATN7	9	1.19
PATN7	10	1.06
PATN7	11	1.09
PATN7	12	0.99
PATN7	13	1.06
PATN7	14	1.1
PATN7	15	1.13
PATN7	16	1.01
PATN7	17	0.88
PATN7	18	1.75
PATN7	19	1.65
PATN7	20	1.47
PATN7	21	0.98
PATN7	22	0.8
PATN7	23	0.71
PATN7	24	0.73
PATN9	0	0.84
PATN9	1	0.87
PATN9	2	0.81
PATN9	3	0.83
PATN9	4	0.77
PATN9	5	0.81
PATN9	6	0.89
PATN9	7	0.92
PATN9	8	1.04
PATN9	9	1.21
PATN9	10	1.24
PATN9	11	1.22
PATN9	12	1.22
PATN9	13	1.17
PATN9	14	1.1
PATN9	15	1.08
PATN9	16	1.18
PATN9	17	1.06

PATN9	18	0.87
PATN9	19	0.98
PATN9	20	1.02
PATN9	21	1
PATN9	22	0.97
PATN9	23	0.92
PATN9	24	0.84
PATN11	0	0.8
PATN11	1	0.8
PATN11	2	0.8
PATN11	3	0.8
PATN11	4	0.8
PATN11	5	0.8
PATN11	6	0.8
PATN11	7	0.8
PATN11	8	0.8
PATN11	9	0.8
PATN11	10	0.8
PATN11	11	0.8
PATN11	12	0.8
PATN11	13	0.8
PATN11	14	0.8
PATN11	15	0.8
PATN11	16	0.8
PATN11	17	0.8
PATN11	18	0.85
PATN11	19	0.85
PATN11	20	0.85
PATN11	21	0.85
PATN11	22	0.85
PATN11	23	0.85
PATN11	24	0.8
PATN13	0	0.74
PATN13	1	0.74
PATN13	2	0.74
PATN13	3	0.74
PATN13	4	0.74
PATN13	5	0.74
PATN13	6	0.74
PATN13	7	0.74
PATN13	8	0.74
PATN13	9	0.74
PATN13	10	0.74
PATN13	11	0.74
PATN13	12	0.74

PATN13	13	0.74
PATN13	14	0.74
PATN13	15	0.74
PATN13	16	0.74
PATN13	17	0.74
PATN13	18	0.74
PATN13	19	0.74
PATN13	20	0.74
PATN13	21	0.74
PATN13	22	0.74
PATN13	23	0.74
PATN13	24	0.74
PATN15	0	0
PATN15	1	0
PATN15	2	0
PATN15	3	0
PATN15	4	0
PATN15	5	0
PATN15	6	0
PATN15	7	0
PATN15	8	0
PATN15	9	0
PATN15	10	0
PATN15	11	0
PATN15	12	0
PATN15	13	0
PATN15	14	0
PATN15	15	0
PATN15	16	0
PATN15	17	1
PATN15	18	0
PATN15	19	0
PATN15	20	0
PATN15	21	0
PATN15	22	0
PATN15	23	0
PATN15	24	0
PATN17	24	0
PATN17	23	0
PATN17	22	0
PATN17	21	0
PATN17	20	0
PATN17	19	0
PATN17	18	0
PATN17	17	0

PATN17	16	0
PATN17	15	0
PATN17	14	0
PATN17	13	0
PATN17	12	0
PATN17	11	0
PATN17	10	0.8
PATN17	9	0.8
PATN17	8	0.8
PATN17	7	0
PATN17	6	0
PATN17	5	0
PATN17	4	0
PATN17	3	0
PATN17	2	0
PATN17	1	0
PATN17	0	0
PATN19	0	0
PATN19	1	1
PATN19	2	1
PATN19	3	0
PATN19	4	0
PATN19	5	0
PATN19	6	0
PATN19	7	0
PATN19	8	0
PATN19	9	0
PATN19	10	0
PATN19	11	0
PATN19	12	0
PATN19	13	0
PATN19	14	0
PATN19	15	0
PATN19	16	0
PATN19	17	0
PATN19	18	0
PATN19	19	0
PATN19	20	0
PATN19	21	0
PATN19	22	0
PATN19	23	0
PATN19	24	0
PATN25	24	3,090.28
PATN25	23	3,250.00
PATN25	22	3,451.39

PATN25	21	3,638.89
PATN25	20	3,770.83
PATN25	19	3,381.94
PATN25	18	3,090.28
PATN25	17	3,368.06
PATN25	16	3,951.39
PATN25	15	3,881.94
PATN25	14	3,916.67
PATN25	13	3,993.06
PATN25	12	3,937.50
PATN25	11	4,013.89
PATN25	10	4,034.72
PATN25	9	3,937.50
PATN25	8	3,527.78
PATN25	7	3,208.33
PATN25	6	3,062.50
PATN25	5	2,923.61
PATN25	4	2,791.67
PATN25	3	2,895.83
PATN25	2	3,916.67
PATN25	1	3,250.00
PATN25	0	3,083.33
PATN27	24	0
PATN27	23	0
PATN27	22	0
PATN27	21	0
PATN27	20	0
PATN27	19	0
PATN27	18	1
PATN27	17	1
PATN27	16	1
PATN27	15	0
PATN27	14	0
PATN27	13	0
PATN27	12	0
PATN27	11	0
PATN27	10	0
PATN27	9	0
PATN27	8	0
PATN27	7	0
PATN27	6	0
PATN27	5	0
PATN27	4	0
PATN27	3	0
PATN27	2	0

Tables F.2
Glades Region Water Model
General Control Settings Common to All Scenarios

PATN27	1	0
PATN27	0	0
PATN33	0	0.75
PATN33	1	0.8
PATN33	2	0.74
PATN33	3	0.74
PATN33	4	0.74
PATN33	5	0.74
PATN33	6	0.74
PATN33	7	0.76
PATN33	8	0.76
PATN33	9	0.78
PATN33	10	0.8
PATN33	11	0.8
PATN33	12	0.8
PATN33	13	0.83
PATN33	14	0.79
PATN33	15	0.79
PATN33	16	0.81
PATN33	17	0.76
PATN33	18	0.78
PATN33	19	0.82
PATN33	20	0.79
PATN33	21	0.79
PATN33	22	0.76
PATN33	23	0.76
PATN33	24	0.76
PATN41	24	0.89
PATN41	23	0.98
PATN41	22	1.08
PATN41	21	1.11
PATN41	20	1.05
PATN41	19	1.1
PATN41	18	1.07
PATN41	17	1.08
PATN41	16	1.08
PATN41	15	1.11
PATN41	14	1.05
PATN41	13	1.08
PATN41	12	1.1
PATN41	11	1.09
PATN41	10	1.11
PATN41	9	1.08
PATN41	8	1.04
PATN41	7	0.95

PATN41	6	0.87
PATN41	5	0.81
PATN41	4	0.79
PATN41	3	0.77
PATN41	2	0.78
PATN41	1	0.83
PATN41	0	0.89
PATN43	24	0.81
PATN43	23	1
PATN43	22	1.04
PATN43	21	1.2
PATN43	20	1.26
PATN43	19	1.29
PATN43	18	1.19
PATN43	17	1.06
PATN43	16	1.14
PATN43	15	1.17
PATN43	14	1.25
PATN43	13	1.23
PATN43	12	1.19
PATN43	11	1.18
PATN43	10	1.18
PATN43	9	1.2
PATN43	8	1.05
PATN43	7	0.9
PATN43	6	0.63
PATN43	5	0.57
PATN43	4	0.57
PATN43	3	0.58
PATN43	2	0.62
PATN43	1	0.69
PATN43	0	0.81
PATN45	24	0.93
PATN45	23	1
PATN45	22	1.08
PATN45	21	1.1
PATN45	20	1.12
PATN45	19	1.13
PATN45	18	1.11
PATN45	17	1.11
PATN45	16	1.11
PATN45	15	1.13
PATN45	14	1.12
PATN45	13	1.12
PATN45	12	1.11

PATN45	11	1.06
PATN45	10	1.05
PATN45	9	1.05
PATN45	8	1.04
PATN45	7	0.95
PATN45	6	0.81
PATN45	5	0.77
PATN45	4	0.77
PATN45	3	0.77
PATN45	2	0.76
PATN45	1	0.8
PATN45	0	0.93
PATN47	23	0
PATN47	22	0
PATN47	21	0
PATN47	20	0
PATN47	19	0
PATN47	18	0
PATN47	17	0
PATN47	16	1.5
PATN47	15	2
PATN47	14	2
PATN47	13	2
PATN47	12	2
PATN47	11	2
PATN47	10	2
PATN47	9	2
PATN47	8	2
PATN47	7	2
PATN47	6	2
PATN47	5	2
PATN47	4	1.5
PATN47	3	0
PATN47	2	0
PATN47	1	0
PATN47	0	0
PATN49	24	0.76
PATN49	23	0.76
PATN49	22	0.76
PATN49	21	0.76
PATN49	20	0.76
PATN49	19	0.76
PATN49	18	0.76
PATN49	17	0.76
PATN49	16	0.76

PATN49	15	0.76
PATN49	14	0.76
PATN49	13	0.76
PATN49	12	0.76
PATN49	11	0.76
PATN49	10	0.76
PATN49	9	0.76
PATN49	8	0.76
PATN49	7	0.76
PATN49	6	0.76
PATN49	5	0.76
PATN49	4	0.76
PATN49	3	0.76
PATN49	2	0.76
PATN49	1	0.76
PATN49	0	0.76

Curve Header - Applied to All Scenarios	
ID (Char)	**Description (Char)**
WTP_SOUTHBAY	pump1 impeller 13.0625
WTP_SOUTHBAY2	pump2 impeller 12.875
XNG5	SB GST
XNG1	Pump Curve WTP11
XNG3	Pump Curve Old Belle Glade WTP
XNG7	Pump Curve Belle Glade Repump Station

Curve Detail - Applied to All Scenarios		
ID (Char)	**X (Double)**	**Y (Double)**
WTP_SOUTHBAY	0	182
WTP_SOUTHBAY	408	173
WTP_SOUTHBAY	544	163
WTP_SOUTHBAY	600	157
WTP_SOUTHBAY	680	147
WTP_SOUTHBAY	816	125
WTP_SOUTHBAY2	0	176
WTP_SOUTHBAY2	924	165
WTP_SOUTHBAY2	1,232.00	153
WTP_SOUTHBAY2	1,288.00	150
WTP_SOUTHBAY2	1,540.00	135
WTP_SOUTHBAY2	1,848.00	111
WTP_SOUTHBAY	850	120
WTP_SOUTHBAY2	1,950.00	100
XNG5	740	164
XNG5	925	148
XNG5	1,110.00	128

Tables F.2
Glades Region Water Model
General Control Settings Common to All Scenarios

XNG1	3,500.00	179
XNG1	3,000.00	205
XNG1	2,300.00	230
XNG1	2,000.00	241
XNG1	1,000.00	260
XNG1	0	267
XNG3	168	148
XNG3	128	200
XNG3	96	225
XNG3	64	240
XNG3	40	247
XNG7	1,920.00	128
XNG7	1,600.00	161
XNG7	1,280.00	187
XNG7	960	207
XNG7	640	219
XNG5	555	173

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

Final Data Set and QuerySet Applied to 2013 Scenarios			
Year	**Type**	**Data Set**	**QuerySet**
2013	Average	DMD21	QSET9
		CTRL27	
		PTNSET1	
		PUMP1	
2013	Max Day	DMD23	QSET9
		CTRL29	
		PTNSET1	
		PUMP1	
2013	Peak Hour	DMD25	QSET9
		CTRL31	
		PTNSET1	
		PUMP1	
2013	Fire Flow	DMD51	QSET9
		CTRL33	
		PTNSET1	
		PUMP1	
2013	PH - Vulnerability	DMD25	QSET9
		CTRL59	
		PTNSET1	
		PUMP1	

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Annual Average Scenario - Initial Node Status		
ID (Char)	Status (Int)	Setting (Double)
U7040	0: Closed	-
U7042	0: Closed	-
U7044	0: Closed	-
U7050	0: Closed	-
U7052	0: Closed	-
U7054	0: Closed	-
U7056	0: Closed	-
U7058	0: Closed	-
U7060	0: Closed	-
U7062	0: Closed	-
U7064	0: Closed	-
U7066	0: Closed	-
V8020	2: Setting	62
V8022	2: Setting	3,600
V8032	2: Setting	67
V8042	2: Setting	55

2013 Annual Average Scenario - Initial Pipe Status	
ID (Char)	Status (Int)
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Annual Average Scenario - Node Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	0	1: Open	0	4: By Clock Time	0	-	0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	1: By Node Level	0	T5020	1: Below	4.5	0: 24hr	-
U7064	No	2	0: Closed	0	2: By Link Flow	0	P3071	0: Above	0.1	0: 24hr	-

2013 Annual Average Scenario - Pipe Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0	-	0: Above	0	0: 24hr	1
P3136	No	1	0: Closed	0	4: By Clock Time	0	-	0: Above	0	0: 24hr	5

2013 Annual Average Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	65	-	-	1	1

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Maximum Day Scenario - Initial Node Status		
ID (Char)	Status (Int)	Setting (Double)
U7040	0: Closed	-
U7042	0: Closed	-
U7044	0: Closed	-
U7050	0: Closed	-
U7052	0: Closed	-
U7054	0: Closed	-
U7056	0: Closed	-
U7058	0: Closed	-
U7060	0: Closed	-
U7062	0: Closed	-
U7064	0: Closed	-
U7066	0: Closed	-
V8020	2: Setting	69
V8022	2: Setting	4,700
V8032	2: Setting	67
V8042	2: Setting	55

2013 Maximum Day Scenario - Initial Pipe Status	
ID (Char)	Status (Int)
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Maximum Day Scenario - Node Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	20

2013 Maximum Day Scenario - Pipe Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	2
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	5

2013 Maximum Day Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	75	-	-	1	2

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Peak Hour Scenario - Initial Node Status		
ID (Char)	Status (Int)	Setting (Double)
U7040	0: Closed	-
U7042	0: Closed	-
U7044	0: Closed	-
U7050	0: Closed	-
U7052	0: Closed	-
U7054	0: Closed	-
U7056	0: Closed	-
U7058	0: Closed	-
U7062	0: Closed	-
U7066	0: Closed	-
V8020	2: Setting	69
V8022	2: Setting	4,700
V8032	2: Setting	67
V8042	2: Setting	70

2013 Peak Hour Scenario - Initial Pipe Status	
ID (Char)	Status (Int)
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Peak Hour Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	75	-	-	1	2
U7060	2: Junction Pressure	70	J4130	-	1	1
U7064	2: Junction Pressure	70	J2751	-	1	1

2013 Fire Flow Scenarios - Initial Node Status		
ID (Char)	Status (Int)	Setting (Double)
U7040	0: Closed	-
U7042	0: Closed	-
U7044	0: Closed	-
U7050	0: Closed	-
U7052	0: Closed	-
U7054	0: Closed	-
U7056	0: Closed	-
U7058	0: Closed	-
U7062	0: Closed	-
U7066	0: Closed	-
V8020	2: Setting	69
V8022	2: Setting	4,700
V8032	2: Setting	67
V8042	2: Setting	70

Tables F.3
Glades Region Water Model
Control Settings for 2013 Scenarios

2013 Fire Flow Scenarios - Initial Pipe Status	
ID (Char)	**Status (Int)**
P1836	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

2013 Fire Flow Scenarios - VSP Control						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	80	-	-	1	2
U7060	2: Junction Pressure	76	J4133	-	1	0
U7064	2: Junction Pressure	70	J2751	-	1	0

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

Final Data Set and QuerySet Applied to 2015 Scenarios			
Year	**Type**	**Data Set**	**QuerySet**
2015	Average	DMD27	QSET11
		PTNSET1	
		PIPE15	
		CTRL35	
		PUMP1	
		DMD29	
		PTNSET1	
		PIPE15	
		CTRL37	
		PUMP1	
		DMD31	
		PTNSET1	
		PIPE15	
		CTRL39	
		PUMP1	
		DMD35	
		PTNSET1	
		PIPE15	
		CTRL41	
		PUMP1	

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Annual Average Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
V8020	2: Setting	62
V8022	2: Setting	4,700
V8032	2: Setting	67
V8042	2: Setting	55

2015 Annual Average Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Annual Average Scenario - Node Controls											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	1: By Node Level	0	T5020	1: Below	4.5	0: 24hr	
U7064	No	2	0: Closed	0	2: By Link Flow	0	P3071	0: Above	0.1	0: 24hr	

2015 Annual Average Scenario - Pipe Controls											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	5

2015 Annual Average Scenario - VSP Controls						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	65			1	1
U7064	2: Junction Pressure	70	J2751		1	0

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Maximum Day Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
V8020	2: Setting	69
V8022	2: Setting	4700
V8032	2: Setting	67
V8042	2: Setting	55

2015 Maximum Day Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Maximum Day Scenario - Node Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	20

2015 Maximum Day Scenario - Pipe Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	1: AM	2
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	1: AM	5
P3212	No	0	0: Closed	0	2: By Link	0	P3326	0: Above	0.1	0: 24hr	
P3212	No	1	1: Open	0	2: By Link Flow	0	P3326	1: Below	0.01	0: 24hr	

2015 Maximum Day Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	75			1	2
U7064	2: Junction Pressure	70	J2751		1	0

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Peak Hour Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7062	0: Closed	
U7066	0: Closed	
V8020	2: Setting	69
V8022	2: Setting	4700
V8032	2: Setting	67
V8042	2: Setting	70

2015 Peak Hour Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Peak Hour Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	75			1	2
U7060	2: Junction Pressure	70	J4130		1	1
U7064	2: Junction Pressure	70	J2751		1	1

2015 Fire Flow Scenario - Initial Node Status		
ID (Char)	Status (Int)	Setting (Double)
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
V8020	2: Setting	65
V8022	2: Setting	6100
V8032	2: Setting	67
V8042	2: Setting	55

Tables F.4
Glades Region Water Model
Control Settings for 2015 Scenarios

2015 Fire Flos Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P1836	0: Closed
P1959	0: Closed
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed
P3212	0: Closed

2015 Fire Flos Scenario - VSP Control						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	75			1	2
U7040	2: Junction Pressure	80	J4313		1	0

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

Final Data Set and QuerySet Applied to 2025 Scenarios			
Year	**Type**	**Data Set**	**QuerySet**
2025	Average	DMD33	QSET13
		TANK1	
		PUMP3	
		PTNSET1	
		PIPE17	
		CTRL43	
2025	Max Day	DMD37	QSET13
		TANK1	
		PUMP3	
		PTNSET1	
		PIPE17	
		CTRL45	
2025	Peak Hour	DMD39	QSET13
		TANK1	
		PUMP3	
		PTNSET1	
		PIPE17	
		CTRL47	
2025	Fire Flow	DMD41	QSET13
		TANK1	
		PUMP3	
		PTNSET1	
		PIPE17	
		CTRL49	

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Annual Average Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
V8020	2: Setting	58
V8022	2: Setting	5,000.00
V8032	2: Setting	67
V8042	2: Setting	55

2025 Annual Average Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Annual Average Scenario - Node Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	1: By Node Level	0	T5020	1: Below	4.5	0: 24hr	
U7064	No	2	0: Closed	0	2: By Link Flow	0	P3071	0: Above	0.1	0: 24hr	

2025 Annual Average Scenario - Pipe Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	1: AM	1
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	1: AM	5

2025 Annual Average Scenario - VSP Control						
ID (Char)	Control Type (Int)	Control Setting (Double)	Control Element (Char)	Setting Pattern (Char)	Maximum Speed (Double)	Parallel Pumps (Long)
U7038	1: Discharge Preesure	70			1	2

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Maximum Day Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
V8020	2: Setting	65
V8022	2: Setting	6,100.00
V8032	2: Setting	67
V8042	2: Setting	55

2025 Maximum Day Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Maximum Day Scenario - Node Control											
ID (Char)	**Disabled (Boolean)**	**Sequence (Long)**	**Status (Int)**	**Setting (Double)**	**Control Method (Int)**	**Control Time (hr)**	**Control ID (Char)**	**Control Context (Int)**	**Control Value (Double)**	**Clock Style (Int)**	**Clock Time (Char)**
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	17
U7064	No	1	0: Closed	0	1: By Node Level	0	T5020	1: Below	4.5	0: 24hr	
U7064	No	2	0: Closed	0	2: By Link Flow	0	P3071	0: Above	0.1	0: 24hr	

2025 Maximum Day Scenario - Pipe Control											
ID (Char)	**Disabled (Boolean)**	**Sequence (Long)**	**Status (Int)**	**Setting (Double)**	**Control Method (Int)**	**Control Time (hr)**	**Control ID (Char)**	**Control Context (Int)**	**Control Value (Double)**	**Clock Style (Int)**	**Clock Time (Char)**
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	1: AM	1
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	1: AM	5

2025 Maximum Day Scenario - VSP Control						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	75			1	2

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Peak Hour Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7062	0: Closed	
U7066	0: Closed	
V8020	2: Setting	69
V8022	2: Setting	6100
V8032	2: Setting	67
V8042	2: Setting	55

2025 Peak Hour Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Peak Hour Scenario - VSP Control						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	75			1	2
U7060	2: Junction Pressure	70	J4130		1	1
U7064	2: Junction Pressure	70	J2751		1	1

2025 Fire Flow Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7062	0: Closed	
U7066	0: Closed	
V8020	2: Setting	69
V8022	2: Setting	6100
V8032	2: Setting	67
V8042	2: Setting	55

Tables F.5
Glades Region Water Model
Control Settings for 2025 Scenarios

2025 Fire Flow Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed

2025 Fire Flow Scenario - VSP Controls						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	80			1	2
U7060	2: Junction Pressure	76	J4130		1	0
U7064	2: Junction Pressure	70	J2751		1	0

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

Final Data Set and QuerySet Applied to 2035 Scenarios			
Year	**Type**	**Data Set**	**QuerySet**
2035	Average	DMD43	QSET15
		TANK1	
		PUMP5	
		PTNSET1	
		PIPE25	
		CTRL51	
2035	Max Day	DMD45	QSET15
		TANK1	
		PUMP5	
		PTNSET1	
		PIPE25	
		CTRL53	
2035	Peak Hour	DMD47	QSET15
		TANK1	
		PUMP5	
		PTNSET1	
		PIPE25	
		CTRL55	
2035	Fire Flow	DMD49	QSET15
		TANK1	
		PUMP5	
		PTNSET1	
		PIPE25	
		CTRL57	
2035	Vulnerability	DMD47	QSET15
		TANK1	
		PUMP5	
		PTNSET1	
		PIPE25	
		CTRL61	

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Annual Average Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
U7068	0: Closed	
U7070	0: Closed	
V8020	2: Setting	80
V8022	2: Setting	6,100.00
V8032	2: Setting	67
V8042	2: Setting	55
V8050	2: Setting	55

2035 Annual Average Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed
P3208	0: Closed

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Annual Average Scenario - Node Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
U7064	No	1	0: Closed	0	2: By Link Flow	0	P3071	0: Above	0.1	0: 24hr	
U7064	No	2	0: Closed	0	1: By Node Level	0	T5020	1: Below	4.5	0: 24hr	
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	16
U7068	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	13
U7068	No	1	0: Closed	0	1: By Node Level	0	T5028	1: Below	5	0: 24hr	
U7068	No	2	0: Closed	0	2: By Link Flow	0	P3208	0: Above	0.1	0: 24hr	

2035 Annual Average Scenario - Pipe Control											
ID (Char)	Disabled (Boolean)	Sequence (Long)	Status (Int)	Setting (Double)	Control Method (Int)	Control Time (hr)	Control ID (Char)	Control Context (Int)	Control Value (Double)	Clock Style (Int)	Clock Time (Char)
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	5
P3208	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	5
P3208	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Annual Average Scenario - VSP Control					
Control Type (Int)	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
1: Discharge Preesure	70			1	2
2: Junction Pressure	68	J3753		1	0

2035 Maximum Day Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7060	0: Closed	
U7062	0: Closed	
U7064	0: Closed	
U7066	0: Closed	
U7068	0: Closed	
U7070	0: Closed	
V8020	2: Setting	80
V8022	2: Setting	7000
V8032	2: Setting	67
V8042	2: Setting	55
V8050	2: Setting	60

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Maximum Day Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed
P3207	0: Closed
P3208	0: Closed

2035 Maximum Day Scenario - Node Control											
ID (Char)	**Disabled (Boolean)**	**Sequence (Long)**	**Status (Int)**	**Setting (Double)**	**Control Method (Int)**	**Control Time (hr)**	**Control ID (Char)**	**Control Context (Int)**	**Control Value (Double)**	**Clock Style (Int)**	**Clock Time (Char)**
U7064	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	8
U7064	No	1	0: Closed	0	1: By Node Level	0	T5020	1: Below	5	0: 24hr	
U7068	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	8
U7068	No	1	0: Closed	0	1: By Node Level	0	T5028	1: Below	5.2	0: 24hr	

2035 Maximum Day Scenario - Pipe Control											
ID (Char)	**Disabled (Boolean)**	**Sequence (Long)**	**Status (Int)**	**Setting (Double)**	**Control Method (Int)**	**Control Time (hr)**	**Control ID (Char)**	**Control Context (Int)**	**Control Value (Double)**	**Clock Style (Int)**	**Clock Time (Char)**
P3136	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1
P3136	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	7
P3207	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1
P3207	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	6
P3208	No	1	0: Closed	0	4: By Clock Time	0		0: Above	0	0: 24hr	6
P3208	No	0	1: Open	0	4: By Clock Time	0		0: Above	0	0: 24hr	1

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Maximum Day Scenario - VSP Control						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	77			1	2
U7064	2: Junction Pressure	60	J2751		1	0
U7068	2: Junction Pressure	60	J3753		1	0

2035 Peak Hour Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7062	0: Closed	
U7066	0: Closed	
U7070	0: Closed	
V8020	2: Setting	80
V8022	2: Setting	6100
V8032	2: Setting	67
V8042	2: Setting	55

2035 Peak Hour Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed
P3207	0: Closed

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Peak Hour Scenario - VSP Controls						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	75			1	2
U7060	2: Junction Pressure	70	J4130		1	1
U7064	2: Junction Pressure	65	J2751		1	2
U7068	2: Junction Pressure	65	J3753		1	1

2035 Fire Flow Scenario - Initial Node Status		
ID (Char)	**Status (Int)**	**Setting (Double)**
U7040	0: Closed	
U7042	0: Closed	
U7044	0: Closed	
U7050	0: Closed	
U7052	0: Closed	
U7054	0: Closed	
U7056	0: Closed	
U7058	0: Closed	
U7062	0: Closed	
U7066	0: Closed	
U7070	0: Closed	
V8020	2: Setting	80
V8022	2: Setting	7600
V8032	2: Setting	67
V8042	2: Setting	55

Tables F.6
Glades Region Water Model
Control Settings for 2035 Scenarios

2035 Fire Flow Scenario - Initial Pipe Status	
ID (Char)	**Status (Int)**
P3082	0: Closed
P3087	0: Closed
P3134	0: Closed
P3135	0: Closed
P3136	0: Closed
P3207	0: Closed

2035 Fire Flow Scenario - VSP Controls						
ID (Char)	**Control Type (Int)**	**Control Setting (Double)**	**Control Element (Char)**	**Setting Pattern (Char)**	**Maximum Speed (Double)**	**Parallel Pumps (Long)**
U7038	1: Discharge Preesure	80			1	2
U7060	2: Junction Pressure	76	J4130		1	0
U7064	2: Junction Pressure	65	J2751		1	0
U7068	2: Junction Pressure	80	J3753		1	1

APPENDIX G– ADDITIONAL RESULTS MAPS FOR 2013, 2015, 2025, AND 2035 SCENARIOS

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 40.1 - 50
- 50.1 - 60
- 60.1 - 67.8
- 2013 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

LAKE REGION WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacom Point Rd

S Lake Ave

S Barfield Hwy

N State Market Ln

E 7th St

Muck City Rd

Mc Cune Rd

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Hooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

NW Avenue L

Main St

Canal St W

SW 4th St

SW 1st St

E Canal St N

Duda Rd

Gator Blvd

N US Highway 27

SW 1st Ave

SE Avenue G

S Main St

S 3rd St

E Canal St S

US Highway 27

SW 1st St

County Road 827A

County Road 880

Junction Minimum Pressure during 2013 Annual Average Demand Condition

Figure G.1

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Velocity (fps)

- 0.0 - 7.0
- 7.1 - 8.9
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Lanmore Rd
Beacon Point Rd
Clarke Ave
S Barfield Hwy
N State Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue E
NW Main St
NW 3rd St
E Canal St N
SW Avenue C
SW Main St
SE 3rd St
SE Avenue C
E Canal St S
Gator Blvd
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Maximum Velocity Throughout the Glades Region During 2013 Maximum Day Demand Condition

Figure G.2

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Velocity (fps)

- 0 - 2
- 2.1 - 4
- 4.1 - 8
- 8.1 - 8.2
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larimore Rd
Bacom Point Rd
S Barfield Hwy
N State Market Ln
Muck City Rd
Mc Clure Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue C
Main St
Gator Blvd
E Canal St N
SW 1st St
SW Main St
SE Avenue C
SE 3rd St
S Main St
E Canal St S
US Highway 27
N US Highway 27
County Road 827A
Duda Rd
County Road 880

Pipe VelocitiesThroughout the Glades Region During 2013 Peak Hour Demand Condition

Figure G.3

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 40.3 - 50
- 50.1 - 60
- 60.1 - 67.5
- 2015 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larimore Rd
Bacon Point Rd
S Lake Ave
S State Rd 15
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Bell Glade Rd
State Road 15
County Road 715
Booker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue I
NW Main St
Gator Blvd
SW 5th St
SW 10th St
SE Avenue G
SW Main St
SE 3rd St
E Canal St N
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Dupa Rd
County Road 880

Junction Minimum Pressure during 2015 Annual Average Demand Condition

Figure G.4

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Maximum Velocity (fps)

- 0 - 7
- 7.1 - 9.1
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larimore Rd
Bacom Point Rd
Stake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue E
NW Main St
NW 2nd St
E Canal St N
SW 4th St
SW Main St
SE Avenue C
SE 3rd St
SE Main St
E Canal St S
Gator Blvd
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

carollo

Maximum Velocity Throughout the Glades Region During 2015 Maximum Day Demand Condition

Figure G.5

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Velocity (fps)

- 0 - 8
- 8.1 - 9.1
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue L
Main St
Gator Blvd
Canal St N
E Canal St N
SW 10th St
SW 6th St
SE Avenue C
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Pipe VelocitiesThroughout the Glades Region During 2015 Peak Hour Demand Condition

Figure G.6

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend
Minimum Pressure (psi)
- 40.3 - 50
- 50.1 - 60
- 60.1 - 72.4
- 2025 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacon Point Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Belle Glade Rd
Section 20 Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
SW Sugar House Rd
NW Avenue E
Gator Blvd
Duda Rd
SW 1st St
N US Highway 27
US Highway 27
E Canal St S
County Road 880
County Road 827A

Junction Minimum Pressures during 2025 Annual Average Demand Condition

Figure G.7

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

Maximum Velocity (fps)

- 0 - 7
- 7.1 - 11.1
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larimore Rd
Bacom Point Rd
SR 15 Alt
S Berfield Hwy
N State Market Rd
E 7th St
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
NW Sugar House Rd
Gator Blvd
NW Avenue C
Main St
SW 1st St
E Canal St N
SW 1st Ct
SW 2nd St
SE Avenue C
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Maximum Velocities Throughout the Glades Region During 2025 Maximum Day Demand Condition

Figure G.8

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend
Headloss per 1,000 feet
Pipe diameter less than 24"
- Less than 10 ft/kft
- Above 10 ft/kft

Pipe diameter 24" and above
- Less than 7.5 ft/kft
- Above 7.5 ft/kft
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N Slate Market Ln
E 11th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue L
Main St
Gator Blvd
Canal St N
E Canal St N
SW 6th St
SW 10th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Dude Rd
County Road 880

HeadlossThroughout the Glades Region During 2025 Peak Hour Demand Condition

Figure G.9

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend
Velocity (fps)
0 - 8
8.1 - 11.7
City Boundary
GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK
PAHOKEE 0.1 MG ELEVATED TANK
PAHOKEE 0.075 MG ELEVATED TANK
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
BELLE GLADE OLD WTP
SOUTH BAY WTP
SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N Slate Market Ln
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue L
Main St
Gator Blvd
Canal St N
E Canal St N
SW 10th St
SW 6th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Dude Rd
County Road 880

Velocities Throughout the Glades Region During 2025 Peak Hour Demand Condition

Figure G.10

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Minimum Pressure (psi)

- 43.3 - 50
- 50.1 - 60
- 60.1 - 72.1
- 2035 Water Mains
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PROPOSED PAHOKEE 1.5 MG GST

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N

Old Conners Hwy

Conners Hwy

Lakeshore Dr

E Main St

Larrimore Rd

Bacon Point Rd

S Lake Ave

S Barfield Hwy

N State Market Rd

Muck City Rd

Mc Cure Rd

7th St

Section 20 Rd

Belle Glade Rd

State Road 15

State Road 715

Brooker Hwy

State Road 80

Curlee Rd

N Sugar House Rd

NW Avenue G

SW Avenue G

SW Main St

SE 3rd St

Gator Blvd

E Canal St S

N US Highway 27

US Highway 27

SW 1st St

State Road 80

County Road 827A

Duda Rd

County Road 880

Junction Minimum Pressure during 2035 Annual Average Demand Condition

Figure G.11

N

0 2,750 5,500 Feet

carollo

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend
Maximum Velocity (fps)
0.0 - 7.0
7.1 - 12.2
City Boundary
GUUSA

LAKE OKEECHOBEE
PROPOSED PAHOKEE 1.5 MG GST
WATER TREATMENT PLANT 11
BELLE GLADE REPUMP STATION
SOUTH BAY REPUMP STATION
US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
W Sugar House Rd
NW Avenue L
Gator Blvd
W Canal St N
NW Canal St N
E Canal St N
N Main St
SW 6th St
SW 10th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Maximum Velocities Throughout the Glades Region During 2035 Maximum Day Demand Condition

Figure G.12

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Velocity (fps)

- 0 - 8
- 8.1 - 12.4
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PROPOSED PAHOKEE 1.5 MG GST

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

Lakeshore Dr
US Highway 441 N
Conners Hwy
E Main St
Larimore Rd
Bacom Point Rd
Stake Ave
S Barfield Hwy
N State Market Rd
E 1st St
Mc Cuen Rd
Muck City Rd
Section 25 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
N Sugar House Rd
NW Avenue C
W Canal St N
N Main St
SW 4th St
SW Main St
SE Avenue C
SE 3rd St
E Canal St N
E Canal St S
Gator Blvd
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Velocities Throughout the Glades Region During 2035 Peak Hour Demand Condition

Figure G.13

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

2015 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
W Sugar House Rd
NW Avenue L
Gator Blvd
W Canal St N
W Canal St S
E Canal St N
N Main St
SW 5th St
SW 10th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
State Road 80
County Road 827A
Duda Rd
County Road 880

Proposed Pipe Improvements and Future Infrastructure in the Glades Region by the Planning Year 2015

Figure G.14

N

0 2,750 5,500 Feet

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

2025 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
W Sugar House Rd
NW Avenue L
W Canal St N
W Canal St S
E Canal St N
N Main St
SW 5th St
SW 10th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
Gator Blvd
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Proposed Pipe Improvements and Future Infrastructure in the Glades Region by the Planning Year 2025

Figure G.15

N

0 2,750 5,500 Feet

carollo

Palm Beach County Water Utilities Department
Glades Region Water Master Plan

Legend

2035 Water Pipe Diameter (in)

- Less than 6"
- 6
- 8
- 10
- 12
- 16
- 20
- 24
- 30
- GUUSA
- City Boundary

LAKE OKEECHOBEE

PROPOSED PAHOKEE 1.5 MG GST

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

SOUTH BAY REPUMP STATION

US Highway 441 N
Old Conners Hwy
Conners Hwy
Lakeshore Dr
E Main St
Larrimore Rd
Bacom Point Rd
S Lake Ave
S Barfield Hwy
N State Market Rd
E 7th St
Mc Clure Rd
Muck City Rd
Section 20 Rd
Belle Glade Rd
State Road 15
State Road 715
Hooker Hwy
State Road 80
Curlee Rd
W Sugar House Rd
NW Avenue L
Gator Blvd
W Canal St N
W Canal St S
E Canal St N
N Main St
SW 5th St
SW 10th St
SE Avenue G
SE 3rd St
S Main St
E Canal St S
N US Highway 27
US Highway 27
SW 1st St
County Road 827A
Duda Rd
County Road 880

Proposed Pipe Improvements and Future Infrastructure in the Glades Region by the Planning Year 2035

Figure G.16

N

0 2,750 5,500 Feet

carollo

Palm Beach County Water Utilities Department

Glades Region Water Master Plan

Legend

Property Use Type

- Commercial Parcel
- Residential Parcel
- Residential Fire Hydrant
- Commercial Fire Hydrant
- 2013 Water Mains
- City Boundary
- GUUSA

LAKE OKEECHOBEE

PAHOKEE 0.5 MG ELEVATED TANK

PAHOKEE 0.1 MG ELEVATED TANK

PAHOKEE 0.075 MG ELEVATED TANK

WATER TREATMENT PLANT 11

BELLE GLADE REPUMP STATION

BELLE GLADE OLD WTP

SOUTH BAY WTP

SOUTH BAY REPUMP STATION

U S Highway 441 N

Old Conners Hwy

Conners Hwy

Lake Shore Dr

E Main St

Lakeshore Rd

State Road 15

N State Market Rd

E 7th St

Muck City Rd

Section 20 Rd

Bell Glade Rd

State Road 715

Hookes Hwy

State Road 80

Curlee Rd

NW Sugar House Rd

NW Avenue I

Gator Blvd

SW 30th St

SW 31st St

E Canal St S

SW Main St

E Avenue G

N US Highway 27

US Highway 27

County Road 827A

Duda Rd

County Road 880

Residential and Commercial Parcels and Fire Hydrants at the Glades Region

Figure G.17

N

0 2,750 5,500 Feet

APPENDIX H– COST ESTIMATES

Engineers...Working Wonders With Water®

PIC: LDM
PM: LB
By/Checked: AG/LB
Date: July 30, 2013

Preliminary Opinion of Cost
WTP No. 11 Expansion

Full RO Skid Package - 2.375 mgd

Description	Quantity	Unit	Unit Price	Total Price
2.375 mgd RO Skid Mounted Unit	1	LS	$674,000	$674,000
Membrane Elements Estimate	1	LS	$273,000	$273,000
Cartridge Filter	1	LS	$50,000	$50,000
First Stage Feed Pumps	1	LS	$252,000	$252,000
Turbine Assisted Boost Pumps	1	LS	$98,000	$98,000
Mechanical	1	LS	$160,000	$160,000
Electrical	1	LS	$54,000	$54,000
Instrumentation	1	LS	$102,000	$102,000
Calibration and Startup of Instruments	1	LS	$10,000	$10,000
Transportation, Handling & Storage	1	LS	$14,000	$14,000
Startup and Training	1	LS	$52,000	$52,000
Total Direct Costs				$1,739,000
Contingency			20%	$347,800
Engineering and CEI Fees			15%	$260,850
Administration and Legal Fees			10%	$173,900
Total Estimated Construction Costs				**$2,520,000**

PIC:	LDM
PM:	LB
By/Checked:	AG/LB
Date:	July 25, 2013

Preliminary Opinion of Cost
Pahokee Storage and Pumping Additions

Pahokee 1.5 MG GST and Associated Pump Station

Description	Quantity	Unit	Unit Price	Total Price
GST				
1.5 MG Ground Domed Prestressed Concrete Tank, 90-ft Diameter x 30-ft Tall	1	LS	$740,000	$740,000
Foundation Piles @ 6.5-ft spacing for 90-feet Tank	150	EA	$175	$26,250
27-ft Long Piers	4050	FT	$30	$121,500
Pile-driving (cut-offs, testing and related)	1	LS	$51,713	$51,713
Backfill (shipped, placed, compacted)	1908.522	CY	$15	$28,628
Subsurface Exploration	1	LS	$22,809	$22,809
				$990,899
Pump Station				
Centrifugal Horizontal Split Case Pumps, 3,200 gpm, 135-ft TDH, 150 HP 1800 RPM, inverter duty motor, 2 duty, 1 stby	3	EA	$46,733	$140,199
New VFDs	3	EA	$22,591	$67,773
Electrical, Instrumentation, and Controls	1	LS	$45,500	$45,500
Pump Station Building, Structural	625	SF	$160	$100,000
				$353,472
Total Direct Costs				$1,344,371
Contingency			20%	$268,874
Engineering and CEI Fees			15%	$201,656
Administration and Legal Fees			10%	$67,219
Total Estimated Construction Costs				**$1,880,000**

Booster Pump Station at Pahokee 0.5 MG EVT

Repump Station Building, Structural	625	SF	$160	$100,000
Centrifugal Horizontal Split Case Pumps, 1 duty, 1 stby, VFD	2	EA	$30,000	$60,000
Electrical, Instrumentation, and Controls	1	LS	$35,000	$35,000
Total Direct Costs				$195,000
Contingency			20%	$39,000
Engineering and CEI Fees			15%	$29,250
Administration and Legal Fees			10%	$9,750
Total Estimated Construction Costs				**$270,000**

Total City of Pahokee Storage and Pumping Additions **$2,150,000**

Engineers...Working Wonders With Water®

PIC: LDM
PM: LB
By/Checked: AG/LB
Date: July 30, 2013

Preliminary Opinion of Cost
South Bay Pumping Replacement

Description	Quantity	Unit	Unit Price	Total Price
Centrifugal Horizontal Split Case Pumps, 3,200 gpm, 135-ft TDH, 150 HP 1800 RPM, inverter duty motor, 1 duty, 1 stby	2	EA	$46,733	$93,466
New VFDs	2	EA	$22,591	$45,182
Electrical, Instrumentation, and Controls	1	LS	$35,000	$35,000
Total Direct Costs				$173,648
Contingency			20%	$34,730
Engineering and CEI Fees			15%	$26,047
Administration and Legal Fees			10%	$8,682
Total Estimated Construction Costs				**$240,000**

carollo
Engineers...Working Wonders With Water®
9897 Lake Worth Road, Suite 302
Lake Worth, Florida 33467
P 561.868.6400
F 561.868.6401
carollo.com

APPENDIX D

Glades Wastewater Master Plan –
Hazen and Sawyer, P.C., September 2014

Palm Beach County Water Utilities Department

Glades Wastewater Master Plan
WUD 12-068

September 2014

HAZEN AND SAWYER
Environmental Engineers & Scientists

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
Boca Corporate Center
2101 NW Corporate Boulevard, Suite 301
Boca Raton, Florida 33431
(561) 997-8070 Telephone
(561) 997-8159 Fax

September 19, 2014

Maurice Tobon, P.E.
Engineering Director
Water Utilities Department
P.O. Box 16097
West Palm Beach, FL 33416-6097

Palm Beach County Water Utilities Department
Contract for Consulting Services (R2011-0631)
Consultant Authorization No. 5
Glades Wastewater Master Plan
Project No.: WUD 12-068

Dear Mr. Tobon:

Enclosed please find six (6) copies of the Glades Wastewater Master Plan Report and six (6) CDs of the entire report. We sincerely appreciate the opportunity to assist you with this project.

Please feel free to contact me should you have any questions.

Best regards,

Hazen and Sawyer, P.C.

Albert Muniz, P.E.
Vice President

c: *45103-004.3.0*
Jennifer Prettel / PBCWUD
John Koroshec / H&S
Kurt Pfeffer / H&S
Rob Taylor / H&S
Felipe Martinez / H&S

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
2101 N.W. Corporate Blvd.
Suite 301
Boca Raton, Florida 33431
Bus: 561-997-8070
Fax: 561997-8153

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1.	Introduction
2.	Renewal and Replacement Improvements
3.	Wastewater Service Area
4.	Population Projections
5.	Wastewater Flow and Loading Projections
6.	Hydraulic Modeling
7.	Collection System Capacity Analysis
8.	Infiltration and Inflow Assessment
9.	Regulatory Overview
10.	Operation and Maintenance Performance
11.	Capacity Analysis and Plant Optimization
12.	Implementation Plan

Appendices

Appendix A – Technical Memoranda

Appendix B – Climate Resilience Reports

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
2101 N.W. Corporate Blvd.
Suite 301
Boca Raton, Florida 33431
Bus: 561-997-8070
Fax: 561997-8153

Executive Summary

This section summarizes the findings of the Glades Region Wastewater Master Plan prepared for the Palm Beach County Water Utilities Department (PBCWUD). The purpose of this project was to determine the requirements for future utilities infrastructure, including renewal and replacement, through the 2035 planning horizon and to develop a guide for capital improvements planning and implementation. Specific areas addressed in the Wastewater Master Plan include:

- Wastewater service area and existing facilities
- Renewal and replacement needs
- Population projections
- Wastewater flow and loading projections
- Transmission system hydraulic modeling
- Collection and transmission system capacity and reliability analysis
- Infiltration and inflow assessment
- Regulatory driven issues and improvements
- Wastewater treatment plant operations and maintenance performance evaluations and capacity analysis and plant optimization studies conducted for the Belle Glade and Pahokee wastewater treatment facilities.

The objective was to develop a plan that would provide an equitable, technologically sound and economical implementation strategy for managing the wastewater collection, treatment and disposal systems in the western portion of the Palm Beach County service area, known as the Glades Region Urban Service Area. The goal of the final plan is to provide responsive, flexible and cost effective solutions that improve wastewater management practices and satisfy existing and future needs of the community.

Wastewater Service Area and Existing Facilities

The overall Glades Region Wastewater Service Area encompasses approximately 43.5 square miles in northwest Palm Beach County. The wastewater service area is made up of two adjacent sub-areas with a common boundary slightly north of Paul Rardin Park. The 16.5 square mile service area to the north of Paul Rardin Park is comprised of collection basins whose flows are treated at the Pahokee Wastewater Treatment Facility (WWTF), and extends north to Canal Point. The 27 square mile service area to the south, extending to the G2 Canal, includes the collection and transmission system providing flows to the Belle Glade WWTF. The two wastewater service areas associated with the Glades WWTF and Pahokee WWTF are shown in **Figure ES-1.** There are currently no interconnections between the two collection/treatment systems.

The Belle Glade WWTF is located on West Canal Street South in Belle Glade, Florida, just east of US-27 and south of State Road 80, and was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Belle Glade). The treatment plant is permitted to operate with a capacity of 6.5 million gallon per day (MGD) maximum monthly average daily flow (MMADF) under Florida Department of Environmental Protection (FDEP) Permit No. FLA027740-008-DW1P that was issued on May 23, 2011 and expires May 22, 2016.

The Pahokee WWTF is located on Rim Canal Road in Pahokee, Florida, east of Lake Okeechobee and north of State Road 80, and was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Pahokee). The treatment plant is permitted to operate with a capacity of 1.2-MGD three-month average daily flow (TMADF) under FDEP Permit No. FLA0136778-006-DW1P/NR that was issued on August 22, 2012 and expires August 21, 2017.

Within the wastewater collection network, small capacity lift stations receive wastewater from defined areas or developments and pump it through a network of force mains to the larger master pump stations. Typically, the flows from master pump stations are re-pumped to one of the two WWTFs. **Table ES.1** summarizes the extent of both gravity sewers and pressurized force mains within both the Pahokee WWTF and Belle Glade WWTF portions of the service area. There are a total of 69 miles of gravity sewers and 54 miles of pressurized force mains in active service within the PBCWUD Glades Region Urban Service Area system.

Table ES.1
Summary of Palm Beach County Piping
within the PBCWUD Glades Region Wastewater Service Area

Description	Gravity Sewers (miles)	Pressurized Force Mains (miles)
Total	69	54
Pahokee WWTF	21	16
Belle Glade WWTF	48	38

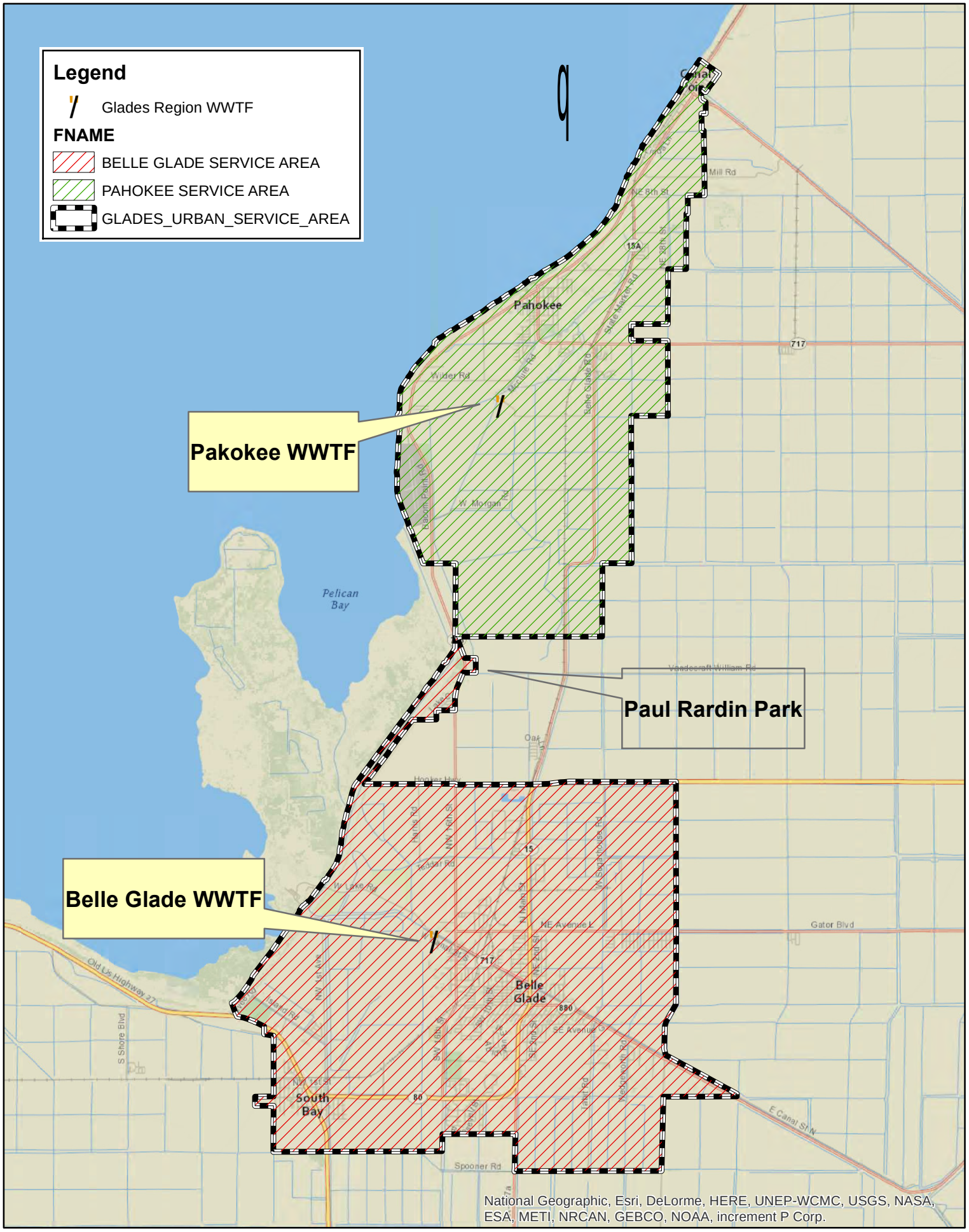

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Figure ES-1 - Glades Region Urban Service Sub-Areas

Table ES.2 provides a summary of lift stations operating within the PBCWUD Glades Region wastewater service area collection network. The system utilizes a total of 101 lift stations.

Table ES.2
Summary of Lift Stations within the
PBCWUD Glades Region Urban Service Area

Description	# Lift Stations
Total	101
Pahokee WWTF	40
Belle Glade WWTF	55
Other[1]	6

[1] *"Other" includes lift stations within the two WWTFs, an in-line booster station in South Bay and Lift Station 6069 that serves the Palm Beach County Police Training Facility.*

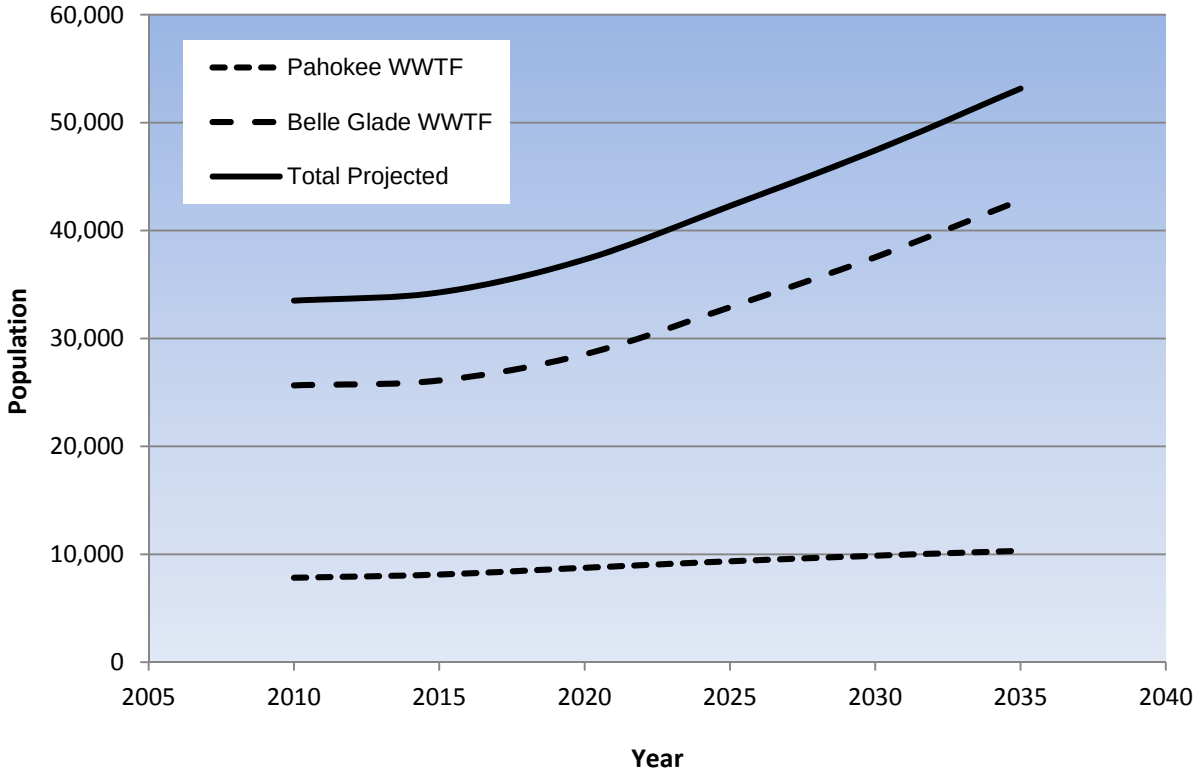
Population Projections

Population projections for each wastewater service area were developed by summing the future population estimates of the individual TAZs within the service area and are summarized in **Table ES.3** and **Figure ES-2.**

Table ES.3
Population Summary

Area	Projected Population					
	2010 (Base Year)	2015	2020	2025	2030	2035
Palm Beach County	1,320,134	1,325,743	1,394,300	1,482,900	1,568,500	No Data
Change from base year (%)	n/a	0%	6%	12%	19%	No Data
Belle Glade Service Area	25,671	26,125	28,547	32,909	37,539	42,816
Change from base year (%)	n/a	2%	11%	28%	46%	67%
Pahokee Service Area	7,836	8,140	8,767	9,368	9,887	10,347
Change from base year (%)	n/a	4%	12%	20%	26%	32%
Glades Region Urban Service Area	33,506	34,266	37,314	42,278	47,426	53,163
Change from base year (%)	n/a	2%	11%	26%	42%	59%

Figure ES-2
Wastewater Service Area Population Projections



The 2010 service area population was estimated to be approximately 33,506 with 23 percent, or 7,836 in the Pahokee WWTF service area and 77 percent, or 25,671 in the Belle Glade WWTF service area. The Pahokee WWTF service area population is expected to increase by nearly 32 percent by 2035 to just over 10,347. By comparison the Belle Glade WWTF population is expected to grow by about 67 percent to nearly 42,816. The entire service area is expected to grow to about 53,136 by 2035, or just over 59 percent.

Wastewater Flow and Loading Projections

Table ES.4 summarizes historical wastewater flow to the Belle Glade and Pahokee WWTFs as measured by the influent flow meters for the period from October 1, 2010 through September 30, 2011.

Table ES.4
Historical Monthly Average Daily Flow to the Pahokee WWTF and the Belle Glade WWTF

Month	Pahokee WWTF (mgd)	Belle Glade WWTF (mgd)
Oct-10	0.77	1.87
Nov-10	0.80	1.91
Dec-10	0.83	2.18
Jan-11	0.85	2.17
Feb-11	0.75	1.98
Mar-11	0.84	2.64
Apr-11	0.83	2.20
May-11	0.68	2.39
Jun-11	0.68	1.98
Jul-11	0.78	4.77
Aug-11	0.69	2.74
Sep-11	0.74	4.32
Average	**0.77**	**2.60**

The overall wastewater flow forecast (on an annual average daily flow basis) for the entire Glades Region Urban Service Area is presented in **Table ES.5**.

Table ES.5
Annual Average Day
Forecasted Wastewater Flow

Year	Belle Glade (mgd)	Pahokee (mgd)	Combined Flow (mgd)
2015	2.57	0.77	3.34
2020	2.69	0.80	3.49
2025	2.89	0.83	3.72
2030	3.09	0.84	3.93
2035	3.35	0.89	4.24

Maximum Day and Peak Hour peaking factors for each plant are provided in **Table ES.6**.

Table ES.6
Wastewater Treatment Facility Peaking Factors

Description	Pahokee WWTF	Belle Glade WWTF
Maximum Day Influent Flow	2.19	7.91
Average Day Influent Flow	0.77	2.60
Maximum Day Flow Peaking Factor	**2.84**	**3.04**
Peak Hour Flow	3.49	10.91
Average Hour Flow	0.89	2.60
Peak Hour Flow Peaking Factor	**3.93**	**4.20**

Pahokee WWTF and Belle Glade WWTF historical annual average influent concentrations and loadings can be found in **Tables ES.7 and ES.8**, respectively. The predicted future influent loadings can be found in **Table ES.9 and Table ES.10**.

Table ES.7
Historical Pahokee WWTF Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	**0.78**		**0.90**	
Parameter and Concentration	**Conc. (mg/L)**	**Load (ppd)**	**Conc. (mg/L)**	**Load (ppd)**
$CBOD_5$*	129	840	111	837
TSS	117	767	114	860

**Adjusted $CBOD_5$ (lab data is inhibited, ratio used = 0.84)*

Table ES.8
Historical Belle Glade WWTF Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	**2.77**		**2.61**	
Parameter and Concentration	**Conc. (mg/L)**	**Load (ppd)**	**Conc. (mg/L)**	**Load (ppd)**
$CBOD_5$*	137	3,121	111	2,422
TSS	125	2,854	103	2,250

**Adjusted $CBOD_5$ (lab data is inhibited, ratio used = 0.84)*

Table ES.9
Predicted Pahokee WWTF Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	**0.80**	**0.86**	**0.92**	**0.97**	**1.02**
Parameter and Concentration	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**
$CBOD_5$*	943	1,016	1,086	1,145	1,199
TSS	861	967	991	1,045	1,044

**Estimated concentrations for predicting future loads:*
$CBOD_5$ in mg/L - 141 (highest year of historical data +10%)
TSS in mg/L - 129 (highest year of historical data +10%)

Table ES.10
Predicted Belle Glade WWTF Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	**2.62**	**2.80**	**3.18**	**3.58**	**4.01**
Parameter and Concentration	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**
$CBOD_5$*	3,285	3,514	3,980	4,482	5,021
TSS	3,004	3,213	3,639	4,098	4,591

** Estimated concentrations for predicting future loads:*
$CBOD_5$ in mg/L – 150 (highest year of historical data +10%)
TSS in mg/L – 137 (highest year of historical data +10%)

Transmission System Hydraulic Modeling

The Glades Region Urban Service Area wastewater master planning effort includes an evaluation of the wastewater transmission system through the use of hydraulic modeling methods. Hazen and Sawyer developed, calibrated and deployed a Glades Region wastewater transmission system hydraulic model using the County's preferred modeling platform, InfoWater®. The hydraulic model encompasses individual transmission systems associated with both the Pahokee WWTF and the Belle Glade WWTF. Transmission system elements (i.e., pipes, pumps, and wetwells) were evaluated against a set of performance criteria approved by County staff. Improvements needed to address system hydraulic deficiencies identified through the modeling process were proposed and tested for efficacy. Corresponding improvement recommendations were also made.

Collection and Transmission System Capacity and Reliability Analysis

This wastewater collection system is comprised of gravity mains, force mains, lift stations and master pump stations located throughout the service area. There are a total of 101 stations

in the Glades Region Urban Service Area, with 95 submersible lift stations, two plant site lift stations at the Belle Glade WWTF, one plant site lift station at the Pahokee WWTF, an in-line booster (re-pump station) in South Bay and Lift Station No. 6069 that services the Palm Beach County Police Training Facility.

The 95 lift stations that make-up the majority of the wastewater collection system service area are broken out into four separate regions.

The analysis of these facilities is presented with a general assessment of the lift stations within each of the regions, followed by a detailed analysis based on the risk of failure.

To create a ranked or prioritized list of submersible lift station rehabilitation over the planning horizon, a method similar to the one used for the PBCWUD's Wastewater Master Plan (June 2013) was utilized. The method establishes a consequence of failure (COF) and the possibility of failure (POF) for each lift station. The total risk is then the product of the COF and the POF (Risk = COF x POF), and facilities were ranked based upon this ranking.

Results of the assessment suggest that lift stations should be scheduled for rehabilitation/ replacement as shown in **Table ES.11**

Table ES.11
Summary of Lift Stations Scheduled for Rehabilitation / Replacement

Combined Risk and Condition Score	R&R Planning Year	Number of Lift Stations
110,000 to 60,000	2015	27
59,900 to 45,000	2020	27
44,900 to 30,000	2025	16
29,900 to 20,000	2030	23
19,000 to 17,000	2035	4

Infiltration and Inflow Assessment

The communities of Belle Glade, Pahokee, and South Bay were settled in the early 1900s and owe their subsequent development and expansion in part to the federal project of draining the land around Lake Okeechobee. The gravity collection systems in these areas were reportedly installed from the 1950s through the 1990s, although some pipes are of unknown age. Pipe materials consist primarily of vitrified clay and newer, PVC pipe.

A system-level evaluation of the effects of potable water usage, rainfall, and groundwater elevation on total WWTF flows was conducted. Observations concerning the relationships

among these variables for the overall system, and for Belle Glade, Pahokee, and South Bay individually are presented in the report. Furthermore, a basin-level evaluation was conducted, which involved selection of 30 pump station collection areas representing "study areas" for more detailed analysis. Basins were selected through consultation with Utility O&M personnel following characterization based on a number of specific criteria.

A number of conclusions were made based on the system-level and basin-level evaluations, and are presented in the report. A comprehensive program of assessment and repair is recommended for the Belle Glade, South Bay, and Pahokee wastewater collection systems to limit infiltration and inflow and help maintain a reliable and structurally sound system. A number of actions, in support of those goals, are recommended in the report.

Regulatory Driven Issues and Improvements

As part of the planning effort, a regulatory overview of current and emerging wastewater treatment and disposal requirements was presented. Although a detailed analysis of records and operations was not completed, it was found that the Belle Glade and Pahokee WWTFs generally comply with current regulatory standards for wastewater effluent, injection wells, reclaimed water, and biosolids.

The regulatory overview also includes information about emerging local, state, and federal regulations. Existing and/or future regulations were categorized as either short-term (within the next five years) or long-term (beyond the next five years) and summarized regarding their effects on the Belle Glade or Pahokee WWTFs with respect to potential future compliance issues.

Operation and Maintenance Performance Report

A separate Operation and Maintenance (O&M) Performance Report was prepared for each WWTF. Such reports evaluate the capability of treatment facilities to function as intended, including a detailed assessment of the physical condition of treatment process equipment, overall treatment efficiency of the plant, performance trends and the Operations and Maintenance program. O&M Performance Reports also identify deficiencies, if any, with the physical capacity and performance conditions of the plant including problems with the present O&M program. Finally, the report provides recommendations and schedules, if needed, for corrective actions leading to improved operations. The respective O&M Performance Reports for Belle Glade and Pahokee WWTF's include a listing of "critical" and "non-critical" repairs which are recommended.

Capacity Analysis and Plant Optimization

Capacity Analysis Reports were prepared for the Belle Glade and Pahokee WWTFs. The reports summarize evaluation of the capacity of the plants and contain data showing the permitted capacity; monthly average flows, three-month average flows; and annual average

daily flows for the past 10 years; seasonal variations in flow; flow projections based on local population growth and water usage rates over the next 10 years; and an estimate of time required for the three-month average daily flow to reach the permitted capacity. The reports also include capital cost estimates of infrastructure improvements required to maintain permitted plant capacities.

In addition to the capacity analysis, baseline energy efficiency models were developed for both plants, using Hazen Energy Efficiency Tool (HEET). The HEET model was used to evaluate potential optimization improvements at each plant.

Lastly, a preliminary evaluation was conducted relative to the potential conversion of the Pahokee WWTF to a regional wastewater pump station that would transfer all Pahokee service area flows to the Belle Glade WWTF. Based on the evaluations and analyses noted above, a summary of conclusions and recommendations is presented in the report, and several key items are highlighted below:

- The Belle Glade WWTF has adequate capacity to treat projected Belle Glade service area flows through the Year 2035
- The Pahokee WWTF's hydraulic treatment capacity will be exceeded by the Year 2018.
- The Belle Glade WWTF has adequate capacity to treat projected flows from the Belle Glade and Pahokee service areas through the Year 2035, provided that Belle Glade WWTF renewal and replacement projects (proposed in Technical Memorandum No. 2) are completed.
- The option to demolish the Pahokee WWTF, convert the Pahokee WWTF to a regional wastewater pump station, install force mains to convey Pahokee service area flows to the Belle Glade WWTF, and consolidate treatment at the Belle Glade WWTF appears to be more cost-effective than upgrading both plants, expanding the Pahokee WWTF and operating / maintaining two separate treatment plants. A Business Case Evaluation should be performed to justify this project.

Implementation Plan

The wastewater master planning effort for the Glades Region Urban Service area includes an evaluation of its wastewater system, consisting of collection (i.e. lift stations), transmission (force mains), treatment and disposal.

Projects have been grouped based on the following categories:

- Collection System (Lift Stations)
- Transmission System (Force Mains)

- Infiltration and Inflow
- Wastewater Treatment and Disposal

Wastewater treatment and disposal projects have been further subdivided into the following sub-categories:

- Belle Glade WWTF Renewal and Replacement
- Pahokee WWTF Renewal and Replacement
- Pahokee Conversion to Regional Pump Station (for treatment at Belle Glade WWTF)

The recommended capital improvements plan is identified in detail in Chapter 12 of the Wastewater Master Plan report. The recommended improvements were developed for several time horizons through 2035 as summarized in **Table ES.12** below. The table provides variations expected depending upon which scenario (expand and continue to use Pahokee WWTF or convert Pahokee WWTF to regional pump station) is ultimately selected by the County.

Table ES.12
Capital Improvement Schedule Through 2035

PROJECT DESCRIPTION	IMPLEMENTATION SCHEDULE							
Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
1.0 – Collection System (Lift Stations)	**$26,254,500**	$4,111,250	$5,692,500	$2,530,000	$2,530,000	$2,530,000	$4,743,750	$4,117,000
2.0 – Transmission System (Force Mains)	**$2,770,000**	$0	$2,550,000	$220,000	$0	$0	$0	$0
3.0 - Infiltration and Inflow	**$9,270,000**	$0	$650,000	$3,340,000	$3,340,000	$1,940,000	$0	$0
4.0 – Wastewater Treatment and Disposal								
Long-Term Use of Pahokee WWTF	**$27,410,000**	$1,260,000	$2,340,000	$2,160,000	$1,250,000	$1,600,000	$11,380,000	$7,420,000
Pahokee Regional Pump Station, All Treatment at Belle Glade WWTF	**$25,360,000**	$1,260,000	$1,440,000	$7,000,000	$6,180,000	$30,000	$3,750,000	$5,700,000
TOTAL ESTIMATED ANNUAL CAPITAL COSTS (Sections 1.0 through 4.0)								
LONG-TERM USE OF PAHOKEE WWTF	***$65,704,500***	***$5,371,250***	***$11,232,500***	***$8,250,000***	***$7,120,000***	***$6,070,000***	***$16,123,750***	***$11,537,000***
PAHOKEE REGIONAL PUMP STATION, ALL TREATMENT AT BELLE GLADE WWTF	***$63,654,500***	***$5,371,250***	***$10,332,500***	***$13,090,000***	***$12,050,000***	***$4,500,000***	***$8,493,750***	***$9,817,000***

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Chapter 1.0
Introduction

The County authorized Hazen and Sawyer to prepare an updated comprehensive wastewater Master Plan for the Glades Region Urban Service area (i.e., Glades Region) for the 2035 time horizon. This Master Plan Report is largely comprised of the contents of various technical memoranda written to address specific tasks. These tasks and the technical memoranda addressing the data, methodologies, findings and recommendations of each were completed at various times with updates from the County as modifications were made. Most County comments on the technical memoranda were completed by spring 2014; however, it should be noted that improvements are ongoing and some information may have changed as of the present. It should be noted that the information contained in this report is based on the data/conditions current as of the writing of the technical memoranda. A CD containing a copy of the final technical memoranda can be found in **Appendix A**. These deliverables have been used as the basis for this Master Plan and are being presented in 12 chapters, each associated with a specific topic as summarized below:

- The Executive Summary is presented first and summarizes the findings of the entire Master Plan.
- Chapter 1 is an introduction to the project.
- Chapter 2 includes findings from the renewal and replacement evaluation performed at both the Belle Glade and Pahokee wastewater treatment facilities and collection systems.
- Chapter 3 provides information on the wastewater service area.
- Chapter 4 describes the population forecast for the planning horizons in five-year increments to the year 2035.
- Chapter 5 discusses future system-wide wastewater generation rates and loading projections for the Belle Glade and Pahokee wastewater treatment facilities. Flows from South Bay are combined with Belle Glade.

- Chapter 6 presents the findings of the review of the collection system and transmission hydraulic modeling
- Chapter 7 includes findings from the collection and transmission system capacity and reliability analysis.
- Chapter 8 provides an assessment of the ongoing inflow and infiltration (I-I) reduction program for the Glades region.
- Chapter 9 describes legislation and regulatory issues that may affect existing wastewater treatment and disposal methods employed by the Palm Beach County Water Utilities Department (PBCWUD).
- Chapter 10 discusses results from the operations and maintenance performance evaluations conducted at the Belle Glade and Pahokee wastewater treatment facilities.
- Chapter 11 presents a summary of the capacity analysis and plant optimization study conducted for the Belle Glade and Pahokee wastewater treatment facilities.
- Chapter 12 presents the recommended, multi-year Capital Improvements Plan (CIP) and includes implementation timelines and cost schedules.

Subject matter and issues associated with wastewater treatment are limited to the Glades Region Urban Service Area (owned and operated by the PBCWUD). The primary service areas include the Cities of Pahokee, Belle Glade and South Bay. The analysis undertaken in this study provides guidance to the PBCWUD for future upgrades and improvements.

Objective

The objective of the Master Plan team was to develop a plan that would provide an equitable, technologically sound and economical implementation strategy for managing the wastewater collection, treatment and disposal systems in the western portion of the Palm Beach County service area known as the Glades Region Urban Service Area. The goal of the final plan is to provide responsive, flexible and cost effective solutions that improve wastewater management practices and satisfy existing and future needs of the community.

This Master Plan was intended to provide updated information for the PBCWUD wastewater service area based upon recent data associated with service area demographics, water demands, wastewater flows, completed capital improvements, anticipated capital expenditures and relevant local, state and federal regulations.

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Chapter 2.0
Renewal and Replacement Improvements

This chapter addresses the renewal and replacement improvements needed to maintain the integrity of the structural, electrical, instrumentation, mechanical and wastewater process elements of the wastewater treatment facilities (WWTFs) within the Glades Region. Detailed results of the evaluation are included in Technical Memorandum No. 2 (TM-2). For the purpose of this report, the Glades Region Wastewater Service Area will be subdivided by service area. **Figure 2-1** presents the general location map including the location of the WWTFs. **Figures 2-2 and 2-3** show the site plans of Belle Glade and Pahokee WWTFs, respectively.

2.0 Background

The overall Glades Region Wastewater Service Area encompasses approximately 43.5 square miles (27,878 acres) in northwest Palm Beach County. As shown in **Figure 2-4**, there are three municipalities in the PBCWUD Glades Region Wastewater Service Area: the cities of Belle Glade, Pahokee and South Bay. Originally each city owned and operated its own WWTF within its own wastewater service area. Recently, however, the South Bay WWTF was replaced with a booster pump station that sends all wastewater within the South Bay service area to the Belle Glade WWTF. Consequently, the City of South Bay service area was incorporated into the Belle Glade wastewater service area, decreasing the number of service areas in the Glades Region to two. The Belle Glade and Pahokee wastewater service areas are shown in **Figure 2-5**.

PALM BEACH COUNTY FLORIDA

FIGURE 2-1
PAHOKEE AND BELLE GLADE WASTEWATER TREATMENT FACILITIES LOCATION MAP

Palm Beach County
Water Utilities Department
Glades Utility Authority

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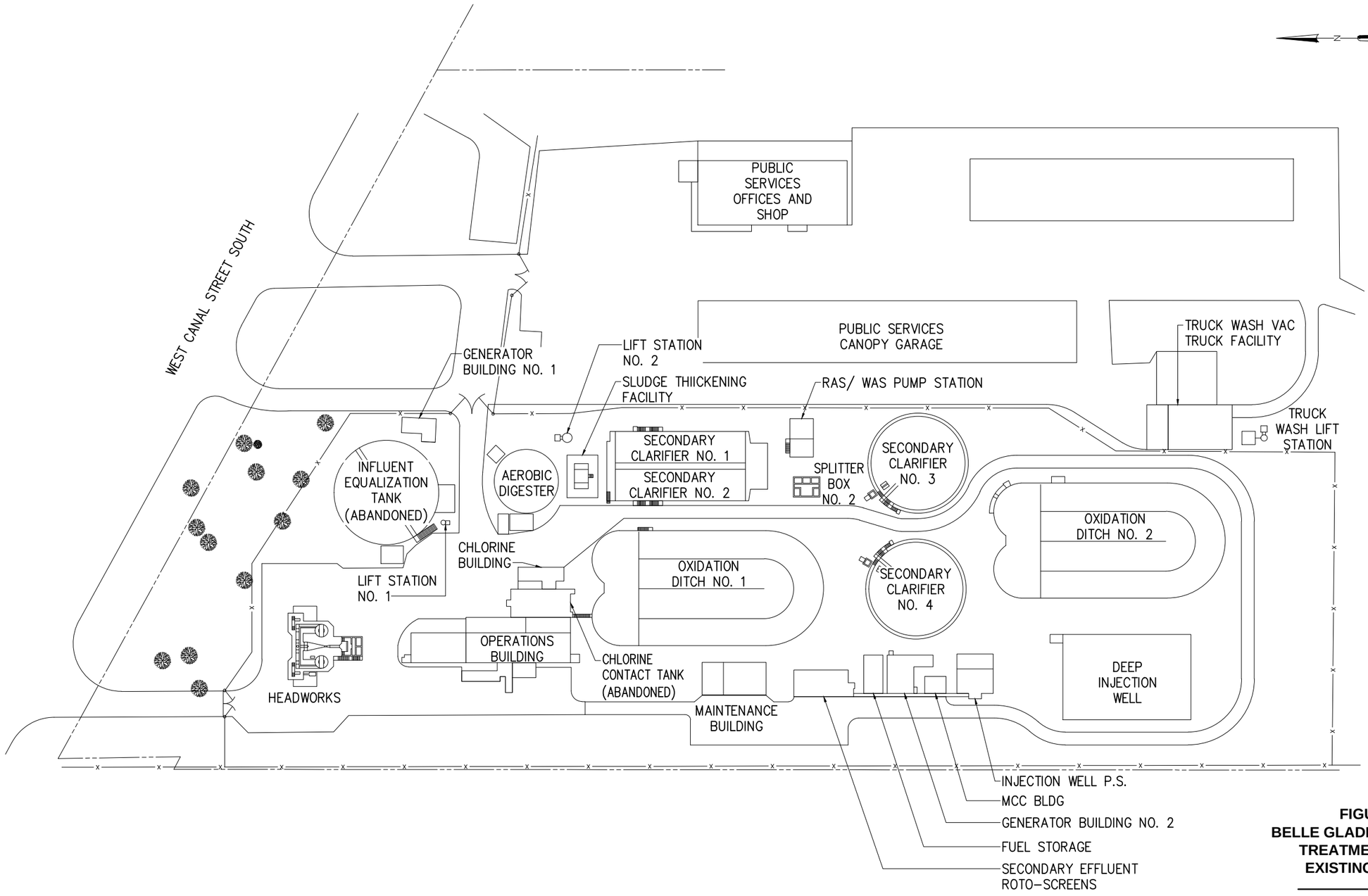

FIGURE 2-2
BELLE GLADE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

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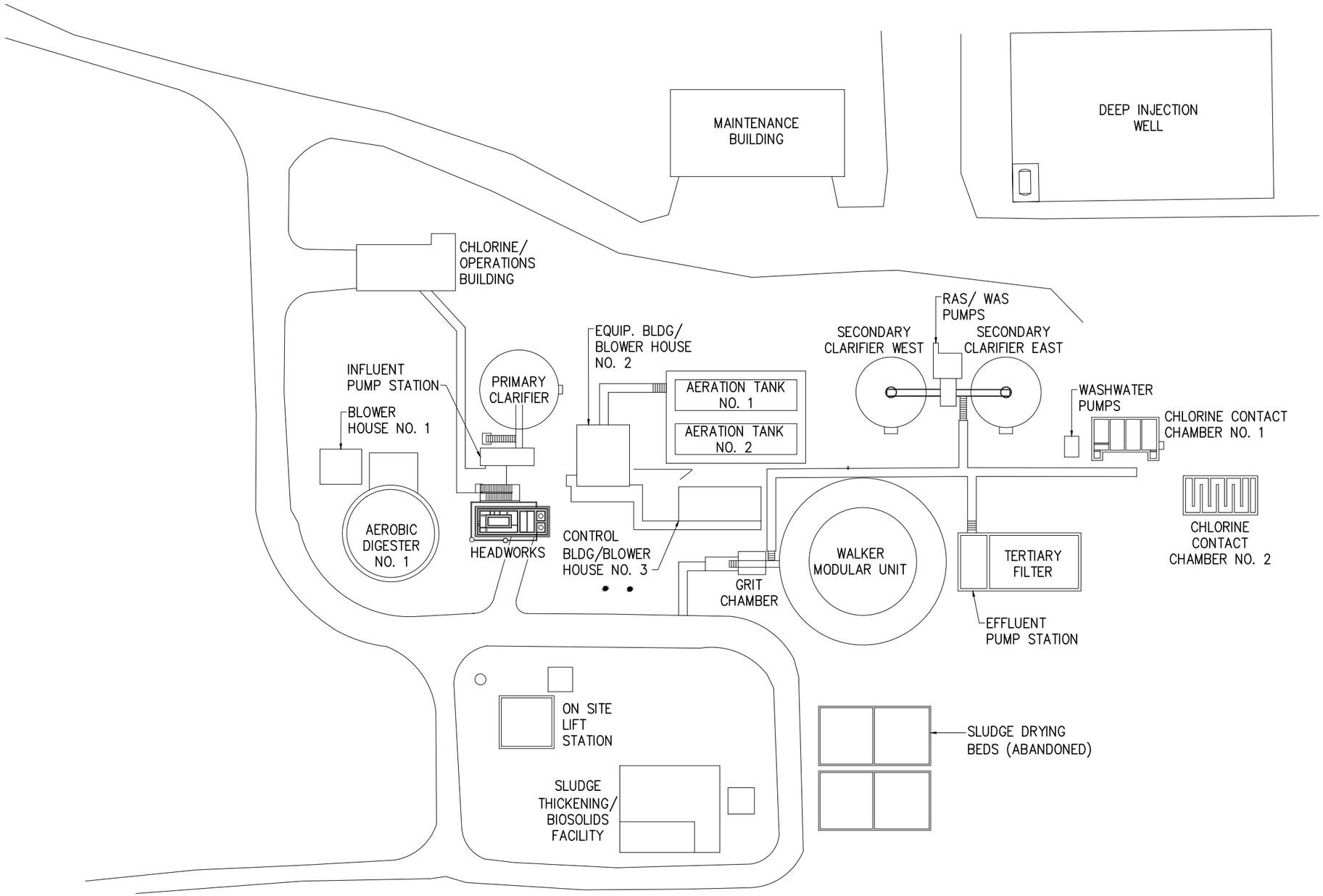

FIGURE 2-3
PAHOKEE WASTEWATER TREATMENT FACILITY EXISTING SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

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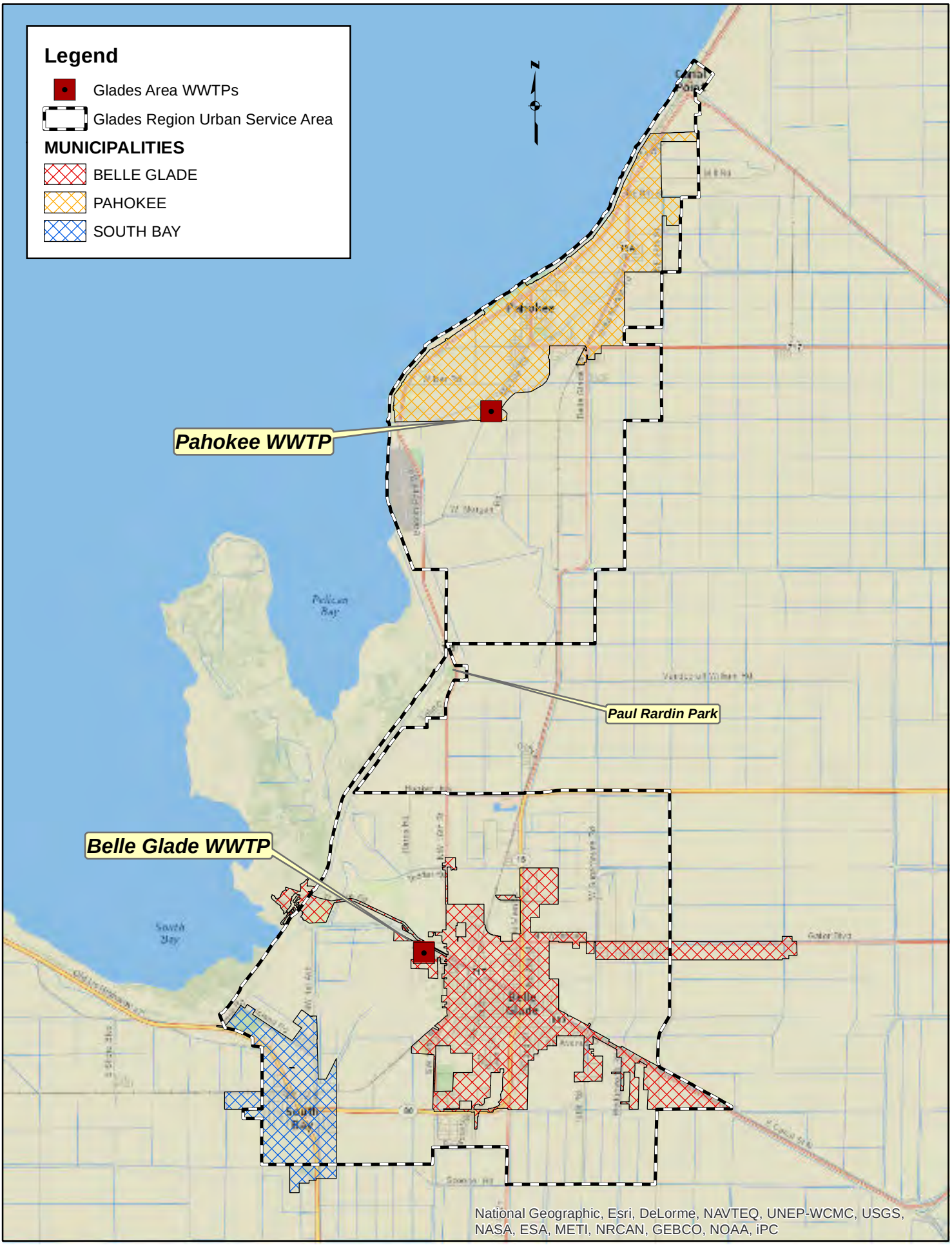

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Figure 1 - Glades Region Urban Service Area

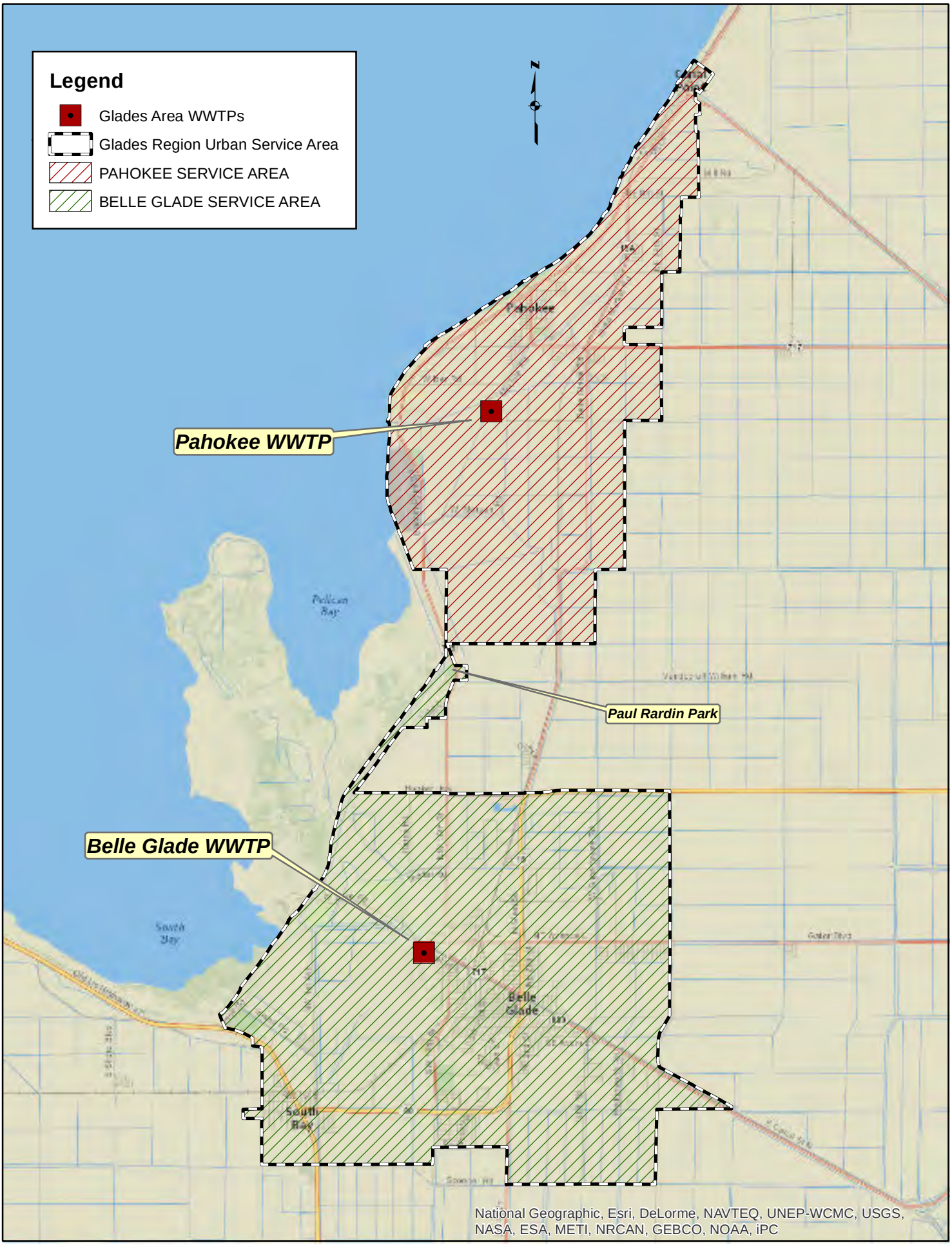

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Figure 2 - Glades Region Wastewater Service Sub-areas

2.1 Belle Glade WWTF

The Belle Glade WWTF is located on West Canal Street South in Belle Glade, Florida, just east of US-27 and south of State Road 80. The service area for this treatment facility is approximately 27 square miles (17,313 acres), extends from slightly north of Paul Rardin Park south to the G2 Canal. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Belle Glade WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Belle Glade). The treatment plant is permitted to operate with a capacity of 6.5 million gallon per day (MGD) maximum monthly average daily flow (MMADF) under Florida Department of Environmental Protection (FDEP) Permit No. FLA027740-008-DW1P that was issued on May 23, 2011 and expires May 22, 2016. A copy of this permit is included in **Appendix A** in TM-2. The Belle Glade WWTF is an oxidation ditch aeration type activated sludge wastewater treatment plant originally built in 1950 that consists of the following facilities:

- Two mechanically cleaned bar screens;
- Two grit forced vortex chambers with two cyclone/inclined screw classifier grit dewatering units;
- Two Carousel oxidation ditch basins with a downstream flow splitter;
- Two rectangular secondary clarifiers with a volume of approximately 373,000 gallons each and two circular secondary clarifiers with a volume of 822,000 gallons each;
- Four 0.1-inch roto-screens;
- One injection well pump station with a pumping capacity of 12.0 MGD when three pumps are online and one is a backup;
- One 20-inch, 10.2-MGD maximum daily flow Class I injection well;
- One 465,000 gallon aerobic digester;
- Two rotary drum thickeners with a polymer blend system;
- One 310 kilowatt (kW) and one 800 kW diesel engine auxiliary power generators;
- One 0.069-MGD maximum monthly average daily flow percolation pond.

2.2 Pahokee WWTF

The Pahokee WWTF is located on Rim Canal Road in Pahokee, Florida, east of Lake Okeechobee and north of State Road 80. The service area for this treatment facility is approximately 16.5 square miles (10,569 acres), extends from north of Paul Rardin Park to Canal Point and is comprised of several collection basins. Wastewater generated in this service

area is generally from residential with some commercial and non-categorical industrial contributors.

The Pahokee WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Pahokee). The treatment plant is permitted to operate with a capacity of 1.2-MGD three-month average daily flow (TMADF) under FDEP Permit No. FLA0136778-006-DW1P/NR that was issued on August 22, 2012 and expires August 21, 2017. A copy of this permit is included in Appendix A in TM-2. The Pahokee WWTF is an activated sludge treatment facility originally built in 1955 consisting of the following: a 0.50-MGD TMADF conventional activated sludge WWTF (Plant 1) and a 0.70-MGD TMADF complete mix Walker WWTF (Plant 2).

Major treatment components for Plant 1 include the following:

- One 53,000 gallon primary clarifier;
- Two 75,000 gallon aeration tanks with air requirements provided by two 750 cfm blowers;
- Two secondary clarifiers.

Major treatment components for Plant 2 consist of the following:

- One aerated grit removal system;
- One 123,000 gallon aeration basin with air requirements provided by two 1,500 cfm blowers;
- One 172,000 gallon clarifier.

Common treatment plant components consist of the following:

- One influent mechanical bar screen with a manually cleaned by-pass bar screen;
- One influent splitter box;
- Two chlorine contact tanks;
- One effluent pump station;
- Two emergency generators;
- One 675 pounds per hour dry solids BIOSET Class A stabilization unit comprised of one input hopper with primary motive mixer, one lime storage silo with feed assembly, one sulfamic acid hopper and feed assembly and one solids/lime/acid reactor;
- One 172,000 gallon aerobic digester with air requirements provided by one mechanical aerator;
- One supernate disposal bed;

- One 12.75-inch, 4.0-MGD monthly average daily flow Class I injection well;
- One 0.08-MGD annual average daily flow rapid infiltration basin.

2.3 Evaluation Approach

As part of the renewal and replacement improvements evaluation, a condition evaluation was performed on the equipment and structures at the WWTFs. Various tests were conducted to determine the integrity of the facilities. Vibration analysis, power circuit evaluation, thermographic inspection, lubrication analysis, alignment inspection and physical condition inspection were executed on all major process equipment and structures within the WWTFs. This report summarizes the findings of the evaluation in the following categories:

- Structural
- Mechanical
- Instrumentation
- Electrical
- Other

These findings will be used to establish the facility's current condition and to provide a baseline for the necessary WWTFs upgrades. Additionally, this report provides facility staff with information regarding the current condition of the WWTFs equipment and structures so that appropriate maintenance, repair, replacement or other action can be conducted.
Data for this report were collected as described below:

- Hazen and Sawyer on December 4, 2012, April 29, 2013 and May 16, 2013.
- Hillers Electrical Engineering, Inc. on February 31, 2013.
- Florida Bearing from April 29, 2013 to May 10, 2013.

Photographs from the site visits to the Belle Glade and Pahokee WWTF are included as an appendix in TM-2 along with the mechanical and electrical equipment at the Belle Glade and Pahokee WWTFs.

2.3.1 Structural Evaluation Techniques Utilized

Evaluation performed on the structures previously identified consisted of a visual inspection during normal operation of the facility. Exterior above grade areas of structures and accessible interior areas were observed, photographed, and documented. Interior conditions of the structures below the water line were not observed. The inspection of concrete elements was performed following the applicable guidelines in ACI 201.1R-08.

2.3.2 Mechanical and Instrumentation Evaluation Techniques Utilized

An independent sub-consultant, Florida Bearings, Inc. was retained to perform the mechanical equipment portion of the process equipment evaluation. The plant equipment condition evaluation concentrated only on the major plant equipment. As part of this evaluation, vibration analyses, oil analyses, and alignment evaluations were performed on equipment. The following section briefly summarizes each test performed. Further detail is provided in the Equipment Condition Evaluation Report by Florida Bearings, Inc., which is included as **Appendix B**.

Equipment Nameplate Information Acquisition

Equipment nameplate data was obtained to help determine if the equipment is operating under normal conditions. Horsepower, speed, bearings and other pertinent data were recorded and verified.

Following the equipment nameplate information acquisition, the following test techniques were used to determine the condition of each piece of equipment. Tests are as follows:

- Vibration Analysis
- Power Circuit Evaluation
- Thermographic Inspection
- Lubrication Analysis (Tribology)
- Alignment Inspection

The various testing procedures were used in conjunction with each other to best determine the overall equipment condition.

Vibration Analysis

The discreet frequency of the equipment vibration was recorded and plotted against the amplitude of velocity and displacement of the machine vibration.

Power Circuit Evaluation

Power circuit inspection measured voltage, current, and overall voltage drop across the control. The voltage drop was measured, when possible, from the incoming line side of the starter breaker to the outgoing leads to the motor. True electrical input horsepower and percent load were calculated.

Thermographic Inspection

Infrared radiation emitted from each machine was recorded and converted to a video thermographic signal to be monitored on the computer screen. The computer analyzes the various shades of colors and reports temperature as a variable directly proportional to intensity

of the color reflection.

Lubrication Analysis

The analytical techniques used for the lubrication analysis included plasma emission, spectroscopy, volumetric analysis by centrifuge, fuel dilution by flash point, viscosity by saybolt viscometer, pH and titration. Results were evaluated, taking into consideration the type and service of the individual machine.

Alignment Inspections

The alignment inspections measured and detected coupling misalignment and the alignments of the axis of rotation of each machine at the axial centerline of the coupling device.

2.3.3 Electrical Evaluation Techniques Utilized

Nameplate data were obtained by physical visual inspection of the nameplates attached to the individual components of each overall machine unit or/and by reviewing the operation and maintenance information obtained from the Owner.

Measured electrical values documented in the Equipment Status Sheets were obtained through the use of standard electrical power metering instruments. Voltage and current values were obtained for the machines while they were in operation. Other values, such as kW, kVA, kVAR, power factor, were measured and calculated. True electrical input horsepower and percent load were calculated to determine approximately what percent of the load the equipment is using.

In addition, devices and some machines were scanned thermographically. Infrared (IR) inspection was conducted using a thermographic camera as described in Section 4.2. The results of these infrared inspections, including descriptions of the units tested, thermal data and electrical data recorded at the time of the IR inspection, are included in the Thermographic Report section of the Florida Bearings, Inc. Reports and included in TM-2 (i.e., Thermography Inspection at the Belle Glade WWTF – May 4, 2013, and Thermography Inspection at the Pahokee WWTF – May 3, 2014).

2.4 Evaluation / Findings

Items evaluated and discussed in the report are: Headworks, Secondary Treatment (Oxidation Ditches, Clarifiers, Walker Unit), Sludge Handling, Splitter Boxes, Disposal Systems, Chlorine Facilities and other miscellaneous buildings and equipment around the sites. Additionally, equipment lists have been included in TM-2 for the Belle Glade and Pahokee WWTFs. The following sections provide a brief description of each building / treatment unit followed by its condition. Additionally, as mentioned previously, this report summarizes the evaluation and findings by category (i.e., structural, mechanical, instrumentation, electrical, and other as appropriate).

2.4.1 Belle Glade WWTF

Visual inspection identified the following:

- Headworks: The facility consists of a two level reinforced concrete structure above grade. Level one is on grade, open (no walls), and serves to house two grit classifiers. The second level consists of multiple channels supported on columns and covered with aluminum grating. Access to the top level is via reinforced concrete stairs. The effluent box is located at the south side of the structure and is the full height of the structure. The top level also contains the following unit processes: two mechanical self-cleaning fine bar screens, two vortex grit tanks, two grit pumps, two air compressors (for the vortex grit removal system) and four slide gates. Level one contains two grit classifiers which receive grit from the grit pumps.

  Structural – The underside of upper level channels appear in good condition except for a leak under the influent parshall flume and several cracks at the cantilevered concrete walkway which appear to have been caused by shrinkage cracks. The access stair to the upper level has cracked at the intermediate landing apparently due to settlement of the bottom landing. Several cracks with evidence of leakage or past repairs are visible on the outside of the effluent box. Cracks are also visible on the bottom floor slab around columns. Exterior coating has deteriorated in some locations, particularly at the columns.

  The top level of the structure has suffered deterioration with some areas showing concrete aggregate due to erosion and corrosion near the splash zone of the effluent box, and map cracking near the parshall flume. Interior wall surfaces appear to be in good conditions, however the coating has failed in some areas, including at the joint with the partial flume. Several aluminum grating sections are loose. Concrete surfaces below the water line were not observed as the facility was in normal operation.

  Based on the findings above, it is recommended to coat the interior channel surfaces and other upper level surfaces exposed to wastewater gases to prevent further deterioration, replace the access stair with an aluminum stair, replace the parshall flume and repair the leak under the parshall flume, repair any other leak at the effluent box, and re-paint the entire exterior of the structure. It is also recommended that the concrete behind the flume be inspected when the parshall flume is removed for replacement to determine if additional repairs are required. Cracks on the ground level slab need not be repaired as they appear to be narrow and are likely re-entrant corner cracks. Spider cracking at the upper level slab can be repaired by removing unsound concrete and replacing with a thin cementitious patching material.

  Mechanical – The mechanical bar screens were rebuilt within the last three years and therefore are in good condition. However, wastewater treatment plant staff have expressed their concerns associated with the amount of captured screening material that is carried over the Aqua Guard mechanical bar screen to the downstream side of the screenings

channel due to the installed screening units' inefficient cleaning mechanism. To address this inefficiency, Parkson Corporation (the manufacturer of the Aqua Guard), can provide upgrades to existing Aqua Guard units to improve the cleaning mechanism and reduce the amount of screened material carryover. Additionally, the existing screens are equipped with 6-mm elements. To improve the capture rate of the screening media within the channel, the existing screens can be fitted with 3-mm elements similar to what was implemented at the PBCWUD Southern Region Water Reclamation Facility.

The bar screen channels can be isolated by four slide gates which are in fair condition, except for the metal frames. It is recommended that these slide gates be replaced within the next several years to ensure that the channels can be isolated and that no leaks are present. The existing grit system is functional and in good condition. There are no recommendations for the grit system at this time. Lastly, the control of odorous emissions from wastewater collection and treatment facilities may increase in importance over the next several years as buffer zones between the facility and residential areas decreases. It is recommended that the grit tanks and containers, areas in which hydrogen sulfide odors from the influent sewage and screenings are emitted, should be contained and treated prior to discharge to the atmosphere. It is also recommended that a bypass around the headworks structure be installed to allow the raw wastewater to proceed through the rest of the plant in case of an emergency or extended repair to the headworks structure.

The following recommendations are per H&S inspections and the Florida Bearings report:

1. Pista Grit No. 1 Gearbox: Abrasives are at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

2. Pista Grit No. 1 Air Compressor: High compressor vane passing frequencies are present indicating excessive clearances are present. It is recommended that the compressor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

3. Pista Grit No. 2 Gearbox: Abrasives are at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

4. Electrical – There is a 7.0 degree temperature difference between legs in the fuse for Grit Classifier No. 1, MCC1. It is recommended that the fuse be inspected and replaced if necessary.

- Oxidation Ditch No. 1: Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Tank dimensions are approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the east and north. A structural evaluation by AECOM from March 2011 indicates

that this structure was built in 1985 and modified in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

Structural – Multiple cracks are present all around the exterior of the structure. Cracks on the straight walls are vertical and are approximately evenly spaced. This type of cracking is typical of shrinkage cracking and, although unsightly, does not typically indicate an inherent structural integrity problem. Some vertical cracks have evidence of leakage.

Diagonal cracks were observed towards the north end of the structure, with some evidence of leakage. Diagonal cracks are typically indicative of an underlying structural condition which most likely is differential settlement or differential deflection between structural members.

Interior surfaces of the walls were not inspected as the tank was in normal operation. The water level in the tank was observed to be very close to the top of the wall. A report from AECOM from March 2011 indicates that during a plant expansion in 2000 when Oxidation Ditch No. 2 was built and hydraulically connected to Oxidation Ditch No. 1, water level in Oxidation Ditch No. 1 was raised, thus increasing the loading on the exterior walls. Plant staff indicates that there is a risk of water from inside the tank spilling and splashing on windy days. Circular walls on the north end were raised during the plant expansion of 2000 and a top slab was added which also increased the wall loading.

Based on the observations presented above and the AECOM 2011 report, it is recommended to repair all vertical cracks on the exterior wall surfaces with a flexible hydrophilic grout that will allow slight movement of the cracks without future leakage. Repair of diagonal cracks will likely be more involved. It is recommended to perform a more detailed evaluation of the condition of the structure by reviewing the record drawings and performing a limited geotechnical investigation to try to determine the causes of the diagonal cracks and develop a long term solution. Soil improvement, structural strengthening, or a combination of both may be required. Increase in the wall height of the tank to prevent spills and splashing is not recommended until a more detailed evaluation is performed to determine feasibility. Without strengthening of the structure, an increase to the wall height should not be done. A temporary partial solution that may reduce splashing is to install meshed panels that capture splashes, but allow raising water to pass through which will not increase the hydraulic loading on the tank walls.

Once all cracks are repaired, the entire structure should be re-painted.

Mechanical – The aerators were found to be in good condition. However, the flow split between Oxidation Ditch No. 1 and Oxidation Ditch No. 2 is unknown. It is recommended that flow meters be installed on the influent piping to Oxidation Ditch Nos. 1 and 2 and that automatic control gates be installed to help control the flow split. It is also recommended that a drain be installed to facilitate emptying the tank. In the interim, to more fully inspect the oxidation ditch, it is recommended that the tank be drained and that any grit be removed.

The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report:

1. Ditch No. 1, Aerator No. 2 Gearbox: Antimony is at higher than usual level which could result from Babbitt bearings with antimony and/or a lube supplement. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

2. Electrical: There is an 8.4 degree temperature difference between legs in the breaker for the Oxidation Ditch No. 1, Aerator No. 1 MCC3. It is recommended that the connections be inspected and amp readings be checked.

- Oxidation Ditch No. 2: Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Tank dimensions are approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the north-east. Oxidation Ditch No. 2 is newer than Oxidation Ditch No. 1, and is approximately 18 inches higher than Oxidation Ditch No. 1. A structural evaluation by AECOM from March 2011 indicates that this structure was built in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

  Structural – Multiple vertical cracks are present all around the exterior of the structure on both the straight walls and the circular walls. Some cracks have evidence of leakage. This type of cracking is typical of shrinkage cracking and does not typically indicate an inherent structural integrity problem. Several concrete spalls were observed on the east wall towards the north end. The top slab over the north end of the tank appears to be separating from the exterior walls. Interior surfaces of the walls were not observed as the tank was in normal operation.

  Based on the findings presented above, it is recommended to repair all vertical cracks on the exterior wall surfaces with a flexible hydrophilic grout that will allow slight movement of the cracks without future leakage. Spalled concrete may be repaired with a specialized cementitious repair mortar after the unsound concrete is completely removed.

  A more detailed structural evaluation is recommended around the north end of the tank to determine the cause of the separation of the top slab from the exterior wall. The gap between the slab and wall, and the difference in the top elevation may be an underlying structural issue or simply a construction deficiency.

  Once all cracks are repaired, the entire structure should be re-painted.

  Mechanical – The aerators were found to be in good condition. However, as mentioned previously, the flow split between Oxidation Ditch No. 1 and Oxidation Ditch No. 2 is unknown. It is recommended that flow meters be installed on the influent piping to the Oxidation Ditch Nos. 1 and 2 and that automatic control gates be installed. Additionally, in

order to more fully inspect the oxidation ditch, it is recommended that the tank be drained to allow for a thorough inspection and that any grit be removed. The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report:

1. Ditch No. 2, Aerator No. 1 Gearbox: Antimony, titanium and other metals were identified at higher than usual levels. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

2. Ditch No. 2, Aerator No. 2 Gearbox: Nickel is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

- Splitter Box No. 2: Structure consists of a rectangular reinforced concrete tank covered with aluminum grating accessible via reinforced concrete stairs and serves to split flow to the secondary clarifiers. Flow to each clarifier structure is controlled by three slide gates installed in the Splitter Box No. 2 structure.

  Structural – The Splitter Box No. 2 is in overall good condition and does not require structural repairs. However, the top surface does not have a kick plate around the perimeter along the guardrails. It is recommended to add a kick plate on the perimeter of the walking area.

  Mechanical – The slide gates are in good condition. There are no recommendations at this time.

- Secondary Clarifier Nos. 1 and 2: This structure consists of a rectangular reinforced concrete tank partially below grade. A center wall separates Clarifier No. 1 from Clarifier No. 2. One steel trussed walkway spans the structure in the short direction and is accessible from grade via aluminum stairs. The south end of the structure contains the pipe gallery which is below grade and covered with a reinforced concrete slab. The pipe gallery is accessible by a hatch on the top concrete slab and reinforced concrete stairs. Two rectangular reinforced concrete scum boxes (one for each clarifier) are located at the south end and connected to the main structure with a short section of ductile iron pipe. The 373,000-gallon (each) rectangular secondary clarifiers include overflow weirs, scum skimming, removal troughs and two scum pumps. The two drive mechanisms are supported on the respective exterior and center walls.

  Structural – Clarifier Nos. 1 and 2 are currently not in service but provide extra capacity to the plant during peak flow conditions. Several cracks with leakage evidence are visible on the east wall. Cracks are also visible on the cantilevered channel at the north end of the structure. The connection between the main basins and the scum boxes shows evidence of leakage even though prior repairs are evident. The steel trussed structure for the walkway bridge has minimal signs of corrosion and the coating has failed. Plant staff has indicated that the structure and mechanisms are difficult to clean due to the lack of drains and sumps.

It is recommended to repair all cracks with a hydrophilic grout and paint the steel trussed walkway bridge. Exterior wall surfaces should also be painted. The connection between the main basins and the adjacent scum boxes should be modified to a more watertight condition such as with a channel instead of a connecting pipe. For ease of clean-up, the County may consider adding sumps at one end of the structure but this will require partial demolition of the foundation slab to form the sumps.

The pipe gallery at the south end is in overall good condition; however there is evidence of flooding. It is recommended to replace the access hatch with a watertight hatch to prevent future flooding. The interior wall surfaces should be re-painted.

Mechanical – The mechanical equipment is in adequate condition for the extent that these clarifiers are utilized (i.e., backup during wet weather flow). If these clarifiers remain in service, it is recommended that a flow meter be installed on the influent piping to these clarifiers.

Miscellaneous – It should be mentioned that these clarifiers are difficult to maintain, operate and clean. If the WWTF expanded its treatment capacity in the future, it is recommended that this tank be demolished to make room for an additional circular clarifier. This would negate all recommendations mentioned previously for this structure.

- Secondary Clarifier No. 3: This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – Overall condition of the clarifier is good. There is minor evidence of concrete spalls at the perimeter walkway where guardrail posts are embedded in the concrete walkway. The steel bridge appears to be in good condition but the protective coating is deteriorating.

  Based on the above observations, it is recommended to paint the steel walkway bridge and repair the concrete spalls at the guardrail posts. Concrete spall repairs may require modification of the post embedment to a base plate installation because the posts appear to be installed very close to the walkway edge and differences in thermal conductivity between aluminum and concrete can cause the aluminum to expand differently than the concrete and crack the concrete edge.

  Once all repairs to the concrete are completed, the entire structure should be re-painted.

  Mechanical – The secondary clarifier visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. However, the flow

split between Clarifier Nos. 3 and is unknown. It is recommended that flow meters be installed on the influent piping to Clarifier Nos. 3 and 4. Additionally, in order to more fully inspect the clarifier, it is recommended that the tank be drained to allow for a thorough inspection of the mechanism, arms and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report:

1. Clarifier No. 3 Lower Gearbox: Continue to observe the trend and monitor equipment and fluid conditions as gear and/or bearing metal is at a moderate level.

2. Clarifier No. 3 Upper Gearbox: Water is at a severe level in the gearbox, bushing / thrust metal is at a moderate level and gear and/or bearing metal is at a minor level. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant be changed.

- Secondary Clarifier No. 4: This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – Overall condition of the clarifier is good. The steel bridge appears to be in good condition but the protective coating is deteriorating.

  Based on the above observations, it is recommended to paint the steel walkway bridge, and re-paint the entire concrete structure.

  Mechanical – The secondary clarifier visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. However, the flow split between Clarifier Nos. 3 and 4 is unknown. It is recommended that flow meters be installed on the influent piping to Clarifier Nos. 3 and 4. Additionally, in order to more fully inspect the clarifier, it is recommended that the tank be drained to allow for a thorough inspection of the mechanism, arms and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendations are per the Florida Bearings, Inc. Report. In Clarifier No. 4 Upper Gearbox, water is at a severe level in the gearbox, bushing / thrust metal is at a severe level and gear and/or bearing metal is at a moderate level. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination, that the lubricant be changed, that the unit be inspected for excessive bushing / thrust wear and that an analytical ferrogram be performed to clarify the type of wear and/or contamination that is present.

- Secondary Effluent Roto-Screens: This structure consists of a pre-engineered steel open building with metal roof panels on steel purlins. Foundation for the steel structure is a

reinforced concrete slab on grade. Screen equipment is placed on reinforced concrete channels on grade. The four self-cleaning 0.1-inch Roto-Screens remove any remaining solids from the wastewater before it is pumped down the deep injection well.

Structural – The concrete structure of the Roto Screens Facility is in overall good condition and does not require structural repairs. The metal framed structure covering the screens shows evidence of corrosion at the bases of columns and some of the roof members such as the purlins, metal roofing panels and cross-bracing rods.

Based on the findings detailed above, it is recommended to rehabilitate the entire metal structure including repairs to column bases, replacement of roof purlins, and replacement of roof panels. Once all repairs are complete, the entire metal structure should be painted to prevent further corrosion. As per plant staff, it is also recommended to paint the concrete floor around the dumpsters with an epoxy coating to facilitate clean-up and prevent deterioration of concrete from spills and splashes.

Mechanical – The Roto-Screens are in good condition. However, during periods of high flow (i.e., rainfall events) and/or if maintenance is required on one of the units, a hydraulic constraint occurs. It is recommended that a bypass line be installed to provide a means of removing the hydraulic constraint during these situations. The installation of this bypass line would also require some optimization of the bar screens (in the Headworks) to achieve higher screenings capture rates. As the rotary drum screens approach the end of their useful life, an alternative means of screening the secondary effluent prior to the deep well injection (and to remove the hydraulic constraint that currently exists upstream of the rotary drum screens) is to replace the rotary drum screens with an inline automatic self-cleaning strainer in the discharge header of the deep injection well pump station. This alternative should only be considered; however, if the deep injection well high pressure condition is resolved so that the strainer installed on the discharge side of the effluent pump station would not add to the already higher than desired pressure condition of the deep well. Additionally, the metal frames on the Roto-Screen effluent wet well slide gate and isolation gate are in poor condition and should be replaced. The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report:

1. Roto-Screen No. 1 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

2. Roto-Screen No. 2 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

3. Roto-Screen No. 3 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

4. Roto-Screen No. 4 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed. Additionally, water is at a severe level. It is

recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination.

- Injection Well Pump Station: The structure for the injection well pump station consists of a reinforced concrete wet well below grade with a concrete cover, and an adjacent reinforced concrete slab on grade. The Injection well pumps are placed over the wet well on the concrete cover, and the slab on grade supports piping and valves. The injection well pump station has a pumping capacity of 12.0 MGD with three duty pumps and one standby pump.

  Structural – Overall condition of the visible areas of the structure is good and does not require structural repairs. The interior condition of the wet well was not accessible and was not observed.

  Mechanical – The pumps have been recently replaced / repaired and are in good condition. The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report:

  1. Pump No. 1: Copper is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions. For the Pump No. 1, it is also recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

  2. Pump No. 2: Direct Reading Ferrography is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

  3. Pump No. 4: Direct Reading Ferrography is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions. For the Pump No. 4, it is also recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

- Deep Injection Well: The injection well system consists of one deep injection well and an associated monitor well.

  Structural – Concrete slab on grade at the deep injection well is in overall good condition and does not require structural repairs.

  Mechanical – Overall the injection well is in poor condition. It is recommended that the well be acidized to recover lost capacity and also that the injection well be rerated from its current permitted 8 ft/s up to 10 ft/s. This would provide an additional 2.54 mgd of disposal capacity. It is also recommended that the Deep Injection Well flow meter be replaced with a new magnetic flow meter.

Electrical – The following recommendations are per the Florida Bearings, Inc. Report. For Injection Well Pump No. 2, there is a 31.8 degree temperature difference between legs in the breaker, a 12.3 degree temperature difference between legs in the starter and a 7.8 degree temperature difference between fuses. It is recommended that the breaker / starter connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.

Instrumentation – Replacement parts for the existing PLC system are unavailable. It is recommended that the Injection Well PLC be replaced.

- RAS / WAS Pump Station: This structure consists of a rectangular reinforced concrete tank covered with a reinforced concrete slab accessible via reinforced concrete stairs. The outdoor pipe gallery is supported on a reinforced concrete slab covered with an open steel framed structure. Three return activated sludge (RAS) pumps and two waste activated sludge (WAS) pumps collect settled sludge in the secondary clarifiers and return it to the oxidation ditches or waste to the Sludge Thickening Facility, respectively.

  Structural – The RAS / WAS Pump Station concrete structure is in overall good condition. No cracks or leaks were observed. The metal framed structure at the west housing the pumps has deteriorated paint and minor corrosion. Asbestos was found on some of the roof elements.

  Based on the observations above, it is recommended to rehabilitate the metal framing structure and remove all asbestos containing elements.

  Mechanical – The pumps are in good condition. However, it is recommended that the RAS flow meter be replaced with a new magnetic flow meter. The following recommendations are per H&S inspections and the Florida Bearings, Inc. Report:

  1. RAS Pump No. 3 Gearbox: Water is at a severe level in the. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant is changed.
  2. WAS Pump No. 1: There is internal looseness (excessive clearances) present on the pump. It is recommended that the pump bearings be inspected for the proper fit on the shaft and within the housings. Repair and replace as necessary.

  Electrical – The following recommendations are per H&S inspections and the Florida Bearings, Inc. Report:

  1. RAS No. 1, MCC1 has a 17.3 degree temperature difference between legs in the breaker and a 5.4 degree temperature difference between fuses. It is recommended that the breaker connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.

2. WAS No. 1, MCC1 has a 12.8 degree temperature difference between legs in the starter and a 50.2 degree temperature difference between connections on the load reactor. It is recommended that the breaker and load reactor connections be inspected and amp readings be checked.

3. RAS No. 3, MCC2 has a 4.3 degree temperature difference between legs in the starter and a 5.4 degree temperature difference between fuses. It is recommended that the breaker connections be inspected and amp readings be checked.

4. WAS No. 2, MCC2 has a 25.5 degree temperature difference between legs in the starter and a 143.8 degree temperature difference between fuses. It is recommended that the breaker connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.

- Chlorine Building: Facility consists of a one-level steel framed structure supported on a reinforced concrete slab on grade. FRP wall and roof panels partially cover the storage tanks. The chlorine equipment consists of two covered crosslink polyethylene chemical storage tanks storing 12 percent sodium hypochlorite solution, three diaphragm metering pumps and one sodium hypochlorite batching pump. Chlorine is diluted to 9 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the well is out of service or they have a peak flow conditions that exceeds the well capacity, sodium hypochlorite is injected into Clarifier No. 3 so that the secondary effluent can be discharged to the percolation ponds.

  Structural – Structure is in overall good condition with minimal paint deterioration and FRP panel deterioration. Replacement of the wall and roof panels is not necessary at the present time but should be considered in the long term due to their natural deterioration with extended exposure to UV. As per plant staff, to protect the concrete floor surface from potential chlorine spills, it is recommended to coat the floor with an epoxy coating.

  Mechanical – Overall the mechanical equipment is in good condition. There are no recommendations at this time.

- Sludge Thickening Facility: Structure consists of an open steel frame with metal roof panels supported on a reinforced concrete slab on grade. Thickening is employed to reduce the sludge prior to the aerobic digestion process. Two rotary drum thickeners located at the Sludge Thickening Facility thicken the WAS prior to digestion. The Sludge Thickening Facility also contains two thickened sludge pumps.

  Structural – The metal framed structure covering the thickening equipment has corrosion with widespread coating failure. It is recommended to rehabilitate the entire metal framing structural members and replace roof panels as required. Once repairs are complete, the entire structure should be painted.

Mechanical – The rotary drum thickeners, which were repaired recently, and the sludge pumps are in fair condition. However, the rotary drum thickeners have been repaired several times prior to this as well and are close to the end of their useful life. It is recommended that the rotary drum thickeners be replaced and that alternative thickening technologies, including Gravity Belt Thickeners, be considered.

- Aerobic Digester: Structure consists of a circular reinforced concrete tank with several steel walkways on the top accessible via one aluminum stair structure. Adjacent to the tank is an open steel framed structure housing two blowers. This facility utilizes aerobic digestion for sludge stabilization. The major components of the digester system are the 465,000-gallon circular concrete tank, two blowers and one truck loading pump.

  Structural – Several cracks with evidence of leaks can be observed. One horizontal crack at approximately one-third of the wall height extends all around the perimeter of the tank. Several other smaller cracks can be seen around pipe penetrations. The walkway bridges and access stairs are in good condition.

  Based on the findings mentioned above, it is recommended to perform a more detailed structural evaluation of the tank to determine if the horizontal crack is indicative of a structural insufficiency or a construction deficiency. A horizontal crack of this nature may indicate there is insufficient ring steel reinforcement, or a faulty construction joint. The interior of the tank should be inspected at this time.

  Cracks and leaks around pipe penetrations may indicate faulty construction around these areas where concrete may have been placed without sufficient consolidation. It is recommended to repair these areas with hydrophilic crack injection materials.

  Once all concrete repairs are complete, the entire concrete structure should be re-painted, including the floor at the blower slab.

  Mechanical – The mechanical equipment is in good condition. However, in order to ensure the Aerobic Digester does not exceed a maximum level, it is recommended that an overflow be constructed for the tank. Additionally, the following recommendation is per the Florida Bearings, Inc. Report. For Blower No. 2, it is recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

- Influent Equalization (EQ) Tank: Structure consists of a circular reinforced concrete tank. A steel bridge spans the tank completely and is accessible from grade via steel stairs. This structure has been abandoned and is no longer in use.

  Structural – Several cracks were observed on the exterior wall surface, with one horizontal crack of particular significance at the top of the wall towards the south. This crack is long and there is evidence of corrosion of reinforcing steel within the wall. The exterior surface

of the concrete walls appears to be in good condition; however the protective coating has failed.

The interior steel bridge and access stair appear to be in good condition but their protective coating has failed. The FRP grating at the bridge is deteriorated. Parts of the guardrail are damaged. The bridge walkway lacks OSHA required toe boards.

If the County wishes to keep the tank in case of a peak condition where additional water storage is required or to serve as an alternative treatment process tank, it is recommended to repair the exterior cracks with a hydrophilic grout. The long horizontal crack will likely require removal of unsound concrete, replacement of reinforcing steel, and placement of a cementitious repair mortar. Steel bridge and stairs should be painted, FRP grating replaced, and guardrails repaired. Toe boards should be added to all horizontal walking surfaces of the bridge. Finally, the entire concrete structure should be re-painted.

Mechanical – This tank does not have any mechanical equipment. There are no recommendations at this time.

Miscellaneous – It should be mentioned that this abandoned tank could be converted to an additional clarifier or aerobic digester depending on the future needs of the WWTF or as identified in the technical memorandum regarding plant optimization.

- MCC Building: Facility consists of a one story reinforced concrete and masonry building with a flat roof supporting AC equipment.

  Structural – The MCC Building is in overall good condition and does not require structural repairs.

  Mechanical – This cooling of this building is critical for the electrical equipment housed inside. It is recommended that two air handlers be replaced.

- Operations Building: This structure consists of a two story reinforced concrete and masonry building with a tiled hip roof. Access to the building is via a concrete ramp and concrete stairs on the west side. The adjacent old Influent Structure to the north and old Chlorine Contact Tanks to the east have been abandoned, filled with sand and covered with a thin concrete slab to serve as a deck. The abandoned Influent Structure at the north end of the Operations Building has a basement level which has been cleared of all equipment.

  Structural – The new operations building is in overall good condition, however, plant staff report some roof leaks. The access ramp at the west side has cracked at the location of a support post for a walkway roof.

  Concrete decks over the abandoned influent structure and chlorine contact basin have cracked on the top surface and at the interface with the old structure. Several cracks and spalls are visible on the walls of the abandoned structures with evidence of moisture

seepage. An effluent box of the old chlorine contact basin is used as a planting area for a tree but roots of the tree have cracked the concrete. Exterior paint of the old structures has failed. The basement level of the old influent structure has been stripped of all equipment but is very humid, possibly due to groundwater intrusion.

Based on the above findings, it is recommended to replace the roofing of the new operations building. A thorough inspection of the roof structure should be performed to determine the condition and evaluate if replacement is necessary. The crack at the access ramp should be repaired, and support of the roof post should be replaced with a different type to avoid further cracking. Top surfaces of concrete decks over abandoned structures should be sealed to prevent rainwater intrusion to fill below; this activity, however, is not a priority as this structure should eventually be demolished. All wall cracks and spalls at the abandoned structures should be repaired, and the entire structure should be re-painted. Trees and plants placed inside abandoned structures should be either removed or relocated to prevent future cracking by roots, and the cracked box should be demolished.

Mechanical – The air conditioning units have reached the end of their useful life. It is recommended that five air handlers be replaced.

Miscellaneous – Storage is inadequate in the break room. It is recommended that cabinets be upgraded.

- Maintenance Building: Facility consists of a one story reinforced concrete and masonry building with a tiled hip roof.

  Structural – The maintenance building is in overall good condition, however plant staff report roof leaks. It is recommended to replace the roofing and inspect the roof structure to determine if it also requires replacement.

  Mechanical – This tank does not have any functional mechanical equipment. There are no recommendations at this time.

- On–site Lift Station No. 1: Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two 5-Hp submersible pumps.

  Structural – The wet well is in poor condition. The 6-foot diameter wet well liner is failing. It has delaminated from the concrete walls in several places and has exposed the concrete. Most of the delaminating occurs around the pipe penetration into the wet well. There were no signs of soft concrete or exposed steel inside the wet well. The lifting eyes in the top slab are exposed and are rusted. The valve vault is concrete and does not have any coating and is in fair condition.

  Based on the above findings, it is recommended to replace the entire interior liner of the wet well, and coat the exposed lifting eyes at the top slab.

Mechanical – The pumps appear to be in fair condition. The lift station has eight separate influent lines ranging in size from 2-inches up to 8-inches and their inverts range from 4 to 6 feet below grade. The discharge piping and valves are 6-inches in diameter and are significantly corroded. There is little to no protective coating or paint on the piping and valves. The isolation valves are plug valves and the check valves are spring cushioned swing checks. The spring systems are rusted or missing and not working on both check valves. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault does not drain into the wet well or is not equipped with a drain as it holds water.

- On–site Lift Station No. 2: Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two Flygt submersible pumps.

  Structural – The wet well is in fair condition. The 6-foot diameter wet well liner/coating is failing. There is exposed concrete in several places. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition, there are a few cracks in the top slab and evidence of differential settlement between the wet well top slab and the surrounding slab on grade. The valve vault has a coating and is in good condition.

  Based on the findings above, it is recommended to replace the entire interior liner of the wet well.

  Mechanical – The pumps were not visible so the condition could not be determined. The lift station has several separate influent lines ranging in size from 2 inches up to 6 inches. The discharge piping and valves are 4 inches in diameter and have some rust inside the wet well. There is a protective coating or paint on the piping and valves in the valve box and they appear to be in good condition with very little rust, mainly around the pump out connection. The isolation valves are plug valves and the check valves are leaver and weight swing checks. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault is equipped with a drain to the wet well.

- Generator Building No. 1: Building consists of a one story reinforced concrete and masonry building with a flat roof over half of the building fully enclosing the generator. Approximately half of the building is open on the top at the location of the fuel tank.

  Structural – The Generator Building No. 1 is in overall good condition; however, plant staff report roof leaks. It is recommended to replace the roofing.

  Mechanical – This building does not have any mechanical equipment. There are no recommendations at this time.

- Generator Building No. 2: Structure consists of a one-story reinforced concrete and masonry building with a tiled hip roof

Structural – The building is in overall good condition; however, plant staff report roof leaks. It is recommended to replace the roofing and perform a thorough inspection of the roof structure to determine if replacement is necessary.

Mechanical – This building does not have any mechanical equipment. There are no recommendations at this time.

Electrical – The following recommendations are per H&S inspections and the Florida Bearings, Inc. Report. For the 300-kW generator MCC3, there is an 8.7 degree temperature difference between legs in the breaker. It is recommended that the breaker connections be inspected and that amp readings be checked.

- Polymer Storage Building: Structure consists of a one-story reinforced concrete and masonry building with a flat roof. Adjacent to the building is an uncovered concrete pad for temporary storage of polymer totes. The Polymer Storage Building also contains a polymer system with two polymer totes, one feeder outside storage for the polymer totes.

  Structural – The building is in overall good condition. To protect the concrete floor, it is recommended to coat the building floor and exterior pad with an epoxy coating.

  Mechanical – The polymer system is inefficient and many parts / components do not function. It is recommended that two new polymer feeders be installed. Additionally, the polymer storage totes are stored outside on a slab. It is recommended that these totes be protected from exposure to the sun.

  Electrical – The following recommendations are per H&S inspections and the Florida Bearings, Inc. Report. For the 300-kW generator MCC3, there is an 8.7 degree temperature difference between legs in the breaker. It is recommended that the breaker connections be inspected and that amp readings be checked.

- Electrical System: The electrical distribution system at the Belle Glade WWTF consists of two utility FPL services. Utility Service No. 1 is located in the north-east corner of the plant and is connected to a 750kVA FPL transformer. The 750kVA FPL transformer is located in the existing FPL vault. The step-down transformer is connected to the main switchboard (MSB-1) located in Generator Building No. 1. MSB-1 consists of one 800A rated main breaker, one 600A rated generator breaker, one 800A rated automatic transfer switch (ATS), and other feeder breakers. The main breaker and emergency breakers are electrically interlocked through an ATS control scheme to prevent from closing both breakers at the same time. MSB-1 provides power to Digester Blower No.1, Digester Blower No. 2, Oxidation Ditch No. 1 Aerator No. 1, Oxidation Ditch No. 1 Aerator No. 2, Chlorine Building and the Polymer Building. MSB-1 and the starters for the aerators were installed in 1982. This equipment is past its reliable life span (-11 to -6 years) and is in poor condition and also in a non-air-conditioned space. The digester blower starters were installed in

1996; these starters are near the end of their expected life span (3-8 years) and also need to be replaced.

Back-up power for MSB-1 is provided by a 300-kW (375kVA) generator rated at 480V, 3-phase. The generator was installed in 1982. MSB-1 is well past the reliable life span for electrical equipment, typically 20-25 years and needs to be replaced. The generator can be replaced or eliminated. There are two options for eliminating the existing 300-kW generator. Option one is to re-feed all of the existing electrical loads from the existing MSB-1 to the Utility Service No. 2 and leave Utility Service No. 1 for future use. Option two is to replace the existing MSB-1 at the same location including the ATS and connect the emergency power from the 1500-kW generator. A new 600A breaker will be added at the 1500-kW generator and new conduits/cables will be installed to MSB-1. Option two will require a new cable and conduit system from the existing Generator Building No. 2 to the new MSB-1 located at Generator Building No. 1. Due to the long distance from the existing Generator Building No. 2 to the new MSB-1, new manholes will be needed for the conduits for cable pulling at every 500 feet or 270 degree bends. It is recommended that the cost of this duct bank installation be compared with the cost of a new 375-kVA in order to make the most economic decision.

Utility Service No. 2 is located in the west-center of the plant and consists of two feeders derived from the same FPL distribution point. Each feeder is connected to an individual 1000-kVA outdoor pad mounted FPL transformer. The step-down transformers feed main switchboard No. 2 (MSB-2) located at Generator Building No.2. MSB-2 consists of two main breakers and two emergency breakers, rated 1600A. One main breaker and emergency breaker pair is connected to one bus and the other remaining pair is connected to another bus. Each set of main and generator breakers are electrically interlocked through an ATS control scheme such that both breakers cannot be closed at the same time. The two 1600A rated buses in the MSB-2 are connected to a Main-Tie-Main (MTM) switchboard. The MTM, installed in 2012, is a 1600A switchboard with two 1600A main breakers and a 1600A tie breaker used to provide the flexibility of connecting the power from either side of MSB-2 in the event of equipment failure at either bus of the MSB-2. From the MTM, power is distributed to switchboard IWA (SWBD-IWA) and switchboard IWB (SWBD-IWB). SWBD-IWA and SWBD-IWB are located in the MCC Building. SWBD-IWA provides power to Injection Well Pump No. 1 Variable Frequency Drives (VFD), Injection Well Pump No. 2, Oxidation Ditch No.2 Aerator No. 1 starter, Panel IWHA (480V) and MCC-1. SWBD-IWB provides power to Injection Well Pump No. 3 VFD and Injection Well Pump No. 4 VFD, Oxidation Ditch No. 2 Aerator No. 2 starter, Panel IWHB (480V), and MCC-1. The VFDs for Injection Well Pump Nos. 3 and 4 were installed in 2012 and are in excellent condition. SWBD-IWA, SWBD-IWB and Injection Well Pump Nos. 1 and 2 VFDs were installed in 1994 and are near the end of their expected life span (1-6 years) but are in good condition. The starters for Oxidation Ditch No. 2 Aerators were installed in 1996 and are in good condition but near the end of expected life span (3-8 years). The 480V panels IWHA and IWHB and low voltage panels associated with each were also installed in 1996 and are in good

condition. MCC-1 and MCC-2 located in the Operations Building electric room provide power to the plants' headworks, clarifiers, on-site lift stations, plant water booster pumps, and general power for the Operations and Maintenance Buildings. The MCCs were installed in 1996 and are in good condition.

Back-up emergency power for MSB-2 is from Generator No. 2, a 1500-kW (1875kVA) generator rated at 480V / 3-phase, also located in Generator Building No. 2. The generator was installed in 1994 and is in very good condition due to excellent maintenance. MSB-2 was installed in 1994 and near the end of its expected life span (1-6 years). With the recent replacement of the main and generator breakers at MSB-2 in the past year the switchboard is in good condition.

Plant operations are monitored and controlled by three PLCs. PLC-1, located in the Operations Building Electric Room, was installed in 1998 and is good condition. PLC-1, located in the MCC Building, was installed in 1996 and is good condition. PLC-3, located near the chlorine facilities, was installed in 2012 and is in excellent condition. There are no recommendations for replacement or renewal at this time.

- Miscellaneous: The following are miscellaneous improvements recommended for the Belle Glade WWTF.
  - It is recommended that a security fence be installed around the Truck Wash Lift Station to restrict access and allow PBCWUD to log the date, time, amount and contents of the trucks that access the washing facility.
  - It is recommended that the main PLC system be replaced (with different software) to allow staff at the Belle Glade WWTF to modify the programming if necessary and because replacement parts are difficult and/or impossible to obtain.
  - It is recommended that all valve operators be upgraded to allow electronic control such that Belle Glade WWTF staff would be able to operate all the valves via the upgraded PLC system.
  - The existing asphalt near the Operations Building is overall in fair to good condition but has some problem areas where it is cracking, crumbling and/or settling. It is recommended that the existing asphalt paving be overlaid with a second layer of asphalt. After the asphalt overlay, it is recommended that the parking configuration be modified to provide for additional parking spaces.
  - It is recommended that the PBCWUD start provisioning for reuse at the Belle Glade WWTF. Reuse water would be used at the site as plant service water and could also be used off-site by local businesses. The reuse system at the Belle Glade WWTF would likely consist of filtration, an upgraded disinfection system, a chlorine contact chamber and a distribution pumping system.

- It is recommended that the pond be dredged to remove vegetation and debris and that the pond bypass gate be replaced.
- It is recommended that plant lighting be replaced with higher illumination LED lights.

2.4.2 Pahokee WWTF

Wastewater at the Pahokee WWTF is treated via either the 0.50–MGD TMADF conventional WWTF (Plant 1) or the 0.70–MGD TMADF complete mix Walker WWTF (Plant 2). Facilities at the plant have been denoted as either common (shared between the two treatment technologies), Plant 1 (part of the "conventional" Plant) or Plant 2 (part of the Walker Modular Plant, aka "complete mix"). Visual inspection identified the following:

- Influent Pump Station (common): This structure consists of a rectangular reinforced concrete tank with a concrete top slab cover. The top slab is accessible through an aluminum stair that also serves as access to the Primary Clarifier bridge. Raw wastewater enters the Influent Pump Station, which is comprised of two submersible pumps.

  Structural – The exterior concrete surfaces of the splitter box are in good condition. Interior surfaces above the water line shows signs of erosion. Structure was in operation so the interior condition below the water line was not visible.

  It is recommended to re-coat the entire structure and inspect the interior.

  Mechanical – The condition of the influent pumps is unknown because this structure does not have a bypass. It is recommended that a bypass be installed so that the structure and pumps can be rehabilitated.

- Headworks (common): The facility consists of a two level reinforced concrete structure above grade. The bottom level is open and the top level consists of multiple channels supported on columns. The top level walking surface consists of a perimeter concrete cantilevered slab and metal grating over the screening channels. An aluminum staircase serves as access to the top level. The top level also contains pretreatment equipment consisting of one mechanical self–cleaning bar screen, one bypass manually cleaned bar screen, flow control slide gates and one grinder which is piped downward to screenings trash cans placed on the ground level.

  Structural – The Headworks structure is in overall good condition. At the time of the visit, the facility was in normal operation and the interior surfaces of the upper level channels could not be inspected. It is recommended to perform an inspection of the interior channel surfaces.

  Mechanical – The equipment in the Headworks structure is in fair condition. However, the placement of the grinder prior to the mechanical bar screen creates solids small enough to

pass through the screen thus affecting downstream equipment. It is recommended that the mechanical bar screen be replaced and the grinder be removed to reduce this issue.

Electrical – The grounding wire around the headworks structure is oxidizing and resulting in the discoloration stains on the floor deck and streaking down the walls from the upper deck. It is recommended that this grounding wire be replaced.

- Primary Clarifier (Plant 1): This structure consists of a circular reinforced concrete tank on grade with a steel bridge for access to the clarifier mechanism motor. Access to the steel bridge is via an aluminum stair which also serves as access to the top level of the Influent Pump Station. The 53,000-gallon center feed primary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one primary sludge pump that pumps directly to the aerobic digester. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly. Flow to the clarifier is controlled by splitter box at the end of the Headworks. There is also a Primary Clarifier Grit Chamber Structure which consists of a reinforced concrete slab with shallow channels.

  Structural – Exterior of the concrete structure of the primary clarifier is in good condition. Steel support members of the steel bridge are corroded. Interior of the clarifier was not visible during this visit as it was in operation, but the top of the interior wall surface above the water line was visible and had some erosion.

  It is recommended to replace the steel bridge supports, re-paint the steel bridge, and re-coat the entire structure. It is also recommended to inspect the interior of the clarifier.

  The Primary Clarifier Grit Chamber Structure has settled and replacement is recommended.

  Mechanical – After over 20 years in service, the primary clarifier's visible mechanical equipment was found to be in poor condition with rusting of several components. Above-grade piping appeared in good condition. In order to more fully inspect the clarifier, it is recommended that the tanks be drained to allow for a thorough inspection of the mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per H&S inspections and the Florida Bearings, Inc. Report. On the Primary Clarifier, water appears to be at a severe level in the oil. It is recommended that the lubricant be changed.

- Aeration Tank Nos. 1 and 2 (Plant 1): Structure consists of a rectangular reinforced concrete multi-cell tank above grade. A center wall separates Aeration Tank No. 1 from Aeration Tank No. 2. A concrete walkway on the north wall extends the full length of Aeration Tank No. 1. Metal grating over channels on the center wall and the outer east, west, and south walls serve as additional walkways. An aluminum stair serves as access to the top level of the tanks. Secondary treatment on the conventional side of the Pahokee WWTF starts with two aeration tanks. Air is introduced near the tank bottom which causes the basin's contents to be mixed. Dissolved oxygen (DO) levels in the tanks are monitored and blower rates

adjusted to maintain the desired DO levels. The Aeration Tanks are comprised of the following components: two single pass Aeration Tanks, air piping and air diffusers.

Structural – The exterior of the tanks appears to be in good condition as there is no evidence of leakage. The top level walkway is cracked in several locations, and one corner at the east end is spalled. Cracks and spalls can also be seen along the interface between the embedded grating frames and the concrete. The top support of the aluminum stairs that serve as access to the top level of the tanks is anchored to cracked and spalled concrete. There is evidence that old guardrails have been removed and new ones installed as a replacement. The exterior coating is stained. At the time of the visit, the tanks were in service and the interior of the tanks could not be inspected.

Based on the above observations, it is recommended to repair all top level cracks and spalls, and modify the stair top support to provide an anchorage less prone to cracking. An interior inspection of the tanks is recommended to determine if any repairs are required inside. Once all repairs are done, it is recommended to re-paint the entire structure.

Mechanical – The Aeration Tanks are critical to the operation of the Pahokee WWTF. It has been several years since the tanks have been inspected. It is recommended that PBCWUD replace all diffusers as they are likely in poor condition. Plant staff have also noted that diffuser clogging is an issue. While rehabilitation is taking place and the tanks are drained, the tanks should be inspected to fully determine the extent of capital improvements that may possibly be needed.

- Equipment Building / Blower House No. 2 (Plant 1): Structure consists of a one-story reinforced masonry building with precast double-tees forming a flat roof. Process air is delivered to the aeration tanks by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 2 also contains one generator.

  Structural – Overall, the structure for Blower House 2 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the single door and louvers with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

  Mechanical – The blowers in the Equipment Building / Blower House No. 2 are in fair condition. Both have been rebuilt on various occasions. It is recommended that the two blowers be replaced. The following recommendations are per H&S inspections and the Florida Bearings, Inc. Report:

  1. Blower House No. 2 Blower 1: Bushing / thrust metal is at a severe level. It is recommended to inspect this unit for excessive bushing / thrust wear. Lubricant and

filter change are also recommended. Additionally, it is recommended that an analytical ferrogram be performed to clarify the type of wear and/or contamination that is present.

2. Blower House No. 2 Blower 2: Lead is at a moderate level. Lead sources in the gear systems include bushing / thrust overlay, lead solder, coatings or contamination from grease. It is recommended that plant staff continue to monitor the equipment and fluid conditions.

Electrical – The generator in the Equipment Building / Blower House No. 2 is in poor condition despite several recent repairs. To keep plant in operation and prevent possible failure (especially in the middle of a rain event), it is recommended that this generator be replaced. Additionally, the MCC located in the Equipment Building / Blower House No. 2 needs to be replaced and contained within a climate controlled room, isolated from the rest of the equipment. Lastly, there is a 14.9 degree temperature difference between legs in the breaker for Effluent Pump No. 3. It is recommended that the connections be inspected and amp readings be checked.

Instrumentation – Without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that the PLC system be upgraded to allow staff at the Belle Glade WWTF (staffed 24 hours per day) to monitor the DO levels and the blowers be upgraded to allow flow pacing.

Miscellaneous – Currently, fuel for the generators is stored in three 500-gallon tanks and piped throughout the plant. It is recommended that these three tanks be replaced by one 2,000-gallon tank with containment and contained piping to the generators.

- Secondary Clarifiers – East and West (Plant 1): These structures consist of a circular reinforced concrete tanks on grade with a steel bridge for access to the clarifier mechanism motor of each clarifier. Access to the steel bridges is via a common aluminum stair. The center feed secondary clarifiers include overflow weirs, full radius scum skimming, removal troughs and two sludge pumps (see RAS / WAS pumps). A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – The exterior of the concrete structures of the secondary clarifiers is in good condition. The steel bridge has some slight corrosion and its protective coating has failed. The supports for the steel bridge have corrosion and are anchored to deteriorated concrete. The interior of the clarifiers were not visible during this visit as they were in operation.

  It is recommended to re-paint the steel bridge, replace bridge supports, repair concrete at bridge support locations and re-coat the entire structure. It is also recommended to inspect the interior of the clarifiers.

Mechanical – The secondary clarifiers' visible mechanical equipment was found to be in poor condition. It is recommended that the secondary clarifier mechanical equipment be rebuilt, including surface leveling. Above-grade piping appeared in good condition. However, in order to more fully inspect the clarifiers, it is recommended that the tanks be drained to allow for a thorough inspection of the mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per the Florida Bearings, Inc. Report. On the Secondary Clarifier - West, water appears to be at a severe level in the oil. It is recommended that the lubricant be changed.

- Grit Chamber (Plant 2): Structure consists of a rectangular reinforced concrete tank on grade. A top level steel walkway is accessible from grade through a steel stair that also serves as access to the adjacent Walker Unit. Before wastewater enters the Walker Unit, it goes through additional pretreatment. The additional pretreatment equipment consists of one degritter / classifier unit.

  Structural – At the time of the visit, the tank was in service and the interior could not be inspected. Exterior wall surfaces appear to be in good condition, however, the top surfaces of the walls are deteriorated showing exposed aggregate, and have a diagonal crack at every wall corner intersection. Diagonal cracks at wall corner intersections may indicate separation of the walls caused by overstressing of the reinforcement steel as a result of insufficient reinforcement or unforeseen additional loading. The top steel walkway is corroded.

  Based on the observations noted, it is recommended to replace the top walkway, and perform a detailed structural evaluation to determine if there is a structural deficiency that has caused the corner cracks. It is also recommended to re-paint the entire structure.

  Several steel pipe supports for DIP from the headworks to the grit chamber consist of steel posts and steel saddles. Steel pipe supports for elevated DIP are corroded and require replacement.

  Mechanical – The existing grit system is not functional. It is recommended that a new grit removal system be installed for entire plant at the Headworks structure. In this location, the new grit removal system would benefit the entire plant and not just the complete mix portion of the plant.

- Walker Modular Unit (Plant 2): Structure consists of a circular reinforced concrete tank on grade with a rotating steel bridge to access the center mechanism. The bridge is accessible via an aluminum stair that also serves as access to the Grit Chamber. Similar to the conventional plant, the secondary treatment in the Pahokee WWTF complete mix plant consists of one aeration basin (1/2 of the outer circle), one clarifier (inner circle) and one aerobic digestion (1/2 of the outer circle). In the aeration basin, air is introduced near the tank bottom which causes the basin's contents to be mixed. DO levels in the tanks are

monitored and blower rates adjusted to maintain the desired DO levels. The clarifier portion of the Walker Unit includes effluent weirs, "full radius" scum skimming and a scum box. The aerobic digester consists of air piping and coarse bubble membrane diffusers.

Structural – The exterior of the concrete structure of the Walker Unit is in good condition. The steel bridge has some slight corrosion and its protective coating has failed. Interior of the unit was not visible during this visit as it was in operation.

It is recommended to re-paint the steel bridge, and re-coat the entire structure. It is also recommended to inspect the interior of the unit.

Mechanical – The Walker Unit mechanical equipment was found to be in fair condition with minor rusting of some components. Above-grade piping appeared in good condition. In order to more fully inspect the Walker Unit, it should be drained to allow for a thorough inspection of the diffusers, air piping, clarifier mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. While rehabilitation is taking place and the tank is drained, the tank should be inspected to fully determine the extent of any other capital improvements that may possibly be needed.

If the Pahokee WWTF is to remain in operation, it is recommended that all secondary clarifiers operate in parallel. This would require piping modifications to the Walker Unit, however, it would make plant operations less complicated and has the potential to improve effluent water quality.

- Control Building / Blower House No. 3 (Plant 2): The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to the Walker Unit by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 3 also contains one generator.

  Structural – Overall, the structure for Blower House 3 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the single door and louvers with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

  Mechanical – The blowers in the Control Building / Blower House No. 3 are in fair condition. Both have been rebuilt on various occasions. It is recommended that the two blowers be replaced.

  Electrical – The generator in the Control Building / Blower House No. 3 is in poor condition despite several recent repairs. To keep plant in operation and prevent possible failure (for example in the middle of a rain event), it is recommended that this generator be replaced.

Additionally, there is a 9.8 degree temperature difference between legs in the breaker for Blower No. 2. It is recommended that the connections be inspected and amp readings be checked.

Instrumentation – Without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that the PLC system be upgraded to allow staff at the Belle Glade WWTF (staffed 24 hours per day) to monitor the DO levels and the blowers be upgraded to allow flow pacing.

- Effluent Pump Station (common): Structure consists of a rectangular reinforced concrete tank on grade open at the top. The east end of the structure serves as the effluent pump station and is covered with metal plates serving as walkway for access to the pumps. The Effluent Pump Station at the Pahokee WWTF consists of a large wet well followed by three pumps in the effluent pump station. The wet well for the three effluent pumps can be bypassed by diverting flow to the two chlorine contact chambers during wet well maintenance.

  Structural – Concrete structure of the wet well is in good condition. The west end of the structure that serves as the effluent pump station showed signs of corrosion on the metal covers supporting the pumps. However, the County has repaired the corroded metal plates and members since this visit.

  It is recommended to re-paint the entire structure.

  Mechanical – Overall the tertiary filters / effluent pump station is in good condition. The addition of the covers over both the wet well and pump station was an effective solution to reduce algal growth. Additionally, the effluent pumps were rebuilt within the last year. However, it is recommended that all three effluent pump starters be replaced with VFDs so that the pumps may be operated from the PLC. This will allow operators to control / adjust various pump setpoints, choose / modify backup pumps, start / stop pumps, run pumps in manual mode from the Operations Building (or the Belle Glade WWTF) and monitor pump status including running / off, local / remote, auto / manual, fault and speed. Additionally, it is recommended that the Effluent Pump Station wet well bypass valve be replaced within the next several years. Based upon the Florida Bearings, Inc. Report, Effluent Pump No. 2 should be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

  Instrumentation – If the pump starters are replaced with VFDs, as mentioned above, it is recommended that the PLC be upgraded with several displays to allow remote operation and control.

- Deep Injection Well (common): The injection well system consists of one deep injection well and an associated monitor well.

Structural – The concrete pad around the well is in good condition and does not require structural repairs.

Mechanical – On June 11, 2010, FDEP was notified that changes in conductivity, chloride and pressure were occurring in the dual zone monitor well. During an investigation of the monitor well it was discovered that a 431-foot section of the 6 5/8-inch tubing had separated at a casing joint and fallen within the 16-inch casing. Per the permit application submitted on June 26, 2012, it is recommended that the repair plan for the monitor well (currently being drafted) be submitted to FDEP. Only after the plan is approved can the extent of capital improvements needed be determined. Additionally, it is recommended that the semi-functional 12-inch back pressure relief valve on the influent piping of the deep injection well be replaced in kind and that the injection well be rerated from its current permitted 8.22 ft/s up to 10 ft/s. This would provide an additional 0.87 mgd of disposal capacity.

- Chlorine Contact Chamber Nos. 1 and 2 (common): Structures consist of rectangular reinforced concrete tanks partially below grade with internal concrete baffle walls. Guardrails are placed on the perimeter of the tanks, however there are no walkways at the top level. Chlorine contact chambers are only used when the injection well is out of service (for maintenance reasons).

  Structural – The Chlorine Contact Chamber No. 1 structure is in good condition. Exterior painting is stained by rust from steel guardrails on the top of the walls. The steel guardrails do not seem to serve any purpose and some sections are missing. It is recommended to remove all remaining sections of guardrail and blast / coat the entire structure including the interior wall surfaces.

  The Chlorine Contact Chamber No. 2 structure is also in good condition. The steel guardrails do not seem to serve any purpose and some sections are missing, but is in overall good condition. It is recommended to repair sections of guardrail and coat the entire structure including the interior wall surfaces.

  Mechanical – There is no mechanical equipment on or near Chlorine Contact Chamber Nos. 1 and 2. There are no recommendations at this time.

- Washwater Pumps (common): Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Plant service water was previously pumped throughout the Pahokee WWTF by this facility's two pumps.

  Structural – Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed. It is recommended to place fill under the slab.

  Mechanical – The mechanical equipment is not currently function and has been abandoned. There are no recommendations at this time.

- RAS / WAS Pump Station (common): Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Two RAS / WAS pumps collect settled sludge in the secondary clarifiers for either returning to the Aeration Tanks / Walker Unit or wasting to the sludge treatment facilities.

  Structural – Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed. It is recommended to place fill under the slab.

  Mechanical – The RAS / WAS pumps were replaced within the last year and appear to be in very good condition. There are no recommendations at this time.

- Chlorine / Operations Building (common): This structure consists of a one-story reinforced concrete and masonry building with precast double tees forming a flat roof. Part of the building is open on the sides for chlorine storage. The chemical feed system consists of two covered crosslink polyethylene chemical storage tanks and three diaphragm metering pumps for the storage and distribution of 12 percent sodium hypochlorite. Chlorine is diluted to 6 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the well is out of service or they have a peak flow conditions that exceeds the well capacity, sodium hypochlorite is injected into the chlorine contact chambers so that the secondary effluent can be discharged to the percolation ponds. The Operations Building contains the plant staff offices / lunch area (one room), the plant laboratory / PLC Controls (one room) and one bathroom.

  Structural – The condition of the concrete and masonry is good. Some windows are broken, doors and hardware are slightly corroded, and all components are not likely wind rated.

  Based on the findings, it is recommended to replace all doors and windows with wind rated components, and re-paint the entire structure.

  Mechanical – The chlorine tanks and pumps were replaced within the last three years and appear to be in very good condition. Additionally, the roof covering improves the expected life. There are no recommendations at this time regarding the chlorine equipment. On the other hand, the Operations (interior) portion of the building is small for its numerous uses. Currently, there are two spaces for five functions including plant staff offices, lunch area, plant laboratory, PLC Controls and restroom facilities. It is recommended that a few of the operation functions of the building be moved into a newly constructed “warehouse”, which would be built where the existing Maintenance Building is located, and the Chlorine / Operations Building be reconfigured such that it is more conducive for its intended, limited activity. The office half of the “warehouse” would be split into several rooms to accommodate its various intended functions (e.g., plant staff offices, lunch area, plant laboratory, PLC Controls) and would also contain two restrooms, one for men and one for women. Additionally, it is recommended that the Chlorine / Operations Building 4-inch sewer line be replaced due to repeated clogging episodes after this line was crushed by equipment.

- Sludge Thickening / Biosolids Facility (common): This structure consists of a one-story partially open pre-engineered metal building supported on a reinforced concrete slab on grade. A steel lime silo is adjacent to the metal building. The major components of the sludge thickening system are as follows: one grinder, one high service pump, one high service feed pump, one sludge feed pump, four augers, one biosolids pump, one belt press, one lime silo system and one polymer mix and feed system.

  Structural – The metal building of the sludge facility is in good condition. One support leg of the lime silo adjacent to the metal building is slightly damaged. The ladder serving as access to the top of the silo and the guardrail at the top are corroded and unsafe. Exterior coating of the silo is damaged.

  It is recommended to repair the damaged support leg, replace the access ladder and guardrails, and re-paint the entire exterior of the silo. As per plant staff, the floor of the building should also be epoxy coated for added protection.

  Mechanical – Overall the mechanical equipment at the Sludge Thickening / Biosolids Facility is in good condition. However, there are several pieces of equipment which have minor issues. It is recommended that the lime silo system's vibrator and screw conveyor be replaced with more effective equipment and that the biosolids pump and one auger (in the Bioset system) be replaced. Additionally, the following recommendations are per the Florida Bearings, Inc. Report.

  1. Biosolid Gearbox: continue to observe the trend and monitor equipment and fluid conditions as gear and/or bearing metal is at a moderate level and abrasives are at a minor level.

  2. Lime Auger: Water is at a severe level in the gearbox. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant be changed.

  3. High Service Feed Pump: Replace pump bearings.

  Electrical – There is a 48.6 degree temperature difference between legs in the starter for the Primary Sludge Pump. It is recommended that the connections be inspected and amp readings be checked.

- Aerobic Digester No. 1 (common): The structure consists of a circular reinforced concrete tank without cover. A metal stair structure serves as access to the top of the tank. The major components of digester are one digester transfer pump and the 172,000-gallon circular concrete tank.

  Structural – Two horizontal cracks around the entire perimeter of the tank are visible. One crack is approximately at the mid-height of the tank wall, and the other is at approximately ¾ of the wall height. It appears that there have been attempts of repairing the cracks as

evidenced by multiple circular patches along the cracks which is typical when cracks are injected with a chemical grout. No leakage is evident from the repaired cracks which may indicate that the cracks were caused by joints in the concrete construction and not by a structural deficiency. Stairs for access to the top of the structure are steep, similar to a ship's ladder.

At the time of the visit, the tank was in service and the interior could not be inspected.

Based on the above observations, it is recommended to perform a more detailed structural evaluation to determine if there are any reinforcement deficiencies that caused the horizontal cracking. It is also recommended to replace the stairs to have normal dimensioned treads and risers for ease of access. Once all repairs are complete, it is recommended to re-paint the entire structure.

Mechanical – The following recommendation is per the Florida Bearings, Inc. Report. For the Digester Transfer Pump, water level in the gearbox is at a severe level, abrasives are at a significant level, gear and/or bearing metal is at a significant level and aluminum is at an abnormal level. It is recommended that the gearbox be checked for the source of the water and other contamination. Additionally, a lubrication change is recommended.

- Blower House No. 1 (Plant 1): The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to Digester No. 1 by a blower system comprised of two blowers and air piping.

  Structural – Overall, the structure for Blower House 1 is in good condition. Roof flashing is bent and separating from the walls and the roll-up door is corroded. Doors and louvers are not likely to be rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the roll-up door with a wind rated door. Further hurricane hardening may be achieved by replacing the single door and louver with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

  Mechanical / Instrumentation – The blowers are in fair condition, however, both have been rebuilt on various occasions. It is recommended that the two blowers be replaced. The following recommendation is per the Florida Bearings, Inc. Report. For Blower Motor No. 2, it is recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

  Electrical – There is a 4.9 degree temperature difference between legs in the starter for Blower No. 1. It is recommended that the connections be inspected and amp readings be checked.

- Maintenance Building (common): The structure consists of a one-story pre-engineered metal building built in two phases. Phase one of the building is supported on reinforced concrete footings and does not have a concrete floor slab. Phase two of the building is supported on a concrete slab on grade.

  Structural – Extensive corrosion is evident around the entire steel building including on the exterior metal panels, roof purlins, wall girts, and main frames. Wall panels are damaged and bent. One half of the building does not have a floor slab. Complete demolition and replacement of this building is recommended.

  Mechanical – As described under the "Chlorine / Operations Building" section, it is recommended that a few of the operation functions of the Chlorine / Operations Building be moved into a newly constructed warehouse, which would be built where the existing Maintenance Building is located. One half of the warehouse would be utilized for storage, etc. The other half of the warehouse would contain several rooms for the various functions (i.e., plant staff offices, lunch area, plant laboratory, PLC Controls and two bathrooms - one men's and one women's).

- On–site Lift Station (common): The lift station is a duplex station with two 7.5-Hp submersible pumps.

  Structural – The wet well is in good condition. The 8-foot diameter wet well liner/coating appears to be in good condition. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition and there is evidence of ground settlement around the top slab. There is no valve vault as the discharge piping is above ground.

  Mechanical – The pumps appear to be in good condition. The lift station has one 8-inch influent line with an invert 7 feet from the top of slab. The 4-inch discharge piping inside the wet well has severe rust and corrosion on the piping and hardware. There is no protective coating or paint on the piping inside the wet well. The discharge piping and valves are above ground and they appear to be in fair condition. There is a coating on the piping and isolation valves (plug type) however there is no coating on the check valves (leaver and weight swing checks). There is rust mainly around the piping flange connections and there is some severe corrosion between one of the flange connections. There was no evidence of surcharging or grease accumulation in the wet well.

- Electrical System (common): The electrical distribution system at the Pahokee WWTF consists of two utility FPL services. Utility service No. 1 is located at Blower House No. 3 and is connected to three 100kVA pole mount FPL transformers. The FPL step-down transformers are connected to two service entrance rated main disconnects from the utility meter.

The primary power distribution electrical equipment is housed within Blower House No. 3 and Blower House No. 2. Blower House No. 3 contains main disconnect 1 of 2 and main disconnect 2 of 2. Main disconnect 1 of 2 is a service entrance rated 600A, 480V, 3-phase enclosed circuit breaker connected to a 600A ATS. The ATS is connected to distribution panel DP-1. DP-1 is a 600A, 480V, 3-phase panel. DP-1 provides power to Walker Unit Blower No. 1 and Blower No. 2 starters (in the Control Building / Blower House No. 3), Grit Blower starter, Grit Auger starter, Grit Blower, Walker Plant Bridge Drive control panel and panel LP-1. This electrical equipment was replaced in 2009 and is in excellent condition. Back-up power for DP-1 is from a 200-kW (250kVA) generator. The generator was installed in 2005 and is in poor condition. It is recommended that this generator be replaced.

Main disconnect 2 of 2 is a 400A fused disconnect. Main disconnect 2 of 2 is connected to Motor Control Center 3 (MCC-3) located in Blower House No. 2. MCC-3 is a 600A, 480V, 3-phase motor control center with a 400A ATS. MCC-3 contains feeder breakers and starters for the conventional plant's Blowers Nos. 1 and 2 (in the Equipment Building / Blower House No. 2), Effluent Pumps Nos. 1, 2, and 3, Floating Mixer disconnect, DP-2 and control power for the Effluent Pump Control Panel. Panel DP-2 also located in Blower House No. 2 is a 480V, 3-phase panel rated at 225A with feeder breakers for the Headworks control panel, on-site lift station, Blower control panel (Digester No. 1 blowers 1 and 2 in Blower House No. 1). Feeder breakers from DP-2 are also connected to starters for the primary sludge pumps, washwater pumps, RAS pumps, east and west secondary clarifiers and primary clarifier. The starters and DP-2 were installed in 2009 and are in excellent condition. General house power for Blower House No. 2 and the Chlorine / Operations Building are supplied thru a 50kVA, 480V/120/240V single phase step-down transformer feed from DP-2. This transformer was installed in 2005 and is in good condition. The main breakers for the Chlorine / Operations Building and Blower House No. 2 panel-boards are located in Blower House No. 2, were installed in 2005 and are in poor condition. It is recommended that both enclosed breakers be replaced.

The current bus configuration of MCC-3 only allows back-up power for one blower and one effluent pump to operate during a power outage. MCC-3 was installed in 2005 in a non-air-conditioned environment and is in poor condition. It should be replaced with a new MCC with bus configuration that allows operators the option to run critical equipment during a normal power failure. It is also recommended to enclosure the electrical equipment area with walls and install HVAC environment. Back-up power for MCC-3 is from a 230-kW (288kVA) generator. This generator was installed in 2006 and is in poor condition. It is recommended that this generator be replaced with a generator sized to allow for more flexibility for plant operations.

Utility Service No. 2 is located at the Sludge Thickening / Biosolids Facility and is connected to three 50kVA FPL pole mount transformers. The FPL step-down transformers are connected to a service entrance rated 480V, 3-phase, 200A disconnect. The Main disconnect is connected to panel-board P1, a 480V, 3-phase, 225A rated distribution panel. P1 contains feeder breakers for the belt drive, conveyor, booster pump, etc. for the process

of solids. A 30kVA, 480V/120/208V 3-phase step-down transformer is feed from P1. The transformer feeds panel LP-1. LP-1 is a 208/120V, 3-phase panel-board rated for 100A. This panel board provides power for controls, convenience receptacles, lighting etc. Overall the electrical equipment at the Sludge Thickening / Biosolids Facility are in good condition. There are no recommendations for renewal or replacement at this time.

Plant operations are monitored and controlled with a supervisory control and data acquisition (SCADA) system. PLC-1 consists of an Allen-Bradley CompactLogix controller with associated terminal strips, relays, surge protectors, breakers, UPS, etc. All the associated PLC equipment is housed in a NEMA 3R stainless steel enclosure located in Blower House No.2. PLC-1 was installed in 2011 and is in excellent condition. There are no recommendations for replacement or renewal at this time.

- Miscellaneous: The following are miscellaneous improvements recommended for the Pahokee WWTF.
  - It is recommended to remove and replace all sidewalks as the WWTF has settled significantly in many areas. Concrete sidewalks can be replaced with asphalt to provide flexibility to accommodate differential settlement due to the poor soil conditions.
  - It is recommended that a security fence be installed around the entire facility, including the ponds.
  - As mentioned previously, without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that all valve operators be upgraded to allow electronic control such that Belle Glade WWTF staff would be able to operate all the valves at the Pahokee WWTF via the upgraded PLC system.

2.5 Recommendations

Based on the field observations and results of the investigation and testing, the recommended repairs/modifications are presented below.

2.5.1 Belle Glade WWTF

Based on the evaluation, the Belle Glade WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the facility is good and the plant is in operable condition. Deficiencies were observed (as documented in the previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a facility of this age. However, it is noted that overall, the Belle Glade WWTF operates adequately. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also separated into three categories: critical for continued use, non-critical / enhancement and maintenance.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection, but their implementation may be delayed to meet the PBCWUD budget constraints. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired, but their implementation is not required as part of the rehabilitation and will not impair the use of the facility.

Critical Repairs

1. Oxidation Ditch No. 1 Structural Rehabilitation
2. Oxidation Ditch No. 2 Structural Rehabilitation
3. Improvements to the Deep Injection Well
4. Installation of a Roto-Screen Bypass line
5. Repair cracks and leaks in Aerobic Digester
6. Replacement of Main Switchboard No. 1 (Generator Building No. 1)
7. Replacement of 300 kW generator (Generator Building No. 1)
8. Injection Well PLC replace (Parts are unavailable)
9. Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)

Non-Critical Repairs

1. Replace parshall flume (in the Headworks)
2. Installation of a Headworks Bypass
3. Additional circular clarifier (to replace Clarifier Nos. 1 and 2)
4. Construct chlorine contact chamber
5. Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)
6. Optimize Bar screens to achieve higher capture rate
7. Add toe board to Splitter Box No. 2 hand rail
8. Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum
9. Replacement of several air handlers and compressors

10. Replace Roto-Screen roof purlins and roof panels that have deteriorated
11. Replacement of the main PLC and PLC software
12. Lift station Nos. 1 and 2 rehabilitation
13. Replace Headworks access stair with an aluminum stair
14. Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)
15. Rehabilitation of the RAS / WAS structure
16. Installation of two polymer feeders
17. Repair leaks at the effluent box of the headworks
18. Replace Roto-Screen effluent wet well slide gate and isolation gate
19. Replace pond bypass gate
20. Paint steel roof over the Aerobic Digester blowers
21. Rehabilitate the Roto-Screen metal structure
22. Rehabilitate the Sludge Thickening Facility metal structure
23. Upgrading control room
24. Paint steel walkway bridge and structure on Clarifier 3 and 4
25. Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2
26. Paint steel bridge, stairs and EQ tank
27. New roofs on the Operation, Maintenance and both Generator buildings
28. Replace doors in MCC Building
29. Repair cracking at Headworks upper level slab
30. Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure
31. Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2
32. Replace Thickeners
33. Remove, replace and rewire Headwork's control panel
34. Relocate trees and plants placed inside abandoned structures
35. Construct overflow in Aerobic Digester
36. Repair crack at the Operations Building access ramp
37. Re-paint the entire exterior of the Headworks

38. Support of the Operations Building roof post should be replaced with a different type to avoid further cracking
39. Install flow meters on Oxidation Ditch Nos. 1 and 2
40. Install flow meters on Clarifier Nos. 3 and 4
41. Polymer containment and enclosure
42. Construction of a Switchgear Building with space for future equipment
43. Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight
44. Replace manual valves with electronic controlled valves
45. Repair the concrete spalls at guardrail posts at Clarifier No. 3
46. Replacing ceiling tiles in the Operations Building break room
47. Replace plant lighting with higher illumination LED lights
48. Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway
49. Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)
50. Replacement of four slide gates in Headworks
51. Replace RAS and Deep Injection Well flow meters with new magnetic meters
52. Replacement of MCC-3 (in the Operations Building Electric Room)
53. Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)
54. Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center MCC-1, Panel PP-1 480V, Motor Control Center MCC-2, PLC-1 (Main Control Panel))
55. Install automatic control gates for Oxidation Ditch No. 1 and 2
56. Flow meter for Clarifier Nos. 1 and 2
57. Crack repair on the exterior wall surfaces of EQ tank
58. Repair guardrails on EQ tank
59. Install fencing to enclose Truck Wash Lift Station
60. Install an odor control system at the Headworks
61. Install an onsite plant service water system including reuse system
62. Add sumps at one end of the Clarifier Nos. 1 and 2 structure

63. Painting of the facility
64. Upgrading cabinets in the Operations Building break room
65. Asphalt overlay and addition of parking spaces
66. Epoxy coat floors
67. Convert EQ tank to additional Clarifier or Aerobic Digester
68. Install drain on Oxidation Ditch No. 1

Maintenance Repairs

1. Remove grit from Oxidation Ditch No. 2
2. Dredge pond of vegetation and debris
3. Pista Grit No. 1 Gearbox: Observe equipment and monitor fluid for abrasives
4. Pista Grit No. 1 Air Compressor: Closely monitor vibration amplitude and/or noise and perform another vibration survey in six months
5. Pista Grit No. 2 Gearbox: Observe equipment and monitor fluid for abrasives
6. Grit Classifier No. 1, MCC1: Inspect fuse, replace if necessary
7. Ditch No. 1, Aerator No. 2 Gearbox: Observe equipment and monitor fluid for antimony
8. Oxidation Ditch No. 1, Aerator No. 1 MCC3: Inspect breaker connections and check amp readings
9. Ditch No. 2, Aerator No. 1 Gearbox: Observe equipment and monitor fluid for antimony, titanium and other metals
10. Ditch No. 2, Aerator No. 2 Gearbox: Observe equipment and monitor fluid for nickel
11. Clarifier No. 3 Lower Gearbox: Observe equipment and monitor fluid for gear and/or bearing metal
12. Clarifier No. 3 Upper Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
13. Clarifier No. 4 Upper Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination, change the lubricant, inspect the unit for excessive bushing / thrust wear and perform an analytical ferrogram to clarify the type of wear and/or contamination that is present
14. Roto-Screen No. 1 Gearbox: Change the lubricant
15. Roto-Screen No. 2 Gearbox: Change the lubricant
16. Roto-Screen No. 3 Gearbox: Change the lubricant

17. Roto-Screen No. 4 Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
18. Pump No. 1: Observe equipment and monitor fluid for copper, closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
19. Pump No. 2: Observe equipment and fluid and monitor the Direct Reading Ferrography
20. Pump No. 4: Observe equipment and fluid and monitor the Direct Reading Ferrography, closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
21. Injection Well Pump No. 2: Inspect the breaker / starter connections, check the amp readings, and inspect the fuse
22. RAS Pump No. 3 Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
23. WAS Pump No. 1: Inspect the pump bearings for the proper fit on the shaft and within the housings, repair / replace as necessary
24. RAS No. 1, MCC1: Inspect the breaker / starter connections, check the amp readings, and inspect the fuse
25. WAS No. 1, MCC1: Inspect the breaker connections, check the amp readings, and inspect the load reactor connections
26. RAS No. 3, MCC2: Inspect the breaker connections, check the amp readings, and inspect the fuse
27. WAS No. 2, MCC2: Inspect the breaker connections, check the amp readings, and inspect the fuse
28. Blower No. 2: Closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
29. 300-kW generator MCC3: Inspect the breaker / starter connections and check the amp readings

See **Table 2.1** for an opinion of probable cost for the rehabilitation work to assist the PBCWUD with its planning efforts. It should be noted that some of the recommended repairs may be able to be completed by PBCWUD staff at reduced costs. This cost estimate is an order-of-magnitude estimates based on published cost literature, past contractor bids, and previous experience with similar facilities. The accuracy of this type of cost estimate typically ranges from +50 to -30 percent. Costs are rounded to the nearest thousand dollars and presented in present-day dollars as defined by the association for the Advancement of Cost Engineering International (AACEI).

Table 2.1
Belle Glade WWTF Opinion of Cost

CRITICAL Capital Items (listed in order of importance)		**FY-2014 thru FY-2018**	**FY-2019 thru FY-2023**	**FY-2024 thru FY-2035**	**Total**
1	Oxidation Ditch No. 1 Structural Rehabilitation	$770,000	--	--	$770,000
2	Oxidation Ditch No. 2 Structural Rehabilitation	$280,000	--	--	$280,000
3	Improvements to the Deep Injection Well	$980,000	--	--	$980,000
4	Installation of a Roto-Screen Bypass line	$280,000	--	--	$280,000
5	Repair cracks and leaks in Aerobic Digester	$140,000	--	--	$140,000
6	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	$100,000	--	--	$100,000
7	Replacement of 300 kW generator (Generator Building No. 1)	$560,000	--	--	$560,000
8	Injection Well PLC replace. Parts are unavailable	$120,000	--	--	$120,000
9	Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)	$550,000	--	$150,000	$700,000
	Total CRITICAL Capital Cost	**$3,780,000**	**$0**	**$150,000**	**$3,930,000**

Note: Costs include 30% contingency and 20% engineering

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Replace parshall flume (in the Headworks)	--	$70,000	--	$70,000
2	Installation of a Headworks Bypass	--	$280,000	--	$280,000
3	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	$700,000	--	--	$700,000
4	Construct chlorine contact chamber	--	$980,000	--	$980,000
5	Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)	--	[a]	--	$0
6	Optimize Bar screens to achieve higher capture rate	--	$490,000	--	$490,000
7	Add toe board to Splitter Box No. 2 hand rail	--	$10,000	--	$10,000
8	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	--	$30,000	--	$30,000
9	Replacement of several air handlers and compressors	--	$100,000	--	$100,000
10	Replace Roto-Screen roof purlins and roof panels that have deteriorated	$50,000	--	--	$50,000
11	Replacement of the main PLC and PLC software	$280,000	--	--	$280,000
12	Lift station No. 1 and No. 2 rehabilitation	--	$50,000	--	$50,000
13	Replace Headworks access stair with an aluminum stair	--	$30,000	--	$30,000
14	Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)	--	$790,000	--	$790,000
15	Rehabilitation of the RAS / WAS structure	$30,000	--	--	$30,000
16	Installation of two polymer feeders	--	$30,000	--	$30,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
17	Repair leaks at the effluent box of the headworks	--	$20,000	--	$20,000
18	Replace Roto-Screen effluent wet well slide gate and isolation gate	--	$50,000	--	$50,000
19	Replace pond bypass gate	--	$30,000	--	$30,000
20	Paint steel roof over the Aerobic Digester blowers	--	$30,000	--	$30,000
21	Rehabilitate the Roto-Screen metal structure	--	$20,000	--	$20,000
22	Rehabilitate the Sludge Thickening Facility metal structure	$90,000	--	--	$90,000
23	Upgrading control room	--	$60,000	--	$60,000
24	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	$200,000	--	--	$200,000
25	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	--	$50,000	--	$50,000
26	Paint steel bridge, stairs and EQ tank	--	$110,000	--	$110,000
27	New roofs on the Operation, Maintenance and both Generator buildings	--	$60,000	--	$60,000
28	Replace doors in MCC Building	--	$20,000	--	$20,000
29	Repair cracking at Headworks upper level slab	--	$20,000	--	$20,000
30	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	--	$210,000	--	$210,000
31	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	--	$30,000	--	$30,000
32	Replace Thickeners	$840,000	--	--	$840,000
33	Remove, replace and rewire Headwork's control panel	--	$70,000	--	$70,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
34	Relocate trees and plants placed inside abandoned structures	--	$30,000	--	$30,000
35	Construct overflow in Aerobic Digester	--	$60,000	--	$60,000
36	Repair crack at the Operations Building access ramp	--	--	$20,000	$20,000
37	Re-paint the entire exterior of the Headworks	--	--	$70,000	$70,000
38	Support of the Operations Building roof post should be replaced with a different type to avoid further cracking	--	--	$10,000	$10,000
39	Install flow meters on Oxidation Ditch Nos. 1 and 2	--	--	$180,000	$180,000
40	Install flow meters on Clarifier Nos. 3 and 4 [b]	--	--	$140,000	$140,000
41	Polymer containment and enclosure	--	--	$60,000	$60,000
42	Construction of a Switchgear Building with space for future equipment	--	--	$280,000	$280,000
43	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	--	--	$20,000	$20,000
44	Replace manual valves with electronic controlled valves	--	--	$100,000	$100,000
45	Repair the concrete spalls at guardrail posts at Clarifier No. 3	--	--	$30,000	$30,000
46	Replacing ceiling tiles in the Operations Building break room	--	--	$20,000	$20,000
47	Replace plant lighting with higher illumination LED lights	--	--	$20,000	$20,000
48	Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway grating	--	--	$40,000	$40,000
49	Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)	--	$20,000	$50,000	$70,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
50	Replacement of four slide gates in Headworks	--	--	$50,000	$50,000
51	Replace RAS and Deep Injection Well flow meters with new magnetic meters	--	--	$50,000	$50,000
52	Replacement of MCC-3 (in the Operations Building Electric Room)	--	--	$120,000	$120,000
53	Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)	--	--	$10,000	$10,000
54	Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center No. 1, Panel PP-1 480V, Motor Control Center No. 2, PLC-1 (Main Control Panel))	--	--	$340,000	$340,000
55	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	--	--	$70,000	$70,000
56	Flow meter for Clarifier Nos. 1 and 2 b	--	--	$110,000	$110,000
57	Crack repair on the exterior wall surfaces of EQ tank	--	--	$30,000	$30,000
58	Repair guardrails on EQ tank	--	--	$40,000	$40,000
59	Install fencing to enclose Truck Wash Lift Station	--	--	$280,000	$280,000
60	Install an odor control system at the Headworks	--	--	$980,000	$980,000
61	Install an onsite plant service water system including reuse system	--	--	$1,960,000	$1,960,000
62	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	--	--	$50,000	$50,000
63	Painting of the facility	--	--	$210,000	$210,000
64	Upgrading cabinets in the Operations Building break room	--	--	$20,000	$20,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
65	Asphalt overlay and addition of parking spaces	--	--	$50,000	$50,000
66	Epoxy coat floors	--	--	$70,000	$70,000
67	Convert EQ tank to additional Clarifier or Aerobic Digester	--	--	--	$0
68	Install drain on Oxidation Ditch No. 1	--	--	$70,000	$70,000
Total NON-CRITICAL Capital Cost		**$2,190,000**	**$3,750,000**	**$5,550,000**	**$11,490,000**
Total CRITICAL + NON-CRITICAL Capital Cost		**$5,970,000**	**$3,750,000**	**$5,700,000**	**$15,420,000**

Notes:

a) It is recommended to demolish these structures.

b) Assumes flow measurement is achieved to Clarifier Nos. 1-4 using motorized gates and an ultrasonic level sensor in the Splitter Box No. 2 structure; combines #40 and #56. This modification will also allow plant staff to control the flow split to each of the clarifiers.

c) Will be priced if this is justified by TM 11 (Plant Optimization)

2.5.2 Pahokee WWTF

Based on the evaluation, the Pahokee WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the facility is good and the plant is in operable condition. Deficiencies were observed (as documented in previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in facility of this age. However, it is noted that overall, the Pahokee WWTF operates adequately. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also separated into three categories: critical for continued use, non-critical / enhancement and maintenance.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection, but their implementation may be delayed to meet the PBCWUD budget. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired but their implementation is not required as part of the rehabilitation and will not impair the use of the facility.

Critical Repairs

1. Replacement of generators
2. New grit removal system at Headworks
3. Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps
4. Replace steel bridge supports on Primary and Secondary Clarifiers
5. Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)
6. Replace Walker Unit elevated influent pipe supports
7. Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)
8. Replacement of 12” valve on the Deep Injection Well System
9. Rehabilitate all three Secondary Clarifiers
10. Modify stair top support on Aeration Tank Nos. 1 and 2
11. Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office

Non-Critical Repairs

1. Replacement of the mechanical bar screen
2. Replace Digester stairs
3. Replace all diffusers
4. Influent Pump Station rehabilitation
5. Reconfigure Chlorine / Operations Building and replace 4-inch sewer line
6. Remove and replace all sidewalks
7. Replace Wet well By-Pass valve
8. Rehabilitate Chlorine Contact Chamber Nos. 1 and 2
9. Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)
10. Replace all six blowers
11. Recoat two Secondary Clarifiers and repaint the steel bridges
12. Recoat Primary Clarifier and repaint the steel bridge
13. Recoat the Walker Unit and repaint the steel bridge
14. Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)
15. Blower House Nos.1, 2 and 3 roof, door and louver replacement
16. Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator NO. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panelboard, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))
17. Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator NO. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)
18. Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))
19. Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))

20. Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)
21. Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panel-board, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)
22. Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump Nos. 1, 2 and 3))
23. Flow pace blowers
24. Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2
25. Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures
26. Replace pump and auger in the Bioset system
27. Installation of a security fence
28. Replace Effluent Pump starters with VFDs
29. PLC system upgrade
30. Replace manual valves with electronic controlled valves
31. Replace grounding at the Headworks
32. Painting of the facility
33. Epoxy coat floors

Maintenance Repairs

1. Primary Clarifier: Change the lubricant
2. Blower House No. 2 Blower 1: Observe equipment and monitor fluid for bushing / thrust metal, change the lubricant and filter and perform an analytical ferrogram to clarify the type of wear and/or contamination that is present.
3. Blower House No. 2 Blower 2: Observe equipment and monitor fluid for lead
4. Equipment Building / Blower House No. 2, Effluent Pump No. 3: Inspect the breaker connections and check the amp readings
5. Secondary Clarifier - West: Change the lubricant
6. Control Building / Blower House No. 3, Blower No. 2: Inspect the breaker connections and check the amp readings
7. Effluent Pump No. 2: Closely monitor the pump for any increase in vibration amplitude and/or noise and perform another vibration survey in six months

8. Biosolid Gearbox: Observe equipment and monitor fluid for gear and/or bearing metal
9. Lime Auger: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
10. High Service Feed Pump: Replace pump bearings
11. Primary Sludge Pump: Inspect the starter connections and check the amp readings
12. Digester Transfer Pump: Observe equipment and monitor fluid for water, abrasives, gear and/or bearing metal and aluminum and change the lubricant
13. Blower Motor No. 2: Closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
14. Blower No. 1: Inspect the starter connections and check the amp readings

See **Table 2.2** for an opinion of probable cost for the rehabilitation work to assist the PBCWUD with its planning efforts. It should be noted that some of the recommended repairs may be able to be completed by PBCWUD staff at reduced costs. This cost estimate is an order-of-magnitude estimates based on published cost literature, past contractor bids, and previous experience with similar facilities. The accuracy of this type of cost estimate typically ranges from +50 to -30 percent. Costs are rounded to the nearest thousand dollars and presented in present-day dollars as defined by the association for the AACEI.

Table 2.2
Pahokee WWTF Opinion of Cost

CRITICAL Capital Items (listed in order of importance)		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Replacement of generators	$700,000	--	--	$700,000
2	New grit removal system at Headworks	$600,000	--	--	$600,000
3	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	$70,000	--	--	$70,000
4	Replace steel bridge supports on Primary and Secondary Clarifiers	$60,000	--	--	$60,000
5	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	$110,000	--	--	$110,000
6	Replace Walker Unit elevated influent pipe supports	$70,000	--	--	$70,000
7	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	$40,000	--	--	$40,000
8	Replacement of 12-inch valve on the Deep Injection Well System	$20,000	--	--	$20,000
9	Rehabilitate all three Secondary Clarifiers	$200,000	--	--	$200,000
10	Modify stair top support on Aeration Tank Nos. 1 and 2	$20,000	--	--	$20,000
11	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	$750,000	--	--	$750,000
	Total CRITICAL Capital Cost	**$2,640,000**	**$0**	**$0**	**$2,640,000**

Note: Costs include 30% contingency and 20% engineering

Table 2.2 (Continued)
Pahokee WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Replacement of the mechanical bar screen	--	$490,000	--	$490,000
2	Replace Digester stairs	--	$60,000	--	$60,000
3	Replace all diffusers	--	$40,000	--	$40,000
4	Influent Pump Station rehabilitation	--	$30,000	--	$30,000
5	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	--	$110,000	--	$110,000
6	Remove and replace all sidewalks	--	$20,000	--	$20,000
7	Replace Wet well By-Pass valve	--	$20,000	--	$20,000
8	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	--	$70,000	--	$70,000
9	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint) a	--	$0	--	$0
10	Replace all six blowers	--	$840,000	--	$840,000
11	Recoat two Secondary Clarifiers and repaint the steel bridges	--	$70,000	--	$70,000
12	Recoat Primary Clarifier and repaint the steel bridge	--	$50,000	--	$50,000
13	Recoat the Walker Unit and repaint the steel bridge	--	$130,000	--	$130,000
14	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	--	$5,600,000	--	$5,600,000
15	Blower House Nos.1, 2 and 3 roof, door and louver replacement	--	$70,000	--	$70,000
16	Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator No. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panel-board, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))	--	--	$170,000	$170,000

Table 2.2 (Continued)
Pahokee WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
17	Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator No. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)	--	--	$180,000	$180,000
18	Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))	--	--	$10,000	$10,000
19	Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))	--	--	$10,000	$10,000
20	Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)	--	--	$100,000	$100,000
21	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panel-board, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)	--	$30,000	--	$30,000
22	Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump No. 1, 2 and 3))	--	--	$30,000	$30,000
23	Flow pace blowers	--	--	$30,000	$30,000
24	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	--	--	$20,000	$20,000
25	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	--	--	$50,000	$50,000

Table 2.2 (Continued)
Pahokee WWTF Opinion of Cost

NON-CRITICAL Capital Items		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
26	Replace pump and auger in the Bioset system	--	--	$30,000	$30,000
27	Installation of a security fence	--	--	$630,000	$630,000
28	Replace Effluent Pump starters with VFDs	--	--	$170,000	$170,000
29	PLC system upgrade	--	--	$70,000	$70,000
30	Replace manual valves with electronic controlled valves	--	--	$30,000	$30,000
31	Replace grounding at the Headworks	--	--	$10,000	$10,000
32	Painting of the facility	--	--	$140,000	$140,000
33	Epoxy coat floors	--	--	$40,000	$40,000
Total NON-CRITICAL Capital Cost		**$0**	**$7,630,000**	**$1,720,000**	**$9,350,000**
Total CRITICAL + NON-CRITICAL Capital Cost		**$2,640,000**	**$7,630,000**	**$1,720,000**	**$11,990,000**

Notes:

a) The cost to rehabilitate the Chlorine / Operation Building (i.e., replace all doors / windows and repaint) has been combined with the cost to reconfigure the Chlorine / Operations Building and replace the 4-inch sewer line

In addition to the information developed as part of the renewal and replacement evaluation, the following reports are included in **Appendix B** for reference purposes related to climate resiliency:

- Climate Resilience for Various Palm Beach County Water Utility Department Facilities – Western Region Waste Water Treatment Facility-North, Pahokee, Florida (April 3, 2014)
- Climate Resilience for Various Palm Beach County Water Utility Department Facilities – Belle Glade Waste Water Treatment Facility, Belle Glade, Florida (April 3, 2014)
- Climate Resilience for Various Palm Beach County Water Utility Department Facilities – Water Treatment Plant 11, Belle Glade, Florida (April 28, 2014)
- Climate Resilience for Various Palm Beach County Water Utility Department Facilities – Belle Glade and South Bay Storage Tanks, Belle Glade, Florida (April 30, 2014)

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Chapter 3.0
Wastewater Service Area

This chapter summarizes the Glades Region Urban Service Area for wastewater. Data and other information concerning the wastewater service area were gathered from interviews with PBCWUD staff and from GIS data provided by PBCWUD staff.

3.1 Existing Wastewater Service Area

The overall Glades Region Urban Service Area shown in **Figure 3-1** encompasses approximately 43.5 square miles (27,878 acres) in northwest Palm Beach County. The PBCWUD currently provides both potable water and wastewater services in both incorporated and unincorporated areas of the region. This memorandum only addresses the wastewater component of the utilities. There are three municipalities in the PBCWUD Glades Region Wastewater Service Area. **Table 3.1** lists the incorporated communities. Unincorporated communities depend on Palm Beach County for police and other services.

Table 3.1
Incorporated Communities
within the PBCWUD Glades Region Wastewater Service Area

Incorporated Community	Designation	Year incorporated
Belle Glade	City	1918
Pahokee	City	1922
South Bay	City	1941

The wastewater service area is made up of two adjacent sub-areas with a common boundary slightly north of Paul Rardin Park. The 16.5 square mile (10,569 acres) service area to the north of Paul Rardin Park is comprised of collection basins whose flows are treated at the Pahokee WWTF, and extends north to Canal Point. The 27 square mile (17,313 acre) service area to the south, extending to the G2 Canal, includes the collection and transmission system providing flows to the Belle Glade WWTF. The two wastewater service areas asssociated

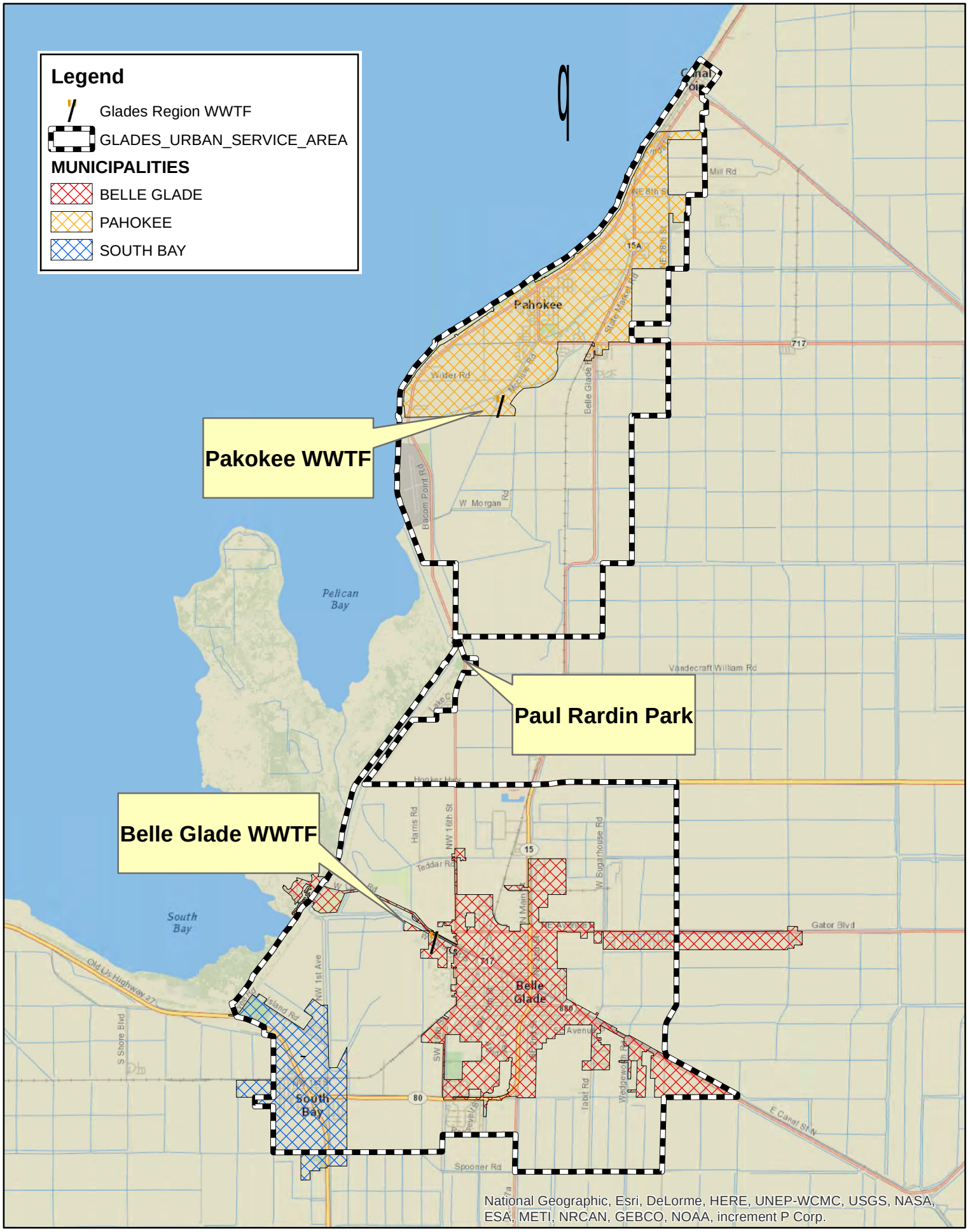

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Figure 3-1 - Glades Region Urban Service Area

with the Glades WWTF and Pahokee WWTF are shown in **Figure 3-2**. **Figures 3-3 and 3-4** illustrate each of the Pahokee WWTF service sub-area and the Belle Glade WWTF sub-area, respectively. There are currently no interconnections between the two collection/treatment systems.

Within the wastewater collection network, small capacity lift stations receive wastewater from defined areas or developments and pump it through a network of force mains to the larger master stations. Typically, the flows from master stations are re-pumped to one of the WWTFs. Wastewater transmitted to either the Pahokee WWTF or the Belle Glade WWTF is directed from master pump stations as described below and shown in **Figure 3-5**.

Table 3.2 summarizes the extent of both gravity sewers and pressurized force mains within both the Pahokee WWTF and Belle Glade WWTF portions of the service area. There are a total of 69 miles of gravity sewers and 54 miles of pressurized force mains in active service within the PBCWUD Glades Region Urban Service Area system.

Table 3.2
Summary of Palm Beach County Piping
within the PBCWUD Glades Region Urban Service Area

Description	Gravity Sewers (miles)	Pressurized Force Mains (miles)
Total	69	54
Pahokee WWTF	21	16
Belle Glade WWTF	48	38

Table 3.3 provides a summary of lift stations operating within the PBCWUD Glades Region wastewater service area collection network.

Table 3.3
Summary of Lift Stations within the
PBCWUD Glades Region Urban Service Area

Description	# Lift Stations
Total	101
Pahokee WWTF	40
Belle Glade WWTF	55
Other[1]	6

[1] *"Other" includes lift stations within the two WWTFs, an in-line booster station in South Bay and Lift Station 6069 that serves the Palm Beach County Police Training Facility.*

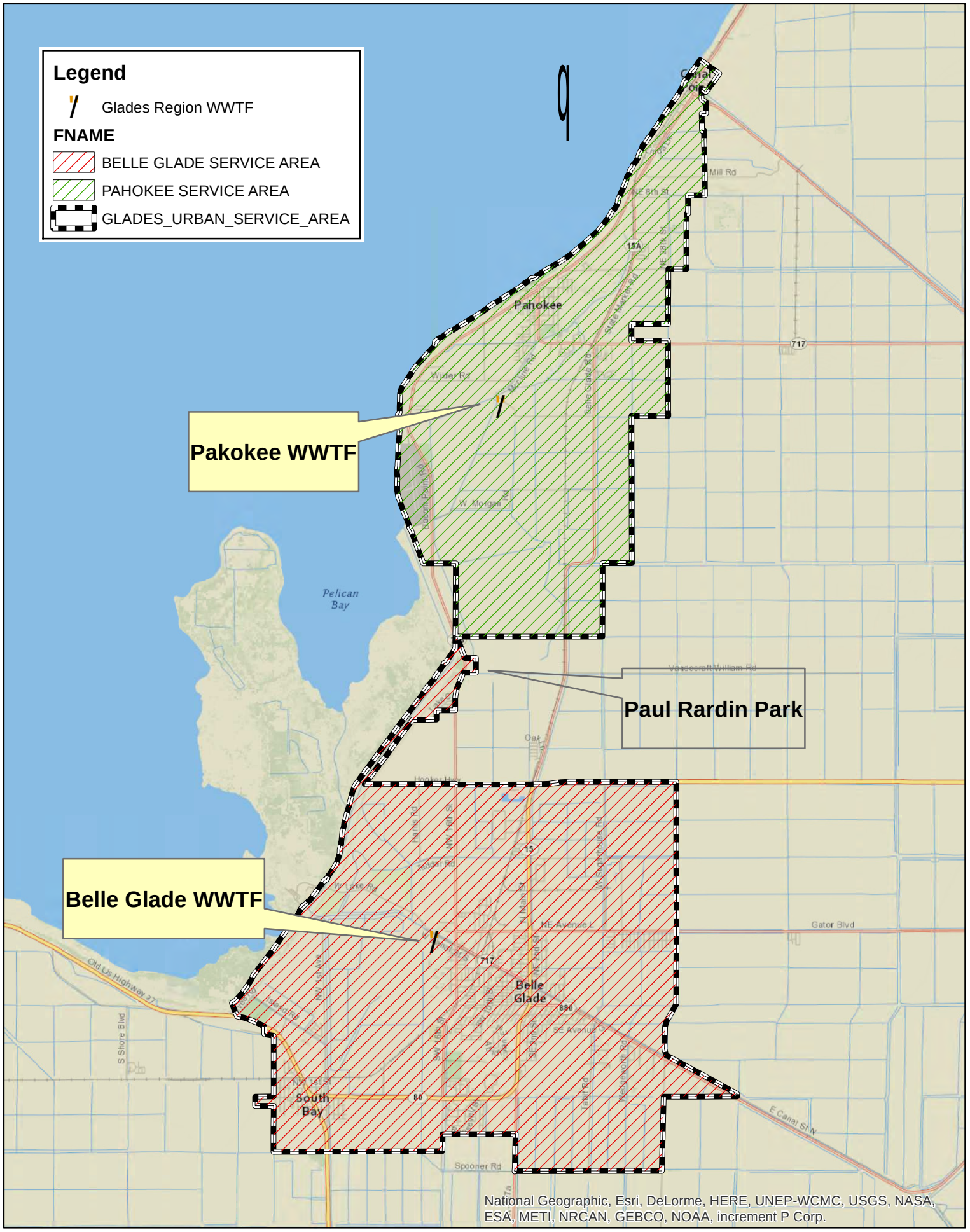

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Figure 3-2 - Glades Region Urban Service Sub-Areas

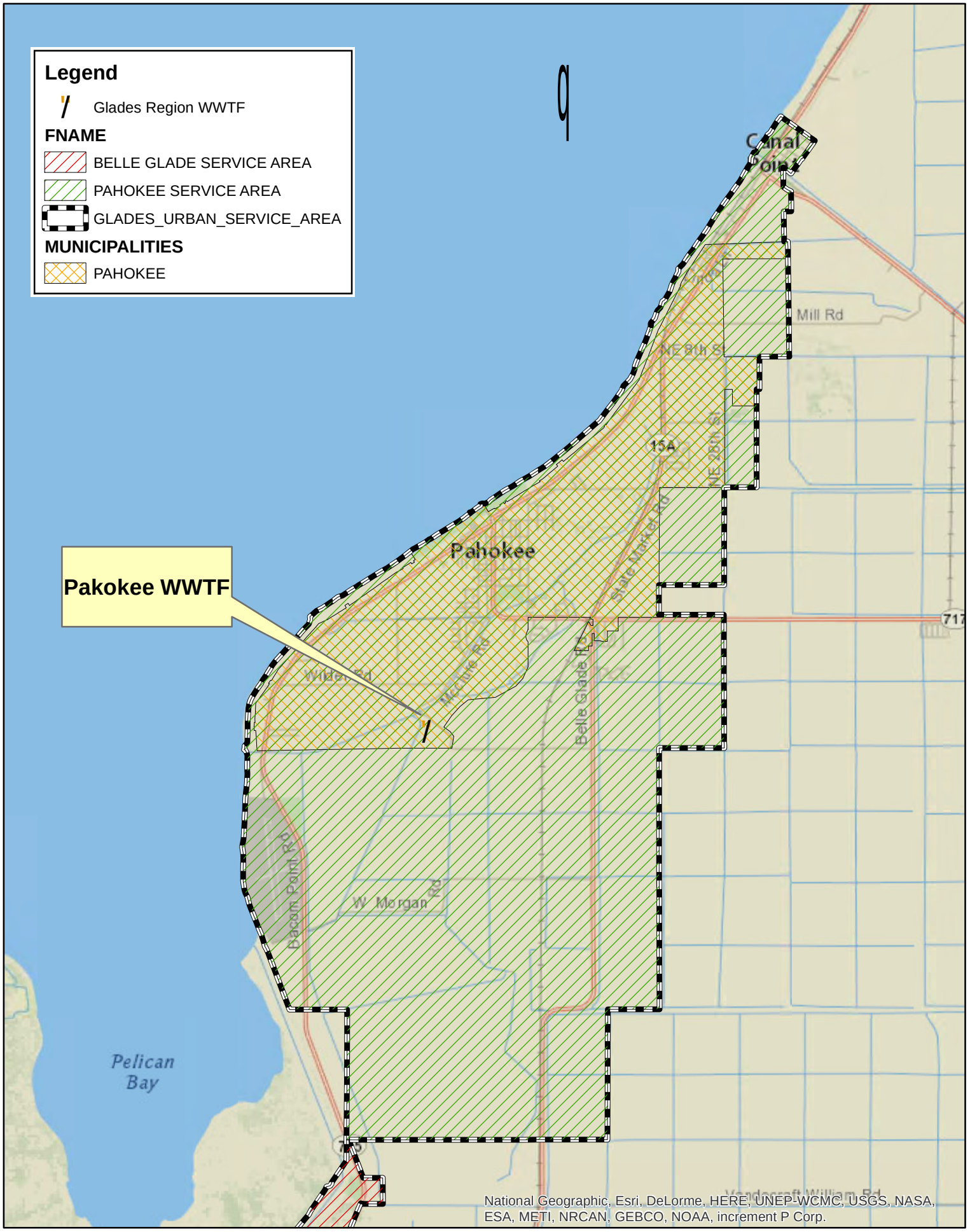

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Figure 3-3 - Pahokee WWTF Service Sub-Area

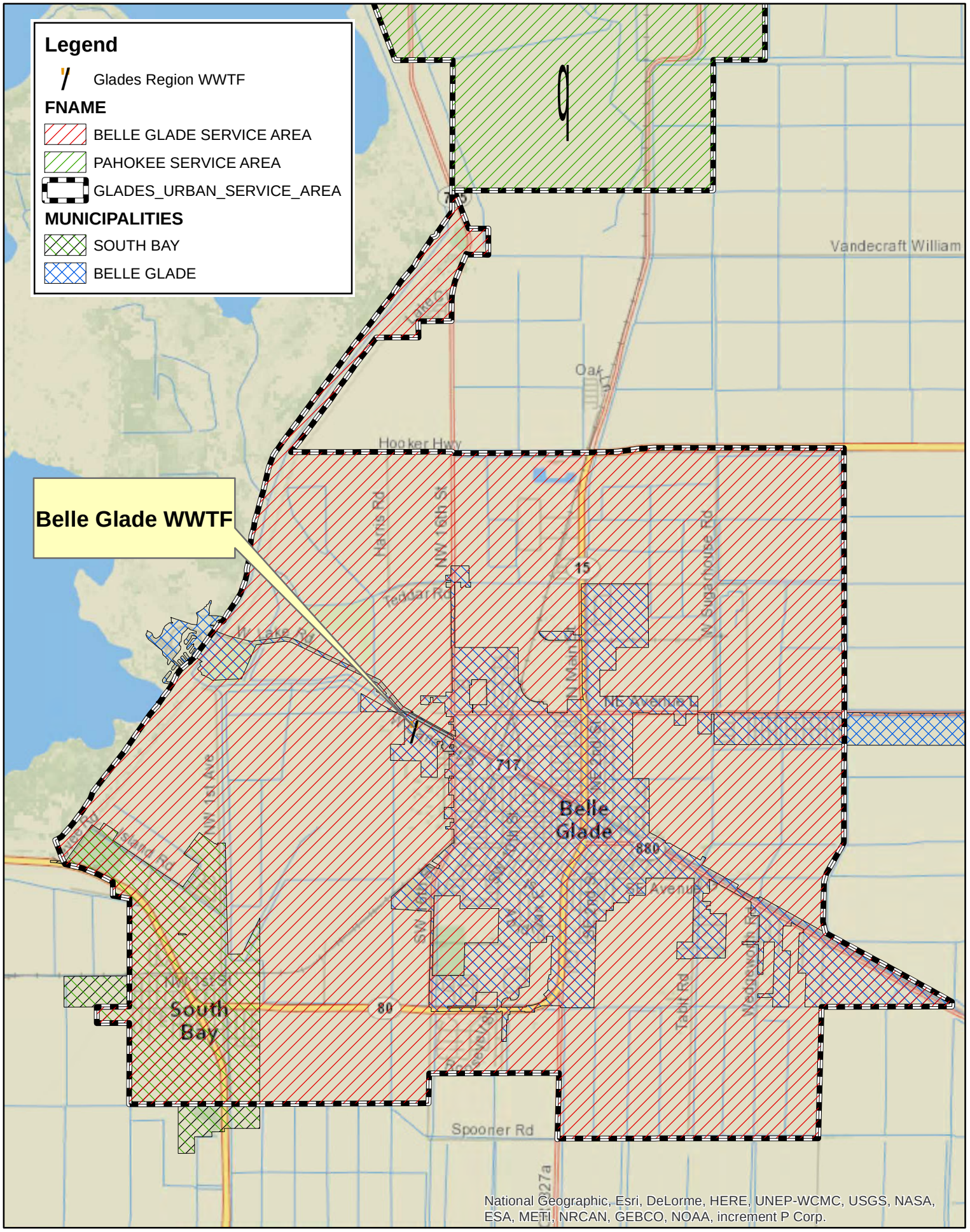

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Figure 3-4 - Belle Glade WWTF Service Sub-Area

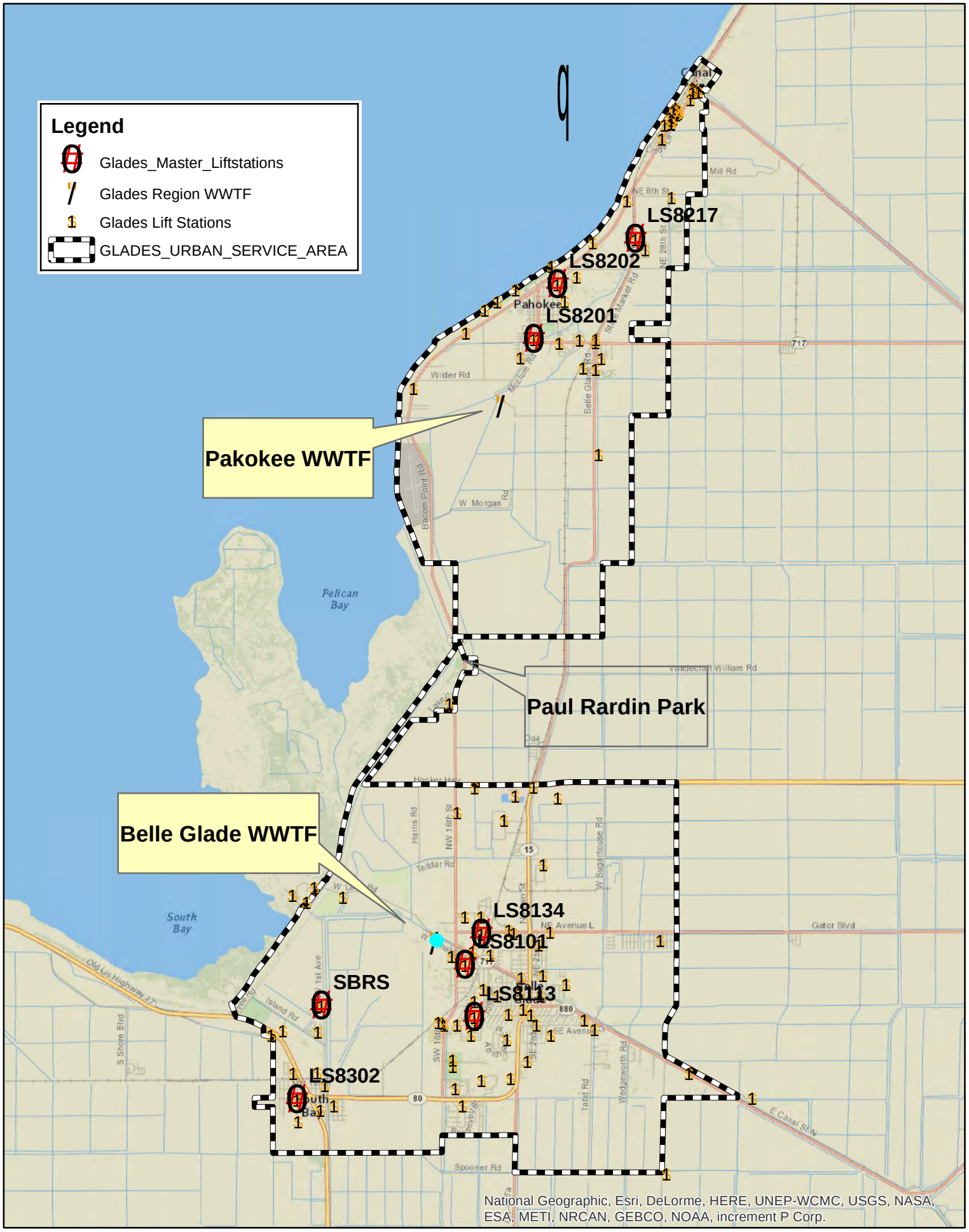

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Figure 3-5 - Lift Stations and Master Pump Stations

Areas without Service

Areas within the PBCWUD Glades Region Urban Service Area currently not being served by the PBCWUD are shown in **Figure 3-6**.

3.2 Future Expansion of Wastewater Service Area

Future expansion of the wastewater service area is not planned by PBCWUD. However, PBCWUD staff has indicated that expansion of the wastewater service area could occur under the following two conditions:

- When requested by a home owners association or similar entity (only if the full cost of the expansion is funded through a special assessment); and
- Where infrastructure is provided for new development by a developer

In practice, PBCWUD staff have indicated that owner initiated service area expansion occurs rarely and is typically the result of a Palm Beach Health Department order imposed in response to a septic system failure within a multi-family community. To aid in locating areas of potential future expansion, all areas within the wastewater service area will be considered. PBCWUD staff has indicated that it is very unlikely that expansion of the existing collection system would occur outside of the grey area highlighted in **Figure 3-6**.

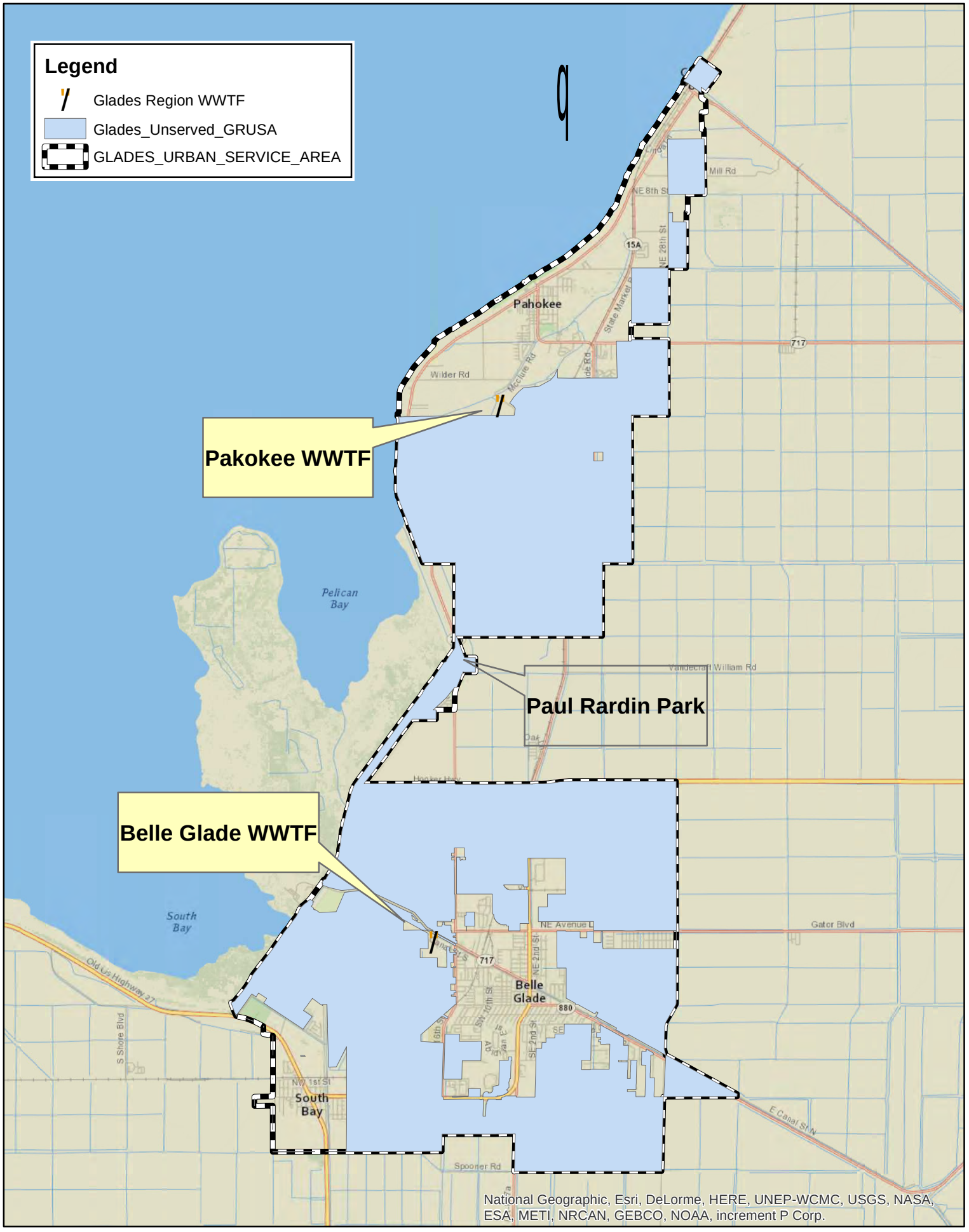

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Figure 3-6 - Glades Region - Areas Without Wastewater Service

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Chapter 4.0
Population Projections

This chapter of the Glades Region Wastewater Master Plan summarizes the historical population data and projected population growth for the Glades Region Urban Service Area through the year 2035. Glades Region population data were supplied to Hazen and Sawyer in electronic format (MS Excel – .xls) by PBCWUD staff. These data were based on 2010 US Census data, updated by the University of Florida's Bureau of Economic and Business Research (BEBR) with estimates at the county level for future years, in 5 year time increments, to 2030. The BEBR population data for Palm Beach County was processed by the Palm Beach County Planning Division using its Population Allocation Model that spatially distributes the County's population by Traffic Analysis Zones (TAZs). The Planning Division reports that the model incorporates the following:

- 2010 Census populations and related information (Summary File 1, released in August 2011) such as persons per household, group quartered populations, vacancy and seasonal rates by TAZs. Henceforth the baseline for future population models will be the year 2010.
- Latest BEBR projections, released in June 2011. These projections are based on the 2010 Census released in late March of 2011.
- Land use density changes, approved or expired residential projects, annexations and BEBR Municipal population estimates, adopted up to 2011.

4.1 Population Forecast Analysis

Population projections provided by TAZs were grouped into either the Pahokee WWTF Service Area or the Belle Glade WWTF Service Area by associating the Planning Division's tabular data with TAZ polygons within the GIS environment, then selecting TAZs that lie within either of two wastewater service areas. The PBCWUD Glades Region Urban Service Area (addressed in Technical Memorandum No. 3 – Glades Region Wastewater Service Area) represents the current collection areas for the two wastewater treatment facilities: the Pahokee WWTF and the Belle Glade WWTF. PBCWUD Glades Region service area TAZs are shown in **Figure 4-1**.

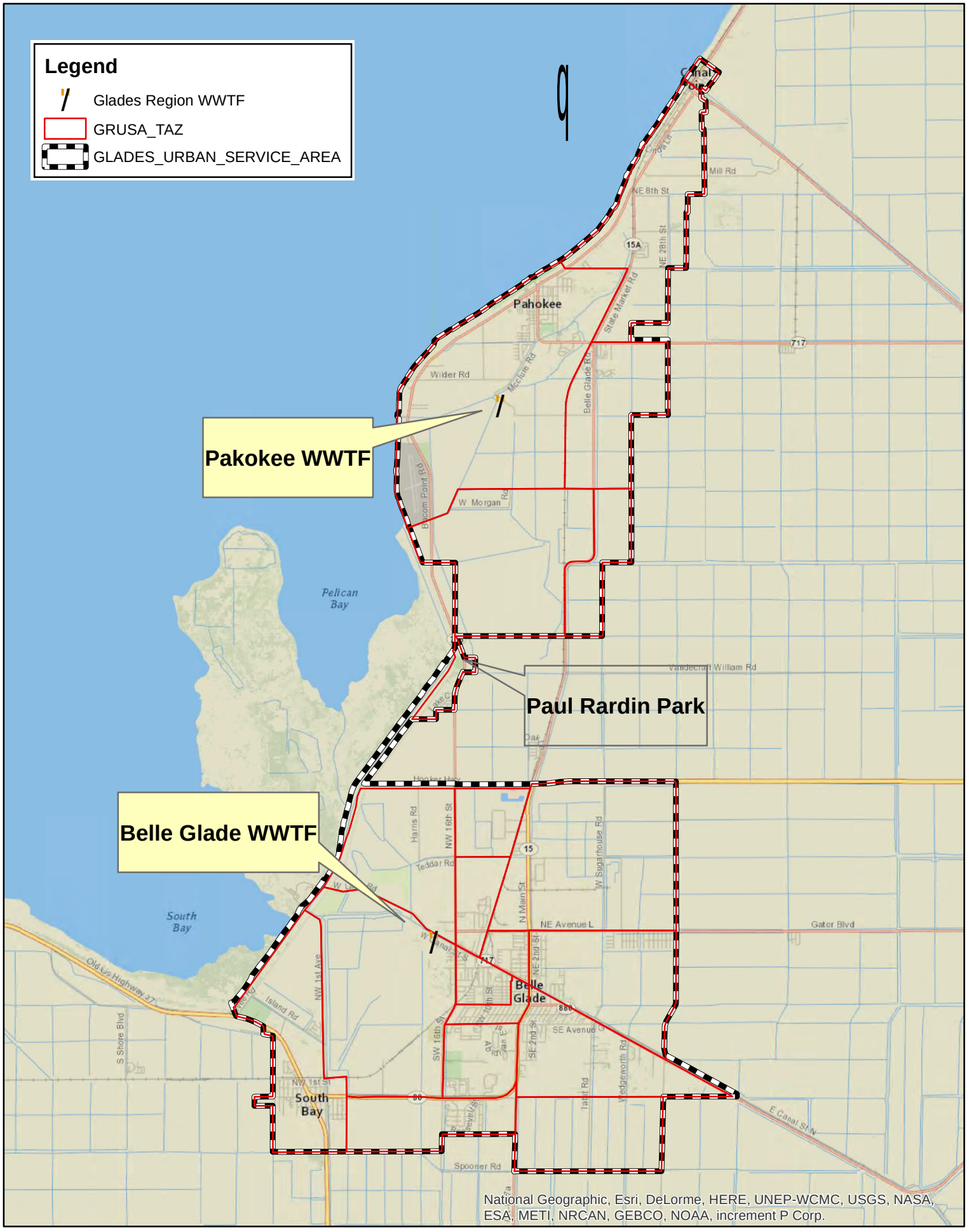

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Figure 4-1 - Glades Region Traffic Analysis Zones (TAZ)

Population projections for each wastewater service area were developed by summing the future population estimates of the individual TAZs within the service area. Detailed service area population by TAZ is provided in Technical Memorandum No. 4.

The following assumptions were made in preparation of the population projections:

- Expansion of service within the current wastewater service area will be relative to estimated growth in population within each existing service area TAZ.
- The census data are based on permanent residents and do not reflect possible seasonal changes. For the purposes of this Master Plan, all data are based on permanent populations and addresses seasonal fluctuations using peaking factors.

4.2 Population Projection Results

The PBCWUD populations by service area are summarized in **Table 4.1** and **Figure 4-2,** and include only those TAZs that fall within the Glades Region Urban Service Area boundary. The 2010 service area population is estimated to be 33,506 with 23 percent, or 7,836 in the Pahokee WWTF service area and 77 percent, or 25,671 in the Belle Glade WWTF service area. The Pahokee WWTF service area population is expected to increase by nearly 32 percent by 2035 to 10,347. By comparison the Belle Glade WWTF population is expected to grow by about 67 percent to 42,816. The entire service area is expected to grow to about 53,136 by 2035, or almost 59 percent.

Table 4.1
Population Summary

Area	Projected Population					
	2010 (Base Year)	2015	2020	2025	2030	2035
Palm Beach County	1,320,134	1,325,743	1,394,300	1,482,900	1,568,500	No Data
Change from base year (%)		0%	6%	12%	19%	No Data
Belle Glade Service Area	25,671	26,125	28,547	32,909	37,539	42,816
Change from base year (%)		2%	11%	28%	46%	67%
Pahokee Service Area	7,836	8,140	8,767	9,368	9,887	10,347
Change from base year (%)		4%	12%	20%	26%	32%
Glades Region Urban Service Area	33,506	34,266	37,314	42,278	47,426	53,163
Change from base year (%)		2%	11%	26%	42%	59%

Figure 4-2
Wastewater Service Area Population Projections

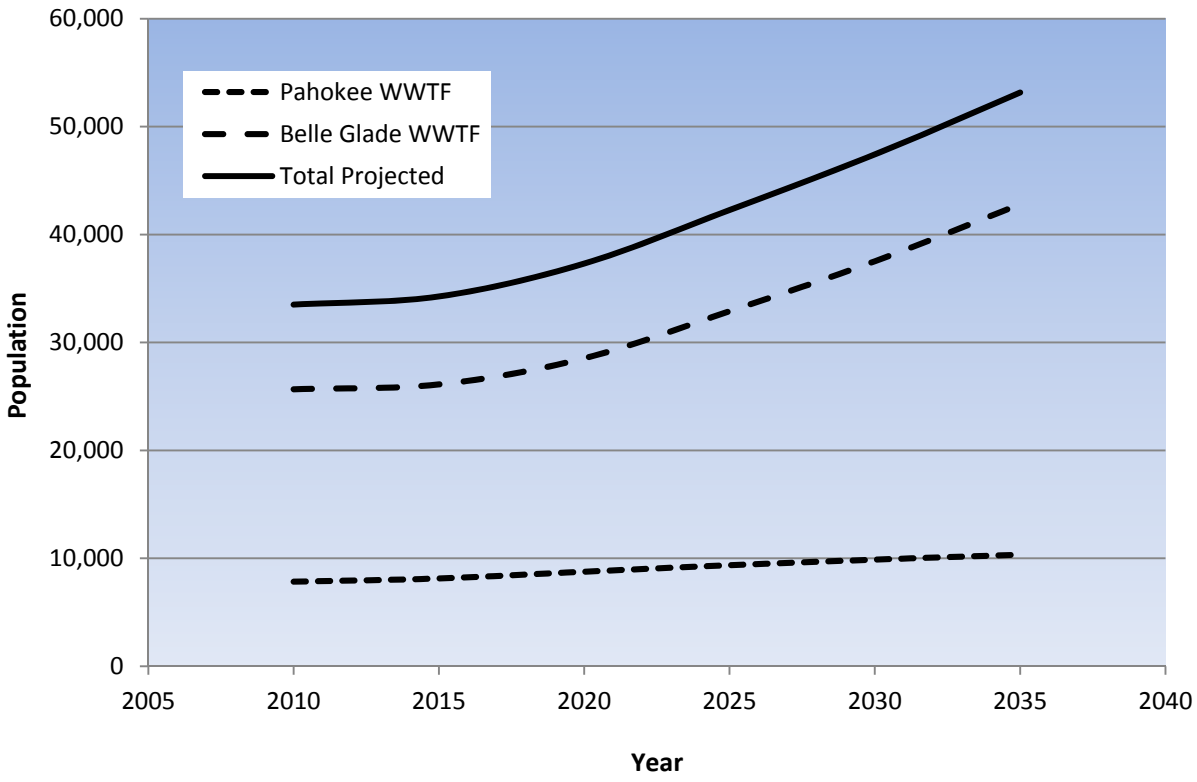

Table 4.1 also includes the percent change in population calculated by TAZ for each time step relative to the base year (2010). The percent change in population is important because of its relationship to percent change in water demand which ultimately drives wastewater generation. **Figures 4-3 through 4-7** show a progression of population percent change, grouped in 20 percent increments, from 2015 to 2035. **Figure 4-7** shows some areas within the wastewater service area anticipated to grow at a disproportionately higher rate than other areas resulting in an uneven distribution of population change over the planning horizon based on population data provided the County. Population growth is expected to occur within and in areas that are adjacent to currently developed areas in Pahokee, South Bay and Belle Glade. **Table 4.2** provides the percent change in population in the Glades wastewater services area by TAZ.

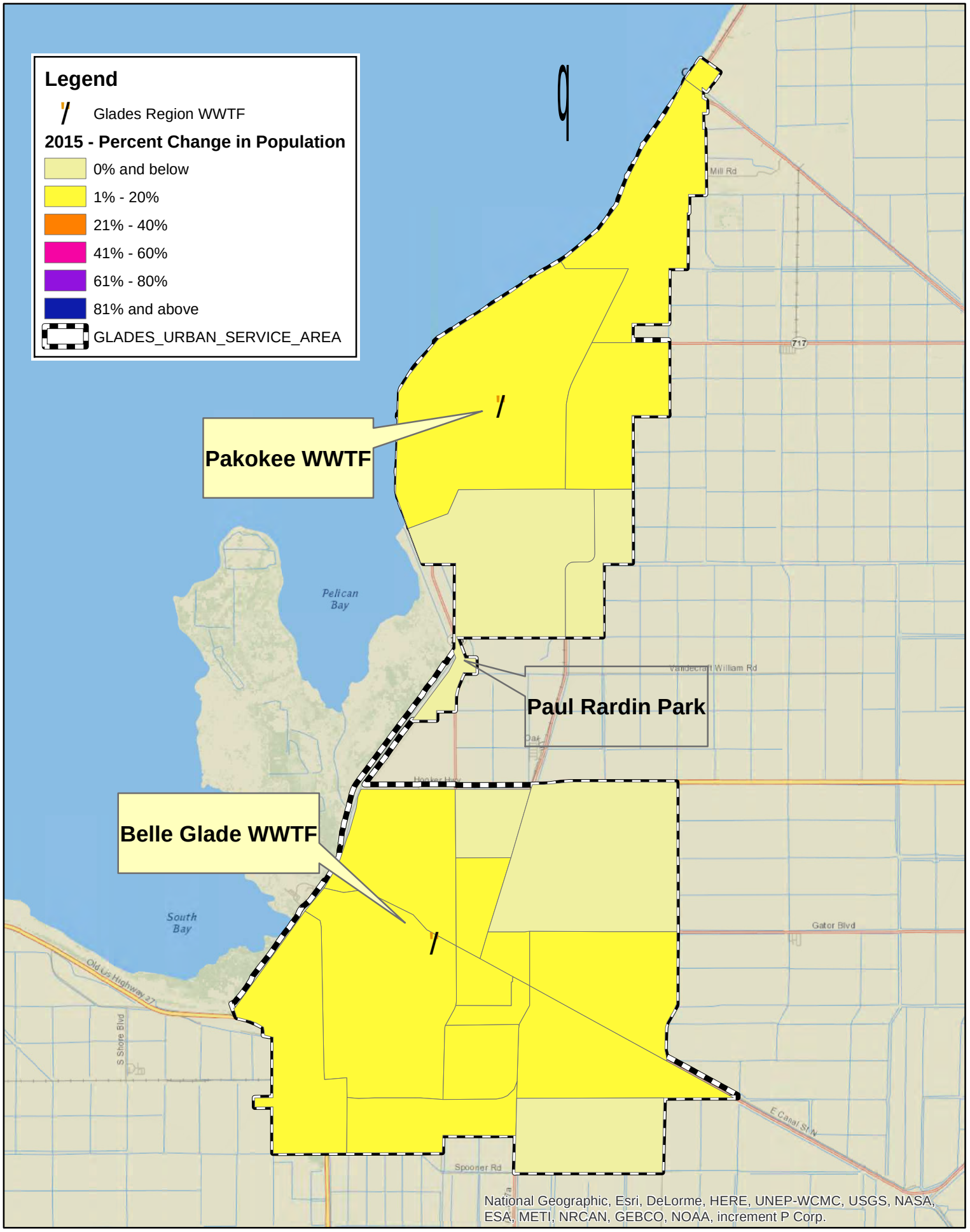

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Figure 4-3 - Percent Change in Population Between 2010 and 2015 by TAZ

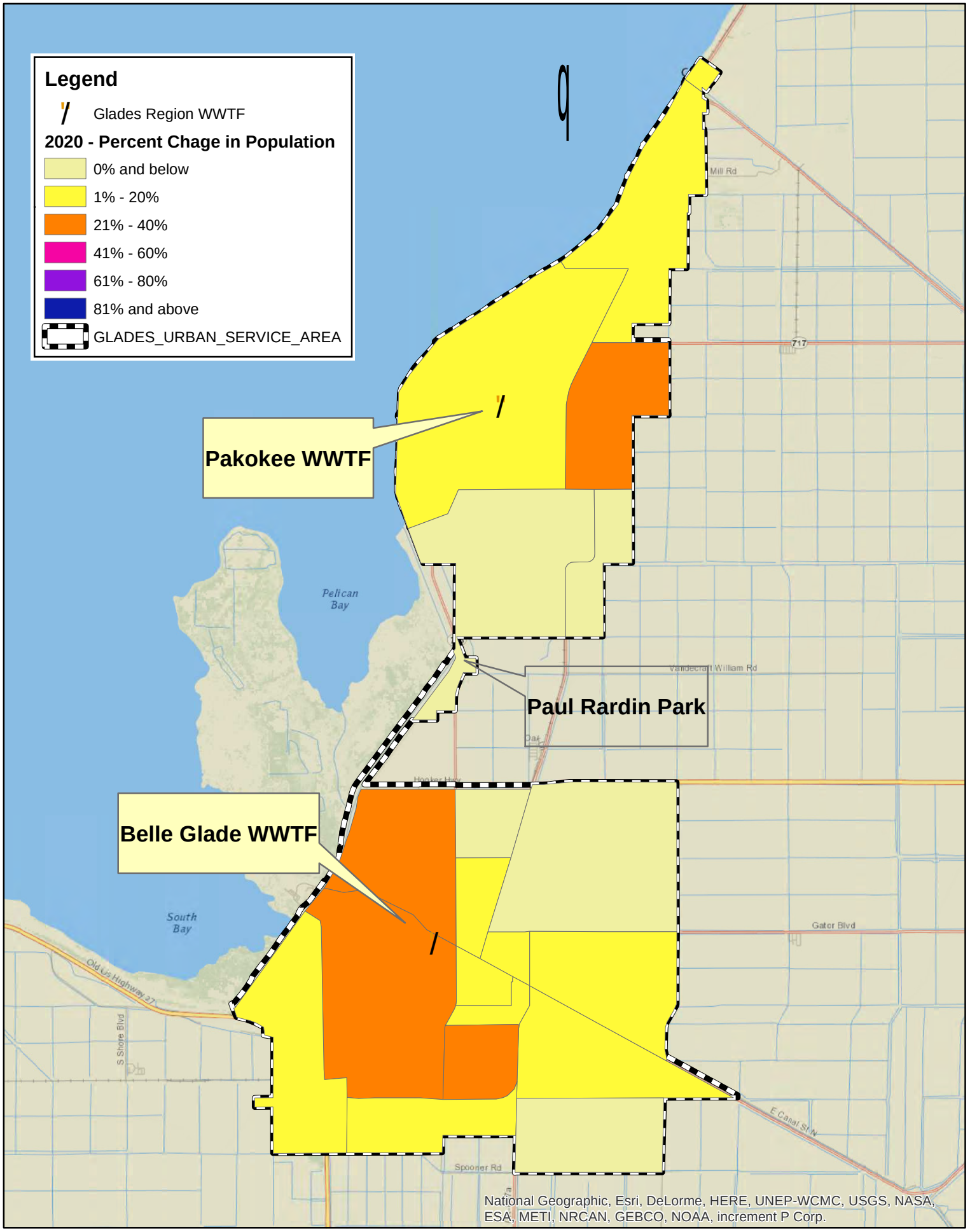

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Figure 4-4 - Percent Change in Population Between 2010 and 2020 by TAZ

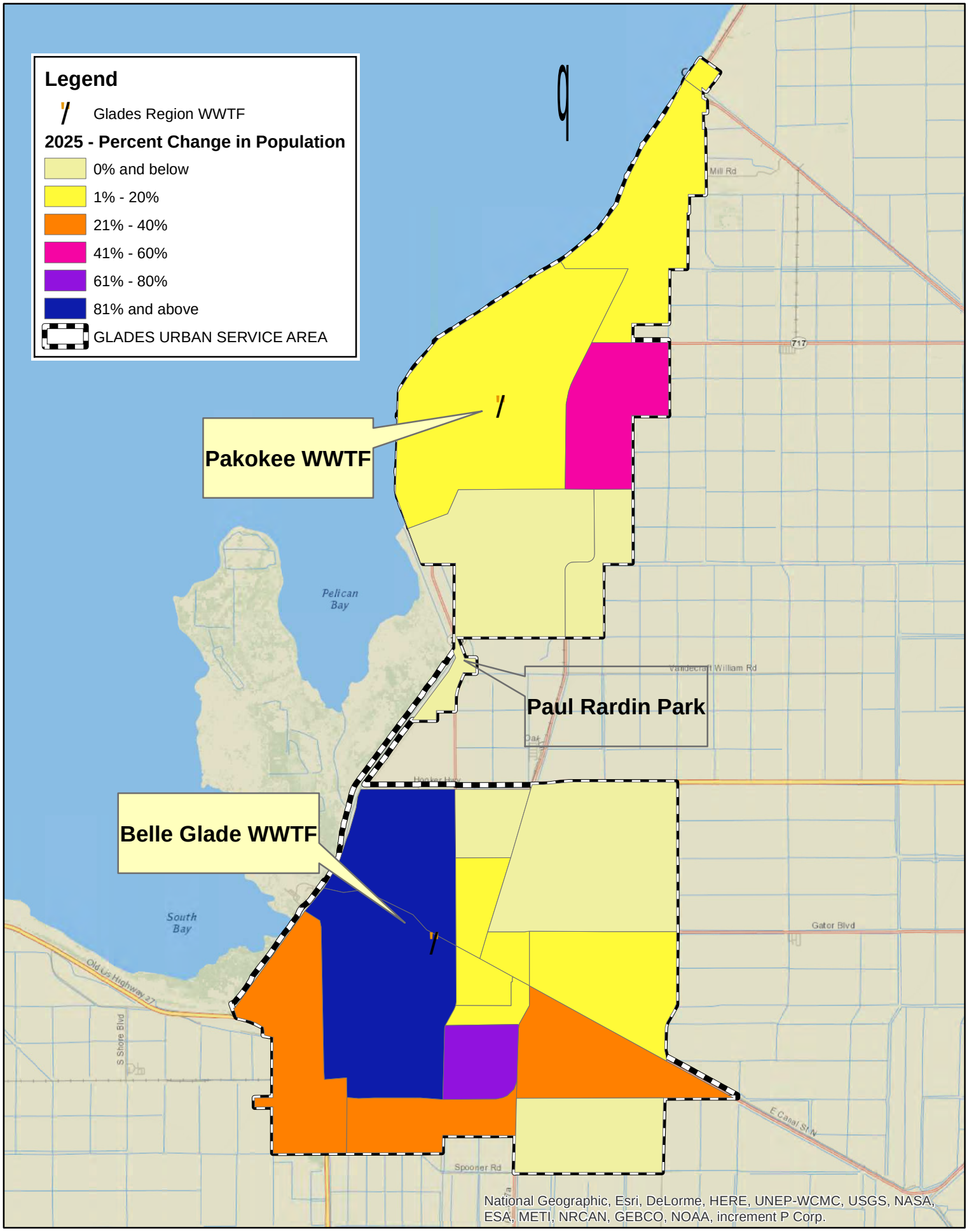

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Figure 4-5 - Percent Change in Population Between 2010 and 2025 by TAZ

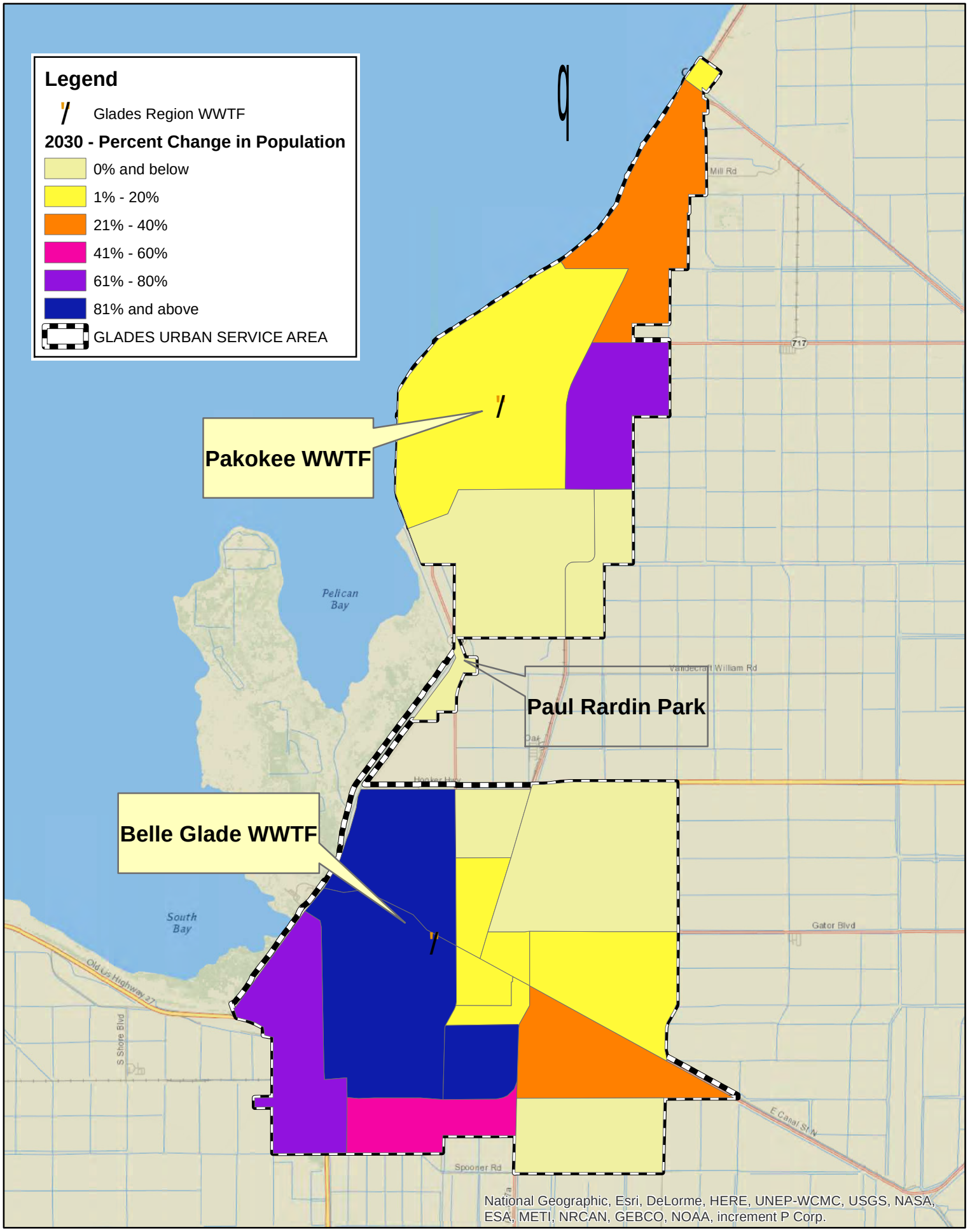

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Figure 4-6 - Percent Change in Population Between 2010 and 2030 by TAZ

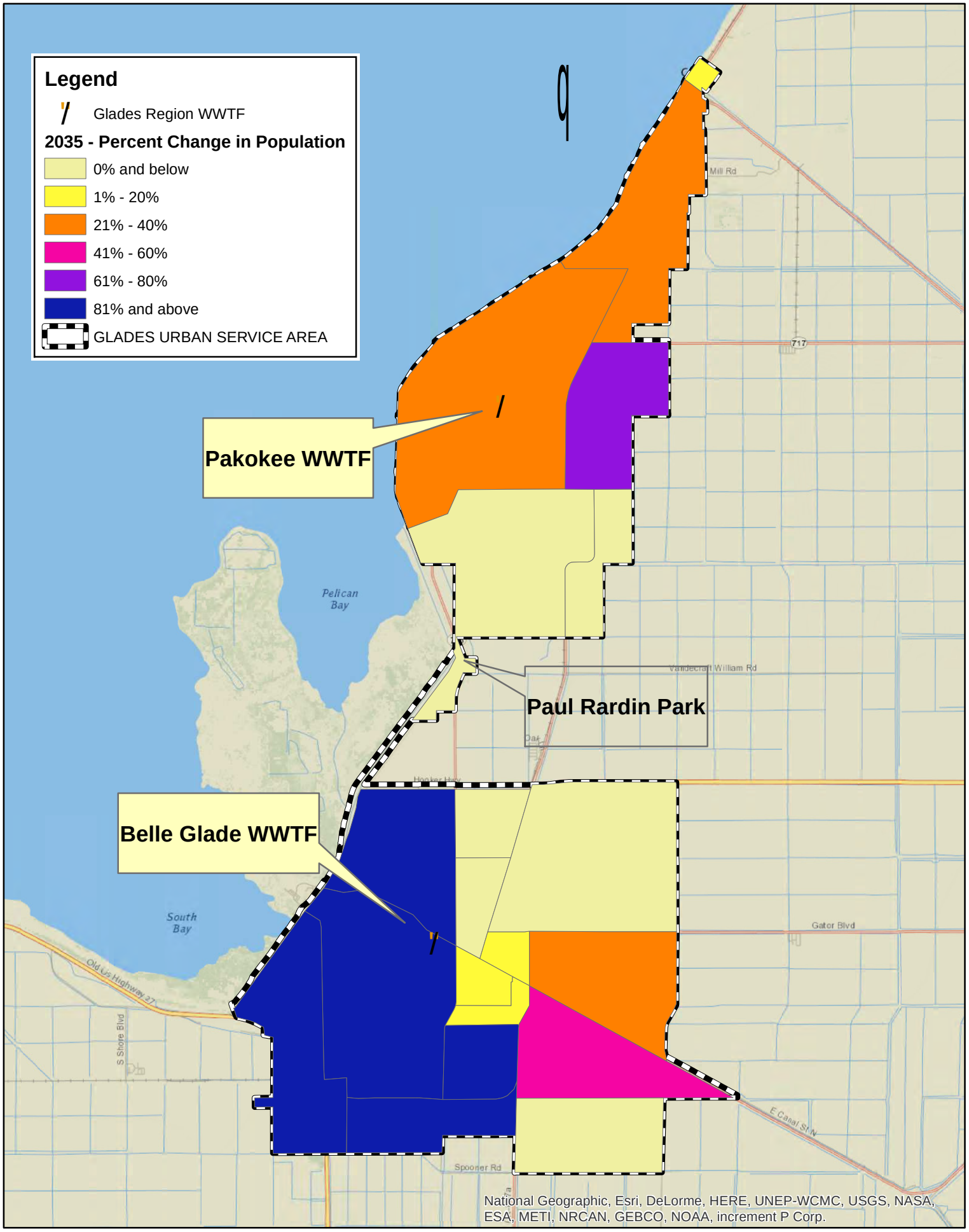

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Figure 4-7 - Percent Change in Population Between 2010 and 2035 by TAZ

Table 4.2
Glades Region Service Area Population Projections by TAZ

TAZ ID	Population (Raw Data from County)						Percent Change from 2010				
	2010	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
1204	256	258	268	276	289	293	0.8	4.8	8.1	12.9	14.5
1205	1,612	1,666	1,762	1,852	1,936	2,013	3.3	9.3	14.8	20.0	24.8
1206	1,236	1,348	1,603	1,839	2,048	2,213	9.0	29.7	48.7	65.6	78.9
1207	4,731	4,869	5,134	5,402	5,615	5,829	2.9	8.5	14.2	18.7	23.2
1208	576	576	576	576	576	576	0.0	0.0	0.0	0.0	0.0
1209	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
1210	483	483	483	483	483	483	0.0	0.0	0.0	0.0	0.0
1211	672	672	672	672	672	672	0.0	0.0	0.0	0.0	0.0
1212	3,062	3,163	3,377	3,542	3,665	3,755	3.3	10.3	15.7	19.7	22.6
1213	703	705	716	722	726	731	0.2	1.8	2.7	3.2	3.9
1214	1,224	1,227	1,227	1,227	1,227	1,123	0.2	0.2	0.2	0.2	-8.3
1215	70	72	91	395	870	1,345	2.7	30.0	466.3	1,148.1	1,829.9
1217	4,743	4,755	5,343	6,489	7,847	9,170	0.3	12.6	36.8	65.4	93.3
1218	499	517	608	1,673	2,511	3,271	3.5	21.9	235.2	403.4	555.6
1219	3,980	4,021	4,112	4,176	4,222	4,253	1.0	3.3	4.9	6.1	6.9
1220	2,708	2,755	2,836	2,887	2,920	2,940	1.7	4.7	6.6	7.8	8.5
1221	2,767	2,878	3,766	4,674	5,790	7,829	4.0	36.1	68.9	109.2	183.0
1222	2,485	2,596	2,885	3,171	3,443	3,715	4.5	16.1	27.6	38.5	49.5
1223	208	208	208	208	208	208	0.0	0.0	0.0	0.0	0.0
1224	1,490	1,497	1,647	2,013	2,379	2,745	0.5	10.6	35.1	59.7	84.3
All TAZs	33,506	34,266	37,314	42,278	47,426	53,163	2.3	11.4	26.2	41.5	58.7

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Chapter 5.0
Wastewater Flow and Loading Projections

This chapter presents information regarding historical collection system flows to the Belle Glade and Pahokee WWTFs, provides projections future collection system flows to the individual pump / lift stations, and provides estimates of future wastewater constituent concentrations and loadings through the planning year 2035. Additionally, this chapter provides an evaluation of peaking factors within the two WWTFs. The wastewater flow forecast presented herein is based upon the population forecast information presented in Technical Memorandum No. 4 (TM-4), which is included in **Appendix A**, and used as the principal driver of the wastewater hydraulic model (see Chapter 6). Current and projected collection and transmission system wastewater flows and loadings were estimated for the Glades Region Urban Service Area based on information provided by County staff including SCADA, laboratory and utility billing data as well as regulatory and operational reports.

The County's Glades Region wastewater master planning effort includes an evaluation of its wastewater collection and transmission system through the use of hydraulic modeling methods. A collection and transmission system hydraulic model is being developed that, when fully configured and calibrated, will provide a medium for simulating current and future system performance based on physical and operational characteristics of the system. This chapter provides several data elements required to configure the Glades Region hydraulic model for use as a planning tool.

5.1 Historical Wastewater Flows

Table 5.1 summarizes historical wastewater flow to the Belle Glade and Pahokee WWTFs as measured by the influent flow meters for the period from October 1, 2010 through September 30, 2011. Over this period, the wastewater flow conveyed to the Pahokee WWTF averaged about 0.77 MGD and to the Belle Glade WWTF has averaged about 2.60 MGD.

Table 5.1
Historical Monthly Average Daily Flow to the Pahokee WWTF and the Belle Glade WWTF

Month	Pahokee WWTF (mgd)	Belle Glade WWTF (mgd)
Oct-10	0.77	1.87
Nov-10	0.80	1.91
Dec-10	0.83	2.18
Jan-11	0.85	2.17
Feb-11	0.75	1.98
Mar-11	0.84	2.64
Apr-11	0.83	2.20
May-11	0.68	2.39
Jun-11	0.68	1.98
Jul-11	0.78	4.77
Aug-11	0.69	2.74
Sep-11	0.74	4.32
Average	**0.77**	**2.60**

5.1.1 Data Used for Estimations

Principal data used for estimating and assigning flows to collection system lift stations and pump stations, and their sources, are shown in **Table 5.2**. Data used to complete this Task was obtained from PBCWUD sources using Traffic Analysis Zones (TAZs).

Table 5.2
Wastewater Flow Data and Sources

Data Item	Source	Filename
Population by TAZ to 2030	Palm Beach County Planning Division Population Allocation Model (via PBCWUD)	Glades Population Analysis.xlsx
Glades Region Monthly Water Meter Flow	PBCWUD Utility Billing Section	gua_usage_fy_2011.xlsx
Pahokee WWTF Influent Flow	Pahokee WWTF SCADA Historical Data	PAHOKEE WW PLANT DATA WORKSHEET -1-xlsx.xlsx
Belle Glade WWTF Influent Flow	Belle Glade WWTF SCADA Historical Data	BelleGlade_WWTP_Flows.xlsx
Lift Station/Pump Station Collection Basin Polygons	PBCWUD	LSParcels.shp
Public and Private Lift Station Points	PBCWUD	PBCWUD_SewerNetwork_Structure_Glades.shp

5.1.2 Estimation of Individual Lift / Pump Station Flows

Flows for individual lift stations were estimated for the current period using potable water metered flow data obtained from utility billing summary data spreadsheet file. This dataset provided billing summary information for utility accounts within the Glades Region billing database as of September 2011. The datasets provided identification and location information as well as monthly water meter flow for each account. Each account record was spatialized within a GIS environment to distribute water demands to the sites where they occurred. Account spatialization was achieved in one of two ways, depending on the data quality of individual billing account records.

- The majority of account records included an entry for the Parcel ID number. With this number, a water account record could be attached to its associated parcel using a GIS table joining technique. As many account records shared the same Parcel ID number, duplicate records with a usable Parcel ID were combined and monthly meter flow values summed using a dissolve technique within a Microsoft Access database prior to the GIS join. Once water meter flow data was attached to associated parcels, parcel polygons were converted to points.
- Accounts that did not have a usable Parcel ID number were spatialized using GIS geocoding techniques that located individual accounts using the service address field of the account record. A composite address locator was created that used the parcel polygon layer (noted previously) as the primary locator and a road centerline layer as a secondary locator.

With water meter flow data distributed across the service area, individual meter flow records were associated with a service area lift station. This was accomplished in GIS by overlaying spatialized water account point data on wastewater collection basin polygons, such that each account received a lift station identifier. Water account points that did not fall within a collection basin polygon was given the lift station identifier of the closest basin.

The County's lift station point file was edited to provide Station ID numbers to the 15 private stations without identification.

Individual water meter account flows were subtotaled based on each accounts lift station basin affiliation to calculate total monthly water demands for each basin.

5.2 Flow Projections

This section presents the methodology used to estimate the theoretical wastewater generated from the Glades Region wastewater service area. The 2011 station flows, described previously, were converted from thousand gallons per month (kgal/mo) to gallons per minute (gpm). For developed areas, flow projections for 2015, 2020, 2025, 2030, and 2035 were calculated for each basin, based on expected population growth, as discussed below.

Future lift station flows were derived with the assumption that system-wide water consumption grows at a rate that is consistent with that of population. Hence, the percent change in population for each service area TAZ between the 2011 (the base year) and each of the time step years (2015, 2020, 2025, 2030, and 2035) was calculated as a water demand growth coefficient. Each wastewater collection basin was assigned a TAZ identifier for the TAZ in which it resides. Three areas spanned more than a single basin and were assigned a TAZ identifier for the TAZ where the majority of its area was found. Each lift station basin's average potable meter flow was multiplied by its TAZ growth coefficient for each time step to produce an array of five future meter flows. The total metered flow associated with each WWTF service area was equal to the sum of its associated lift station basin potable water flows.

The 2011 and future potable water meter flow values associated with each lift station were converted to wastewater flows by adjusting for both irrigation usage and expected improvements to collection system infiltration and inflow. Hence,

WW = PW – IRR + I/I

Where:

WW = WWTF inflow,

PW = metered potable water use,

IRR = irrigation use, and

I/I = infiltration and inflow

Irrigation use was set at 10% of total water use. Infiltration and inflow was estimated in the base year (i.e., 2011) as being historic WWTF average daily influent flow minus irrigation adjusted potable water use, or about 0.87 mgd in Belle Glade / South Bay, and 0.44 mgd in Pahokee. WWTF influent flows at each of the future time steps were estimated by taking the population adjusted potable water use, subtracting irrigation use, then adding adjusted base year infiltration and inflow flow. Infiltration and inflow was adjusted downward by 5% at each successive time step (1% per year until 2035) to adjust for expected improvements in infiltration and inflow due to the remediation efforts made by the County. After 2035, it was assumed that the improvements to infiltration and inflow in a given year will be balanced by increases caused by aging infrastructure.

The overall wastewater flow forecast (on an annual average daily flow basis) for the entire Glades Region Urban Service Area is presented in **Table 5.3**.

Table 5.3
Annual Average Day
Forecasted Wastewater Flow

Year	Belle Glade (mgd)	Pahokee (mgd)	Combined Flow (mgd)
2015	2.57	0.77	3.34
2020	2.69	0.80	3.49
2025	2.89	0.83	3.72
2030	3.09	0.84	3.93
2035	3.35	0.89	4.24

5.2.1 Wastewater Influent Flow Peaking Factors

Historical wastewater flow data were evaluated to determine the historical maximum day flow (MDF) and the peak hour flow (PHF) and their associated individual peaking factors (PFs) for 2011, for each of the two WWTFs. The maximum day flow peaking factor is defined as the MDF divided by the annual average daily flow (AADF) (i.e., MDF PF = MDF / AADF). The peak hour flow peaking factor is defined as the PHF divided by the AADF (i.e., PHF PF = PHF / AADF). Wastewater influent flow peaking factors were calculated from 2011 SCADA historical data for the Pahokee and Belle Glade WWTFs (provided by County staff). Maximum Day and Peak Hour peaking factors for each plant are provided in **Table 5.4**.

Table 5.4
Wastewater Treatment Facility Peaking Factors

Description	Pahokee WWTF	Belle Glade WWTF
Maximum Day Influent Flow	2.19	7.91
Average Day Influent Flow	0.77	2.60
Maximum Day Flow Peaking Factor	**2.84**	**3.04**
Peak Hour Flow	3.49	10.91
Average Hour Flow	0.89	2.60
Peak Hour Flow Peaking Factor	**3.93**	**4.20**

5.2.2 Wastewater Constituent Concentrations and Loadings

Wastewater influent concentrations and loads for the Pahokee WWTF and Belle Glade WWTF were calculated from the 2011 to 2012 historical influent data provided by County staff. Three parameters, 5-day Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), and Total Kjeldahl Nitrogen (TKN) were not included in this analysis as the available data was insufficient.

Pahokee WWTF and Belle Glade WWTF historical annual average influent concentrations and loadings can be found in **Tables 5.5 and 5.6**, respectively. The daily and 30-day moving average influent concentrations and loads were plotted for 2011 to 2012 to determine if the loadings are increasing over time and to determine loading trends and estimate future loadings to the facilities. Pahokee WWTF 5-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) loadings remained steady and Total Suspended Solids (TSS) loadings increased by about 12% over the period from 2011 to 2012. The $CBOD_5$ and TSS concentrations are measured daily. Over the same 2-year period the flow increased by approximately 15%. Therefore, from the data it appears that TSS loading is increasing at about the same rate as is flow, indicating a wastewater that is consistent in strength. It was assumed that additional future flow will have the same trend in loadings as the 2011 through 2012 time period for $CBOD_5$ and TSS.

Belle Glade WWTF $CBOD_5$ and TSS loadings have decreased over the period from 2011 to 2012 by approximately 22% and 21%, respectively. The $CBOD_5$ and TSS concentrations are measured daily. Over the same 2-year period the flow decreased by approximately 5%. Therefore, from the data it appears that loading is decreasing at a greater rate than flow indicating a gradual decrease in the strength of the wastewater. It was assumed that additional future flow will have the same incremental decrease in load as the 2011 through 2012 time period for $CBOD_5$ and TSS.

The predicted future influent loadings can be found in **Table 5.7 and Table 5.8**.

Table 5.5
Historical Pahokee WWTF Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	0.78		0.90	
Parameter and Concentration	Conc. (mg/L)	Load (ppd)	Conc. (mg/L)	Load (ppd)
$CBOD_5$*	129	840	111	837
TSS	117	767	114	860

**Adjusted $CBOD_5$ (lab data is inhibited, ratio used = 0.84)*

Table 5.6
Historical Belle Glade WWTF Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	2.77		2.61	
Parameter and Concentration	Conc. (mg/L)	Load (ppd)	Conc. (mg/L)	Load (ppd)
$CBOD_5$*	137	3,121	111	2,422
TSS	125	2,854	103	2,250

**Adjusted $CBOD_5$ (lab data is inhibited, ratio used = 0.84)*

Table 5.7
Predicted Pahokee WWTF Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	0.80	0.86	0.92	0.97	1.02
Parameter and Concentration	Load (ppd)	Load (ppd)	Load (ppd)	Load (ppd)	Load (ppd)
$CBOD_5$*	943	1,016	1,086	1,145	1,199
TSS	861	967	991	1,045	1,044

** Estimated concentrations for predicting future loads:*
$CBOD_5$ in mg/L - 141 (highest year of historical data +10%)
TSS in mg/L - 129 (highest year of historical data +10%)

Table 5.8
Predicted Belle Glade WWTF Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	2.62	2.80	3.18	3.58	4.01
Parameter and Concentration	Load (ppd)	Load (ppd)	Load (ppd)	Load (ppd)	Load (ppd)
$CBOD_5$*	3,285	3,514	3,980	4,482	5,021
TSS	3,004	3,213	3,639	4,098	4,591

** Estimated concentrations for predicting future loads:*
$CBOD_5$ in mg/L - 150
TSS in mg/L - 137

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Chapter 6.0
Hydraulic Modeling

This chapter presents the wastewater collection and transmission system hydraulic model for the Glades Region Urban Service Area. The model includes elements representing the network of master pump stations, lift stations, and pressurized force mains that are owned and operated by the PBCWUD. Private lift stations and associated force mains that contribute flow through the Glades Region Urban Service Area network are also represented in the model. This chapter focuses on the general specification and calibration of the model, and on model scenarios configured to identify the hydraulic deficiencies present in the network. It also identifies and evaluates proposed transmission system improvements designed to address hydraulic deficiencies. A copy of Technical Memorandum No. 6 (TM-6) – Hydraulic Model is included in **Appendix A** of this report.

6.1 Wastewater Transmission System Model

The Glades Region Urban Service Area wastewater master planning effort includes an evaluation of the wastewater collection and conveyance system through the use of hydraulic modeling methods. Accordingly, Hazen and Sawyer developed, calibrated and deployed a Glades Region wastewater transmission system hydraulic model using the County's preferred modeling platform, InfoWater®. The hydraulic model encompasses individual transmission systems associated with both the Pahokee WWTF and the Belle Glade WWTF. Transmission system elements (i.e., pipes, pumps, and wetwells) were evaluated against a set of performance criteria approved by County staff. Improvements needed to address system hydraulic deficiencies surfaced by the modeling process were proposed and tested for efficacy.

The model is constructed using the *InfoWater® v10.0* hydraulic modeling platform and is configured with the model elements shown in **Table 6.1**.

Table 6.1
Inventory of Model Elements

Model Element	Quantity
Pipes	229
Junctions	124
Reservoirs	2
Pumps	48
Existing PBCWUD Lift Stations	29

Model elements, including piping, lift stations and wastewater treatment plants were added to the model from GIS data provided by PBCWUD. As PBCWUD's Glades Region GIS is in the development phase, several modifications to model topology were required to enable the model to conform to actual network conditions. It is these lift stations which constitute the Glades Region Urban Service Area wastewater transmission network, and which are modeled under this task. The remainder of network lift stations, either directly or indirectly, pump to a downstream lift station or a gravity line, and are therefore, hydraulically disconnected from the primary transmission system.

6.1.1 Pipes

There are a total of 229 pipe segments making up the model's wastewater transmission network. Pipe diameters range from 2 to 18 inches. The total length of pressurized mains in the model is 162,012 feet, or approximately 30.7 miles. Model pipe configuration settings are provided in **Table 6.2**.

Table 6.2
Model Pipe Summary

Pipe Diameter (inches)	Number of Pipes	Total Length (feet)
2	6	3,863
4	79	12,555
6	38	30,108
8	16	33,378
10	17	30,189
12	56	32,672
14	3	6,771
16	12	10,537
18	2	1,937
Total	**229**	**162,842**

As transmission network pipe material and age information was generally not available, the following initial material and friction coefficient assumptions were integrated into the model.

- Force main pipe material – PVC
- Force main friction coefficient – 120

Figure 6-1 presents the Glades Region hydraulic model Belle Glade/South Bay wastewater transmission network and lift stations. There are twenty-two lift stations included in the wastewater transmission network in the Belle Glade/South Bay sub-region. The Pahokee wastewater transmission network includes seven lift stations as shown in **Figure 6-2**.

6.1.2 Lift Stations

Each of the modeled lift stations have been configured with an appropriate array of pumps. These stations are configured as duplex stations except LS 8101 and LS 8146, each of which has four pumps, and the South Bay In-line booster station, which also has four. Modeled lift station pumps have been configured with pump curves supplied by PBCWUD or obtained from applicable pump manufacturers. Other lift station attributes, such as wet well dimensions and pump control elevations, were obtained from PBCWUD and were based on record drawings or direct field measurements by PBCWUD staff. Technical Memorandum No. 7 provides detailed evaluations of the Glades Region lift stations.

The Belle Glade WWTF wastewater transmission network has one in-line booster pump station which supports wastewater transmission from the South Bay service area during periods of high flow. As previously noted, the South Bay Booster Station has a total of four pumps.

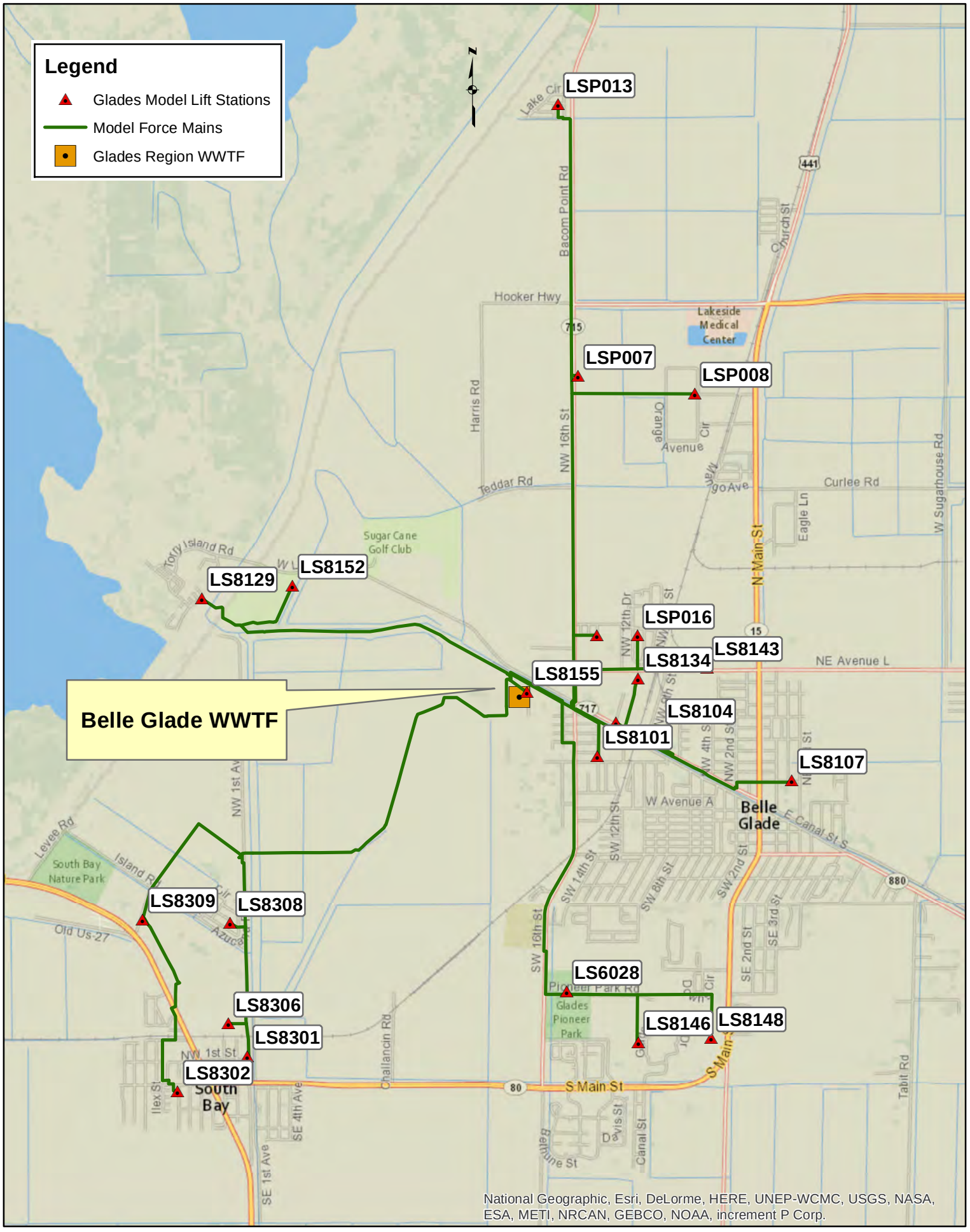

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Figure 6-1 - Belle Glade / South Bay Wastewater Transmission Network

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Figure 6-2 - Pahokee Wastewater Transmission Network

The model includes four private lift stations located in the north Belle Glade service area (LS P007, LS P008, LS P013 and LS P016). As information regarding these stations was not available, they are represented in the model with associated diurnal flow curves as continuous flows, rather than regulated flows provided by a fully configured lift stations.

6.1.3 Extended Period Simulation

The two basic types of hydraulic model simulations are:

- Steady-State Simulation
- Extended Period Simulation

Steady-State Simulation computes the state of the system (i.e., flows, pressures, lift station operating status, wet well sewage levels) assuming that neither the wastewater generation rate nor the system state change with time. Steady-state simulation is a snap shot of system performance at a particular time.

Extended Period Simulation determines the dynamic behavior of the system, computing the state of the system as wastewater generation rate, lift station operating status, wet well level, force main pressure, etc. vary over time. Extended Period Simulation allows the model to evaluate wet well level, daily pump run-time, along with force main pressures and flow rates throughout the system. The Glades Region wastewater transmission system was modeled utilizing the Extended Period Simulation technique.

Extended Period Simulation requires that flows at each pump station be regulated throughout each 24-hour period in a manner that reflects the wastewater generation behavior of customers found with in a station's wastewater collection basin. To achieve a dynamic lift station wastewater flow, a diurnal curve is assigned that reflects the variations of potable water use and wastewater generation. Diurnal curves for each of the model's lift stations were derived from pump operations data using recorders that were deployed at many of PBCWUD's Glades Region Urban Service Area lift stations. The recorders collected pump run/off information for several weeks from October 2012 to January 2013. Using lift station wetwell operating volume information, variable time step flows were derived over the course of each day of deployment, then normalized for a fixed time step. The flows were then indexed to the average flow for specific days, to produce a unique 24 hour diurnal curve for each station.

6.1.4 Current and Projected Flows

Current and projected wastewater average daily flow (ADF) rates assigned to lift stations in the model are those presented in Chapter 5 of this report. Because only pressurized portions of the Glades Region Urban Service Area lift stations are represented in the model (i.e., manifolded stations pumping into a force main terminating at a wastewater treatment plant) wastewater flows estimated for non-manifolded stations were concentrated in their first

respective downstream manifolded station. For example, LS 8101, the primary master station serving the Belle Glade area, has been assigned flows from 25 upstream lift stations.

Model scenarios were developed using Maximum Daily Flows (MDF). Due to the large, but unevenly distributed contribution of Infiltration and Inflow (I/I) to MDF, individual lift station MDF were not assigned to individual lift stations using the peaking factors presented in **Table 6.3**. Rather, I/I flows (essentially the difference between billed potable water and the measured wastewater treatment plant measured inflows) were distributed to lift stations based on their I/I potential. That is, in proportion to each lift station's inch-feet of upstream gravity piping. Hence, lift stations with the largest gravity collection basins were assigned the greatest amount of I/I flow in addition to their metered potable water flow. The MDF moving to the two wastewater treatment facilities conformed to those shown in **Table 6.3**.

Table 6.3
Wastewater Treatment Facility Flow and Peaking Factors

Description	Pahokee WWTF	Belle Glade WWTF
Maximum Day Influent Flow	2.19	7.91
Average Day Influent Flow	0.77	2.60
Maximum Day Flow Peaking Factor	**2.85**	**3.04**

Future flows for lift stations to which I/I flows have been assigned were adjusted to reflect the impacts of expected improvements associated with PBCWUD's ongoing I/I remediation program. Accordingly, I/I flows associated with lift stations having upstream gravity collection systems were reduced at a rate of one percent per year through the year 2030. After 2030, it was assumed that I/I reductions associated with ongoing remediation measures would be balanced by increasing I/I flow in non-improved areas of the collection network.

Inflows are presented for each station as "Base Flow", flow associated with consumption/disposal of metered potable water, and "I/I Flow". The separation of these two flow components is significant within the Glades Region model configuration as the Base Flow fraction of total wetwell inflow is regulated by individual lift station diurnal curves, while I/I inflows are not (I/I flows represent a constant inflow). In addition to the distinction between Base Flow and I/I Flow, the period of record evaluated extends from the baseline in 2011 through 2035. A total of 22 lift stations were assigned flows in the Belle Glade/South Bay service area.

Seven lift stations were included in the Pahokee service area. Base Flow and I/I Flow was distributed using similar techniques to those used for the Belle Glade/South Bay service area.

6.1.5 Field Data Collection

The project team installed digital pressure recorders on the discharge side of the pumps at PBCWUD owned lift stations, sixteen of which were verified as part of the primary wastewater transmission network. The 17 locations were monitored in three groups. The first group was monitored from November 29 through December 12, 2012 in the South Bay and Belle Glade areas. The second group was monitored from December 20, 2012 through January 3, 2013 in the Belle Glade area. The third group was monitored from January 4 through January 19, 2013 and included locations in the Pahokee area.

Figure 6-3 presents the locations where temporary pressure recorders were installed. **Table 6.4** provides a summary of the locations where pressure recorders were deployed.

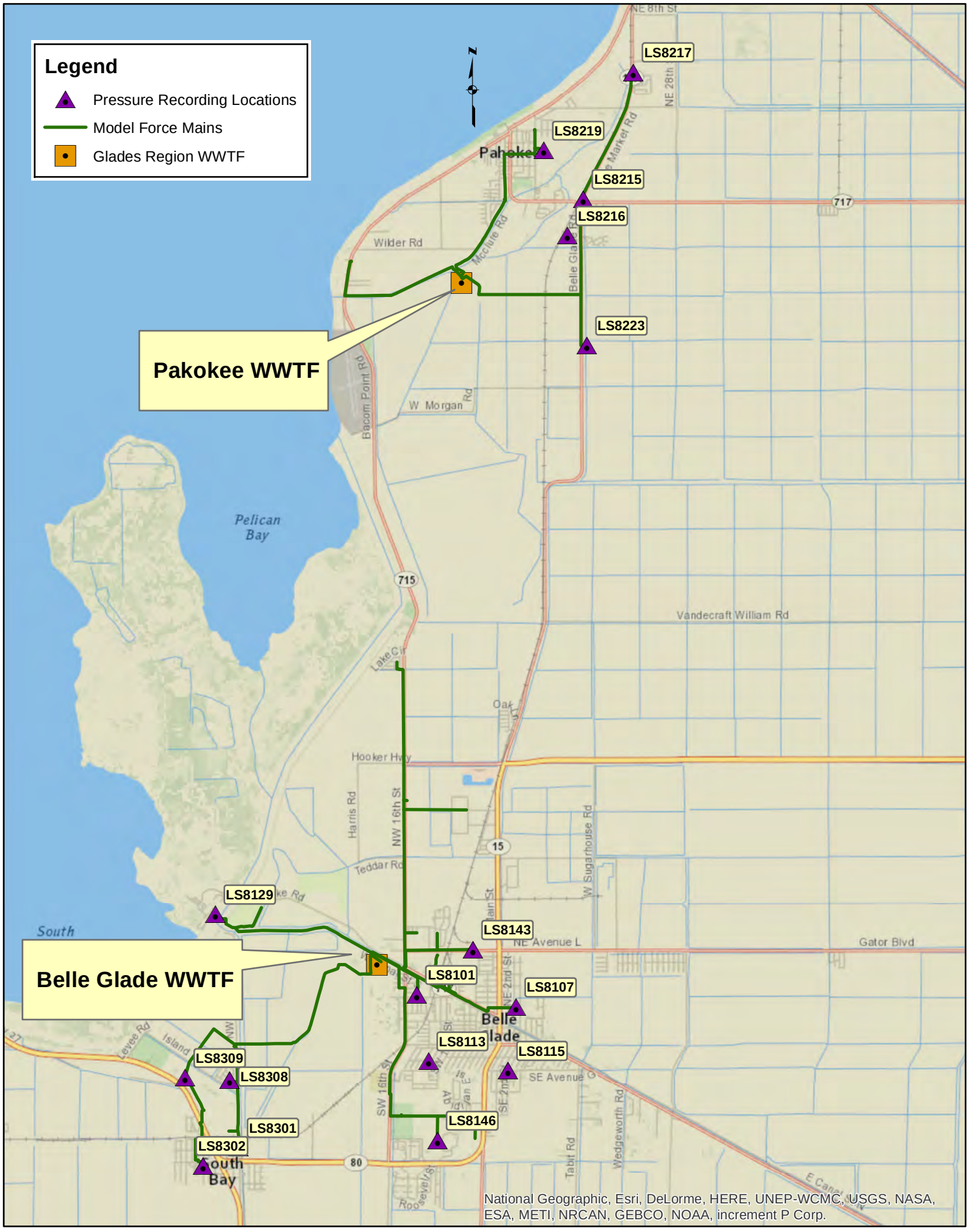

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Figure 6-3 - Field Pressure Monitoring Locations

Table 6.4
Temporary Pressure Recorder Installation Locations

	Recording Period		
Station	**11/29-12/12**	**12/20-1/3**	**1/4-1/19**
LS8101		X	
LS8107		X	
LS8113[A]		X	
LS8115[A]		X	
LS8129	X		
LS8143 [A]		X	
LS8146		X	
LS8215			X
LS8216[A]			X
LS8217			X
LS8219[B]			X
LS8222[A]			X
LS8223			X
LS8301	X		
LS8302	X		
LS8308	X		
LS8309	X		

[A] *Based on the field pressure recording data collected, these lift station discharge to downstream gravity collection basins. Hence, these data could not be used for calibration of the transmission system hydraulic model*

[B] *Pressure recorder malfunctioned – no data available*

It should be noted that field investigations revealed that lift stations LS 8113, LS 8143, LS 8216 and LS 8222 discharge to downstream gravity collection basins and not to the force main network as originally anticipated. As a result, the wastewater transmission piping in the model was adjusted accordingly.

6.1.6 Calibration

The wastewater transmission system hydraulic model was designed to predict the system's present and future operational conditions under specific demand scenarios. The key parameters are pressure, velocity and flow. Verification of the accuracy of these is required to gain confidence in using the model to make long term predictions.

Model calibration was accomplished by comparing pressure records obtained from field measurements and wastewater treatment plant inflow data to model predictions. Friction coefficient factors were adjusted as needed and reasonable to match actual data measured. It should be noted that only minor adjustments were required to effectively calibrate the model once pipe and pump capacity specification issues were resolved.

To assess the accuracy of the model, the average of the peak field measured pressure conditions (over a selected 24-hour period) were compared to the peak pressures in the model predictions over the same time period. For the purpose of this study, it was deemed that successful model calibration is achieved when an overall average of ten percent difference between measured and predicted system pressures is achieved for a 24-hour period at each of the "calibration" model lift stations (16 of the model's 29 stations). This goal was achieved.

6.1.7 Model Calibration Results

The wastewater transmission system model performance was verified by comparing the model generated pump discharge pressures versus the field measured pressures in the transmission system over a 24-hour period. **Table 6.5** summarizes the model calibration results. As shown in this table, the average of the differences (error) between pressures measured in the field and the model output was 5.9 percent across the modeled lift stations. The American Water Works Association Manual M32, Distribution *Network Analysis for Water Utilities*, states that a model can be considered calibrated acceptably if it predicts performance within ten percent of the observed performance. Hence, the calibration results for this model, which had an average error of approximately 5.9 percent, are well within the recommended range of accuracy for the analysis of model scenarios. The wastewater transmission system hydraulic model was considered acceptable for master planning transmission system improvement needs. It should be noted that LS 8115 was not manifolded and excluded from the listed stations listed in **Table 6.5**. In addition, the recorder installed at LS 8219 malfunctioned; hence, the data was not available so this lift station is also not shown in **Table 6.5**.

Table 6-5
Wastewater Model Calibration Results

Lift Station ID	Telog	Model	Difference	% Difference
LS8101	11.0	10.0	-1.0	9.1
LS8107	36.0	36.0	0.0	0.0
LS8129	39.0	33.5	-5.5	14.1
LS8146	16.0	14.7	-1.3	8.1
LS8215	17.0	18.7	1.7	10.0
LS8217	26.5	27.0	0.5	1.9
LS8223	14.0	15.5	1.5	10.7
LS8301	37.0	37.5	0.5	1.4
LS8302	51.0	51.0	0.0	0.0
LS8308	43.0	40.5	-2.5	5.8
LS8309	47.0	45.0	-2.0	4.3
			Average	**5.9**

6.2 Model Execution

Once fully specified and calibrated, model scenarios were developed and executed to evaluate several model elements (i.e., piping, lift station pumps, and lift station wetwells), against an array of performance criteria. Five performance criteria were used for the evaluation as shown below:

1. Pump run-time – to evaluate pump capacity
2. Pump starts – to evaluate wetwell capacity
3. Pipe velocity – to evaluate force main capacity
4. Pipe head-loss gradient – to evaluate force main capacity
5. Wetwell surcharge – to evaluate pump capacity

Model scenarios for the above performance evaluation were executed under MDF conditions. An additional scenario was run under ADF conditions for the purpose of determining the extent to which lift station pumps remain on their respective pump curves under low flow conditions. Finally, separate model scenarios were developed using projected wastewater flows associated with each of the required six time steps, 2011, 2015, 2020, 2025, 2030 and 2035.

6.2.1 Performance Criteria

The criteria used to assess the adequacy of the Glades Region wastewater transmission system relative to lift station run-time, pump starts, force main flow velocity and head-loss, and wetwell surcharging are described in the following paragraphs.

Pump Run-Time Performance Criteria

Pump run-time is the average hours of operation per day per duty pump in a lift station (assuming one pump is out of service). For example, given a quadplex station with the first duty pump running 12 hours per day and the second duty pump running 2 hours per day, the run-time would be 7 hours per day per duty pump. The run-time analysis is based upon annual average day wastewater flow conditions. The criteria in **Table 6.6** were used to assess the capacity of the pumps in each lift station relative to run-time.

Table 6.6
Duty Pump Run-Time Performance Criteria

Type	Run-Time per Duty Pump	Assessment
Duplex (1 duty + 1 backup)	10 hours per day or less	Acceptable
Duplex (1 duty + 1 backup)	Greater than 10 hours per day	Not Acceptable
Quadplex (3 duty + 1 backup)	10 hours per day or less	Acceptable
Quadplex (3 duty + 1 backup)	Greater than 10 hours per day	Not Acceptable

Pump Starts Performance Criteria

The number of pump starts provides a measure of the capacity of a lift station's wet well. An excessive number of starts indicates that a lift station's volume is inadequate to accommodate its rate of inflow. Wetwell capacity (pump starts) performance criteria are presented in **Table 6.7**.

Table 6.7
Duty Pump Starts Performance Criteria

Type	Run-Time per Duty Pump	Assessment
Duplex (1 duty + 1 backup)	20 starts per hour or less	Acceptable
Duplex (1 duty + 1 backup)	Greater than 20 starts per hour	Not Acceptable
Quadplex (3 duty + 1 backup)	20 starts per hour or less	Acceptable
Quadplex (3 duty + 1 backup)	Greater than 20 starts per hour	Not Acceptable

Force Main Flow Velocity and Head-loss Gradient Performance Criteria

The diameter of the force main should be sized such that the velocity during pumping will be neither too low (less than two feet per second) such that deposits build-up (potentially clogging

the pipeline), nor too high (greater than eight feet per second) resulting in excessive energy consumption and possible scouring of mains. The head-loss gradient in pressurized force mains should be less than 0.010 feet/feet. A force main is considered transmission piping outside of the lift station; piping internal to the lift station is not considered force main. **Table 6.8** presents the criteria utilized to assess the capacity of force mains relative to flow velocity and head-loss.

Table 6.8
Force Main Flow Velocity and Head-loss Gradient Performance Criteria

Flow Velocity (fps)	Head-loss Gradient (feet/feet)	Assessment
less than 2	-	Not Acceptable
2 to 8	Less than 0.010	Acceptable
greater than 8	Greater than 0.010	Not Acceptable

A capital project to upgrade the size of the force main was identified to bring velocity into the acceptable range if the model indicated that the flow velocity in the existing force main piping was not acceptable.

Wet Well Surcharge Performance Criteria

Surcharge refers to an overload of sewer system where the wastewater flow is greater than the system is capable of conveying per unit of time resulting in wastewater being stored within system piping and wetwells. The result of a surcharge is the sewage level in the wet well rises. If sewage rises above the top of the wet well slab, it will overflow (potentially causing an environmental and /or health hazard). **Table 6.9** presents the criteria used to assess the capacity of the system relative to wet well surcharge.

Table 6.9
Wet Well Surcharge Performance Criteria

Sewage Level in Wet Well	Assessment
above the lead pump on set-point + 1.00	Not Acceptable
below the lead pump on set-point + 1.00	Acceptable

If the model predicted that the sewage level in the wet well would be above the lead pump on set-point level plus one foot, then a capital project was identified to reduce the likelihood of surcharging the system.

6.3 Model Results

This section summarizes the results of scenario runs of the wastewater transmission system hydraulic model. The model was run as an Extended Period Simulation under MDF conditions

for 2011, 2015, 2020, 2025, 2030 and 2035. Modeling results relative to each of the five performance criteria discussed above are presented below.

6.3.1 Pipe Velocity

Other than piping added to the model to support the placement of pumps at model lift station assemblies, all network piping presented velocities in the acceptable range for all six model time steps. The high velocity pipes were not part of the GIS transmission piping dataset that was provided by PBCWUD for configuration of the hydraulic model. As they are very short pipes, elevated velocities have no hydraulic impact on model hydraulics.

6.3.2 Pipe Head-loss Gradient

Table 6.10 summarizes the model results for existing force mains that exhibited head-loss gradient issues under maximum day flow conditions. Model run results indicate that there were 15 violations of the 0.010 feet/feet maximum head-loss gradient threshold under 2011 and future MDF conditions.

Table 6.10
Force Mains with Inadequate Capacity Due to High Hydraulic Grade Line Loss

Description	Length (feet)	Diameter (inches)	Hydraulic Grade Line Loss (feet/feet)					
			2011	2015	2020	2025	2030	2035
Pipe 15409 downstream of LS8107	1,796	8	0.023	0.024	0.024	0.024	0.024	0.024
Pipe P715 between SBPS and Belle Glade WWTF	6,499	10	0.019	0.018	0.018	0.020	0.021	0.021
Pipe 18618 between SBPS and Belle Glade WWTF	885	10	0.019	0.018	0.018	0.020	0.021	0.021
Pipe 27896 between SBPS and Belle Glade WWTF	522	10	0.017	0.016	0.017	0.017	0.018	0.018
Pipe 18619 between SBPS and Belle Glade WWTF	4,121	10	0.017	0.016	0.016	0.017	0.018	0.018
Pipe 21819 between LS8201 and Rardin Avenue force main	41	8	0.018	0.018	0.018	0.018	0.018	0.018
Pipe 15085 between LS8103 and LS8104 along N. Canal Street	1,145	6	0.018	0.017	0.017	0.018	0.020	0.022
Pipe 15086 between LS8104 and N. Canal Street force main	483	6	0.016	0.017	0.018	0.016	0.017	0.014
Pipe 30457 between LS8152 and LS8128 to Belle Glade WWTF force main	2,150	2	0.016	0.016	0.016	0.016	0.016	0.016

Table 6.10 (continued)
Force Mains with Inadequate Capacity Due to High Hydraulic Grade Line Loss

Description	Length (feet)	Diameter (inches)	Hydraulic Grade Line Loss (feet/feet)					
			2011	2015	2020	2025	2030	2035
Pipe 21818 between LS8219 and Barfield Hwy force main	562	4	0.016	0.016	0.015	0.016	0.016	0.015
Pipe 14460 Between LS8306 and NW 1st Avenue force main	514	4	0.014	0.015	0.015	0.015	0.015	0.014
Pipe 15421 between NW 16th Street canal crossing and Belle Glade WWTF along S Canal Street	2,167	16	0.012	0.011	0.011	0.011	0.011	0.009
Pipe 15090 between LS8103 and N Canal Street force main	289	6	0.011	0.010	0.007	0.011	0.014	0.015
Pipe P29, along N Canal Street between LS8104 and connection to 12 in N Canal St force main	499	8	0.011	0.011	0.011	0.011	0.012	0.012
Pipe 15088 between LS8134 and N Canal Street FM	1,469	6	0.010	0.012	0.012	0.012	0.012	0.012

The highest head-loss gradient was found in the 8 inch diameter force main into which LS 8107 discharges. While this head-loss gradient was significantly above the performance threshold, a pipe upgrade was not fully investigated as it does not induce performance problems at LS 8107. It is very likely, however, that the high head-loss conditions in this force main result in elevated power consumption at LS 8107. Further review of this condition is recommended with respect to the cost of a pipe diameter upgrade (to 10 inches) and the expected energy cost savings.

Of immediate significance are the elevated head-losses in pipes P715, 27896, 18619, and 21819, with head-loss gradients between 0.015 and 0.021 feet/feet. Elevated head-losses occur in all model time periods. The combination of these four pipes constitute the force main that connects the South Bay Booster Pump Station and the Belle Glade WWTF. The significance of these elevated head-losses lies in the fact that, during high rainfall/high flow periods, the South Bay Booster Pump Station must produce very high discharge pressures (80 to 90 psi) to pump the required wastewater volumes from the South Bay service area. These high discharge pressures result in a South Bay Booster Pump Station intake manifold pressure to be in the range of 35 to 45 psi. This, in turn, causes lift station pumps upstream of the South Bay Booster Pump Station to struggle, especially LS 8301, LS 8306 and LS 8308, causing wetwell overflows and extreme pump run-times. Upgrades for these pipes were investigated due to the consequences of these elevated head-loss gradients.

Head-loss gradients in pipe 15085 ranged from 0.0165 to 0.0215 feet/feet between 2011 and 2035. As the elevated head-loss gradient in this force main causes pump run-times in LS 8103 to be above the performance threshold, a pipe upgrade was investigated.

Upgrades of the remaining force mains exhibiting elevated head-loss gradients were not investigated if:

- they did not result in a performance issue in an upstream lift station (e.g., LS 8107)
- the head-loss exceedance was mitigated by another improvement;
- the exceedance was small and was reduced in the future by anticipated I/I remediation improvements

6.3.3 Wetwell Surcharging

Table 6.11 summarizes the model results for lift stations that exhibited capacity issues relative to surcharging of the wet well.

Wetwell surcharging, defined here as a wetwell exhibiting water levels one foot or more above the lead pump start elevation, was shown to occur at LS 8103 (in 2011, 2030 and 2035), and at LS 8301, LS 8306 and LS 8308 at all model time steps. In each case, surcharging was shown to be caused by high head conditions in the associated downstream force mains. These high head conditions, for which installed pumps had difficulty overcoming, were the result of elevated head-loss gradients discussed in the previous section. Pump capacity improvements for these lift stations were not investigated, given that surcharging was caused by the head-loss characteristics of the associated force mains.

Table 6.11
Lift Stations with Surcharge Based on Model Output [A]

Lift Station	Wetwell Surcharge					
	2011	2015	2020	2025	2030	2035
LS6028	-	-	-	-	-	-
LS8101	-	-	-	-	-	-
LS8103	S[A]	-	-	-	S[A]	S[A]
LS8104	-	-	-	-	-	-
LS8107	-	-	-	-	-	-
LS8129	-	-	-	-	-	-
LS8134	-	-	-	-	-	-
LS8141	-	-	-	-	-	-
LS8146	-	-	-	-	-	-
LS8148	-	-	-	-	-	-
LS8152	-	-	-	-	-	-
LS8201	-	-	-	-	-	-
LS8202	-	-	-	-	-	-
LS8205	-	-	-	-	-	-
LS8215	-	-	-	-	-	-
LS8217	-	-	-	-	-	-
LS8219	-	-	-	-	-	-
LS8223	-	-	-	-	-	-
LS8301	S[A]	S[A]	S[A]	S[A]	S[A]	S[A]
LS8302	-	-	-	-	-	-
LS8306 [B]	S[B]	S[B]	S[B]	S[B]	S[B]	S[B]
LS8308 [B]	S[B]	S[B]	S[B]	S[B]	S[B]	S[B]
LS8309	-	-	-	-	-	-

[A] S = maximum day flow wet well surcharge

[B] S = maximum day flow wetwell overflow

6.3.4 Pump Run-Time

Table 6.12 summarizes the model results for lift stations that exhibited capacity issues relative to run-time. Eight lift stations exhibited average daily pump run-times greater than 10 hours, the performance criteria maximum threshold, during the six model time steps. At LS 8101, LS 8103, LS 8134 and LS 8143, pump run-times fell below the performance threshold at a point in the future due to the reduced flow impacts of anticipated I/I remediation improvements.

Table 6-12
Lift Station Pump Run-Time Based on Model Output

Lift Station	Number of Pumps	Run-Time (Hours per day per Duty Pump) [A]					
		2011	2015	2020	2025	2030	2035
LS6044	2	2.2	2.0	2.3	2.8	3.7	6.8
LS8101	4	10.9	10.6	10.2	9.8	9.4	9.4
LS8103	2	20.4	14.6	10.2	7.8	6.5	6.3
LS8104	2	9.1	8.5	7.9	7.2	6.9	7.1
LS8107	2	4.8	4.7	4.6	4.4	4.2	4.4
LS8129	2	1.4	1.4	1.3	1.2	1.2	1.2
LS8134	2	11.4	10.7	9.9	9.4	9.1	9.5
LS8141	2	7.8	6.6	5.9	5.0	4.6	4.5
LS8143	2	11.2	10.7	10.2	9.7	9.2	9.2
LS8146	4	4.7	4.4	4.4	4.4	4.4	4.8
LS8148	2	5.6	5.4	5.1	5.0	4.7	4.9
LS8152	2	0.2	0.2	0.2	0.3	0.4	0.5
LS8201	2	6.0	6.0	6.1	6.3	6.4	6.6
LS8202	2	1.1	1.1	1.0	0.9	0.9	0.9
LS8205	2	3.1	3.0	2.8	2.6	2.5	2.5
LS8215	2	0.5	0.6	0.6	0.6	0.7	0.7
LS8217	2	1.5	1.4	1.4	1.4	1.3	1.4
LS8219	2	0.5	0.5	0.6	0.6	0.6	0.6
LS8223	2	0.1	0.1	0.1	0.1	0.1	0.1
LS8301	2	24.0	24.0	24.0	24.0	23.9	24.0
LS8302	2	11.1	10.6	10.8	11.8	13.9	16.9
LS8306[B]	2	24.0	24.0	24.0	24.0	24.0	24.0
LS8308[B]	2	24.0	24.0	24.0	24.0	24.0	24.0
LS8309	2	4.7	4.4	4.3	4.5	4.7	5.3

[A] Values highlighted indicate performance criteria is exceeded

[B] Experiences maximum day flow wetwell overflow

Pumps at several lift stations in the South Bay service area have unacceptably high run-times in all model time periods (LS 8301, LS 8302, LS 8306, LS 8308). Pumps associated with lift stations LS 8301, LS 8306 and LS-8308 operate continuously over the 24 hour simulation period under MDF conditions. Lift stations LS 8306 and LS 8308 experienced periods of overflow throughout the day.

While the high pump run-times noted here would typically call for pump capacity improvements, such improvements were not considered justified for the following reasons.

- Run-times at LS 8101 and LS 8143 were only slightly above the performance threshold for the first three time periods, then fell below the threshold in 2025 onward (due to anticipated I/I remediation improvements).
- Elevated run-times at LS 8103, and LS 8134, while severe, would be reduced by a proposed downstream force main upgrade along North Canal Street. The recommended improvements corrected this issue.
- Elevated run-times at LS 8301, and LS 8306 and LS 8308 would be reduced by a proposed upgrade to the South Bay Booster Pump Station / Belle Glade WWTF force main. Proposed improvements addressed this concern.

6.3.5 Pump Starts

Table 6.13 presents the model results relative to pump starts. None of the modeled lift stations experienced pump starts greater than the 20 starts/hour performance threshold within any of the model's six time steps, indicating that wetwell capacities are likely adequate for projected lift station inflows.

Table 6.13
Lift Stations Pump Starts Based on Model Output

Lift Station	Number of Pumps	Starts (Starts per hour per Duty Pump)					
		2011	2015	2020	2025	2030	2035
LS6044	2	2	2	2	3	3	3
LS8101	4	4	5	6	7	8	7
LS8103	2	2	4	5	8	10	10
LS8104	2	12	15	16	18	18	18
LS8107	2	11	11	11	11	11	11
LS8129	2	2	2	2	2	1	1
LS8134	2	3	6	8	11	12	10
LS8141	2	2	2	2	3	3	3
LS8143	2	4	6	8	10	12	12
LS8146	4	7	7	7	7	7	6
LS8148	2	4	4	4	3	3	3
LS8152	2	0	0	0	0	1	1
LS8201	2	13	13	13	13	13	13
LS8202	2	4	4	4	4	3	3
LS8205	2	3	3	3	3	3	3
LS8215	2	1	1	1	1	1	1
LS8217	2	2	2	2	2	2	2
LS8219	2	1	1	1	1	1	1
LS8223	2	0	0	0	0	0	0
LS8301	2	0	0	0	0	0	0
LS8302	2	4	5	5	4	5	5
LS8306	2	0	0	0	0	0	0
LS8308	2	0	0	0	0	0	0
LS8309	2	2	2	2	2	2	1

6.3.6 Performance Summary

Table 6.14 presents a summary of performance criteria exceedances by the modeled system prior to implementation of improvements. Exceedances of performance criteria were limited to head-loss gradient, surcharge and pump run-time. No exceedances of velocity or pump starts criteria were found within the modeled system for any of the six model time periods. Pipe head-loss gradient problems were assigned in Table 6.14 to upstream lift stations that would be hydraulically impacted by the associated elevated head-loss gradients.

Table 6.14
Occurrences of Performance Criteria Exceeded with Existing Conditions

Lift Station	Performance Criteria				
	Run-time	Pump Starts	Pipe Velocity	Pipe Head-loss Gradient	Wetwell Surcharge
LS6044	None	None	None	None	None
LS8101	X	None	None	None	None
LS8103	X	None	None	X	None
LS8104	None	None	None	X	None
LS8107	None	None	None	X	None
LS8129	None	None	None	None	None
LS8134	X	None	None	None	None
LS8141	None	None	None	None	None
LS8143	X	None	None	None	None
LS8146	None	None	None	None	None
LS8148	None	None	None	None	None
LS8152	None	None	None	X	None
LS8201	None	None	None	X	None
LS8202	None	None	None	None	None
LS8205	None	None	None	None	None
LS8215	None	None	None	None	None
LS8217	None	None	None	None	None
LS8219	None	None	None	X	None
LS8223	None	None	None	None	None
LS8301	X	None	None	X	X
LS8302	X	None	None	X	None
LS8306	X	None	None	X	X
LS8308	X	None	None	X	X
LS8309	None	None	None	X	None

In addition to the performance evaluations discussed above, lift station pumps were evaluated to determine if, during ADF conditions, they would run off of their pump curves during periods of low flow. The evaluation showed that the lift station pumps remained within the confines of their respective pump curves, indicating that none of the pumps in the network are likely oversized.

6.4 Proposed Improvements

6.4.1 Hydraulic Improvements

Based upon the above findings, recommended improvements were identified and are discussed below. Improvements for violations of performance criteria were not identified and tested if:

- The violation was slightly above the performance threshold and was not sustained over the entire 2011 to 2035 study period. For example pump run-time at LS 8134 which exceeded the performance threshold for the 2011 and 2015 simulation periods, but was below the threshold for other future time-steps, the result of anticipated I/I improvements. A re-evaluation should be performed if the anticipated I/I improvements are not implemented.
- The violation did not cause a significant impairment of the transmission network. An example would be pipe head-loss gradient of the force main downstream of LS 8107. This section of force main has the highest head-loss calculated in the entire network. However, the existing pump is capable of pumping flows without high run-times, high number of pump starts, or surcharging. Therefore, even though there is concern with respect to the head-loss, this station is capable of meeting projected demands. The section of force main creating the high head-loss is an 8-inch diameter line with a length of approximately 1,800 feet. It is recommended that this station be monitored closely and improvements considered should the assumed conditions change. Upgrading this section of force main to a 10-inch diameter line would reduce the head-loss gradient from to 0.009 feet/feet under 2011 MDF conditions.

Belle Glade – North Canal Street Force Main Upgrade: Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade between LS 8103 and LS 8104 and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS 8103 pump run-time is reduced below the performance criteria threshold and surcharging is eliminated. Model run-time performance results for the upgraded 8-inch diameter force main are presented in **Table 6.15**.

Table 6.15
Lift Station Pump Run-time with Improvements Based on Model Output

Lift Station	Run-time (Hours per day per Duty Pump) [A]											
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
	2012		2015		2020		2025		2030		2035	
LS8103	20.4	7.7	14.6	7.0	10.2	6.7	7.8	6.2	6.5	5.9	6.3	5.8
LS8301	24.0	4.4	24.0	4.2	24.0	4.2	24.0	4.1	23.9	4.2	24.0	4.5
LS8302	11.1	7.0	10.6	6.7	10.8	6.8	11.8	7.1	13.9	7.5	16.9	8.2
LS8306	24.0	2.1	24.0	2.1	24.0	2.0	24.0	2.0	24.0	2.0	24.0	2.0
LS8308	24.0	9.6	24.0	9.3	24.0	9.0	24.0	8.6	24.0	8.2	24.0	8.5

[A] *Values highlighted indicate exceedances of performance criteria.*

Belle Glade – South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade: Take existing 10-inch diameter force main out of service (for possible maintenance as a standby force main or removal) and replace with approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump run-time and wet well surcharging at LS 8201, LS 8302, LS 8306 and LS 8308 by reducing extreme head-loss in the upgraded force main this supports a reduction of the SBBPS suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS 8301, LS 8302, LS 8306 and LS 8308, thereby eliminating surcharging and reducing run-times below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which is well above the 2 feet/second minimum velocity requirement. An alternative 16-inch diameter force main was tested in place of the 12-inch diameter to determine the feasibility of deploying the larger pipe, that increases the system's ability to accommodate South Bay wastewater flows that are greater than anticipated by those driven by population projections (e.g., if an inland port facility were to be constructed in the South Bay area). The larger 16-inch diameter force main further improves the performance of upstream lift stations while maintaining a target pipe average velocity (i.e., 2.3 feet/second) that is above the minimum velocity criteria. Model run-time results for the proposed 12 inch force main are presented in **Table 6.15**. A 16-inch diameter pipe would further reduce headlosses and provide additional capacity. A cost analysis should be performed during final design to select the optimal pipe size. Given the substantial infiltration and inflow flows in the South Bay service area, this improvement is considered essential for the reliable operation of the wastewater transmission system in that area. It is recommended that it be added to the 5-year capital improvement plan for the Glades Region and be implemented in the near term. The locations of proposed improvements are shown in **Figure 6-4**.

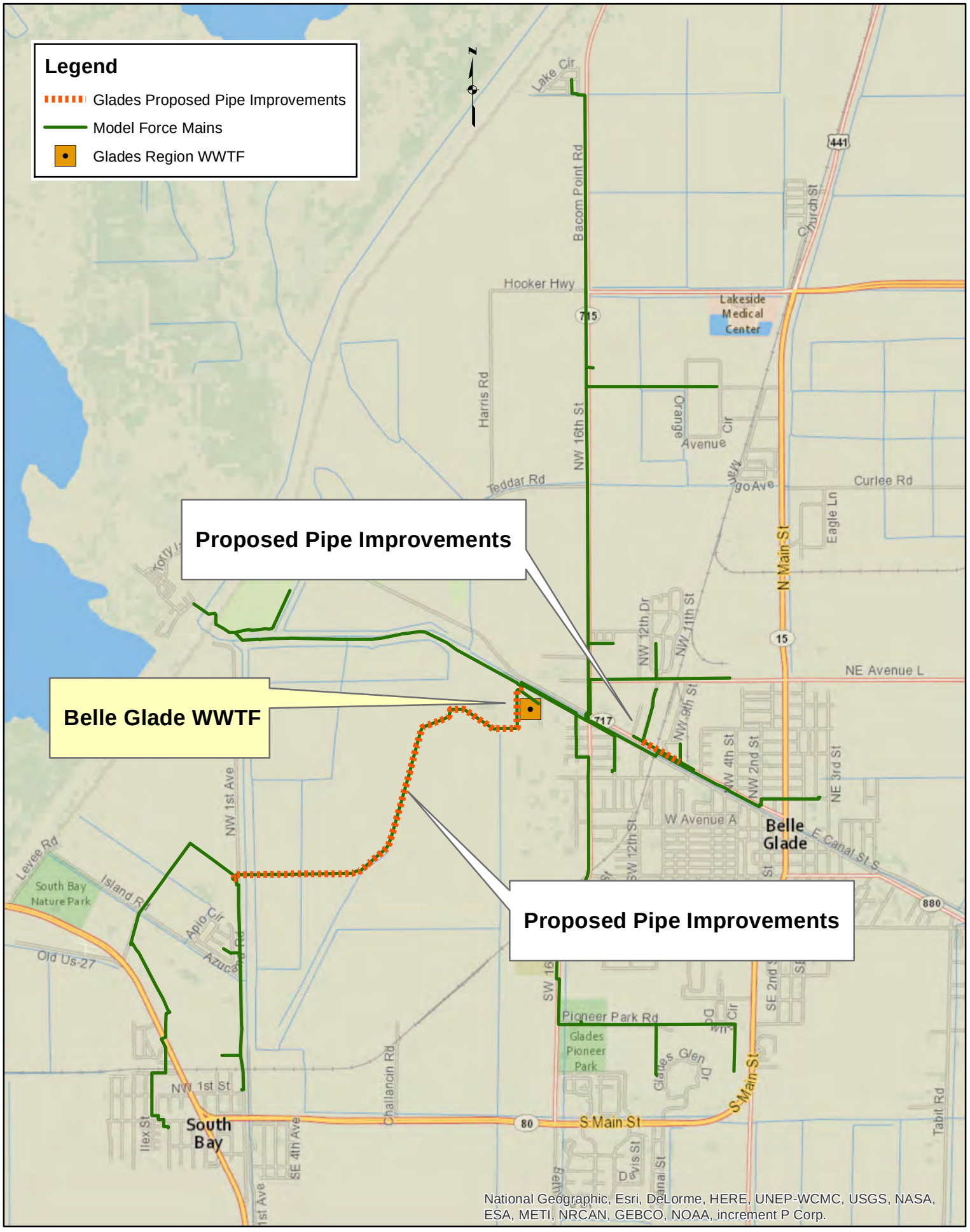

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Figure 6-4 - Glades Region Proposed Improvements

6.4.2 Pumping Infrastructure Improvements

The hydraulic model was used to analyze the capacity of lift station pumping systems by focusing on both pump run-times and lift station wet well levels (surcharges). The most problematic violations of both pump run-time and surcharging were at LS 8103, LS 8301, LS 8302, LS 8306 and LS 8308, and were addressed effectively through the implementation of the pipe improvements discussed above, without the need for increases in pump capacity (and the attendant increases in operating costs)). While three additional lift stations presented pump run-time exceedances under MDF conditions (LS 8101, LS 8134 and LS 8143), pump capacity improvements are not recommended, as those exceedances are minor (less than 2 hours/day), and fell below the performance criteria threshold of 10 hours/day in the future under the assumption that I/I improvements reduce MDF through 2035. No pump infrastructure improvements are recommended.

6.4.3 Wetwell Capacity Improvements

The identification of wetwell capacity deficiencies was conducted by calculating the average hourly number of pump starts at each lift station throughout the course of a 24 hour simulation. Lift stations with an average number of hourly pump starts greater than 20 would be flagged for possible wetwell capacity improvements. However, model results in all six time steps found no lift stations with excessive pump starts. Therefore, no wetwell capacity improvements are recommended.

6.4.3 Overall Summary of Improvements

Table 6.16 presents a summary of performance criteria exceedances by modeled lift station after proposed improvements have been put in place. The table shows that surcharge problems are eliminated from the network and run-time violations are reduced. As without the proposed improvements, exceedances of velocity or pump starts criteria were found within the modeled system and in any of the six model time periods. Pipe head-loss gradient problems were assigned in **Table 6.16** to upstream lift stations that would be hydraulically impacted by the associated elevated head-loss gradients.

Table 6.16
Occurrences of Performance Criteria Exceeded after Improvements [A]

Lift Station	Performance Criteria							
	Pump Run-time		Pump Starts	Pipe Velocity	Pipe Head-loss Gradient		Wetwell Surchage	
	Before	After			Before	After	Before	After
LS6044								
LS8101	X	X					X	X
LS8103	X	√			X	X	X	√
LS8104					X	X		
LS8107					X	X		
LS8129								
LS8134	X	X					X	X
LS8141								
LS8143	X	X					X	X
LS8146								
LS8148								
LS8152					X	X		
LS8201					X	X		
LS8202								
LS8205								
LS8215								
LS8217								
LS8219					X	X		
LS8223								
LS8301					X	√	X	√
LS8302					X	√		
LS8306					X	X	X	√
LS8308					X	√	X	√
LS8309					X	√		

[A] *X - indicates threshold exceeded; √ - indicates criteria is been met after improvement*

6.4.4 Operational Improvements

An essential element for the management of a wastewater collection system is a reliable telemetric SCADA system. Such a system allows for the monitoring of lift station status and the control of basic facility functions such as disabling pumps and adjusting of pump start/stop set points, and the processing of high wetwell and other alarms. It also provides the basis for the processing and collection of historical operational data that is essential when analyzing system performance, as was done in preparing the master plan hydraulic model. Such information as pump run-time, wetwell inflow (based on pump start/stop data recorded by a

station's telemetry RTU), pump starts and wetwell level data are all valuable in the process of developing and vetting a hydraulic model, but also in the day to day evaluation and operation of the system. These data will also prove invaluable in support of ongoing infiltration and inflow remediation efforts.

A lift station telemetry system has been established within the Belle Glade/South Bay collection network with a telemetry base station and SCADA server located at WTP 11 on Hooker Highway and a remote RTU monitoring the South Bay Booster Pump Station. This system has been in place for about one year and, besides enabling remote adjustment of station control parameters, has provided useful process data needed for the configuration of the wastewater collection system hydraulic model. The Pahokee WWTF collection system does not currently have telemetry facilities in place.

The current Belle Glade/South Bay telemetry system was installed by PBCWUD, but is not based on the extensive TIMS telemetry network that supports lift station remote monitoring and control functions across PBCWUD's entire eastern wastewater operations service area.

We recommend that PBCWUD initially develop a Belle Glade WWTF based telemetry system for the monitoring and control coverage to the following remote facilities:

- LS8101
- LS8107
- LS8113
- LS8115
- LS8143
- LS8146
- LS8301
- LS8302
- LS8308
- LS8309

We also recommend that a similar telemetry base station and SCADA server system be established at the Pahokee WWTF, with the following remote facilities initially supported:

- LS8201
- LS8202
- LS8205
- LS8207
- LS8215
- LS8217

Subsequent to these initial stations, we recommend that PBCWUD increase the number of lift stations supported by telemetry in both service areas by several sites per year until all County owned lift stations are fully monitored.

6.5 Summary and Recommendations

6.5.1 Summary

This technical memorandum presents the results of the hydraulic model prepared by Hazen and Sawyer to evaluate the pressurized wastewater transmission system for the Glades Region (Belle Glade / South Bay and Pahokee). Model development was based on facility and operational data provided by PBCWUD staff. The model is based on the *InfoWater® v10.0* hydraulic modeling platform, and transmission network elements that includes pipes, pumps, and wetwells. Hydraulic analyses were performed over a series of time steps, which included 2011, 2015, 2020, 2025, 2030, and 2035. Assigned model lift station inflows were based on potable water account (consumption) data, and estimates of local I/I based on the inch-feet of upstream gravity main. Model runs were executed with lift station inflows set to MDF levels (7.91 mgd – Belle Glade, 2.16 – Pahokee). Future flows were derived using estimated changes in population and associated with each model time step. Estimated future lift station inflows were adjusted to reflect an anticipated one percent per year reduction in I/I flows through 2030 due to I/I remediation efforts by PBCWUD.

Following a successful model calibration, model scenarios were developed and executed to evaluate the capacity of model piping, lift station pumps, and lift station wetwells, against an array of performance criteria. The five performance criteria used for the evaluation included:

1. Pump run-time – to evaluate pump capacity
2. Pump starts – to evaluate wetwell capacity
3. Pipe velocity – to evaluate force main capacity
4. Pipe head-loss gradient – to evaluate force main capacity
5. Wetwell surcharge – to evaluate pump capacity

An additional scenario was run under ADF conditions for the purpose of determining the extent to which lift station pumps remain on their respective pump curves under low flow conditions.

Network deficiencies were identified with respect to pump capacities (pump run-time and wetwell surcharge) and force main capacities (head-loss gradient) at several locations in the system. There were no wetwell capacity (pump starts) or force main velocity problems found in the transmission network for the current time period of 2011, nor at any future time period.

It was found that high head-loss gradients in the 10 inch diameter force main between the South Bay Booster Pump Station and the Belle Glade WWTF was responsible for elevated pump run-times and wetwell surcharge conditions at several South Bay lift stations (LS 8301, LS 8302, LS 8306 and LS 8308). Wetwell overflows were shown to occur at LS 8306 and LS

8308. Likewise, high head-loss gradient conditions in the 6-inch diameter force main along North Canal Street caused wetwell surcharging at LS8103, and elevated pump run-times at LS 8103 and LS 8134. Pipe replacements were proposed for each affected force main to increase its respective capacity, the South Bay force main from 10 to 12 inches in diameter, and the North Canal Street force main from 6 to 8 inches in diameter. These improvements successfully addressed each of these run-time and surcharge related capacity deficiencies.

Improvements were not identified or tested for the remainder of force main capacity deficiencies because:

- they did not cause a performance issue in an upstream lift station
- the head-loss exceedance was mitigated by another improvement;
- the exceedance was small and was reduced in the future by anticipated I/I remediation improvements

Improvements were not identified or tested for the remainder of pump capacity deficiencies because:

- Run-times at LS 8101 and LS 8143 were only slightly above the performance threshold for the first three time periods, then fell below the threshold in 2025 onward (due to anticipated I/I remediation improvements).
- Elevated run-times at LS 8103 and LS 8134, while initially severe, would be reduced to adequate levels by the proposed force main upgrade along North Canal Street. Surcharging at LS8103 is also eliminated by this same improvement.
- Elevated run-times and wetwell surcharging at LS 8301, LS 8306 and LS 8308 would be reduced or eliminated by the proposed upgrade to the South Bay Booster Pump Station / Belle Glade WWTF force main.

6.5.2 Recommendations

The following is a listing of the recommended improvements:

- Belle Glade – North Canal Street Force Main Upgrade: Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade between LS 8103 and LS 8104, and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS 8103 pump run-time is reduced below the performance criteria threshold and surcharging is eliminated. It is recommended that this improvement be implemented within the current 5 year planning horizon.
- Belle Glade – South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade: Replace the existing 10-inch diameter force main and replace with

approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump run-time and wet well surcharging at LS 8201, LS 8302, LS 8306 and LS 8308 by reducing high head-loss in the upgraded force main which supports a reduction of the South Bay Booster Pump Station suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS 8301, LS 8302, LS 8306 and LS 8308, thereby eliminating surcharging and reducing run-time below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which is well above the 2 feet/second minimum velocity requirement. Because this improvement successfully address several serious deficiencies at upstream lift stations, including overflows at LS 8306 and LS 8308, it is recommended that this proposed improvement be implemented as soon as is practical within the current 5-year planning horizon.

- It is recommended a lift stations telemetry system be developed for both the Belle Glade and Pahokee service areas in accordance with the County's TIMS telemetry performance standards. This improvements should be implemented in a phased approach during the next 5 years.

Other key findings which do not require action at this time are presented below:

- Pump capacity upgrades improvements are not recommended at LS 8101 or LS 8143 as modeled run-time exceedances are small (less than 2 hours per day over the threshold) and are expected to fall below the performance criteria threshold with anticipated improvements to upstream I/I. This recommendation may need to be revisited when I/I mitigation planning for the Glades region comes into better focus.

- Pump capacity upgrade improvements are not recommended for LS 8134 as excessive pump run-times were sufficiently reduced to just 0.3 hours per day above the performance threshold by the proposed pipe improvement along North Canal Street, and is reduced below the threshold through the impacts of anticipated upstream I/I improvements.

- Pipe capacity improvements are not recommended for force mains downstream of LS 8103, LS 8104 and LS 8152 in Belle Glade as the high head-loss gradients identified through model simulations were relatively minor and were not shown to negatively impact the performance of these lift stations with respect to pump run-time or wetwell surcharging.

- Pipe capacity improvements are not recommended for force main down stream of LS 8107 in Belle Glade, despite it having the highest head-loss gradient in the entire network as it was not shown to negatively impact the performance of the lift station with respect to pump run-time or wetwell surcharging. However, a single preliminary model run did show that increasing the diameter of this force main from 8 inches to 10 inches would reduce the head-loss gradient from around 0.022 feet/feet to around 0.009 feet/feet, just below the performance threshold.

- Pipe capacity improvements are not recommended for force mains down stream of LS 8201 and LS 8219 in Pahokee as the high head-loss gradients identified through model simulations were not shown to negatively impact the performance of these lift stations with respect to pump run-time or wetwell surcharging.

- Pipe capacity improvements are not recommended for the force main connecting LS 8306 in South Bay as this line is short and was not shown to negatively impact the performance of the lift station with respect to pump run-time or wetwell surcharging after the implementation of the pipe capacity upgrade to the existing 10 inch force main connecting the South Bay booster pump station and the Belle Glade WWTF.

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Chapter 7.0
Collection and Transmission System Capacity and Reliability Analysis

This chapter presents the evaluation conducted on the collection and transmission system serving the Glades Region Urban Service Area. The wastewater collection system serving the communities of Pahokee, South Bay and Belle Glade, is divided into two service areas as shown in **Figure 7.1**. The service areas are Belle Glade, which includes the South Bay area, and Pahokee, which includes the Canal Point area.

This wastewater collection system is comprised of gravity mains, force mains, lift stations and master pump stations located throughout its service area. There are a total of 101 stations in the Glades Region Urban Service Area, with 95 lift stations (submersible) as shown in **Figure 7.2**. In addition to the 95 lift stations, there are two plant site lift stations at the Belle Glade WWTF and one plant site lift station at the Pahokee WWTF, an in-line booster (re-pump station) in South Bay and Lift Station No. 6069 that services the Palm Beach County Police Training Facility. Lift Station No. 6069 is located in the Belle Glade service area and is maintained by the Police Department. Palm Beach County Utilities Collection staff will make periodic station checks and advise the Police Department of needed repairs. Inspection of Lift Station No. 6069 was conducted to determine if the facility meets current Palm Beach County code requirements.

The 95 lift stations that make-up the majority of the wastewater collection system service area are broken out into four separate regions. The Belle Glade service area has a total of 46 lift stations in the Belle Glade region and nine lift stations in the South Bay region. The 9 lift stations in the South Bay Region pump to a common in-line booster re-pump station that pumps directly to the Belle Glade WWTF. The Pahokee service area has 23 lift stations in the Pahokee Region and 17 grinder stations in the Canal Point Region.

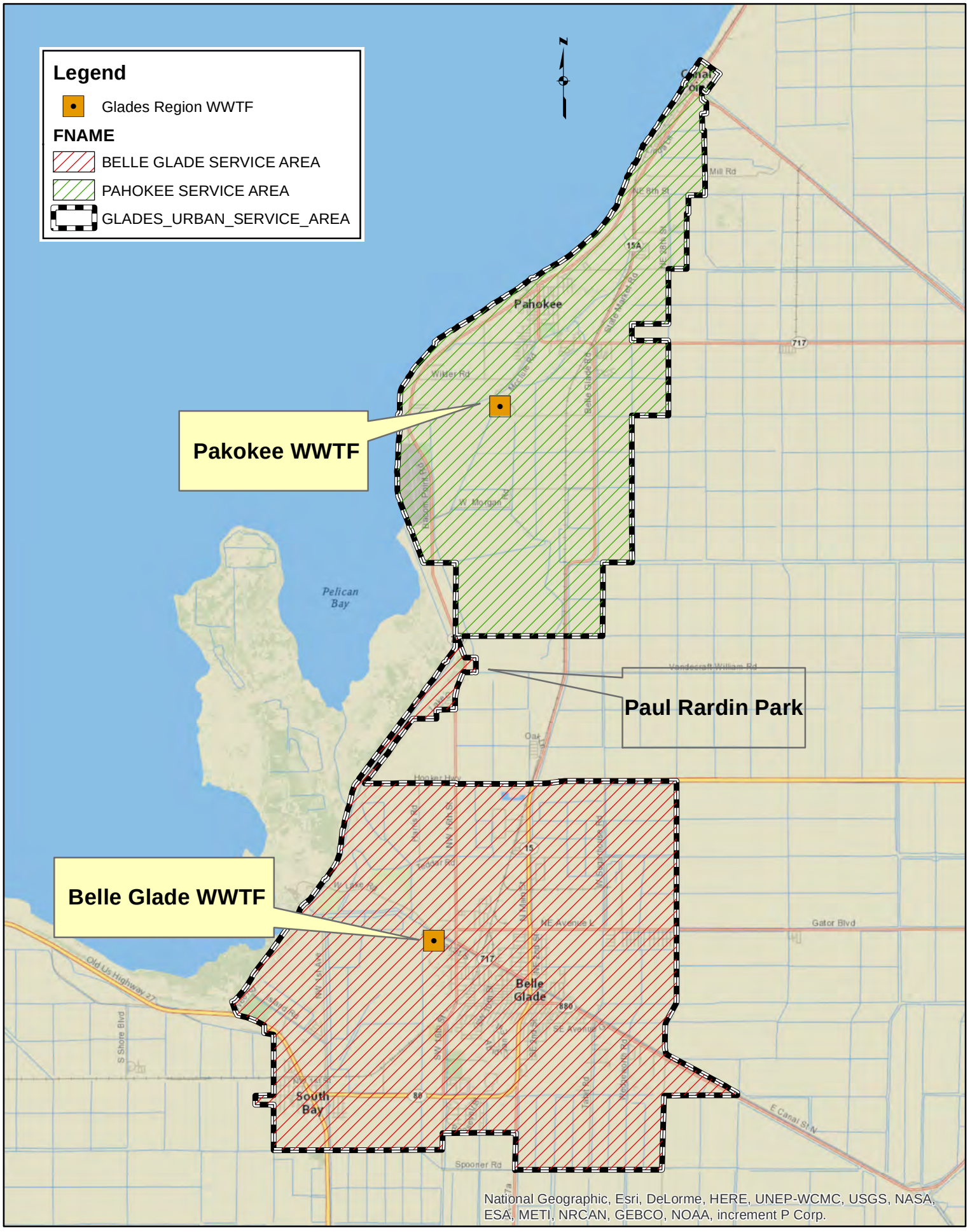

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Figure 7-1 - Glades Region Wastewater Service Areas

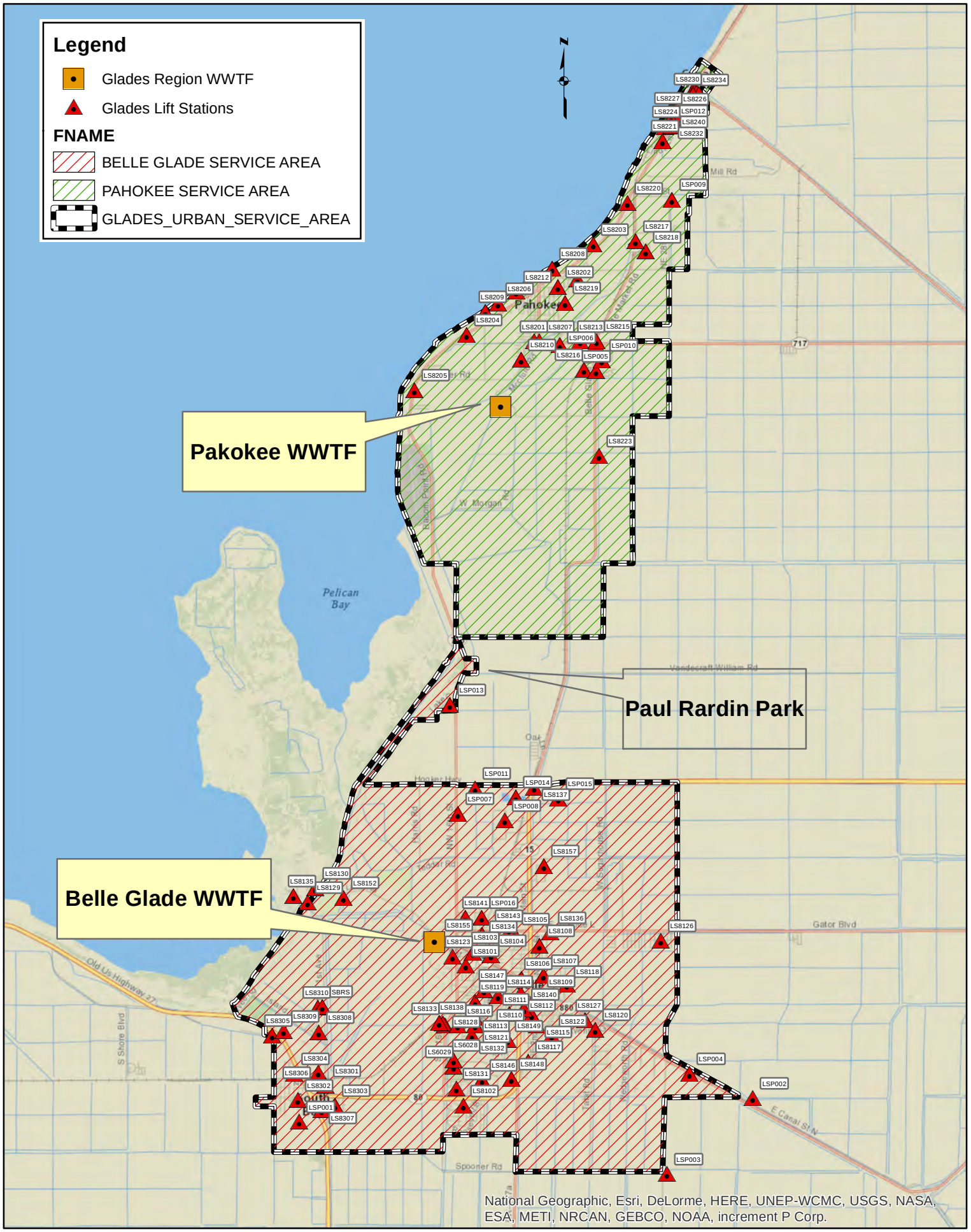

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Figure 7-2 - Glades Region Lift Stations

Lift station types and sizes vary throughout the Glades Region collection system. Lift station capacities range from small 1-Hp simplex grinder pumps stations (8 gpm at 80 psi); up to 88 Hp submersible pumps capable of pumping 1,320 gpm at 50 psi. The majority of the stations located in the Glades Region wastewater collection service area are of the submersible or grinder type. Small capacity lift stations (satellite stations) collect wastewater from a particular building, strip center, or small development and pump it through a force main to larger stations (master stations). In both the Belle Glade and Pahokee service areas the flow from the satellite stations can be re-pumped up to four times before it is delivered to the Belle Glade WWTF or the Pahokee WWTF for treatment. Technical Memorandum No. 7 (TM-7) presents the findings of the detailed analysis conducted including a diagram of the lift station network.

7.1 Lift Station Analysis

As discussed above, there are currently 95 lift stations located within the two regions (Pahokee / Canal Point, and South Bay / Belle Glade) of the Pahokee and Belle Glade wastewater collection service areas. The analysis of these is presented with a general assessment of the lift station within each of the regions followed by a detailed analysis based on the risk of failure.

7.1.1 Canal Point

The 17 Canal Point lift stations consist of two types; either simplex or duplex 1 Hp D-Series or W-Series grinder type lift stations manufactured by Environment One. The D-Series stations are self-contained grinder stations typically with small HDPE collection tanks of approximately 150 gallons that receive gravity flow from up to four sources. The pumps have internal check valves and there is a seal between the pumps / wet well and the top compartment of the tank. Most of these stations have been installed within the last five years and are in good mechanical and structural condition.

Environment One D-Series Grinder Station

D-Series Grinder Upper Compartment

The other type of grinder station is the W-Series station manufactured by Environment One. These stations consist of a four foot diameter fiberglass wet well with one or two 4-inch inlets, two 1 Hp grinder submersible pumps and an aluminum wet well cover and access hatch. The wet wells of these stations are in good condition mechanically and structurally as they have typically been replaced within the last five years. The biggest problem with these stations (other than grease buildup) is the carbon steel 2-inch vents are rusted or missing from some of the stations.

Station power is provided by the local utility via a utility meter and a main circuit breaker. The control panel for these stations is provided by the packaged pump system supplier. The controls are housed in a fiber reinforced plastic (FRP) enclosure and are equipped with 30-Amp emergency generator receptacles, high level alarm beacons, motor starters and printed circuit boards for level control. Pump controls (on/off) are provided by internal pressure switches. The control panels were found to be in good condition although there are some minor issues with conduit separating from connectors and shrubs growing in front of the control panels.

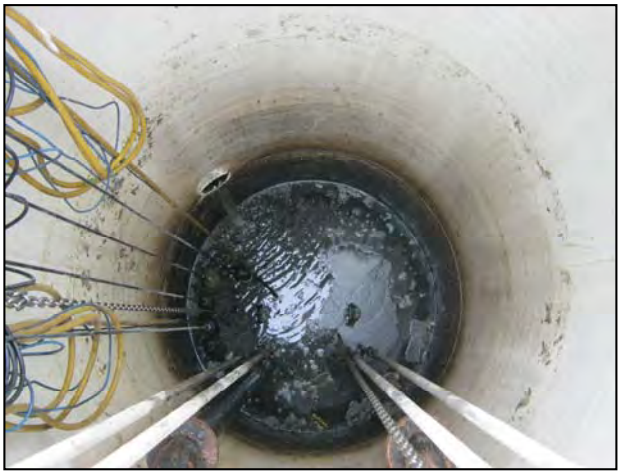
Environment One W-Series FRP Lift Station

Typical FRP Lift Station Control Panel

7.1.2 Pahokee

There are a total of 23 lift stations in the Pahokee wastewater collection system. The wet wells range in size from four feet up to nine feet in diameter and are typically concrete except for some of the 4-foot diameter stations that have fiberglass wet wells. These lift stations are duplex stations with pumps ranging from 2 Hp up to 25 Hp. Some of the wet wells are in good condition because they are either fiberglass, or have a good liner or coating system. However, the majority of the wet wells have a coating or liner system that has failed and there is exposed concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete or exposed steel was observed during our inspections of the Pahokee lift stations. The top slabs of the wet wells appear to be in good condition. Lift Station 8210 was

observed to have a steady inflow of approximately 10 gpm. Utility staff reported that this station always has approximately the same inflow.



Typical Wet Well with Good Coating

Typical Wet Well with No Liner or Coating

The lift station pumps within the Pahokee stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. The discharge piping and valves appear to be in good condition. Most of the lift stations in the Pahokee collection system have aboveground discharge piping and no associated valve vault. Only stations 8204, 8208, 8212, and 8213 have valve vaults. Most of the piping systems appear to have a good protective coating on them with only minor rust on the discharge piping that is located aboveground. Most of the rust and corrosion on the discharge piping is on the piping inside the wet wells. Most of the pipe supports are not actually supporting the discharge piping however the supports appear to be in good condition.

Station power is provided by the local utility via a utility meter and a main circuit breaker. All control panels for lift stations are custom made and constructed of stainless steel except station 8223. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters. Floats are used at the stations for pump on/off control and to monitor high wet well levels. The control panels are in good condition. Station 8223 control panel is constructed of FRP and is in fair condition. The control panel for Station 8223 is installed 24 inches from the wet well opening. This is a code violation and needs to be relocated to provide the 36 inches of clearance required. It is recommended that this control panel be replaced and installed to meet national electrical code (NEC) requirements. Gas seal-off fittings at stations 8201, 8208, 8210, and 8214 are either missing or not filled and need to be corrected. Other minor issues include

gaskets on main breaker enclosures in several lift stations are compromised, allowing water intrusion, and broken alarm lights.

Typical Lift Station in Good Condition

Lift Station with Fall Protection

7.1.3 South Bay

There are a total of nine lift stations and one in-line booster re-pump station in the South Bay wastewater collection system. The wet wells range in size from 5 feet up to 10 feet in diameter and are all concrete. These lift stations are duplex stations with pumps ranging from 5 Hp up to 88 Hp. Some of the wet wells have a liner or coating system and some have no coating or liner. Most of the coating or liner systems that do exist have failed and there is exposed aggregate in the concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete was observed during our inspections of the South Bay lift stations. However, several of the lift stations have exposed steel near the top slab or in the top slab of the wet well. Some of the valve vaults are in very bad condition due to differential settlement and have started to break apart.

Valve Vault that has Failed in South Bay

Failing Wet Well Top Slab in South Bay

The lift station pumps within the South Bay stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. It was reported that typical past problems were associated with electrical issues and not mechanical related issues. The discharge piping and valves appear to be in bad condition. Most of the lift stations have valve vaults and the only station with aboveground discharge piping is Station 8304. The aboveground discharge piping and valve system appears to have a good protective coating with only minor rust. However, most of the rust and corrosion on the discharge piping and valves occurs on the piping inside the wet wells or inside the valve vaults. This piping does not have a coating system or it has failed and the piping and valves are rusted and corroded badly.

Failed Liner and Severe Pipe Corrosion

Failing Control Panel in South Bay

Station power is provided by the local utility via a utility meter and a main circuit breaker. The control panels for lift stations are custom made and constructed of stainless steel. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters. Floats are used at the stations for pump on/off control and to monitor high wet well levels. The control panels are in good condition with the exception of stations 8303, 8305, and 8307. The control panels for these stations are old painted sheet steel and are rusted. It is highly recommended that these panels be replaced. Other issues include gas seal-off fittings are either not filled or missing at several stations. At station 8305, the pump power cable is lying on top of the ground and passes through a hole in the wet well access hatch.

The South Bay in-line booster station re-pumps all of the South Bay wastewater collection system flow from the nine lift stations directly to the Belle Glade WWTF. It is equipped with three 60 Hp vertical non-clog pumps. The booster station was placed into operation August 25, 2010 and is in good condition. There is no wet well and only minor rust on the suction and discharge piping. Mechanically, the biggest issue is the pump suction reducers are concentric instead of eccentric. However, no operational issues were reported with this station.

It should be noted that lift stations 8302, 8303, 8304 and 8307 are in the process of being upgraded.

South Bay In-line Booster Repump Station

South Bay In-line Booster Control Panels

7.1.4 Belle Glade

There are a total of 46 lift stations in the Belle Glade wastewater collection system. The wet wells range in size from 3.5 feet up to 11 feet in diameter and are all concrete. Lift Station 8101 is a master station that is rectangular, 10 feet by 12 feet, and is equipped with four 20

Hp submersible pumps. The rest of the lift stations are duplex stations with pumps ranging in size from 2 Hp up to 51 Hp. Some of the wet wells have a liner or coating system but most have no coating or liner system. Most of the wet wells with a coating or liner systems have failed and there is exposed aggregate in the concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete was observed during our inspections of the Belle Glade lift stations. However, several of the lift stations have exposed steel in the walls, and near the top slab or in the top slab of the wet well. Exposed brick and mortar was observed in several wet wells mainly at pipe penetrations and near the top of the wet well. Some of the valve vaults are in bad condition due to differential settlement and have started to break apart or do not have any protective coating on the exposed concrete. During our field inspections (May 1 through May 3, 2013) of the Belle Glade collection system, 25 lift stations were observed to have some steady clear inflow. The inflow rate was estimated to range from approximately 5 gpm up to 200 gpm with several stations having an inflow of roughly 100 gpm.

Typical Exposed Steel and Corrosion in Wet Well

Failing Guide Rails and Wet Well Inflow

The pumps within the Belle Glade lift stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. It was reported that typical past problems were associated with only a few stations and they were both mechanical and electrical in nature. The discharge piping and valves appear to be in bad condition. Most of the lift stations have valve vaults; only stations 8112 and 8129 have discharge piping aboveground. The aboveground discharge piping and valve systems appear to have some protective coating on them but still have some minor rust and corrosion. Most of the rust and corrosion on the discharge piping and valves occurs on the piping inside the wet wells or inside the valve vaults. Most of the piping inside the wet wells or value vaults does not have a coating system, or the coating system has failed and the piping and valves are rusted and corroded badly.

Failing Brick and Mortar around Discharge Pipes

Discharge Pipe Leaking due to Corrosion

It should be noted that several of the existing lift stations in the Belle Glade collection system are in the process of being upgraded, they include; lift stations 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, and 8149.

Station power is provided by the local utility via a utility meter and a main circuit breaker. All control panels for lift stations are custom made and constructed of stainless steel. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters for level control. Floats are predominantly used at the stations for pump on/off control and to monitor for high wet well levels, however, a few stations use ultrasonic level controllers and others use conductive probe level controllers. Most of the existing control panels are in bad condition and have been replaced or are currently being replaced. Therefore, most of the control panels will be in good condition as soon as the new panels are placed into service. There are code issues with respect to working clearance in front of control panels at stations 8110, 8111, 8122, 8120. Minor issues also include gas seal-off fittings are either not filled or missing, ventilation fans added without louvers, and open unused holes in control panels.

7.2 Lift Station Rankings

To create a ranked or prioritized list of submersible lift station rehabilitation over the planning horizon, a method similar to the one used for the PBCWUD's Wastewater Master Plan (June 2013) was utilized. A copy of the methodology used is included in Appendix 7-2 of TM-7. The method establishes a consequence of failure (COF) and the possibility of failure (POF) for each lift station. The total risk is then the product of the COF and the POF (Risk = COF x POF). In this evaluation the COF would be the sum total of the risk assessment factors, as the evaluated criteria shows the importance of each station as it relates to what would be the impact if it were to become non-operational. The POF would be the sum total of all the condition assessment factors as it provides a representation as to the condition of the lift

station and probability that the station may become non-operational due to the physical condition of the station.

Results of the assessment suggest that 27 lift stations should be scheduled for rehabilitation/ replacement by 2015 as shown in **Table 7.1**

Table 7.1
Summary of Lift Stations Scheduled for Rehabilitation / Replacement

Combined Risk and Condition Score	R&R Planning Year	Number of Lift Stations
110,000 to 60,000	2015	27
59,900 to 45,000	2020	27
44,900 to 30,000	2025	16
29,900 to 20,000	2030	23
19,000 to 17,000	2035	4

A cost estimate was prepared to assess the capital dollars needed for the planning horizon with emphasis on the next five years. **Table 7.2** presents a listing of stations and associated costs for rehabilitation / replacement over the next five years. Lift stations scheduled for rehabilitation / replacement beyond the next five years are grouped as shown.

Table 7.2
Capital Improvement Schedule Through 2030

PROJECT DESCRIPTION		IMPLEMENTATION SCHEDULE							
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
1.0 - Lines and Lifts			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Years 6-10**	**Years 11-22**
7.1	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	**$4,111,250**	$4,111,250	$0	$0	$0	$0	$0	$0
7.2	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	**$5,692,500**	$0	$5,692,500	$0	$0	$0	$0	$0
7.3	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	**$2,530,000**	$0	$0	$2,530,000	$0	$0	$0	$0
7.4	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	**$2,530,000**	$0	$0	$0	$2,530,000	$0	$0	$0
7.5	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	**$2,530,000**	$0	$0	$0	$0	$2,530,000	$0	$0
7.6	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	**$4,743,750**	$0	$0	$0	$0	$0	$4,743,750	$0
7.7	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	**$4,117,000**	$0	$0	$0	$0	$0	$0	$4,117,000
Total Estimated Annual Costs		***$26,254,500***	*$4,111,250*	*$5,692,500*	*$2,530,000*	*$2,530,000*	*$2,530,000*	*$4,743,750*	*$4,117,000*

Costs based on an estimated cost of $275,000 for construction and $41,250 for engineering services ($316,250 per lift station)

Costs for Grinder Lift Stations estimated at $65,000 for construction and $9,750 for engineering services ($74,750 per grinder station)

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Chapter 8.0
Infiltration and Inflow Assessment

This chapter summarizes the Infiltration and Inflow (I/I) assessment performed for the Glades Region Urban Service Area and discussed in Technical Memorandum No. 8 (TM-8) which is included in **Appendix A**. The chapter is presented in six sections as summarized below:

- System Description;
- Existing Infiltration and Inflow Reduction Program;
- System-Level Evaluation;
- Basin-Level Evaluation;
- Conclusions; and
- Recommendations

8.1 System Description

The communities of Belle Glade, Pahokee, and South Bay were settled in the early 1900s and owe their subsequent development and expansion in part to the federal project of draining the land around Lake Okeechobee. The gravity collection systems in these areas were reportedly installed from the 1950s through the 1990s, although some pipes are of unknown age. Pipe materials consist primarily of vitrified clay and newer, PVC pipe. Key information for the Glades Region wastewater collection and transmission system is summarized below in **Table 8.1**.

Table 8.1
Glades Region Wastewater System

Collection System	Number of Pump Stations	Number of Pump Stations w/ Gravity Systems	Linear Feet of Gravity Mains	Number of Manholes[1]	2012 Average Annual Daily Flow (MGD)	Wastewater Treatment Facility (WWTF)
Belle Glade	46	26	174,697	781	2.05[2]	Belle Glade
Pahokee	40	12	91,145	415	0.91[3]	Pahokee
South Bay	10	7	47,360	188	0.56[4]	Belle Glade
Total	**96**	**45**	**313,202**	**1,384**	**3.52**	**---**

[1] Based on the number of pipe segments in GIS

[2] Obtained by subtracting South Bay in-line booster pump station flow from total flow to Belle Glade WWTF

[3] Total flow to Pahokee WWTF

[4] South Bay in-line booster pump station flow

8.2 Existing Infiltration and Inflow Reduction Program

Documentation available for review as part of this I/I study is listed below.

- City of Pahokee Smoke Test Inspection Report, JCC Enterprises, Inc. (March, 2013).
- City of Belle Glade Sewer Main Video Logs and CDs, Lanzo Lining Services, Inc. (January – March, 2013).
- City of Belle Glade Smoke Test Inspection Report, FloTech Environmental, LLC (January, 2013).
- City of Belle Glade Sewer Manhole Inspection Forms and Photographs (November, 2012).
- Pahokee and South Bay repair location maps, PBCWUD (December, 2009).
- Pahokee Infiltration and Inflow Study, AECOM (October, 2009).
- City of Pahokee, Study of the Existing Gravity Sewer System, Craig Smith and Associates (April, 1999).

Based on the available documentation, the PBCWUD has undertaken several targeted efforts at investigation and rehabilitation related to the reduction of I/I, but has not previously performed a comprehensive, system-wide analysis and prioritization of lift station collection areas (basins) to identify those basins most susceptible to I/I. It should be noted that County personnel have communicated a clear understanding of where the most severe problems appear to exist;

moreover, as part of its day-to-day operation and maintenance responsibilities the County routinely performs investigative field activities and repairs to sewer mains, manholes, and laterals to address priority issues.

8.3 System-Level Evaluation

A series of exhibits, listed below, were developed to assess and illustrate the effects of potable water usage, rainfall, and groundwater elevation on total WWTF flows. Observations concerning the relationships among these variables for the overall system, and for Belle Glade, Pahokee, and South Bay individually are presented in the subsequent text.

Figure 8-1 System-Level Water Usage and Rainfall

Figure 8-2 Groundwater Elevation and Rainfall

Figure 8-3 Groundwater Elevation, Rainfall, and Wastewater Flow

Figure 8-4 Groundwater Elevation, Rainfall, and Wastewater Flow - Belle Glade

Figure 8-5 Groundwater Elevation, Rainfall, and Wastewater Flow - South Bay

Figure 8-6 Groundwater Elevation, Rainfall, and Wastewater Flow - Pahokee

Figure 8-7 Estimated Infiltration and Inflow

Figure 8-8 Estimated Infiltration and Inflow - Belle Glade

Figure 8-9 Estimated Infiltration and Inflow - South Bay

Figure 8-10 Estimated Infiltration and Inflow - Pahokee

Figure 8-11 Service Area Map with Gauge Locations

8.3.1 Potable Water

Figure 8-1 provides a graphical illustration (on a monthly basis) of total potable water produced and monthly rainfall between January 2012 and February 2013. Potable water production appears to be generally higher during the dry winter season and lower during the wet summer season, most likely due to decreased irrigation during periods with higher rainfall.

8.3.2 Wastewater

A graphical illustration, on a monthly basis, of rainfall and groundwater elevation between January 2012 and February 2013 is presented in **Figure 8-2**. It can be seen that groundwater elevation shows a consistent and direct correlation with rainfall. This relationship will be seen more clearly at smaller data intervals in the basin-level evaluation.

Figure 8-1
System-Level Water Usage and Rainfall (January 2012 – February 2013)

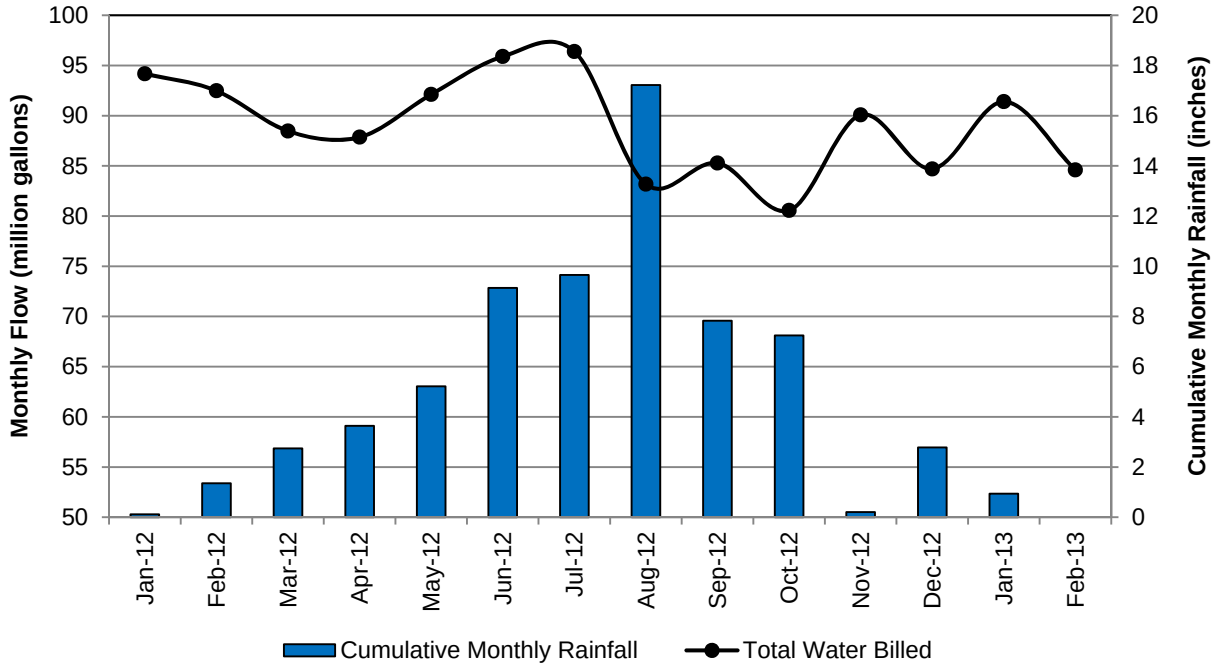
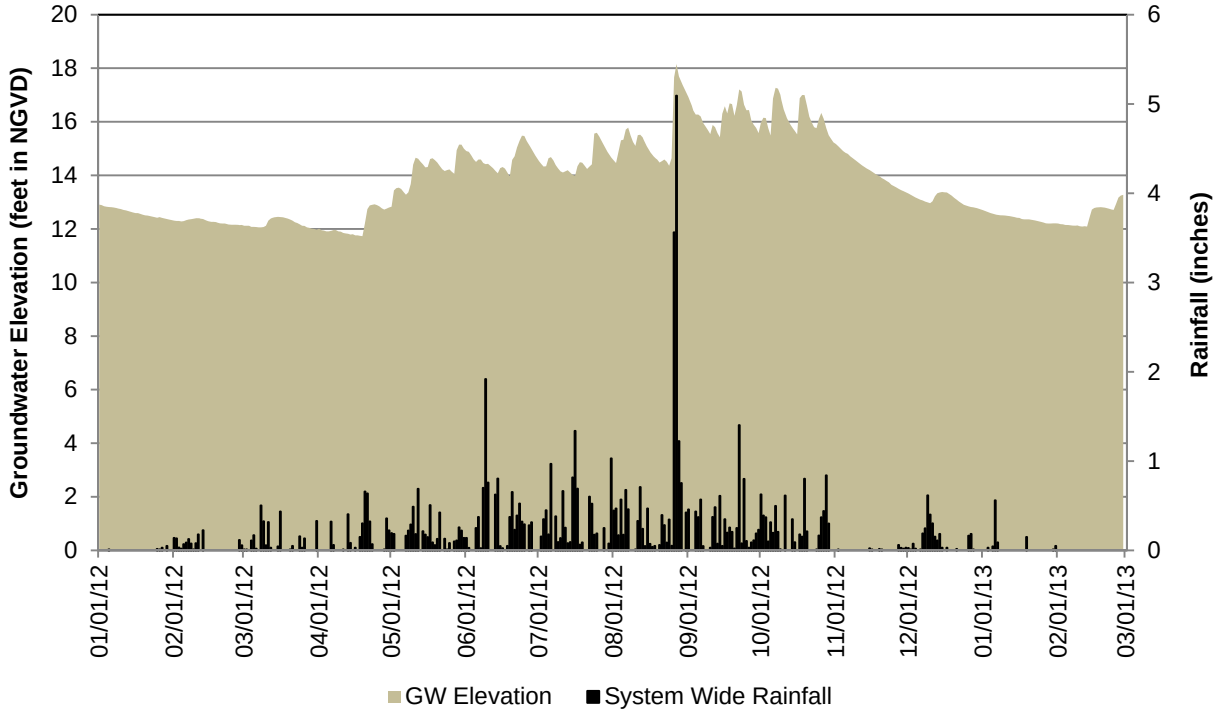


Figure 8-2
Groundwater Elevation and Rainfall for Gauge PB 685
(January 2012 - February 2013)



It should be noted that while multiple sources for groundwater elevation were researched, including United States Geological Survey (USGS), South Florida Water Management District (SFWMD), and Army Corps of Engineers, the nearest location with available data was found to be SFWMD PB685, located some 23 miles from the study area adjacent to State Road 80 near Lion Country Safari. For this reason, an effort was made to use readily available local canal elevation data in place of groundwater elevations. However, since the canal elevations are actively managed for purposes of flood control, it was found that these elevations did not provide a useful surrogate for groundwater levels, and ultimately the analysis was conducted using the SFWMD PB685 groundwater gauge despite its distance from the study area.

Figure 8-3 provides a graphical illustration on a monthly basis of rainfall, groundwater elevation, and wastewater production between January 2012 and February 2013. It can be seen that increases in wastewater production clearly follow increases in rainfall and groundwater elevation. These relationships will also be seen at smaller data intervals in the basin-level evaluation.

Figures 8-4, 8-5, and **8-6** provide the same illustration as **Figure 8-3** but for the individual systems of Belle Glade, South Bay, and Pahokee respectively. These figures show that flow in all three systems is directly influenced by rainfall and elevated groundwater conditions.

8.3.3 Infiltration and Inflow

An estimate on a monthly basis of the total volume of I/I entering the system between January of 2012 and February of 2013 is shown in **Figure 8-7**. This graph was arrived at by assuming that a specified percentage (75 percent) of potable water produced ultimately enters the sewer through sinks, toilets, and showers. This quantity is titled "*Sanitary Flow*" in the graph, and "*Infiltration and Inflow*" is calculated to be the difference between total wastewater production and "*Sanitary Flow*". It must be emphasized that the I/I calculated in this fashion is highly dependent on the percent of potable water assumed to enter the sewer, and while 75 percent is within the range of typical estimates, this estimate should be refined if data are available to permit the assumed percentage to be more reliably quantified.

Figures 8-8, 8-9, and **8-10** provide the same illustration as **Figure 8-7** but for the individual systems of Belle Glade, South Bay, and Pahokee respectively.

The system-level monthly data do not allow I/I to be separately quantified with much confidence. It should be noted that a significant portion of the infiltration that affects South Florida's gravity collection systems is in fact rainfall-dependent infiltration (RDI) that results from a temporarily higher groundwater table due to rainfall percolating through pervious surfaces. In general, however, the level of baseline, dry weather infiltration should correspond to the difference between sanitary flow and the minimum levels of wastewater flow seen during the time period depicted in **Figure 8-7**. Inflow and rainfall-dependent infiltration generally align with the wet months. The data presented in **Figures 8-7** through **8-10** suggest that I/I for the three systems

combined ranges from approximately 20 percent of total flows in the dry season (November through April) to approximately 49 percent of total flows in the wet season (May through October), with an annual average of approximately 37 percent.

Figure 8-3
Groundwater Elevation, Rainfall, and Wastewater Flow (January 2012 – February 2013)

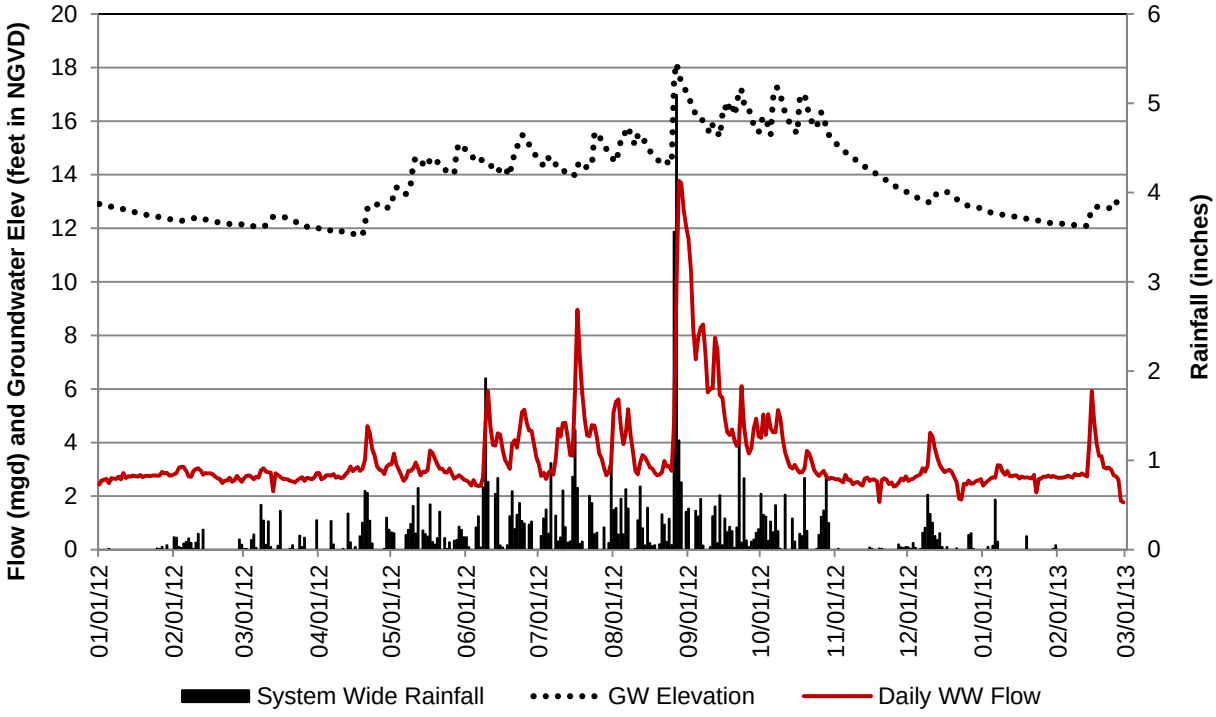


Figure 8-4
Groundwater Elevation, Rainfall, and Wastewater Flow - Belle Glade
(January 2012 – February 2013)

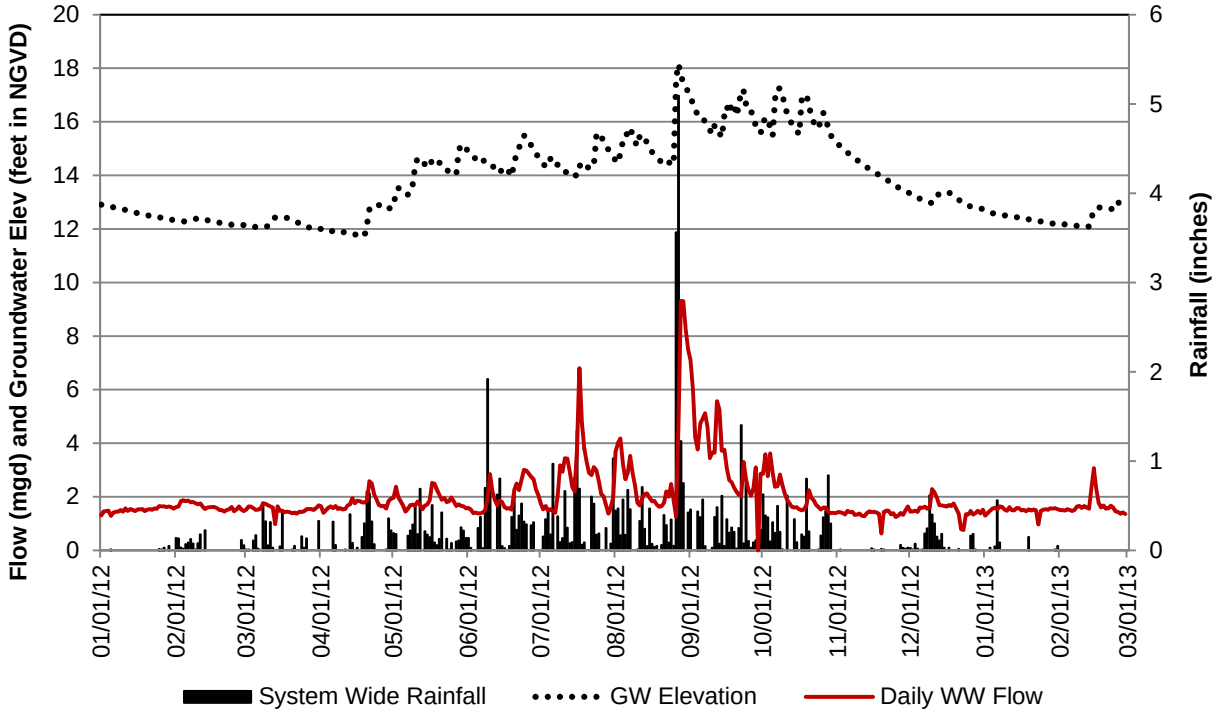


Figure 8-5
Groundwater Elevation, Rainfall, and Wastewater Flow – South Bay
(January 2012 – February 2013)

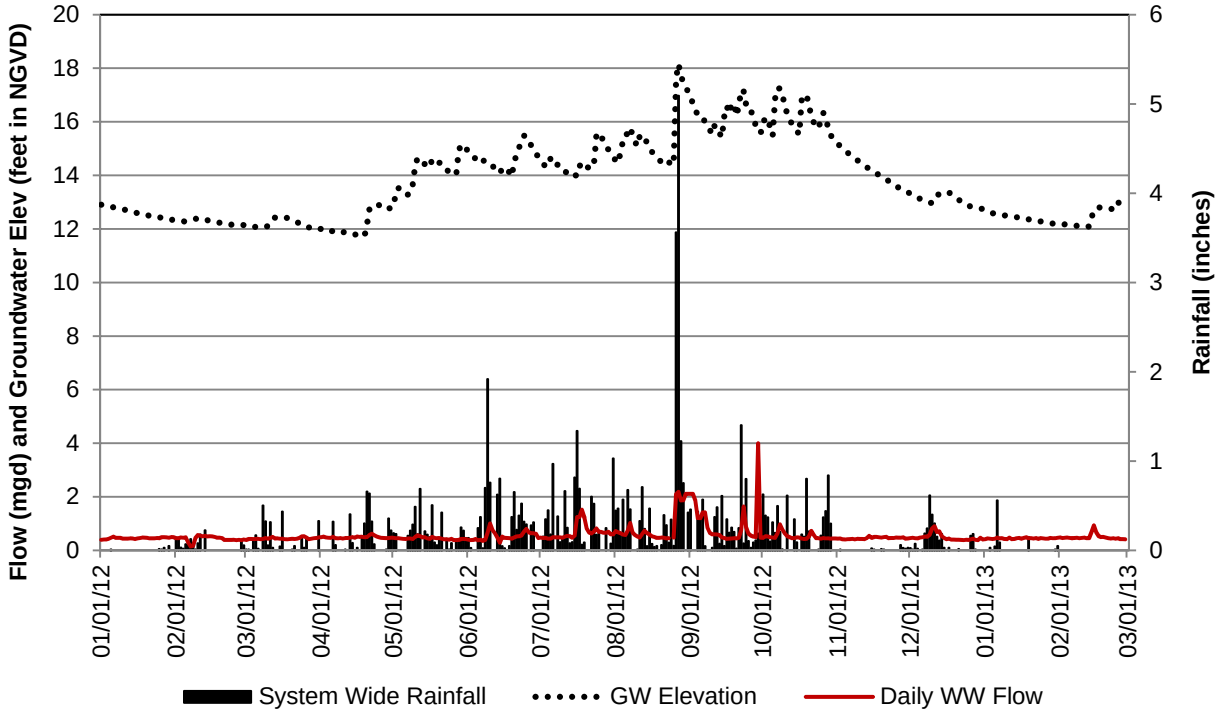


Figure 8-6
Groundwater Elevation, Rainfall, and Wastewater Flow - Pahokee
(January 2012 – February 2013)

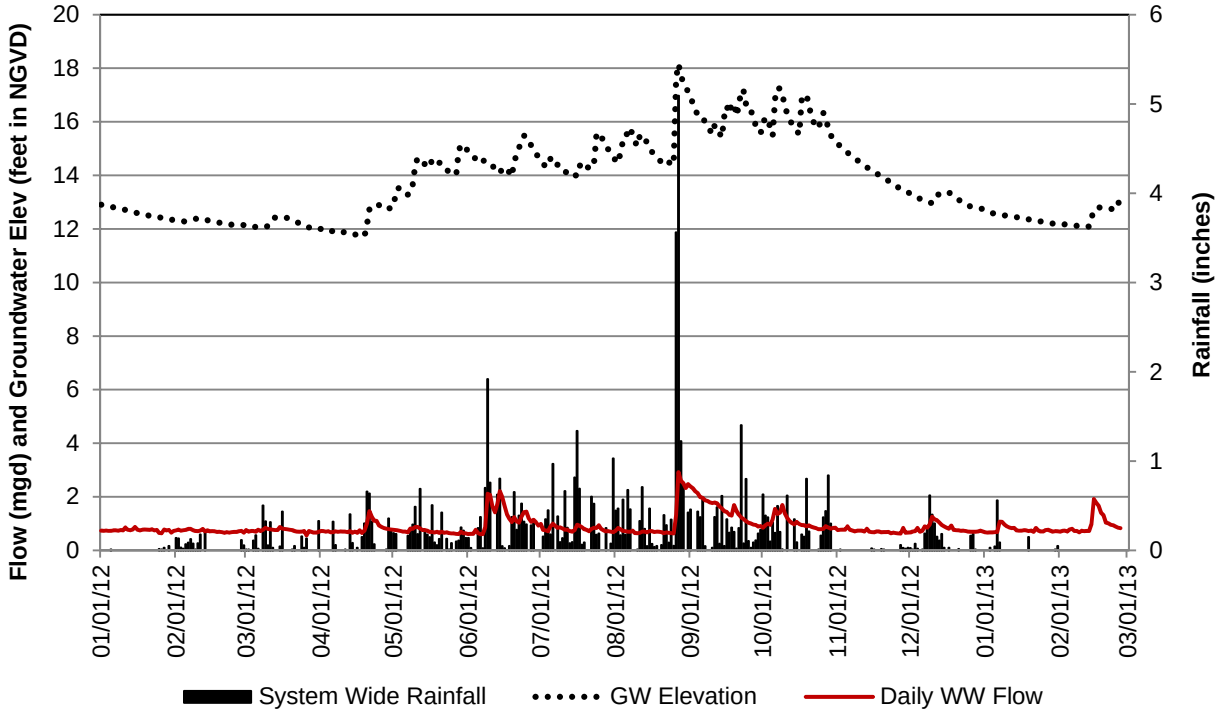


Figure 8-7
Estimated Infiltration and Inflow (January 2012 – February 2013)

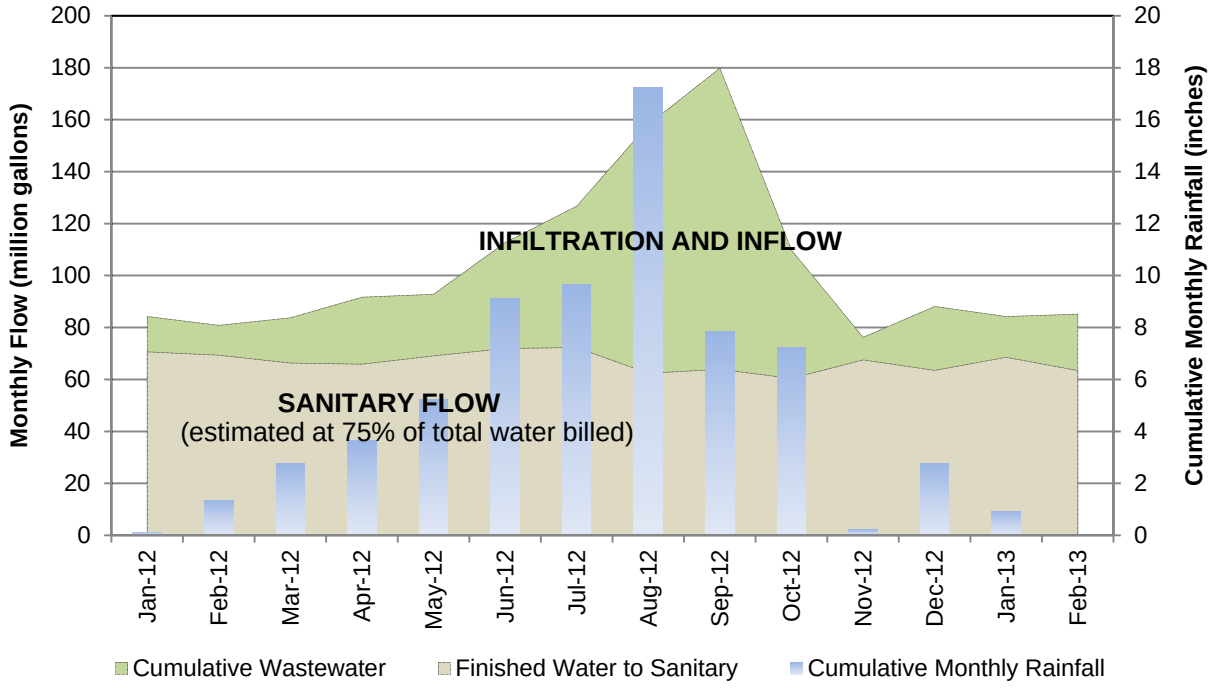


Figure 8-8
Estimated Infiltration and Inflow - Belle Glade (January 2012 – February 2013)

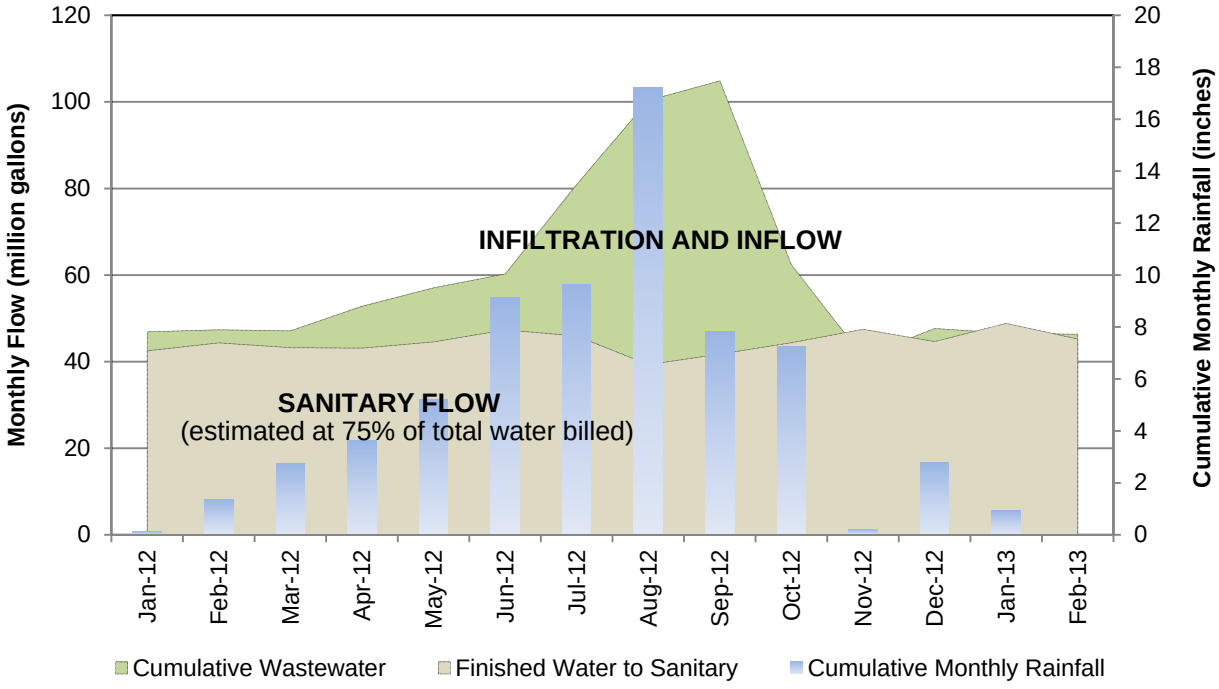


Figure 8-9
Estimated Infiltration and Inflow – South Bay (January 2012 – February 2013)

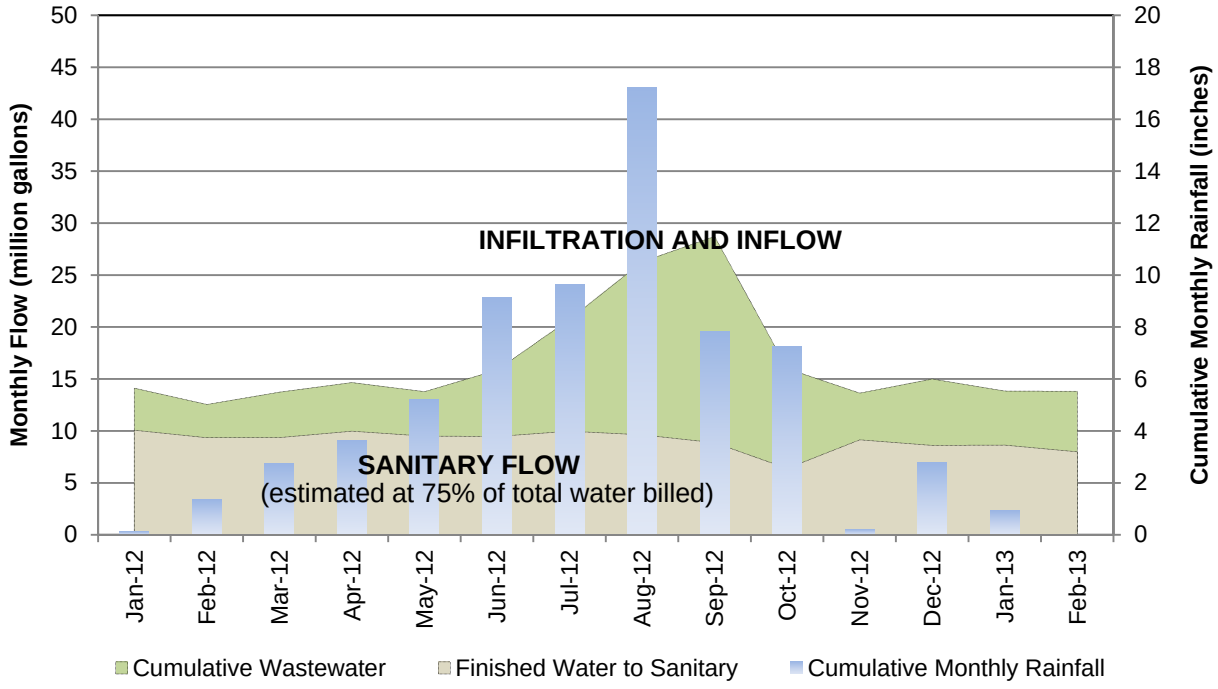


Figure 8-10
Estimated Infiltration and Inflow – Pahokee (January 2012 – February 2013)

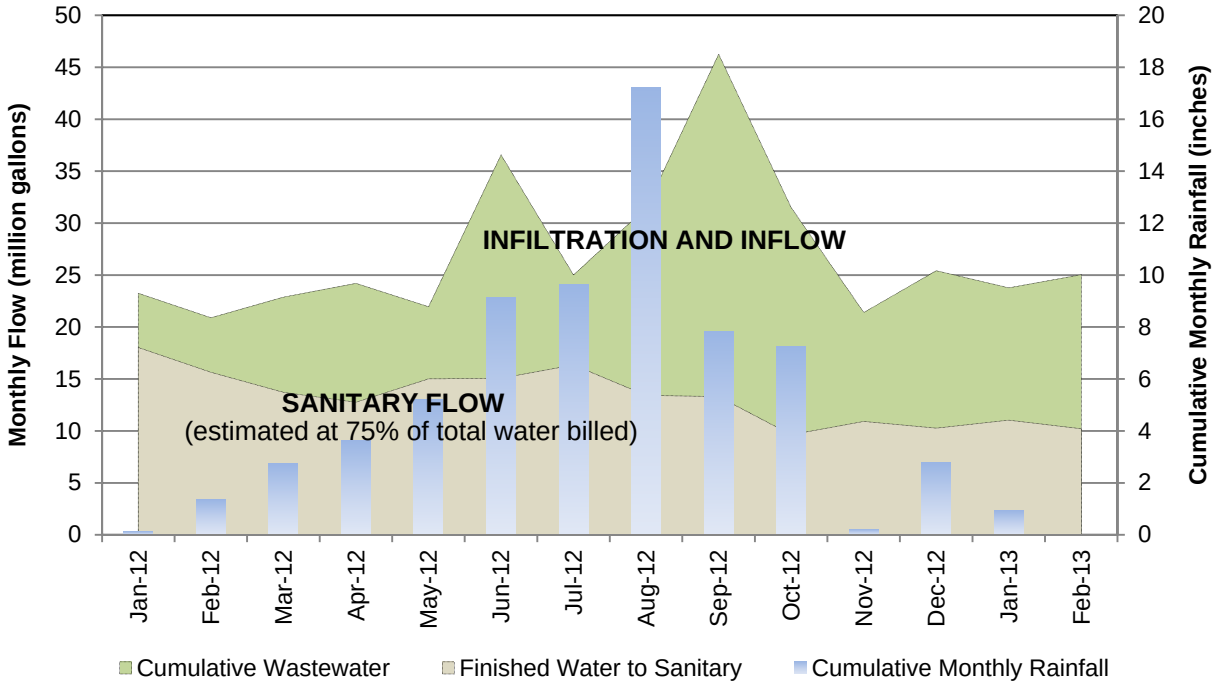


Table 8.2 shows these estimated percentages for the three systems combined along with estimated percentages for each of Belle Glade, South Bay, and Pahokee individually. It is interesting to note that the above-referenced study by AECOM, which included night flow isolation measurements for 14 of the 23 Utility-owned basins in Pahokee, concluded that approximately half a million gallons per day of infiltration existed in the selected basins at that time (June 2009). While the system-level analysis presented herein focused on WWTF flows during a different time period and employed a different methodology to estimate I/I, both estimates are of a similar order of magnitude.

While as previously noted the amount of I/I estimated herein is highly dependent on the percent of potable water assumed to enter the sewer, and could in fact be somewhat more or less than shown, the data clearly indicate that I/I are a significant issue in the subject collection systems. Conditions are particularly acute during the wet season when direct Inflow and RDI result in peak flows to the WWTFs that are multiples of average dry weather flows. The system-level evaluation, therefore, supports the conclusion that a comprehensive I/I reduction program is warranted for the Belle Glade, South Bay, and Pahokee wastewater collection systems.

Table 8.3 identifies the sources of data used in the foregoing system-level analysis and in the basin-level analysis that follows.

Figure 8-11 is a map of the service area showing the locations of rain and groundwater gauges.

Table 8.2
Estimated Infiltration and Inflow Percentages

System	2012 Wet Season (May - October)			2012 Full Year (January - December)			2012 Dry Season (November - April)		
	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)
Belle Glade	2.55	1.11	43%	2.05	0.60	29%	1.55	0.10	6%
Pahokee	1.06	0.60	57%	0.91	0.46	50%	0.76	0.31	41%
South Bay	0.67	0.37	56%	0.56	0.26	46%	0.46	0.15	32%
Total	**4.27**	**2.08**	**49%**	**3.52**	**1.32**	**37%**	**2.77**	**0.56**	**20%**

Table 8.3
Data Types and Sources

Type	Smallest Available Interval			Source
	Hourly or Sub-hourly	Daily	Monthly	
Potable water - system level			X	PBCWUD Historical Flows Records, MS Excel spreadsheet, 1987 - 2011
Potable water - volume customers		X		PBCWUD Bulk User Records, MS Excel spreadsheet, 2008 - 2011
Wastewater - system level	X			PBCWUD Bulk User Records, MS Excel spreadsheet, 1987 - 2011
Wastewater - volume customers		X		PBCWUD Bulk User Records, MS Excel spreadsheet, 2008 - 2011
Wastewater - basin level		X		PBCWUD Wastewater SCADA System, January 1, 2011 - December 31, 2011
Water level				USGS Groundwater Monitoring Wells (G-1226,G-2035,F-291), January 2008 - March 2011 http://groundwaterwatch.usgs.gov/countymaps/FL_011.html
Rain				South Florida Water Management District Rain Gages (FHCHSX, G300_R, G56_R, LWD.E1.3_R, LWD.E2.2_R, LWD.GA_R, LWD.HQ_R), January 2008 - December 2011 http://www.sfwmd.gov/dbhydroplsql

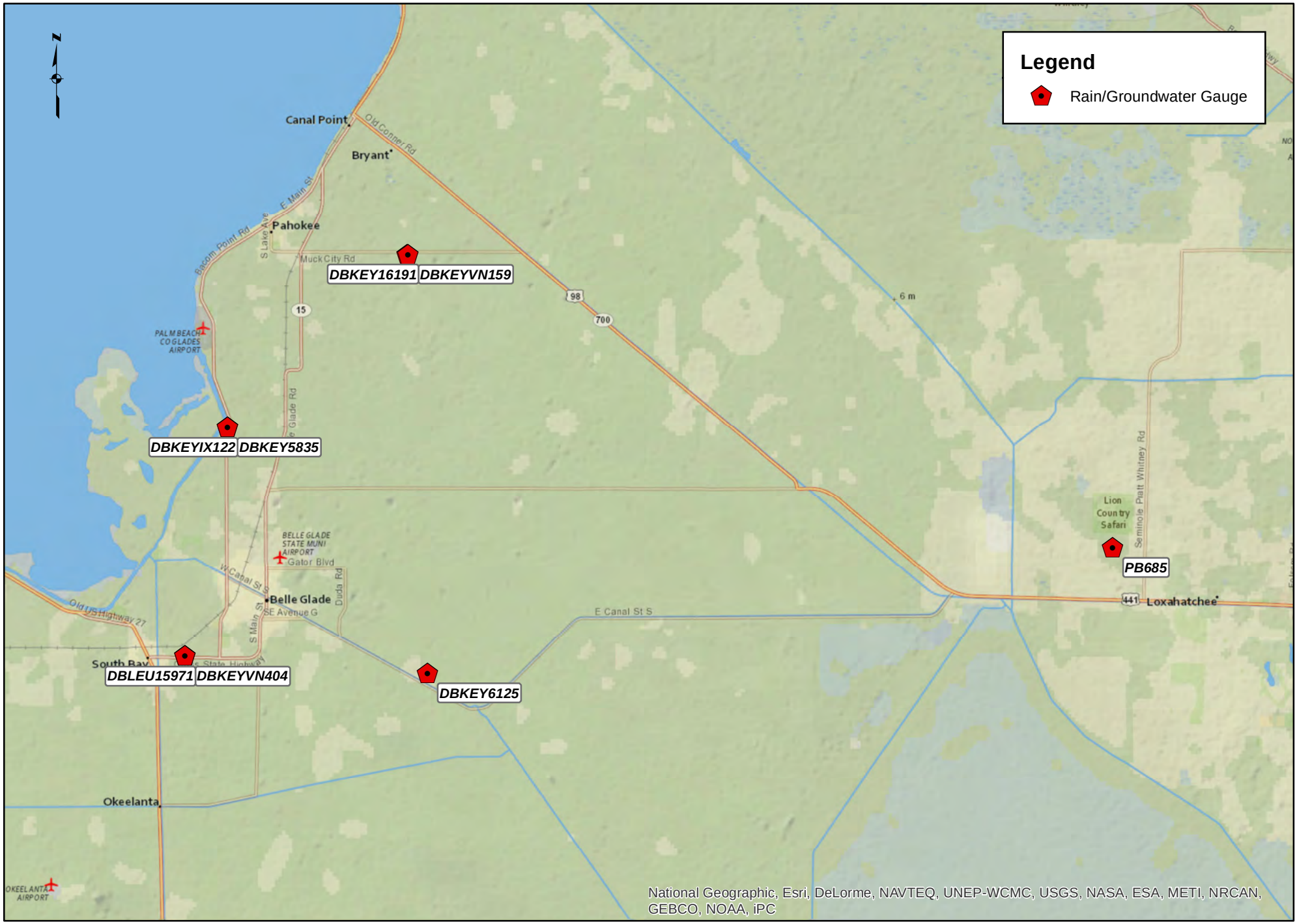


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Figure 8-11 - Rain and Groundwater Gauge Locations

8.4 Basin-Level Evaluation

A review of existing inspection documentation was performed to assist in the development of cost estimates for investigation and rehabilitation of the Belle Glade, Pahokee, and South Bay systems. The inspection documentation, produced by others, included manhole inspection reports, sewer mainline video, and smoke testing reports.

Appendix E in TM-8 contains a summary of the specific documentation reviewed, as well as the number of occurrences of defects that appear to warrant some type of near-term intervention. Appendix E of TM-8 also contains system-specific cost estimates that incorporate the defect occurrence rates into assumptions concerning the condition of the remainder of the Belle Glade, Pahokee, and South Bay systems, respectively, and the corresponding level of inspection and repair that would be recommended or required. Where available documentation did not permit a defect occurrence rate to be developed for a particular collection system or type of repair (for example, no inspection documentation of any kind was available for South Bay, and no lateral video was available for any of the three collection systems), assumptions were made based on experience in similar systems. Such assumptions are noted for each of the estimates along with any other applicable assumptions concerning defect occurrence rates. This review, it should be noted, focused on structural defects and other defects affecting I/I. Maintenance-type issues such as grease and solids deposition were not included.

The basin-level evaluation involved selection of 30 pump station collection areas to represent "study areas" for more detailed analysis. Basins were selected through consultation with Utility O&M personnel following characterization based on the following criteria:

A. Does the basin have relatively low I/I levels as a result of being newer, smaller, and/or in better condition?

B. Is the gravity system privately owned?

C. Is the basin subject to flooding and/or heavy I/I?

D. Is I/I reduction work currently scheduled under other contracts?

Basins for which the answer to questions A, B, or D was "yes" were not selected. The answer to question C did not affect selection either way and was simply for informational purposes.

Basins selected for flow monitoring are as listed in **Table 8.4**, along with the total linear footage of pipe of each diameter.

Table 8.4 - Wastewater Collection System Inventory for Selected Basins and Basins Upstream

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
BG	8101		92	**573**	16,618	2,486		2,735	1,501	**23,340**	**164,019**	**4.42**	**50.85**	**269**
		8119	18		4,690					**4,690**		**0.89**	**7.11**	
		8123	16		3,815					**3,815**		**0.72**	**5.78**	
		8106	33		7,134	240	1,745			**9,119**		**1.73**	**15.23**	
		8105	28		6,921	652				**7,573**		**1.43**	**11.72**	
		8114	73		14,291	331	718			**15,340**		**2.91**	**23.91**	
		8147 [b]	--		9,677					**9,677**		**1.83**	**14.66**	
		8113	67		14,458	778	880			**16,116**		**3.05**	**25.38**	
		8121	6		1,718					**1,718**		**0.33**	**2.60**	
		8116	14		1,870					**1,870**		**0.35**	**2.83**	
		8132	11		3,192					**3,192**		**0.60**	**4.84**	
		8128 [b]	--		1,866					**1,866**		**0.35**	**2.83**	
		8133 [b]	--		0					**0**		**0.00**	**0.00**	
		8138 [b]	--		0					**0**		**0.00**	**0.00**	
		8140 [b]	--		0					**0**		**0.00**	**0.00**	
		8111	37		8,406	903				**9,309**		**1.76**	**14.45**	
		8149	8		2,451					**2,451**		**0.46**	**3.71**	
		8112	60		13,136	951				**14,087**		**2.67**	**21.70**	
		8109	18		4,741					**4,741**		**0.90**	**7.18**	
		8110	36		8,329	1,110	980			**10,419**		**1.97**	**16.95**	
		8117	24		6,337					**6,337**		**1.20**	**9.60**	
		8115	27		7,910	330				**8,240**		**1.56**	**12.61**	
		8122 [b]	--		8,749					**8,749**		**1.66**	**13.26**	
		Private [c]	--							**0**		**0.00**	**0.00**	

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		Private [c]	--							0		0.00	0.00	
		Private [c]	--							0		0.00	0.00	
		8120 [b]	--		0					0		0.00	0.00	
		8127	5		1,370					1,370		0.26	2.08	
BG	8102		5		651					651		0.12	0.99	
BG	8107		24	114	4,349	2,180				6,529	30,347	1.24	10.72	11
		8108	27		7,681					7,681				
		8118	25		6,653					6,653				
		8126	38		9,484					9,484				
		8136 [b]	--		0					0				
BG	8108		27		7,681					7,681		1.45	11.64	
BG	8110		36		8,329	1,110	980			10,419		1.97	16.95	
BG	8111		37	45	8,406	903				9,309	11,760	1.76	14.45	14
		8149	8		2,451					2,451				
BG	8112		60	78	13,136	951				14,087	18,828	2.67	21.70	22
		8109	18		4,741					4,741				
BG	8114		73	73	14,291	331	718			15,340	25,017	2.91	23.91	24
		8147 [b]	--		9,677					9,677				
BG	8126		38		9,484					9,484		1.80	14.37	
BG	8128 [b]		--	0	1,866					1,866	1,866	0.35	2.83	3
		8133 [b]	--		0					0				
		8138 [b]	--		0					0				
BG	8132		11		3,192					3,192		0.60	4.84	
BG	8148		15		3,640					3,640		0.69	5.52	
BG	8149		8		2,451					2,451		0.46	3.71	
P	8201		168	225	39,055					39,055	51,735	7.40	59.17	78

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		8210	12		3,216					3,216		0.61	4.87	
		8212	5		1,944					1,944		0.37	2.95	
		8207	15		2,334					2,334		0.44	3.54	
		Private [c]	--							0		0.00	0.00	
		8213	13		3,056					3,056		0.58	4.63	
		8216	12		2,130					2,130		0.40	3.23	
P	8202		38	68	11,375					11,375	21,479	2.15	17.23	33
		8203	17		5,126					5,126		0.97	7.77	
		8208	4		2,334					2,334		0.44	3.54	
		8211	4		700					700		0.13	1.06	
		8212	5		1,944					1,944		0.37	2.95	
P	8203		17		5,126					5,126		0.97	7.77	
P	8204		12	22	3,872					3,872	6,237	0.73	5.87	9
		8209	7		1,755					1,755		0.33	2.66	
		8206	3		610					610		0.12	0.92	
P	8205		42	64	12,320					12,320	18,557	2.33	18.67	28
		8204	12		3,872					3,872		0.73	5.87	
		8209	7		1,755					1,755		0.33	2.66	
		8206	3		610					610		0.12	0.92	
P	8210		12		3,216					3,216		0.61	4.87	
P	8214		23		5,841					5,841		1.11	8.85	
P	8216		12		2,130					2,130		0.40	3.23	
P	8218		23		5,348					5,348		1.01	8.10	
P	8220		8		2,343					2,343		0.44	3.55	
SB	8301		30	85	3,900		1,389			5,289	19,853	1.00	9.07	31
		8303	35		9,272					9,272		1.76	14.05	

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		8306	3		1,076					**1,076**		**0.20**	**1.63**	
		8307	17		4,216					**4,216**		**0.80**	**6.39**	
SB	8302		65	**65**	17,025	2,254	205			**19,484**	**19,484**	**3.69**	**30.53**	**31**
		Private [c]	--							**0**		**0.00**	**0.00**	
SB	8303		35		9,272					**9,272**		**1.76**	**14.05**	
SB	8304		12	**12**	3,200					**3,200**	**3,200**	**0.61**	**4.85**	**5**
		8305 [b]	--		0					**0**		**0.00**	**0.00**	
SB	8305 [b]		--		0					**0**		**0.00**	**0.00**	
SB	8307		17		4,216					**4,216**		**0.80**	**6.39**	
SB	8308		23		4,821					**4,821**		**0.91**	**7.30**	

Notes:

(a) BG - Belle Glade, P - Pahokee and SB - South Bay

8.4.1 Flow Monitoring Methodology

Basin-level flow monitoring was conducted using the HOBO Motor On/Off Data Logger (Model UX90-004), which records motor on/off conditions by detecting the AC magnetic fields given off by a rotating motor and stores the dates and times of pump starts and stops. To implement this method of data collection, the following tasks were performed for the selected basins:

1. Measure cross-sectional area of wet well
2. Measure vertical distance between pump start float and pump stop float
3. Multiply cross sectional area from Task 1 by vertical distance from Task 2 to obtain wet well fill volume
4. Calculate time between pump stop and pump start using times recorded by the data logger to obtain wet well fill time
5. Divide wet well fill volume from Task 3 by wet well fill time from Task 4 to obtain flow rate

To initiate this work, Utility operations staff completed Tasks 1 and 2 for each pump station, and verified that the pump start elevation was at or below the invert of the incoming pipe to avoid any surcharging into the collection piping that would invalidate the volume calculation. H&S staff then completed the remaining steps and initiated a detailed analysis of data for each pump station.

Appendix B of TM-8 contains a summary of wet well dimensions and control elevations.

8.4.2 Gravity System Gallon per Day-Inch-Mile Calculation

The basin diameter and footage inventory in **Table 8.4** allows the development of a useful metric for assessing the relative severity of infiltration among basins of different sizes. This metric, gallons per day-inch-mile (GPDIM), is arrived at as follows:

1. Measure basin-level wastewater flow during the so-called “night flow” time period between 1:00 AM and 5:00 AM, when flow derived from potable water usage is minimal and the majority of flow is infiltration. Convert this flow into units of gallons per day.
2. For each different gravity pipe diameter, multiply the diameter in inches by the total length of pipe in miles. Add the results for each different pipe diameter to obtain an overall value for the basin in units of inch-mile.
3. Divide gallons per day from Step 1 by inch-mile from Step 2 to obtain GPDIM.

The usefulness of this metric can be illustrated with the following example:

> Basins A and B both have night flow infiltration rates of 100 gallons per minute (144,000 gallons per day), but Basin A consists of one mile of 8-inch pipe and Basin B consists of 10 miles of 8-inch pipe, resulting in GPDIM values of 18,000 and 1,800 for Basins A and B respectively. This means that while both basins contribute an identical amount of infiltration to the overall system, Basin A on a relative basis has a much more severe infiltration problem that will likely be easier to locate and repair. It is therefore more cost-effective and efficient for the system's owner to focus inspection and rehabilitation efforts on Basin A.

8.4.3 Data Analysis

Analysis of basin level data was conducted for each pump station using the following procedure:

1. Develop formulas and commands within electronic data files to calculate wet well fill times throughout the monitoring period using the data logger pump start and stop times.

2. Identify data gaps along with any apparent erroneous or unreliable data.

3. Graph monitoring period with wastewater flow and concurrent rainfall. Identify specific periods of dry and wet weather for more detailed analysis of I/I.

4. Conduct Inflow analysis using a selected wet weather event to assess the effect on wastewater flow. Ideally, a significant rain event is preceded and followed by a period of dry weather to more clearly illustrate the effects of the rainfall.

5. Conduct infiltration analysis using dry weather data under high and low groundwater conditions. Reference **Figure 8-12** for an example taken from Basin 8107 in Belle Glade during dry weather from November 1 through November 7, 2012. Note that the lowest portion of this regular, dry weather diurnal pattern corresponds to the so-called "night flow" period between 1:00 AM and 5:00 AM when water use is minimal and the majority of flow is infiltration.

6. Produce graphs illustrating daily rainfall, daily average flow, and hourly average flow throughout the monitoring period. Reference **Figure 8-13** for an example taken from Basin 8107 in Belle Glade.

Figure 8-12
Sample Dry Weather Diurnal Pattern – LS 8107 (November 1 – 7, 2012)

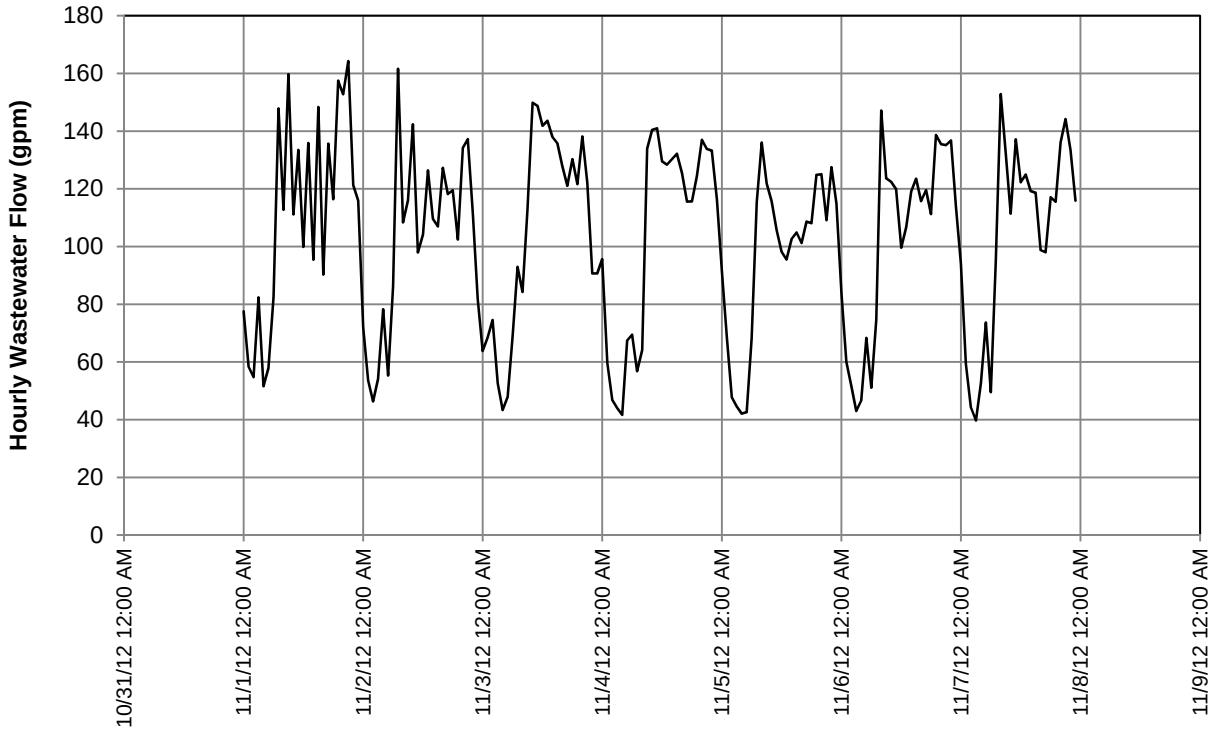
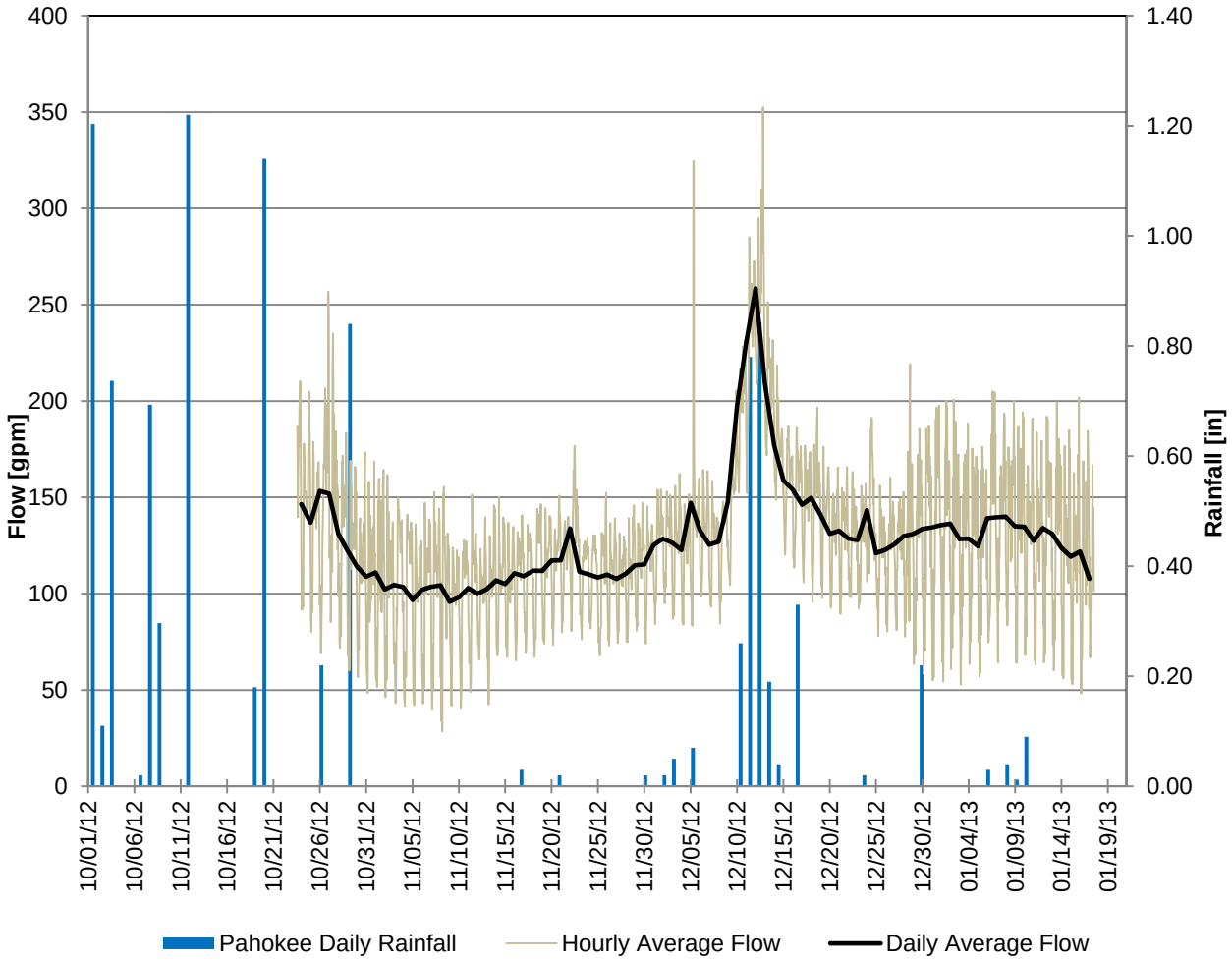


Figure 8-13
Sample Illustration of Daily Rainfall and Wastewater Flow – LS 8107
(October - December 2012)



Appendix C of TM-8 contains graphs showing daily rainfall, daily average flow, and hourly average flow for each pump station. The Appendix C graphs and associated data provide a basis for the I/I prioritization described in the following paragraphs. Appendix D of TM-8 summarizes the data monitoring period for each basin and identifies reasons for data gaps or observed discrepancies in the data.

It should be noted that many of the stations re-pump wastewater from tributary basins. Appendix A of TM-8 identifies these stations and the associated upstream basins. Since the subtraction of upstream flows would require a considerably more complex data collection and analysis process that is beyond the scope of this task, this type of measurement and adjustment was not attempted. The results, therefore, represent not only flows originating in gravity collection piping directly associated with the selected basins, but also flow originating in gravity collection piping belonging to any upstream basins. This means that the analysis for these "Basin Groups", while still useful as a screening tool to identify areas of the system where excessive I/I may exist, is less specific in that the relative I/I contributions of basins within a group cannot be observed, and more elevated I/I within one basin may be obscured by low I/I within other basins belonging to that group.

Table 8.5 summarizes the results of the flow monitoring analysis in order of basin number. **Table 8.5** is constructed based on analysis of the data presented Appendix C of TM-8, and summarizes average flows, peak hourly flows, and night flows for dry weather and wet weather periods throughout the data collection period from October of 2012 into January of 2013.

Table 8.6 shows basin priority using the **Table 8.5** data and multiple criteria as follows:

- By "**Dry Weather Period 1 Infiltration**" (GPDIM) in descending order. In this case, infiltration is measured as "night flow" – flow measured between 1:00 AM and 5:00 AM when most residents are asleep and water usage is at a minimum. As previously described, the GPDIM unit allows basins of different sizes to be compared with respect to the relative severity, not magnitude, of infiltration. This analysis focused on an extended period of dry weather (November 1 through 30, 2012) to exclude temporarily high groundwater elevations associated with specific rain events, thereby isolating baseline infiltration from rainfall-dependent infiltration. This could be considered to represent dry weather, dry season infiltration.

- By **"Dry Weather Period 2 Infiltration**" (GPDIM) in descending order. This analysis also used dry weather night flow data, but from December 15 through 21, 2012. This period followed a substantial period of wet weather ("Wet Weather Period") that occurred the previous week, when between December 8 and 14 the communities of Belle Glade, Pahokee, and South Bay received 2.44, 1.62, and 1.54 inches of rainfall, respectively. Dry Weather Period 2, therefore, provides an indication as to the baseline level of

Table 8.6 - Basin Prioritization Analyses

System	Pump Station	Linear Feet of All Gravity Mains Upstream of Pump Station	Infiltration Prioritization								Inflow Prioritization					
			Dry Weather Period 1 Infiltration			Dry Weather Period 2 Infiltration			Night Flow (DW2) ÷ Night Flow (DW1)		Average (WW) ÷ Average (DW1)			Peak Hourly (WW) ÷ Average (DW1)		
			Basin	GPM	GPDIM	Basin	GPM	GPDIM	Basin	Ratio	Basin	ADF WW1 (GPM)	Ratio	Basin	PHF (GPM)	Ratio
Belle Glade	8101	164,019	8214	131	21,370	8112	381	25,267	8112	3.93	8149	73	3.88	8132	81	8.82
Belle Glade	8102	651	8128	21	10,447	8214	130	21,116	8149	2.18	8201	707	2.35	8149	133	7.01
Belle Glade	8107	30,347	8220	24	9,633	8107	100	13,385	8110	1.90	8110	85	2.13	8201	1,361	4.53
Belle Glade	8108	7,681	8107	64	8,650	8149	26	9,947	8201	1.60	8301	89	1.99	8101	3,795	4.39
Belle Glade	8110	10,419	8112	97	6,437	8220	23	9,443	8107	1.55	8128	66	1.80	8128	161	4.39
Belle Glade	8112	18,828	8202	131	5,811	8128	18	9,336	8108	1.51	8210	27	1.79	8307	26	4.12
Belle Glade	8126	9,484	8201	251	4,602	8201	402	7,383	8101	1.32	8107	167	1.78	8218	78	3.99
Belle Glade	8128	1,866	8149	12	4,565	8202	130	5,742	8216	1.27	8218	34	1.76	8301	177	3.97
Belle Glade	8132	3,192	8102	3	4,425	8110	61	5,169	8148	1.22	8108	49	1.57	8308	20	3.65
Belle Glade	8148	3,640	8210	13	3,817	8102	3	5,077	8305	1.17	8304	10	1.42	8110	140	3.51
Belle Glade	8149	2,451	8101	678	3,628	8101	898	4,803	8102	1.15	8101	1225	1.42	8107	307	3.27
Pahokee	8201	51,735	8108	23	2,894	8108	35	4,361	8210	1.09	8214	232	1.40	8216	16	3.06
Pahokee	8202	21,479	8110	32	2,716	8210	14	4,143	8304	1.05	8202	232	1.40	8204	21	2.85
Pahokee	8203	5,126	8302	55	2,607	8302	53	2,482	8205	1.03	8307	8	1.31	8302	195	2.81
Pahokee	8204	6,237	8203	14	2,556	8203	13	2,403	8307	1.02	8302	88	1.27	8210	41	2.75
Pahokee	8205	18,557	8218	11	2,040	8148	9	2,275	8214	0.99	8148	13	1.21	8304	19	2.62
Pahokee	8210	3,216	8148	7	1,869	8218	11	1,933	8202	0.99	8216	6	1.21	8220	80	2.22
Pahokee	8214	5,841	8132	6	1,845	8216	4	1,708	8220	0.98	8308	6	1.19	8108	70	2.21
Pahokee	8216	2,130	8301	29	1,361	8132	6	1,687	8302	0.95	8112	129	1.12	8148	23	2.10
Pahokee	8218	5,348	8216	3	1,345	8205	25	1,274	8218	0.95	8204	8	1.11	8214	332	2.00
Pahokee	8220	2,343	8205	24	1,239	8304	4	1,086	8203	0.94	8205	32	1.07	8202	332	2.00
South Bay	8301	19,853	8304	3	1,031	8307	3	650	8132	0.91	8220	37	1.04	8102	7	1.97
South Bay	8302	19,484	8308	4	814	8308	3	613	8128	0.89	8102	4	1.03	8205	58	1.96
South Bay	8304	3,200	8204	5	691	8204	3	486	8308	0.75	8305	5	0.99	8305	9	1.90
South Bay	8305	0	8307	3	638	8301	---	0	8204	0.70	8132	9	0.94	8112	202	1.75
South Bay	8307	4,216	8126	6	593	8126	---	0	8301	0.00	8203	17	0.79	8203	31	1.45
South Bay	8308	4,821	8305	2		8305	2		8126	0.00	8126	---	0.00	8126	---	0.00

Notes:

1 DW1 = Dry Weather Period 1; WW = Wet Weather Period; DW2 = Dry Weather Period 2

2 Colors designate how top basins from the first infiltration prioritization rank in the 2 subsequent infiltration prioritizatons, then separately how top basins from the first inflow prioritzation rank in the second inflow prioritization.

infiltration that occurs when the groundwater table approaches higher levels due to seasonal rainfall. This could be considered to approximate dry weather, wet season infiltration. For most of the basins, this "wet season" infiltration is higher than dry season infiltration, suggesting that with higher groundwater elevations more pipeline defects become submerged in groundwater and/or a higher hydraulic gradient acts on submerged defects to drive a higher rate of infiltration. It is interesting to observe that both the infiltration prioritizations – Dry Weather Period 1 and Dry Weather Period 2 – result in a very similar prioritization, with the top 8 basins being the same in both cases. It should be noted that in addition to the relative severity of infiltration (GPDIM), the absolute level of infiltration is shown in units of gallons per minute (GPM). This provides indication as to the approximate volume of flow that could be removed from the system through rehabilitation of the associated basins. As an example, Basin 8112 appears to exhibit the most severe infiltration problem on a relative basis with a "wet season" rate of 25,267 GPDIM. On an absolute basis Basin 8112 also appears to be a high contributor of infiltration to the system, having an absolute rate of approximately 381 GPM under higher groundwater table conditions. Basin 8149, in contrast, ranks as No. 4 on the "wet season" GPDIM list but only by virtue of its small size (2,451 LF), since the absolute contribution is only approximately 26 GPM.

- By **Wet Weather Period Average Flow versus Dry Weather Period 1 Average Flow** (ratio) in descending order. This comparison provides an indication as to the sensitivity of each basin to direct Inflow, but would also include RDI. In the top basin, 8149, average wet weather flows were nearly four times greater than average dry weather flows.

- By **Wet Weather Period Peak Hourly Flow versus Dry Weather Period 1 Average Flow** (ratio) in descending order. This quantity may be useful for consideration of pump station transmission capacity and the likelihood of having overflows in severe wet weather events. For this quantity, Basin 8101 exhibited the largest peak hourly flow at 3,795 GPM, whereas Basin 8132 showed the largest peak to average flow ratio at 8.82. It should be noted that Basin 8101 (including upstream basins) is much larger than Basin 8132 in terms of the gravity collection mains the measured flows represent, with 164,019 linear feet versus 3,192 linear feet respectively, and it is not unusual to see higher peak to average ratios in smaller basins. Elevated wet weather flows are an indication of direct surface runoff entering the sewer through defects in laterals, mains, and manholes as well as possibly storm sewer cross connections, and basins of this type would be good candidates for a smoke testing program.

8.4.4 Infiltration Prioritization

A number of the basins studied exhibit elevated infiltration levels, as illustrated by the summary of the ten highest GPDIM values measured (shown in **Table 8.7**). Some south Florida utilities use a standard of 5,000 GPDIM as previously noted. This value is provided as an example and is not necessarily applicable to the Glades Region Urban Service Area. The United States

Environmental Protection Agency (USEPA) has used other metrics for infiltration. For example, infiltration was previously characterized as non-excessive provided that per capita dry weather values for wastewater did not exceed the national average, although the USEPA accepted higher values where removal could be shown not be cost effective. At this time, it seems most appropriate for PBCWUD to focus investigation and rehabilitation activities on basins having the highest GPDIM values, where such work is likely to provide the greatest benefit at the lowest cost.

Table 8.7
Infiltration Prioritization

Priority	Basin	Night Flow (GPDIM)
1	8112	25,267
2	8214	21,116
3	8107	13,385
4	8149	9,947
5	8220	9,443
6	8128	9,336
7	8201	7,383
8	8202	5,742
9	8110	5,169
10	8102	5,077

Data from December 15-21, 2012

8.4.5 Inflow Prioritization

In addition to infiltration under dry weather conditions, a number of the basins studied exhibit elevated wet weather flows. This is illustrated by **Table 8.8**, which prioritizes the study basins using the ratio of *Wet* Weather *Period Average Flow to Dry Weather Period 1 Average Flow*. It is interesting to note that six of these ten basins are also on the list of the ten highest *Wet Weather Period Peak Hourly Flow to Dry Weather Period 1 Average Flow* ratios (reference Table 8.6), which provides a somewhat closer indication of direct Inflow as opposed to direct Inflow combined with rainfall dependent infiltration. Whereas smoke testing may be effective for detecting some sources of rainfall-dependent infiltration, it is more likely to be effective as a tool for detecting direct Inflow, and therefore these basins would appear to be among the best candidates for a smoke testing program.

Table 8.8
Wet Weather Prioritization

Priority	Basin	Average (Wet Weather Period) ÷ Average (Dry Weather Period 1)
1	8149*	3.88
2	8201*	2.35
3	8110*	2.13
4	8301*	1.99
5	8128*	1.80
6	8210	1.79
7	8107	1.78
8	8218*	1.76
9	8108	1.57
10	8304	1.42

Wet Weather Period data from December 8-14, 2012

Dry Weather Period 1 data from November 1-30, 2012

* *Designates basin also on list of ten highest* Wet Weather Period Peak Hourly Flow to Dry Weather Period 1 Average Flow *ratios*

8.4.6 Cost Effectiveness

Rehabilitation of a collection system main line, manhole or service line is typically termed "cost-effective" when the cost of rehabilitation to remove a given amount of extraneous flow is less than the cost of continuing to transport, treat, and dispose of that same amount of extraneous flow over some specified number of years. To assist in the evaluation of this metric, the PBCWUD provided guidance (see **Table 8.9**) concerning the costs of collection, transmission, treatment, and disposal in 2012.

Table 8.9 – Estimated Costs of Collection, Transmission, Treatment, and Disposal (2012)

Item	Unit	Quantity
WWTF Cost		
Belle Glade	$	1,738,342
Pahokee	$	539,316
Total	$	**2,277,658**
WWTF Total Flow		
Belle Glade	MG	961.04
Pahokee	MG	332.20
Total	MG	**1,293.24**
Lines and Lift Stations Cost		
Belle Glade and South Bay	$	1,417,549
Pahokee	$	489,996
Total	$	**1,907,545**
WWTF plus Lines and Lift Stations		
Belle Glade and South Bay	$ / 1,000 gallons	$3.28
Pahokee	$ / 1,000 gallons	$3.10
Total	$ / 1,000 gallons	**$3.24**

To provide a simple theoretical example of how this might be used, a 1 GPM leak coming from a broken pipe in Belle Glade would amount to 525,600 gallons per year, and at a rate of $3.28 per 1,000 gallons would result in an annual collection, pumping, treatment, and disposal cost of $1,724. Assuming this defect could be repaired via an excavated point repair costing approximately $7,000, the "payback period" would be about 4 years; that is, the cost of the repair would be recouped over a four-year period through reduced costs in collection, pumping, treatment, and disposal, after which a net cost savings would begin to accrue. Under such an analysis, those repairs having the shortest payback periods (quickest return on investment) would be considered most cost effective and would be given the highest priority in the expenditure of limited repair budgets.

It should be noted that in addition to cost-effectiveness, factors such as structural condition, public nuisance, health hazards, system hydraulics, and operation and maintenance demand may become the determining factor as to whether a given repair is assigned a higher priority for rehabilitation, should one or more such considerations constitute a sufficient basis for action.

8.5 Conclusions and Recommendations

The following conclusions are made based on the system-level and basin-level evaluations presented herein:

- For the period studied, January of 2012 through February of 2013, the data indicate that I/I for the Belle Glade, Pahokee, and South Bay systems combined ranges from approximately 20 percent of total flows in the dry season (November through April) to approximately 49 percent of total flows in the wet season (May through October), with an annual average of approximately 37 percent.

- Baseline, dry weather infiltration on an average daily basis is estimated to be approximately 0.56 MGD for the period studied. The remaining fraction of extraneous flow is comprised of direct Inflow and rainfall-dependent infiltration that results from a temporarily higher groundwater table caused by rainfall percolating through pervious surfaces. Peak monthly Inflow (and rainfall-dependent infiltration) during the period studied was approximately 100 MG.

- I/I are a significant issue in the subject collection systems. Conditions are particularly acute during the wet season when direct Inflow and rainfall-dependent infiltration result in peak flows to the WWTFs that can be multiples of average dry weather flows.

- The basin-level flow data permit the individual basins to be characterized and prioritized with respect to infiltration and Inflow. When SCADA data are unavailable, data loggers can provide a reliable, low-cost method of measuring flow to prioritize I/I reduction as well as to document flow reductions following rehabilitation.

- While direct Inflow is observable in multiple basins following rain events, a significant percentage of rain-related flow increases appears to be rainfall-dependent infiltration resulting from a temporarily higher groundwater table. For many basins this effect continues for multiple days following rainfall events. This suggests that laterals may be a significant source of infiltration.

A comprehensive program of assessment and repair is recommended for the Belle Glade, South Bay, and Pahokee wastewater collection systems to limit I/I and help maintain a reliable and structurally sound system. The following actions are recommended in support of those goals:

- Conduct detailed field investigations in the identified priority basins (reference Tables 8.7 and 8.8) to identify the specific defects in mains, manholes, and laterals that contribute to the elevated rates of I/I observed. Investigations should include manhole inspection, smoke testing, and video inspection of sewer mains. Television inspection of suspect laterals should be performed as warranted following inspection of mains. Flow data analysis and night flow isolation can be used to focus and limit the scope of such investigations. Infiltration investigation activities should ideally coincide with periods of high groundwater

to approximate worst-case conditions. Inflow investigation activities should ideally coincide with periods of dry weather and low groundwater, and should include manhole inspection and smoke testing. During the investigation activities, Inflow dishes should be installed in manholes and missing or damaged cleanout caps should be replaced.

- Process, evaluate, and electronically store the results of inspection activities. Estimate flow rates associated with I/I sources and develop repair recommendations with cost estimates and payback period analysis. Prioritize the recommended rehabilitation work based on cost-effectiveness as well as other factors such as structural condition and maintenance demand.

- Policies may need to be developed concerning appropriate methods for addressing defects on the privately owned portion of the lateral. Based on the age and general condition of the collection systems studied herein, it is likely that laterals are a significant source of I/I to the system.

- The 2009 study in Pahokee by AECOM concluded that high levels of infiltration appeared to originate in privately owned gravity systems that rely on the Utility for subsequent conveyance, treatment, and disposal of flows. Unfortunately, it is not uncommon for maintenance budgets and practices in such systems to be severely deficient. The County should consider contacting the owners of these private systems and initiating a program to assure that reasonable standards of maintenance and repair are upheld.

- As a general practice, the County should continue to monitor pump run times throughout the system to detect changes over time, and where Inflow or infiltration is suspected the actual measurement of flows can be conducted using the data logger method implemented for this study. Since aging and deterioration of gravity collection systems is an ongoing process, the overall system should be evaluated periodically and priority basins should be identified for detailed investigation and rehabilitation as warranted.

Table 8.10 provides a summary of inspection and rehabilitation requirements along with estimated costs for Belle Glade, Pahokee, and South Bay. A three- to five-year program duration is recommended so that the financial costs, as well as the demands on Utility personnel, can be held to a manageable level.

Table 8.10
Anticipated Tasks and Costs

Task	Estimated Cost		
	Belle Glade	Pahokee	South Bay
Inspection			
Preliminary evaluation and prioritization	$30,000	$14,000	$8,000
Smoke testing	$49,000	$26,000	$14,000
Manhole inspection	$50,000	$27,000	$13,000
Cleaning and video inspection of mains	$84,000	$22,000	$12,000
Cleaning and video inspection of laterals	$140,000	$37,000	$19,000
Program management and reporting	$71,000	$25,000	$13,000
Subtotal	**$424,000**	**$151,000**	**$79,000**
Rehabilitation			
Lining - manhole to manhole	$1,996,000	$261,000	$136,000
Lining - sectional	$84,000	$11,000	$6,000
Lining - lateral	$1,678,000	$438,000	$228,000
Excavated point repairs	$806,000	$105,000	$55,000
Excavated line replacement	$42,000	$6,000	$3,000
Manhole liners - cementitious	$570,000	$152,000	$69,000
Manhole liners - cementitious/epoxy or polyethylene	$113,000	$30,000	$14,000
Manhole repairs - miscellaneous	$282,000	$75,000	$34,000
Engineering and construction management	$1,114,000	$216,000	$109,000
Subtotal	**$6,685,000**	**$1,294,000**	**$654,000**
ESTIMATED PROGRAM TOTAL	**$7,109,000**	**$1,445,000**	**$733,000**

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Chapter 9.0
Regulatory Overview

This chapter provides a regulatory overview of existing and new wastewater treatment and disposal requirements. This chapter also describes regulatory and permit issues affecting the two wastewater treatment facilities serving the Glades Region Urban Service Area as well as emerging trends in local, state and federal wastewater regulations. This Master Plan Report is largely comprised of the contents of various technical memoranda written to address specific tasks. These tasks and the technical memoranda addressing the data, methodologies, findings and recommendations of each were completed at various times. As such, some information may have changed as of the present. For example, regarding regulatory updates, certain issues have progressed, such as positions by the FDEP and the EPA. Please note that the information contained in this report is based on the data/conditions current as of September 2013, the writing of the Technical Memorandum No. 9 (TM-9 – Regulatory Overview).

9.1 Background

This regulatory overview of existing and new wastewater treatment and disposal requirements was developed as part of the Glades Region Urban Service Area Wastewater Master Plan.

9.1.1 Scope of Work

This task consists of a regulatory overview of the current and emerging wastewater treatment and disposal requirements that may affect the Belle Glade and Pahokee WWTFs. Emerging trends in local, state and federal wastewater regulations as well as potential future compliance issues are discussed with respect to the following areas:

- Wastewater effluent
- Injection wells
- Reclaimed water (including numeric nutrient criteria)
- Biosolids
- Recent state legislation and rulemaking
- Other regulations

9.2 Wastewater Effluent Regulations

9.2.1 Current Effluent Disposal Practices

The Belle Glade WWTF uses both deep well injection and percolation ponds for effluent disposal. The Belle Glade WWTF is currently permitted to dispose of 10.2 mgd maximum daily flow (MDF) of secondary effluent via a Class I underground injection well. The Belle Glade WWTF is also permitted to dispose of an additional 0.069 mgd maximum monthly average daily flow (MMADF) of disinfected secondary effluent via a one million gallon percolation pond.

The Pahokee WWTF also uses deep well injection and percolation ponds for effluent disposal. The Pahokee WWTF is currently permitted to dispose of 4.0 mgd monthly average daily flow (MADF) of secondary effluent via a Class I underground injection well, and an additional 0.08 mgd annual average daily flow (AADF) of disinfected effluent via a rapid infiltration basin.

9.2.2 Wastewater Effluent – Current Regulations

State regulations governing the design and operation of the Belle Glade and Pahokee WWTFs include the following:

- Florida Administrative Code (FAC) 62-600 – Domestic Wastewater Facilities
- FAC 62-601 – Domestic Wastewater Treatment Plant Monitoring

9.2.3 Wastewater Effluent – Emerging or New Regulations

There are no emerging or new regulations for wastewater effluent that will apparently affect the Belle Glade and / or Pahokee WWTF from a wastewater effluent perspective. However, various emerging or new regulations could affect the application of reclaimed water produced are discussed in later sections.

9.3 Injection Well Regulations

There are no emerging or new regulations for injection wells that will affect the Belle Glade and Pahokee WWTFs from a wastewater effluent disposal perspective. The Numeric Nutrient Criteria has been a high profile issue that will place more stringent standards on entities affecting or discharging to classified surface water bodies. Since the Belle Glade and Pahokee WWTFs do not currently discharge to classified surface water-bodies, nor are there plans for them to discharge to classified surface water-bodies, it is not anticipated that Numeric Nutrient Criteria will affect the current or future operation of the facilities.

9.3.1 Injection Well – Current Regulations

As previously stated, the primary means of disposal of secondary effluent at the Belle Glade and Pahokee WWTFs are via on-site Class I underground injection wells. Injection wells were originally designed and permitted based on State regulations, including the following:

- FAC 62-520 – Ground Water Classes, Standards and Exemptions
- FAC 62-528 – Underground Injection Control

For Class I injection wells to operate in compliance with the Federal and State standards established in the mid-1980's there must be the presence of suitable confinement layers. These confinement layers were questioned when several injection well sites in Florida experienced changes in water quality within their respective monitoring wells. The issue was the subject of a lengthy legal debate which culminated with the promulgation of revisions to the Federal and State regulations in December 2005.

The December 2005 rule revisions allow continued discharge of secondary effluent to Class I injection wells, permitted or in the permitting process prior to the December 2005, as long as operational data indicate that the injectate remains within the injection zone. If monitoring indicates that there is upward movement of the effluent, indicating there may not suitable confinement at an existing site, then FDEP may require further investigation. If FDEP determines that the treatment facilities effluent must be filtered and disinfected to meet high level disinfection (HLD) standards prior to discharge to the well there would be a five year compliance period established to meet the requirements.

Discharges to Class I wells permitted for construction after December 2005 must comply with HLD standards prior to injection. As a minimum, new injection wells will be required to comply with the HLD standards codified in FAC 62-600.440(5). HLD regulations require additional total suspended solids (TSS) control beyond secondary treatment to maximize disinfection effectiveness, and the rule also requires that HLD facilities be designed to result in an effluent in which fecal coliform values are below detectable limits.

9.3.2 Injection Well – Emerging or New Regulations

There are no apparent emerging or new regulations related to underground injection. However, permitting activities for underground injection control have recently been shifted from the FDEP southeast district office to the main office in Tallahassee.

9.4 Reclaimed Water Regulations (Including Numeric Nutrient Criteria)

This section discusses regulations pertaining to reclaimed water. Current regulations and emerging or new regulations are discussed.

9.4.1 Reclaimed Water – Current Regulations

State regulations governing the reclaimed water distribution and application at the Belle Glade and Pahokee WWTFs include the following:

- FAC 62-610 – Reuse of Reclaimed Water and Land Application

If the Pahokee WWTF is taken out of service and flow is redirected to the Belle Glade WWTF, the effluent disposal capacity of the injection well must be considered. The Belle Glade and Pahokee WWTFs are not currently planning to install a reuse system or expand their percolation ponds. However, per FAC 62-610.525 installation of new percolation ponds may require additional treatment of secondary effluent to HLD standards and additional removal of TN. The requirement for this additional treatment may depend upon the FDEPs interpretation of the criteria in FAC 62-610.525.

9.4.2 Reclaimed Water – Emerging or New Regulations

There are no emerging or new regulations for wastewater effluent that will affect the Belle Glade and Pahokee WWTFs from a reclaimed water perspective

9.5 Biosolids Regulations

The Belle Glade WWTF currently stabilizes waste activated sludge with one 465,000 gallon aerobic digester. The facility reportedly currently produces biosolids that are disposed of at the Okeechobee Landfill. The facility is also permitted to dispose of Class B biosolids through land application at the Corkscrew Ranch in Lee County, and has previously disposed of biosolids at other agricultural use sites. The facility is permitted to meet Class B pathogen reduction per the requirements of 40 CFR 503.32(b)(2) (Monitoring of Indicator Organisms), and to meet vector attraction reduction per the requirements of 40 CFR 503.33(b)(4) (Meet a specific oxygen uptake rate for aerobically treated biosolids).

The Pahokee WWTF currently stabilizes waste activated sludge with two 75,000 gallon aerobic digesters. The facility is permitted to produce Class A biosolids that are currently disposed of at the Okeechobee Landfill, and additionally has a Bioset lime treatment process which produces Class AA biosolids which are hauled to various locations in South Florida for agricultural use. The facility is permitted to dispose of biosolids by marketing and distribution, use as a biofuel or for bioenergy and/or disposal in a Class I solid waste landfill. The facility is permitted to meet Class A pathogen reduction by meeting the pathogen reduction per the requirements of 40 CFR 503.32(a)(3) (Thermally Treated Biosolids)" (for Alternative 1), or by meeting the pathogen reduction requirements in 40 CFR 503.32(a)(8) (Use of equivalent Processes to Further Reduce Pathogens for Alternative 6). The facility is permitted to meet Class A vector attraction reduction per 40 CFR 503.33(b)(6) (Add alkaline materials to raise the pH under specified conditions).

9.5.1 Biosolids – Current Regulations

State regulations governing biosolids processing and disposal at the Belle Glade and Pahokee WWTFs include the following;

- FAC 62-640 – Domestic Wastewater Residuals

9.5.2 Biosolids – Emerging or New Regulations

The latest rulemaking on revisions to Chapter 62-640, F.A.C became effective on August 29, 2010. The new rule includes the following general changes for wastewater treatment facilities producing biosolids:

- New permit application requirements
- New record keeping and reporting requirements
- New monitoring and notification requirements
- Other licensing, labeling, and notification requirements specific to facilities that are distributing and marketing Class AA biosolids as fertilizer

The new rule also requires all sites receiving biosolids to be permitted. The following general requirements for sites applying biosolids were enacted:

- Site permit application and nutrient management plan requirements
- Background metals sampling
- Phosphorus assessment
- Crop yield assessment
- Restrictions on storage time and areas
- Prohibitions for applying biosolids in the Wekiva Study area, and the Northern Everglades and Estuary Protection Program areas

Both the Belle Glade and Pahokee WWTFs have been re-permitted to the most recent regulations following the Chapter 62-640, F.A.C revisions that became effective in August 2010. Recent records show that the Corskscrew Ranch biosolids application site was in the process of applying for a permit in March 2013.

9.6 Summary of Recent State Legislation and Rulemaking

Recent state legislation and rulemaking was surveyed, and recent developments potentially affecting the Belle Glade or Pahokee WWTFs wastewater effluent, injection wells, reclaimed water, and biosolids were investigated. No recent rules have been enacted or are under discussion that would directly affect the operation of the facilities, from the following entities:

- State of Florida
- South Florida Water Management District (SFWMD)
- Environmental Protection Agency (EPA)
- FDEP

9.6.1 Greenhouse Gas Legislation

In May 2010, the EPA issued its final "tailoring" rule for greenhouse gas (GHG) emissions, which exempted small “polluters” from its Clean Air Act permitting requirement. Facilities applying for New Source Review permits for other pollutants will be required to include greenhouse gases in their permits if they increase their emissions of GHG by at least 50,000 tons of carbon dioxide equivalent per year. This rulemaking would not require permitting for sources that emit less than 50,000 tons of carbon dioxide equivalent per year.

On July 1, 2011, the EPA finalized a three-year deferral of GHG permitting for “biogenic carbon dioxide emissions from bioenergy and other biogenic stationary sources” (including wastewater treatment plants). At this time, the EPA determined it is not appropriate to apply New Source Review Prevention of Significant Deterioration and Title V permitting requirements to additional, smaller sources of GHG emissions. On June 29, 2012 the EPA issued a final rule that does not revise the GHG permitting thresholds that were established in the previous GHG Tailoring Rule that went into effect July 1, 2011.

Although a detailed analysis would need to be performed to more accurately estimate the GHG emissions for the Belle Glade and Pahokee WWTFs, a rough approximation can be made using values reported in literature. Currently there is a mandatory reporting rule for GHG emission sources which emit more than 25,000 tons of carbon dioxide equivalent per year. It is not anticipated the Belle Glade or Pahokee WWTFs will be required to report for flows up to their rated capacity, and it is estimated that the GHG production of each plant is well below the current emissions permit limits and the proposed 50,000 tons of carbon dioxide equivalent per year permitting limit.

9.6.2 The Southeast Florida Regional Climate Action Plan

The Southeast Florida Regional Climate Action Plan issued in October 2012 was developed by the Southeast Florida Regional Climate Change Compact; a collaborative effort among Palm Beach, Broward, Miami-Dade, and Monroe Counties, as well as municipalities and other partners within the four counties. The group has worked to develop regionally-consistent methodologies for mapping sea-level rise impacts, assessing vulnerability, and understanding the sources of regional greenhouse gas emissions. The Regional Climate Action Plan calls for action and provides recommendations for reducing greenhouse gas emissions and adapting to regional and local impacts of climate change. While the report appears to be non-binding, it will purportedly be used to guide legislative activity and expenditures for the planning and management of the effects of climate change. Multiple recommendations are made relevant to water and wastewater utilities related to water supply, saltwater intrusion, reclaimed water, and energy efficiency that may guide future local and state legislation.

9.6.3 Micro-constituents

Micro-constituents include organic chemicals, such as pharmaceutically active substances,

personal care products, endocrine disrupting compounds, and previously unregulated inorganic elements whose toxicity may be reassessed or newly evaluated. The impacts of the extremely low concentrations of these compounds found in wastewater effluent or reclaimed water are unknown. To date, there is no evidence that micro-constituents cause human health effects at environmentally relevant concentrations. Monitoring for specific micro-constituents may become a part of the standard testing protocol as the use of reclaimed water for indirect potable reclaimed water applications increases. Additionally, it is possible future regulations may require reduction of micro-constituents from wastewater.

9.7 Conclusions and Recommendations

As part of the planning effort, a regulatory overview of existing and new wastewater treatment and disposal requirements was presented. Although a detailed analysis of records and operations was not completed, it was found that the Belle Glade and Pahokee WWTFs generally comply with current regulatory standards for wastewater effluent, injection wells, reclaimed water, and biosolids.

The regulatory overview also includes information about emerging local, state, and federal regulations. The following categorizes the existing and/or future regulations as either short-term (within the next five years) or long-term (beyond the next five years) and summarizes the effects of the emerging rule on the Belle Glade or Pahokee WWTFs with respect to potential future compliance issues.

9.7.1 Short Term

An emerging rule was considered short term if it had the potential to affect the plant within five years. The following emerging regulations fall into this category:

Climate Change Legislation

It is advisable for the PBCWUD to monitor issues related to climate change, such as the recommendations by the Southeast Florida Regional Climate Action Plan issued in October 2012, to keep abreast of potential areas of concern regarding future developing climate change legislation. The PBCWUD should focus on the recommendations related to water supply, saltwater intrusion, reclaimed water, and energy efficiency.

9.7.2 Long Term

Emerging regulations were considered long term if more than five years were assumed to pass before the PBCWUD would need to take action or if there is uncertainty regarding the sustainability of a proposed rule. Only one emerging rule met this criterion.

Micro-constituents

Although currently no legislation exists or is forthcoming regarding micro-constituents in

reclaimed water, future regulations may require monitoring or removal of micro-constituents. PBCWUD should remain apprised of local, state, and federal legislation and participate in any workshops, conferences, or other efforts related to micro-constituents.

9.7.3 Other Actions

Other actions for consideration by the PBCWUD related to reclaimed water and injection wells are presented below:

Reclaimed Water

If the PBCWUD considers expanding the percolation ponds, effluent being discharged to the basin may require additional treatment to HLD standards and additional removal of TN per FAC 62-610.525. The requirement for this additional treatment may depend upon the FDEPs interpretation of the criteria in FAC 62-610.525.

Injection Wells

The current permitted deep injection well disposal capacity at each plant is based on a velocity of 8 feet per second (fps), whereas the current regulations allow 10 fps. This could potentially increase the capacity per well from 10.18 mgd to 12.72 mgd at the Belle Glade WWTF, and from 4.00 to 4.87 mgd at the Pahokee WWTF. Existing injection well pumping stations may require upgrades to increase the pumping capacity to meet the rerated disposal capacities.

If the PBCWUD considers installing new injection wells, each new injection well will be required to comply with the HLD standards codified in FAC 62-600.440(5).

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Chapter 10.0
Operation and Maintenance Performance

This chapter summarizes the findings of the Operation and Maintenance (O&M) Performance reports prepared for the Belle Glade and Pahokee WWTFs. O&M Performance Reports are intended to meet the requirements of Florida Administrative Code (FAC) Chapter 17-600.735, by providing reasonable assurance that the facility will meet or exceed the effluent limit requirements during the period for which the facility is permitted. Such reports evaluate the capability of treatment facilities to function as intended including a detailed assessment of the physical condition of treatment process equipment, overall treatment efficiency of the plant, performance trends and the Operations and Maintenance program. O&M Performance Reports also identify deficiencies, if any, with the physical capacity and performance conditions of the plant including problems with the present Operations and Maintenance program. Finally, the report provides recommendations and schedules, if needed, for corrective actions leading to improved operations.

A separate O&M Performance Report was prepared for each WWTF. As noted above, the reports are specifically tailored to address regulatory requirements set forth in FAC Chapter 17-600.735. Hence, the reports follow the outline shown below:

- Chapter 1: Introduction – Provides general background information and describes the treatment process
- Chapter 2: Physical Condition – Summarizes the conditions of process equipment and components
- Chapter 3: Treatment Efficiency – Discusses general treatment efficiency
- Chapter 4: Performance Trends – Reviews historical performance trends
- Chapter 5: Operation and Maintenance Program – Reviews the operation and maintenance history
- Chapter 6: Collection System Evaluation – Provides an oversight of the collection system

- Chapter 7: Problems, Deficiencies, and Corrective Actions – Describes areas of concern along with recommendations
- Field Evaluation Form: Standard form that provides an overview of the facility

Technical Memorandum 10 (TM-10) – Operation and Maintenance Performance Reports, which is included in the attached CD, contains a copy of the O&M Performance Report for both the Belle Glade WWTF and the Pahokee WWTF.

10.1 Belle Glade WWTF O&M Performance Report Overview

This section presents a summary of the O&M Performance Report for the Belle Glade WWTF.

10.1.1 Background

The Belle Glade WWTF is located on West Canal Street South in Belle Glade, Florida, just east of US-27 and south of State Road 80. The service area for this treatment plant facility is approximately 27 square miles (17,313 acres) and extends from slightly north of Paul Rardin Park south to the G2 Canal. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Belle Glade WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Belle Glade). The treatment plant is permitted to operate with a capacity of 6.5 MGD Maximum Monthly Average Daily Flow (MMADF), 9.8 MGD Peak Hour Flow (PHF) under FDEP Permit No. FLA027740-008-DW1P that was issued on May 23, 2011 and expires May 22, 2016. The facility is also permitted to discharge up to 0.069 MGD MMADF capacity via on-site land application in a 7.4 acre percolation pond. The facility has an existing Underground Injection permit (0048217-008-UO) with a MDF permitted capacity of 10.2 MGD. Primary effluent disposal is deep well injection.

10.1.2 Belle Glade WWTF Treatment Efficiency

Treatment efficiency of the major wastewater treatment units and overall treatment efficiency at the Belle Glade WWTF are presented in this section. The design and operating parameters used for the evaluation of treatment efficiency are those established in the treatment facility's Capacity Analysis Report.

Factors which affect plant performance and treatment efficiency include:

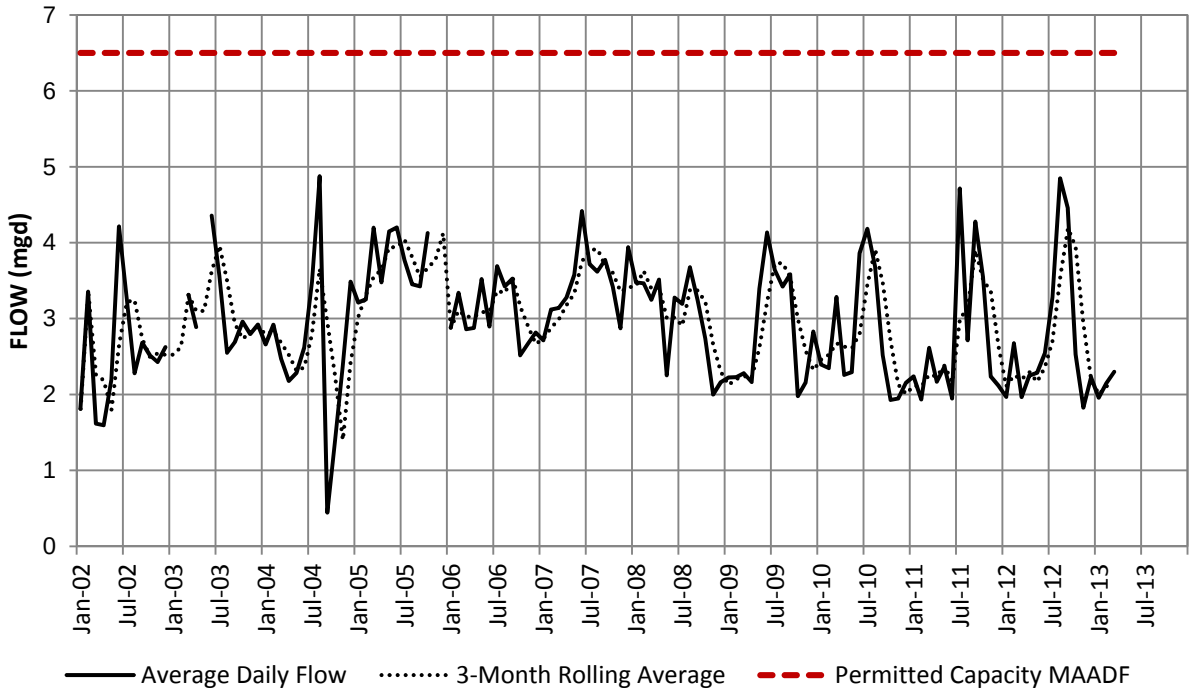
- Hydraulic and organic loadings
- Seasonal variation in flow
- Infiltration and inflow
- Contribution from industrial wastewater and septage

- Operations flexibility
- Accumulations of sand and grit
- Rag build-up
- Deterioration of baffles

The complete mix activated sludge treatment process at the Belle Glade WWTF is designed to operate in the range of MLSS concentration from 2,000 to 3,200 mg/L and an SRT of 15 to 25 days. RAS flow range is from 67 to 128 percent of the plant influent and typically operated at 70 percent return.

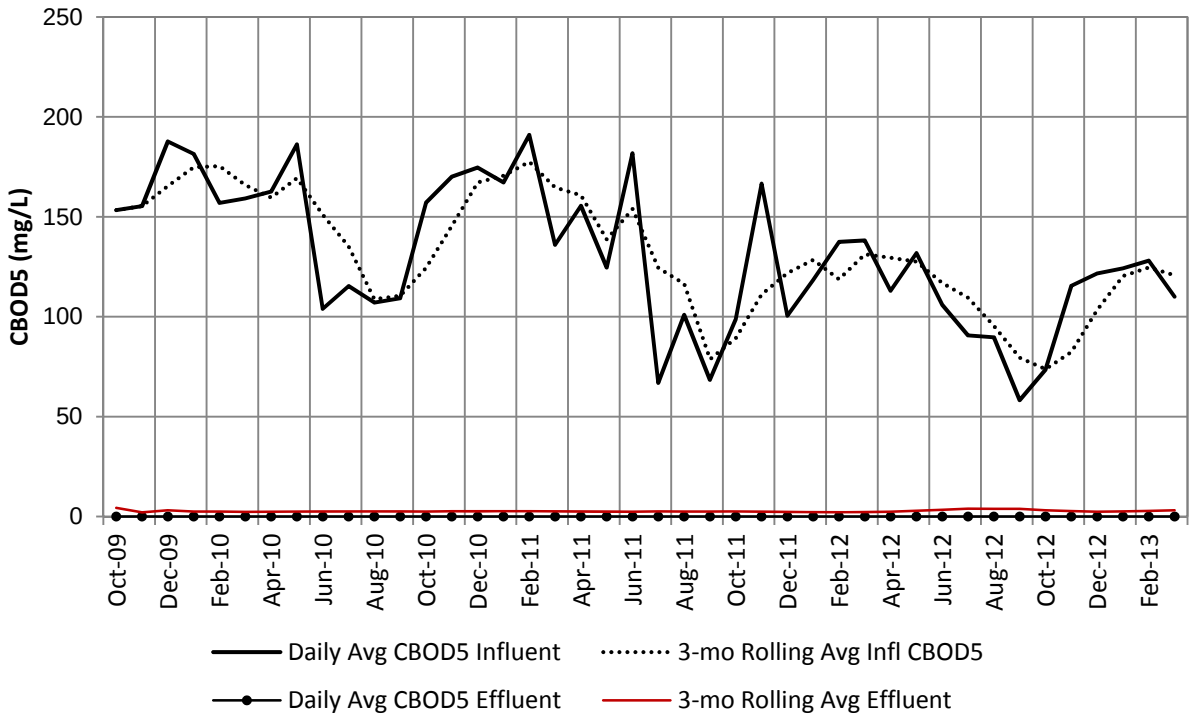
The average monthly operating conditions for the period extending from January 2002 through March 2013 are presented in O&M Performance Report found in TM-10. It should be noted that data for carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) is only included from October 2009 through March 2013 and evaluated in this report due to inconsistencies in the data prior to October 2009. **Figure 10-1** contains plots of average daily flows and a 3-month rolling average from January 2002 through March 2013. Flows during this 10 year period have averaged 2.79 MGD, which is well below the permitted MMADF of 6.5 MGD.

Figure 10-1 – Historical Flow Data (January 2002 through March 2013)



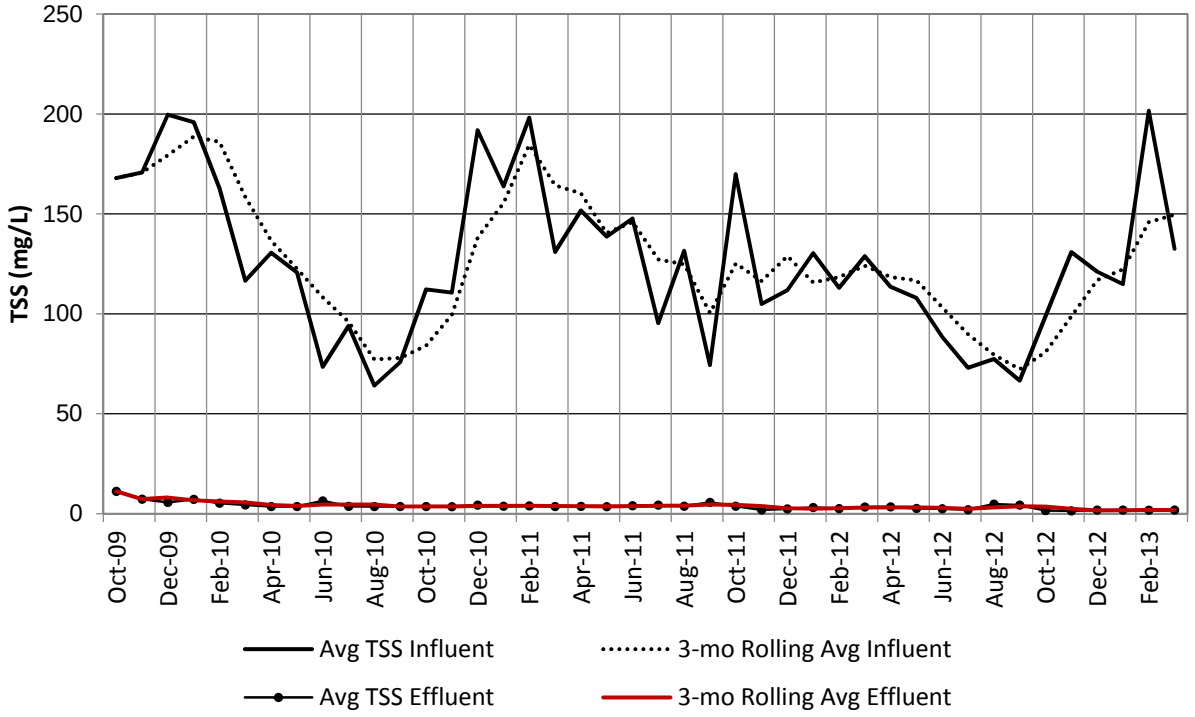
Historical treatment performance at the Belle Glade WWTF has been excellent with $CBOD_5$ and TSS removal efficiencies of 98% and 97%, respectively. **Figure 10-2** is a plot of monthly average values for $CBOD_5$ loadings from October 2009 through March 2013. This figure (i.e., Figure 10-2) illustrates the historical performance for the period of record shown. The treatment process consistently produces an effluent with average $CBOD_5$ concentrations of approximately 2.70 mg/L.

Figure 10-2 – Historical $CBOD_5$ Influent / Effluent Data (October 2009 through March 2013)



The performance with respect to TSS removal has also been excellent as shown in **Figure 10-3**. **Figure 10-3** shows both influent and effluent data from October 2009 through March 2013. Percent removal of TSS has averaged approximately 97% for the period of record shown. The average effluent TSS values for the period of record shown is approximately 4.30 mg/L.

Figure 10-3 – Historical TSS Influent / Effluent Data (October 2009 through March 2013)



10.1.3 Corrective Actions for the Belle Glade WWTF

Based on the field observations and results of the investigation and testing, most problems associated with the Belle Glade WWTF have to do with the age of the facility and some of the equipment. The Belle Glade WWTF receives routine maintenance and corrective action. Structurally, the overall condition of the entire facility is good and the plant is in operating within the requirements of the operating permit. Deficiencies were observed such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 63 year old facility. The recommended repairs are also separated into two categories: critical (i.e., for continued use) and non-critical (i.e., needs to be addressed before it becomes a critical item).

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD budget constraints. However, non-critical repairs may become critical if not implemented within a prudent time period. Below are the recommended repairs / modifications, listed in order of priority, for the Belle Glade WWTF:

Critical Repairs

1. Oxidation Ditch No. 1 Structural Rehabilitation
2. Oxidation Ditch No. 2 Structural Rehabilitation
3. Improvements to the Deep Injection Well
4. Installation of a Roto-Screen Bypass line
5. Repair cracks and leaks in Aerobic Digester
6. Replacement of Main Switchboard No. 1 (Generator Building No. 1)
7. Replacement of 300 kW generator (Generator Building No. 1)
8. Injection Well PLC replace (Parts are unavailable)
9. Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)

Non-Critical Repairs

1. Replace Parshall flume (in the Headworks)
2. Installation of a Headworks Bypass
3. Additional circular clarifier (to replace Clarifier Nos. 1 and 2)
4. Construct chlorine contact chamber
5. Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)
6. Optimize Bar screens to achieve higher capture rate
7. Add toe board to Splitter Box No. 2 hand rail
8. Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum
9. Replacement of several air handlers and compressors
10. Replace Roto-Screen roof purlins and roof panels that have deteriorated
11. Replacement of the main PLC and PLC software
12. Lift station Nos. 1 and 2 rehabilitation
13. Replace Headworks access stair with an aluminum stair
14. Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)

15. Rehabilitation of the RAS / WAS structure
16. Installation of two polymer feeders
17. Repair leaks at the effluent box of the headworks
18. Replace Roto-Screen effluent wet well slide gate and isolation gate
19. Replace pond bypass gate
20. Paint steel roof over the Aerobic Digester blowers
21. Rehabilitate the Roto-Screen metal structure
22. Rehabilitate the Sludge Thickening Facility metal structure
23. Upgrading control room
24. Paint steel walkway bridge and structure on Clarifier 3 and 4
25. Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2
26. Paint steel bridge, stairs and EQ tank
27. New roofs on the Operation, Maintenance and both Generator buildings
28. Replace doors in MCC Building
29. Repair cracking at Headworks upper level slab
30. Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure
31. Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2
32. Replace Thickeners
33. Remove, replace and rewire Headwork's control panel
34. Relocate trees and plants placed inside abandoned structures
35. Construct overflow in Aerobic Digester
36. Repair crack at the Operations Building access ramp
37. Re-paint the entire exterior of the Headworks
38. Support of the Operations Building roof post should be replaced with a different type to avoid further cracking
39. Install flow meters on Oxidation Ditch Nos. 1 and 2
40. Install flow meters on Clarifier Nos. 3 and 4
41. Polymer containment and enclosure
42. Construction of a Switchgear Building with space for future equipment
43. Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight

44. Replace manual valves with electronic controlled valves
45. Repair the concrete spalls at guardrail posts at Clarifier No. 3
46. Replacing ceiling tiles in the Operations Building break room
47. Replace plant lighting with higher illumination LED lights
48. Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway
49. Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)
50. Replacement of four slide gates in Headworks
51. Replace RAS and Deep Injection Well flow meters with new magnetic meters
52. Replacement of MCC-3 (in the Operations Building Electric Room)
53. Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)
54. Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center MCC-1, Panel PP-1 480V, Motor Control Center MCC-2, PLC-1 (Main Control Panel))
55. Install automatic control gates for Oxidation Ditch No. 1 and 2
56. Flow meter for Clarifier Nos. 1 and 2
57. Crack repair on the exterior wall surfaces of EQ tank
58. Repair guardrails on EQ tank
59. Install fencing to enclose Truck Wash Lift Station
60. Install an odor control system at the Headworks
61. Install an onsite plant service water system including reuse system
62. Add sumps at one end of the Clarifier Nos. 1 and 2 structure
63. Painting of the facility
64. Upgrading cabinets in the Operations Building break room
65. Asphalt overlay and addition of parking spaces
66. Epoxy coat floors
67. Convert EQ tank to additional Clarifier or Aerobic Digester
68. Install drain on Oxidation Ditch No. 1

10.2 Pahokee WWTF O&M Performance Report Overview

This section presents a summary of the O&M Performance Report for the Pahokee WWTF.

10.2.1 Background

The Pahokee WWTF is located on Rim Canal Road in Pahokee, Florida, east of Lake Okeechobee and north of State Road 80. The service area for this treatment plant facility is approximately 16.5 square miles (10,569 acres) and extends to the north of Paul Rardin Park up to Canal Point and is comprised of several collection basins. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Pahokee WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Pahokee). The treatment plant is permitted to operate with a capacity of 1.2 MGD TMADF under FDEP Permit No. FLA0136778-006-DW1P/NR that was issued on August 22, 2012 and expires August 21, 2017. The Pahokee WWTF is an activated sludge WWTF originally built in 1955 consisting of the following: a 0.50-MGD TMADF conventional activated sludge WWTF (Plant 1) and a 0.70-MGD TMADF complete mix Walker WWTF (Plant 2). The facility is also permitted to discharge up to 0.08 MGD AADF capacity via on-site rapid infiltration basin (RIB). The facility also has an existing Underground Injection permit (UO 50-194658) with a monthly average daily flow permitted capacity of 4.0 MGD. Primary effluent disposal is deep well injection.

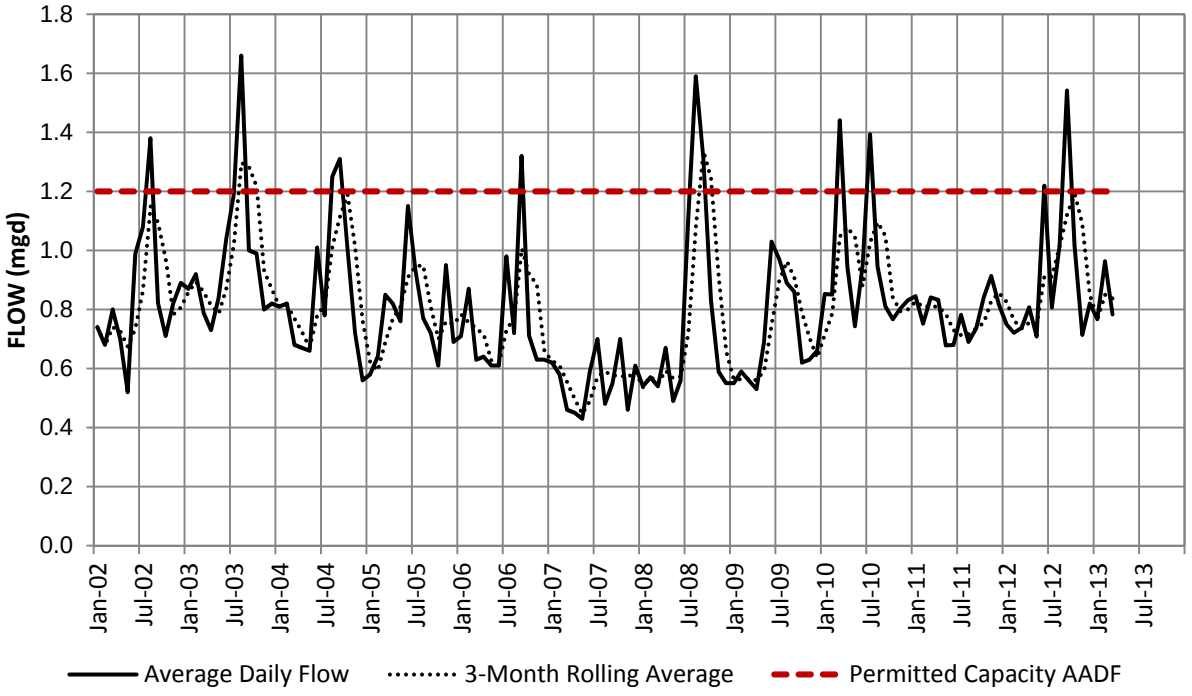
10.2.2 Pahokee WWTF Treatment Efficiency

Treatment efficiency of the major wastewater treatment units and overall treatment efficiency at the Pahokee WWTF are presented in this section. The design and operating parameters used for the evaluation of treatment efficiency are those established in the treatment facility's Capacity Analysis Report.

The complete mix activated sludge treatment process at the Belle Glade WWTF is designed to operate in the range of MLSS concentration from 2,000 to 3,200 mg/L and an SRT of 15 to 25 days. RAS flow range is from 60 to 100 percent of the plant influent and typically operated at 65 percent return.

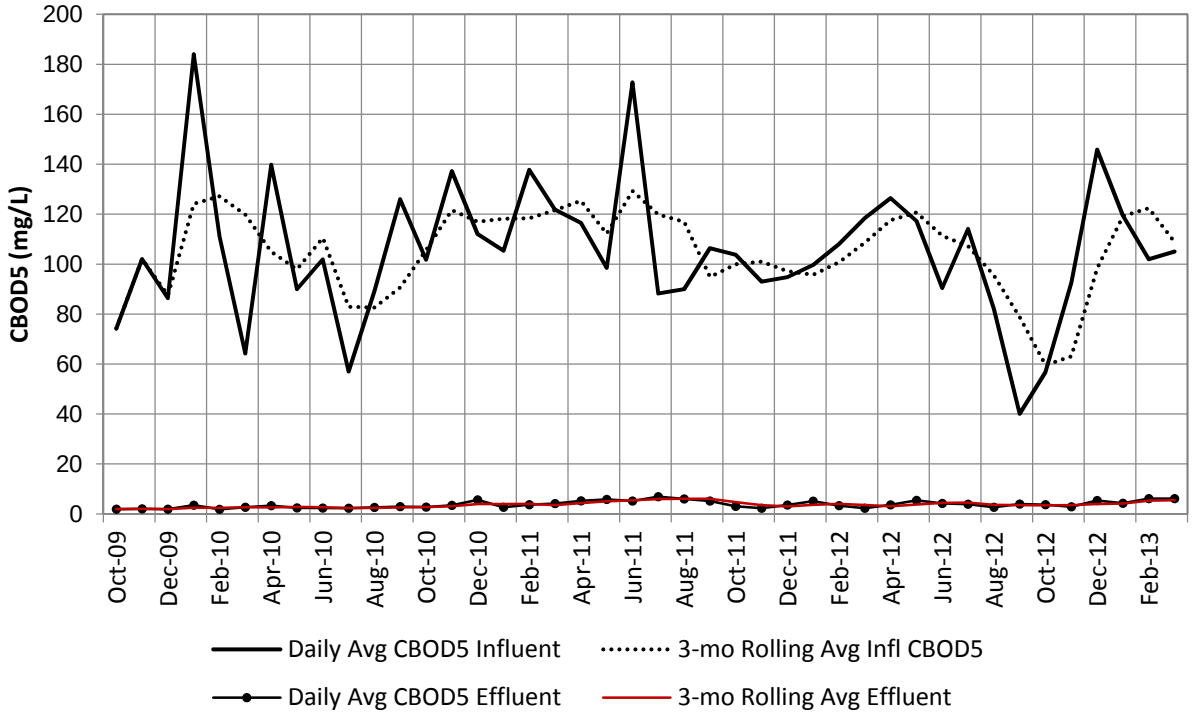
The average monthly operating conditions for the period extending from January 2002 through March 2013 are presented in O&M Performance Report found in TM-10. It should be noted that data for $CBOD_5$ and TSS is only included from October 2009 through March 2013 and evaluated in this report due to inconsistencies in the data prior to October 2009. **Figure 10.4** contains plots of average daily flows and a 3-month rolling average from January 2002 through March 2013. Flows during this 10 year period have averaged 0.81 MGD, which is below the permitted TMADF of 1.2 MGD.

Figure 10-4 – Historical Flow Data (January 2002 through March 2013)



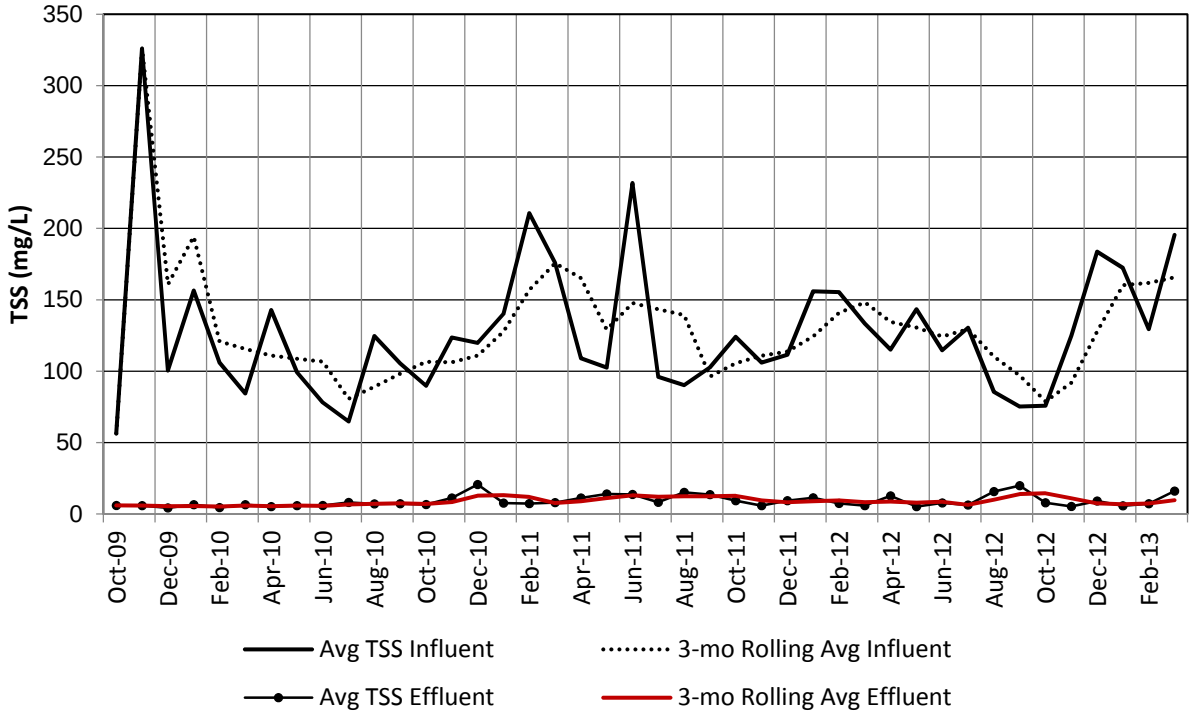
Historical performance for this four year period has been excellent with CBOD5 and TSS removal efficiencies of 96% and 93%, respectively. **Figure 10-5** is a plot of monthly average values for $CBOD_5$ loadings from October 2009 through March 2013. The treatment process consistently produces an effluent with average $CBOD_5$ concentrations of approximately 3.76 mg/L.

Figure 10-5 – Historical $CBOD_5$ Influent / Effluent Data (October 2009 through March 2013)



The performance with respect to TSS removal is also excellent as shown in **Figure 10-6**. **Figure 10-6** shows both influent and effluent data from October 2009 through March 2013. Percent removal of TSS has averaged approximately 93% for the period of record shown. The average effluent TSS values for the period of record shown is approximately 8.51 mg/L.

Figure 10-6 – Historical TSS Influent / Effluent Data (October 2009 through March 2013)



10.2.3 Corrective Actions for the Pahokee WWTF

Similar to the Belle Glade WWTF, most problems associated with the Pahokee WWTF have to do with the age of the facility and some of the equipment. Based on the evaluation, the Pahokee WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the entire facility is good and the plant is in operable condition. Deficiencies observed such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 58 year old facility. However, it is noted that overall, the Pahokee WWTF operates adequately. The recommended repairs are separated into two categories: critical (i.e., for continued use) and non-critical (i.e., needs to be addressed before it becomes a critical item).

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD fiscal year budget. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired but their implementation is not required as part of the rehabilitation and will not impair the use of the facility. The recommended repairs / modifications, listed in order of priority, are presented below:

Critical Repairs

1. Replacement of generators
2. New grit removal system at Headworks
3. Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps
4. Replace steel bridge supports on Primary and Secondary Clarifiers
5. Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)
6. Replace Walker Unit elevated influent pipe supports
7. Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)
8. Replacement of 12" valve on the Deep Injection Well System
9. Rehabilitate all three Secondary Clarifiers
10. Modify stair top support on Aeration Tank Nos. 1 and 2
11. Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office

Non-Critical Repairs

1. Replacement of the mechanical bar screen
2. Replace Digester stairs
3. Replace all diffusers
4. Influent Pump Station rehabilitation
5. Reconfigure Chlorine / Operations Building and replace 4-inch sewer line
6. Remove and replace all sidewalks
7. Replace Wet well By-Pass valve
8. Rehabilitate Chlorine Contact Chamber Nos. 1 and 2
9. Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)
10. Replace all six blowers
11. Recoat two Secondary Clarifiers and repaint the steel bridges
12. Recoat Primary Clarifier and repaint the steel bridge
13. Recoat the Walker Unit and repaint the steel bridge
14. Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)
15. Blower House Nos.1, 2 and 3 roof, door and louver replacement

16. Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator NO. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panelboard, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))
17. Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator NO. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)
18. Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))
19. Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))
20. Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)
21. Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panelboard, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)
22. Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump Nos. 1, 2 and 3))
23. Flow pace blowers
24. Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2
25. Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures
26. Replace pump and auger in the Bioset system
27. Installation of a security fence
28. Replace Effluent Pump starters with VFDs
29. PLC system upgrade
30. Replace manual valves with electronic controlled valves
31. Replace grounding at the Headworks
32. Painting of the facility
33. Epoxy coat floors

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Chapter 11.0
Capacity Analysis and Plant Optimization

This chapter provides a summary of the Capacity Analysis Reports for the Belle Glade and Pahokee WWTFs. Capacity Analysis Reports were prepared for both WWTFs based on the requirements of Florida Administrative Code (FAC) Chapter 62-600.405. Copies of the reports are included in Technical Memorandum No. 11 (TM-11) entitled "Capacity Analysis and Plant Optimization". The reports summarize evaluation of the capacity of the plants and contain data showing the permitted capacity; monthly average flows, three-month average flows; and annual average daily flows for the past 10 years; seasonal variations in flow; flow projections based on local population growth and water usage rates over the next 10 years; and an estimate of time required for the three-month average daily flow to reach the permitted capacity. The reports also include capital cost estimates of infrastructure improvements required to maintain permitted plant capacities.

In addition to the capacity analysis, baseline energy efficiency models were developed for both plants, using Hazen Energy Efficiency Tool (HEET). The HEET model was used to evaluate potential optimization improvements.

11.1 Background

Work performed evaluated the 10-year window as typically required by FDEP for regulatory compliance and a 20-year window for master planning efforts. Both scenarios are discussed in this chapter.

11.2 Capacity Analysis

Work performed evaluated the 10-year window as typically required by FDEP for regulatory compliance. In addition to Capacity Analysis Reports, which are required to assess plant capacities over the next 10 years to satisfy FDEP regulatory requirements, flows and loadings were also projected for each facility over the next 20 years to identify any longer term capacity shortfalls during the master planning period (Years 2015 – 2035).

Previous work efforts indicated that the Belle Glade WWTF has adequate capacity to process

projected flows and loadings over the next ten (10) years, provided that renewal and replacement projects listed in Technical Memorandum No. 2 are completed. Flows are projected to exceed the Pahokee WWTF's permitted capacity in the Year 2018. Total influent loadings for biochemical oxygen demand (BOD) and total suspended solids (TSS) are projected to remain below the Pahokee WWTF's organic loading capacity for the next ten (10) years. Therefore, improvements would be required at the Pahokee plant to increase treatment capacity for unit processes governed by hydraulic loading rates.

11.2.1 Belle Glade WWTF

The Belle Glade WWTF provides secondary treatment, on-site sludge thickening and digestion, and effluent disposal via deep well injection and land application. Digested sludge is dewatered and disposed offsite by a contract provider. The Belle Glade WWTF is currently permitted to treat 6.5 mgd maximum monthly average daily flow (MMADF) with permitted effluent discharge capacities of 10.2 mgd maximum daily flow (MDF) via a Class I underground injection well and an additional 0.069 mgd maximum monthly average daily flow (MMADF) via a percolation pond. **Figures 11-1 and 11-2** show the existing site plan and process flow diagram, respectively.

The Belle Glade WWTF is permitted based on the design criteria shown in **Table 11.1**.

Table 11.1
General Influent Design Criteria for Belle Glade WWTF

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	6.5
Influent $CBOD_5$ and TSS (mg/L)	220
Influent $CBOD_5$ and TSS (lbs/day)	12,000
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

Figures 11-3 and **11-4** present flow and loadings projections for the Belle Glade WWTF through the Year 2035.

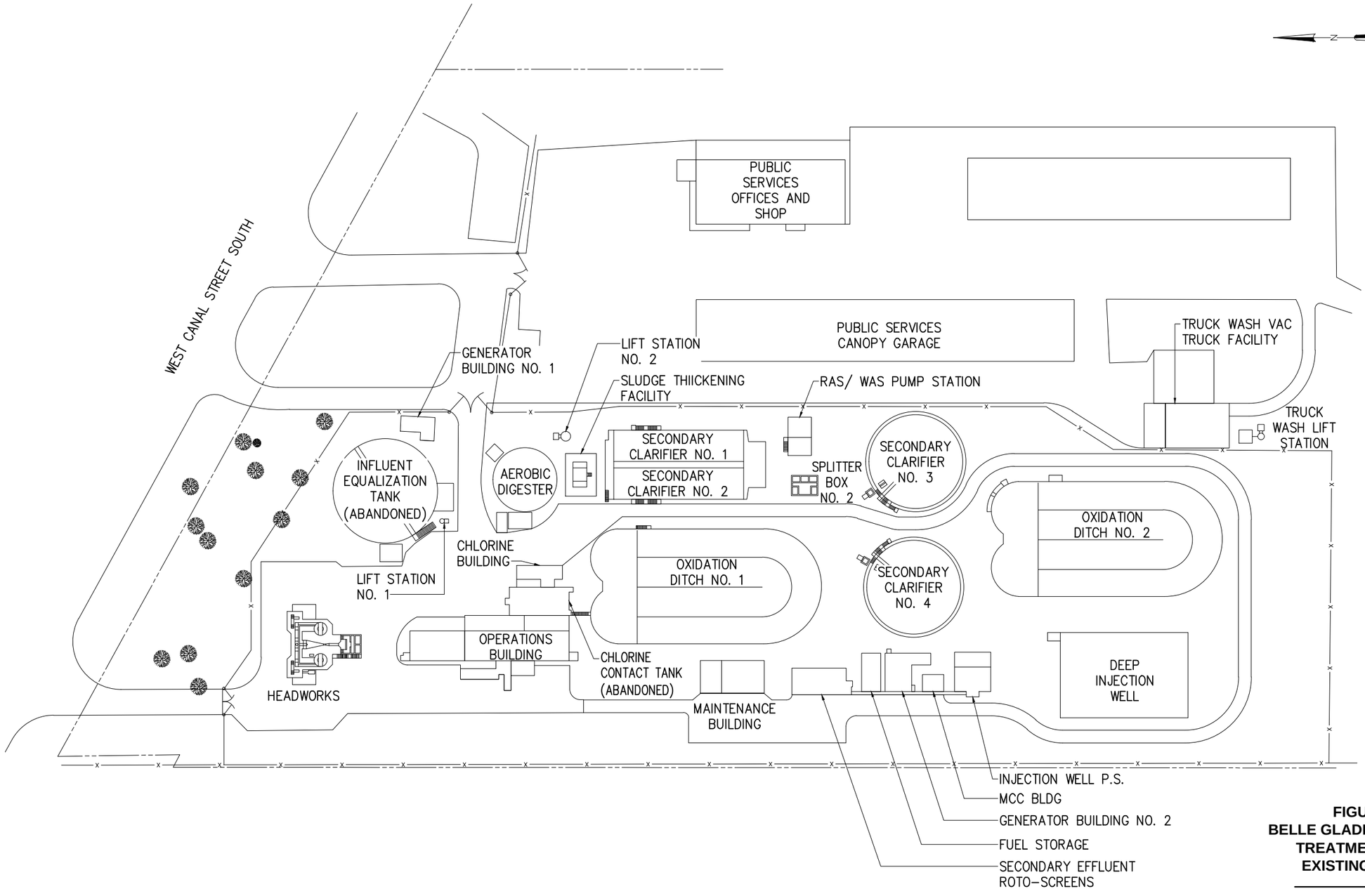

FIGURE 11-1
BELLE GLADE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department

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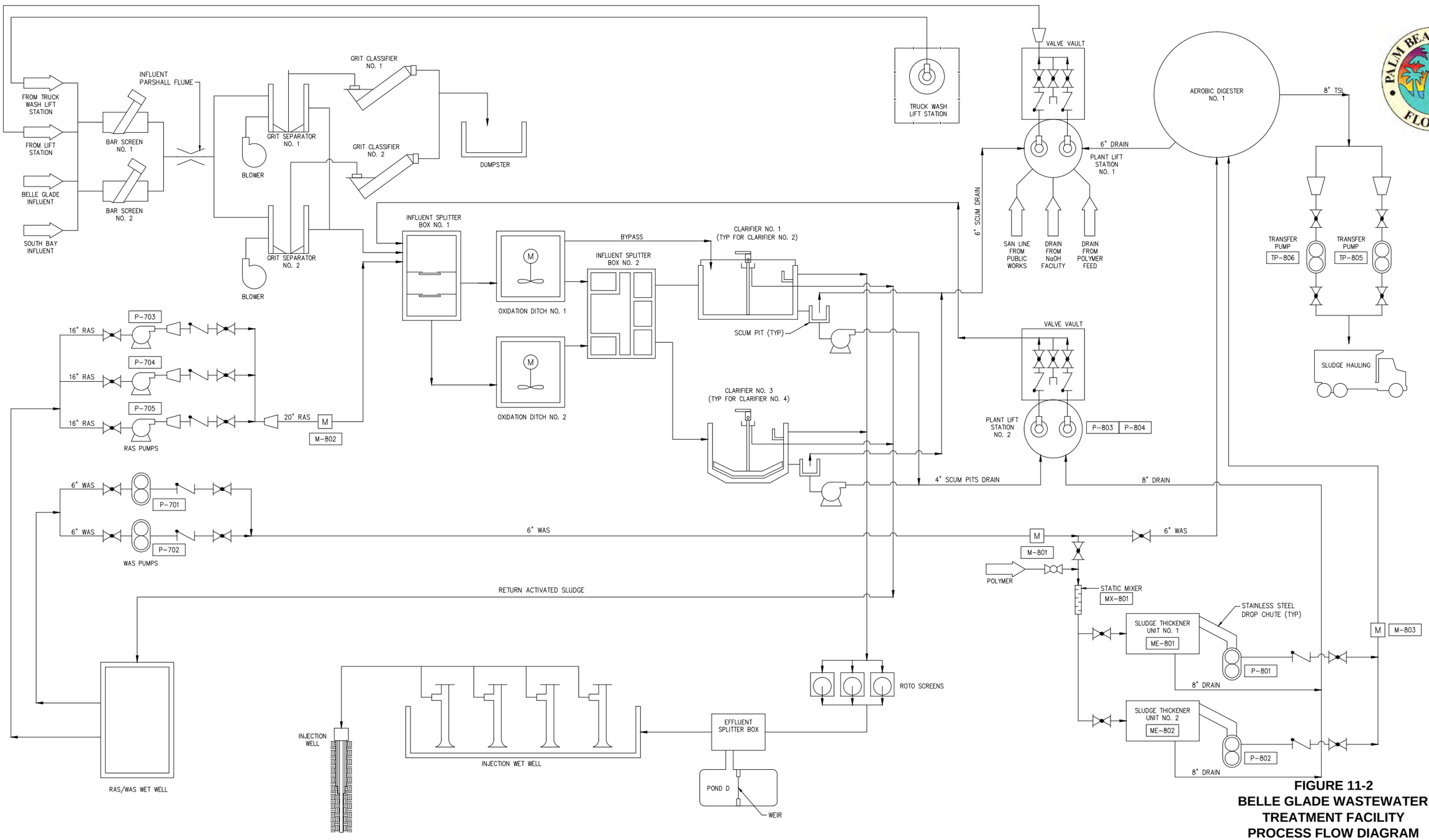

FIGURE 11-2
BELLE GLADE WASTEWATER TREATMENT FACILITY
PROCESS FLOW DIAGRAM

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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Figure 11-3
Belle Glade WWTF Projected Flows

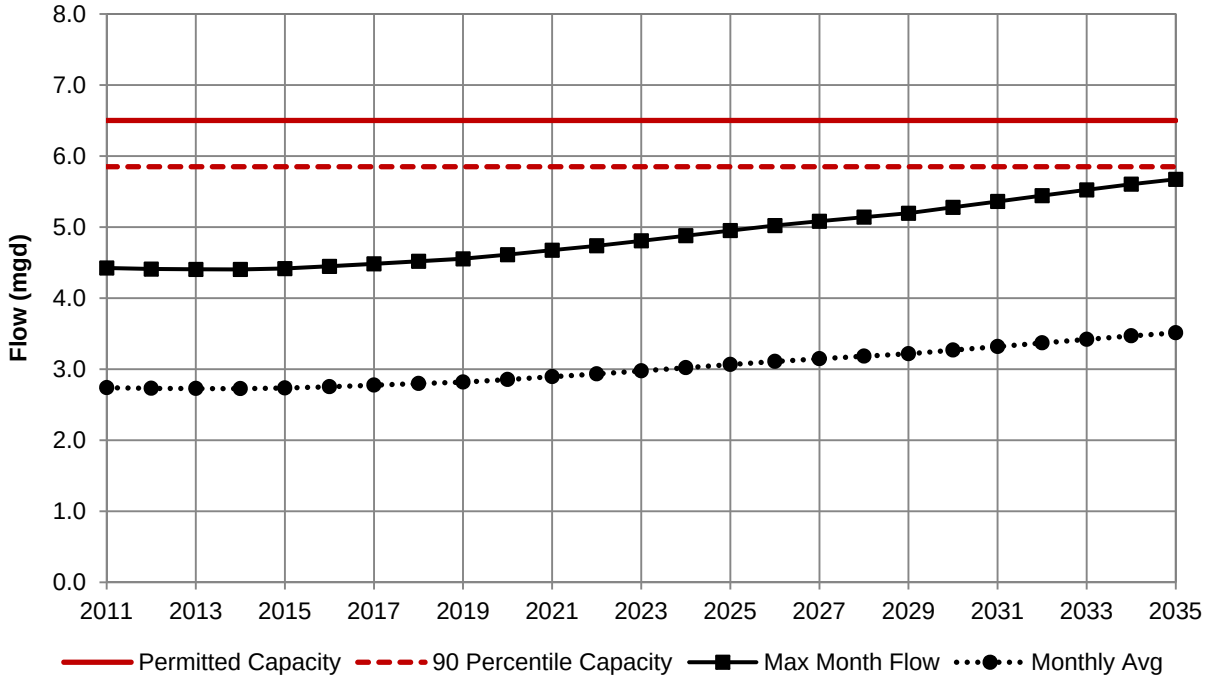
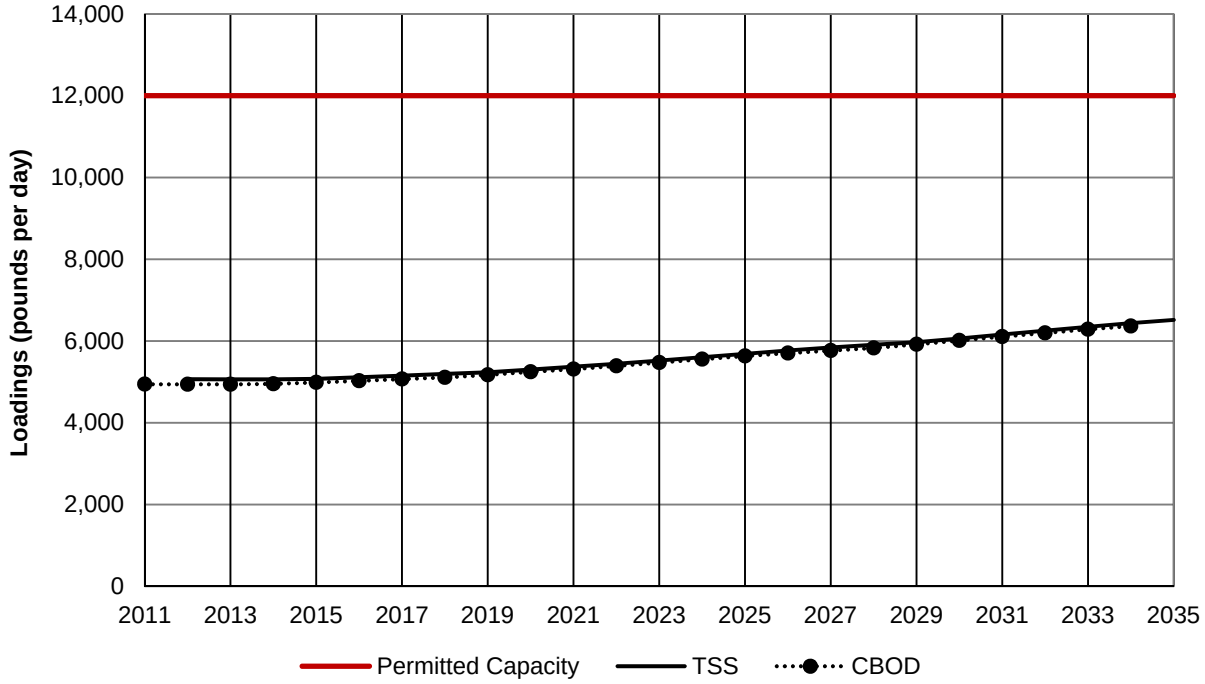


Figure 11-4
Belle Glade WWTF Projected Loadings



Future flows and loadings are both projected to remain below original design capacity criteria through the Year 2035. As such, there is no need to expand the Belle Glade WWTF to meet Belle Glade WWTF service area growth.

11.2.2 Pahokee WWTF

The Pahokee WWTF provides secondary treatment, on-site biosolids processing and stabilization, and effluent disposal primarily via deep well injection. The Pahokee WWTF is currently permitted to treat 1.2 mgd TMADF with permitted effluent discharge capacities of 4.0 mgd maximum daily flow (MDF) via a Class I underground injection well and an additional 0.8 mgd MMADF via a percolation pond.

The Pahokee WWTF is an activated sludge wastewater treatment plant consisting of a 0.50 mgd (TMADF) conventional wastewater treatment train and a 0.70 mgd (TMADF) complete-mix treatment train (Walker Modular Plant) to provide its total rated capacity of 1.20 mgd (TMADF). **Figures 11-5** and **11-6** show the existing site plan and process flow diagram, respectively.

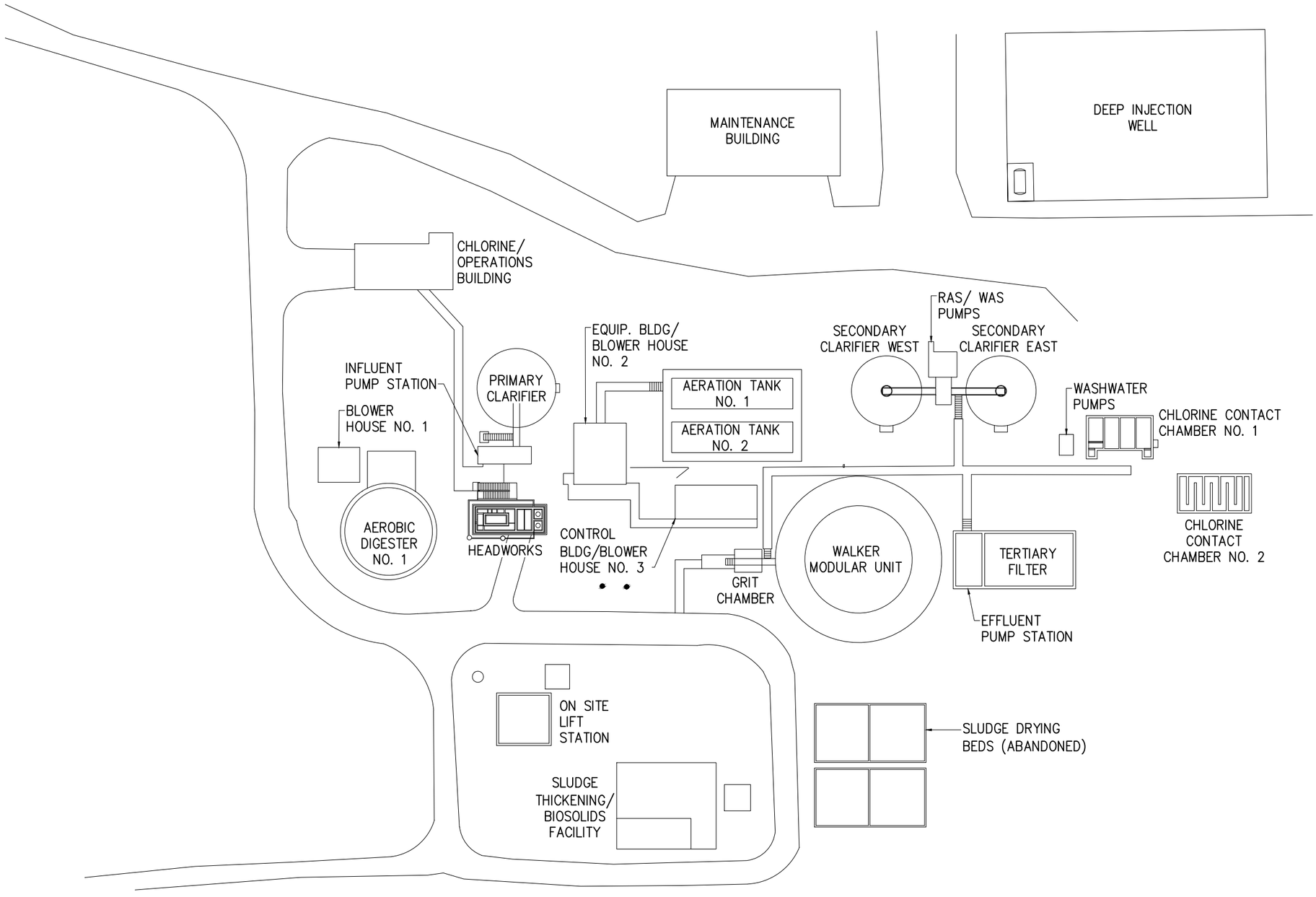


FIGURE 11-5
PAHOKEE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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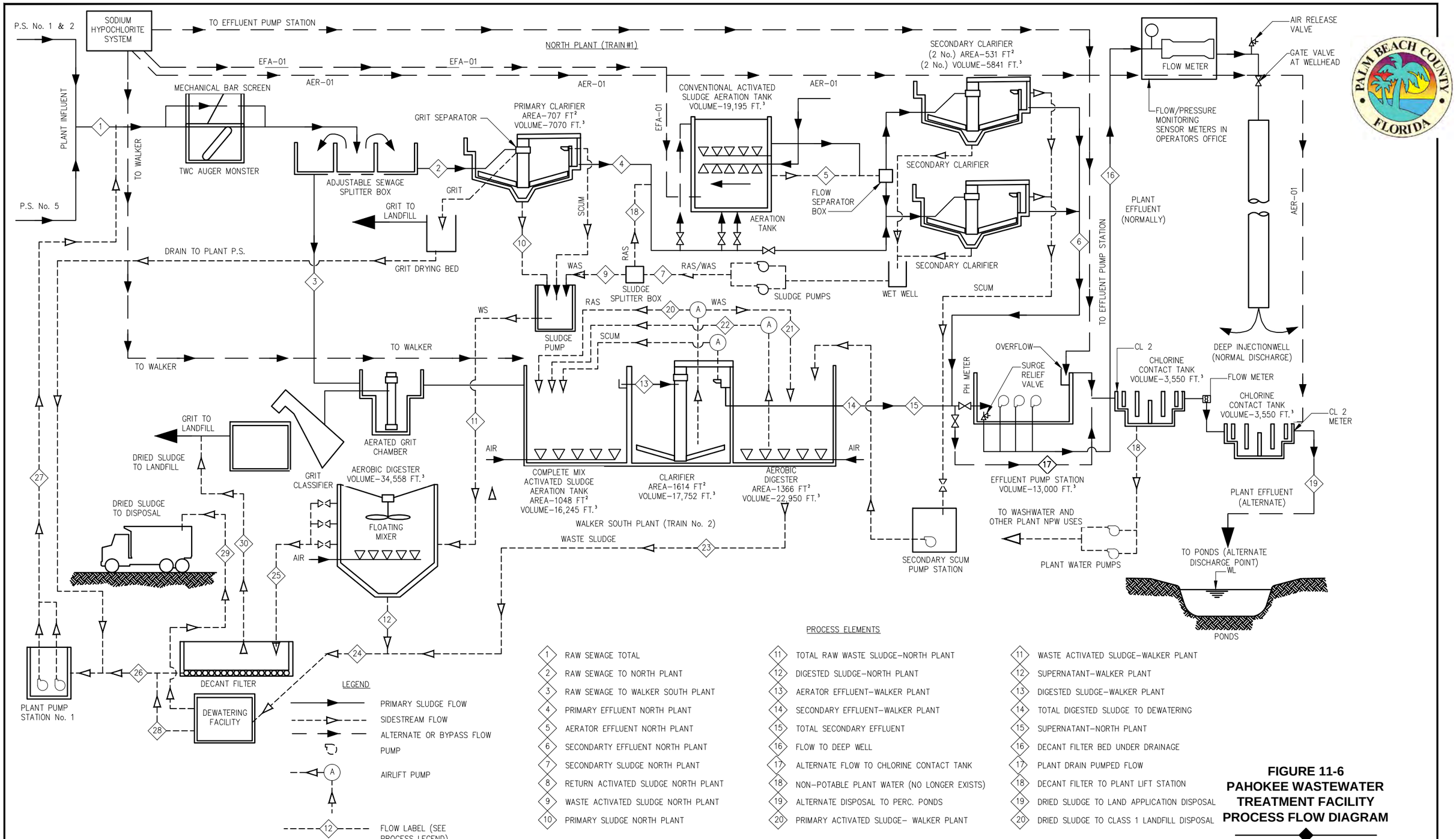

PROCESS ELEMENTS

1. RAW SEWAGE TOTAL
2. RAW SEWAGE TO NORTH PLANT
3. RAW SEWAGE TO WALKER SOUTH PLANT
4. PRIMARY EFFLUENT NORTH PLANT
5. AERATOR EFFLUENT NORTH PLANT
6. SECONDARTY EFFLUENT NORTH PLANT
7. SECONDARTY SLUDGE NORTH PLANT
8. RETURN ACTIVATED SLUDGE NORTH PLANT
9. WASTE ACTIVATED SLUDGE NORTH PLANT
10. PRIMARY SLUDGE NORTH PLANT
11. TOTAL RAW WASTE SLUDGE–NORTH PLANT
12. DIGESTED SLUDGE–NORTH PLANT
13. AERATOR EFFLUENT–WALKER PLANT
14. SECONDARY EFFLUENT–WALKER PLANT
15. TOTAL SECONDARY EFFLUENT
16. FLOW TO DEEP WELL
17. ALTERNATE FLOW TO CHLORINE CONTACT TANK
18. NON–POTABLE PLANT WATER (NO LONGER EXISTS)
19. ALTERNATE DISPOSAL TO PERC. PONDS
20. PRIMARY ACTIVATED SLUDGE– WALKER PLANT
11. WASTE ACTIVATED SLUDGE–WALKER PLANT
12. SUPERNATANT–WALKER PLANT
13. DIGESTED SLUDGE–WALKER PLANT
14. TOTAL DIGESTED SLUDGE TO DEWATERING
15. SUPERNATANT–NORTH PLANT
16. DECANT FILTER BED UNDER DRAINAGE
17. PLANT DRAIN PUMPED FLOW
18. DECANT FILTER TO PLANT LIFT STATION
19. DRIED SLUDGE TO LAND APPLICATION DISPOSAL
20. DRIED SLUDGE TO CLASS 1 LANDFILL DISPOSAL

PAHOKEE WWTP PROCESS FLOW DIAGRAM

FIGURE 11-6
PAHOKEE WASTEWATER TREATMENT FACILITY PROCESS FLOW DIAGRAM

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The Pahokee WWTF is permitted based on the design criteria shown in **Table 11.2**.

Table 11.2
General Influent Design Criteria for Pahokee WWTF

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	1.2
Influent $CBOD_5$ and TSS (mg/L)	180
Influent $CBOD_5$ and TSS (lbs/day)	1,800
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

Figures 11-7 and **11-8** present flow and loadings projections for the Pahokee WWTF through the Year 2035.

Figure 11-7
Pahokee WWTF Projected Flows

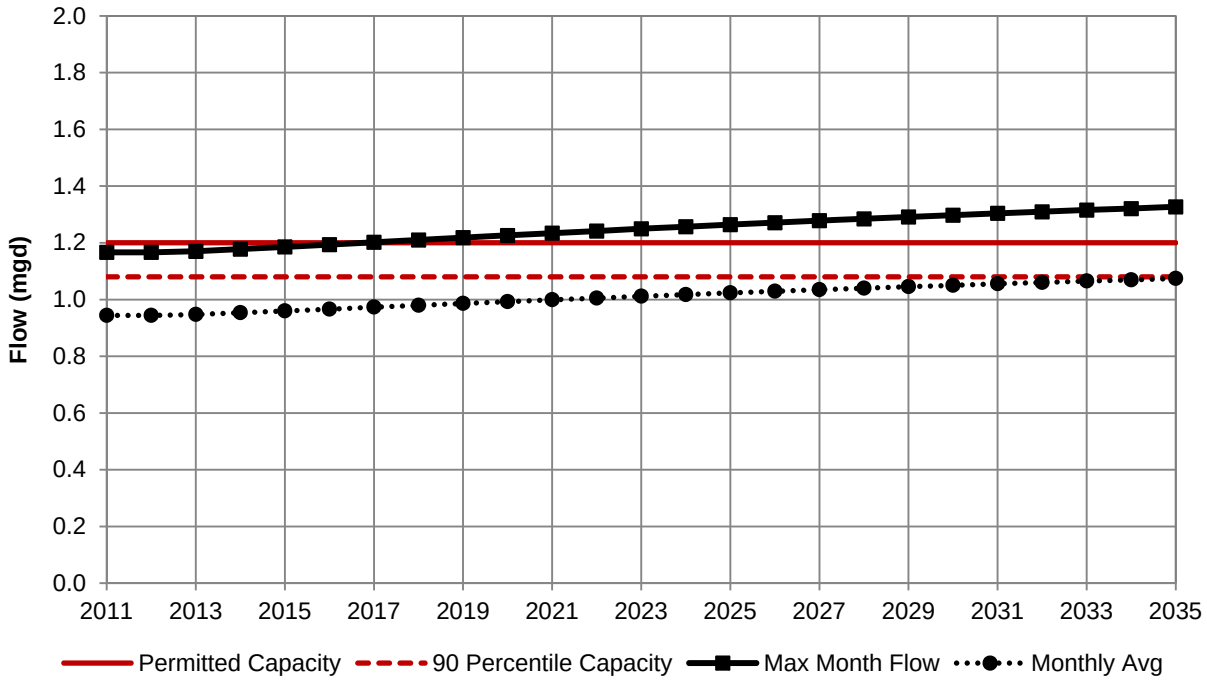
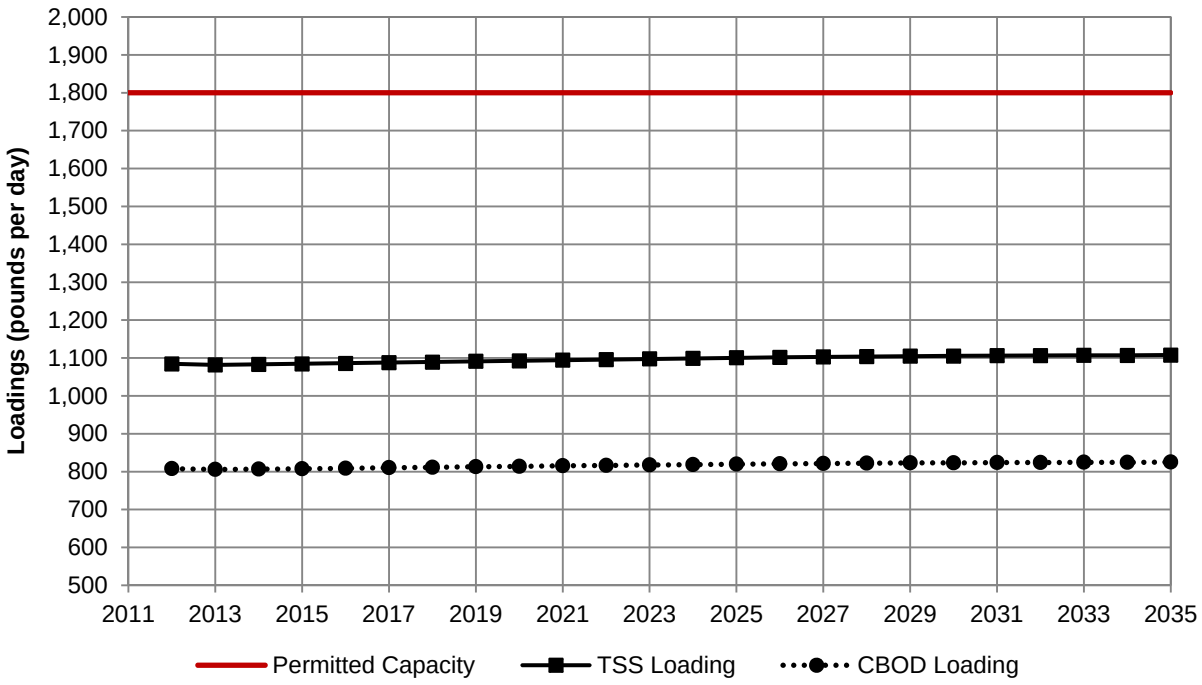


Figure 11-8
Pahokee WWTF Projected Loadings



Future flows are projected to exceed the Pahokee WWTF's rated capacity by the Year 2018. However, due to the fact that influent BOD and TSS concentrations (103 mg/L) are significantly lower than the original design criteria (180 mg/L), future loadings (pounds per day) are projected to remain below original design capacity criteria through the Year 2035. Therefore, a review of individual unit process capacities through the Year 2035 was conducted and indicates the following:

- The headworks screen is hydraulically overloaded, even at current peak hourly flows (note that the screen is already scheduled for replacement under renewal and replacement projects identified in Technical Memorandum No. 2).
- Primary clarifier capacity in the conventional train is adequate through 2035.
- Conventional train aeration basins have adequate volume to meet future BOD loading rates through 2035, with or without primary treatment.
- Conventional train secondary clarifiers are hydraulically overloaded with one clarifier out of service, even at current flows. A new secondary clarifier would be recommended to provide adequate firm capacity. Recommended clarifier upgrades also include a new mixed liquor splitter box to connect existing and new clarifiers; additional return activated sludge (RAS) / waste activated sludge (WAS) pumps/piping for the new clarifier; and replacement of the

two existing clarifier mechanisms. Note that replacement of mechanisms is already planned as a renewal and replacement project identified in Technical Memorandum No. 2.

- The Walker train's aeration basin would experience higher than recommended BOD loading rates within the 20-year planning period.
- Since solids loading rates will remain under original design loading rates through the Year 2035, aerobic digester capacity should also be adequate through the Year 2035.
- The injection well pump station and deep injection well are adequate through the Year 2035.

In addition to the hydraulic capacity concerns, Technical Memorandum No. 2 (Renewal and Replacement Improvements) concluded that the following major components of the Pahokee plant were in poor condition and in need of complete replacement or major repairs:

- Headworks mechanical screen (replacement)
- Conventional plant
  - Primary clarifier equipment (replacement)
  - Aeration basin walkways and air diffusers (replacement)
  - Aeration blowers (replacement)
  - Instrumentation and controls (upgrades)
  - Secondary clarifier mechanism (replacement)
- Walker Plant
  - Grit removal system (replacement)
  - Concrete tank and mechanical equipment (inspection and rehabilitation)
  - Aeration blowers (replacement)
  - Secondary clarifier mechanism (replacement)
  - Instrumentation and controls (upgrades)
- Effluent Pump Station and Deep Injection Well
  - Replace effluent pump starters with VFDs
  - Repair monitoring well
- Aerobic Digester
  - Potential tank crack repairs
  - Blowers (replacement)

- Electrical
  - Common standby generator (replacement)
  - Main breakers (replacement)
  - MCC-3 (replacement, new bus configuration)

Since current TMADF flows have virtually reached the Pahokee WWTF's permitted capacity, there is not adequate firm capacity to remove any major process unit from service for inspection, replacement or upgrades. Therefore, one new aeration basin and the additional secondary clarifier must be constructed and placed into service before one of the existing aeration basins or clarifiers can be removed from service for structural rehabilitation and/or equipment replacement (e.g., blowers, diffusers).

The following general approach is recommended to rehabilitate and provide reliable capacity to the Pahokee WWTF:

1. Construct and commission the following new facilities:
   a. 0.7 MGD aeration basin and new blower building
   b. Two secondary clarifiers (equal in capacity to the existing clarifiers); and related RAS/WAS pumping and piping
   c. Clarifier influent splitter box to distribute a common mixed liquor stream from the existing and new aeration basins to the existing and new secondary clarifiers
2. Once new facilities are operating, maintain the Walker train in service, and upgrade and "re-rate" the existing 0.5 MGD conventional train to 0.7 MGD capacity, as follows:
   a. All renewal and replacement work listed in Technical Memorandum No. 2
   b. Hydraulic improvements as required
3. Once the upgraded 0.7 MGD conventional train is back in service, abandon the Walker train or maintain it for emergency service.

11.3 Baseline Energy Efficiency Models

Energy consumption was modeled at each plant using the HEET, an integrated process and energy model. The main inputs to the HEET model are basic wastewater quality information at various locations throughout the treatment process and operational information related to the various motors and electric loads at the treatment plants. Based on plant records and information obtained during site visits, HEET models were populated and the overall electrical consumption at each facility was computed.

Preliminary energy evaluations of the Belle Glade and Pahokee WWTFs establish a baseline for potential plant optimization projects. The baseline energy efficient models are used to

identify, within a strategic framework, optimization opportunities that have the potential to result in reduced energy and operational costs. The focus of the work is to identify major opportunities available with the understanding that some minor items such as lighting, building fixtures, smaller HP equipment, etc. are not included.

Energy models are also used to project O&M costs at each plant over the 20-year planning period; those O&M costs will factor into a subsequent life-cycle cost analysis of two major facilities options:

- Option 1 – Upgrade and operate Belle Glade and Pahokee WWTFs separately
- Option 2 – Upgrade Belle Glade WWTF only; convert the Pahokee WWTF to a regional pump station and treat Pahokee service area flows at the upgraded Belle Glade WWTF

11.3.1 Belle Glade WWTF

11.3.1.1 Summary of Existing Major Equipment

Existing major equipment items are summarized below in **Table 11.3** to determine the instantaneous power demands.

Table 11.3
Existing Major Equipment Items at Belle Glade WWTF

Item	Horsepower	Operational Frequency	Comment
Bar Screen Motor	2 @ 5 HP	2 Bar Screens, 24/7	--
Grit Separator, Compressor, and Classifier	2 @ 6.5 HP	2 Systems, 24/7	Combined HP of grit system listed
Oxidation Ditch Motor	4 @ 100 HP	4 Motors, 24/7	Motors running at 60% in model
Clarifier Motor	4 @ 0.33 HP	2 Clarifiers, 24/7	--
Clarifier Scum Pump	4 @ 3 HP	2 Scum Pumps, 24/7	--
RAS Pump	3 @ 25 HP	1 RAS pump, 24/7	Pumps running at 60% Influent flow in model
WAS Pump	2 (HP not available)	1 WAS pump, 12/7	No HP listed, assumed one (1) 10 pump HP running
Injection Well Pump	4 @ 300 HP	1 Pump, 8/7	Assumed 1 pump running at 150' Head. (+20' head for high discharge pressure)
Rotary Drum Thickener	2 @ 2 HP	2 RDT, 1 day/week	--
Thickened Sludge Pump	2 @ 5 HP	2 TS pump, 1 day/week	--
Truck Loading Pump	1 (HP not available)	1 Running, 1 day/week	No HP listed, assumed one(1) 5 HP pump
Chlorination Pump	3 (HP not available)	Chlorine Pump, 24/7	--

11.3.1.2 Overall Electrical Consumption at Belle Glade WWTF

The results of the Belle Glade HEET model are summarized by process in **Table 11.4**.

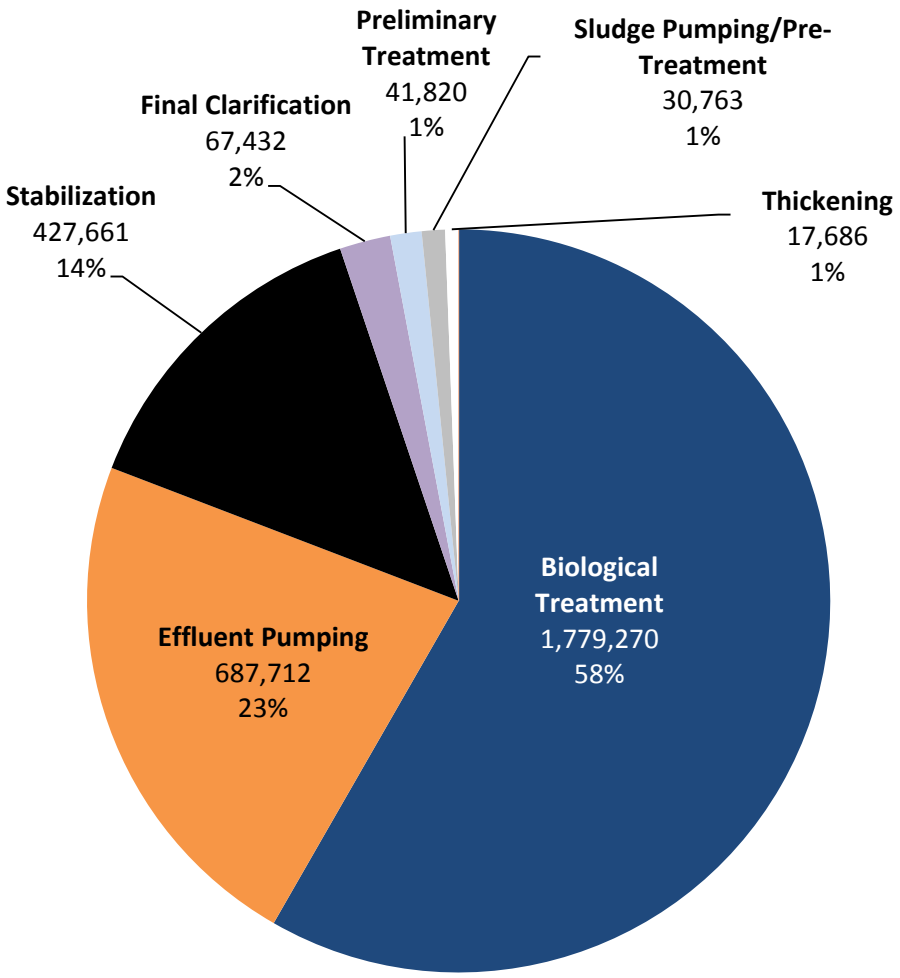
Table 11.4
HEET Model Electrical Consumption Summary for Belle Glade WWTF

Process	Annual Energy Consumption (kWh / year)
Biological Treatment	1,779,270
Effluent Pumping	687,712
Stabilization	427,661
Final Clarification	67,432
Preliminary Treatment	41,820
Sludge Pumping	30,763
Thickening	17,686
Disinfection	11
TOTAL	**3,052,355**

Total electrical use modeled is slightly less than the total electrical consumption billed for the plant between October 2012 and July 2013. August and September 2013 billed electrical use was estimated based on the average of October 2012, June 2013 and July 2013 data to produce a complete year of electrical data. The billed electrical consumption was converted to energy use using a unit cost of $0.08/kWh, leading to a billed energy use of 3,209,525 kWh over that period. The total consumption estimated by the HEET model is 5% less than the billed data, or 3,052,355 kWh. This 5% variance is expected due to the exclusion of building, lighting, HVAC and other non-process related consumption in the HEET model. Based on this minor variance, the HEET model appears to provide a reasonable estimate of the process-related electrical consumption at the Belle Glade WWTF. Results are summarized graphically by major process in **Figure 11-9**.

The Belle Glade WWTF baseline energy model provides a basis for evaluating the cost-effectiveness of proposed optimization strategies evaluated in Section 4 of TM-11. For example, if one oxidation ditch were adequate for treatment of projected flows through the Year 2023, aerators for second oxidation ditch would be turned off in the HEET model to compute the reduction in energy consumption over that period of time.

Figure 11-9
HEET Model Electrical Consumption for Belle Glade WWTF



11.3.2 Pahokee WWTF

Existing major equipment items are summarized below in **Table 11.5** to determine the instantaneous power demands.

Table 11.5
Existing Major Equipment Items at Pahokee WWTF

Item	Horsepower	Operational Frequency	Comment
Auger Monster	1 @ 5 HP	1 Unit, 24/7	---
Primary Clarifier	1 @ 1.5 HP	1 Motor, 24/7	Includes collector & Scum Pump
Blowers (North)	2 @ 750 SCFM	1 Blower, 24/7	Model scales energy based on air needed for nitrification
Blowers (Walker)	2 @ 1,500 SCFM	1 Blower, 24/7	Model scales energy based on air needed for nitrification
Secondary Clarifiers	2 @ 3 HP	1 clarifier, 24/7	Includes collector & scum pump
RAS Pumps	1 (HP not available)	1 pump, 24/7	Pumps running at 50% Influent flow in model
WAS Pumps	1 (HP not available)	1 pump, 12/7	No HP listed, assumed 5 HP
Aerobic Digester Mixer (North)	1 @ 15 HP	1 mixer, 24/7 @ 50%	Estimated Based on 37% VSR
Aerobic Digester Blower (South)	2 @ 1,500 SCFM	1 Blower, 24/7	Air requirement shared with aeration basin. 37% VSR
Primary Sludge Pump	1 @ 11.4HP	1 Pump 12/7	---
Belt Filter Press Feed Pump	1 @ 7.5HP	1 BFP, 1 day per week	Only run when BFP is running
Belt Filter Press	1 @ 4.5HP	1 BFP, 1 day per week	Includes Belt Drive & polymer system
Biosolids Pump	1 @ 20 HP	1 Pump, 1 day per week	Only run when BFP is running
Effluent Pump Station	3 @ 60 HP	1 Pump 24/7	---
Chlorination	---	1 Chlorine Pump, 24/7	Assume 5 mg/L dose

11.3.2.1 Overall Electrical Consumption at Pahokee WWTF

The results of the Pahokee HEET model are summarized by process in **Table 11.6**.

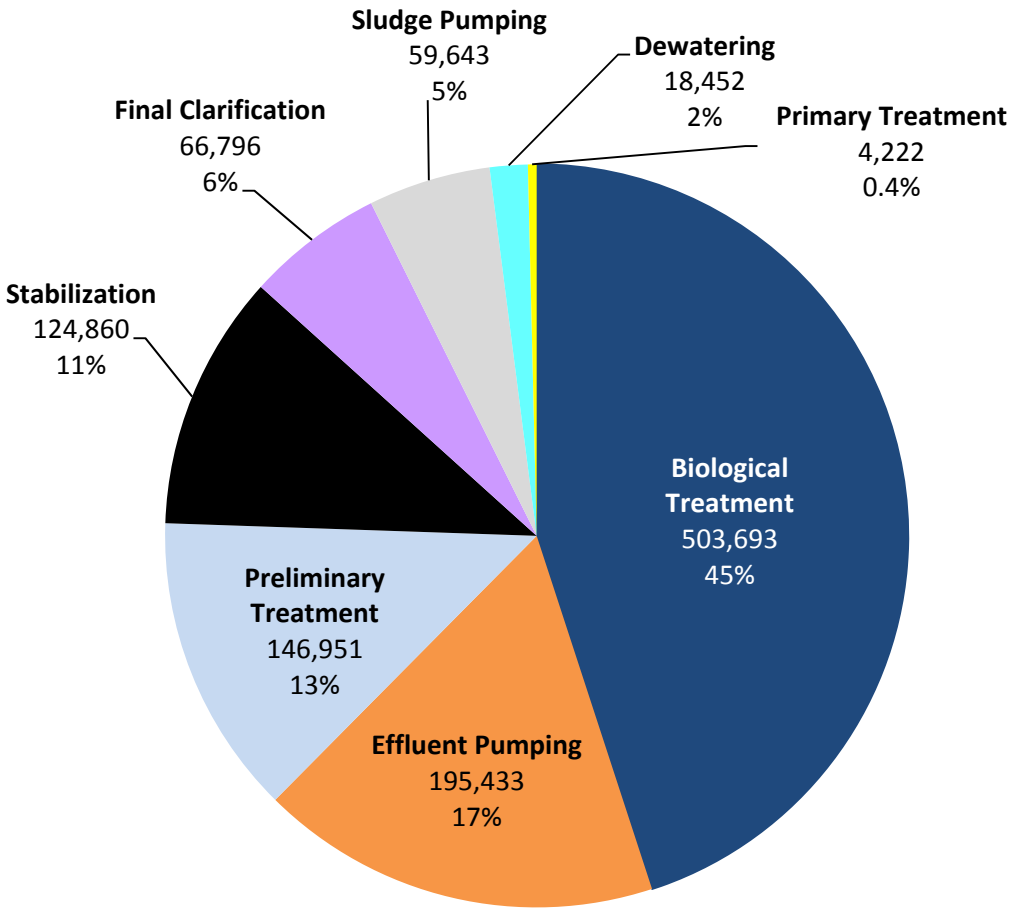
Table 11.6
HEET Model Electrical Consumption Summary for Pahokee WWTF

Process	Annual Energy Consumption (kWh/year)
Biological Treatment	503,693
Effluent Pumping	195,433
Preliminary Treatment	146,951
Stabilization	124,860
Final Clarification	66,796
Sludge Pumping	59,643
Dewatering	18,452
Primary Treatment	4,222
Disinfection	5
TOTAL	**1,120,051**

This total electrical use is slightly less than the total electrical consumption billed for the plant between October 2012 and July 2013. August and September 2013 billed electrical use was estimated based on the average of October 2012, and June and July 2013 data to have a complete year of electrical data. The billed electrical consumption was converted to energy use using $0.08/kWh, leading to an energy use of 1,168,978 kWh over that period. The total consumption estimated by the HEET model is 4% less than the billed data. This 4% variance can be explained through the exclusion of building, lighting, HVAC and other non-process related consumption in the HEET model. Based on this relative difference, the HEET model appears to provide a reasonable estimate of the process-related electrical consumption at the Pahokee WWTF. Graphically, the results are summarized in **Figure 11-10**.

The Pahokee WWTF baseline energy model provides a basis for evaluating the cost-effectiveness of proposed optimization strategies evaluated in Section 4 of TM-11. For example, if aeration basin coarse bubble diffusers were replaced (per the renewal and replacement projects listed in Technical Memorandum No. 2) with fine-bubble diffusers, the improved oxygen transfer efficiency would be updated in the model to compute the reduction in energy consumption over the next 20 years.

Figure 11-10
HEET Model Electrical Consumption for Pahokee WWTF



11.4 Conversion of Pahokee WWTF to Regional Pump Station

This section evaluates the potential conversion of the Pahokee WWTF to a wastewater pump station that would transfer all Pahokee service area flows to the Belle Glade WWTF. Key factors to be considered in this evaluation include:

- Capacity of the Belle Glade WWTF to process additional flow from the Pahokee WWTF
- Improved energy efficiency from treating all flow through the Belle Glade WWTF
- Capital savings by eliminating renewal and replacement projects at the Pahokee WWTF
- Added capital costs for Pahokee pump station and force main to Belle Glade WWTF
- Added energy costs for pumping Pahokee flows to Belle Glade WWTF

11.4.1 Capacity Analysis of Belle Glade WWTF to Treat Pahokee Service Area

Figures 11-11 and **11-12** present combined flows and loadings projections from the Belle Glade and Pahokee service areas through the Year 2035. Note that, unlike the Capacity Analysis Reports, these projections include a one percent per year reduction in infiltration and inflow based on projected improvements discussed in TM-8.

Figure 11-11
Combined Flows Projected from Belle Glade and Pahokee Service Area

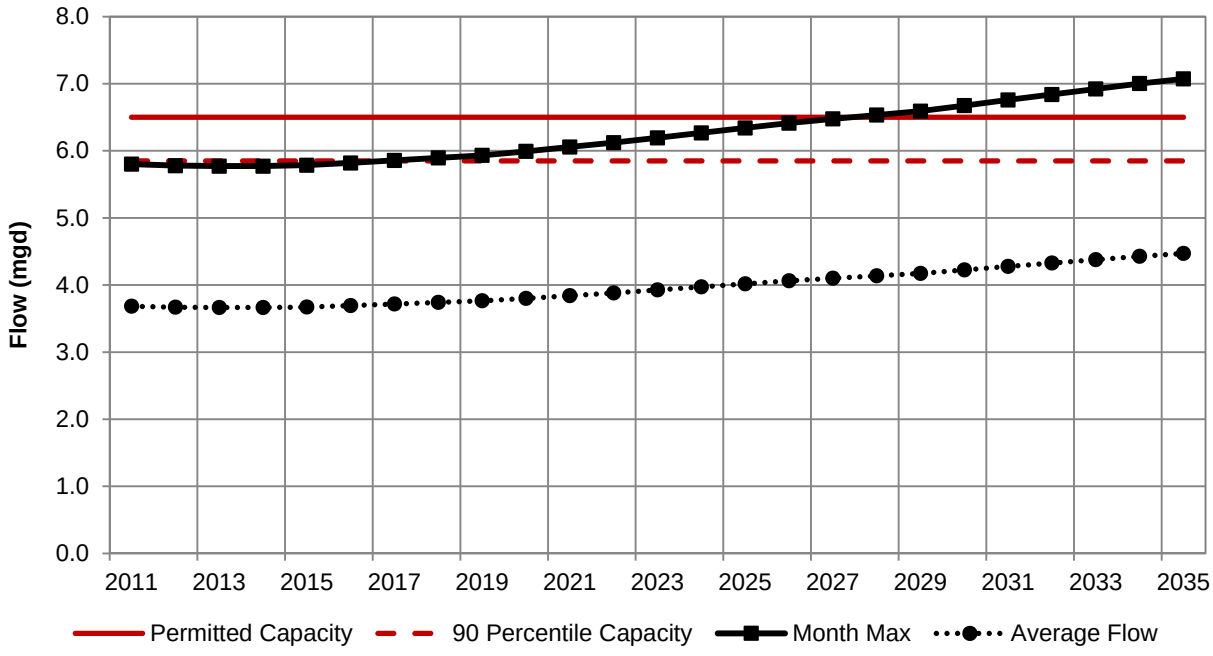


Figure 11-12
Projected Combined Loadings from Belle Glade and Pahokee Service Areas

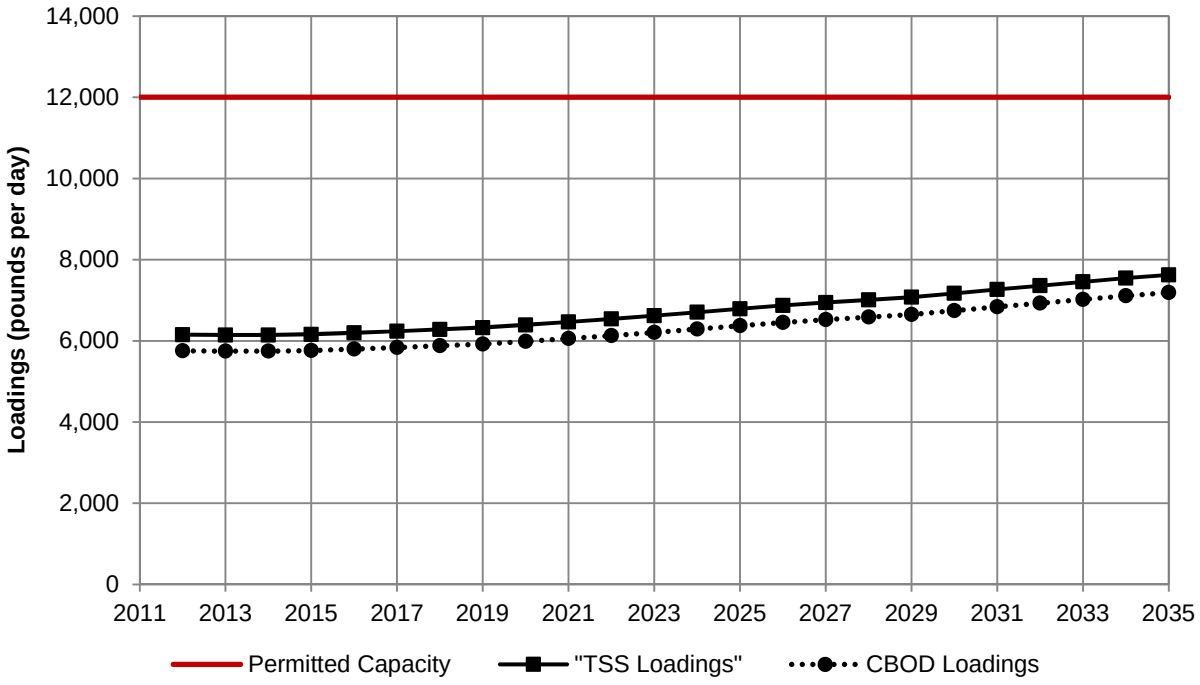


Figure 11-11 indicates that future combined flows from Belle Glade and Pahokee service areas are projected to exceed the Belle Glade WWTF's rated capacity by the Year 2027. However, due to the fact that influent BOD and TSS concentrations (130 mg/L, approximate weighted average of the two plants) are significantly lower than the original design criteria (220 mg/L), future loadings (pounds per day) are projected to remain below original design capacity criteria through the Year 2035. Therefore, a review of individual unit process capacities through the Year 2035 was conducted and is summarized below.

11.4.1.1 Mechanical Screens

Technical Memorandum No. 2 (Renewal and Replacement Improvements) recommends replacing the 6 mm screens with 3mm screens for better solids debris capture. New screens could be sized to accommodate projected combined peak flows from both service areas.

11.4.1.2 Grit Chambers

Technical Memorandum No. 2 states that the two Pista Grit Chambers are in good condition. Projected combined flows will exceed Belle Glade WWTF design flows by less than 10 percent by the Year 2035. The added flows from Pahokee may slightly reduce grit removal efficiency by the Year 2035, but expansion of the grit removal facilities would not be warranted at this time.

11.4.1.3 Oxidation Ditches

Since BOD loadings are projected to remain below original Belle Glade WWTF design loadings through the Year 2035, it would be reasonable to conclude that Oxidation Ditches 1 and 2 are adequate to treat combined flows from both service areas through the Year 2035. BioWin model runs of the Belle Glade WWTF with combined flows and loadings confirm that the oxidation ditches, in fact, have adequate volume and adequate oxygen transfer capacities to treat combined service area flows through the Year 2035.

11.4.1.4 Secondary Clarifiers

The Belle Glade WWTF contains four secondary clarifiers, as described below:

- Secondary Clarifiers 1 and 2 are abandoned rectangular basins with flight and chain sludge collectors. As discussed in Technical Memorandum No. 2, there are several cracks and evidence of leakage in exterior tank walls and the divider wall between Clarifiers 1 and 2. Plant staff indicates that the structure and collector mechanisms are difficult to clean due to the lack of drains and sumps. Crack injection and retrofit of drainage sumps would be required if these clarifiers were to be placed back unto service.

- Secondary Clarifiers 3 and 4 are 85' diameter circular tanks, consisting of center feed wells, full-radius scum troughs and perimeter effluent weirs. Technical Memorandum No. 2 indicates that the tanks and mechanisms are in good condition. Plant staff has indicated that they are easier to operate and maintain than the abandoned rectangular clarifiers.

Table 11.7 summarizes design criteria for the four secondary clarifiers, total and firm secondary clarifier capacity with the abandoned rectangular units out of service, and total and firm secondary clarifier capacity with additional circular secondary clarifiers.

Table 11.7
Belle Glade WWTF – Secondary Clarifier Capacity Analysis

Description	Current		Year 2023		Year 2035	
	All in Service	One Off-Line	All in Service	One Off-Line	All in Service	One Off-Line
Number of Clarifiers	2	1	3	2	4	3
Diameter, feet	85		85		85	
Maximum Month						
Plant Flow, mgd	3.9		4.4		7.1	
Surface Overflow Rate						
Projected, gpd/ft2	346	692	258	388	309	412
Max. Recommended, gpd/ft2	550 - 600					
Peak Hour						
Plant Flow, mgd	10.3		11.6		18.5	
Surface Overflow Rate						
Projected, gpd/ft2	910	**1,820**	681	1,022	813	1,084
Max. Recommended, gpd/ft2	**1,000 - 1,200**					
Adequate Capacity?	Yes	**No**	Yes	Yes	Yes	Yes

Table 11.7 indicates that Secondary Clarifiers 3 and 4 do not have adequate capacity to treat current or projected flows with one clarifier out of service; that one additional circular clarifier should be constructed to provide adequate firm capacity for Year 2023 flows; and that a fourth circular clarifier should be constructed around the Year 2023 to provide adequate firm capacity for Year 2035 conditions with one clarifier out of service. **Figure 11-13** shows the locations of existing, abandoned and proposed secondary Clarifiers as recommended above. Note that Technical Memorandum No. 2 already recommends a renewal and replacement capital project to construct two additional secondary clarifiers to replace the abandoned and difficult to maintain rectangular clarifiers. Therefore, costs for the additional clarifiers are not included in this life-cycle cost analysis for the consolidated WWTF option.

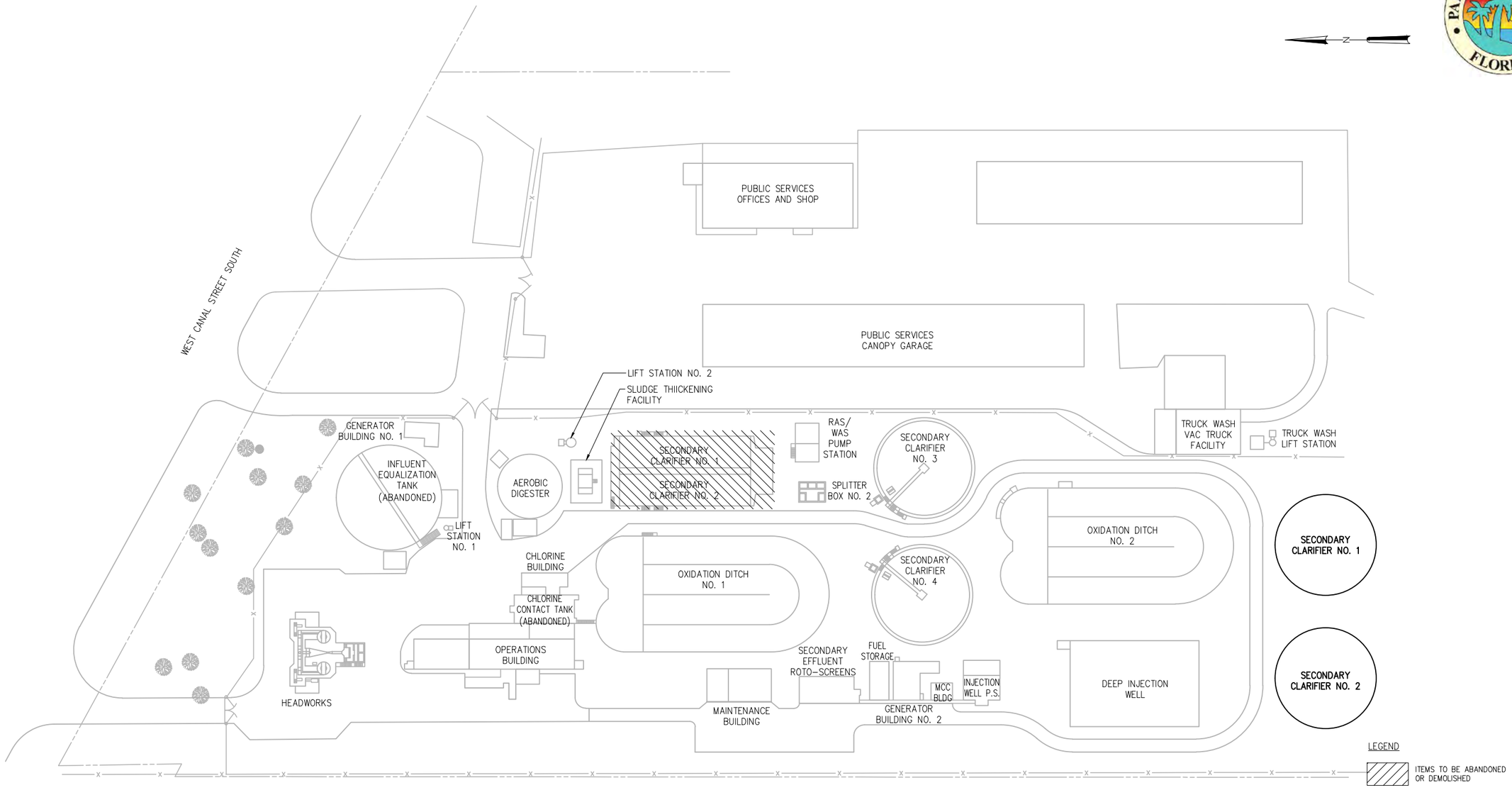


FIGURE 11-13
BELLE GLADE WASTEWATER TREATMENT FACILITY
PROPOSED SECONDARY CLARIFIERS

Palm Beach County
Water Utilities Department

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Environmental Engineers & Scientists

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11.4.1.5 Hydraulic Capacity between Oxidation Ditches and Clarifiers

Mixed liquor from Oxidation Ditches 1 and 2 combine in Splitter Box 2, which was designed to distribute mixed liquor to Secondary Clarifiers 1, 2, 3 and 4. Flow to (rectangular) Secondary Clarifiers 1 and 2 (when in service) discharged over a single 5' weir into a common clarifier influent pipe header. Flow to Secondary Clarifiers 3 and 4 discharge over separate 5' weirs and clarifier influent pipes.

Recent hydraulic profile evaluations conducted by another consultant (*Belle Glade Wastewater Treatment Plant Hydraulic Profile Technical Memorandum, AECOM, December 2010*) indicate that Splitter Box 2 weirs become submerged at current maximum month flows; and oxidation ditch weirs also become submerged at the plant's permitted capacity of 6.5 mgd. The hydraulic profile evaluations recommended that the submerged weirs be addressed by making improvements to Splitter Box 2 and clarifier influent piping.

As previously stated, two (2) new secondary clarifiers are recommended to provide adequate process capacity to treat design flows. The design of new clarifiers can incorporate the following improvements to alleviate submerged weirs at the oxidation ditches and Splitter Box 2:

- Hydraulic profile analysis to determine the required weir lengths and clarifier influent pipe diameters to eliminate weir submergence at Splitter Box 2 and upstream in Oxidation Ditches 1 and 2.
- Expansion or replacement of Splitter Box 2 to provide a fourth distribution weir and fourth clarifier influent pipe (i.e. dedicated weirs and influent pipes to each of the four clarifiers)

Costs for these improvements are also already included in the renewal and replacement project list in TM-2.

11.4.1.6 Original Design Criteria and Current Performance

The primary means of effluent disposal at the Belle Glade and Pahokee WWTFs are injection wells. Injection well design criteria is summarized in **Table 11.9**.

Table 11.9
Design Criteria for Injection Wells

Description	Belle Glade WWTF	Pahokee WWTF
FDEP Permit Number	0048217-008-UO	0138286-017-UO
Outside Diameter Final Casing,	20.00 inches	12.75 inches
Inside Diameter Final Casing	19.00 inches	11.75 inches
Velocity (fps)	8	8
Permitted Capacity (based on a velocity of 8 fps)	10.18	4.00

Injection wells are typically designed to accept a designated flow at a reasonable injection pressure. Effluent being injected underground will have had clarification, filtration and disinfection prior to injection. Hence, no floating matter or debris should be injected into the well as this may cause formation plugging. Formation plugging is a concern because it adversely affects the injection pressure. Partially clogged injection horizons require a larger amount of pressure (i.e., energy) for disposal of an equivalent flow. This leads to inefficient operation and may also impact the design operating pressures of the pumping system. The Belle Glade deep injection well is fouled due to debris from injection of unscreened raw wastewater. Staff has recovered a portion of the original flow capacity through surfactant cleaning, but the well is still fouled and pumping pressures are significantly higher than original design, resulting in higher energy consumption. Redevelopment with aggressive surging and acidization may recover significant specific capacity and reduce pumping pressures for long-term energy savings.

The Belle Glade WWTF Deep Injection Well – IW-1 Mechanical Integrity Test Report (July 2010) indicates that the injectivity index (injection flow rate divided by injection pressure) has decreased from approximately 80-100 gpm/psi in Year 2003 to approximately 30-35 gpm/psi in Year 2010. If the injection well were redeveloped, the injectivity index could likely be restored to a value of approximately 80 gpm/psi, resulting in injection flows and pressures for future conditions as shown in **Table 11.10**.

Table 11.10
Future Flow / Pressure Conditions for Redeveloped Belle Glade WWTF Injection Well

Belle Glade Flows Only	Injection Flow (mgd)	Injection Pressure (psi)	Velocity (fps)
Year 2023 AADF	3.08	27	2.4
Year 2023 MMADF	4.96	43	3.9
Year 2023 MDF	9.36	81	7.4
Year 2023 PHF	12.94	112	10.2
Year 2035 AADF	3.71	32	2.9
Year 2035 MMADF	5.97	52	4.7
Year 2035 MDF	11.28	98	8.9
Year 2035 PHF	15.58	135	12.2
Belle Glade and Pahokee Flows			
Year 2023 AADF	3.93	34	3.1
Year 2023 MMADF	6.17	54	4.8
Year 2023 MDF	11.79	102	9.3
Year 2023 PHF	16.23	141	12.8
Year 2035 AADF	4.47	39	3.5
Year 2035 MMADF	7.02	61	5.5
Year 2035 MDF	13.41	116	10.5
Year 2035 PHF	18.46	160	14.5

11.4.2 Re-Rating Injection Wells

Belle Glade and Pahokee injection wells are rated at a velocity of 8 feet per second (fps); FDEP now allows re-rating of wells by minor permit revision to a design velocity of 10 fps and an emergency discharge velocity of 12 fps. Re-rating injection wells at both plants is desirable to meet future flow conditions listed in **Table 11.10**.

Under the option of consolidating treatment at the Belle Glade WWTF, a fully redeveloped, re-rated injection well at Belle Glade WWTF would provide adequate disposal capacity to meet Year 2035 maximum day flow conditions, but not peak hour flow conditions. Maximum day flows are associated with extreme wet-weather events; under these conditions, the emergency discharge velocity of 12 fps would apply. There appears to be adequate land available to construct a lined pond to store the difference between peak hour flows and maximum day flows. That stored volume could then be pumped back through the plant (with rented portable pumps) for deep well injection once the wet-weather flow conditions subside.

If redevelopment of the Belle Glade WWTF injection well did not recover sufficient specific capacity to take advantage of full re-rating, an effluent pipeline from the Belle Glade WWTF

back to the Pahokee injection well would be recommended and could be installed in a common trench with the Pahokee Wastewater Pump Station force mains.

11.4.3 Effluent Pump Station

The Belle Glade WWTF Effluent Pump Station includes four 300 horsepower vertical turbine pumps, each with a rated capacity of 3,450 gpm at 245 feet of total dynamic head (TDH) or 2,950 gpm at 300 feet TDH. Based on the vendor O&M manual pump/system curves for the effluent pumps, the pump station has a firm capacity (3 of 4 pumps running) of 8,900 gpm (12.7 mgd) at 300 feet (130 psi) total dynamic head. Under this consolidated plant scenario, the Belle Glade WWTF Effluent Pump Station must have adequate capacity to pump combined Year 2035 maximum day flows from both service areas of 13.41 mgd at 268 feet TDH (116 psi) (per Table 10).

The existing pumps have adequate capacity to pump combined plant flows to a redeveloped, re-rated injection wells for at least the next 10 years. It appears that pumps could be upgraded by changing bowls and impellers to meet Year 2035 maximum day flows.

11.4.4 Demolition of Pahokee WWTF and Conversion to Pump Station

This analysis assumes that the Pahokee WWTF would be completely demolished so that the land could be restored for another use. For the life-cycle cost analysis, it was assumed that a demolition crew would consist of a foreman, 6 laborers, 3 equipment operators, 2 truck drivers and 2 dump trucks. It was assumed that the combined crew and equipment cost would total $9,000 per day; that debris would be disposed at a landfill for $50 per cubic yard; and that the crew would complete the demolition, disposal and restoration in two months. The total cost for demolition, disposal and restoration was projected at $640,000.

This analysis assumes that the new Pahokee Pump Station would be constructed as a skid-mounted, inline wastewater pump station similar to the South Bay Pump Station (placed into service in 2010). The proposed station would consist of three pumps (two duty plus one standby) designed to pump a peak flow of 4.2 mgd. Pumps would be powered by variable speed drives to modulate input based on a range of minimum to peak flow rates; and the skid-mounted station would include a master control panel to automatically control pumping rates. The total estimated construction cost for the proposed pump station is projected at $1,200,000.

11.4.5 New Force Main to Belle Glade WWTF

Multiple alignments are available to route force mains from the Pahokee. For the three most likely alignments considered, the total length is approximately eight (8) miles. Minimum, average and peak flows from the Pahokee pump station would be 0.5 mgd, 1.0 mgd and 4.2 mgd, respectively. The force main diameter must be sized to maintain minimum velocity of 2 feet per second at average flows to prevent solids settling; while limiting maximum velocities and total head loss at peak flow conditions. Due to the wide range in flows and the length of

the force main, two parallel 12-inch force mains are assumed to satisfy minimum and maximum flow conditions. The total cost for installation of dual force mains was projected at $8,100,000.

11.4.6 Life-Cycle Cost Analysis of Separate WWTFs vs. Conversion of Pahokee WWTF to Regional Pump Station with Combined Treatment at Belle Glade WWTF

Life cycle cost analyses were performed for the following options:

- Upgrade the Belle Glade and Pahokee WWTFs separately as required for each WWTF to treat projected Year 2035 flows and loadings
- Convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF

Life cycle cost analyses were based on the following common economic assumptions:

- Duration: 20 years
- Annual interest rate: 3.8% (Bond-Buyer 20-year GO Index, 12-month average)
- Annual Inflation: 2.3% (20-year average Consumer Price Index)

Life cycle costs included the following components:

- Capital costs for Belle Glade and Pahokee renewal and replacement projects identified in Technical Memorandum No. 2
- Annual labor costs for operations and maintenance staff at each plant
- Annual treatment costs (energy, chemicals) at each plant
- Annual miscellaneous fixed O&M costs at each plant
- Capital costs for demolition of the Pahokee WWTF, construction of the Pahokee Pump Station and force mains to the Belle Glade WWTF
- Annual O&M costs for the Pahokee Pump Station and force mains

Summaries of life-cycle and total net present worth costs for upgrades and continued operation of separate Belle Glade and Pahokee WWTFs are presented in **Tables 11.11** and **11.12**, respectively. The cost for improvements to the Pahokee WWF monitoring well is pending and should be added to the Pahokee WWTF renewal and replacement costs once determined.

A summary of life-cycle and total net present worth costs for the option to convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF, including Belle Glade upgrades, is presented in **Table 11.13**. A summary of new present worth costs for the two options is presented in **Table 11.14**.

Table 11.11
Life Cycle Cost Analysis Summary for Upgrades to and Separate Operation of Belle Glade WWTF

Assumptions:	Value	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	R&R Capital Improvements	Labor	Treatment	Miscellaneous	O&M Cost per Year	Operation Cost Per 1,000 Gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	2.74	$1,360,000	$846,084	$540,750	$814,918	$2,201,752	$2.20	$2,201,752	$1,360,000	$3,561,752
2015	2.77	$1,580,000	$846,084	$545,618	$814,918	$2,206,620	$2.18	$2,174,010	$1,580,000	$3,754,010
2016	2.81	$840,000	$846,084	$554,035	$814,918	$2,215,037	$2.16	$2,150,052	$840,000	$2,990,052
2017	2.86	$0	$846,084	$563,195	$814,918	$2,224,197	$2.13	$2,127,038	$0	$2,127,038
2018	2.90	$0	$846,084	$572,420	$814,918	$2,233,422	$2.11	$2,104,296	$0	$2,104,296
2019	2.95	$2,560,000	$846,084	$581,387	$814,918	$2,242,389	$2.08	$2,081,521	$2,560,000	$4,641,521
2020	3.02	$1,330,000	$846,084	$594,617	$814,918	$2,255,619	$2.05	$2,062,859	$1,330,000	$3,392,859
2021	3.09	$270,000	$846,084	$608,721	$814,918	$2,269,723	$2.01	$2,045,081	$270,000	$2,315,081
2022	3.16	$520,000	$846,084	$622,675	$814,918	$2,283,677	$1.98	$2,027,246	$520,000	$2,547,246
2023	3.24	$1,260,000	$846,084	$637,876	$814,918	$2,298,878	$1.95	$2,010,581	$1,260,000	$3,270,581
2024	3.31	$250,000	$846,084	$653,575	$814,918	$2,314,577	$1.91	$1,994,396	$250,000	$2,244,396
2025	3.39	$380,000	$846,084	$669,210	$814,918	$2,330,212	$1.88	$1,978,195	$380,000	$2,358,195
2026	3.47	$400,000	$846,084	$684,685	$814,918	$2,345,687	$1.85	$1,961,904	$400,000	$2,361,904
2027	3.54	$70,000	$846,084	$698,325	$814,918	$2,359,327	$1.82	$1,944,149	$70,000	$2,014,149
2028	3.61	$140,000	$846,084	$711,044	$814,918	$2,372,046	$1.80	$1,925,744	$140,000	$2,065,744
2029	3.67	$180,000	$846,084	$723,688	$814,918	$2,384,690	$1.78	$1,907,398	$180,000	$2,087,398
2030	3.76	$410,000	$846,084	$741,132	$814,918	$2,402,134	$1.75	$1,892,957	$410,000	$2,302,957
2031	3.85	$180,000	$846,084	$758,574	$814,918	$2,419,576	$1.72	$1,878,524	$180,000	$2,058,524
2032	3.94	$3,860,000	$846,084	$775,849	$814,918	$2,436,851	$1.70	$1,863,976	$3,860,000	$5,723,976
2033	4.02	$2,220,000	$846,084	$792,996	$814,918	$2,453,998	$1.67	$1,849,352	$2,220,000	$4,069,352
2034	4.11	$210,000	$846,084	$810,074	$814,918	$2,471,076	$1.65	$1,834,701	$210,000	$2,044,701
							Total	***$42,015,800***	***$18,020,000***	***$60,035,800***

Notes:

1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD

2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow

3. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.

Table 11.12
Life Cycle Cost Analysis Summary for Upgrades to and Separate Operation of Pahokee WWTF

Assumptions:	**Value**	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	R&R Capital Improvements	Labor	Treatment	Miscellaneous	O&M Cost per Year	Operation Cost Per 1,000 gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	0.96	$1,300,000	$205,011	$163,550	$355,242	$723,803	$2.06	$723,803	$1,300,000	$2,023,803
2015	0.98	$240,000	$205,011	$166,066	$355,242	$726,319	$2.04	$715,586	$240,000	$955,586
2016	0.99	$110,000	$205,011	$168,583	$355,242	$728,836	$2.01	$707,454	$110,000	$817,454
2017	1.01	$220,000	$205,011	$144,877	$355,242	$705,130	$1.92	$674,329	$220,000	$894,329
2018	1.02	$770,000	$205,011	$146,939	$355,242	$707,192	$1.90	$666,305	$770,000	$1,436,305
2019	1.04	$590,000	$205,011	$149,283	$355,242	$709,536	$1.87	$658,635	$590,000	$1,248,635
2020	1.05	$160,000	$205,011	$151,229	$355,242	$711,482	$1.85	$650,681	$160,000	$810,681
2021	1.07	$110,000	$205,011	$153,488	$355,242	$713,741	$1.83	$643,101	$110,000	$753,101
2022	1.08	$960,000	$205,011	$155,461	$355,242	$715,714	$1.81	$635,348	$960,000	$1,595,348
2023	1.10	$5,830,000	$205,011	$157,626	$355,242	$717,879	$1.79	$627,852	$5,830,000	$6,457,852
2024	1.11	$350,000	$205,011	$159,542	$355,242	$719,795	$1.78	$620,224	$350,000	$970,224
2025	1.12	$20,000	$205,011	$161,607	$355,242	$721,860	$1.76	$612,811	$20,000	$632,811
2026	1.14	$100,000	$205,011	$163,420	$355,242	$723,673	$1.74	$605,272	$100,000	$705,272
2027	1.15	$50,000	$205,011	$165,381	$355,242	$725,634	$1.73	$597,943	$50,000	$647,943
2028	1.16	$80,000	$205,011	$167,090	$355,242	$727,343	$1.71	$590,494	$80,000	$670,494
2029	1.18	$630,000	$205,011	$168,947	$355,242	$729,200	$1.70	$583,252	$630,000	$1,213,252
2030	1.19	$100,000	$205,011	$170,552	$355,242	$730,805	$1.69	$575,897	$100,000	$675,897
2031	1.20	$150,000	$205,011	$172,304	$355,242	$732,557	$1.67	$568,747	$150,000	$718,747
2032	1.21	$170,000	$205,011	$173,770	$355,242	$734,023	$1.66	$561,464	$170,000	$731,464
2033	1.22	$30,000	$205,011	$175,493	$355,242	$735,746	$1.65	$554,465	$30,000	$584,465
2034	1.23	$40,000	$205,011	$176,824	$355,242	$737,077	$1.64	$547,258	$40,000	$587,258
Notes:							***Total***	***$13,121,000***	***$12,010,000***	***$25,131,000***

1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD

2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow

3. Reduction in Pahokee treatment cost starting in Year 2017 based on upgrades to high-efficiency blowers and fine bubble diffusers under R&R projects already accounted for in TM-2

4. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.

Table 11.13
Life Cycle Cost Analysis Summary for Consolidation of Pahokee Treatment to Belle Glade WWTF

Assumptions:	**Value**	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	Pahokee Decommission, PS and FM	Belle Glade Capital Improvements to Treat Pahokee	Belle Glade R&R Capital Improvements	BG (with Pahokee Flows) Labor	BG (with Pahokee Flows) Treatment	BG (with Pahokee Flows) Miscellaneous	Pahokee PS and FM O&M (Energy, Maint.)	O&M Cost per Year	Operation Cost Per 1,000 Gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	3.70	$0	$0	$1,360,000	$1,051,095	$730,428	$814,918	$0	$2,596,441	$1.92	$2,596,442	$1,360,000	$3,956,442
2015	3.74	$0	$0	$1,580,000	$1,051,095	$738,214	$814,918	$0	$2,604,227	$1.91	$2,565,741	$1,580,000	$4,145,741
2016	3.80	$10,470,000	$0	$840,000	$1,051,095	$749,550	$814,918	$96,000	$2,703,463	$1.95	$2,624,149	$11,310,000	$13,934,149
2017	3.86	$0	$0	$0	$1,051,095	$761,897	$814,918	$97,564	$2,717,242	$1.93	$2,598,545	$0	$2,598,545
2018	3.93	$0	$0	$0	$1,051,095	$773,949	$814,918	$98,953	$2,730,566	$1.91	$2,572,696	$0	$2,572,696
2019	3.99	$0	$0	$2,560,000	$1,051,095	$786,131	$814,918	$100,531	$2,744,193	$1.89	$2,547,326	$2,560,000	$5,107,326
2020	4.07	$0	$0	$1,330,000	$1,051,095	$802,030	$814,918	$101,842	$2,761,292	$1.86	$2,525,319	$1,330,000	$3,855,319
2021	4.16	$0	$0	$270,000	$1,051,095	$819,232	$814,918	$103,363	$2,779,887	$1.83	$2,504,753	$270,000	$2,774,753
2022	4.24	$0	$0	$520,000	$1,051,095	$835,893	$814,918	$104,692	$2,797,764	$1.81	$2,483,607	$520,000	$3,003,607
2023	4.33	$0	$0	$1,260,000	$1,051,095	$854,063	$814,918	$106,150	$2,817,269	$1.78	$2,463,962	$1,260,000	$3,723,962
2024	4.42	$0	$0	$250,000	$1,051,095	$872,390	$814,918	$107,440	$2,836,777	$1.76	$2,444,359	$250,000	$2,694,359
2025	4.52	$0	$0	$380,000	$1,051,095	$890,856	$814,918	$108,831	$2,856,597	$1.73	$2,424,993	$380,000	$2,804,993
2026	4.61	$0	$0	$400,000	$1,051,095	$908,818	$814,918	$110,052	$2,875,597	$1.71	$2,405,114	$400,000	$2,805,114
2027	4.69	$0	$0	$70,000	$1,051,095	$925,148	$814,918	$111,372	$2,893,136	$1.69	$2,384,023	$70,000	$2,454,023
2028	4.77	$0	$0	$140,000	$1,051,095	$940,211	$814,918	$112,523	$2,909,253	$1.67	$2,361,875	$140,000	$2,501,875
2029	4.85	$0	$0	$180,000	$1,051,095	$955,401	$814,918	$113,774	$2,925,588	$1.65	$2,340,037	$180,000	$2,520,037
2030	4.95	$0	$0	$410,000	$1,051,095	$975,047	$814,918	$114,854	$2,946,223	$1.63	$2,321,716	$410,000	$2,731,716
2031	5.05	$0	$0	$180,000	$1,051,095	$994,893	$814,918	$116,035	$2,967,150	$1.61	$2,303,652	$180,000	$2,483,652
2032	5.14	$0	$0	$3,860,000	$1,051,095	$1,014,178	$814,918	$117,022	$2,987,339	$1.59	$2,285,051	$3,860,000	$6,145,051
2033	5.24	$0	$0	$2,220,000	$1,051,095	$1,033,689	$814,918	$118,182	$3,007,912	$1.57	$2,266,786	$2,220,000	$4,486,786
2034	5.34	$0	$0	$210,000	$1,051,095	$1,052,590	$814,918	$119,078	$3,027,634	$1.55	$2,247,929	$210,000	$2,457,929
Notes:										***Total***	***$51,268,100***	***$28,4900,000***	***$79,758,100***
1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD													
2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow													
3. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.													

Table 11.14
Net Present Worth Cost Comparison of Separate and Consolidated WWTF Options

Description	O&M Costs	Capital Improvements	Total
Belle Glade WWTF	*$42,015,800*	*$18,020,000*	*$60,035,800*
Pahokee WWTF	*$13,121,000*	*$12,010,000*	*$25,131,000*
Total Belle Glade and Pahokee WWTFs (separate treatment plants)	$55,136,800	$30,030,000	$85,166,800
Convert Pahokee WWTF to Pump Station, treat all flows at Belle Glade WWTF	$51,628,100	$28,490,000	$79,758,100

The total net present worth of the option to convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF results in approximately $5 million in net present worth savings (including approximately $1.5 million of capital cost savings) over the option to upgrade and continue operation of both plants. The cost to demolish the Pahokee WWTF and construct a Pahokee Pump Station and force mains is more than offset by the savings in eliminating renewal and replacement costs required for long-term operation of the Pahokee WWTF. Annual O&M costs associated with the Pahokee Pump Station are also more than offset by the savings in consolidating treatment costs to the Belle Glade WWTF.

Based on these preliminary life-cycle cost analyses, it is recommended that the County convert the Pahokee WWTF to a Pahokee Wastewater Pump Station and treat flows from the Belle Glade and Pahokee service areas at the upgraded Belle Glade WWTF. A Business Case Evaluation should be performed to justify this project.

11.5 Potential Optimization Improvements at Belle Glade WWTF

Since the life-cycle cost analysis shows that treatment of flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF is more cost effective than upgrading and maintaining the Pahokee WWTF in service, this section evaluates options for optimizing the Belle Glade WWTF under the combined flow scenario. Based on process, hydraulic and operational evaluations of the existing Belle Glade WTF, the following potential optimization improvements were identified in the scope of work:

11.5.1 Influent Flow Equalization

Influent flow equalization is typically used to attenuate dry-weather diurnal peaks. Peak flow attenuation provides more constant, steady-state loading of the activated sludge process, which generally results in better process control, reduced aeration energy demand and improved secondary effluent quality.

Influent flow equalization is generally not practical for attenuating wet-weather peak flows. Operating data and discussions with plant staff indicate that infiltration and inflow in the Belle Glade and Pahokee service areas results in wet weather peak flows that remain elevated for several days. A sustained wet-weather flow of 12 mgd lasting two days (consistent with reports from plant staff) would require an equalization volume of several million gallons. The abandoned equalization tank volume is only 830,000 gallons.

Influent flow equalization can also improve a plant's hydraulic profile by eliminating submerged weirs at peak flow conditions. According to the Belle Glade Wastewater Treatment Plant Hydraulic Profile Technical Memorandum (AECOM, December 2010), clarifier influent splitter box weirs become submerged at current maximum month flows; and oxidation ditch weirs also become submerged at the plant's permitted capacity of 6.5 mgd. This previous hydraulic study recommended that weir submergence be addressed by reducing the head loss through the clarifier influent splitter box and clarifier influent piping. Construction of two additional circular clarifiers to restore process capacity related to the abandoned rectangular clarifiers is recommended. The clarifier influent splitter box would be modified to incorporate the new circular clarifiers. These improvements will address hydraulic profile issues without the need for influent flow equalization.

Therefore, the benefits of influent flow equalization are limited to reduced aeration energy demand. Aeration energy savings are far less than the capital and O&M costs to construct and operate an influent flow equalization system. Therefore, this optimization is not recommended.

11.5.2 Evaluation of Permanent Sludge Dewatering Facilities

Digested sludge from the Belle Glade WWTF is currently dewatered and hauled off site once per month by a contract provider using portable centrifuge dewatering equipment. The scope includes an evaluation of whether relocation of the dewatering and Bioset stabilization systems from the Pahokee WWTF for implementation of permanent dewatering at the Belle Glade WWTF would be more cost effective than continued contract dewatering.

Before conducting a payback analysis, confirmation that the belt filter press and Bioset systems can process Year 2035 sludge production rates is required. Projected annual sludge production rates from the Belle Glade WWTF (based on consolidated treatment of both service areas at the Belle Glade WWTF), capacities of the existing belt press and Bioset systems and required run times are listed in **Table 11.15**.

Table 11.15
Belt Filter Press Capacity Analysis for Consolidated WWTF Option

Year	Digested Sludge (lbs per day)	Belt Press / Bioset Capacity (lbs/hour)	Belt Press / Bioset Run Time (hours/day)
2023 Average Annual	2,731	675	4.0
2023 Maximum Month	3,928	675	5.8
2035 Average Annual	3,167	675	4.7
2035 Maximum Month	4,644	675	6.9

Therefore, the belt filter press and Bioset systems have adequate capacity to process combined plant sludge production rates.

The estimated capital cost to relocate the belt filter press and Bioset systems from the Pahokee WWTF to the Belle Glade WWTF, including new concrete structures, piping, electrical and SCADA connections, is approximately $900,000. A summary of the comparative net present worth analysis for permanent dewatering facilities and continued contract dewatering and disposal is presented in **Table 11.16**.

Table 11.16
Permanent Dewatering and Bioset Stabilization Net Present Worth Analysis

Contract Dewatering and Disposal	
Net Present Worth of Annual Costs	$3,930,000
Permanent Dewatering	
Capital Costs	$900,000
Net Present Worth of Annual Costs	$2,990,000
Total Net Present Worth	$3,890,000
Cost/Savings from Permanent Dewatering	$40,000

The total net present worth costs of the two options are virtually equal. Therefore, relocation of Pahokee dewatering and Bioset systems to the Belle Glade WTP for permanent dewatering is not recommended at this time. Should contract disposal costs increase significantly due to a potential reduction in available Class B disposal sites, permanent dewatering and stabilization at the Belle Glade WWTF should be reconsidered.

11.5.3 Feasibility of One Oxidation Ditch Offline (Energy Savings)

The Belle Glade WWTF operates both Oxidation Ditches 1 and 2 at current MMADF flows of 2.8 mgd, or less than half of the plant's rated MMADF capacity of 6.5 mgd. BioWin modeling was conducted to evaluate whether the plant could take one oxidation ditch off line; and if so for how many years. Modeling results presented below in **Table 11.17** indicate that one

oxidation ditch has adequate volume and oxygen transfer capacity to process MMADF flows from both the Belle Glade and Pahokee service areas through the Year 2023.

Table 11.17
Modeling Results for Operating One of Two Belle Glade WWTF Oxidation Ditches

	Annual Average	Maximum Month	Maximum Day
BOD, pounds/day	2,814	3,972	5,130
Dissolved Oxygen, mg/L	2.0	1.5	1.0
Aerator Horsepower Required	135	163	176
Aerator Horsepower Available	200	200	200

HEET modeling indicates that energy savings from taking one oxidation ditch out of service through the Year 2023 would result in an annual savings of approximately $30,000 per year. Over ten years (Years 2013 to 2023), energy savings would total approximately $300,000.

11.6 Summary and Conclusions

Based on the evaluations and analyses presented above, a summary of conclusions and recommendations is presented below:

- The Belle Glade WWTF has adequate capacity to treat projected Belle Glade service area flows through the Year 2035
- The Pahokee WWTF's hydraulic treatment capacity will be exceeded by the Year 2018.
- The Belle Glade WWTF has adequate capacity to treat projected flows from the Belle Glade and Pahokee service areas through the Year 2035, provided that Belle Glade WWTF renewal and replacement projects (Technical Memorandum No. 2) are completed.
- The option to demolish the Pahokee WWTF, convert the Pahokee WWTF to a regional wastewater pump station, install force mains to convey Pahokee service area flows to the Belle Glade WWTF, and consolidate treatment to the Belle Glade WWTF is more cost-effective than upgrading both plants, expanding the Pahokee WWTF and operating / maintaining two separate treatment plants. A Business Case Evaluation should be performed to justify this project.
- Influent flow equalization at the Belle Glade WWTF is not cost-effective and is not recommended.
- Under the consolidated treatment option, the Belle Glade WWTF can treat flows with one oxidation ditch and take the second oxidation ditch offline until the Year 2023, resulting in a total energy savings of approximately $300,000.

- Hydraulic constraints (submerged weirs and limited freeboard) at the Belle Glade WWTF oxidation ditches and clarifier influent splitter box can be alleviated when new circular clarifiers are added to replace the two abandoned rectangular clarifiers.
- The Belle Glade deep injection well should be redeveloped and acidized to recover specific capacity; and re-rated to 10 feet per second. If redeveloped and re-rated, the Belle Glade injection well will have adequate capacity to serve the consolidated treatment plant option through Year 2035 maximum day flows. A lined effluent storage pond may become necessary after Year 2023 to store the difference between maximum day and peak hour flows until those stored flows can be pumped back to the treatment process.

The Pahokee WWTF dewatering belt press and Bioset stabilization systems have adequate capacity to process projected sludge production from the Belle Glade WWTF under the consolidated treatment option. Net present worth costs of the two options are virtually equal. Continued contract dewatering and hauling at the Belle Glade WWTF is recommended unless contract costs increase due to the potential reduction in Class B disposal sites.

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Chapter 12.0
Implementation Plan

This chapter describes an implementation plan for projects identified during development of the Glades Wastewater Master Plan. Estimated costs for projects identified have been prepared and assigned to fiscal years based on criticality of renewal and replacement improvements and priorities established with the PBCWUD staff. For the purpose of this plan, the planning horizon extends through Fiscal Year 2035. Fiscal years commence on October 1st. Therefore, Fiscal Year 2015 is represented as FY15; meaning the period from October 1, 2014 through September 30, 2015.

12.1 Introduction

The wastewater master planning effort for the Glades Region Urban Service area includes an evaluation of its wastewater system, consisting of collection (i.e., lift stations), transmission (force mains), treatment and disposal.

12.2 Implementation Plan

Projects have been grouped based on the following categories:

- Collection System (Lift Stations)
- Transmission System (Force Mains)
- Infiltration and Inflow
- Wastewater Treatment

Wastewater treatment and disposal projects have been further subdivided into the following sub-categories:

- Belle Glade WWTF Renewal and Replacement
- Pahokee WWTF Renewal and Replacement
- Pahokee Conversion to Regional Pump Station (for treatment at Belle Glade WWTF)

As discussed in Chapter 11, the wastewater master plan presents two possible scenarios for treatment of wastewater flows from the Pahokee service area. The first option assumes continued treatment at a rehabilitated Pahokee WWTF. The second option assumes demolition of the Pahokee WWTF, construction of a regional Pahokee Regional Wastewater Pump Station and force main, and treatment of Pahokee service area wastewater flows at the Belle Glade WWTF. Each scenario is presented separately below. PBCWUD is in the process of conducting a Business Case Evaluation of the two scenarios, and this implementation plan should be updated once the County selects between the two scenarios.

In addition to the categories listed above, tables presented below include descriptive columns to further define the projects. For example, each project has been assigned a: 1) project number, 2) project name, 3) improvement type, and 4) cost. The project number is an identification code to facilitate project tracking, and the project name is a short descriptive title related to the project scope. Brief descriptions of the project scopes are also included herein where applicable. The detailed descriptions of the project scopes are presented in prior sections of this report.

The improvement type column, if applicable, provides an indication of what drives the need for the project. In some instances, as discussed below, the criteria is either not applicable or is being addressed separately by the PBCWUD engineering staff. Descriptions of criteria are presented below:

1. Regulatory: Regulatory driven projects are improvements that are considered necessary for compliance with current regulations and/or possible future regulations.

2. Capacity: Capacity driven projects are improvements that increase the capacity of the wastewater collection, wastewater pumping, transmission and treatment/ disposal systems to meet the needs of current customers as well as meeting the needs for forecasted population growth.

3. Renewal and Replacement: Renewal and Replacement (R&R) projects are those needed to address aging infrastructure to maintain a reliable and sustainable utility.

4. Facility Improvement: Facility improvement projects are those recommended to enhance operational effectiveness, reliability, and / or efficiency.

12.3 Opinions of Probable Construction Cost

The opinions of probable cost presented herein have been prepared based upon master plan level information. Because of the level of scope development at this stage the opinion is an “Order Of Magnitude” estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected range of accuracy for this type of opinion is +50 percent to -30 percent. These opinions of probable cost have been prepared for guidance in project evaluation and implementation from the information available at this stage of the

estimate. The final costs of the projects will depend on actual labor and material cost, competitive market conditions, final project scope, implementation schedule, and other variable conditions. As a result, the final project costs will vary from the opinions presented herein.

The cost opinions are "project costs" and are inclusive of: construction costs; contractor overhead and profit; estimated allowance for permit application fees; 20 percent estimated allowance for engineering services during the design, permitting, construction and startup of the project; along with a 30 percent contingency. The costs are based upon year 2013 dollars and do not include escalation for inflation.

12.3.1 Collection System (Lift Station) Projects

The opinions of probable cost for collection system projects are presented in **Table 12.1**.

Table 12.1
Opinions of Probable Project Cost
Collection System (Lift Station) Projects

Project No.	Project Name	Improvement Type	Project Cost
LS001	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	R&R	$4,111,250
LS002	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	R&R	$5,692,500
LS003	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	R&R	$2,530,000
LS004	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	R&R	$2,530,000
LS005	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	R&R	$2,530,000
LS006	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	R&R	$4,743,750
LS007	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	R&R	$4,117,000
Total – Collection System (Lift Station) Projects			***$26,254,500***

See Chapter 7 for further details regarding the scope of rehabilitation of the various lift stations.

12.3.2 Transmission System (Force Main) Projects

The opinions of probable cost for transmission system projects are presented in **Table 12.2**.

Table 12.2
Opinions of Probable Project Cost
Transmission System (Force Main) Projects

Project No.	Project Name	Improvement Type	Project Cost
FM001	Belle Glade – North Canal Street Force Main Upgrade	Capacity	$220,000
FM002	Belle Glade - South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade	Capacity	$2,550,000
Total – Transmission System (Force Main) Projects			***$2,770,000***

Project No. FM001

Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade between LS 8103 and LS 8104, and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS 8103 pump run-time is reduced below the performance criteria threshold and surcharging is eliminated. It is recommended that this improvement be implemented within the current 5 year planning horizon.

Project No. FM002

Replace the existing 10-inch diameter force main from the South Bay Booster Pump Station to the Belle Glade WWTF and with approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump run-time and wet well surcharging at LS 8201, LS 8302, LS 8306 and LS 8308 by reducing high head-loss in the upgraded force main which supports a reduction of the South Bay Booster Pump Station suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS 8301, LS 8302, LS 8306 and LS 8308, thereby eliminating surcharging and reducing run-time below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which is well above the 2 feet/second minimum velocity requirement. Because this improvement successfully address several deficiencies at upstream lift stations, including overflows at LS 8306 and LS 8308, it is recommended that this proposed improvement be implemented as soon as is practical within the current 5-year planning horizon.

12.3.3 Infiltration and Inflow Projects

The opinions of probable cost for infiltration and inflow related projects are presented in **Table 12.3**.

Table 12.3
Opinions of Probable Project Cost
Infiltration and Inflow Projects

Project No.	Project Name	Improvement Type	Project Cost
I&I001	Inspection – Belle Glade service area	R&R	$420,000
I&I002	Inspection – Pahokee service area	R&R	$150,000
I&I003	Inspection – South Bay service area	R&R	$80,000
I&I004	Rehabilitation – Belle Glade service area	R&R	$6,680,000
I&I005	Rehabilitation – Pahokee service area	R&R	$1,290,000
I&I006	Rehabilitation – South Bay service area	R&R	$650,000
Total – Infiltration and Inflow (I&I) Projects			***$9,270,000***

Project Nos. I&I 001, 002 and 003

Inspection projects for the Belle Glade, Pahokee and South Bay collection systems will consist of field investigations in the identified priority basins (referenced in Chapter 8) to identify the specific defects in mains, manholes, and laterals that contribute to the elevated rates of I/I observed. Investigations should include manhole inspection, smoke testing, and video inspection of sewer mains. Television inspection of suspect laterals should be performed as warranted following inspection of mains. Flow data analysis and night flow isolation can be used to focus and limit the scope of such investigations. During the investigation activities, inflow dishes should be installed in manholes and missing or damaged cleanout caps should be replaced. Process, evaluate, and electronically store the results of inspection activities. Estimate flow rates associated with I/I sources and develop repair recommendations with cost estimates and payback period analysis. Prioritize the recommended rehabilitation work based on cost-effectiveness as well as other factors such as structural condition and maintenance demand.

Project Nos. I&I 004, 005 and 006

Based on inspection results, rehabilitation projects in the priority basins of the Belle Glade,

Pahokee and South Bay collection systems will generally consist of lining (manholes, manhole to manhole, sectional and lateral), excavated point repairs, excavated line replacements and manhole repairs. More specific scopes for rehabilitation projects will be identified based on the recommendations developed in Projects I&I 001, 002 and 003.

12.3.4 Wastewater Treatment and Disposal

Opinions of probable construction cost for wastewater treatment and disposal projects are presented in the following subsections.

12.3.4.1 Belle Glade WWTF

The opinions of probable cost for wastewater treatment and disposal projects at the Belle Glade WWTF are presented in **Table 12.4**. All projects address renewal and replacement recommendations developed in Chapter 2 are are subdivided into critical and non-critical categories. There are no capacity-driven projects, since the capacity analysis provided in Chapter 11 concludes that the Belle Glade WWTF has adequate treatment capacity through the Year 2035. Critical items are highlighted in blue.

Table 12.4
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG001	Oxidation Ditch No. 1 Structural Rehabilitation	R&R, Critical	$770,000
WWBG002	Oxidation Ditch No. 2 Structural Rehabilitation	R&R, Critical	$280,000
WWBG003	Improvements to the Deep Injection Well	R&R, Critical	$980,000
WWBG004	Installation of Roto-Screen Bypass Line	R&R, Critical	$280,000
WWBG005	Repair cracks and leaks in Aerobic Digestor	R&R, Critical	$140,000
WWBG006	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	R&R, Critical	$100,000
WWBG007	Replacement of 300 kW generator (Generator Building No. 1)	R&R, Critical	$560,000
WWBG008	Injection Well PLC replace. Parts are unavailable	R&R, Critical	$120,000
WWBG009	Replacement of electrical equipment in the MCC Building	R&R, Critical	$700,000
WWBG010	Replace parshall flume (in the Headworks)	R&R, Non-Critical	$70,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG011	Installation of a Headworks Bypass	R&R, Non-Critical	$280,000
WWBG012	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	R&R, Non-Critical	$700,000
WWBG013	Construct chlorine contact chamber	R&R, Non-Critical	$980,000
WWBG014	Prevent water intrusion to Operations Building	R&R, Non-Critical	$0
WWBG015	Optimize Bar screens to achieve higher capture rate	R&R, Non-Critical	$490,000
WWBG016	Add toe board to Splitter Box No. 2 hand rail	R&R, Non-Critical	$10,000
WWBG017	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	R&R, Non-Critical	$30,000
WWBG018	Replacement of several air handlers and compressors	R&R, Non-Critical	$100,000
WWBG019	Replace Roto-Screen roof purlins and roof panels that have deteriorated	R&R, Non-Critical	$50,000
WWBG020	Replacement of the main PLC and PLC software	R&R, Non-Critical	$280,000
WWBG021	Lift station No. 1 and No. 2 rehabilitation	R&R, Non-Critical	$50,000
WWBG022	Replace Headworks access stair with an aluminum stair	R&R, Non-Critical	$30,000
WWBG023	Generator Building No. 2 electrical equipment replacement	R&R, Non-Critical	$790,000
WWBG024	Rehabilitation of the RAS / WAS structure	R&R, Non-Critical	$30,000
WWBG025	Installation of two polymer feeders	R&R, Non-Critical	$30,000
WWBG026	Repair leaks at the effluent box of the headworks	R&R, Non-Critical	$20,000
WWBG027	Replace Roto-Screen effluent wet well slide gate and isolation gate	R&R, Non-Critical	$50,000
WWBG028	Replace pond bypass gate	R&R, Non-Critical	$30,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG029	Paint steel roof over the Aerobic Digester blowers	R&R, Non-Critical	$30,000
WWBG030	Rehabilitate the Roto-Screen metal structure	R&R, Non-Critical	$20,000
WWBG031	Rehabilitate the Sludge Thickening Facility metal structure	R&R, Non-Critical	$90,000
WWBG032	Upgrading control room	R&R, Non-Critical	$60,000
WWBG033	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	R&R, Non-Critical	$200,000
WWBG034	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	R&R, Non-Critical	$50,000
WWBG035	Paint steel bridge, stairs and EQ tank	R&R, Non-Critical	$110,000
WWBG036	New roofs on the Operation, Maintenance and both Generator buildings	R&R, Non-Critical	$60,000
WWBG037	Replace doors in MCC Building	R&R, Non-Critical	$20,000
WWBG038	Repair cracking at Headworks upper level slab	R&R, Non-Critical	$20,000
WWBG039	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	R&R, Non-Critical	$210,000
WWBG040	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	R&R, Non-Critical	$30,000
WWBG041	Replace Thickeners	R&R, Non-Critical	$840,000
WWBG042	Remove, replace and rewire Headwork's control panel	R&R, Non-Critical	$70,000
WWBG043	Relocate trees and plants placed inside abandoned structures	R&R, Non-Critical	$30,000
WWBG044	Construct overflow in Aerobic Digester	R&R, Non-Critical	$60,000
WWBG045	Repair crack at the Operations Building access ramp	R&R, Non-Critical	$20,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG046	Re-paint the entire exterior of the Headworks	R&R, Non-Critical	$70,000
WWBG047	Support of the Operations Building roof post should be replaced with a different type to avoid further cracking	R&R, Non-Critical	$10,000
WWBG048	Install flow meters on Oxidation Ditch Nos. 1 and 2	R&R, Non-Critical	$180,000
WWBG049	Install flow meters on Clarifier Nos. 3 and 4 b	R&R, Non-Critical	$140,000
WWBG050	Polymer containment and enclosure	R&R, Non-Critical	$60,000
WWBG051	Construction of a Switchgear Building with space for future equipment	R&R, Non-Critical	$280,000
WWBG052	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	R&R, Non-Critical	$20,000
WWBG053	Replace manual valves with electronic controlled valves	R&R, Non-Critical	$100,000
WWBG054	Repair the concrete spalls at guardrail posts at Clarifier No. 3	R&R, Non-Critical	$30,000
WWBG055	Replacing ceiling tiles in the Operations Building break room	R&R, Non-Critical	$20,000
WWBG056	Replace plant lighting with higher illumination LED lights	R&R, Non-Critical	$20,000
WWBG057	Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway grating	R&R, Non-Critical	$40,000
WWBG058	Chlorine Building electrical equipment replacement	R&R, Non-Critical	$70,000
WWBG059	Replacement of four slide gates in Headworks	R&R, Non-Critical	$50,000
WWBG060	Replace RAS and Deep Injection Well flow meters with new magnetic meters	R&R, Non-Critical	$50,000
WWBG061	Replacement of MCC-3 (in the Operations Building Electric Room)	R&R, Non-Critical	$120,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG062	Polymer electrical equipment replacement	R&R, Non-Critical	$10,000
WWBG063	Electrical equipment replacement in the Operations Building Electrical Room	R&R, Non-Critical	$340,000
WWBG064	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	R&R, Non-Critical	$70,000
WWBG065	Flow meter for Clarifier Nos. 1 and 2 b	R&R, Non-Critical	$110,000
WWBG066	Crack repair on the exterior wall surfaces of EQ tank	R&R, Non-Critical	$30,000
WWBG067	Repair guardrails on EQ tank	R&R, Non-Critical	$40,000
WWBG068	Install fencing to enclose Truck Wash Lift Station	R&R, Non-Critical	$280,000
WWBG069	Install an odor control system at the Headworks	R&R, Non-Critical	$980,000
WWBG070	Install an onsite plant service water system including reuse system	R&R, Non-Critical	$1,960,000
WWBG071	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	R&R, Non-Critical	$50,000
WWBG072	Painting of the facility	R&R, Non-Critical	$210,000
WWBG073	Upgrading cabinets in the Operations Building break room	R&R, Non-Critical	$20,000
WWBG074	Asphalt overlay and addition of parking spaces	R&R, Non-Critical	$50,000
WWBG075	Epoxy coat floors	R&R, Non-Critical	$70,000
WWBG076	Convert EQ tank to additional Clarifier or Aerobic Digester	R&R, Non-Critical	$0
WWBG077	Install drain on Oxidation Ditch No. 1	R&R, Non-Critical	$70,000
Total – Wastewater Treatment and Disposal Projects at Belle Glade WWTF			***$15,420,000***

12.3.4.2 Pahokee WWTF

The opinions of probable cost for wastewater treatment projects at the Pahokee WWTF are presented in **Table 12.5**. The majority of these projects address renewal and replacement recommendations developed in Chapter 2 and are subdivided into critical and non-critical projects.

In addition, the capacity analysis provided in Chapter 11 determined that the following capacity-related projects are required:

1. A new mechanical screen to replace the existing screen that is hydraulically overloaded under current peak flow conditions.

2. Two new secondary clarifiers to supplement existing secondary clarifiers that are currently hydraulically overloaded when one unit out of service.

3. A new conventional aeration basin to provide adequate reliable treatment capacity while the existing conventional aeration basin and Walker process unit are each removed from service for required renewal and replacement.

4. Secondary clarifier influent splitter box to distribute a common mixed liquor stream from the existing and proposed aeration basins to the existing and proposed secondary clarifiers.

If the County elects to convert the Pahokee WWTF into a regional pump station, some or all of the critical renewal and replacement projects should still be implemented to maintain reliable treatment until Pahokee flows can be routed to the Belle Glade WWTF and the Pahokee WWTF can be decommissioned. Under this scenario, non-critical R&R projects and capacity-related projects for the Pahokee WWTF would not be implemented. Critical items are highlighted in blue.

Table 12.5
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP001	Replacement of generators	R&R, Critical	$700,000
WWP002	New grit removal system at Headworks	R&R, Critical	$600,000
WWP003	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	R&R, Critical	$70,000
WWP004	Replace steel bridge supports on Primary and Secondary Clarifiers	R&R, Critical	$60,000
WWP005	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	R&R, Critical	$110,000
WWP006	Replace Walker Unit elevated influent pipe supports	R&R, Critical	$70,000
WWP007	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	R&R, Critical	$40,000
WWP008	Replacement of 12-inch valve on the Deep Injection Well System	R&R, Critical	$20,000
WWP009	New conventional aeration basis, two new secondary clarifiers, and secondary clarifier influent splitter box (required for firm capacity prior to aeration and secondary clarifier R&R projects)	Capacity	$5,000,000
WWP010	Rehabilitate all three Secondary Clarifiers	R&R, Critical	$200,000
WWP011	Modify stair top support on Aeration Tank Nos. 1 and 2	R&R, Critical	$20,000
WWP012	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	R&R, Critical	$750,000
WWP013	Replacement of the mechanical bar screen	Capacity	$490,000
WWP014	Replace Digester stairs	R&R, Non-Critical	$60,000

Table 12.5 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP015	Replace all diffusers	R&R, Non-Critical	$40,000
WWP016	Influent Pump Station rehabilitation	R&R, Non-Critical	$30,000
WWP017	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	R&R, Non-Critical	$110,000
WWP018	Remove and replace all sidewalks	R&R, Non-Critical	$20,000
WWP019	Replace Wet well By-Pass valve	R&R, Non-Critical	$20,000
WWP020	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	R&R, Non-Critical	$70,000
WWP021	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)	R&R, Non-Critical	$0
WWP022	Replace all six blowers	R&R, Non-Critical	$840,000
WWP023	Recoat two Secondary Clarifiers and repaint the steel bridges	R&R, Non-Critical	$70,000
WWP024	Recoat Primary Clarifier and repaint the steel bridge	R&R, Non-Critical	$50,000
WWP025	Recoat the Walker Unit and repaint the steel bridge	R&R, Non-Critical	$130,000
WWP026	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	R&R, Non-Critical	$600,000
WWP027	Blower House Nos.1, 2 and 3 roof, door and louver replacement	R&R, Non-Critical	$70,000
WWP028	Replacement of electrical equipment in the Blower House No. 3	R&R, Non-Critical	$170,000
WWP029	Replacement of electrical equipment in the Blower House No. 2	R&R, Non-Critical	$180,000
WWP030	Replacement of electrical equipment in the Blower House No. 1	R&R, Non-Critical	$10,000

Table 12.5 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP031	Replacement of electrical equipment in the Pump Pad	R&R, Non-Critical	$10,000
WWP032	Replacement of electrical equipment in the Chlorine / Operations Building	R&R, Non-Critical	$100,000
WWP033	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility	R&R, Non-Critical	$30,000
WWP034	Replacement of electrical equipment in the Effluent Pump Station	R&R, Non-Critical	$30,000
WWP035	Flow pace blowers	R&R, Non-Critical	$30,000
WWP036	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	R&R, Non-Critical	$20,000
WWP037	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	R&R, Non-Critical	$50,000
WWP038	Replace pump and auger in the Bioset system	R&R, Non-Critical	$30,000
WWP039	Installation of a security fence	R&R, Non-Critical	$630,000
WWP040	Replace Effluent Pump starters with VFDs	R&R, Non-Critical	$170,000
WWP041	PLC system upgrade	R&R, Non-Critical	$70,000
WWP042	Replace manual valves with electronic controlled valves	R&R, Non-Critical	$30,000
WWP043	Replace grounding at the Headworks	R&R, Non-Critical	$10,000
WWP044	Painting of the facility	R&R, Non-Critical	$140,000
WWP045	Epoxy coat floors	R&R, Non-Critical	$40,000
Total – Wastewater Treatment and Disposal Projects at Pahokee WWTF			***$11,990,000***

12.4.3.3 Pahokee Regional Pump Station and Force Main

The opinions of probable cost for the conversion of the Pahokee WWTF to a regional pump station and force main to direct Pahokee wastewater flows to the Belle Glade WWTF for treatment are presented in **Table 12.6**.

Table 12.6
Opinions of Probable Project Cost
Wastewater Treatment Projects for Conversion of Pahokee WWTF to Regional Pump Station and Force Main to Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWRPS001	Pahokee Regional Pump Station	R&R, Facility Improvements	$1,200,000
WWRPS002	Force Main from Pahokee Regional Pump Station to Belle Glade WWTF	R&R, Facility Improvements	$8,100,000
WWRPS003	Demolition of Pahokee WWTF	R&R, Facility Improvements	$640,000
Total – Wastewater Treatment Projects for Conversion of Pahokee WWTF to Regional Pump Station			***$9,940,000***

12.4 Summary

Pending the decision regarding whether to rehabilitate the Pahokee WWTF or pump Pahokee service area flows to the Belle Glade WWTF for treatment, summary tables of total capital costs for each scenario are presented in **Tables 12.7** and **12.8**. Based on priorities and discussions with PBCWUD, a schedule for implementation was prepared and is shown in **Table 12.9**. The implementation schedule also includes wastewater treatment and disposal projects for each of the two Pahokee wastewater treatment scenarios.

Table 12.7
Opinions of Probable Project Cost
Summary of Capital Projects
Scenario of Long-Term Wastewater Treatment at Pahokee WWTF

Project Category	Project Cost
Collection System (Lift Stations)	$26,254,500
Transmission System (Force Mains)	$2,770,000
Infiltration and Inflow	$9,270,000
Wastewater Treatment	$27,410,000
Total – Capital Projects	***$65,704,500***

Table 12.8
Opinions of Probable Project Cost
Summary of Capital Projects
Scenario of Converting Pahokee WWTF to Regional Pump Station

Project Category	**Project Cost**
Collection System (Lift Stations)	$26,254,500
Transmission System (Force Mains)	$2,770,000
Infiltration and Inflow	$9,270,000
Wastewater Treatment (and conversion of Pahokee WWTF to Regional Pump Station)	$25,360,000
Total – Capital Projects	***$63,654,500***

(Continued on Next Page)

Table 12.9
Capital Improvement Schedule Through 2035

PROJECT DESCRIPTION		IMPLEMENTATION SCHEDULE							
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
1.0 – Collection System (Lift Stations)									
LS001	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	**$4,111,250**	$4,111,250	$0	$0	$0	$0	$0	$0
LS002	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	**$5,692,500**	$0	$5,692,500	$0	$0	$0	$0	$0
LS003	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	**$2,530,000**	$0	$0	$2,530,000	$0	$0	$0	$0
LS004	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	**$2,530,000**	$0	$0	$0	$2,530,000	$0	$0	$0
LS005	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	**$2,530,000**	$0	$0	$0	$0	$2,530,000	$0	$0
LS006	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	**$4,743,750**	$0	$0	$0	$0	$0	$4,743,750	$0
LS007	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	**$4,117,000**	$0	$0	$0	$0	$0	$0	$4,117,000
1.0 - Total Estimated Annual Capital Costs, Collection System (Lift Stations)		***$26,254,500***	***$4,111,250***	***$5,692,500***	***$2,530,000***	***$2,530,000***	***$2,530,000***	***$4,743,750***	***$4,117,000***

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

2.0 – Transmission System (Force Mains)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
FM001	Belle Glade – North Canal Street Force Main Upgrade	**$220,000**	$0	$0	$220,000	$0	$0	$0	$0
FM002	Belle Glade - South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade	**$2,550,000**	$0	$2,550,000	$0	$0	$0	$0	$0
2.0 - Total Estimated Annual Capital Costs, Transmission System (Force Mains)		***$2,770,000***	***$0***	***$2,550,000***	***$220,000***	***$0***	***$0***	***$0***	***$0***
3.0 - Infiltration and Inflow									
I&I001	Inspection – Belle Glade service area	**$420,000**	$0	$420,000	$0	$0	$0	$0	$0
I&I002	Inspection – Pahokee service area	**$150,000**	$0	$150,000	$0	$0	$0	$0	$0
I&I003	Inspection – South Bay service area	**$80,000**	$0	$80,000	$0	$0	$0	$0	$0
I&I004	Rehabilitation – Belle Glade service area	**$6,680,000**	$0	$0	$3,340,000	$3,340,000	$0	$0	$0
I&I005	Rehabilitation – Pahokee service area	**$1,290,000**	$0	$0	$0	$0	$1,290,000	$0	$0
I&I006	Rehabilitation – South Bay service area	**$650,000**	$0	$0	$0	$0	$650,000	$0	$0
3.0 - Total Estimated Annual Capital Costs, Infiltration and Inflow		***$9,270,000***	***$0***	***$650,000***	***$3,340,000***	***$3,340,000***	***$1,940,000***	***$0***	***$0***

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG001	Oxidation Ditch No. 1 Structural Rehabilitation	**$770,000**	$0	$770,000	$0	$0	$0	$0	$0
WWBG002	Oxidation Ditch No. 2 Structural Rehabilitation	**$280,000**	$0	$0	$0	$280,000	$0	$0	$0
WWBG003	Improvements to the Deep Injection Well	**$980,000**	$980,000	$0	$0	$0	$0	$0	$0
WWBG004	Installation of Roto-Screen Bypass Line	**$280,000**	$280,000	$0	$0	$0	$0	$0	$0
WWBG005	Repair cracks and leaks in Aerobic Digester	**$140,000**	$0	$0	$140,000	$0	$0	$0	$0
WWBG006	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	**$100,000**	$0	$0	$100,000	$0	$0	$0	$0
WWBG007	Replacement of 300 kW generator (Generator Building No. 1)	**$560,000**	$0	$0	$560,000	$0	$0	$0	$0
WWBG008	Injection Well PLC replace. Parts are unavailable	**$120,000**	$0	$120,000	$0	$0	$0	$0	$0
WWBG009	Replacement of electrical equipment in the MCC Building	**$700,000**	$0	$550,000	$0	$0	$0	$0	$150,000
WWBG010	Replace parshall flume (in the Headworks)	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWBG011	Installation of a Headworks Bypass	**$280,000**	$0	$0	$0	$0	$0	$280,000	$0
WWBG012	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	**$700,000**	$0	$0	$700,000	$0	$0	$0	$0
WWBG013	Construct chlorine contact chamber	**$980,000**	$0	$0	$0	$0	$0	$980,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG014	Prevent water intrusion to Operations Building	**$0**	$0	$0	$0	$0	$0	$0	$0
WWBG015	Optimize Bar screens to achieve higher capture rate	**$490,000**	$0	$0	$0	$0	$0	$490,000	$0
WWBG016	Add toe board to Splitter Box No. 2 hand rail	**$10,000**	$0	$0	$0	$0	$0	$10,000	$0
WWBG017	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG018	Replacement of several air handlers and compressors	**$100,000**	$0	$0	$0	$0	$0	$100,000	$0
WWBG019	Replace Roto-Screen roof purlins and roof panels that have deteriorated	**$50,000**	$0	$0	$50,000	$0	$0	$0	$0
WWBG020	Replacement of the main PLC and PLC software	**$280,000**	$0	$0	$280,000	$0	$0	$0	$0
WWBG021	Lift station No. 1 and No. 2 rehabilitation	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG022	Replace Headworks access stair with an aluminum stair	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG023	Generator Building No. 2 electrical equipment replacement	**$790,000**	$0	$0	$0	$0	$0	$790,000	$0
WWBG024	Rehabilitation of the RAS / WAS structure	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWBG025	Installation of two polymer feeders	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG026	Repair leaks at the effluent box of the headworks	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG027	Replace Roto-Screen effluent wet well slide gate and isolation gate	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG028	Replace pond bypass gate	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG029	Paint steel roof over the Aerobic Digester blowers	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG030	Rehabilitate the Roto-Screen metal structure	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG031	Rehabilitate the Sludge Thickening Facility metal structure	**$90,000**	$0	$0	$0	$90,000	$0	$0	$0
WWBG032	Upgrading control room	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG033	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	**$200,000**	$0	$0	$200,000	$0	$0	$0	$0
WWBG034	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG035	Paint steel bridge, stairs and EQ tank	**$110,000**	$0	$0	$0	$0	$0	$110,000	$0
WWBG036	New roofs on the Operation, Maintenance and both Generator buildings	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG037	Replace doors in MCC Building	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG038	Repair cracking at Headworks upper level slab	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG039	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	**$210,000**	$0	$0	$0	$0	$0	$210,000	$0
WWBG040	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG041	Replace Thickeners	**$840,000**	$0	$0	$0	$840,000	$0	$0	$0
WWBG042	Remove, replace and rewire Headwork's control panel	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWBG043	Relocate trees and plants placed inside abandoned structures	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG044	Construct overflow in Aerobic Digester	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG045	Repair crack at the Operations Building access ramp	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG046	Re-paint the entire exterior of the Headworks	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG047	Replace support of the Operations Building roof post	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWBG048	Install flow meters on Oxidation Ditch Nos. 1 and 2	**$180,000**	$0	$0	$0	$0	$0	$0	$180,000
WWBG049	Install flow meters on Clarifier Nos. 3 and 4 b	**$140,000**	$0	$0	$0	$0	$0	$0	$140,000
WWBG050	Polymer containment and enclosure	**$60,000**	$0	$0	$0	$0	$0	$0	$60,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG051	Construction of a Switchgear Building with space for future equipment	**$280,000**	$0	$0	$0	$0	$0	$0	$280,000
WWBG052	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG053	Replace manual valves with electronic controlled valves	**$100,000**	$0	$0	$0	$0	$0	$0	$100,000
WWBG054	Repair the concrete spalls at guardrail posts at Clarifier No. 3	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWBG055	Replacing ceiling tiles in the Operations Building break room	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG056	Replace plant lighting with higher illumination LED lights	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG057	Add toe boards to all horizontal walking surfaces of the EQ tank bridge, replace fiberglass walkway grating	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWBG058	Chlorine Building electrical equipment replacement	**$70,000**	$0	$0	$0	$0	$0	$20,000	$50,000
WWBG059	Replacement of four slide gates in Headworks	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG060	Replace RAS and Deep Injection Well flow meters with new magnetic meters	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG061	Replacement of MCC-3 (in the Operations Building Electric Room)	**$120,000**	$0	$0	$0	$0	$0	$0	$120,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG062	Polymer electrical equipment replacement	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWBG063	Electrical equipment replacement in the Operations Building Electrical Room	**$340,000**	$0	$0	$0	$0	$0	$0	$340,000
WWBG064	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG065	Flow meter for Clarifier Nos. 1 and 2 b	**$110,000**	$0	$0	$0	$0	$0	$0	$110,000
WWBG066	Crack repair on the exterior wall surfaces of EQ tank	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWBG067	Repair guardrails on EQ tank	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWBG068	Install fencing to enclose Truck Wash Lift Station	**$280,000**	$0	$0	$0	$0	$0	$0	$280,000
WWBG069	Install an odor control system at the Headworks	**$980,000**	$0	$0	$0	$0	$0	$0	$980,000
WWBG070	Install an onsite plant service water system including reuse system	**$1,960,000**	$0	$0	$0	$0	$0	$0	$1,960,000
WWBG071	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG072	Painting of the facility	**$210,000**	$0	$0	$0	$0	$0	$0	$210,000
WWBG073	Upgrading cabinets in the Operations Building break room	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG074	Asphalt overlay and addition of parking spaces	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG075	Epoxy coat floors	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG076	Convert EQ tank to additional Clarifier or Aerobic Digester	**$0**	$0	$0	$0	$0	$0	$0	$0
WWBG077	Install drain on Oxidation Ditch No. 1	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWP001	Replacement of generators	**$700,000**	$0	$700,000	$0	$0	$0	$0	$0
WWP002	New grit removal system at Headworks	**$600,000**	$0	$0	$0	$0	$600,000	$0	$0
WWP003	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	**$70,000**	$0	$0	$70,000	$0	$0	$0	$0
WWP004	Replace steel bridge supports on Primary and Secondary Clarifiers	**$60,000**	$0	$0	$60,000	$0	$0	$0	$0
WWP005	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	**$110,000**	$0	$110,000	$0	$0	$0	$0	$0
WWP006	Replace Walker Unit elevated influent pipe supports	**$70,000**	$0	$70,000	$0	$0	$0	$0	$0
WWP007	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	**$40,000**	$0	$0	$0	$40,000	$0	$0	$0
WWP008	Replacement of 12-inch valve on the Deep Injection Well System	**$20,000**	$0	$20,000	$0	$0	$0	$0	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP009	Rehabilitate all three Secondary Clarifiers	**$200,000**	$0	$0	$200,000	$0	$0	$0	$0
WWP010	Modify stair top support on Aeration Tank Nos. 1 and 2	**$20,000**	$0	$0	$0	$20,000	$0	$0	$0
WWP011	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	**$750,000**	$0	$0	$0	$0	$750,000	$0	$0
WWP012	Replacement of the mechanical bar screen	**$490,000**	$0	$0	$0	$0	$0	$490,000	$0
WWP013	Replace Digester stairs	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWP014	Replace all diffusers	**$40,000**	$0	$0	$40,000	$0	$0	$40,000	$0
WWP015	Influent Pump Station rehabilitation	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWP016	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	**$110,000**	$0	$0	$0	$0	$0	$110,000	$0
WWP017	Remove and replace all sidewalks	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWP018	Replace Wet well By-Pass valve	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWP019	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP020	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)	**$0**	$0	$0	$0	$0	$0	$0	$0
WWP021	Replace all six blowers	**$840,000**	$0	$0	$0	$0	$0	$840,000	$0
WWP022	Recoat two Secondary Clarifiers and repaint the steel bridges	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWP024	Recoat the Walker Unit and repaint the steel bridge	**$130,000**	$0	$0	$0	$0	$0	$130,000	$0
WWP025	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	**$5,600,000**	$0	$0	$0	$0	$0	$5,600,000	$0
WWP026	Blower House Nos.1, 2 and 3 roof, door and louver replacement	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWP027	Replacement of electrical equipment in the Blower House No. 3	**$170,000**	$0	$0	$0	$0	$0	$170,000	$0
WWP028	Replacement of electrical equipment in the Blower House No. 2	**$180,000**	$0	$0	$0	$0	$0	$0	$180,000
WWP029	Replacement of electrical equipment in the Blower House No. 1	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWP030	Replacement of electrical equipment in the Pump Pad	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP031	Replacement of electrical equipment in the Chlorine / Operations Building	**$100,000**	$0	$0	$0	$0	$0	$0	$100,000
WWP032	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP033	Replacement of electrical equipment in the Effluent Pump Station	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP034	Flow pace blowers	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP035	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWP036	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWP037	Replace pump and auger in the Bioset system	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWP038	Installation of a security fence	**$630,000**	$0	$0	$0	$0	$0	$0	$630,000
WWP039	Replace Effluent Pump starters with VFDs	**$170,000**	$0	$0	$0	$0	$0	$0	$170,000
WWP040	PLC system upgrade	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWP041	Replace manual valves with electronic controlled valves	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWP042	Replace grounding at the Headworks	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP043	Painting of the facility	**$140,000**	$0	$0	$0	$0	$0	$0	$140,000
WWP044	Epoxy coat floors	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWRPS001	Pahokee Regional Pump Station	**$1,200,000**	$0	$0	$0	$0	$0	$0	$1,200,000
WWRPS002	Force Main from Pahokee Regional Pump Station to Belle Glade WWTF	**$8,100,000**	$0	$0	$0	$0	$0	$0	$8,100,000
WWRPS003	Demolition of Pahokee WWTF	**$640,000**	$0	$0	$0	$0	$0	$0	$640,000
4.0 - Total Estimated Annual Costs, Wastewater Treatment									
Long-Term Use of Pahokee WWTF		***$27,410,000***	*$1,260,000*	*$2,340,000*	*$2,160,000*	*$1,250,000*	*$1,600,000*	*$11,380,000*	*$7,420,000*
Pahokee Regional Pump Station, All Treatment at Belle Glade WWTF		***$25,360,000***	*$1,260,000*	*$1,440,000*	*$7,000,000*	*$6,180,000*	*$30,000*	*$3,750,000*	*$5,700,000*
TOTAL ESTIMATED ANNUAL CAPITAL COSTS (Sections 1.0 through 4.0)									
LONG-TERM USE OF PAHOKEE WWTF		***$65,704,500***	***$5,371,250***	***$11,232,500***	***$8,250,000***	***$7,120,000***	***$6,070,000***	***$16,123,750***	***$11,537,000***
PAHOKEE REGIONAL PUMP STATION, ALL TREATMENT AT BELLE GLADE WWTF		***$63,654,500***	***$5,371,250***	***$10,332,500***	***$13,090,000***	***$12,380,000***	***$4,500,000***	***$8,493,750***	***$9,817,000***

APPENDIX – A
Technical Memoranda

HAZEN AND SAWYER
Environmental Engineers & Scientists

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TECHNICAL MEMORANDUM No. 2 – Renewal and Replacement Improvements

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer

FROM: Hazen and Sawyer / Hillers Electrical Engineering, Inc.

DATE: May 20, 2014

FILE: 45103-004.3.0

SUBJECT: Palm Beach County Water Utilities Department (PBCWUD)
Glades Wastewater Master Plan
Project Number: WUD 12-068

SCOPE

The scope for *Task 2 – Renewal and Replacement Improvements* is as follows.

> *The CONSULTANT will assemble a team of engineers with expertise in structural, electrical, instrumentation, mechanical and wastewater process engineering. This team will conduct a two day site visits to each of the two WWTFs (i.e., Belle Glade and Pahokee) to review existing facilities with COUNTY operations and maintenance personnel.*
>
> *Perform six major test techniques used to determine the condition of major process equipment as follows:*
>
> - *Vibration Analysis*
> - *Power Circuit Evaluation*
> - *Thermographic Inspection*
> - *Lubrication Analysis (Tribology)*
> - *Alignment Inspection*
> - *Physical Conditions*

The work will be done in close cooperation with facility staff and will include review meetings with staff before the preliminary evaluation period to verify nameplate and design information such as horsepower, speed, bearing temperature and other pertinent data required to determine if the machine is operating normally.

Perform a site inspection of structures and process unit tankage to determine the current condition of the unit items relative to the extent of corrosion and structural integrity. CONSULTANT will also identify necessary repairs and replacement requirements needed to maintain the integrity of the structural components.

Based on field reviews of the VWVTP facilities, CONSULTANT will develop a Microsoft Excel spreadsheet list of major wastewater treatment above ground infrastructure (e.g., pump, motors, treatment unit rake mechanisms, filter media, filter controls, chemical systems, diesel engine generators, etc.). The list will also include the following information, if available:

- *Equipment name;*
- *Equipment tag number;*
- *Location;*
- *Year installed;*
- *Estimate expected life of equipment (expected life based upon values in published literature and agreed upon by COUNTY);*
- *Estimate the remaining useful lives of major equipment and facilities on the basis of age and expected total life;*
- *Estimate the cost of anticipated equipment replacement expenditures; and*
- *Calculate annual equipment replacement funding requirements over the next years.*

Buried infrastructure and piping condition will not be physically evaluated as part of this task effort. A limited assessment of onsite WWTF piping will be performed based on available information provided by the COUNTY. The COUNTY will provide information on the onsite WWTF piping infrastructure regarding material type and age that will be utilized by the CONSULTANT for the purpose of evaluating useful life based on industry guidelines. Salvage value will be assumed to be zero.

INTRODUCTION

The Palm Beach County Water Utility District (PBCWUD) requested that Hazen and Sawyer prepare a Wastewater Master Plan for the Glades Region. Technical Memorandum No. 2 (TM-

2) addresses the renewal and replacement improvements needed to maintain the integrity of the structural, electrical, instrumentation, mechanical and wastewater process at the wastewater treatment facilities (WWTFs) within the Glades Region. For the purpose of this technical memorandum, the Glade Region Wastewater Service Area will be subdivided by service area. **Figure 1** presents the general location map including the facilities. **Figures 2 and 3** show the site plans of Belle Glade and Pahokee WWTFs, respectively.

BACKGROUND

The overall Glades Region Wastewater Service Area encompasses approximately 43.5 square miles (27,878 acres) in northwest Palm Beach County. As shown in **Figure 4**, there are three municipalities in the PBCWUD Glades Region Wastewater Service Area: the cities of Belle Glade, Pahokee and South Bay. Originally each city owned and operated its own WWTF within its own wastewater service area. Recently, however, the South Bay WWTF was replaced with a booster pump station that sends all wastewater within the South Bay service area to the Belle Glade WWTF. Consequently, the City of South Bay service area was incorporated into the Belle Glade wastewater service area, decreasing the number of service areas in the Glades Region to two. The Belle Glade and Pahokee wastewater service areas are shown in **Figure 5**. The following sections provide background data and other information concerning the Belle Glade and Pahokee WWTFs gathered from site visits, interviews and data provided by PBCWUD staff.

Belle Glade WWTF

The Belle Glade WWTF is located on West Canal Street South in Belle Glade, Florida, just east of US-27 and south of State Road 80. The service area for this treatment plant facility is approximately 27 square miles (17,313 acres), extends from slightly north of Paul Rardin Park south to the G2 Canal. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Belle Glade WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Belle Glade). The treatment plant is permitted to operate with a capacity of 6.5 million gallon per day (MGD) maximum monthly average daily flow (MMADF) under Florida Department of Environmental Protection (FDEP) Permit No. FLA027740-008-DW1P that was issued on May 23, 2011 and expires May 22, 2016 (see **Appendix 2-1**). The Belle Glade WWTF is an oxidation ditch aeration type activated sludge wastewater treatment plant originally built in 1950 that consists of the following facilities:

- Two mechanical cleaned bar screens;
- Two grit forced vortex chambers with two cyclone/inclined screw classifier grit dewatering units;

PALM BEACH COUNTY FLORIDA

FIGURE 2-1
PAHOKEE AND BELLE GLADE WASTEWATER TREATMENT FACILITIES LOCATION MAP

Palm Beach County
Water Utilities Department
Glades Utility Authority

HAZEN AND SAWYER
Environmental Engineers & Scientists

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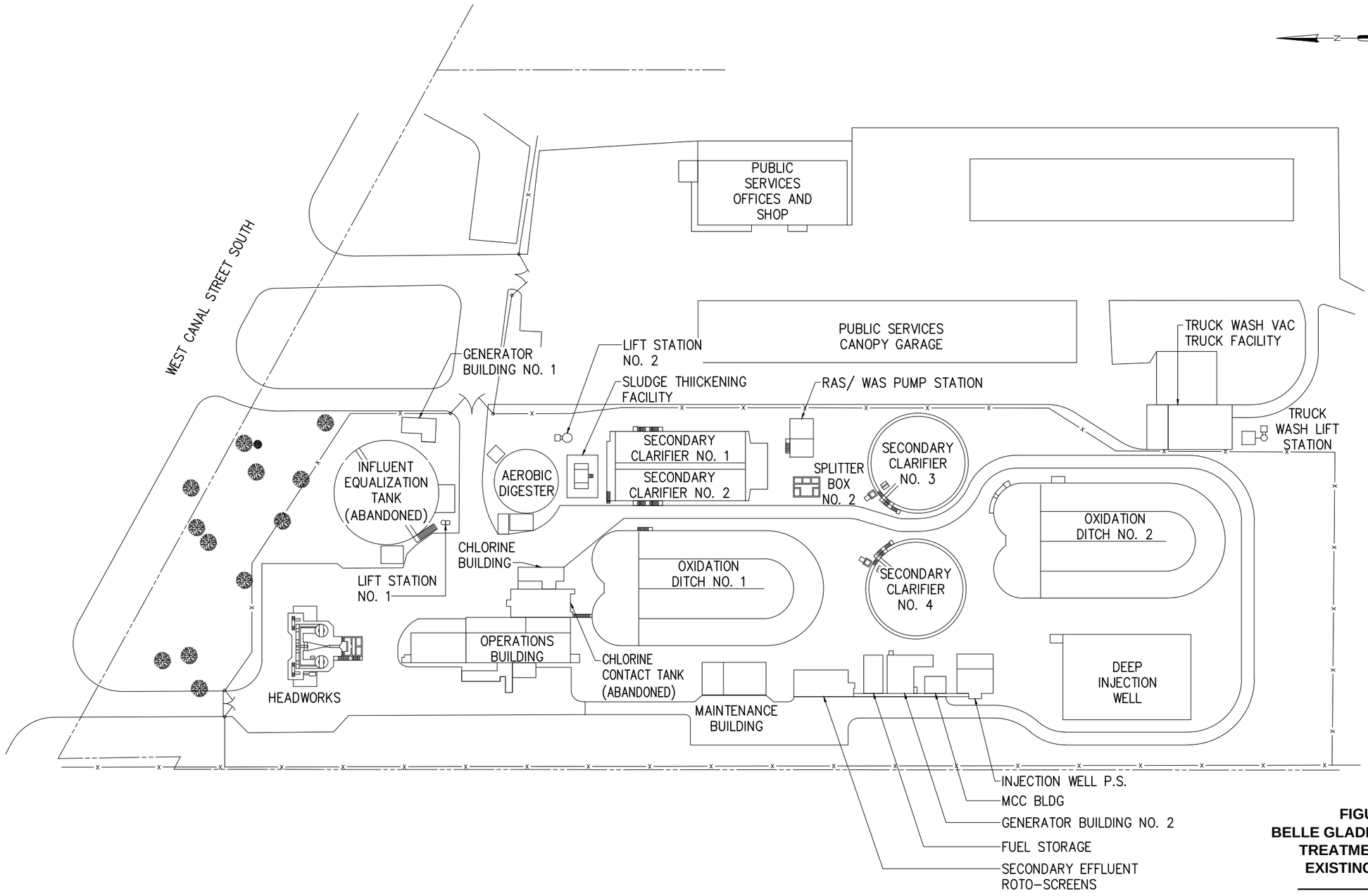

FIGURE 2-2
BELLE GLADE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

HAZEN AND SAWYER
Environmental Engineers & Scientists

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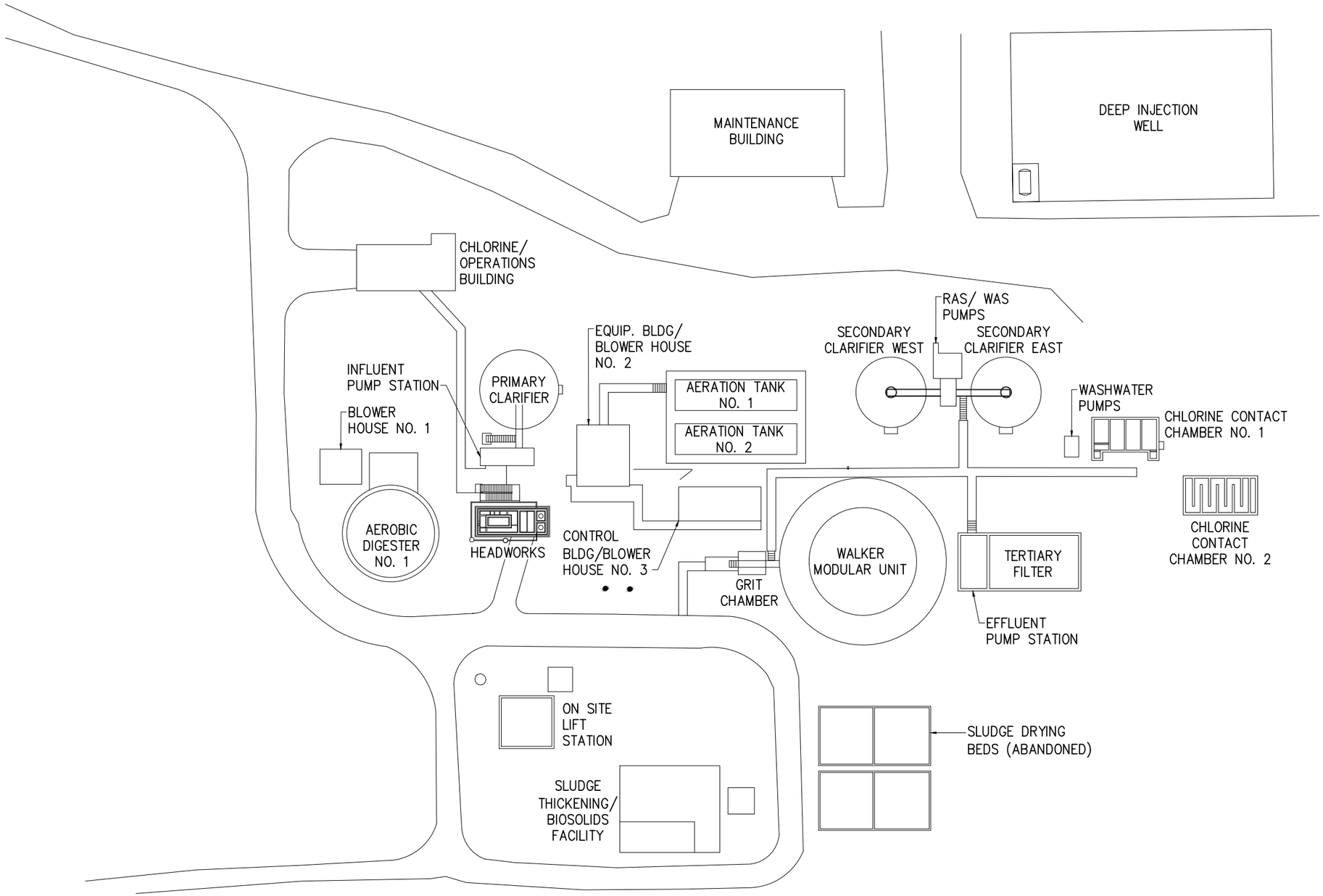

FIGURE 2-3
PAHOKEE WASTEWATER TREATMENT FACILITY EXISTING SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

HAZEN AND SAWYER
Environmental Engineers & Scientists

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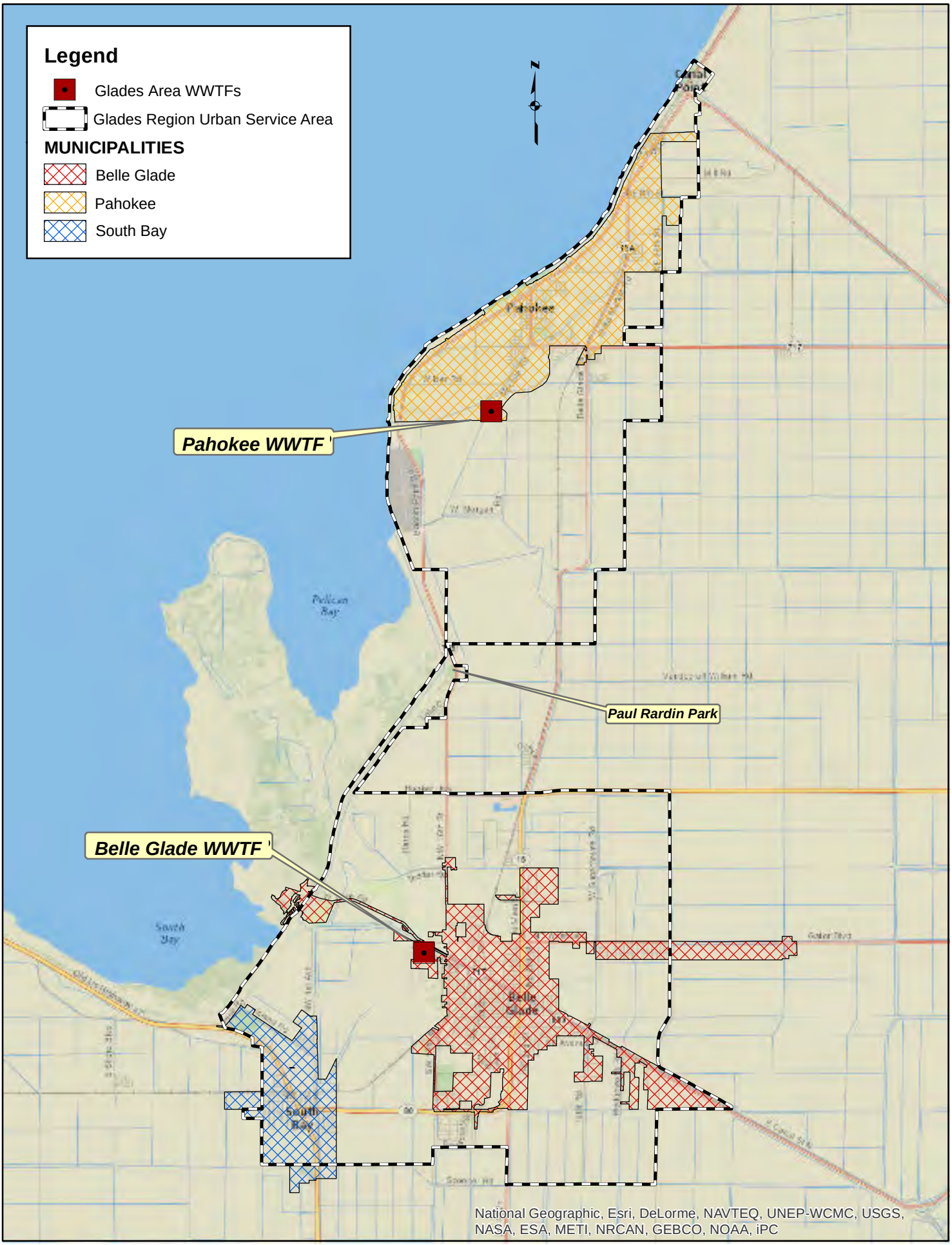

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Figure 2-4 - Glades Region Urban Service Area

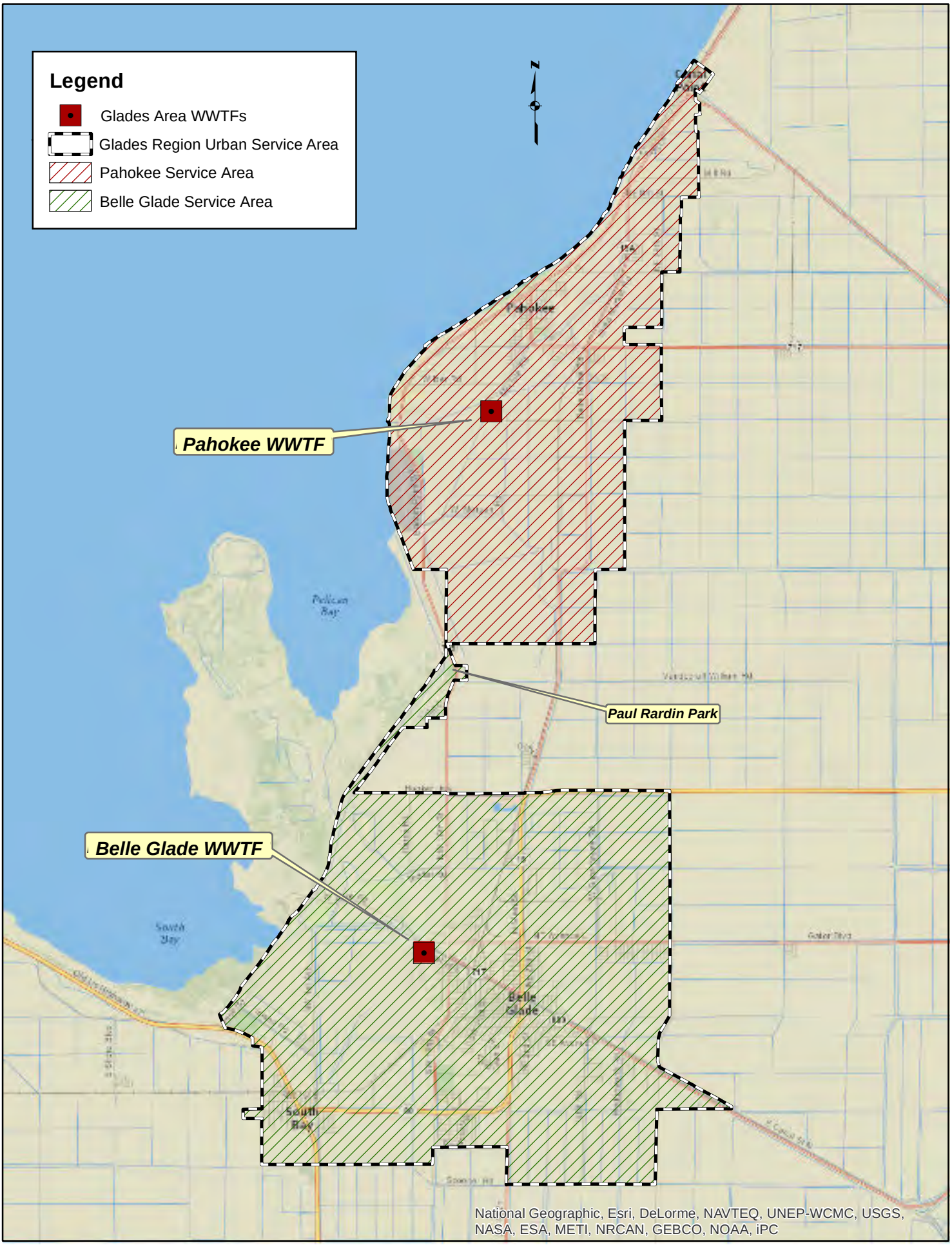

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Figure 2-5 - Glades Region Wastewater Service Sub-areas

- Two Carousel oxidation ditch basins with a downstream flow splitter;
- Two rectangular secondary clarifiers with a volume of approximately 373,000 gallon each and two circular secondary clarifiers with a volume of 822,000 gallon each;
- Four 0.1-inch roto-screens;
- One injection well pump station with a pumping capacity of 12.0 MGD when three pumps are online and one is a backup;
- One 20-inch, 10.2-MGD maximum daily flow Class I injection well;
- One 465,000 gallon aerobic digester;
- Two rotary drum thickeners with a polymer blend system;
- One 310 kilowatt (kW) and one 800 kW diesel engine auxiliary power generators;
- One 0.069-MGD maximum monthly average daily flow percolation pond.

Pahokee WWTF

The Pahokee WWTF is located on Rim Canal Road in Pahokee, Florida, east of Lake Okeechobee and north of State Road 80. The service area for this treatment plant facility is approximately 16.5 square miles (10,569 acres), extends to the north of Paul Rardin Park up to Canal Point and is comprised of several collection basins. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Pahokee WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Pahokee). The treatment plant is permitted to operate with a capacity of 1.2-MGD three-month average daily flow (TMADF) under FDEP Permit No. FLA0136778-006-DW1P/NR that was issued on August 22, 2012 and expires August 21, 2017 (see **Appendix 2-1**). The Pahokee WWTF is an activated sludge wastewater treatment plant (WWTF) originally built in 1955 consisting of the following: a 0.50-MGD TMADF conventional activated sludge WWTF (Plant 1) and a 0.70-MGD TMADF complete mix Walker WWTF (Plant 2).

Major treatment plant components for the Plant 1 include the following:

- One 53,000 gallon primary clarifier;
- Two 75,000 gallon aeration tanks with air requirements provided by two 750 cfm blowers;
- Two secondary clarifiers.

Major treatment components for the Plant 2 consist of the following:

- One aerated grit removal system;

- One 123,000 gallon aeration basin with air requirements provided by two 1,500 cfm blowers;
- One 172,000 gallon clarifier.

Common treatment plant components consist of the following:

- One influent mechanical bar screen with a manually cleaned by-pass bar screen;
- One influent splitter box;
- Two chlorine contact tanks;
- One effluent pump station;
- Two emergency generators;
- One 675 pounds per hour dry solids BIOSET Class A stabilization unit comprised of one input hopper with primary motive mixer, one lime storage silo with feed assembly, one sulfamic acid hopper and feed assembly and one solids/lime/acid reactor;
- One 172,000 gallon aerobic digester with air requirements provided by one mechanical aerator;
- One supernate disposal bed;
- One 12.75-inch, 4.0-MGD monthly average daily flow Class I injection well;
- One 0.08-MGD annual average daily flow rapid infiltration basin.

EVALUATION APPROACH

As part of the Renewal and Replacement Improvements Evaluation, a condition evaluation was performed on the equipment and structures at the WWTFs. Various tests were conducted to determine the integrity of the machines. Vibration analysis, power circuit evaluation, thermographic inspection, lubrication analysis, alignment inspection and physical condition inspection were executed on all major process equipment and structures within the WWTFs. This report summarizes the findings of the equipment and structural evaluation in the following categories:

- Structural
- Mechanical
- Instrumentation
- Electrical
- Other

These findings will be used to establish the facility's current condition and to provide a baseline for the necessary WWTFs upgrades. Additionally, this report provides facility staff with

information regarding the current condition of the WWTFs equipment and structures so that appropriate maintenance, repair, replacement or other action can be conducted.

Data for this report was collected as described below:

- Hazen and Sawyer on December 4, 2012, April 29, 2013 and May 16, 2013.
- Hillers Electrical Engineering, Inc. on February 31, 2013.
- Florida Bearing from April 29, 2013 to May 10, 2013.

Photographs from the site visits to the Belle Glade and Pahokee WWTF are included in **Appendices 2-5 and 2-6**, respectively. Mechanical equipment at the Belle Glade and Pahokee WWTFs are included in **Appendices 2-7 and 2-8**, respectively. Electrical equipment at the Belle Glade and Pahokee WWTFs are listed in **Appendices 2-9 and 2-10**, respectively.

Structural Evaluation Techniques Utilized

Evaluation performed on the structures previously identified consisted of a visual inspection during normal operation of the facility. All exterior above grade areas of structures and accessible interior areas were observed, photographed, and documented. Interior conditions of the structures below the water line were not observed. The inspection of concrete elements was performed following the applicable guidelines in ACI 201.1R-08.

Mechanical and Instrumentation Evaluation Techniques Utilized

An independent sub-consultant, Florida Bearings, Inc. (FBI), was retained to perform the mechanical equipment portion of the process equipment evaluation. The plant equipment condition evaluation concentrated only on the major plant equipment. As part of this evaluation, vibration analyses, oil analyses, and alignment evaluations were performed on equipment. The following section briefly summarizes each test performed. Further detail is provided in the Equipment Condition Evaluation Report by FBI, which is included as **Appendices 2-3 and 2-4**.

Equipment Nameplate Information Acquisition

Equipment nameplate data information was obtained to help determine if the equipment is operating under normal conditions. Horsepower, speed, bearings and other pertinent data were recorded and verified.

Following the equipment nameplate information acquisition, six major test techniques were used to determine the condition of a piece of equipment. These are as follows:

- Vibration Analysis
- Power Circuit Evaluation
- Thermographic Inspection

- Lubrication Analysis (Tribology)
- Alignment Inspection

The various testing procedures were used in conjunction with each other to best determine the overall equipment condition.

Vibration Analysis

The discreet frequency of the equipment vibration is recorded and plotted against the amplitude of velocity and displacement of the machine vibration.

Power Circuit Evaluation

Power circuit inspection measured voltage, current, and overall voltage drop across the control. The voltage drop was measured, when possible, from the incoming line side of the starter breaker to the outgoing leads to the motor. True electrical input horsepower and percent load was calculated and included in **Appendices 2-3 and 2-4**.

Thermographic Inspection

Infrared radiation emitted from each machine was recorded and converted to a video thermographic signal to be monitored on the computer screen. The computer analyzes the various shades of colors and reports temperature as a variable directly proportional to intensity of the color reflection.

Lubrication Analysis

The analytical techniques used for the lubrication analysis included plasma emission, spectroscopy, volumetric analysis by centrifuge, fuel dilution by flash point, viscosity by saybolt viscometer, pH and titration. Results were evaluated, taking into consideration the type and service of the individual machine.

Alignment Inspections

The alignment inspections measured and detected coupling misalignment and the alignments of the axis of rotation of each machine at the axial centerline of the coupling device.

Electrical Evaluation Techniques Utilized

Nameplate data were obtained by physical visual inspection of the nameplates attached to the individual components of each overall machine unit or/and by reviewing the operation and maintenance information obtained from the Owner.

Measured electrical values documented in the Equipment Status Sheets (refer **to Appendices 2-3 and 2-4** for FBI report) were obtained through the use of standard electrical power metering

instruments. Voltage and current values were obtained for the machines while they were in operation. Other values, such as kW, kVA, kVAR, power factor, were measured and calculated. True electrical input horsepower and percent load were calculated to determine approximately what percent of the load the equipment is using.

In addition, all devices and some machines were scanned thermographically. Infrared (IR) inspection was conducted using a thermographic camera as described in Section 4.2. The results of these infrared inspections, including descriptions of the units tested, thermal data and electrical data recorded at the time of the IR inspection, are included in the Thermographic Report section of the FBI Report included in **Appendices 2-3 and 2-4**.

EVALUATION / FINDINGS

Items evaluated and discussed in the report are: Headworks, Secondary Treatment (Oxidation Ditches, Clarifiers, Walker Unit), Sludge Handling, Splitter Boxes, Disposal Systems, Chlorine Facilities and other miscellaneous buildings and equipment around the sites. Additionally, equipment lists have been included for the Belle Glade and Pahokee WWTFs in **Appendices 2-7 and 2-8**, respectively. The following sections provide a brief description of each building / treatment unit followed by its condition. Additionally, as mentioned previously, this report summarizes the evaluation and findings by category (i.e., structural, mechanical, instrumentation, electrical, and other as appropriate).

Belle Glade WWTF

Visual inspection identified the following:

- Headworks: The facility consists of a two level reinforced concrete structure above grade. Level one is on grade, open (no walls), and serves to house two grit classifiers. The second level consists of multiple channels supported on columns and covered with aluminum grating. Access to the top level is via reinforced concrete stairs. The effluent box is located at the south side of the structure and is the full height of the structure. The top level also contains the following unit processes: two mechanical self-cleaning fine bar screens, two vortex grit tanks, two grit pumps, two air compressors (for the vortex grit removal system) and four slide gates. Level one contains two grit classifiers which receive grit from the grit pumps.

  Structural – The underside of upper level channels appear in good condition except for a leak under the influent parshall flume and several cracks at the cantilevered concrete walkway which appear to have been caused by shrinkage cracks. The access stair to the upper level has cracked at the intermediate landing apparently due to settlement of the bottom landing. Several cracks with evidence of leakage or past repairs are visible on the outside of the effluent box. Cracks are also visible on the bottom floor slab

around columns. Exterior coating has deteriorated in some locations, particularly at the columns.

The top level of the structure has suffered deterioration with some areas showing concrete aggregate due to erosion and corrosion near the splash zone of the effluent box, and map cracking near the parshall flume. Interior wall surfaces appear to be in good conditions, however the coating has failed in some areas, including at the joint with the partial flume. Several aluminum grating sections are loose. Concrete surfaces below the water line were not observed as the facility was in normal operation.

Based on the findings above, it is recommended to coat the interior channel surfaces and other upper level surfaces exposed to wastewater gases to prevent further deterioration, replace the access stair with an aluminum stair, replace the parshall flume and repair the leak under the parshall flume, repair any other leak at the effluent box, and re-paint the entire exterior of the structure. It is also recommended that the concrete behind the flume be inspected when the parshall flume is removed for replacement to determine if additional repairs are required. Cracks on the ground level slab need not be repaired as they appear to be narrow and are likely re-entrant corner cracks. Spider cracking at the upper level slab can be repaired by removing unsound concrete and replacing with a thin cementitious patching material.

Mechanical – The mechanical bar screens were rebuilt within the last three years and therefore are in good condition. However, wastewater treatment plant staff have expressed their concerns associated with the amount of captured screening material that is carried over the Aqua Guard mechanical bar screen to the downstream side of the screenings channel due to the installed screening units' inefficient cleaning mechanism. To address this inefficiency, Parkson Corporation (the manufacturer of the Aqua Guard) offers upgrades to existing Aqua Guard units to improve the cleaning mechanism and reduce the amount of screened material carryover. Additionally, the existing screens are equipped with 6-mm elements. To improve the capture rate of the screening media within the channel, the existing screens can be fitted with 3-mm elements similar to what was implemented at the PBCWUD Southern Region Water Reclamation Facility.

The bar screen channels can be isolated by four slide gates which are in fair condition, except for the metal frames. It is recommended that these slide gates be replaced within the next several years to ensure that the channels can be isolated and that no leaks are present. The existing grit system is functional and in good condition. There are no recommendations for the grit system at this time. Lastly, the control of odorous emissions from wastewater collection and treatment facilities may increase in importance over the next several years as buffer zones between the facility and

residential areas decreases. It is recommended that the grit tanks and containers, areas in which hydrogen sulfide odors from the influent sewage and screenings are emitted, should be contained and treated prior to discharge to the atmosphere. It is also recommended that a bypass around the Headworks structure be installed to allow the raw wastewater to proceed through the rest of the plant in case of an emergency or extended repair to the Headworks structure.

The following recommendations are per the Florida Bearings report, see **Appendix 2-3**.

1. Pista Grit No. 1 Gearbox: Abrasives are at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

2. Pista Grit No. 1 Air Compressor: High compressor vane passing frequencies are present indicating excessive clearances are present. It is recommended that the compressor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

3. Pista Grit No. 2 Gearbox: Abrasives are at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

Electrical –There is a 7.0 degree temperature difference between legs in the fuse for Grit Classifier No. 1, MCC1. It is recommended that the fuse be inspected and replaced if necessary.

- Oxidation Ditch No. 1: Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Total tank area is approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the east and north. A structural evaluation by AECOM from March 2011, see **Appendix 2-2**, indicates that this structure was built in 1985 and modified in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

  Structural – Multiple cracks are present all around the exterior of the structure. Cracks on the straight walls are vertical and are approximately evenly spaced. This type of cracking is typical of shrinkage cracking and, although unsightly, do not typically indicate an inherent structural integrity problem. Some vertical cracks have evidence of leakage.

Diagonal cracks were observed towards the north end of the structure, with some evidence of leakage. Diagonal cracks are typically indicative of an underlying structural condition which most likely is differential settlement or differential deflection between structural members.

Interior surfaces of the walls were not inspected as the tank was in normal operation. The water level in the tank was observed to be very close to the top of the wall. A report from AECOM from March 2011 indicates that during a plant expansion in 2000 when Oxidation Ditch No. 2 was built and hydraulically connected to Oxidation Ditch No. 1, water level in Oxidation Ditch No. 1 was raised, thus increasing the loading on the exterior walls. Plant staff indicates that there is a risk of water from inside the tank spilling and splashing on windy days. Circular walls on the north end were raised during the plant expansion of 2000 and a top slab was added which also increased the wall loading.

Based on the observations presented above and the AECOM 2011 report, it is recommended to repair all vertical cracks on the exterior wall surfaces with a flexible hydrophilic grout that will allow slight movement of the cracks without future leakage. Repair of diagonal cracks will likely be more involved. It is recommended to perform a more detailed structural evaluation of the condition of the structure by reviewing the record drawings and performing a limited geotechnical investigation to try to determine the causes of the diagonal cracks and develop a long term solution. Soil improvement, structural strengthening, or a combination of both may be required. Increase in the wall height of the tank to prevent spills and splashing is not recommended until a more detailed evaluation is performed to determine feasibility. Without strengthening of the structure, an increase to the wall height should not be done. A temporary partial solution that may reduce splashing is to install meshed panels that capture splashes but allow raising water to pass through which will not increase the hydraulic loading on the tank walls.

Once all cracks are repaired, the entire structure should be re-painted.

Mechanical – The aerators were found to be in good condition. However, the flow split between Oxidation Ditch No. 1 and Oxidation Ditch No. 2 is unknown. It is recommended that flow meters be installed on the influent piping to the Oxidation Ditch Nos. 1 and 2 and that automatic control gates be installed to help control the flow split. It is also recommended that a drain be installed to facilitate emptying the tank. In the interim, in order to more fully inspect the oxidation ditch, it is recommended that the tank be drained and that any grit be removed. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

1. Ditch No. 1, Aerator No. 2 Gearbox: Antimony is at higher than usual level which could result from Babbitt bearings with antimony and/or a lube supplement. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

Electrical – There is a 8.4 degree temperature difference between legs in the breaker for the Oxidation Ditch No. 1, Aerator No. 1 MCC3. It is recommended that the connections be inspected and amp readings be checked.

- Oxidation Ditch No. 2: Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Total tank area is approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the north-east. Oxidation Ditch No. 2 is newer than Oxidation Ditch No. 1, and is approximately 18 inches higher than Oxidation Ditch No. 1. A structural evaluation by AECOM from March 2011, see **Appendix 2-2**, indicates that this structure was built in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

  Structural – Multiple vertical cracks are present all around the exterior of the structure on both the straight walls and the circular walls. Some cracks have evidence of leakage. This type of cracking is typical of shrinkage cracking and do not typically indicate an inherent structural integrity problem. Several concrete spalls were observed on the east wall towards the north end. The top slab over the north end of the tank appears to be separating from the exterior walls. Interior surfaces of the walls were not observed as the tank was in normal operation.

  Based on the findings presented above, it is recommended to repair all vertical cracks on the exterior wall surfaces with a flexible hydrophilic grout that will allow slight movement of the cracks without future leakage. Spalled concrete may be repaired with a specialized cementitious repair mortar after the unsound concrete is completely removed.

  A more detailed structural evaluation is recommended around the north end of the tank to determine the cause of the separation of the top slab from the exterior wall. The gap between the slab and wall, and the difference in the top elevation may be an underlying structural issue or simply a construction deficiency.

  Once all cracks are repaired, the entire structure should be re-painted.

Mechanical – The aerators were found to be in good condition. However, as mentioned previously, the flow split between Oxidation Ditch No. 1 and Oxidation Ditch No. 2 is unknown. It is recommended that flow meters be installed on the influent piping to the Oxidation Ditch Nos. 1 and 2 and that automatic control gates be installed. Additionally, in order to more fully inspect the oxidation ditch, it is recommended that the tank be drained to allow for a thorough inspection and that any grit be removed. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

1. Ditch No. 2, Aerator No. 1 Gearbox: Antimony, titanium and other metals were identified at higher than usual levels. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

2. Ditch No. 2, Aerator No. 2 Gearbox: Nickel is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

- Splitter Box No. 2: Structure consists of a rectangular reinforced concrete tank covered with aluminum grating accessible via reinforced concrete stairs and serves to split flow to the secondary clarifiers. Flow to each clarifier structure is controlled by three slide gates installed in the Splitter Box No. 2 structure.

  Structural – The Splitter Box No. 2 is in overall good condition and does not require structural repairs. However, the top surface does not have a kick plate around the perimeter along the guardrails. It is recommended to add a kick plate on the perimeter of the walking area.

  Mechanical – The slide gates are in good condition. There are no recommendations at this time.

- Secondary Clarifier Nos. 1 and 2: This structure consists of a rectangular reinforced concrete tank partially below grade. A center wall separates Clarifier No. 1 from Clarifier No. 2. One steel trussed walkway spans the structure in the short direction and is accessible from grade via aluminum stairs. The south end of the structure contains the pipe gallery which is below grade and covered with a reinforced concrete slab. The pipe gallery is accessible by a hatch on the top concrete slab and reinforced concrete stairs. Two rectangular reinforced concrete scum boxes (one for each clarifier) are located at the south end and connected to the main structure with a short section of ductile iron pipe. The 373,000-gallon (each) rectangular secondary clarifiers include overflow weirs, scum skimming, removal troughs and two scum pumps. The two drive mechanisms are supported on the respective exterior and center walls.

Structural – Clarifier Nos. 1 and 2 are currently not in service but provide extra capacity to the plant during peak flow conditions. Several cracks with leakage evidence are visible on the east wall. Cracks are also visible on the cantilevered channel at the north end of the structure. The connection between the main basins and the scum boxes shows evidence of leakage even though prior repairs are evident. The steel trussed structure for the walkway bridge has minimal signs of corrosion and the coating has failed. Plant staff has indicated that the structure and mechanisms are difficult to clean due to the lack of drains and sumps.

It is recommended to repair all cracks with a hydrophilic grout and paint the steel trussed walkway bridge. Exterior wall surfaces should also be painted. The connection between the main basins and the adjacent scum boxes should be modified to a more watertight condition such as with a channel instead of a connecting pipe. For ease of clean-up, the County may consider adding sumps at one end of the structure but this will require partial demolition of the foundation slab to form the sumps.

The pipe gallery at the south end is in overall good condition; however there is evidence of flooding. It is recommended to replace the access hatch with a watertight hatch to prevent future flooding. The interior wall surfaces should be re-painted.

Mechanical – The mechanical equipment is in adequate condition for the extent that these clarifiers are utilized (i.e., backup during wet weather flow). If these clarifiers remain in service, it is recommended that a flow meter be installed on the influent piping to these clarifiers.

Miscellaneous – It should be mentioned that these clarifiers are difficult to maintain, operate and clean. If the WWTF expanded its treatment capacity in the future, it is recommended that this tank be demolished to make room for an additional circular clarifier. This would negate all recommendations mentioned previously for this structure.

- Secondary Clarifier No. 3: This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – Overall condition of the clarifier is good. There is minor evidence of concrete spalls at the perimeter walkway where guardrail posts are embedded in the concrete walkway. The steel bridge appears to be in good condition but the protective coating is deteriorating.

Based on the above observations, it is recommended to paint the steel walkway bridge and repair the concrete spalls at the guardrail posts. Concrete spall repairs may require modification of the post embedment to a base plate installation because the posts appear to be installed very close to the walkway edge and differences in thermal conductivity between aluminum and concrete can cause the aluminum to expand differently than the concrete and crack the concrete edge.

Once all repairs to the concrete are completed, the entire structure should be re-painted.

Mechanical – The secondary clarifier visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. However, the flow split between Clarifier Nos. 3 and is unknown. It is recommended that flow meters be installed on the influent piping to Clarifier Nos. 3 and 4. Additionally, in order to more fully inspect the clarifier, it is recommended that the tank be drained to allow for a thorough inspection of the mechanism, arms and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

1. Clarifier No. 3 Lower Gearbox: Continue to observe the trend and monitor equipment and fluid conditions as gear and/or bearing metal is at a moderate level.

2. Clarifier No. 3 Upper Gearbox: Water is at a severe level in the gearbox, bushing / thrust metal is at a moderate level and gear and/or bearing metal is at a minor level. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant be changed.

- Secondary Clarifier No. 4: This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – Overall condition of the clarifier is good. The steel bridge appears to be in good condition but the protective coating is deteriorating.

  Based on the above observations, it is recommended to paint the steel walkway bridge, and re-paint the entire concrete structure.

Mechanical – The secondary clarifier visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. However, the flow split between Clarifier Nos. 3 and 4 is unknown. It is recommended that flow meters be installed on the influent piping to Clarifier Nos. 3 and 4. Additionally, in order to more fully inspect the clarifier, it is recommended that the tank be drained to allow for a thorough inspection of the mechanism, arms and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendations are per the Florida Bearings report, see **Appendix 2-3**. In Clarifier No. 4 Upper Gearbox, water is at a severe level in the gearbox, bushing / thrust metal is at a severe level and gear and/or bearing metal is at a moderate level. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination, that the lubricant be changed, that the unit be inspected for excessive bushing / thrust wear and that an analytical ferrogram be performed to clarify the type of wear and/or contamination that is present.

- Secondary Effluent Roto-Screens: This structure consists of a pre-engineered steel open building with metal roof panels on steel purlins. Foundation for the steel structure is a reinforced concrete slab on grade. Screen equipment is placed on reinforced concrete channels on grade. The four self-cleaning 0.1-inch Roto-Screens remove any remaining solids from the wastewater before it is pumped down the deep injection well.

  Structural – The concrete structure of the Roto Screens Facility is in overall good condition and does not require structural repairs. The metal framed structure covering the screens shows evidence of corrosion at the bases of columns and some of the roof members such as the purlins, metal roofing panels and cross-bracing rods.

  Based on the findings detailed above, it is recommended to rehabilitate the entire metal structure including repairs to column bases, replacement of roof purlins, and replacement of roof panels. Once all repairs are complete, the entire metal structure should be painted to prevent further corrosion. As per plant staff, it is also recommended to paint the concrete floor around the dumpsters with an epoxy coating to facilitate clean-up and prevent deterioration of concrete from spills and splashes.

  Mechanical – The Roto-Screens are in good condition. However, during periods of high flow (i.e., rainfall events) and/or if maintenance is required on one of the units, a hydraulic constraint occurs. It is recommended that a bypass line be installed to provide a means of removing the hydraulic constraint during these situations. The installation of this bypass line would also require some optimization of the bar screens (in the Headworks) to achieve higher screenings capture rates. As the rotary drum screens approach the end of their useful life, an alternative means of screening the secondary effluent prior to the deep well injection (and to remove the hydraulic constraint that

currently exists upstream of the rotary drum screens) is to replace the rotary drum screens with an inline automatic self cleaning strainer in the discharge header of the deep injection well pump station. This alternative should only be considered however if the deep injection well high pressure condition is resolved so that the strainer installed on the discharge side of the effluent pump station would not add to the already higher than desired pressure condition of the deep well. Additionally, the metal frames on the Roto-Screen effluent wet well slide gate and isolation gate are in poor condition and should be replaced. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

1. Roto-Screen No. 1 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

2. Roto-Screen No. 2 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

3. Roto-Screen No. 3 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed.

4. Roto-Screen No. 4 Gearbox: Viscosity is at a severely low level. It is recommended that the lubricant be changed. Additionally, water is at a severe level. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination.

- Injection Well Pump Station: The structure for the injection well pump station consists of a reinforced concrete wet well below grade with a concrete cover, and an adjacent reinforced concrete slab on grade. The Injection well pumps are placed over the wet well on the concrete cover, and the slab on grade supports piping and valves. The injection well pump station has a pumping capacity of 12.0 MGD with three duty pumps and one standby pump.

  Structural – Overall condition of the visible areas of the structure is good and does not require structural repairs. The interior condition of the wet well was not accessible and was not observed.

  Mechanical – The pumps have been recently replaced / repaired and are in good condition. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

  1. Pump No. 1: Copper is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions. For the Pump No. 1, it is also recommended that the motor be closely monitored for

any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

2. Pump No. 2: Direct Reading Ferrography is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions.

3. Pump No. 4: Direct Reading Ferrography is at a minor level. It is recommended that plant staff continue to observe the trend and monitor equipment and fluid conditions. For the Pump No. 4, it is also recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

- Deep Injection Well: The injection well system consists of one deep injection well and an associated monitor well.

  Structural – Concrete slab on grade at the deep injection well is in overall good condition and does not require structural repairs.

  Mechanical – Overall the injection well is in poor condition. It is recommended that the well be acidized to recover lost capacity and also that the injection well be rerated from its current permitted 8 ft/s up to 10 ft/s. This would provide an additional 2.54 mgd of disposal capacity. It is also recommended that the Deep Injection Well flow meter be replaced with a new magnetic flow meter.

  Electrical – The following recommendations are per the Florida Bearings report, see **Appendix 2-3**. For Injection Well Pump No. 2, there is a 31.8 degree temperature difference between legs in the breaker, a 12.3 degree temperature difference between legs in the starter and a 7.8 degree temperature difference between fuses. It is recommended that the breaker / starter connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.

  Instrumentation – Replacement parts for the existing PLC system are unavailable. It is recommended that the Injection Well PLC be replaced.

- RAS / WAS Pump Station: This structure consists of a rectangular reinforced concrete tank covered with a reinforced concrete slab accessible via reinforced concrete stairs. The outdoor pipe gallery is supported on a reinforced concrete slab covered with an open steel framed structure. Three return activated sludge (RAS) pumps and two waste

activated sludge (WAS) pumps collect settled sludge in the secondary clarifiers and return it to the oxidation ditches or waste to the Sludge Thickening Facility, respectively.

Structural – The RAS / WAS Pump Station concrete structure is in overall good condition. No cracks or leaks were observed. The metal framed structure at the west housing the pumps has deteriorated paint and minor corrosion. Asbestos was found on some of the roof elements.

Based on the observations above, it is recommended to rehabilitate the metal framing structure and remove all asbestos containing elements.

Mechanical – The pumps are in good condition. However, it is recommended that the RAS flow meter be replaced with a new magnetic flow meter. The following recommendation is per the Florida Bearings report, see **Appendix 2-3**.

- RAS Pump No. 3 Gearbox: Water is at a severe level in the. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant is changed.
- WAS Pump No. 1: There is internal looseness (excessive clearances) present on the pump. It is recommended that the pump bearings be inspected for the proper fit on the shaft and within the housings. Repair and replace as necessary.

Electrical – The following recommendations are per the Florida Bearings report, see **Appendix 2-3**.

1. RAS No. 1, MCC1 has a 17.3 degree temperature difference between legs in the breaker and a 5.4 degree temperature difference between fuses. It is recommended that the breaker connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.
2. WAS No. 1, MCC1 has a 12.8 degree temperature difference between legs in the starter and a 50.2 degree temperature difference between connections on the load reactor. It is recommended that the breaker and load reactor connections be inspected and amp readings be checked.
3. RAS No. 3, MCC2 has a 4.3 degree temperature difference between legs in the starter and a 5.4 degree temperature difference between fuses. It is recommended that the breaker connections be inspected and amp readings be checked.
4. WAS No. 2, MCC2 has a 25.5 degree temperature difference between legs in the starter and a 143.8 degree temperature difference between fuses. It is

recommended that the breaker connections be inspected, amp readings be checked, and that the fuse be inspected and replaced if necessary.

- Chlorine Building: Facility consists of a one-level steel framed structure supported on a reinforced concrete slab on grade. FRP wall and roof panels partially cover the storage tanks. The chlorine equipment consists of two covered crosslink polyethylene chemical storage tanks storing 12 percent sodium hypochlorite solution, three diaphragm metering pumps and one sodium hypochlorite batching pump. Chlorine is diluted to 9 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the well is out of service or they have a peak flow conditions that exceeds the well capacity, sodium hypochlorite is injected into Clarifier No. 3 so that the secondary effluent can be discharged to the percolation ponds.

  Structural – Structure is in overall good condition with minimal paint deterioration and FRP panel deterioration. Replacement of the wall and roof panels is not necessary at the present time but should be considered in the long term due to their natural deterioration with extended exposure to UV. As per plant staff, to protect the concrete floor surface from potential chlorine spills, it is recommended to coat the floor with an epoxy coating.

  Mechanical – Overall the mechanical equipment is in good condition. There are no recommendations at this time.

- Sludge Thickening Facility: Structure consists of an open steel frame with metal roof panels supported on a reinforced concrete slab on grade. Thickening is employed to reduce the sludge prior to the aerobic digestion process. Two rotary drum thickeners located at the Sludge Thickening Facility thicken the WAS prior to digestion. The Sludge Thickening Facility also contains two thickened sludge pumps.

  Structural – The metal framed structure covering the thickening equipment has corrosion with widespread coating failure. It is recommended to rehabilitate the entire metal framing structural members and replace roof panels as required. Once repairs are complete, the entire structure should be painted.

  Mechanical – The rotary drum thickeners, which were repaired recently, and the sludge pumps are in fair condition. However, the rotary drum thickeners have been repaired several times prior to this as well and are close to the end of their useful life. It is recommended that the rotary drum thickeners be replaced and that alternative thickening technologies, including Gravity Belt Thickeners, be considered.

- Aerobic Digester: Structure consists of a circular reinforced concrete tank with several steel walkways on the top accessible via one aluminum stair structure. Adjacent to the tank is an open steel framed structure housing two blowers. This facility utilizes aerobic digestion for sludge stabilization. The major components of the digester system are the 465,000-gallon circular concrete tank, two blowers and one truck loading pump.

  Structural – Several cracks with evidence of leaks can be observed. One horizontal crack at approximately one-third of the wall height extends all around the perimeter of the tank. Several other smaller cracks can be seen around pipe penetrations. The walkway bridges and access stairs are in good condition.

  Based on the findings mentioned above, it is recommended to perform a more detailed structural evaluation of the tank to determine if the horizontal crack is indicative of a structural insufficiency or a construction deficiency. A horizontal crack of this nature may indicate there is insufficient ring steel reinforcement, or a faulty construction joint. The interior of the tank should be inspected at this time.

  Cracks and leaks around pipe penetrations may indicate faulty construction around these areas where concrete may have been placed without sufficient consolidation. It is recommended to repair these areas with hydrophilic crack injection materials.

  Once all concrete repairs are complete, the entire concrete structure should be re-painted, including the floor at the blower slab.

  Mechanical – The mechanical equipment is in good condition. However, in order to ensure the Aerobic Digester does not exceed a maximum level, it is recommended that an overflow be constructed for the tank. Additionally, the following recommendation is per the Florida Bearings report, see **Appendix 2-3**. For Blower No. 2, it is recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

- Influent Equalization (EQ) Tank: Structure consists of a circular reinforced concrete tank. A steel bridge spans the tank completely and is accessible from grade via steel stairs. This structure has been abandoned and is no longer in use.

  Structural – Several cracks were observed on the exterior wall surface, with one horizontal crack of particular significance at the top of the wall towards the south. This crack is long and there is evidence of corrosion of reinforcing steel within the wall. The exterior surface of the concrete walls appears to be in good condition; however the protective coating has failed.

The interior steel bridge and access stair appear to be in good condition but their protective coating has failed. The FRP grating at the bridge is deteriorated. Parts of the guardrail are damaged. The bridge walkway lacks OSHA required toe boards.

If the County wishes to keep the tank in case of a peak condition where additional water storage is required or to serve as an alternative treatment process tank, it is recommended to repair the exterior cracks with a hydrophilic grout. The long horizontal crack will likely require removal of unsound concrete, replacement of reinforcing steel, and placement of a cementitious repair mortar. Steel bridge and stairs should be painted, FRP grating replaced, and guardrails repaired. Toe boards should be added to all horizontal walking surfaces of the bridge. Finally, the entire concrete structure should be re-painted.

Mechanical – This tank does not have any mechanical equipment. There are no recommendations at this time.

Miscellaneous – It should be mentioned that this abandoned tank could be converted to an additional clarifier or aerobic digester depending on the future needs of the WWTF or as identified in the Hazen and Sawyer technical memorandum regarding plant optimization (Task 11 of the contract, draft submittal date TBD).

- MCC Building: Facility consists of a one story reinforced concrete and masonry building with a flat roof supporting AC equipment.

  Structural – The MCC Building is in overall good condition and does not require structural repairs.

  Mechanical – This cooling of this building is critical for the electrical equipment housed inside. It is recommended that two air handlers be replaced.

- Operations Building: This structure consists of a two story reinforced concrete and masonry building with a tiled hip roof. Access to the building is via a concrete ramp and concrete stairs on the west side. The adjacent old Influent Structure to the north and old Chlorine Contact Tanks to the east have been abandoned, filled with sand and covered with a thin concrete slab to serve as a deck. The abandoned Influent Structure at the north end of the Operations Building has a basement level which has been cleared of all equipment.

  Structural – The new operations building is in overall good condition, however, plant staff report some roof leaks. The access ramp at the west side has cracked at the location of a support post for a walkway roof.

Concrete decks over the abandoned influent structure and chlorine contact basin have cracked on the top surface and at the interface with the old structure. Several cracks and spalls are visible on the walls of the abandoned structures with evidence of moisture seepage. An effluent box of the old chlorine contact basin is used as a planting area for a tree but roots of the tree have cracked the concrete. Exterior paint of the old structures has failed. The basement level of the old influent structure has been stripped of all equipment but is very humid, possibly due to groundwater intrusion.

Based on the above findings, it is recommended to replace the roofing of the new operations building. A thorough inspection of the roof structure should be performed to determine the condition and evaluate if replacement is necessary. The crack at the access ramp should be repaired, and support of the roof post should be replaced with a different type to avoid further cracking. Top surfaces of concrete decks over abandoned structures should be sealed to prevent rainwater intrusion to fill below; this activity, however, is not a priority as this structure should eventually be demolished.. All wall cracks and spalls at the abandoned structures should be repaired, and the entire structure should be re-painted. Trees and plants placed inside abandoned structures should be either removed or relocated to prevent future cracking by roots, and the cracked box should be demolished.

Mechanical – The air conditioning units have reached the end of their useful life. It is recommended that five air handlers be replaced.

Miscellaneous – Storage is inadequate in the break room. It is recommended that cabinets be upgraded.

- Maintenance Building: Facility consists of a one story reinforced concrete and masonry building with a tiled hip roof.

  Structural – The maintenance building is in overall good condition, however plant staff report roof leaks. It is recommended to replace the roofing and inspect the roof structure to determine if it also requires replacement.

  Mechanical – This tank does not have any functional mechanical equipment. There are no recommendations at this time.

- On–site Lift Station No. 1: Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two 5-Hp submersible pumps.

  Structural – The wet well is in poor condition. The 6-foot diameter wet well liner is failing. It has delaminated from the concrete walls in several places and has exposed the

concrete. Most of the delaminating occurs around the pipe penetration into the wet well. There were no signs of soft concrete or exposed steel inside the wet well. The lifting eyes in the top slab are exposed and are rusted. The valve vault is concrete and does not have any coating and is in fair condition.

Based on the above findings, it is recommended to replace the entire interior liner of the wet well, and coat the exposed lifting eyes at the top slab.

Mechanical – The pumps appear to be in fair condition. The lift station has eight separate influent lines ranging in size from 2-inches up to 8-inches and their inverts range from 4 to 6 feet below grade. The discharge piping and valves are 6-inches in diameter and are significantly corroded. There is little to no protective coating or paint on the piping and valves. The isolation valves are plug valves and the check valves are spring cushioned swing checks. The spring systems are rusted or missing and not working on both check valves. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault does not drain into the wet well or is not equipped with a drain as it holds water.

- On–site Lift Station No. 2: Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two Flygt submersible pumps.

  Structural – The wet well is in fair condition. The 6-foot diameter wet well liner/coating is failing. There is exposed concrete in several places. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition, there are a few cracks in the top slab and evidence of differential settlement between the wet well top slab and the surrounding slab on grade. The valve vault has a coating and is in good condition.

  Based on the findings above, it is recommended to replace the entire interior liner of the wet well.

  Mechanical – The pumps were not visible so the condition could not be determined. The lift station has several separate influent lines ranging in size from 2 inches up to 6 inches. The discharge piping and valves are 4 inches in diameter and have some rust inside the wet well. There is a protective coating or paint on the piping and valves in the valve box and they appear to be in good condition with very little rust, mainly around the pump out connection. The isolation valves are plug valves and the check valves are leaver and weight swing checks. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault is equipped with a drain to the wet well.

- Generator Building No. 1: Building consists of a one story reinforced concrete and masonry building with a flat roof over half of the building fully enclosing the generator. Approximately half of the building is open on the top at the location of the fuel tank.

  Structural – The Generator Building No. 1 is in overall good condition, however plant staff report roof leaks. It is recommended to replace the roofing.

  Mechanical – This building does not have any mechanical equipment. There are no recommendations at this time.
- Generator Building No. 2: Structure consists of a one-story reinforced concrete and masonry building with a tiled hip roof

  Structural – The building is in overall good condition, however plant staff report roof leaks. It is recommended to replace the roofing and perform a thorough inspection of the roof structure to determine if replacement is necessary.

  Mechanical – This building does not have any mechanical equipment. There are no recommendations at this time.

  Electrical – The following recommendations are per the Florida Bearings report, see **Appendix 2-3**. For the 300-kW generator MCC3, there is a 8.7 degree temperature difference between legs in the breaker. It is recommended that the breaker connections be inspected and that amp readings be checked.

- Polymer Storage Building: Structure consists of a one-story reinforced concrete and masonry building with a flat roof. Adjacent to the building is an uncovered concrete pad for temporary storage of polymer totes. The Polymer Storage Building also contains a polymer system with two polymer totes, one feeder outside storage for the polymer totes.

  Structural – The building is in overall good condition. To protect the concrete floor, it is recommended to coat the building floor and exterior pad with an epoxy coating.

  Mechanical – The polymer system is inefficient and many parts / components do not function. It is recommended that two new polymer feeders be installed. Additionally, the polymer storage totes are stored outside on a slab. It is recommended that these totes be protected from exposure to the sun.

  Electrical – The following recommendations are per the Florida Bearings report, see **Appendix 2-3**. For the 300-kW generator MCC3, there is a 8.7 degree temperature

difference between legs in the breaker. It is recommended that the breaker connections be inspected and that amp readings be checked.

- Electrical System: The electrical distribution system at the Belle Glade WWTF consists of two utility FPL services. Utility Service No. 1 is located in the north-east corner of the plant and is connected to a 750kVA FPL transformer. The 750kVA FPL transformer is located in the existing FPL vault. The step-down transformer is connected to the main switchboard (MSB-1) located in Generator Building No. 1. MSB-1 consists of one 800A rated main breaker, one 600A rated generator breaker, one 800A rated automatic transfer switch (ATS), and other feeder breakers. The main breaker and emergency breakers are electrically interlocked through an ATS control scheme to prevent from closing both breakers at the same time. MSB-1 provides power to Digester Blower No.1, Digester Blower No. 2, Oxidation Ditch No. 1 Aerator No. 1, Oxidation Ditch No. 1 Aerator No. 2, Chlorine Building and the Polymer Building. MSB-1 and the starters for the aerators were installed in 1982. This equipment is past its reliable life span (-11 to -6 years) and is in poor condition and also in a non-air-conditioned space. The digester blower starters were installed in 1996; these starters are near the end of their expected life span (3-8 years) and also need to be replaced.

  Back-up power for MSB-1 is provided by a 300-kW (375kVA) generator rated at 480V, 3-phase. The generator was installed in 1982. MSB-1 is well past the reliable life span for electrical equipment, typically 20-25 years and needs to be replaced. The generator can be replaced or eliminated. There are two options for eliminating the existing 300-kW generator. Option one is to re-feed all of the existing electrical loads from the existing MSB-1 to the Utility Service No. 2 and leave Utility Service No. 1 for future use. Option two is to replace the existing MSB-1 at the same location including the ATS and connect the emergency power from the 1500-kW generator. A new 600A breaker will be added at the 1500-kW generator and new conduits/cables will be installed to MSB-1. Option two will require a new cable and conduit system from the existing Generator Building No. 2 to the new MSB-1 located at Generator Building No. 1. Due to the long distance from the existing Generator Building No. 2 to the new MSB-1, new manholes will be needed for the conduits for cable pulling at every 500 feet or 270 degree bends. It is recommended that the cost of this ductbank installation be compared with the cost of a new 375-kVA in order to make the most economic decision.

  Utility Service No. 2 is located in the west-center of the plant and consists of two feeders derived from the same FPL distribution point. Each feeder is connected to an individual 1000-kVA outdoor pad mounted FPL transformer. The step-down transformers feed main switchboard No. 2 (MSB-2) located at Generator Building No.2. MSB-2 consists of two main breakers and two emergency breakers, rated 1600A. One main breaker and emergency breaker pair is connected to one bus and the other remaining pair is

connected to another bus. Each set of main and generator breakers are electrically interlocked through an ATS control scheme such that both breakers cannot be closed at the same time. The two 1600A rated buses in the MSB-2 are connected to a Main-Tie-Main (MTM) switchboard. The MTM, installed in 2012, is a 1600A switchboard with two 1600A main breakers and a 1600A tie breaker used to provide the flexibility of connecting the power from either side of MSB-2 in the event of equipment failure at either bus of the MSB-2. From the MTM, power is distributed to switchboard IWA (SWBD-IWA) and switchboard IWB (SWBD-IWB). SWBD-IWA and SWBD-IWB are located in the MCC Building. SWBD-IWA provides power to Injection Well Pump No. 1 Variable Frequency Drives (VFD), Injection Well Pump No. 2, Oxidation Ditch No.2 Aerator No. 1 starter, Panel IWHA (480V) and MCC-1. SWBD-IWB provides power to Injection Well Pump No. 3 VFD and Injection Well Pump No. 4 VFD, Oxidation Ditch No. 2 Aerator No. 2 starter, Panel IWHB (480V), and MCC-1. The VFDs for Injection Well Pump Nos. 3 and 4 were installed in 2012 and are in excellent condition. SWBD-IWA, SWBD-IWB and Injection Well Pump Nos. 1 and 2 VFDs were installed in 1994 and are near the end of their expected life span (1-6 years) but are in good condition. The starters for Oxidation Ditch No. 2 Aerators were installed in 1996 and are in good condition but near the end of expected life span (3-8 years). The 480V panels IWHA and IWHB and low voltage panels associated with each were also installed in 1996 and are in good condition. MCC-1 and MCC-2 located in the Operations Building electric room provide power to the plants' headworks, clarifiers, on-site lift stations, plant water booster pumps, and general power for the Operations and Maintenance Buildings. The MCCs were installed in 1996 and are in good condition.

Back-up emergency power for MSB-2 is from Generator No. 2, a 1500-kW (1875kVA) generator rated at 480V / 3-phase, also located in Generator Building No. 2. The generator was installed in 1994 and is in very good condition due to excellent maintenance. MSB-2 was installed in 1994 and near the end of its expected life span (1-6 years). With the recent replacement of the main and generator breakers at MSB-2 in the past year the switchboard is in good condition.

Plant operations are monitored and controlled by three PLCs. PLC-1, located in the Operations Building Electric Room, was installed in 1998 and is good condition. PLC-1, located in the MCC Building, was installed in 1996 and is good condition. PLC-3, located near the chlorine facilities, was installed in 2012 and is in excellent condition. There are no recommendations for replacement or renewal at this time.

- Miscellaneous: The following are miscellaneous improvements recommended for the Belle Glade WWTF.

– It is recommended that a security fence be installed around the Truck Wash Lift Station to restrict access and allow PBCWUD to log the date, time, amount and contents of the trucks that access the washing facility.

– It is recommended that the main PLC system be replaced (with different software) to allow staff at the Belle Glade WWTF to modify the programming if necessary and because replacement parts are difficult and/or impossible to obtain.

– It is recommended that all valve operators be upgraded to allow electronic control such that Belle Glade WWTF staff would be able to operate all the valves via the upgraded PLC system.

– The existing asphalt near the Operations Building is overall in fair to good condition but has some problem areas where it is cracking, crumbling and/or settling. It is recommended that the existing asphalt paving be overlayed with a second layer of asphalt. After the asphalt overlay, it is recommended that the parking configuration be modified to provide for additional parking spaces.

– It is recommended that the PBCWUD start provisioning for reuse at the Belle Glade WWTF. Reuse water would be used at the site as plant service water and could also be used off-site by local businesses. The reuse system at the Belle Glade WWTF would likely consist of filtration, an upgraded disinfection system, a chlorine contact chamber and a distribution pumping system.

– It is recommended that the pond be dredged to remove vegetation and debris and that the pond bypass gate be replaced.

– It is recommended that plant lighting be replaced with higher illumination LED lights.

Pahokee WWTF

Wastewater at the Pahokee WWTF is treated via either the 0.50–MGD TMADF conventional WWTF (Plant 1) or the 0.70–MGD TMADF complete mix Walker WWTF (Plant 2). Facilities at the plant have been denoted as either common (shared between the two treatment technologies), Plant 1 (part of the “conventional” Plant) or Plant 2 (part of the Walker Modular Plant, aka “complete mix”). Visual inspection identified the following:

- Influent Pump Station (common): This structure consists of a rectangular reinforced concrete tank with a concrete top slab cover. The top slab is accessible through an aluminum stair that also serves as access to the Primary Clarifier bridge. Raw

wastewater enters the Influent Pump Station, which is comprised of two submersible pumps.

Structural – The exterior concrete surfaces of the splitter box are in good condition. Interior surfaces above the water line shows signs of erosion. Structure was in operation so the interior condition below the water line was not visible.
It is recommended to re-coat the entire structure and inspect the interior.

Mechanical – The condition of the influent pumps is unknown because this structure does not have a bypass. It is recommended that a bypass be installed so that the structure and pumps can be rehabilitated.

- Headworks (common): The facility consists of a two level reinforced concrete structure above grade. The bottom level is open and the top level consists of multiple channels supported on columns. The top level walking surface consists of a perimeter concrete cantilevered slab and metal grating over the screening channels. An aluminum staircase serves as access to the top level. The top level also contains pretreatment equipment consisting of one mechanical self–cleaning bar screen, one bypass manually cleaned bar screen, flow control slide gates and one grinder which is piped downward to screenings trash cans placed on the ground level.

  Structural – The Headworks structure is in overall good condition. At the time of the visit, the facility was in normal operation and the interior surfaces of the upper level channels could not be inspected. It is recommended to perform an inspection of the interior channel surfaces.

  Mechanical – The equipment in the Headworks structure is in fair condition. However, the placement of the grinder prior to the mechanical bar screen creates solids small enough to pass through the screen thus affecting downstream equipment. It is recommended that the mechanical bar screen be replaced and the grinder be removed to reduce this issue.

  Electrical – The grounding wire around the headworks structure is oxidizing and resulting in the discoloration stains on the floor deck and streaking down the walls from the upper deck. It is recommended that this grounding wire be replaced.

- Primary Clarifier (Plant 1): This structure consists of a circular reinforced concrete tank on grade with a steel bridge for access to the clarifier mechanism motor. Access to the steel bridge is via an aluminum stair which also serves as access to the top level of the Influent Pump Station. The 53,000-gallon center feed primary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one primary sludge pump that

pumps directly to the aerobic digester. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly. Flow to the clarifier is controlled by splitter box at the end of the Headworks. There is also a Primary Clarifier Grit Chamber Structure which consists of a reinforced concrete slab with shallow channels.

Structural – Exterior of the concrete structure of the primary clarifier is in good condition. Steel support members of the steel bridge are corroded. Interior of the clarifier was not visible during this visit as it was in operation, but the top of the interior wall surface above the water line was visible and had some erosion.

It is recommended to replace the steel bridge supports, re-paint the steel bridge, and re-coat the entire structure. It is also recommended to inspect the interior of the clarifier.

The Primary Clarifier Grit Chamber Structure has settled and replacement is recommended.

Mechanical – After over 20 years in service, the primary clarifier's visible mechanical equipment was found to be in poor condition with rusting of several components. Above-grade piping appeared in good condition. In order to more fully inspect the clarifier, it is recommended that the tanks be drained to allow for a thorough inspection of the mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per the Florida Bearings report, see **Appendix 2-4**. On the Primary Clarifier, water appears to be at a severe level in the oil. It is recommended that the lubricant be changed.

- Aeration Tank Nos. 1 and 2 (Plant 1): Structure consists of a rectangular reinforced concrete multi-cell tank above grade. A center wall separates Aeration Tank No. 1 from Aeration Tank No. 2. A concrete walkway on the north wall extends the full length of Aeration Tank No. 1. Metal grating over channels on the center wall and the outer east, west, and south walls serve as additional walkways. An aluminum stair serves as access to the top level of the tanks. Secondary treatment on the conventional side of the Pahokee WWTF starts with two aeration tanks. Air is introduced near the tank bottom which causes the basin's contents to be mixed. Dissolved oxygen (DO) levels in the tanks are monitored and blower rates adjusted to maintain the desired DO levels. The Aeration Tanks are comprised of the following components: two single pass Aeration Tanks, air piping and air diffusers.

  Structural – The exterior of the tanks appears to be in good condition as there is no evidence of leakage. The top level walkway is cracked in several locations, and one corner at the east end is spalled. Cracks and spalls can also be seen along the interface between the embedded grating frames and the concrete. The top support of the

aluminum stairs that serve as access to the top level of the tanks is anchored to cracked and spalled concrete. There is evidence that old guardrails have been removed and new ones installed as a replacement. The exterior coating is stained. At the time of the visit, the tanks were in service and the interior of the tanks could not be inspected.

Based on the above observations, it is recommended to repair all top level cracks and spalls, and modify the stair top support to provide an anchorage less prone to cracking. An interior inspection of the tanks is recommended to determine if any repairs are required inside. Once all repairs are done, it is recommended to re-paint the entire structure.

Mechanical – The Aeration Tanks are critical to the operation of the Pahokee WWTF. It has been several years since the tanks have been inspected. It is recommended that PBCWUD replace all diffusers as they are likely in poor condition. Plant staff have also noted that diffuser clogging is an issue. While rehabilitation is taking place and the tanks are drained, the tanks should be inspected to fully determine the extent of capital improvements that may possibly be needed.

- Equipment Building / Blower House No. 2 (Plant 1): Structure consists of a one-story reinforced masonry building with precast double-tees forming a flat roof. Process air is delivered to the aeration tanks by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 2 also contains one generator.

  Structural – Overall, the structure for Blower House 2 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the single door and louvers with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

  Mechanical – The blowers in the Equipment Building / Blower House No. 2 are in fair condition. Both have been rebuilt on various occasions. It is recommended that the two blowers be replaced. The following recommendations are per the Florida Bearings report, see **Appendix 2-4**:

  1. Blower House No. 2 Blower 1: Bushing / thrust metal is at a severe level. It is recommended to inspect this unit for excessive bushing / thrust wear. Lubricant and filter change are also recommended. Additionally, it is recommended that an analytical ferrogram be performed to clarify the type of wear and/or contamination that is present.

2. Blower House No. 2 Blower 2: Lead is at a moderate level. Lead sources in the gear systems include bushing / thrust overlay, lead solder, coatings or contamination from grease. It is recommended that plant staff continue to monitor the equipment and fluid conditions.

Electrical – The generator in the Equipment Building / Blower House No. 2 is in poor condition despite several recent repairs. To keep plant in operation and prevent possible failure (especially in the middle of a rain event), it is recommended that this generator be replaced. Additionally, the MCC located in the Equipment Building / Blower House No. 2 needs to be replaced and contained within a climate controlled room, isolated from the rest of the equipment. Lastly, there is a 14.9 degree temperature difference between legs in the breaker for Effluent Pump No. 3. It is recommended that the connections be inspected and amp readings be checked.

Instrumentation – Without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that the PLC system be upgraded to allow staff at the Belle Glade WWTF (staffed 24 hours per day) to monitor the DO levels and the blowers be upgraded to allow flow pacing.

Miscellaneous – Currently, fuel for the generators is stored in three 500-gallon tanks and piped throughout the plant. It is recommended that these three tanks be replaced by one 2,000-gallon tank with containment and contained piping to the generators.

- Secondary Clarifiers – East and West (Plant 1): These structures consist of a circular reinforced concrete tanks on grade with a steel bridge for access to the clarifier mechanism motor of each clarifier. Access to the steel bridges is via a common aluminum stair. The center feed secondary clarifiers include overflow weirs, full radius scum skimming, removal troughs and two sludge pumps (see RAS / WAS pumps). A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Structural – The exterior of the concrete structures of the secondary clarifiers is in good condition. The steel bridge has some slight corrosion and its protective coating has failed. The supports for the steel bridge have corrosion and are anchored to deteriorated concrete. The interior of the clarifiers were not visible during this visit as they were in operation.

  It is recommended to re-paint the steel bridge, replace bridge supports, repair concrete at bridge support locations and re-coat the entire structure. It is also recommended to inspect the interior of the clarifiers.

Mechanical – The secondary clarifiers' visible mechanical equipment was found to be in poor condition. It is recommended that the secondary clarifier mechanical equipment be rebuilt, including surface leveling. Above-grade piping appeared in good condition. However, in order to more fully inspect the clarifiers, it is recommended that the tanks be drained to allow for a thorough inspection of the mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. The following recommendation is per the Florida Bearings report, see **Appendix 2-4**. On the Secondary Clarifier - West, water appears to be at a severe level in the oil. It is recommended that the lubricant be changed.

- Grit Chamber (Plant 2): Structure consists of a rectangular reinforced concrete tank on grade. A top level steel walkway is accessible from grade through a steel stair that also serves as access to the adjacent Walker Unit. Before wastewater enters the Walker Unit, it goes through additional pretreatment. The additional pretreatment equipment consists of one degritter / classifier unit.

  Structural – At the time of the visit, the tank was in service and the interior could not be inspected. Exterior wall surfaces appear to be in good condition, however, the top surfaces of the walls are deteriorated showing exposed aggregate, and have a diagonal crack at every wall corner intersection. Diagonal cracks at wall corner intersections may indicate separation of the walls caused by overstressing of the reinforcement steel as a result of insufficient reinforcement or unforeseen additional loading. The top steel walkway is corroded.

  Based on the observations noted, it is recommended to replace the top walkway, and perform a detailed structural evaluation to determine if there is a structural deficiency that has caused the corner cracks. It is also recommended to re-paint the entire structure.

  Several steel pipe supports for DIP from the headworks to the grit chamber consist of steel posts and steel saddles. Steel pipe supports for elevated DIP are corroded and require replacement.

  Mechanical – The existing grit system is not functional. It is recommended that a new grit removal system be installed for entire plant at the Headworks structure. In this location, the new grit removal system would benefit the entire plant and not just the complete mix portion of the plant.

- Walker Modular Unit (Plant 2): Structure consists of a circular reinforced concrete tank on grade with a rotating steel bridge to access the center mechanism. The bridge is accessible via an aluminum stair that also serves as access to the Grit Chamber. Similar

to the conventional plant, the secondary treatment in the Pahokee WWTF complete mix plant consists of one aeration basin (1/2 of the outer circle), one clarifier (inner circle) and one aerobic digestion (1/2 of the outer circle). In the aeration basin, air is introduced near the tank bottom which causes the basin's contents to be mixed. DO levels in the tanks are monitored and blower rates adjusted to maintain the desired DO levels. The clarifier portion of the Walker Unit includes effluent weirs, “full radius” scum skimming and a scum box. The aerobic digester consists of air piping and coarse bubble membrane diffusers.

Structural – The exterior of the concrete structure of the Walker Unit is in good condition. The steel bridge has some slight corrosion and its protective coating has failed. Interior of the unit was not visible during this visit as it was in operation.

It is recommended to re-paint the steel bridge, and re-coat the entire structure. It is also recommended to inspect the interior of the unit.

Mechanical – The Walker Unit mechanical equipment was found to be in fair condition with minor rusting of some components. Above-grade piping appeared in good condition. In order to more fully inspect the Walker Unit, it should be drained to allow for a thorough inspection of the diffusers, air piping, clarifier mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed. While rehabilitation is taking place and the tank is drained, the tank should be inspected to fully determine the extent of any other capital improvements that may possibly be needed.

If the Pahokee WWTF is to remain in operation, it is recommended that all secondary clarifiers operate in parallel. This would require piping modifications to the Walker Unit, however, it would make plant operations less complicated and has the potential to improve effluent water quality.

- Control Building / Blower House No. 3 (Plant 2): The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to the Walker Unit by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 3 also contains one generator.

  Structural – Overall, the structure for Blower House 3 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the single door and louvers with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

Mechanical – The blowers in the Control Building / Blower House No. 3 are in fair condition. Both have been rebuilt on various occasions. It is recommended that the two blowers be replaced.

Electrical – The generator in the Control Building / Blower House No. 3 is in poor condition despite several recent repairs. To keep plant in operation and prevent possible failure (for example in the middle of a rain event), it is recommended that this generator be replaced. Additionally, there is a 9.8 degree temperature difference between legs in the breaker for Blower No. 2. It is recommended that the connections be inspected and amp readings be checked.

Instrumentation – Without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that the PLC system be upgraded to allow staff at the Belle Glade WWTF (staffed 24 hours per day) to monitor the DO levels and the blowers be upgraded to allow flow pacing.

- Effluent Pump Station (common): Structure consists of a rectangular reinforced concrete tank on grade open at the top. The east end of the structure serves as the effluent pump station and is covered with metal plates serving as walkway for access to the pumps. The Effluent Pump Station at the Pahokee WWTF consists of a large wet well followed by three pumps in the effluent pump station. The wet well for the three effluent pumps can be bypassed by diverting flow to the two chlorine contact chambers during wet well maintenance.

  Structural – Concrete structure of the wet well is in good condition. The west end of the structure that serves as the effluent pump station showed signs of corrosion on the metal covers supporting the pumps. However, the County has repaired the corroded metal plates and members since this visit.
  It is recommended to re-paint the entire structure.

  Mechanical – Overall the tertiary filters / effluent pump station is in good condition. The addition of the covers over both the wet well and pump station was an effective solution to reduce algal growth. Additionally, the effluent pumps were rebuilt within the last year. However, it is recommended that all three effluent pump starters be replaced with VFDs so that the pumps may be operated from the PLC. This will allow operators to control / adjust various pump setpoints, choose / modify backup pumps, start / stop pumps, run pumps in manual mode from the Operations Building (or the Belle Glade WWTF) and monitor pump status including running / off, local / remote, auto / manual, fault and speed. Additionally, it is recommended that the Effluent Pump Station wet well bypass valve be replaced within the next several years. Based upon the Florida Bearings report,

see **Appendix 2-4**, Effluent Pump No. 2 should be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

Instrumentation – If the pump starters are replaced with VFDs, as mentioned above, it is recommended that the PLC be upgraded with several displays to allow remote operation and control.

- Deep Injection Well (common): The injection well system consists of one deep injection well and an associated monitor well.

  Structural – The concrete pad around the well is in good condition and does not require structural repairs.

  Mechanical – On June 11, 2010, FDEP was notified that changes in conductivity, chloride and pressure were occurring in the dual zone monitor well. During an investigation of the monitor well it was discovered that a 431-foot section of the 6 5/8-inch tubing had separated at a casing joint and fallen within the 16-inch casing. Per the permit application submitted on June 26, 2012, it is recommended that the repair plan for the monitor well (currently being drafted) be submitted to FDEP. Only after the plan is approved can the extent of capital improvements needed be determined. Additionally, it is recommended that the semi-functional 12-inch back pressure relief valve on the influent piping of the deep injection well be replaced in kind and that the injection well be rerated from its current permitted 8.22 ft/s up to 10 ft/s. This would provide an additional 0.87 mgd of disposal capacity.

- Chlorine Contact Chamber Nos. 1 and 2 (common): Structures consist of rectangular reinforced concrete tanks partially below grade with internal concrete baffle walls. Guardrails are placed on the perimeter of the tanks, however there are no walkways at the top level. Chlorine contact chambers are only used when the injection well is out of service (for maintenance reasons).

  Structural – The Chlorine Contact Chamber No. 1 structure is in good condition. Exterior painting is stained by rust from steel guardrails on the top of the walls. The steel guardrails do not seem to serve any purpose and some sections are missing. It is recommended to remove all remaining sections of guardrail and blast / coat the entire structure including the interior wall surfaces.

  The Chlorine Contact Chamber No. 2 structure is also in good condition. The steel guardrails do not seem to serve any purpose and some sections are missing, but is in

overall good condition. It is recommended to repair sections of guardrail and coat the entire structure including the interior wall surfaces.

Mechanical – There is no mechanical equipment on or near Chlorine Contact Chamber Nos. 1 and 2. There are no recommendations at this time.

- Washwater Pumps (common): Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Plant service water was previously pumped throughout the Pahokee WWTF by this facility's two pumps.

  Structural – Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed. It is recommended to place fill under the slab.

  Mechanical – The mechanical equipment is not currently function and has been abandoned. There are no recommendations at this time.

- RAS / WAS Pump Station (common): Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Two RAS / WAS pumps collect settled sludge in the secondary clarifiers for either returning to the Aeration Tanks / Walker Unit or wasting to the sludge treatment facilities.

  Structural – Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed. It is recommended to place fill under the slab.

  Mechanical – The RAS / WAS pumps were replaced within the last year and appear to be in very good condition. There are no recommendations at this time.

- Chlorine / Operations Building (common): This structure consists of a one-story reinforced concrete and masonry building with precast double tees forming a flat roof. Part of the building is open on the sides for chlorine storage. The chemical feed system consists of two covered crosslink polyethylene chemical storage tanks and three diaphragm metering pumps for the storage and distribution of 12 percent sodium hypochlorite. Chlorine is diluted to 6 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the well is out of service or they have a peak flow conditions that exceeds the well capacity, sodium hypochlorite is injected into the chlorine contact chambers so that the secondary effluent can be discharged to the percolation ponds.. The Operations Building contains the plant staff offices / lunch area (one room), the plant laboratory / PLC Controls (one room) and one bathroom.

Structural – The condition of the concrete and masonry is good. Some windows are broken, doors and hardware are slightly corroded, and all components are not likely wind rated.

Based on the findings, it is recommended to replace all doors and windows with wind rated components, and re-paint the entire structure.

Mechanical – The chlorine tanks and pumps were replaced within the last three years and appear to be in very good condition. Additionally, the roof covering improves the expected life. There are no recommendations at this time regarding the chlorine equipment. On the other hand, the Operations (interior) portion of the building is small for its numerous uses. Currently, there are two spaces for five functions including plant staff offices, lunch area, plant laboratory, PLC Controls and restroom facilities. It is recommended that a few of the operation functions of the building be moved into a newly constructed "warehouse", which would be built where the existing Maintenance Building is located, and the Chlorine / Operations Building be reconfigured such that it is more conducive for its intended, limited activity. The office half of the "warehouse" would be split into several rooms to accommodate its various intended functions (e.g., plant staff offices, lunch area, plant laboratory, PLC Controls) and would also contain two restrooms, one for men and one for women. Additionally, it is recommended that the Chlorine / Operations Building 4-inch sewer line be replaced due to repeated clogging episodes after this line was crushed by equipment.

- Sludge Thickening / Biosolids Facility (common): This structure consists of a one-story partially open pre-engineered metal building supported on a reinforced concrete slab on grade. A steel lime silo is adjacent to the metal building. The major components of the sludge thickening system are as follows: one grinder, one high service pump, one high service feed pump, one sludge feed pump, four augers, one biosolids pump, one belt press, one lime silo system and one polymer mix and feed system.

  Structural – The metal building of the sludge facility is in good condition. One support leg of the lime silo adjacent to the metal building is slightly damaged. The ladder serving as access to the top of the silo and the guardrail at the top are corroded and unsafe. Exterior coating of the silo is damaged.

  It is recommended to repair the damaged support leg, replace the access ladder and guardrails, and re-paint the entire exterior of the silo. As per plant staff, the floor of the building should also be epoxy coated for added protection.

Mechanical – Overall the mechanical equipment at the Sludge Thickening / Biosolids Facility is in good condition. However, there are several pieces of equipment which have minor issues. It is recommended that the lime silo system's vibrator and screw conveyor be replaced with more effective equipment and that the biosolids pump and one auger (in the Bioset system) be replaced. Additionally, the following recommendations are per the Florida Bearings report, see **Appendix 2-4**.

1. Biosolid Gearbox: continue to observe the trend and monitor equipment and fluid conditions as gear and/or bearing metal is at a moderate level and abrasives are at a minor level.

2. Lime Auger: Water is at a severe level in the gearbox. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant be changed.

3. High Service Feed Pump: Replace pump bearings.

Electrical – There is a 48.6 degree temperature difference between legs in the starter for the Primary Sludge Pump. It is recommended that the connections be inspected and amp readings be checked.

- Aerobic Digester No. 1 (common): The structure consists of a circular reinforced concrete tank without cover. A metal stair structure serves as access to the top of the tank. The major components of digester are one digester transfer pump and the 172,000-gallon circular concrete tank.

  Structural – Two horizontal cracks around the entire perimeter of the tank are visible. One crack is approximately at the mid-height of the tank wall, and the other is at approximately ¾ of the wall height. It appears that there have been attempts of repairing the cracks as evidenced by multiple circular patches along the cracks which is typical when cracks are injected with a chemical grout. No leakage is evident from the repaired cracks which may indicate that the cracks were caused by joints in the concrete construction and not by a structural deficiency. Stairs for access to the top of the structure are steep, similar to a ship's ladder.

  At the time of the visit, the tank was in service and the interior could not be inspected.

  Based on the above observations, it is recommended to perform a more detailed structural evaluation to determine if there are any reinforcement deficiencies that caused the horizontal cracking. It is also recommended to replace the stairs to have normal dimensioned treads and risers for ease of access. Once all repairs are complete, it is recommended to re-paint the entire structure.

Mechanical – The following recommendation is per the Florida Bearings report, see **Appendix 2-4**. For the Digester Transfer Pump, water level in the gearbox is at a severe level, abrasives are at a significant level, gear and/or bearing metal is at a significant level and aluminum is at an abnormal level. It is recommended that the gearbox be checked for the source of the water and other contamination. Additionally, a lubrication change is recommended.

- Blower House No. 1 (Plant 1): The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to Digester No. 1 by a blower system comprised of two blowers and air piping.

  Structural – Overall, the structure for Blower House 1 is in good condition. Roof flashing is bent and separating from the walls and the roll-up door is corroded. Doors and louvers are not likely to be rated for wind storm events.

  It is recommended to replace the roofing on the building, and replace the roll-up door with a wind rated door. Further hurricane hardening may be achieved by replacing the single door and louver with wind rated components. Once all repairs are done, it is recommended to re-paint the entire structure. It has also been expressed by plant staff that the floor be coated with an epoxy for added protection.

  Mechanical/Instrumentation – The blowers are in fair condition, however, both have been rebuilt on various occasions. It is recommended that the two blowers be replaced. The following recommendation is per the Florida Bearings report, see **Appendix 2-4**. For Blower Motor No. 2, it is recommended that the motor be closely monitored for any increase in vibration amplitude and/or noise and that another vibration survey be performed in six months to evaluate the rate of degradation.

  Electrical – There is a 4.9 degree temperature difference between legs in the starter for Blower No. 1. It is recommended that the connections be inspected and amp readings be checked.

- Maintenance Building (common): The structure consists of a one-story pre-engineered metal building built in two phases. Phase one of the building is supported on reinforced concrete footings and does not have a concrete floor slab. Phase two of the building is supported on a concrete slab on grade.

  Structural – Extensive corrosion is evident around the entire steel building including on the exterior metal panels, roof purlins, wall girts, and main frames. Wall panels are

damaged and bent. One half of the building does not have a floor slab. Complete demolition and replacement of this building is recommended.

Mechanical – As described under the "Chlorine / Operations Building" section, it is recommended that a few of the operation functions of the Chlorine / Operations Building be moved into a newly constructed warehouse, which would be built where the existing Maintenance Building is located. One half of the warehouse would be utilized for storage, etc. The other half of the warehouse would contain several rooms for the various functions (i.e., plant staff offices, lunch area, plant laboratory, PLC Controls and two bathrooms - one mens and one womens).

- On–site Lift Station (common): The lift station is a duplex station with two 7.5-Hp submersible pumps.

  Structural – The wet well is in good condition. The 8-foot diameter wet well liner/coating appears to be in good condition. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition and there is evidence of ground settlement around the top slab. There is no valve vault as the discharge piping is above ground.

  Mechanical –The pumps appear to be in good condition. The lift station has one 8-inch influent line with an invert 7 feet from the top of slab. The 4-inch discharge piping inside the wet well has severe rust and corrosion on the piping and hardware. There is no protective coating or paint on the piping inside the wet well. The discharge piping and valves are above ground and they appear to be in fair condition. There is a coating on the piping and isolation valves (plug type) however there is no coating on the check valves (leaver and weight swing checks). There is rust mainly around the piping flange connections and there is some severe corrosion between one of the flange connections. There was no evidence of surcharging or grease accumulation in the wet well.

- Electrical System (common): The electrical distribution system at the Pahokee WWTF consists of two utility FPL services. Utility service No. 1 is located at Blower House No. 3 and is connected to three 100kVA pole mount FPL transformers. The FPL step-down transformers are connected to two service entrance rated main disconnects from the utility meter.

  The primary power distribution electrical equipment is housed within Blower House No. 3 and Blower House No. 2. Blower House No. 3 contains main disconnect 1 of 2 and main disconnect 2 of 2. Main disconnect 1 of 2 is a service entrance rated 600A, 480V, 3-phase enclosed circuit breaker connected to a 600A ATS. The ATS is connected to distribution panel DP-1. DP-1 is a 600A, 480V, 3-phase panel. DP-1 provides power to

Walker Unit Blower No. 1 and Blower No. 2 starters (in the Control Building / Blower House No. 3), Grit Blower starter, Grit Auger starter, Grit Blower, Walker Plant Bridge Drive control panel and panel LP-1. This electrical equipment was replaced in 2009 and is in excellent condition. Back-up power for DP-1 is from a 200-kW (250kVA) generator. The generator was installed in 2005 and is in poor condition. It is recommended that this generator be replaced.

Main disconnect 2 of 2 is a 400A fused disconnect. Main disconnect 2 of 2 is connected to Motor Control Center 3 (MCC-3) located in Blower House No. 2. MCC-3 is a 600A, 480V, 3-phase motor control center with a 400A ATS. MCC-3 contains feeder breakers and starters for the conventional plant's Blowers Nos. 1 and 2 (in the Equipment Building / Blower House No. 2), Effluent Pumps Nos. 1, 2, and 3, Floating Mixer disconnect, DP-2 and control power for the Effluent Pump Control Panel. Panel DP-2 also located in Blower House No. 2 is a 480V, 3-phase panel rated at 225A with feeder breakers for the Headworks control panel, on-site lift station, Blower control panel (Digester No. 1 blowers 1 and 2 in Blower House No. 1). Feeder breakers from DP-2 are also connected to starters for the primary sludge pumps, washwater pumps, RAS pumps, east and west secondary clarifiers and primary clarifier. The starters and DP-2 were installed in 2009 and are in excellent condition. General house power for Blower House No. 2 and the Chlorine / Operations Building are supplied thru a 50kVA, 480V/120/240V single phase step-down transformer feed from DP-2. This transformer was installed in 2005 and is in good condition. The main breakers for the Chlorine / Operations Building and Blower House No. 2 panelboards are located in Blower House No. 2, were installed in 2005 and are in poor condition. It is recommended that both enclosed breakers be replaced.

The current bus configuration of MCC-3 only allows back-up power for one blower and one effluent pump to operate during a power outage. MCC-3 was installed in 2005 in a non-air-conditioned environment and is in poor condition. It should be replaced with a new MCC with bus configuration that allows operators the option to run critical equipment during a normal power failure. It is also recommended to enclosure the electrical equipment area with walls and install HVAC environment. Back-up power for MCC-3 is from a 230-kW (288kVA) generator. This generator was installed in 2006 and is in poor condition. It is recommended that this generator be replaced with a generator sized to allow for more flexibility for plant operations.

Utility Service No. 2 is located at the Sludge Thickening / Biosolids Facility and is connected to three 50kVA FPL pole mount transformers. The FPL step-down transformers are connected to a service entrance rated 480V, 3-phase, 200A disconnect. The Main disconnect is connected to panelboard P1, a 480V, 3-phase, 225A rated distribution panel. P1 contains feeder breakers for the belt drive, conveyor, booster pump, etc. for the process of solids. A 30kVA, 480V/120/208V 3-phase step-down

transformer is feed from P1. The transformer feeds panel LP-1. LP-1 is a 208/120V, 3-phase panelboard rated for 100A. This panel board provides power for controls, convenience receptacles, lighting etc. Overall the electrical equipment at the Sludge Thickening / Biosolids Facility are in good condition. There are no recommendations for renewal or replacement at this time.

Plant operations are monitored and controlled with a supervisory control and data acquisition (SCADA) system. PLC-1 consists of an Allen-Bradley CompactLogix controller with associated terminal strips, relays, surge protectors, breakers, UPS, etc. All the associated PLC equipment is housed in a NEMA 3R stainless steel enclosure located in Blower House No.2. PLC-1 was installed in 2011 and is in excellent condition. There are no recommendations for replacement or renewal at this time.

- Miscellaneous: The following are miscellaneous improvements recommended for the Pahokee WWTF.

  – It is recommended to remove and replace all sidewalks as the WWTF has settled significantly in many areas. Concrete sidewalks can be replaced with asphalt to provide flexibility to accommodate differential settlement due to the poor soil conditions.

  – It is recommended that a security fence be installed around the entire facility, including the ponds.

  – As mentioned previously, without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that all valve operators be upgraded to allow electronic control such that Belle Glade WWTF staff would be able to operate all the valves at the Pahokee WWTF via the upgraded PLC system.

RECOMMENDATIONS

Based on the field observations and results of the investigation and testing, the recommended repairs/modifications are presented below.

Belle Glade WWTF

Based on the evaluation, the Belle Glade WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the entire facility is good and the plant is in operable condition. Deficiencies were observed (as documented in the previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 63 year old facility. However, it is noted that overall, the Belle Glade WWTF operates adequately. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also

separated into three categories: critical for continued use, non-critical / enhancement and maintenance.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD fiscal year budget constraints. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired but their implementation is not required as part of the rehabilitation and will not impair the use of the facility.

Critical Repairs

1. Oxidation Ditch No. 1 Structural Rehabilitation
2. Oxidation Ditch No. 2 Structural Rehabilitation
3. Improvements to the Deep Injection Well
4. Installation of a Roto-Screen Bypass line
5. Repair cracks and leaks in Aerobic Digester
6. Replacement of Main Switchboard No. 1 (Generator Building No. 1)
7. Replacement of 300 kW generator (Generator Building No. 1)
8. Injection Well PLC replace (Parts are unavailable)
9. Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)

Non-Critical Repairs

1. Replace parshall flume (in the Headworks)
2. Installation of a Headworks Bypass
3. Additional circular clarifier (to replace Clarifier Nos. 1 and 2)
4. Construct chlorine contact chamber
5. Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)
6. Optimize Bar screens to achieve higher capture rate
7. Add toe board to Splitter Box No. 2 hand rail

8. Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum
9. Replacement of several air handlers and compressors
10. Replace Roto-Screen roof purlins and roof panels that have deteriorated
11. Replacement of the main PLC and PLC software
12. Lift station Nos. 1 and 2 rehabilitation
13. Replace Headworks access stair with an aluminum stair
14. Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)
15. Rehabilitation of the RAS / WAS structure
16. Installation of two polymer feeders
17. Repair leaks at the effluent box of the headworks
18. Replace Roto-Screen effluent wet well slide gate and isolation gate
19. Replace pond bypass gate
20. Paint steel roof over the Aerobic Digester blowers
21. Rehabilitate the Roto-Screen metal structure
22. Rehabilitate the Sludge Thickening Facility metal structure
23. Upgrading control room
24. Paint steel walkway bridge and structure on Clarifier 3 and 4
25. Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2
26. Paint steel bridge, stairs and EQ tank
27. New roofs on the Operation, Maintenance and both Generator buildings
28. Replace doors in MCC Building
29. Repair cracking at Headworks upper level slab
30. Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure
31. Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2
32. Replace Thickeners
33. Remove, replace and rewire Headwork's control panel
34. Relocate trees and plants placed inside abandoned structures
35. Construct overflow in Aerobic Digester
36. Repair crack at the Operations Building access ramp
37. Re-paint the entire exterior of the Headworks

38. Support of the Operations Building roof post should be replaced with a different type to avoid further cracking
39. Install flow meters on Oxidation Ditch Nos. 1 and 2
40. Install flow meters on Clarifier Nos. 3 and 4
41. Polymer containment and enclosure
42. Construction of a Switchgear Building with space for future equipment
43. Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight
44. Replace manual valves with electronic controlled valves
45. Repair the concrete spalls at guardrail posts at Clarifier No. 3
46. Replacing ceiling tiles in the Operations Building break room
47. Replace plant lighting with higher illumination LED lights
48. Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway
49. Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)
50. Replacement of four slide gates in Headworks
51. Replace RAS and Deep Injection Well flow meters with new magnetic meters
52. Replacement of MCC-3 (in the Operations Building Electric Room)
53. Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)
54. Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center MCC-1, Panel PP-1 480V, Motor Control Center MCC-2, PLC-1 (Main Control Panel))
55. Install automatic control gates for Oxidation Ditch No. 1 and 2
56. Flow meter for Clarifier Nos. 1 and 2
57. Crack repair on the exterior wall surfaces of EQ tank
58. Repair guardrails on EQ tank
59. Install fencing to enclose Truck Wash Lift Station
60. Install an odor control system at the Headworks
61. Install an onsite plant service water system including reuse system
62. Add sumps at one end of the Clarifier Nos. 1 and 2 structure
63. Painting of the facility

64. Upgrading cabinets in the Operations Building break room
65. Asphalt overlay and addition of parking spaces
66. Epoxy coat floors
67. Convert EQ tank to additional Clarifier or Aerobic Digester
68. Install drain on Oxidation Ditch No. 1

Maintenance Repairs

1. Remove grit from Oxidation Ditch No. 2
2. Dredge pond of vegetation and debris
3. Pista Grit No. 1 Gearbox: Observe equipment and monitor fluid for abrasives
4. Pista Grit No. 1 Air Compressor: Closely monitor vibration amplitude and/or noise and perform another vibration survey in six months
5. Pista Grit No. 2 Gearbox: Observe equipment and monitor fluid for abrasives
6. Grit Classifier No. 1, MCC1: Inspect fuse, replace if necessary
7. Ditch No. 1, Aerator No. 2 Gearbox: Observe equipment and monitor fluid for antimony
8. Oxidation Ditch No. 1, Aerator No. 1 MCC3: Inspect breaker connections and check amp readings
9. Ditch No. 2, Aerator No. 1 Gearbox: Observe equipment and monitor fluid for antimony, titanium and other metals
10. Ditch No. 2, Aerator No. 2 Gearbox: Observe equipment and monitor fluid for nickel
11. Clarifier No. 3 Lower Gearbox: Observe equipment and monitor fluid for gear and/or bearing metal
12. Clarifier No. 3 Upper Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
13. Clarifier No. 4 Upper Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination, change the lubricant, inspect the unit for excessive bushing / thrust wear and perform an analytical ferrogram to clarify the type of wear and/or contamination that is present
14. Roto-Screen No. 1 Gearbox: Change the lubricant
15. Roto-Screen No. 2 Gearbox: Change the lubricant
16. Roto-Screen No. 3 Gearbox: Change the lubricant
17. Roto-Screen No. 4 Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant

18. Pump No. 1: Observe equipment and monitor fluid for copper, closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
19. Pump No. 2: Observe equipment and fluid and monitor the Direct Reading Ferrography
20. Pump No. 4: Observe equipment and fluid and monitor the Direct Reading Ferrography, closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
21. Injection Well Pump No. 2: Inspect the breaker / starter connections, check the amp readings, and inspect the fuse
22. RAS Pump No. 3 Gearbox: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
23. WAS Pump No. 1: Inspect the pump bearings for the proper fit on the shaft and within the housings, repair / replace as necessary
24. RAS No. 1, MCC1: Inspect the breaker / starter connections, check the amp readings, and inspect the fuse
25. WAS No. 1, MCC1: Inspect the breaker connections, check the amp readings, and inspect the load reactor connections
26. RAS No. 3, MCC2: Inspect the breaker connections, check the amp readings, and inspect the fuse
27. WAS No. 2, MCC2: Inspect the breaker connections, check the amp readings, and inspect the fuse
28. Blower No. 2: closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
29. 300-kW generator MCC3: Inspect the breaker / starter connections and check the amp readings

See **Table 2.1** for an opinion of probable cost for the rehabilitation work to assist the PBCWUD with their planning efforts. It should be noted that some of the recommended repairs may be able to be completed by PBCWUD staff at reduced costs. This cost estimate is an order-of-magnitude estimates based on published cost literature, past contractor bids, and previous experience with similar facilities. The accuracy of this type of cost estimate typically ranges from +50 to -30 percent. Costs are rounded to the nearest thousand dollars and presented in present-day dollars as defined by the association for the Advancement of Cost Engineering International (AACEI).

Pahokee WWTF

Based on the evaluation, the Pahokee WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the entire facility is good and the plant is in operable condition. Deficiencies were observed (as documented in previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 58 year old facility. However, it is noted that overall, the Pahokee WWTF operates adequately. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also separated into three categories: critical for continued use, non-critical / enhancement and maintenance.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD fiscal year budget. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired but their implementation is not required as part of the rehabilitation and will not impair the use of the facility.

Critical Repairs

1. Replacement of generators
2. New grit removal system at Headworks
3. Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps
4. Replace steel bridge supports on Primary and Secondary Clarifiers
5. Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)
6. Replace Walker Unit elevated influent pipe supports
7. Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)
8. Replacement of 12” valve on the Deep Injection Well System
9. Rehabilitate all three Secondary Clarifiers
10. Modify stair top support on Aeration Tank Nos. 1 and 2
11. Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office

Non-Critical Repairs

1. Replacement of the mechanical bar screen
2. Replace Digester stairs

3. Replace all diffusers
4. Influent Pump Station rehabilitation
5. Reconfigure Chlorine / Operations Building and replace 4-inch sewer line
6. Remove and replace all sidewalks
7. Replace Wet well By-Pass valve
8. Rehabilitate Chlorine Contact Chamber Nos. 1 and 2
9. Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)
10. Replace all six blowers
11. Recoat two Secondary Clarifiers and repaint the steel bridges
12. Recoat Primary Clarifier and repaint the steel bridge
13. Recoat the Walker Unit and repaint the steel bridge
14. Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)
15. Blower House Nos.1, 2 and 3 roof, door and louver replacement
16. Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator NO. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panelboard, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))
17. Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator NO. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)
18. Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))
19. Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))
20. Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)
21. Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panelboard, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)

22. Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump Nos. 1, 2 and 3))
23. Flow pace blowers
24. Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2
25. Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures
26. Replace pump and auger in the Bioset system
27. Installation of a security fence
28. Replace Effluent Pump starters with VFDs
29. PLC system upgrade
30. Replace manual valves with electronic controlled valves
31. Replace grounding at the Headworks
32. Painting of the facility
33. Epoxy coat floors

Maintenance Repairs

1. Primary Clarifier: Change the lubricant
2. Blower House No. 2 Blower 1: Observe equipment and monitor fluid for bushing / thrust metal, change the lubricant and filter and perform an analytical ferrogram to clarify the type of wear and/or contamination that is present.
3. Blower House No. 2 Blower 2: Observe equipment and monitor fluid for lead
4. Equipment Building / Blower House No. 2, Effluent Pump No. 3: Inspect the breaker connections and check the amp readings
5. Secondary Clarifier - West: Change the lubricant
6. Control Building / Blower House No. 3, Blower No. 2: Inspect the breaker connections and check the amp readings
7. Effluent Pump No. 2: Closely monitor the pump for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
8. Biosolid Gearbox: Observe equipment and monitor fluid for gear and/or bearing metal
9. Lime Auger: Check the gearbox seals, breathers and fill ports checked for the source of the water contamination and change the lubricant
10. High Service Feed Pump: Replace pump bearings
11. Primary Sludge Pump: Inspect the starter connections and check the amp readings

12. Digester Transfer Pump: Observe equipment and monitor fluid for water, abrasives, gear and/or bearing metal and aluminum and change the lubricant
13. Blower Motor No. 2: Closely monitor the motor for any increase in vibration amplitude and/or noise and perform another vibration survey in six months
14. Blower No. 1: Inspect the starter connections and check the amp readings

See **Table 2.2** for an opinion of probable cost for the rehabilitation work to assist the PBCWUD with their planning efforts. It should be noted that some of the recommended repairs may be able to be completed by PBCWUD staff at reduced costs. This cost estimate is an order-of-magnitude estimates based on published cost literature, past contractor bids, and previous experience with similar facilities. The accuracy of this type of cost estimate typically ranges from +50 to -30 percent. Costs are rounded to the nearest thousand dollars and presented in present-day dollars as defined by the association for the AACEI.

Table 2.1
Belle Glade WWTF Opinion of Cost

	CRITICAL Capital Items (listed in order of importance)	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Oxidation Ditch No. 1 Structural Rehabilitation	$770,000	--	--	$770,000
2	Oxidation Ditch No. 2 Structural Rehabilitation	$280,000	--	--	$280,000
3	Improvements to the Deep Injection Well	$980,000	--	--	$980,000
4	Installation of a Roto-Screen Bypass line	$280,000	--	--	$280,000
5	Repair cracks and leaks in Aerobic Digester	$140,000	--	--	$140,000
6	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	$100,000	--	--	$100,000
7	Replacement of 300 kW generator (Generator Building No. 1)	$560,000	--	--	$560,000
8	Injection Well PLC replace. Parts are unavailable	$120,000	--	--	$120,000
9	Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)	$550,000	--	$150,000	$700,000
	Total CRITICAL Capital Cost	$3,780,000	$0	$150,000	$3,930,000

Note: Costs include 30% contingency and 20% engineering

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	**Total**
1	Replace parshall flume (in the Headworks)	--	$70,000	--	$70,000
2	Installation of a Headworks Bypass	--	$280,000	--	$280,000
3	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	--	$700,000	--	$700,000
4	Construct chlorine contact chamber	--	$980,000	--	$980,000
5	Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)	--	[a]	--	$0
6	Optimize Bar screens to achieve higher capture rate	--	$490,000	--	$490,000
7	Add toe board to Splitter Box No. 2 hand rail	--	$10,000	--	$10,000
8	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	--	$30,000	--	$30,000
9	Replacement of several air handlers and compressors	--	$100,000	--	$100,000
10	Replace Roto-Screen roof purlins and roof panels that have deteriorated	--	$50,000	--	$50,000
11	Replacement of the main PLC and PLC software	--	$280,000	--	$280,000
12	Lift station No. 1 and No. 2 rehabilitation	--	$50,000	--	$50,000
13	Replace Headworks access stair with an aluminum stair	--	$30,000	--	$30,000
14	Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)	--	$790,000	--	$790,000
15	Rehabilitation of the RAS / WAS structure	--	$30,000	--	$30,000
16	Installation of two polymer feeders	--	$30,000	--	$30,000
17	Repair leaks at the effluent box of the headworks	--	$20,000	--	$20,000
18	Replace Roto-Screen effluent wet well slide gate and isolation gate	--	$50,000	--	$50,000
19	Replace pond bypass gate	--	$30,000	--	$30,000
20	Paint steel roof over the Aerobic Digester blowers	--	$30,000	--	$30,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	**Total**
21	Rehabilitate the Roto-Screen metal structure	--	$20,000	--	$20,000
22	Rehabilitate the Sludge Thickening Facility metal structure	--	$90,000	--	$90,000
23	Upgrading control room	--	$60,000	--	$60,000
24	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	--	$200,000	--	$200,000
25	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	--	$50,000	--	$50,000
26	Paint steel bridge, stairs and EQ tank	--	$110,000	--	$110,000
27	New roofs on the Operation, Maintenance and both Generator buildings	--	$60,000	--	$60,000
28	Replace doors in MCC Building	--	$20,000	--	$20,000
29	Repair cracking at Headworks upper level slab	--	$20,000	--	$20,000
30	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	--	$210,000	--	$210,000
31	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	--	$30,000	--	$30,000
32	Replace Thickeners	--	$840,000	--	$840,000
33	Remove, replace and rewire Headwork's control panel	--	$70,000	--	$70,000
34	Relocate trees and plants placed inside abandoned structures	--	$30,000	--	$30,000
35	Construct overflow in Aerobic Digester	--	$60,000	--	$60,000
36	Repair crack at the Operations Building access ramp	--	--	$20,000	$20,000
37	Re-paint the entire exterior of the Headworks	--	--	$70,000	$70,000
38	Support of the Operations Building roof post should be replaced with a different type to avoid further cracking	--	--	$10,000	$10,000
39	Install flow meters on Oxidation Ditch Nos. 1 and 2	--	--	$180,000	$180,000
40	Install flow meters on Clarifier Nos. 3 and 4 [b]	--	--	$140,000	$140,000
41	Polymer containment and enclosure	--	--	$60,000	$60,000
42	Construction of a Switchgear Building with space for future equipment	--	--	$280,000	$280,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	**Total**
43	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	--	--	$20,000	$20,000
44	Replace manual valves with electronic controlled valves	--	--	$100,000	$100,000
45	Repair the concrete spalls at guardrail posts at Clarifier No. 3	--	--	$30,000	$30,000
46	Replacing ceiling tiles in the Operations Building break room	--	--	$20,000	$20,000
47	Replace plant lighting with higher illumination LED lights	--	--	$20,000	$20,000
48	Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway grating	--	--	$40,000	$40,000
49	Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)	--	$20,000	$50,000	$70,000
50	Replacement of four slide gates in Headworks	--	--	$50,000	$50,000
51	Replace RAS and Deep Injection Well flow meters with new magnetic meters	--	--	$50,000	$50,000
52	Replacement of MCC-3 (in the Operations Building Electric Room)	--	--	$120,000	$120,000
53	Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)	--	--	$10,000	$10,000
54	Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center No. 1, Panel PP-1 480V, Motor Control Center No. 2, PLC-1 (Main Control Panel))	--	--	$340,000	$340,000
55	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	--	--	$70,000	$70,000
56	Flow meter for Clarifier Nos. 1 and 2 [b]	--	--	$110,000	--
57	Crack repair on the exterior wall surfaces of EQ tank	--	--	$30,000	$30,000
58	Repair guardrails on EQ tank	--	--	$40,000	$40,000
59	Install fencing to enclose Truck Wash Lift Station	--	--	$280,000	$280,000
60	Install an odor control system at the Headworks	--	--	$980,000	$980,000
61	Install an onsite plant service water system including reuse system	--	--	$1,960,000	$1,960,000

Table 2.1 (Continued)
Belle Glade WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
62	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	--	--	$50,000	$50,000
63	Painting of the facility	--	--	$210,000	$210,000
64	Upgrading cabinets in the Operations Building break room	--	--	$20,000	$20,000
65	Asphalt overlay and addition of parking spaces	--	--	$50,000	$50,000
66	Epoxy coat floors	--	--	$70,000	$70,000
68	Convert EQ tank to additional Clarifier or Aerobic Digester	--	--	[c]	$0
69	Install drain on Oxidation Ditch No. 1	--	--	$70,000	$70,000
	Total NON-CRITICAL Capital Cost	$0	$5,940,000	$5,550,000	$11,490,000
	Total CRITICAL + NON-CRITICAL Capital Cost	$2,682,600	$5,940,000	$5,656,000	$14,278,600

Notes:

a) It is recommended to demolish these structures.

b) Assumes flow measurement is achieved to Clarifier Nos. 1-4 using motorized gates and an ultrasonic level sensor in the Splitter Box No. 2 structure; combines #40 and #56. This modification will also allow plant staff to control the flow split to each of the clarifiers.

c) Will be priced if this is justified by TM 11 (Plant Optimization)

Table 2.2
Pahokee WWTF Opinion of Cost

CRITICAL Capital Items (listed in order of importance)		FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Replacement of generators	$700,000	--	--	$700,000
2	New grit removal system at Headworks	$600,000	--	--	$600,000
3	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	$70,000	--	--	$70,000
4	Replace steel bridge supports on Primary and Secondary Clarifiers	$60,000	--	--	$60,000
5	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	$110,000	--	--	$110,000
6	Replace Walker Unit elevated influent pipe supports	$70,000	--	--	$70,000
7	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	$40,000	--	--	$40,000
8	Replacement of 12-inch valve on the Deep Injection Well System	$20,000	--	--	$20,000
9	Rehabilitate all three Secondary Clarifiers	$200,000	--	--	$200,000
10	Modify stair top support on Aeration Tank Nos. 1 and 2	$20,000	--	--	$20,000
11	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	$750,000	--	--	$750,000
	Total CRITICAL Capital Cost	$2,640,000	$0	$0	$2,640,000

Note: Costs include 30% contingency and 20% engineering

Table 2.2 (Continued)
Pahokee WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
1	Replacement of the mechanical bar screen	--	$490,000	--	$490,000
2	Replace Digester stairs	--	$60,000	--	$60,000
3	Replace all diffusers	--	$40,000	--	$40,000
4	Influent Pump Station rehabilitation	--	$30,000	--	$30,000
5	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	--	$110,000	--	$110,000
6	Remove and replace all sidewalks	--	$20,000	--	$20,000
7	Replace Wet well By-Pass valve	--	$20,000	--	$20,000
8	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	--	$70,000	--	$70,000
9	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint) [a]	--	$0	--	$0
10	Replace all six blowers	--	$840,000	--	$840,000
11	Recoat two Secondary Clarifiers and repaint the steel bridges	--	$70,000	--	$70,000
12	Recoat Primary Clarifier and repaint the steel bridge	--	$50,000	--	$50,000
13	Recoat the Walker Unit and repaint the steel bridge	--	$130,000	--	$130,000
14	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	--	$5,600,000	--	$5,600,000
15	Blower House Nos.1, 2 and 3 roof, door and louver replacement	--	$70,000	--	$70,000
16	Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator No. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panelboard, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))	--	--	$170,000	$170,000
17	Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator No. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)	--	--	$180,000	$180,000

Table 2.2 (Continued)
Pahokee WWTF Opinion of Cost

	NON-CRITICAL Capital Items	FY-2014 thru FY-2018	FY-2019 thru FY-2023	FY-2024 thru FY-2035	Total
18	Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))	--	--	$10,000	$10,000
19	Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))	--	--	$10,000	$10,000
20	Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)	--	--	$100,000	$100,000
21	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panelboard, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)	--	$30,000	--	$30,000
22	Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump No. 1, 2 and 3))	--	--	$30,000	$30,000
23	Flow pace blowers	--	--	$30,000	$30,000
24	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	--	--	$20,000	$20,000
25	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	--	--	$50,000	$50,000
26	Replace pump and auger in the Bioset system	--	--	$30,000	$30,000
27	Installation of a security fence	--	--	$630,000	$630,000
28	Replace Effluent Pump starters with VFDs	--	--	$170,000	$170,000
29	PLC system upgrade	--	--	$70,000	$70,000
30	Replace manual valves with electronic controlled valves	--	--	$30,000	$30,000
31	Replace grounding at the Headworks	--	--	$10,000	$10,000
32	Painting of the facility	--	--	$140,000	$140,000
33	Epoxy coat floors	--	--	$40,000	$40,000
	Total NON-CRITICAL Capital Cost	$0	$7,630,000	$1,720,000	$9,350,000
	Total CRITICAL + NON-CRITICAL Capital Cost	$2,640,000	$7,630,000	$1,720,000	$11,990,000

Notes:

a) The cost to rehabilitation the Chlorine / Operation Building (i.e., replace all doors / windows and repaint) has been combined with the cost to reconfigure the Chlorine / Operations Building and replace the 4-inch sewer line

APPENDIX 2-1
Permits

Florida Department of Environmental Protection

Southeast District Office
400 No. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

May 23, 2011
In the Matter of an
Application for Permit by:

Glades Utility Authority
James Stiles, Executive Director
39700 Hooker Highway
Belle Glade, Florida 33430
Email: Jstiles@pbcwater.com

File Number FLA027740-008-DW1P
Palm Beach County
Belle Glade WWTP
FLA027740

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number FLA027740 to operate the Belle Glade WWTP, issued under Chapter 403, Florida Statutes.

Monitoring requirements under this permit are effective on the first day of the second month following permit issuance. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, within fourteen days of receipt of notice. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Under Rule 62-110.106(4), Florida Administrative Code, a person may request an extension of the time for filing a petition for an administrative hearing. The request must be filed (received by the Clerk) in the Office of General Counsel before the end of the time period for filing a petition for an administrative hearing.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Section 120.60(3), Florida Statutes, however, also allows that any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition or request for an extension of time within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an

administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information, as indicated in Rule 28-106.201, Florida Administrative Code:

(a) The name and address of each agency affected and each agency's file or identification number, if known;
(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the determination;
(c) A statement of when and how the petitioner received notice of the Department's decision;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the Department's proposed action;
(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the Department's proposed action; and
(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the Department to take with respect to the Department's proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This permit action is final and effective on the date filed with the Clerk of the Department unless a petition (or request for an extension of time) is filed in accordance with the above. Upon the timely filing of a petition (or request for an extension of time), this permit will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the permit action under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this permit action is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Linda A. Brien. P.G.
Water Facilities Administrator

LAB/JAA/mp: FLA027740-008-DW1P

FILING AND ACKNOWLEDGMENT

FILED, on this date, under Section 120.52, Florida Statutes, with the designated Deputy Clerk, receipt of which is hereby acknowledged.

[Clerk] [Date]

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this NOTICE OF PERMIT ISSUANCE and all copies were mailed before the close of business on May 23, 2011 to the listed persons.

Name

May 23, 2011
Date

Enclosure

Copies furnished to:
Hassan Hadjimiry, Palm Beach County hhadjimiry@pbcwater.com
Bevin A. Beaudet, Palm Beach County bbeaudet@pbcwater.com'
Michael Hambor, DEP/WPB Michael.Hambor@dep.state.fl.us

Florida Department of Environmental Protection
Southeast District Office
400 No. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

STATE OF FLORIDA
DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:
Glades Utility Authority

RESPONSIBLE OFFICIAL:
James Stiles, Executive Director
39700 Hooker Highway
Belle Glade, Florida 33430
Email: Jstiles@pbcwater.com

PERMIT NUMBER: FLA027740-008
FILE NUMBER: FLA027740-008-DW1P
ISSUANCE DATE: **May 23, 2011**
EXPIRATION DATE: **May 22, 2016**

FACILITY:

Belle Glade WWTP
2055 West Canal Street
Belle Glade, FL 33430
Palm Beach County
Latitude: 26°41' 46.29" N Longitude: 80°41' 20.13" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.). This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above named permittee is hereby authorized to operate the facilities in accordance with the documents attached hereto and specifically described as follows:

WASTEWATER TREATMENT:

An existing 6.5 million gallons per day (MGD) maximum monthly average daily flow (MMADF) oxidation ditch aeration type activated sludge wastewater treatment plant consisting of:
- Two (2) mechanical cleaned bar screens;
- Two (2) 2,538 gallon (gal.) grit forced vortex chambers with two (2) grit removals and two (2) cyclone/inclined screw classifier grit dewatering units;
- Two (2) Carousel oxidation ditch basins with a downstream flow splitter;
- Two (2) rectangular secondary clarifiers with a volume of 373,100 gal. each and two (2) circular secondary clarifiers with a volume of 822,469 gal. each;
- Four (4) 0.1-inches opening roto-screens with a flow capacity of 2,650 gallons per minute (gpm) each;
- One (1) 0.03 MG injection well pump station with a pumping capacity of 12.0 MGD when three (3) pumps online and one as a backup;
- One (1) 465,300 gal. aerobic digester;
- Two (2) 117-320 gallon per minute (gpm) rotary drum thickeners with a polymer blend system;
-Two (2) 500 pound per day (each) flow paced chlorinators and one (1) 1,000 pound per day manual chlorinator;
- One (1) 310 kilowatt (kW) and one (1) 800 kW diesel engine auxiliary power generators.

REUSE OR DISPOSAL:

Underground Injection U-001: An existing 10.2 MGD maximum daily flow permitted capacity underground injection well system consisting of one Class I underground injection well permitted under Department permit number(s) 0048217-008-UO discharging to Class G-IV ground water. Underground Injection Well System U-001 is located approximately at latitude 26°41' 42" N, longitude 80°41' 23" W.

Land Application R-001: An existing 0.069 MGD maximum monthly average daily flow permitted capacity "other" system. R-001 is an effluent system which consists of one percolation pond located approximately at latitude 26°41' 42" N, longitude 80°41' 23" W.

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 1 through 26 of this permit.

I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Underground Injection Control Systems

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the permittee is authorized to discharge effluent to Underground Injection Well System U-001 located approximately at latitude 26°41'42", longitude 80°41'23". Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C.8.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	6.5	Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-02	See I.A.2 and 4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFF-01	
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFF-01	
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFF-01	See I.A.3

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-02	Effluent flow to Deep Well. Located on line from injection well pumps to well.
EFF-01	24 hr flow composite sampler located at the effluent distribution box between the wet well and roto screens.

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. Disinfection is not required for discharge to Class G-IV waters using Class I wells. However, the permittee must maintain the capability for disinfection at a level that is consistent with the alternate disposal mechanism approved for this facility pursuant to Rule 62-600.540(5), F.A.C. *[62-600.540(1)]*

B. Reuse and Land Application Systems

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the permittee is authorized to direct water to Effluent System R-001. Such water shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C 8:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Monitoring	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	0.069	Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-03	See I.B.2 and 4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week While discharging	24-hr FPC	EFF-01	
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week while discharging	24-hr FPC	EFF-01	
Coliform, Fecal	#/100mL	Max Max Max	200 200 800	Annual Average Monthly Geometric Mean Single Sample	5 Days/Week while discharging	Grab	EFF-01	See I.B.5
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous during discharge	Meter	EFF-01	See I.B.3
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	Continuous during discharge	Meter	EFF-01	See I.B.6
Nitrogen, Nitrate, Total (as N)	mg/L	Max	12.0	Single Sample	5 Days/Week while discharging	24-hr FPC	EFF-01	

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-03	Effluent flow to pond. Located after the effluent roto screens at the reuse effluent box.
EFF-01	24 hr flow composite sampler located at the effluent distribution box, between the wet well and roto screen.

3. Hourly measurement of pH and total residual chlorine for disinfection during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. The effluent limitation for the monthly geometric mean for fecal coliform is only applicable if 10 or more values are reported. If fewer than 10 values are reported, the monthly geometric mean shall be calculated and reported on the Discharge Monitoring Report. *[62-600.440(4)(c)]*

6. Total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. *[62-610.510, 62-600.440(4)(b) and (5)(b)]*

C. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C.8.:

			Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	6.5	Monthly Average	Continuous	Meter	FLW-01	See I.C.2
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	Monthly	Calculated	OTH-01	See I.C.4
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	5 Days/Week	24-hr FPC	INF-01	See I.C.3
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	5 Days/Week	24-hr FPC	INF-01	See I.C.3

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.C.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-01	Flow meter located at the headworks.
OTH-01	Calculated percent capacity for the influent.
INF-01	Headworks to plant (INF-01).

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. *[62-601.500(4)]*

4. To calculate the monthly value for Percent Capacity, first calculate the three-month average daily flow (TMADF) by taking the sum of Monthly Average Daily Flow (MADFs) for the current month, plus the two months prior to the current month, and dividing this sum by three. The MADF is calculated by taking the total volume of wastewater effluent for the particular month and divide it by the number of days in the month. Both TMADF and MADF are expressed in million gallons per day, MGD. Percent Capacity is then calculated as follows:

   Percent Capacity = [TMADF/Permitted Capacity] x 100.

5. A meter shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

6. The sample collection, analytical test methods and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "*FAC 62-4 MDL/PQL Table (April 26, 2006)*" *is available* http://www.dep.state.fl.us/labs/library/index.htm. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:

   a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;

   b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and

   c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

When the analytical results are below method detection or practical quantitation limits, the permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

Where necessary, the permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. *[62-4.246, 62-160]*

7. The permittee shall provide safe access points for obtaining representative influent, reclaimed water, and effluent samples which are required by this permit. *[62-601.500(5)]*

8. Monitoring requirements under this permit are effective on the first day of the second month following permit issuance. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, toxicity, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below.

REPORT Type on DMR	Monitoring Period	Due Date
Monthly or Toxicity	first day of month - last day of month	28th day of following month
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 30	July 28 January 28
Annual	January 1 - December 31	January 28

DMRs shall be submitted for each required monitoring period including months of no discharge. The permittee shall make copies of the attached DMR form(s) and shall submit the completed DMR form(s) to the Department's Southeast District Office at the address specified in Permit Condition I.D.8. by the twenty-eighth (28th) of the month following the month of operation.

[62-620.610(18)][62-601.300(1),(2), and (3)]

9. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, color, odor, and corrosivity). These monitoring results shall be reported to the Department annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted in lieu of the report. The annual reclaimed water or effluent analysis report or the certification shall be completed and

submitted in a timely manner so as to be received by the Department's Southeast District Office by June 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. *[62-601.300(4)][62-601.500(3)][62-610.300(4)]*

10. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. *[62-610.870(3)]*

11. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted to or reported to, as appropriate, the Department's Southeast District Office at the address specified below:

    Florida Department of Environmental Protection Southeast District Office
    400 N Congress Ave
    Suite 200
    West Palm Beach, Florida 33401-2913
    Phone Number - (561)681-6600
    FAX Number - (561)681-6760
    (All FAX copies and e-mails shall be followed by original copies.)

    [62-620.305]

12. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. *[62-620.305]*

II. RESIDUALS MANAGEMENT REQUIREMENTS

1. The method of residuals use or disposal by this facility is land application or disposal in a Class I or II solid waste landfill. *[62-620,320(6),62-640.880(1)]*

2. The permittee shall be responsible for proper treatment, management, use, and land application or disposal of its residuals. *[62-640.300(5)]*

3. The permittee will not be held responsible for violations resulting from land application of residuals if the permittee can demonstrate that it has delivered residuals that meet the parameter concentrations and appropriate treatment requirements of this rule and the applier (e.g. hauler, contractor, site manager, or site owner) has legally agreed in writing to accept responsibility for proper land application of the residuals. Such an agreement shall state that the applier agrees, upon delivery of residuals that have been treated as required by Chapter 62-640, F.A.C., that he will accept responsibility for proper land application of the residuals as required by Chapter 62-640, F.A.C., and that the applier agrees that he is aware of and will comply with requirements for proper land application as described in the facility's permit. *[62-640.300(5)]*

4. Florida water quality criteria and standards shall not be violated as a result of land application of residuals from this facility. *[62-640.700(2)(b)]*

5. Disposal of residuals, septage, and other solids in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with the requirements of Chapter 62-701, F.A.C. *[62-640.100(6)(k)3&4]*

6. Land application of residuals shall be in accordance with the conditions of this permit, the approved Agricultural Use Plan(s), and the requirements of Chapter 62-640, F.A.C. *[62-640]*

7. The domestic wastewater residuals for this facility are classified as Class B.

8. The permittee shall achieve Class B pathogen reduction by meeting the pathogen reduction requirements in section 503.32(b)(2) (Monitoring of Indicator Organisms) of Title 40 CFR Part 503. *[62-640.600(1)(b)]*

9. The permittee shall achieve vector attraction reduction by meeting the vector attraction reduction requirements in section 503.33(b)(4) (Meet a specific oxygen uptake rate for aerobically treated biosolids) of Title 40 CFR Part 503. *[62-640.600(2)(a)]*

10. Treatment of liquid residuals or septage for the purpose of meeting the pathogen reduction or vector attraction reduction requirements set forth in Rule 62-640.600, F.A.C., shall not be conducted in the tank of a hauling vehicle. Treatment of residuals or septage for the purpose of meeting pathogen reduction or vector attraction reduction requirements shall take place at the permitted facility. *[62-640.400(8)]*

11. The permittee shall sample and analyze the residuals to monitor for pathogen and vector attraction reduction requirements of Rule 62-640.600, F.A.C.

12. Residuals shall be limited and monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report in accordance with Condition I.D.8. Residuals shall not be land applied if a single sample result for any parameter exceeds the following:

			Residuals Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	Annually	Grab	RMP-B
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	Annually	Grab	RMP-B
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	Annually	Grab	RMP-B
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Annually	Composite	RMP-B
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	Annually	Composite	RMP-B
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	Annually	Composite	RMP-B
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	Annually	Composite	RMP-B
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	Annually	Composite	RMP-B
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Annually	Composite	RMP-B

			Residuals Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	Annually	Composite	RMP-B
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	Annually	Composite	RMP-B
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	Annually	Composite	RMP-B
pH	s.u.	Max	Report	Single Sample	Annually	Grab	RMP-B
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	Annually	Grab	RMP-B

[62-640.650(1), 62-640.650(3)(a) and (e), and 62-640.700(1)]

13. Sampling and analysis shall be conducted in accordance with Title 40 CFR part 503, section 503.8 and U.S. Environmental Protection Agency publication – POTW sludge sampling and analysis guidance document, 1989. In cases where disagreements exist between Title 40 CFR part 503. Section 503.8 and POTW sludge sampling and Analysis Guidance Document, the requirements in Title 40 CFR part 503, section 503.8 will apply.

14. The application of residuals to application zones shall be restricted by the following cumulative application limits:

Parameter	Cumulative Application Limits
Arsenic	36.6 pounds/acre
Cadmium	34.8 pounds /acre
Copper	1340 pounds/acre
Lead	268 pounds/acre
Mercury	15.2 pounds/acre
Nickel	375 pounds/acre
Selenium	89.3 pounds/acre
Zinc	2500 pounds/acre

[62-640.700(3)(b)]

15. Sampling and analysis shall be conducted in accordance with Title 40 CFR Part 503, section 503.8 and the U.S. Environmental Protection Agency publication - POTW Sludge Sampling and Analysis Guidance Document, 1989. In cases where disagreements exist between Title 40 CFR Part 503, section 503.8 and the POTW Sludge Sampling and Analysis Guidance

Document, the requirements in Title 40 CFR Part 503, section 503.8 will apply. *[62-640.650(1), 62-640.700(1), 62-640.700(3)(b), and 62-640.850(3)]*

16. All samples shall be representative of the residuals used or land applied and shall be taken after final treatment of the residuals but before use or land application. *[62-640.650(1)(d)]*

17. Class B residuals shall not be used on unrestricted public access areas. Use of Class B residuals is limited to restricted public access areas such as agricultural sites, forests, and roadway shoulders and medians. *[62-640.600(3)(b)]*

18. Plant nursery use of Class B residuals is limited to plants which will not be sold to the public for 12 months after the last application of residuals. *[62-640.600(3)(b)1]*

19. Use of Class B residuals on roadway shoulders and medians is limited to restricted public access roads. *[62-640.600(3)(b)2]*

20. Food crops, feed crops, and fiber crops shall not be harvested for 30 days following the last application of Class B residuals. *[62-640.600(3)(b)6]*

21. Food crops with harvested parts that touch the residuals/soil mixture and are totally above the land surface shall not be harvested for 14 months after the last application of Class B residuals. *[62-640.600(3)(b)3]*

22. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of Class B residuals when the residuals remain on the land surface for four months or longer before incorporation into the soil. *[62-640.600(3)(b)4]*

23. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of Class B residuals when the residuals remain on the land surface for less than four months before incorporation into the soil. *[62-640.600(3)(b)5]*

24. Animals shall not be grazed on the land for 30 days after the last application of Class B residuals. *[62-640.600(3)(b)7]*

25. Sod which will be distributed or sold to the public or used on unrestricted public access areas shall not be harvested for 12 months after the last application of Class B residuals. *[62-640.600(3)(b)8]*

26. The public shall be restricted from application zones for 12 months after the last application of Class B residuals. *[62-640.600(3)(b)]*

27. Residuals that do not meet the requirements of Chapter 62-640, F.A.C., for Class AA designation shall not be used for the cultivation of tobacco or leafy vegetables. *[62-640.400(7)]*

28. Current Agricultural Use Plan(s) identify residuals landspreading on the following site:

Site Name	Latitude			Longitude			Application Area (acres)	County
	o	'	"	o	'	"		
Corkscrew Ranch	26	27	28	81	35	14	220.2	Lee

The wastewater treatment facility permittee shall apply for a minor permit revision on DEP Form 62-620.910(9) for new, modified, or expanded residuals land application sites. The facility's permit shall be revised to include the new or revised Agricultural Use Plan(s) prior to application of residuals to the new, modified, or expanded sites, unless, under unusual circumstances, all of the following conditions are met:

a. The permittee notifies the Department within 24 hours that the site is being used;

b. The site meets the site use restrictions of Rule 62-640.600(3), F.A.C, and the criteria for land application of residuals in Rule 62-640.700, F.A.C.;

c. The permittee submits a new or revised Agricultural Use Plan for the site with a permit application in accordance with Rule 62-640.300(2), F.A.C., within 30 days of beginning use of the site;

d. The permittee does not have another approved land application site, another approved disposal method (e.g. landfilling), or approved storage facilities available for use; and,

e. The permittee demonstrates during permit application that application of additional residuals to an existing approved application site would have resulted in violation of Department rules, or was not possible due to circumstances beyond the permittee's control.

[62-640.300(2)&(3)]

29. Residuals storage facilities at land application sites shall be subject to applicable setback requirements for residuals application sites. Residuals stored at land application sites shall be stored in a manner that will not cause runoff or seepage from the residuals, objectionable odors, or vector attraction. Storage areas must be fenced or otherwise provided with appropriate features to discourage the entry of animals and unauthorized persons. At the time of application, the stored residuals must meet the parameter concentrations, pathogen and vector attraction reduction requirements, and cumulative application limits of this permit. Residuals storage facilities at land application sites may be used only for temporary storage of stabilized residuals for no more than 30 days during periods of inclement weather or to accommodate agricultural operations, or up to the period (not to exceed two years) specified in the Agricultural Use Plan. *[62-640.700(2)(e)]*

30. Residuals application sites shall be posted with appropriate advisory signs identifying the nature of the project area. *[62-640.700(2)(f)]*

31. The pH of the residuals soil mixture shall be 5.0 or greater at the time residuals are applied. At a minimum, soil pH testing shall be done annually. *[62-640.700(5)(d)]*

32. The permittee shall maintain records of application zones and application rates and shall make these records available for inspection within seven days of request by the Department, or delegated Local Program. The permittee shall maintain record items a. through e. below in perpetuity, and maintain record items f. through k. for five years:

a. Date of application of the residuals;

b. Location of the residuals application site as specified in the Agricultural Use Plan;

c. Identification of each application zone used by the permittee at the application site and the acreage of each zone;

d. Amount of residuals applied or delivered to each application zone;

e. Cumulative loading of each application zone;

f. The names of all other wastewater facilities using each of the application zones identified in item c.;

g. Method of incorporation (if any);

h. Measured pH of the residuals soil mixture at the time the residuals are applied (tested at least annually);

i. Unsaturated depth of soil above the water table level at the time of application;

j. Concentration of parameters in the residuals as required by this permit, and the date of last analysis; and

k. The results of any soil testing that is done under Rule 62-640.500(4)(a), F.A.C.

[62-640.650(2)]

33. The permittee shall submit an annual summary of residuals application activity to the Department's Southeast District Office on Department Form 62-640.210(2)(b) for all residuals applied during the period of January 1 through December 31. The summary for each year shall be submitted by February 19 of the following year. If more than one facility applies residuals to the same application zones, the summary must include a subtotal of each facility's contribution of residuals to the application zones. *[62-640.650(3)(b)]*

34. If residuals that are subject to the cumulative loading limitations of Rule 62-640.700(3), F.A.C., have been applied to an application zone, and the cumulative loading amount of one or more of the pollutants is not known, no further applications of residuals may be made to that application zone. *[62-640.700(3)(f)]*

35. Residuals shall be applied with appropriate techniques and equipment to assure uniform application over the application zone. *[62-640.700(2)(c)]*

36. The spraying of liquid domestic wastewater residuals shall be conducted so that the formation of aerosols is minimized. *[62-640.700(2)(d)]*

37. A minimum unsaturated soil depth of two feet above the water table level is required at the time the residuals are applied to the soil. *[62-640.700(6)(a)]*

38. Residuals shall not be applied during rains that cause runoff from the site or when surface soils are saturated. *[62-640.700(7)(a)]*

39. Land application of "other solids" as defined in Chapter 62-640, F.A.C., is only allowed if specifically addressed in the Agricultural Use Plan(s) approved for this facility. Land application of "other solids" is subject to Chapter 62-640, F.A.C., and the permit conditions that apply to land applied residuals. *[62-640.860]*

40. If the permittee intends to accept residuals from other facilities, a permit revision is required pursuant to Rule 62-640.880(2)(d), F.A.C. *[62-640.880(2)(d)]*

41. Storage of residuals or other solids at the permitted facility shall require prior written notification to the Department. *[62-640.300(4)]*

III. GROUND WATER REQUIREMENTS

1. The permittee shall give at least 72-hours notice to the Department's Southeast District Office, prior to the installation of any monitoring wells. *[62-620.320(6)]*

2. Prior to construction of ground water monitoring wells, a soil boring shall be made at each monitoring well location in order to properly determine the well depth and screen interval. *[62-520.900(3)]*

3. Within 30 days after installation of a monitoring well, the permittee shall submit to the Department's Southeast District Office detailed information on the well's location and construction on the attached DEP Form(s) 62-520.900(3), Monitoring Well Completion Report. *[62-532.410 and 62-520.900(3)]*

4. All piezometers and monitoring wells not part of the approved ground water monitoring plan are to be plugged and abandoned in accordance with Rule 62-532.500(4), F.A.C., unless future use is intended. *[62-532.500(4)]*

5. During the period of operation authorized by this permit, the permittee shall continue to sample ground water at the monitoring wells identified in Permit Condition III.1., below in accordance with this permit and the approved ground water monitoring plan prepared in accordance with Rule 62-520.600, F.A.C. *[62-520.600] [62-610.510]*

6. The following monitoring well shall be sampled for System R-001.

Monitoring Well ID	Alternate Well Name and/or Description of Monitoring Location	Aquifer Monitored	New or Existing
MWB-001	W Canal Street S, just west of NW 20th Street	Surficial	Existing
MWC-002	North side of the East segment of the perc pond	Surficial	Existing
MWC-003	North of Well Pad	Surficial	Existing

MWC = Compliance; MWB = Background

[62-520.600] [62-610.510]

7. The following parameters shall be analyzed for each monitoring well identified in Permit Condition III.6.:

Parameter	Compliance Well Limit	Units	Sample Type	Monitoring Frequency
Water Level Relative to NGVD	Report	ft	In Situ	Quarterly
Nitrogen, Nitrate, Total (as N)	10	mg/L	Grab	Quarterly
Solids, Total Dissolved (TDS)	500	mg/L	Grab	Quarterly

Parameter	Compliance Well Limit	Units	Sample Type	Monitoring Frequency
Arsenic, Total Recoverable	10	ug/L	Grab	Quarterly
Chloride (as Cl)	250	mg/L	Grab	Quarterly
Cadmium, Total Recoverable	5	ug/L	Grab	Quarterly
Chromium, Total Recoverable	100	ug/L	Grab	Quarterly
Lead, Total Recoverable	15	ug/L	Grab	Quarterly
Coliform, Fecal	4	#/100mL	Grab	Quarterly
pH	6.5-8.5	s.u.	In Situ	Quarterly
Sulfate, Total	250	mg/L	Grab	Quarterly
Turbidity	Report	NTU	Grab	Quarterly

[62-520.600(11)(b)] [62-601.300(3), 62-601.700, and Figure 3 of 62-601] [62-601.300(6)] [62-520.310(5)]

8. Water levels shall be recorded before evacuating each well for sample collection. Elevation references shall include the top of the well casing and land surface at each well site (NAVD allowable) at a precision of plus or minus 0.01 foot. *[62-520.600(11)(c)] [62-610.510(3)(b)]*

9. Ground water monitoring wells shall be purged prior to sampling to obtain representative samples. *[62-160.210] [62-601.700(5)]*

10. Analyses shall be conducted on unfiltered samples, unless filtered samples have been approved by the Department's Southeast District Office as being more representative of ground water conditions. *[62-520.310(5)]*

11. Ground water monitoring test results shall be submitted on Part D of Form 62-620.910(10) in accordance with Permit Condition I.D.1. *[62-520.600(11)(b)] [62-601.300(3), 62.601.700, and Figure 3 of 62-601] [62-620.610(18)]*

12. If any monitoring well becomes damaged or inoperable, the permittee shall notify the Department's Southeast District Office immediately and a detailed written report shall follow within seven days. The written report shall detail what problem has occurred and remedial measures that have been taken to prevent recurrence. All monitoring well design and replacement shall be approved by the Department's Southeast District Office prior to installation. *[62-520.600] [62-620.320(6)]*

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

A. Rapid Infiltration Basins

1. Advisory signs shall be posted around the site boundaries to designate the nature of the project area. *[62-610.518]*

2. The maximum annual average loading rate to the percolation pond shall be limited to 3 inches per day (as applied to the entire bottom area). *[62-610.523(3)]*

3. Routine control of vegetation growth and maintenance of the percolation capability by scarification or removal of deposited solids must be conducted. Basin bottoms shall be maintained to be level. *[62-610.523(6) and (7)]*

4. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. *[62-610.514 and 62-610.414]*

5. Overflows from emergency discharge facilities on storage ponds or on infiltration ponds, basins, or trenches shall be reported as abnormal events in accordance with Permit Condition IX.20. *[62-610.800(9)]*

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of a(n) operator(s) certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category III, Class B facility and, at a minimum, operators with appropriate certification must be on the site as follows:

   A Class C or higher operator 16 hours/day for 7 days/week. The lead operator must be a Class B operator, or higher.

2. The lead operator shall be employed at the plant full time. "Full time" shall mean at least 4 days per week, working a minimum of 35 hours per week, including leave time. A certified operator shall be on-site and in charge of each required shift and for periods of required staffing time when the lead operator is not on-site. An operator meeting the lead operator classification level of the plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(10), (5), and (1)]*

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

1. The application to renew this permit shall include an updated capacity analysis report prepared in accordance with Rule 62-600.405, F.A.C. *[62-600.405(5)]*

2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. *[62-600.735(1)]*

C. Recordkeeping Requirements

1. The permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.

   a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;

   b. Copies of all reports required by the permit for at least three years from the date the report was prepared;

   c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;

d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the residuals use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least three years from the date of sampling or measurement;

e. A copy of the current permit;

f. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;

g. A copy of any required record drawings;

h. Copies of the licenses of the current certified operators; and

i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed.

[62-620.350, 62-602.650]

VI. SCHEDULES

1. If the permittee wishes to continue operation of this wastewater facility after the expiration date of this permit, the permittee shall submit an application for renewal no later than one-hundred and eighty days (180) prior to the expiration date of this permit. Application shall be made using the appropriate forms listed in Rule 62-620.910, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C. *[62-620.335(1) and (2)]*

2. An evaluation of groundwater monitoring plan shall be submitted with the application for permit renewal. *[62-4.070(1) and (3)]*

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

1. This facility is not required to have a pretreatment program at this time. *[62-625.500]*

VIII. OTHER SPECIFIC CONDITIONS

1. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. *[62-600.410(8) and 62-640.400(6)]*

2. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial

wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. *[62-604.130(3)]*

3. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. *[62-604.550] [62-620.610(20)]*

4. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):

   a. Which may cause fire or explosion hazards; or

   b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or

   c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or

   d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding $40^{o}C$ or otherwise inhibiting treatment; or

   e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

   [62-604.130(5)]

5. The treatment facility and storage pond system shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. *[62-610.518(1) and 62-600.400(2)(b)]*

6. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. *[62-701.300(1)(a)]*

7. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. *[62-620.310(4)]*

8. The permittee shall provide verbal notice to the Department's Southeast District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Southeast District Office in a written report within 7 days of the sinkhole discovery. *[62-620.320(6)]*

9. The permittee shall provide adequate notice to the Department of the following:

   a. Any new introduction of pollutants into the facility from an industrial discharger which would be subject to Chapter 403, F.S., and the requirements of Chapter 62-620, F.A.C., if it were directly discharging those pollutants; and

b. Any substantial change in the volume or character of pollutants being introduced into that facility by a source which was identified in the permit application and known to be discharging at the time the permit was issued.

Adequate notice shall include information on the quality and quantity of effluent introduced into the facility and any anticipated impact of the change on the quantity or quality of effluent or reclaimed water to be discharged from the facility.

[62-620.625(2)]

IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1)]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2)]*

3. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3)]*

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. *[62-620.610(4)]*

5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5)]*

6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. *[62-620.610(6)]*

7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the

permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7)]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8)]*

9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:

   a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;

   b. Have access to and copy any records that shall be kept under the conditions of this permit;

   c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and

   d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

   [62-620.610(9)]

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. *[62-620.610(10)]*

11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11)]*

12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12)]*

13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13)]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14)]*

15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15)]*

16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16)]*

17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:

    a. A description of the anticipated noncompliance;

    b. The period of the anticipated noncompliance, including dates and times; and

    c. Steps being taken to prevent future occurrence of the noncompliance.

    [62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-601, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.

    b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

    c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.

    d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.

e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.

f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

[62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19)]*

20. The permittee shall report to the Department's Southeast District Office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    a. The following shall be included as information which must be reported within 24 hours under this condition:
        (1) Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
        (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
        (3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
        (4) Any unauthorized discharge to surface or ground waters.

    b. Oral reports as required by this subsection shall be provided as follows:
        (1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph (a)4. that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the STATE WARNING POINT TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Warning Point:
            (a) Name, address, and telephone number of person reporting;
            (b) Name, address, and telephone number of permittee or responsible person for the discharge;
            (c) Date and time of the discharge and status of discharge (ongoing or ceased);
            (d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater);
            (e) Estimated amount of the discharge;
            (f) Location or address of the discharge;
            (g) Source and cause of the discharge;
            (h) Whether the discharge was contained on-site, and cleanup actions taken to date;
            (i) Description of area affected by the discharge, including name of water body affected, if any; and

(j) Other persons or agencies contacted.

(2) Oral reports, not otherwise required to be provided pursuant to subparagraph b.1 above, shall be provided to the Department's Southeast District Office within 24 hours from the time the permittee becomes aware of the circumstances.

c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department's Southeast District Office shall waive the written report.

[62-620.610(20)]

21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. *[62-620.610(21)]*

22. Bypass Provisions.

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.

b. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:
(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(3) The permittee submitted notices as required under Permit Condition IX.22.b. of this permit.

c. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.a.1. through 3. of this permit.

e. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.a. through c. of this permit.

[62-620.610(22)]

23. Upset Provisions.

a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee.
   (1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.
   (2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

b. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the cause(s) of the upset;
   (2) The permitted facility was at the time being properly operated;
   (3) The permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and
   (4) The permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.

c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.

d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in West Palm Beach, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Linda A. Brien, P.G.
Water Facilities Administrator

DATE: _May 23, 2011____

Attachment(s):
Discharge Monitoring Report
Pathogen Monitoring Report

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39700 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: Belle Glade WWTP
LOCATION: 2055 West Canal Street
Belle Glade, FL 33430-

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA027740-008-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: R-001
MONITORING GROUP DESCRIPTION: Percolation pond(s) system., with Influent
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-03	Permit Requirement		0.069 (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		5 Days/Week While discharging	24-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		5 Days/Week While discharging	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		5 Days/Week While discharging	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		5 Days/Week While discharging	24-hr FPC
Coliform, Fecal	Sample Measurement										
PARM Code 74055 Y Mon. Site No. EFF-01	Permit Requirement					200 (An.Avg.)		#/100mL		5 Days/Week While discharging	Grab

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Belle Glade WWTP

MONITORING GROUP NUMBER: R-001

PERMIT NUMBER: FLA027740-008-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal	Sample Measurement										
PARM Code 74055 1 Mon. Site No. EFF-01	Permit Requirement					200 (Mo.Geo.Mn.)	800 (Max.)	#/100mL		5 Days/Week While discharging	Grab
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFF-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous during discharge	Meter
Chlorine, Total Residual(For Disinfection)	Sample Measurement										
PARM Code 50060 1 Mon. Site No. EFF-01	Permit Requirement				0.5 (Min.)			mg/L		Continuous during discharge	Meter
Nitrogen, Nitrate, Total (as N)	Sample Measurement										
PARM Code 00620 1 Mon. Site No. EFF-01	Permit Requirement						12.0 (Max.)	mg/L		5 Days/Week While discharging	24-hr FPC
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-01	Permit Requirement	6.5 (Mo.Avg.)		MGD						Continuous	Meter
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 P Mon. Site No. OTH-01	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C(Influent)	Sample Measurement										
PARM Code 80082 Q Mon. Site No. INF-01	Permit Requirement						Report (Max.)	mg/L		5 Days/Week	24-hr FPC
Solids, Total Suspended(Influent)	Sample Measurement										
PARM Code 00530 Q Mon. Site No. INF-01	Permit Requirement						Report (Max.)	mg/L		5 Days/Week	24-hr FPC

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39700 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: Belle Glade WWTP
LOCATION: 2055 West Canal Street
Belle Glade, FL 33430-

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA027740-008-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: U-001
MONITORING GROUP DESCRIPTION: Belle Glade Deep Injection Well.
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-02	Permit Requirement		6.5 (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		5 Days/Week	24-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		5 Days/Week	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFF-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA027740-008-DW1P Facility: Belle Glade WWTP
Monitoring Period From: _____ To: _____

	BOD, Carbonaceous 5 day, 20C mg/L	Chlorine, Total Residual (For Disinfection) mg/L	Coliform, Fecal #/100mL	Nitrogen, Nitrate, Total (as N) mg/L	Solids, Total Suspended mg/L	pH s.u. Maximum	pH s.u. Minimum	Flow MGD
Code	80082	50060	74055	00620	00530	00400	00400	50050
Mon.	EFF-01	EFF-01	EFF-01	EFF-01	EFF-01	EFF-01	EFF-01	FLW-01
1								
2								
3								
4								
5								
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24								
25								
26								
27								
28								
29								
30								
31								
Total								
Mo. Avg.								

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA027740-008-DW1P Facility: Belle Glade WWTP
Monitoring Period From: _____ To: _____

	Flow MGD	Flow MGD	BOD, Carbonaceous 5 day, 20C (Influent) mg/L	Solids, Total Suspended (Influent) mg/L						
Code	50050	50050	80082	00530						
Mon. Site	FLW-02	FLW-03	INF-01	INF-01						
1										
2										
3										
4										
5										
6										
7										
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30										
31										
Total										
Mo. Avg.										

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

GROUNDWATER MONITORING REPORT - PART D

Facility Name: Belle Glade WWTP
Permit Number: FLA027740-008-DW1P
County: Palm Beach
Office: Southeast District

Monitoring Well ID: MWB-001
Well Type: W Canal Street S, Just west of NW 20th Street
Description:
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		Report	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		Report	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		Report	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		Report	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		Report	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		Report	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		Report	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		Report	#/100mL	Grab	Quarterly				
pH	00400		Report	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		Report	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: Belle Glade WWTP
Permit Number: FLA027740-008-DW1P
County: Palm Beach

Monitoring Well ID: MWC-002
Well Type: Compliance
Description: North side of the East segment of the perc pond

Report Frequency: Quarterly
Program: Domestic

Office: Southeast District

Re-submitted DMR: ☐

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		100	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: Belle Glade WWTP
Permit Number: FLA027740-008-DW1P
County: Palm Beach
Office: Southeast District

Monitoring Well ID: MWC-003
Well Type: Compliance
Description: North of well pad
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		100	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39700 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: Belle Glade WWTP
LOCATION: 2055 West Canal Street
Belle Glade, FL 33430-

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA027740-008-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: RMP-B
MONITORING GROUP DESCRIPTION:
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Sludge, Tot, Dry Wt (as N)	Sample Measurement										
PARM Code 78470 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Annually	Grab
Phosphorus, Sludge, Tot, Dry Wt (as P)	Sample Measurement										
PARM Code 78478 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Annually	Grab
Potassium, Sludge, Tot, Dry Wt (as K)	Sample Measurement										
PARM Code 78472 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Annually	Grab
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. RMP-B	Permit Requirement						75.0 (Max.)	mg/kg		Annually	Composite
Cadmium, Sludge, Tot, Dry Weight (as Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. RMP-B	Permit Requirement						85.0 (Max.)	mg/kg		Annually	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. RMP-B	Permit Requirement						4300.0 (Max.)	mg/kg		Annually	Composite

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Belle Glade WWTP MONITORING GROUP NUMBER: RMP-B PERMIT NUMBER: FLA027740-008-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-B	Permit Requirement						840.0 (Max.)	mg/kg		Annually	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-B	Permit Requirement						57.0 (Max.)	mg/kg		Annually	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-B	Permit Requirement						75.0 (Max.)	mg/kg		Annually	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-B	Permit Requirement						420.0 (Max.)	mg/kg		Annually	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-B	Permit Requirement						100.0 (Max.)	mg/kg		Annually	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-B	Permit Requirement						7500.0 (Max.)	mg/kg		Annually	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-B	Permit Requirement						Report (Max.)	s.u.		Annually	Grab
Solids, Total, Sludge, Percent	Sample Measurement										
PARM Code 61553 + Mon. Site No. RMP-B	Permit Requirement						Report (Max.)	percent		Annually	Grab

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28th of the month following the monitoring period. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the permittee or authorized representative:

Resubmitted DMR: Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)
No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units.
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Time Sample Obtained: Enter the time the sample was taken.
Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that.
Detection Limits: Record the detection limits of the analytical methods used.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.
No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.
No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.
Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

PATHOGEN MONITORING

Part I - Instructions

1. Completion of this report is required by Rules 62-610.463(4), 62-610.472(3)(d), 62-610.525(13), 62-610.568(11), 62-610.568(12), and 62-610.652(6)(c), F.A.C., for all domestic wastewater facilities that provide reclaimed water to certain types of reuse activities. The schedule for sampling and reporting shall be in accordance with the permit for the facility. If a schedule for sampling or re-sampling is not included in the permit, the following schedule shall apply:

   a. Routine Sampling:

      If sampling is required once every two years, this report shall be submitted on or before November 28 of each even numbered year (2006, 2008, 2010, etc.).

      If sampling is required once every five years, this report shall be submitted with the application for permit renewal.

      If sampling is required quarterly, this report shall be submitted on or before February 28, May 28, August 28, and November 28 of each year.

   b. Subsequent Re-Sampling:

      If subsequent re-sampling is required by Item 9 in Part I of this form, this form shall be submitted for the subsequent re-sampling(s) in accordance with the schedule established in Item 9 in Part I of this form.

2. Submit one copy of this form and a copy of the laboratory's final report for the analysis of *Giardia* and *Cryptosporidium* to each of the following two addresses:

   a. The appropriate DEP district office (attention Domestic Wastewater Program). Addresses for the DEP district offices are available at www.dep.state.fl.us/secretary/dist/default.htm.

   b. DEP Water Reuse Coordinator
   Mail Station 3540
   2600 Blair Stone Road
   Tallahassee, Florida 32399-2400

3. Please type or print legibly.

4. In Part II, Items 7 through 12 need to be completed only if this is the first submittal of this report, if the information in Items 7 through 12 has changed since the last submittal, or if the information in any of these questions has not been previously provided.

5. Part III is to be used when sampling for *Giardia* and *Cryptosporidium* at the treatment plant. Part III is also to be used when sampling for *Giardia* and *Cryptosporidium* in a supplemental water supply (see Rule 62-610.472, F.A.C.).

6. For each sample, record the sample volume obtained in liters.

7. For *Giardia*, record the concentrations in cysts per 100 liters. For *Cryptosporidium*, record the concentrations in oocysts per 100 liters. Sufficient sample volumes shall be collected and processed such that the detection limit is no greater than 5 cysts or oocysts per 100 liters. Detection levels on the order of 1 cyst or oocyst per 100 liters are recommended. If an observation is less than the detection limit, make an entry in the form "<2" (where 2 per 100

liters is the detection limit in this example). The actual detection limit will be dictated by the volumes of sample obtained, filtered, and processed. Do NOT record nondetectable values as zero.

8. EPA Method 1623 or other approved methods for reclaimed water or nonpotable waters, adjusted appropriately to accommodate the detection limit requirements, shall be used. Methods previously allowed for EPA's Information Collection Rule (ICR) shall not be used. The full requirements of the approved method, including quality assurance and quality control, are to be met. Quality assurance and sampling requirements in Chapter 62-160, F.A.C., shall apply.

   Two concentrations of *Giardia* and *Cryptosporidium* shall be recorded on Part III of this form:

   a. Total cysts and oocysts shall be enumerated using EPA Method 1623 or other approved methods.

   b. Potentially viable cysts and oocysts shall be enumerated using the DAPI staining technique contained in EPA Method 1623 or similar enumeration techniques included in other approved methods. Cysts and oocysts that are stained DAPI positive or show internal structure by D.I.C. shall be considered as being potentially viable. If the laboratory reports separate values for DAPI positive and for cysts or oocysts having internal structure, the larger of the two concentrations will be reported as being potentially viable.

9. If the number of potentially viable cysts of *Giardia* reported exceeds 5 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. If the number of potentially viable oocysts of *Cryptosporidium* reported exceeds 22 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. This subsequent sample shall be collected within 90 days of the date the initial sample was taken, analyzed for both *Giardia* and *Cryptosporidium*, and the results of the subsequent analysis shall be submitted to DEP using this form within 60 days of sample collection.

10. Rule 62-160.300, F.A.C., requires that all laboratories generating environmental data for submission to the DEP shall hold certification from the Department of Health's (DOH) Environmental Laboratory Certification Program (ELCP). Certification by the ELCP for analysis of *Giardia* and *Cryptosporidium* using EPA Method 1623 for non-potable waters is required. If other approved methods are used, certification by the ELCP is required for the specific method and for the test matrix. Lists of certified laboratories can be found at www.dep.state.fl.us/labs/cgi-bin/aams/index.asp

11. Samples shall be collected during peak flow periods (normally between the hours of 8:00 a.m. and 6:00 p.m.).

12. Recognizing that concentrations of these pathogens generally increase during the late summer through fall period, it is recommended that utilities sample during the August through October time period.

13. If the wastewater treatment facility uses chlorination for disinfection, samples obtained for analysis of *Giardia* and *Cryptosporidium* shall be dechlorinated.

14. When sampling at the treatment facility, obtain a grab sample for total suspended solids (TSS) that is representative of the water leaving the filters at the treatment facility during the period when pathogen samples are being obtained. In addition, record the highest turbidity and the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

15. When sampling a supplemental water supply, obtain a grab sample for total suspended solids (TSS) that is representative of the surface water or treated stormwater as it is added to the reclaimed water system. This TSS sample shall be taken during the period when pathogen samples are being obtained. In addition, record the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

Part II - General Information

1. DEP wastewater facility identification number: **FLA027740**

   Wastewater facility name: Belle Glade WWTP

   Permittee name: Glades Utility Authority

2. Person completing this form:

   Name: _____

   Telephone: (_____)_____

   Email address: _____

3. Sampling and analysis:

   Date samples were taken: _____

   Organization collecting the samples: _____

   Was the sample dechlorinated in the field? ☐ Yes ☐ No

   Was the sample refrigerated or kept on ice during shipment to the laboratory? ☐ Yes ☐ No

   Date samples delivered to laboratory: _____

   Date analytical work was done: _____

   Laboratory doing the analysis: _____

   Laboratory's DOH Identification Number: _____

   Approved method used:

   ☐ EPA Method 1623

   ☐ Other approved method: _____

   Contact person at the laboratory: _____

   Email address of the lab contact person: _____

4. Is this the first time that this form has been submitted for the facility?

   ☐ Yes [Please complete Questions 7 through 16.]

   ☐ No [Proceed to Question 5.]

5. Is this a report of "subsequent re-sampling" required by Item 9 in Part I of this form based on concentrations of potentially viable cysts or oocysts in a previous sampling?

☐ No [Proceed to Question 6.]

☐ Yes [Attach a description of any facility or operational changes made to the treatment facilities since the time of the previous sampling and proceed to Question 6.]

6. Has the information requested in Questions 7 through 12 (below) changed since the last submittal of this form?

☐ Yes [Please complete Questions 7 through 16.]

☐ No [Proceed to Questions 13 through 16 of Part II of this form. You do not need to complete Questions 7 through 12.]

7. Type of secondary treatment system:

☐ Conventional activated sludge ☐ Extended aeration

☐ Contact stabilization ☐ Biological nutrient removal (such as Bardenpho)

☐ Other: _____

8. Does this treatment facility nitrify (convert ammonia nitrogen to nitrate)? ☐ Yes ☐ No

9. Filter type:

☐ Deep bed, single media ☐ Deep bed, multiple media

☐ Shallow bed, automatic backwash ☐ Upflow (including Dynasand)

☐ Slow rate sand filter ☐ Diatomaceous earth filter

☐ Fabric filter ☐ Cartridge filter

☐ Membranes (microfiltration, ultrafiltration, membrane bioreactor, reverse osmosis)

☐ Other: _____

10. Filter Media (complete for each type of media provided):

Top layer of media:

Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Middle layer of media: Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Bottom layer of media: Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

11. Filter backwash water:

☐ Backwash water is returned to the headworks of the treatment plant.

☐ Backwash water is returned to the aeration basin.

☐ Other. Please describe: _____

12. Disinfection system:

☐ Chlorination, gas ☐ Hypochlorite

☐ Chlorine dioxide ☐ Chlorination, other _____

☐ Ultraviolet ☐ Ozone

☐ Other: _____

13. Is chlorine added before the filters? ☐ No ☐ Yes Dose: _____ mg/L

14. During the period that samples were taken, did you add a coagulant, coagulant aid, polyelectrolyte, or other chemical to enhance filtration?

☐ No

☐ Yes. Please list the chemicals being added and their dose.

Chemical 1 - Name: _____ Dose: _____ mg/L

Chemical 2 - Name: _____ Dose: _____ mg/L

Chemical 3 - Name: _____ Dose: _____ mg/L

15. Wastewater treatment plant permitted capacity: _____ MGD

16. Wastewater flow being treated at the time samples were collected: _____ MGD

PART III - PATHOGEN MONITORING REPORT

FACILITY ID: FLA027740
FACILITY NAME: Belle Glade WWTP
FACILITY ADDRESS: 2055 West Canal Street, Belle Glade, FL 33430
PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39700 Hooker Highway, Belle Glade, Florida 33430
DATE OF SAMPLING: _____

Parameter	Quantity or Loading		Quality or Concentration	
	Sample Measurement	Units	Sample Measurement	Units
Treatment Plant: After Filter Monitoring Site No.				
Turbidity PARM Code 00070				NTU
TSS PARM Code 00530				mg/L
Treatment Plant: After Disinfection Monitoring Site No.				
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia, total count * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L
Supplemental Water Supply (surface water or stormwater): After Treatment & Disinfection Monitoring Site No.				
TSS PARM Code 00530				mg/L
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia (total count) * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L

* Data entries must be made for both total and potentially viable cysts and oocysts.

PART IV - CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principle Executive Officer or Authorized Agent (Type or Print)	Signature of Principle Executive Officer or Authorized Agent	Telephone No.	Date (YY/MM/DD)
	Email Address		

FACT SHEET
FOR
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMIT NUMBER: FLA027740-008

FACILITY NAME: Belle Glade WWTP

FACILITY LOCATION: 2055 West Canal Street, Belle Glade, FL 33430
Palm Beach County

NAME OF PERMITTEE: Glades Utility Authority

PERMIT WRITER: Meghna Pandya

1. SUMMARY OF APPLICATION

   a. Chronology of Application

      Application Number: FLA027740-008-DW1P

      Application Submittal Date: August 8, 2008

   b. Type of Facility

      Domestic Wastewater Treatment Plant

      Ownership Type: Authority

      SIC Code: 4952

   c. Facility Capacity

	MMADF (MGD)	PHF (MGD)
Existing Design Capacity:	6.5	9.8
Proposed Increase in Design Capacity:	0	0
Proposed Total Design Capacity:	6.5	9.8

An existing 6.5million gallons per day (MGD) maximum monthly average daily flow (MMADF) oxidation ditch aeration type activated sludge wastewater treatment plant consisting of Two (2) mechanical cleaned bar screens; Two (2) 2,538 gallon (gal.) grit forced vortex chambers with two (2) grit

removals and two (2) cyclone/inclined screw classifier grit dewatering units; Two (2) 1.9 million gallon (MG) Carousel oxidation ditch basins with a downstream flow splitter; Two (2) rectangular secondary clarifiers with a volume of 373,100 gal. each and two (2) circular secondary clarifiers with a volume of 822,469 gal. each; Four (4) 0.1-inches opening roto-screens with a flow capacity of 2,650 gallons per minute (gpm) each; One (1) 0.03 MG injection well pump station with a pumping capacity of 12.0 MGD when three (3) pumps online and one as a backup; One (1) 465,300 gal. aerobic digester; Two (2) 117-320 gallon per minute (gpm) rotary drum thickeners with a polymer blend system; Two (2) 500 pound per day (each) flow paced chlorinators and one (1) 1,000 pound per day manual chlorinator; One (1) 310 kilowatt (kW) and one (1) 800 kW diesel engine auxiliary power generators.

e. Description of Effluent Disposal and Land Application Sites (as reported by applicant)

Parameter	Units	Max /Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	0.069	Monthly Average	62-600.400(3)(b) & 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.510 & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-610.510 & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Coliform, Fecal	#/100mL	Max	200	Annual Average	62-610.510 & 62-600.440(4)(c)1. FAC
		Max	200	Monthly Geometric Mean	62-600.440(4)(c)2. FAC
		Max	800	Single Sample	62-600.440(4)(c)4. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	62-610.510 & 62-600.440(4)(b) FAC
Nitrogen, Nitrate, Total (as N)	mg/L	Max	12.0	Single Sample	62-610.510(1) FAC

See attached map(s) for effluent disposal and land application site(s).

2. SUMMARY OF SURFACE WATER DISCHARGE

This facility does not discharge to surface waters.

3. BASIS FOR PERMIT LIMITATIONS AND MONITORING REQUIREMENTS

This facility is authorized to discharge reclaimed water to Underground Injection Well System U-001 which consists of 1 Class I injection wells discharging to Class G-IV ground water based on the following:

Parameter	Units	Max /Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	6.5	Monthly Average	62-600.400(3)(b) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC

This facility is authorized to direct reclaimed water to Reuse System R-001, a rapid infiltration basin system, based on the following:

Other Limitations and Monitoring Requirements:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	6.5	Monthly Average	62-600.400(3)(b) FAC
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	62-600.405(4) FAC
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC
Monitoring Frequencies and Sample Types	-	-	-	All Parameters	62-601 FAC & 62-699 FAC and/or BPJ of permit writer
Sampling Locations	-	-	-	All Parameters	62-601, 62-610.412, 62-610.463(1), 62-610.568, 62-610.613 FAC and/or BPJ of permit writer

4. DISCUSSION OF CHANGES TO PERMIT LIMITATIONS

There are no significant changes to the permit.

5. RESIDUALS MANAGEMENT

The method of residuals use or disposal by this facility is land application or disposal in a Class I or II solid waste landfill.

See the table below for the rationale for the Class B residuals limits and monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	62-640.650(1)(b) & 700(1), FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
pH	s.u.	Max	Report	Single Sample	62-640.650(1)(b) FAC
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Monitoring Frequency		All Parameters			62-640.650 & 650(1)(c) FAC
Pathogen and vector attraction reduction monitoring		All Parameters			62-640.650 & 650(1)(a) FAC

Cumulative limits for arsenic, cadmium, copper, lead, mercury, selenium, and zinc are established in accordance with Rule 62-640.700(3)(b) F.A.C.

6. GROUND WATER MONITORING REQUIREMENTS

Ground water monitoring requirements have been established in accordance with Chapters 62-520, 532, 601, 610, and 620, F.A.C.

7. PERMIT SCHEDULES

8. INDUSTRIAL PRETREATMENT REQUIREMENTS

At this time, the facility is not required to develop an approved industrial pretreatment program. However, the Department reserves the right to require an approved program if future conditions warrant.

9. ADMINISTRATIVE ORDERS (AO) AND CONSENT ORDERS (CO)

This facility has entered into CO 09-3928, effective November 23, 2010, with the Department, which includes a schedule of compliance. Injection well rehabilitation, flow meter recalibration, upgrades at the lift station #7 and Infiltration and Inflow improvements thought the City's collection system.

10. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

No variances were requested for this facility.

11. THE ADMINISTRATIVE RECORD

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received and additional information is available for public inspection during normal business hours at the location specified in item 13. Copies will be provided at a minimal charge per page.

12. DEP CONTACT

Additional information concerning the permit and proposed schedule for permit issuance may be obtained during normal business hours from:

Meghna Pandya
Environmental Specialist III
Southeast District Office
400 N Congress Ave Suite 200
West Palm Beach, FL 33401-2913
Telephone No.: (561) 681-6683

Florida Department of Environmental Protection

Southeast District
400 North Congress Avenue, Suite 200
West Palm Beach, Florida 33401

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

ELECTRONIC CORRESPONDENCE
October 21, 2008

Mr. Mark A. Kutney, AICP, Deputy City Manager
City of Belle Glade
2005 West Central Street South
Belle Glade, Florida 33430

PALM BEACH COUNTY
UIC - City of Belle Glade WWTP
Class I Injection Well IW-1
FILE: 0048217-008-UO

Dear Mr. Kutney:

Enclosed is Permit Number 0048217-008-UO, to operate the City of Belle Glade Class I Injection Wells IW-1, with one associated Dual Zone Monitoring Well, MW-1. This permit issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-4, 62-520, 62-522, 62-528, 62-550, 62-600 and 62-601. The system is located at the City of Belle Glade Wastewater Treatment Plant.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, Mail Stop 35, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Should you have any questions, please contact J. Gardner Strasser, P.G., or Joseph R. May, P.G., of this office at (561) 681-6688 or (561) 681-6691, respectively.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

_____

Jack Long
District Director
Southeast District

JL/LAB/JRM/jgs

Copies furnished to:
Joe L. Haberfeld, FDEP/TLH
Nancy Marsh, USEPA/ATL
Cathy McCarty, FDEP/TLH
Steve Anderson, SFWMD/WPB
Tom Lefevre, PBCHD
Mark A. Kutney, AICP, Deputy City Manager

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on _____ to the listed persons.
Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to the §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

_____ _____
Clerk Date

Florida Department of Environmental Protection

Southeast District
400 North Congress Avenue, Suite 200
West Palm Beach, Florida 33401

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

PERMITTEE:
Mr. Mark A. Kutney, AICP, Deputy City Manager
City of Belle Glade
2005 West Central Street South
Belle Glade, Florida 33430

PERMIT/CERTIFICATION NUMBER: 0048217-008-UO
DATE OF ISSUANCE: October 21, 2008
EXPIRATION DATE:October 20, 2013
COUNTY: Palm Beach
POSITION: 26° 41' 38.349" N / 80° 41' 23.081" W
PROJECT: Renewal Operation Permit for Class I Injection Well IW-1 at the City of Belle Glade Wastewater Treatment Plant (WWTP)

PROJECT: Renewal of the Operation Permit for Injection Well IW-1.

This permit is issued under the provisions of Chapter 403.087, Florida Statutes, and Florida Administrative Code (F.A.C.) Rules 62-4, 62-520, 62-522, 62-528, 62-550, 62-600 and 62-601. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO OPERATE: One (1) Class I Municipal Injection Well, IW-1, and an associated deep Dual Zone Monitoring well, MW-1. The injection wells are operated for the disposal of non-hazardous secondary treated domestic wastewater (effluent) from the City of Belle Glade WWTP. Injection Well IW-1, the primary disposal well, has been tested and rated at 8.00 feet per second or 10.2 million gallons per day (MGD). Emergency disposal is by gravity flow of high-level disinfected effluent to the percolation ponds south of the treatment plant.

Injection Well IW-1 is constructed with one twenty (20)-inch outside diameter (O.D.) casing extending to a depth of 2,850 feet below land surface (bls), and injects through an open-hole interval between 2,850 feet and the total depth of the well at 3,505 feet bls. The open-hole (injection) intervals of the injection well is in the "Boulder Zone", within the lower Oldsmar Formation. The confinement of the injection zone from overlying underground source of drinking water (USDW) aquifers and fluid movement adjacent to the wellbore of the injection well is monitored by a Dual Zone Monitoring Well,MW-1. The Upper Zone monitoring interval is 1,001 to 1,169 feet bls and the Lower Zone monitoring well is 1,871 to 1,940 feet bls (lower monitoring interval).

IN ACCORDANCE WITH: Application to Operate a Class I Injection Well System received June 1, 2004; Certificate of Demonstration of Financial Responsibility issued January 25, 2006; Request for Information (RFI-1) was sent on May 16, 2005; a request for a 70 day extension to respond to RFI-1 received on July 8, 2005; a request for an additional 45 day extension to respond to RFI-1 received on July 19, 2005; a request for an additional 42 day extension to respond to RFI-1 received on August 22, 2005; a request for an additional 30 day extension to respond to RFI-1 received on September 30, 2005; a request for an additional 30 day extension to respond to RFI-1 received on October 5, 2005; a request for an additional 21 day extension to respond to RFI-1 received on November 7, 2005; a request for an additional 14 day extension to respond to RFI-1 received on November 23, 2005; response to RFI-1 received on December 9, 2005; RFI-2 was sent on February 9, 2006; a 45-Day Notice Letter for RFI-2 was sent on March 30, 2006; a request for 30 day extension to respond to RFI-2 received on March 31, 2006; a request for an additional 15 day extension received on April 25, 2006; response to RFI-2 received on May 9 and 11, 2006; RFI Email sent on June 14, 2006; response to RFI Email received on June 20, 2006; RFI-3 sent on May 22, 2007; a 45-Day Notice Letter for RFI-3 was sent on July 6, 2007; a request for a 60 day extension to respond to RFI-3 received on July 24, 2007; a request for an additional 30 day extension to respond to RFI-3 received on September 10, 2007; respond to RFI-3 received on October 5 and 12, 2007; RFI-4 was sent on November 8, 2007; a request for a 90 day extension to respond to RFI-4 received on December 21, 2007; response to RFI-4 received on April 18, 2008; publication of the Notice of Draft Permit Number 0048217-008-UO published in the Palm Beach Post newspaper on July 29, 2008; consideration of receipt of public comment received as a result of a public meeting held on August 29, 2008 at 10:00 AM at the Belle Glade City Hall Commission Chambers, City of Belle Glade.

LOCATED AT: City of Belle Glade Wastewater Treatment Plant (WWTP), 2055 West Canal Street South, Belle Glade, Palm Beach County, Florida 33430.

TO SERVE: The City of Belle Glade WWTP Service Area.

SUBJECT TO: General Conditions 1-24 and Specific Conditions 1-7.

GENERAL CONDITIONS:

The following **General Conditions** are referenced in Florida Administrative Code Rule 62-528.307.

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to Section 403.141, F.S.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action.

3. As provided in Subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land, water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefrom; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, or are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

   a. Have access to and copy any records that must be kept under conditions of this permit;
   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

   Reasonable time will depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

   a. A description of and cause of noncompliance; and
   b. The period of noncompliance, including dates and times; or, if not corrected the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent the recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

GENERAL CONDITIONS:

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is proscribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Rules 62-4.120 and 62-528.350, F.A.C. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. The permittee shall comply with the following:

    a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records shall be extended automatically unless the Department determines that the records are no longer required.
    b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
    c. Records of monitoring information shall include:

        1) the date, exact place, and time of sampling or measurements;
        2) the person responsible for performing the sampling or measurements;
        3) the dates analyses were performed;
        4) the person responsible for performing the analyses;
        5) the analytical techniques or methods used
        6) the results of such analyses

    d. The permittee shall furnish to the Department, within the time requested in writing, any information which the Department requests to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit.
    e. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

14. All applications, reports, or information required by the Department shall be certified as being true, accurate, and complete.

15. Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each scheduled date.

16. Any permit noncompliance constitutes a violation of the Safe Drinking Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

17. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

GENERAL CONDITIONS:

18. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

19. This permit may be modified, revoked and reissued, or terminated for cause, as provided in 40 C.F.R. Sections 144.39(a), 144.40(a), and 144.41 (1998). The filing of a request by the permittee for a permit modification, revocation or reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

20. The permittee shall retain all records of all monitoring information concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under Rule 62-528.435, F.A.C. The permittee shall deliver the records to the Department office that issued the permit at the conclusion of the retention period unless the permittee elects to continue retention of the records.

21. All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C. All reports shall contain the certification required in Rule 62-528.340(4), F.A.C.

22. The permittee shall notify the Department as soon as possible of any planned physical alterations or additions to the permitted facility. In addition, prior approval is required for activities described in Rule 62-528.410(1)(h).

23. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or injection activity which may result in noncompliance with permit requirements.

24. The permittee shall report any noncompliance which may endanger health or the environment including:

    a. Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water; or
    b. Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

    All information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

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SPECIFIC CONDITIONS:

1. General Requirements

   a. In accordance with Rules 62-4.090(1) and 62-528.455(3)(a), F.A.C., the permittee shall submit an application for permit renewal at least 60 days prior to expiration of this permit.

   b. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.

   c. The permittee shall notify the Department and obtain approval prior to any physical alterations or additions to the injection or monitoring wells, including removal of the well head.

2. Operating Requirements

   a. The pressure at the wellhead shall be monitored and controlled at all times to ensure the maximum pressure on the final casing does not exceed 66 percent (%) of the mechanical integrity test pressure of 202.5 pounds per square inch (p.s.i.). Accordingly, the maximum pressure on the final casing shall not exceed:

      - For the Disposal Well IW-1: 133.6 p.s.i.

   b. The flow to the injection well at the wellhead shall be monitored and controlled at all times to ensure the maximum fluid velocity down the well does not exceed a peak hourly flow rate of:

      1) For the Disposal Well IW-1:

         a) 8.0 feet per second (10.2 MGD) during normal operation and 12.0 feet per second during planned testing, maintenance, or emergency conditions.

   c. Injection well system monitoring devices:

      1) Pursuant to Rule 62-528.425(1)(b), F.A.C., the injection well system shall be monitored by continuous indicating, recording and totalizing devices to monitor effluent flow rate and volume, and continuous indicating and recording devices to monitor injection pressure and monitoring zone pressure (or water level, as appropriate; all zones). All indicating, recording and totalizing devices associated with the injection well system shall be maintained in good operating condition and calibrated annually at a minimum.

      2) Pursuant to Rule 62-600.540(4), F.A.C., the surface equipment shall be such that manual backup capability to monitor flow and pressure shall be provided for systems utilizing automatic and continuous recording equipment.

   d. Laboratory equipment, methods, and quality control will follow United States Environmental Protection Agency (USEPA) guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauges, flow meter, and chart records shall be calibrated using standard engineering methods.

   e. The flow from the monitoring zones during well evacuation and sampling shall not be discharged to surface waters or aquifers containing an Underground Source of Drinking Water (USDW).

SPECIFIC CONDITIONS:

f. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water.

g. Only non-hazardous secondary treated domestic wastewater (effluent) from the City of Belle Glade WWTP and purge water from the on-site monitoring well (associated with the injection well system at the City of Belle Glade WWTP) may be discharged into this well.

h. The wastewater stream shall be non-hazardous in nature at all times, as defined in 40-CFR, Part 261 and as adopted in Chapter 62-730, F.A.C.

3. Testing and Reporting Requirements

a. Any failure of Class I injection well monitoring and recording equipment for a period of more than 48 hours shall be reported to the Department within 24 hours. A written report describing the incident shall also be submitted to the Department within five days of the start of the event. The written report shall contain a complete description of the occurrence, a discussion of its cause(s), and the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

b. The permittee shall report any noncompliance which may endanger health or the environment, including:

1) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or

2) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

All information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

c. The injection system shall be monitored in accordance with Rules 62-528.425(1)(g) and 62-528.430(2), F.A.C. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The following injection well performance and monitoring zone data shall be collected and reported to the Department in Monthly Operating Reports (MORs) as indicated below.

1) Injection well performance:

a) Physical characteristics of injection well IW-1:

<u>Flow rate parameters</u>:

- average daily flow rate to injection well (MGD)
- daily maximum sustained (15 minutes minimum) flow rate to injection well (MGD)
- daily minimum sustained (15 minutes minimum) flow rate to injection well (MGD)
- monthly average of the daily flow rates to injection well (MGD)
- monthly maximum (peak hour) flow rate to injection well (MGD)
- monthly minimum flow rate to injection well (MGD)

SPECIFIC CONDITIONS:

Volumetric parameters:

- total daily flow volume to injection well (MG)
- total monthly flow volume to injection well (MG)
- monthly average of the daily flow volumes to injection well (MG)
- monthly maximum of the daily flow volumes to injection well (MG)
- monthly minimum of the daily flow volumes to injection well (MG)

Pressure parameters:

Injection pressure parameters:
- daily average injection pressure at injection well (psig)
- daily maximum sustained (15 minutes minimum) injection pressure at well (psig)
- daily minimum sustained (15 minutes minimum) injection pressure at well (psig)
- monthly average injection pressure at injection well (psig)
- monthly maximum sustained injection pressure at injection well (psig)
- monthly minimum sustained injection pressure at injection well (psig)

Additional:
- monthly wellhead pressure with no flow (shut-in pressure, psig)

b) Chemical characteristics of the wastewater stream sampled from the wet well monthly:

Monthly sampling:

- residue, total filterable (total dissolved solids, TDS) (mg/L)
- chloride (mg/L)
- specific conductance (temperature compensated, μmho/cm or μS/cm)
- total suspended solids (TSS) (mg/L)
- nitrogen, ammonia, total as N (ammonia) (mg/L)
- nitrogen, total Kjeldahl as N (TKN) (mg/L)
- nitrogen, nitrate, total as N (nitrate) (mg/L)
- phosphorous, total as P (mg/L)
- pH (standard units)
- sulfate, total as SO_4 (mg/L)

The MORs shall indicate monthly averages for all parameters sampled daily.

2) Dual zone monitoring well performance:

a) Physical characteristics - upper and lower monitoring zones potentiometric surface or water table height relative to the North American Vertical Datum of 1988 (NAVD 88; feet of head) or pressure (psig) referenced to NAVD 88:

- daily maximum pressure or water level (as appropriate)
- daily minimum pressure or water level (as appropriate)
- daily average pressure or water level (as appropriate)
- monthly maximum pressure or water level (as appropriate)
- monthly minimum pressure or water level (as appropriate)
- monthly average pressure or water level (as appropriate)

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SPECIFIC CONDITIONS:

b) Chemical characteristics of the upper and lower monitoring zones:

Monthly sampling:

- residue, total filterable (total dissolved solids, TDS) (mg/L)
- chloride (mg/L)
- specific conductance (temperature compensated, μmho/cm or μS/cm)
- nitrogen, ammonia, total as N (ammonia) (mg/L)
- nitrogen, total Kjeldahl as N (TKN) (mg/L)
- nitrogen, nitrate, total as N (nitrate) (mg/L)
- phosphorous, total as P (mg/L)
- pH (standard units)
- sulfate, total as SO_4 (mg/L)

d. A minimum of three well volumes of fluid shall be evacuated from the monitoring systems prior to sampling for the chemical parameters listed above. A State-certified laboratory shall analyze all samples. Sufficient purging shall have occurred when either of the following have occurred:

1) pH, specific conductance and temperature when sampled, upon purging the third or subsequent well volume, each vary less than 5% from that sampled upon purging the previous well volume; or
2) upon purging the fifth well volume

e. All samples must be collected and analyzed in accordance with the quality assurance/quality control (QA/QC) requirements of Rule 62-160, F.A.C.

f. Controlled monthly injectivity tests (rate/pressure) shall be conducted on IW-1 in accordance with Rule 62-528.430(2)(d), F.A.C. These tests shall be conducted at a rate that approaches the maximum design flow but which can be repeated on a monthly basis. The injectivity test results shall be reported to the Department in the MORs. The following data shall be recorded and reported:

Parameters pertinent to flow rate:

- injection flow rate (MGD)
- initial totalizer reading (gallons)
- final totalizer reading (gallons)
- time (minutes) from initial to final totalizer readings

Pressure parameters:

- static injection wellhead pressure (psig)
- wellhead injection pressure fall-off — every 30 seconds until again static (psig)
- final pressure upon test cessation — approximately 10-15 minutes (psig)
- wellhead pressure with no flow (shut-in pressure in psig)
- monitoring zone pressures (psig)

Specific Injectivity shall be reported in gpm/psig.
All readings shall be taken after a minimum 5-minute period of stabilized flow.
Pursuant to Rule 62-528.430(2)(d), F.A.C., as part of the specific injectivity test, each well shall be shut-in for a period of time necessary to conduct a valid observation of pressure fall-off.

g. All injection well data submissions, including MORs, shall be clearly identified on each page with: facility name, I.D. Number, permit number, operator's name, license number, daytime phone number, date of sampling/recording and type of data. Monitoring zones shall be identified by well number and depth interval. The lead plant operator or higher official shall sign and date each submittal.

SPECIFIC CONDITIONS:

h. The permittee shall submit monthly to the Department the results of all injection well and monitoring well data required by this permit (MORs) no later than the **last day of the month** immediately following the month of record. The results shall be sent to the Department of Environmental Protection's Southeast District Office (FDEP, UIC Section, 400 N. Congress Avenue, Suite 200, West Palm Beach, FL 33401). A copy of this report shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, MS 3530, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.

i. Pursuant to Rules 62-528.425(1)(a) and 62-528.450(2)(f)3., F.A.C., a wastewater stream analysis (24-hour composite sample) for primary and secondary drinking water standards (Chapter 62-550, F.A.C.) and minimum criteria, see attached list, shall be submitted annually (sampled in February and submitted on or before April 30). VOC parameters and biological parameters shall be sampled either in-situ or grab.

j. The permittee shall demonstrate mechanical integrity pursuant to Rules 62-528.300(6)(b)2., 62-528.300(6)(c), and 62-528.425(1)(d), F.A.C. at least once every five years during the life of the injection well. In the event operational or other data indicate a possible loss of integrity in the injection well, the mechanical integrity and other testing may be required at less than a five-year interval. **The mechanical integrity testing program shall include: TV survey, pressure test, radioactive tracer survey (RTS), and temperature log. All mechanical integrity testing shall be run and completed prior to June 22, 2011.** A plan describing the mechanical integrity procedures shall be submitted to the Department's Southeast District and Tallahassee offices for approval at least one-hundred eighty (180) days prior to the first pressure test date noted above. Pursuant to Rule 62-528.430(2)(b)2.a., F.A.C., the final report for the demonstration of mechanical integrity for the injection well shall be submitted within three months of the completion date for mechanical integrity testing. The final report shall address all tests noted above (including procedures followed, interpretations and results), and shall include a tabular presentation/graphical evaluation of monitoring well data over the previous 5-year period.

k. The Department shall be notified at least 72 hours prior to all testing for mechanical integrity on the injection well.

l. All testing for mechanical integrity on the injection well shall be initiated during normal business hours, Monday through Friday, except legal holidays.

m. Mechanical Integrity for IW-1:

1) The permittee shall maintain the mechanical integrity of the well at all times.
2) If the Department determines that the injection well lacks mechanical integrity, written notice shall be given to the permittee.
3) Unless the Department requires immediate cessation of injection, within 48 hours of receiving written notice that the well lacks mechanical integrity, the permittee shall cease injection into the well unless the Department allows continued injection pursuant to **(4)** below.
4) The Department may allow the permittee to continue operation of a well that lacks mechanical integrity if the permittee demonstrates that fluid movement into or between USDWs is not occurring.

4. Surface Equipment

a. The integrity of the monitoring zone sampling systems shall be maintained at all times. Sampling lines shall be clearly and unambiguously identified by monitoring zone at the point at which samples are drawn. All reasonable and prudent precautions shall be taken to ensure that samples are properly identified by monitoring zone and that samples obtained are representative of those zones. Sampling lines and equipment shall be kept free of contamination with independent discharges and no interconnections with any other lines.

SPECIFIC CONDITIONS:

b. The surface equipment for the injection well system shall maintain compliance with Chapter 62-528.450(2)(j), F.A.C. for water hammer control, screening, access for logging and testing, and reliability and flexibility in the event of damage to the well and effluent piping. A regular program of exercising the valves integral to the well head shall be instituted. At a minimum, all valves integral to the well head shall be exercised during the regularly scheduled monthly injectivity testing.

c. The surface equipment and piping for the injection and monitoring wells shall be kept free of corrosion at all times.

d. Spillage onto the injection well pad during construction activities, and any waters spilled during mechanical integrity testing, other maintenance, testing or repairs to the system shall be contained on the pad and directed to a sump which in turn discharges to the pumping station wet well or via other approved means to the injection well system.

e. The injection well pad shall be maintained and retained in service for the life of the injection wells. The injection and monitoring well pad are not, unless specific approval is obtained from the Department, to be used for storage of any material or equipment at any time.

5. Financial Responsibility

a. The permittee shall maintain the resources necessary to close, plug and abandon the injection and associated monitoring wells, at all times [Rule 62-528.435(9), F.A.C.].

b. **The permittee shall review and update annually the plugging and abandonment cost estimates, or at the very least, every 2.5 years.** An increase of 10 percent or more over the cost estimate upon which financial responsibility is based shall require the permittee to submit documentation to obtain an updated Certificate of Demonstration of Financial Responsibility.

c. In the event the mechanism used to demonstrate financial responsibility should become invalid for any reason, the permittee shall notify the Department of Environmental Protection in writing within 14 days of such invalidation. The permittee shall then within 30 days of said notification submit to the Department for approval new financial documentation in order to comply with Rule 62-528.435(9), F.A.C., and the conditions of this permit.

6. Emergency Disposal

a. All applicable federal, state, and local permits shall be in place to allow for any alternate discharges due to emergency or planned outage conditions.

b. The primary disposal method consists of injection of the highly treated domestic wastewater (effluent) to injection well IW-1. When the capacity of IW-1 is exceeded, or the well is out-of–service, flow may be diverted to the surge tanks, empty treatment units, and effluent storage tanks have been filled, the overflow will be directed to the polishing ponds that has a capacity of approximately One (1) million gallons. Emergency disposal is by gravity slow of highly treated disinfected effluent to the polishing ponds.

c. Any proposed changes in emergency disposal methods shall be submitted for Departmental and USEPA review for approval prior to implementation.

d. Abnormal Events

1) In the event the permittee is temporarily unable to comply with any of the conditions of a permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind, or by other cause, the permittee of the facility shall notify the Department. Notification shall be made in person, by telephone, or by telegraph within 24 hours of breakdown or malfunction to the Department.

SPECIFIC CONDITIONS:

2) A written report of any noncompliance referenced in S.C. **6.d.1)** above shall be submitted to the Department within five days after its occurrence. The report shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in accordance with permit conditions.

7. Signatories and Certification Requirements

a. All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.

b. In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Issued this _____ day of_____, 2008

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Jack Long
District Director
Southeast District

JL/LAB/JRM/jgs

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated May 6, 2002

PRIMARY DRINKING WATER STANDARDS

PARAMETER

Alachlor (Polychlorinated Biphenyl or PCB)
Aldicarb
Aldicarb sulfoxide
Aldicarb sulfone
Aroclors (Polychlorinated Biphenyls or PCBs)
Alpha, Gross
Antimony
Arsenic
Atrazine
Barium
Benzene
Benzo(a)pyrene
Beryllium
Bis(2-ethylhexyl) adipate (Di(2-ethylhexyl) adipate)
Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)
Cadmium
Carbofuran
Carbon Tetrachloride (Tetrachloromethane)
Chlordane
Chlorobenzene (Monochlorobenzene)
Chloroethylene (Vinyl Chloride)
Chromium
Coliforms, Total
Cyanide
2,4-D (2,4-Dichlorophenoxyacetic acid)
Dalapon (2,2-Dichloropropionic acid)
Dibromochloropropane (DBCP)
1,2-Dibromoethane (EDB, Ethylene Dibromide)
1,2-Dichlorobenzene (o-Dichlorobenzene)
1,4-Dichlorobenzene (p-Dichlorobenzene or Para Dichlorobenzene)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (Vinylidene chloride)
1,2-Dichlorethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)
cis-1,2-Dichloroethylene (1,2-Dichlorethylene)
trans-1,2-Dichloroethylene (1,2-Dichlorethylene)
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
Dinoseb
Diquat
EDB (Ethylene dibromide, 1,2-Dibromoethane)
Endothall
Endrin
Ethylbenzene
Ethylene dichloride (1,2-Dichloroethane)
Fluoride
Glyphosate (Roundup)
Gross Alpha
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
gamma-Hexachlorocyclohexane (Lindane)
Hexachlorocyclopentadiene
Lead

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated May 6, 2002

PRIMARY DRINKING WATER STANDARDS, CONT'D

PARAMETER

Lindane (gamma-Hexachlorocyclohexane)
Mercury
Methoxychlor
Methylene chloride (Dichloromethane)
Monochlorobenzene (Chlorobenzene)
Nickel
Nitrate (as N)
Nitrite (as N)
Total Nitrate + Nitrite (as N)
Oxamyl
p-Dichlorobenzene or Para Dichlorobenzene (1,4-Dichlorobenzene)
Pentachlorophenol
Perchloroethylene (Tetrachloroethylene)
Picloram
Polychlorinated biphenyl (PCB or Aroclors)
Radium
Roundup (Glyphosate)
Selenium
Silver
Silvex (2,4,5-TP)
Simazine
Sodium
Styrene (Vinyl benzene)
Tetrachloroethylene (Perchloroethylene)
Tetrachloromethane (Carbon Tetrachloride)
Thallium
Toluene
Toxaphene
2,4,5-TP (Silvex)
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene, TCE)
Trihalomethanes, Total
Vinyl Chloride (Chloroethylene)
Xylenes (total)

SECONDARY DRINKING WATER STANDARDS

PARAMETER

Aluminum
Chloride
Color
Copper
Ethylbenzene
Fluoride
Foaming Agents (MBAS)
Iron
Manganese
Odor
pH
Silver
Sulfate
Toluene
Total Dissolved Solids (TDS)
Xylenes
Zinc

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated May 6, 2002

MUNICIPAL WASTEWATER MINIMUM CRITERIA
GROUND WATER MONITORING PARAMETERS

INORGANICS

Ammonia
Nitrogen (organic)
Total Kjeldahl Nitrogen
Total Phosphorus (phosphate)

VOLATILE ORGANICS

Chloroethane
Chloroform
para-Dichlorobenzene (1,4 Dichlorobenzene)
1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)

BASE/NEUTRAL ORGANICS

Anthracene
Butylbenzylphthalate
Dimethylphthalate
Naphalene
Phenanthrene

PESTICIDES AND PCBs

Aldrin
Dieldrin

ACID EXTRACTABLES

2-chlorophenol
Phenol
2,4,6-trichlorophenol

OTHER

Specific Conductance
Biological Oxygen Demand
Chemical Oxygen Demand
Temperature

Florida Department of Environmental Protection

Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401
561-681-6600

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

August 22, 2012 ELECTRONIC CORRESPONDENCE

In the Matter of an
Application for Permit by:

Mr. James C. Stiles, Executive Director

Glades Utility Authority
39800 Hooker Highway
Belle Glade, Florida 33430
Email: JStiles@pbcwater.com

PA File Number FLA0136778-006-DW1P/NR
City of Pahokee WWTF/Permit Renewal
Permit Number: FLA0136778

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number FLA0136778 to operate the City of Pahokee WWTF, issued under Chapter 403**,** Florida Statutes.

Monitoring requirements under this permit are effective on the first day of the second month following permit issuance. Until such time, the Permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, within fourteen days of receipt of notice. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Under Rule 62-110.106(4), Florida Administrative Code, a person may request an extension of the time for filing a petition for an administrative hearing. The request must be filed (received by the Clerk) in the Office of General Counsel before the end of the time period for filing a petition for an administrative hearing.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Section 120.60(3), Florida Statutes, however, also allows that any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition or request for an extension of time within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an administrative determination (hearing) under

Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information, as indicated in Rule 28-106.201, Florida Administrative Code:

(a) The name and address of each agency affected and each agency's file or identification number, if known;
(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the determination;
(c) A statement of when and how the petitioner received notice of the Department's decision;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the Department's proposed action;
(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the Department's proposed action; and
(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the Department to take with respect to the Department's proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This permit action is final and effective on the date filed with the Clerk of the Department unless a petition (or request for an extension of time) is filed in accordance with the above. Upon the timely filing of a petition (or request for an extension of time), this permit will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the permit action under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this permit action is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

8/17/12

Linda A. Brien, P.G. DATE
Water Facilities Administrator

LAB/jaa/os: FLA0136778-006-DW1P/NR

PERMIT NUMBER: FLA0136778

FILING AND ACKNOWLEDGMENT

FILED, on this date, under Section 120.52, Florida Statutes, with the designated Deputy Clerk, receipt of which is hereby acknowledged.

_____ 8/22/12
[Clerk] [Date]

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this NOTICE OF PERMIT ISSUANCE and all copies were mailed before the close of business on August 22, 2012 to the listed persons.

_____ 8/22/12
Name Date

Electronic copies furnished to:
Hector R. Rodrigues,GUA, hrodrigues@pbcwater.com
Cathy Nance, GUA, CNance@pbcwater.com
Rex McClung, GUA, RWMcClung@pbcwater.com
Krystin Berntsen, PBCWUD, KBerntsen@pbcwater.com
Hassan Hadjimiry, PBCWUD, hhadjimiry@pbcwater.com
Michael Hambor, DEP/SED, Michael.hambor@dep.state.fl.us
William Thiel, DEP/PSL, william.thiel@dep.state.fl.us
Denise Watts, DEP/WPB, Denise.Watts@dep.state.fl.us

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

Florida Department of Environmental Protection

Southeast District Office
400 No. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

STATE OF FLORIDA
DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:
City of Pahokee

RESPONSIBLE OFFICIAL:
Mr. James C. Stiles, Executive Director
Glades Utility Authority
39800 Hooker Highway
Belle Glade, Florida 33430
Email: JStiles@pbcwater.com

PERMIT NUMBER: FLA0136778
FILE NUMBER: FLA0136778-006-DW1P
ISSUANCE DATE: **August 22, 2012**
EXPIRATION DATE: **August 21, 2017**

FACILITY:

City of Pahokee WWTF
1001 Rim Canal Road
Pahokee, FL 33476
Palm Beach County
Latitude: 26°48' 5" N Longitude: 80°40' 27" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.). This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above named Permittee is hereby authorized to operate the facilities in accordance with the documents attached hereto and specifically described as follows:

WASTEWATER TREATMENT:

A 1.2 mgd three-month average daily flow (TMADF) activated sludge wastewater treatment plant consisting of the following: a 0.50 mgd TMADF conventional WWTP (North Plant) and a 0.70 mgd TMADF complete mix WWTP (Walker Modular Plant).
Major treatment plant components for the 0.50 conventional plant are: one (1) 53,000 gallon primary clarifier with 707 sq. ft. of surface area; two (2) 75,000 gallon aerobic digester and air requirements provided by one (1) 15 h.p. mechanical aerator (for digester); and two (2) 750 cfm blowers for the aeration basins. Major treatment components for the 0.70 mgd complete mix plant consist of: aerated grit removal; one (1) 123,000 gallon aeration basin; one (1) 172,000 gallon clarifier with 1,590 sq.ft. of surface area; one (1) 172,000 gallon aerobic digester; and air requirements provided by two (2) 1,500 cfm blowers. Common treatment plant components consist of an influent mechanical bar screen with a by-pass manually cleaned bar screen, an influent splitter box, and two (2) emergency generators.
Residuals treatment includes a BIOSET Class A stabilization unit capable of processing 675 pounds per hour of dry solids (cake sludge) and consists of an input hopper with primary motive mixer, lime storage silo with feed assembly, sulfamic acid hopper and feed assembly, solids/lime/acid reactor, all mounted on a covered concrete containment pad with floor drains for spill control, washdown, and further treatment as necessary. Supernate from digesters will pass through the supernate disposal beds and will be collected at the bottom of the beds, which will be taken to the head of the plant for treatment.

REUSE OR DISPOSAL:

Underground Injection U-001: An existing 4.0 MGD monthly average daily flow permitted capacity underground injection well system consisting of 1 Class I underground injection wells permitted under Department permit number(s) UO 50-194658 discharging to Class G-IV ground water. Underground Injection Well System U-001 is located approximately at latitude 26°48' 3" N, longitude 80°40' 24" W.

Land Application R-001: An existing 0.08 MGD annual average daily flow permitted capacity rapid infiltration basin system. R-001 is a reuse system which consists of an existing 0.08 MGD annual average daily flow (AADF) permitted capacity rapid infiltration basin system (R- having a capacity of 0.08 MGD located approximately at latitude 26°48' 1" N, longitude 80°40' 23" W.

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 1 through 26 of this permit.

I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Underground Injection Control Systems

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the Permittee is authorized to discharge effluent to Underground Injection Well System U-001 located approximately at latitude 26°48'3", longitude 80°40'24". Such discharge shall be limited and monitored by the Permittee as specified below and reported in accordance with Permit Condition I.C.6.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	4.0	Maximum Hourly Rate	Continuous	Recording Flow Meter with Totalizer	FLW-01	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFF-01	
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFF-01	
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFF-01	See I.A.3

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-01	Flow meter located at the injection well #1
EFF-01	Effluent sampling point located at the common wetwell basin prior to the injection well

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. Disinfection is not required for discharge to Class G-IV waters using Class I wells. However, the Permittee must maintain the capability for disinfection at a level that is consistent with the alternate disposal mechanism approved for this facility pursuant to Rule 62-600.540(5), F.A.C. *[62-600.540(1)]*

B. Reuse and Land Application Systems

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the Permittee is authorized to direct reclaimed water to Reuse System R-001. Such reclaimed water shall be limited and monitored by the Permittee as specified below and reported in accordance with Permit Condition I.C.6.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Monitoring	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max Max	0.08 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-02	See I.B.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFA-01	
Coliform, Fecal	#/100mL	Max Max Max	200 200 800	Annual Average Monthly Geometric Mean Single Sample	Weekly	Grab	EFA-01	See I.B.5
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFA-01	See I.B.3
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	Continuous	Meter	EFA-01	See I.B.6 and I.B.3
Nitrogen, Nitrate, Total (as N)	mg/L	Max	12.0	Single Sample	Weekly	16-hr FPC	EFA-01	
Coliform, Fecal, % less than detection	percent	Max	75	Monthly Total	Monthly	Calculated	CAL-03	

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1 and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-02	Flow meter located after chlorine contact chamber for plant effluent to ponds
EFA-01	Effluent sampling point located after chlorine contact chambers
CAL-03	To report the % less than detection", count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer)

3. Hourly measurement of pH and total residual chlorine for disinfection during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. The effluent limitation for the monthly geometric mean for fecal coliform is only applicable if 10 or more values are reported. If fewer than 10 values are reported, the monthly geometric mean shall be calculated and reported on the Discharge Monitoring Report. *[62-600.440(4)(c)]*

6. Total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. *[62-610.510, 62-600.440(4)(b) and (5)(b)]*

C. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the issuance date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the Permittee as specified below and reported in accordance with condition I.C.6.:

			Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max Max	1.2 Report	Quarterly Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	CAL-01	
BOD, Carbonaceous 5 day, 20C	mg/L	Max	Report	Weekly Average	Weekly	16-hr FPC	INF-01	
Solids, Total Suspended	mg/L	Max	Report	Weekly Average	Weekly	16-hr FPC	INF-01	
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	Monthly	Calculated	CAL-02	

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.C.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-03	Flow meter located on Force main from Pump Stations No. 1 and 2
FLW-04	Flow meter located on Force main from Pump Stations No. 5
CAL-01	Total Influent Flow: (FLW-03) + (FLW-04)
INF-01	Influent sampling point at headworks - combined influent to plant.
CAL-02	(TMADF/(FLW-01 + FLW-02)x100

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. *[62-601.500(4)]*

4. The sample collection, analytical test methods and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "FAC 62-4 MDL/PQL Table (April 26, 2006)" is available at http://www.dep.state.fl.us/labs/library/index.htm. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:

   a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;

   b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and

   c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

   When the analytical results are below method detection or practical quantitation limits, the Permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

   Where necessary, the Permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. *[62-4.246, 62-160]*

5. The Permittee shall provide safe access points for obtaining representative influent, reclaimed water, and effluent samples which are required by this permit. *[62-601.500(5)]*

6. Monitoring requirements under this permit are effective on the first day of the second month following permit issuance. Until such time, the Permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit, the Permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, toxicity, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Unless specified otherwise in this permit, monitoring

results for each monitoring period shall be submitted in accordance with the associated DMR due dates below. DMRs shall be submitted for each required monitoring period including periods of no discharge.

Report Type on DMR	Monitoring Period	Mail or Electronically Submit by
Monthly or Toxicity	first day of month - last day of month	28th day of following month
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 30	July 28 January 28
Annual	January 1 - December 31	January 28

The Permittee may submit either paper or electronic DMR forms. If submitting paper DMR forms, the Permittee shall make copies of the attached DMR forms, without altering the original format or content unless approved by the Department, and shall mail the completed DMR forms to the Department's Southeast District Office at the address specified in Permit Condition I.C.9 by the twenty-eighth (28th) of the month following the month of operation.

If submitting electronic DMR forms, the Permittee shall use the electronic DMR system(s) approved in writing by the Department and shall electronically submit the completed DMR forms to the Department by the twenty-eighth (28th) of the month following the month of operation. Data submitted in electronic format is equivalent to data submitted on signed and certified paper DMR forms.

[62-620.610(18)][62-601.300(1),(2), and (3)]

7. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, color, odor, and corrosivity). These monitoring results shall be reported to the Department annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted in lieu of the report. The annual reclaimed water or effluent analysis report or the certification shall be completed and submitted in a timely manner so as to be received by the Department at the address identified on the DMR by June 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. *[62-601.300(4)][62-601.500(3)][62-610.300(4)]*

8. The Permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. *[62-610.870(3)]*

9. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted to or reported to, as appropriate, the Department's Southeast District Office at the address specified below:

   Florida Department of Environmental Protection Southeast District Office
   400 N Congress Ave
   Suite 200
   West Palm Beach, Florida 33401-2913

   Phone Number - (561)681-6600
   FAX Number - (561)681-6760
   (All FAX copies and e-mails shall be followed by original copies.)

   [62-620.305]

10. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. *[62-620.305]*

II. BIOSOLIDS MANAGEMENT REQUIREMENTS

A. Biosolids Management Requirements

1. The method of residuals use or disposal by this facility is marketing and distribution, use as a biofuel or for bioenergy and/or disposal in a Class I solid waste landfill. Transportation of the residuals to an alternative residuals management facility does not require a permit modification. However, use of an alternative residuals management facility requires the submittal of a copy of the agreement pursuant to Rule 62-640.880(1)(c), F.A.C., along with a written notification to the Department at least 30 days before transport of the residuals. *[62-620,320(6),62-640.880(1)]*

2. The Permittee shall monitor and keep records of the quantities of biosolids generated, received from source facilities, treated, distributed and marketed, land applied, used as a biofuel or for bioenergy, transferred to another facility, or landfilled. These records shall be kept for a minimum of five years. *[62-640.650(4)(a)]*

3. Biosolids quantities shall be monitored by the Permittee as specified below. Results shall be reported on the Permittee's Discharge Monitoring Report in accordance with Condition I.C.6.

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Biosolids Quantity (Distributed and Marketed in FL)	Dry tons	Max	Report	Total Monthly	Monthly	Calculated	RMP-01
Biosolids Quantity (Land-Applied)	Dry tons	Max	Report	Total Monthly	Monthly	Calculated	RMP-02
Biosolids Quantity (Transferred)	Dry tons	Max	Report	Total Monthly	Monthly	Calculated	RMP-03
Biosolids Quantity (Landfilled)	Dry tons	Max	Report	Total Monthly	Monthly	Calculated	RMP-04
Biosolids Quantity (Used as a Biofuel or for Bioenergy)	Dry tons	Max	Report	Total Monthly	Monthly	Calculated	RMP-05

[62-640.650(5)(a)1]

4. Biosolids quantities shall be calculated as listed in Permit Condition II. 3 and as described below:

Monitoring Site Number	Description of Monitoring Site Calculation
RMP-Q-01	See Sludge Quantity Operating Protocol as require in Permit Condition VI. 2.
RMP-Q-02	See Sludge Quantity Operating Protocol as require in Permit Condition VI. 2.
RMP-Q-03	See Sludge Quantity Operating Protocol as require in Permit Condition VI. 2.
RMP-Q-04	See Sludge Quantity Operating Protocol as require in Permit Condition VI. 2.
RMP-Q-05	See Sludge Quantity Operating Protocol as require in Permit Condition VI. 2.

5. The treatment, management, transportation, use, land application, or disposal of biosolids shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. *[62-640.400(6)]*

6. Storage of biosolids or other solids at this facility shall be in accordance with the Facility Biosolids Storage Plan. The Facilities Biosolids Storage Plan shall be submitted for the Department's approval/acceptance as covered in Condition VI. 6. *[62-640.300(4)]*

7. Biosolids shall not be spilled from or tracked off the treatment facility site by the hauling vehicle. *[62-640.400(9)]*

8. The Permittee shall be responsible for proper treatment, management, use, and land application or disposal of its residuals. *[62-640.300(5)]*

9. Florida water quality criteria and standards shall not be violated as a result of land application of residuals from this facility. *[62-640.700(2)(b)]*

10. Disposal of residuals, septage, and other solids in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with the requirements of Chapter 62-701, F.A.C. *[62-640.100(6)(k)3&4]*

11. The domestic wastewater residuals for this facility are classified as Class AA.

B. Treatment and Monitoring and Reporting Requirements

1. The Permittee shall achieve Class A pathogen reduction by meeting the pathogen reduction requirements in section 503.32(a)(3) (Thermally Treated Biosolids)" (for Alternative 1) of Title 40 CFR Part 503.

   Or by meeting the pathogen reduction requirements in section "503.32(a)(8) (Use of equivalent PFRP (Processes to Further Reduce Pathogens) – (On August 2011, EPA granted National PFRP Equivalency to the Bioset Process)" (for Alternative 6 of Title 40 CFR Part 503

   [62-640.600(1)(a)]

   The Permittee shall achieve vector attraction reduction by meeting the vector attraction reduction requirements in section 503.33(b)(6) (Add alkaline materials to raise the pH under specified conditions) of Title 40 CFR Part 503. *[62-640.600(2)(a)]*

2. Treatment of liquid residuals or septage for the purpose of meeting the pathogen reduction or vector attraction reduction requirements set forth in Rule 62-640.600, F.A.C., shall not be conducted in the tank of a hauling vehicle. Treatment of residuals or septage for the purpose of meeting pathogen reduction or vector attraction reduction requirements shall take place at the permitted facility. *[62-640.400(8)]*

3. After completion of the Biosolids Routine Monitoring Plan as required in Permit Condition VI.6.2., the operation and process parameters contained in the approved Biosolids Routine Monitoring Plan shall be routinely monitored to demonstrate compliance with pathogen reduction requirements specified in Rule *62-640.600, F.A.C. [62-640.650(3)(a)2]*

4. After completion of the Biosolids Routine Monitoring Plan as required in Permit Condition VI.6.2., the operation and process parameters contained in the approved Biosolids Routine Monitoring Plan shall be routinely monitored to demonstrate compliance with vector attraction reduction requirements specified in Rule 62-640.600, F.A.C. *[62-640.650(3)(a)2]*

5. The Permittee shall sample and analyze the residuals to monitor for pathogen and vector attraction reduction requirements of Rule 62-640.600, F.A.C.

6. Residuals shall be limited and monitored by the Permittee as specified below. Results shall be reported on the Permittee's Discharge Monitoring Report in accordance with Condition I.C.6. Residuals shall not be distributed and marketed if a single sample result or the monthly average of sample results for any parameter exceeds the following Class AA parameter concentrations:

			Residuals Limitations		Monitoring Requirements		
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Monthly Average	Monthly	Grab	RMP-AA
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Monthly Average	Monthly	Grab	RMP-AA
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Monthly Average	Monthly	Grab	RMP-AA
Arsenic Total, Dry Weight, Sludge	mg/kg	Max Max	41.0 75.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max Max	39.0 85.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max Max	1500.0 4300.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Lead, Dry Weight, Sludge	mg/kg	Max Max	300.0 840.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Mercury, Dry Weight, Sludge	mg/kg	Max Max	17.0 57.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Monthly	Composite	RMP-AA
Nickel, Dry Weight, Sludge	mg/kg	Max Max	420.0 420.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Selenium Sludge Solid	mg/kg	Max Max	100.0 100.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Zinc, Dry Weight, Sludge	mg/kg	Max Max	2800.0 7500.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
pH	s.u.	Max Max	Report Report	Monthly Average Single Sample	Monthly	Grab	RMP-AA
Solids, Total, Sludge, Percent	percent	Max Max	Report Report	Monthly Average Single Sample	Monthly	Grab	RMP-AA
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	Monthly	Grab	RMP-AA
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	Monthly	Grab	RMP-AA

*Either the fecal coliform limit or Salmonella sp. limit must be met.
**Note, monthly averages of parameter concentrations shall be determined by taking the arithmetic mean of all sample results for the month
[62-640.650(1), 62-640.650(3)(a) and (e), 62-640.700(1), and 62-640.850(3)]

7. Residuals samples shall be taken at the monitoring site locations listed in Permit Condition II.B.6 and as described below:

Monitoring Site Number	Description of Monitoring Site
RMP-AA	As per the approved existing operational protocol that will be updated as per the schedule in Permit Condition VI.6.2.

8. Sampling and analysis shall be conducted in accordance with Title 40 CFR Part 503, section 503.8 and the U.S. Environmental Protection Agency publication - POTW Sludge Sampling and Analysis Guidance Document, 1989. In cases where disagreements exist between Title 40 CFR Part 503, section 503.8 and the POTW Sludge Sampling and Analysis Guidance Document, the requirements in Title 40 CFR Part 503, section 503.8 will apply. *[62-640.650(1), 62-640.700(1), 62-640.700(3)(b), and 62-640.850(3)]*

9. All samples shall be representative of the residuals used or land applied and shall be taken after final treatment of the residuals but before use or land application. *[62-640.650(1)(d)]*

C. Distribution and Marketing

1. Only domestic wastewater residuals that meet Class AA standards may be sold or given away in a distribution and marketing program. The distribution and marketing of residuals shall be conducted in accordance with Chapter 62-640, F.A.C. *[62-640.850]*

2. The Permittee shall submit a Monthly Residuals Distribution and Marketing Report to the Domestic Wastewater Section of the Department on Form 62-640.210(2)(c) by the 28th day of the month following the reporting month. The report shall be submitted to the following address:

   Florida Department of Environmental Protection
   Domestic Wastewater Section, Mail Station 3540
   Bob Martinez Center
   2600 Blair Stone Road
   Tallahassee, Florida 32399-2400
   [62-640.850(4)]

3. The Permittee shall make the following information available to users by product labels or other means:

   a. The name and address of the facility or person that produced the Class AA residuals;

   b. A statement that the residuals or residuals product meets the criteria of Rule 62-640.850(3), F.A.C.;

   c. A recommendation that residuals be applied at a rate that does not exceed the agronomic rate; and

   d. The following residuals analysis information (dry weight basis):

      Total Nitrogen (%)
      Total Phosphorus (%)
      Total Potassium (%)

   [62-640.850(5)]

4. If the Permittee intends to accept residuals from other facilities, a permit revision is required pursuant to Rule 62-640.880(2)(d), F.A.C. *[62-640.880(2)(d)]*

5. Storage of residuals or other solids at the permitted facility shall require prior written notification to the Department if the storage lasts longer than 30 days. *[62-640.300(4)]*

6. Class AA biosolids that are stored for more than the number of days established in the approved Facilities Biosolids Storage Plan shall be re-sampled for fecal coliform or Salmonella sp.

7. Sampling and analysis shall be conducted in accordance with 40 CFR Part 503.8 and the U.S. Environmental Protection Agency publication - POTW Sludge Sampling and Analysis Guidance Document, August 1989. In cases where conflicts exist between 40 CFR 503.8 and the POTW Sludge Sampling and Analysis Guidance Document, the requirements in 40 CFR Part 503.8 will apply. *[62-640.650(3)(a)1]* Disposal of biosolids, septage, and "other solids" in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with Chapter 62-701, F.A.C. *[62-640.100(6)(b) & (c)]*

8. Incineration or use of biosolids as a biofuel or for bioenergy by gasification shall be in accordance with Chapters 62-204, 62-210, 62-212, 62-213, 62-296, and 62-297, F.A.C., and the Resource Conservation and Recovery Act. *[62-640.100(6)(d)]*

9. The Permittee shall not be held responsible for treatment and management violations that occur after its biosolids have been accepted by a permitted biosolids treatment facility with which the source facility has an agreement in accordance with subsection 62-640.880(1)(c), F.A.C., for further treatment, management, or disposal. *[62-640.880(1)(b)]*

D. Disposal

1. The Permittee shall keep hauling records to track the transport of biosolids between facilities. The hauling records shall contain the following information:

Source Facility
1. Date and time shipped
2. Amount of biosolids shipped
3. Degree of treatment (if applicable)
4. Name and ID number of treatment facility
5. Signature of responsible party at source facility
6. Signature of hauler and name of hauling firm

Biosolids Treatment Facility or Treatment Facility
1. Date and time received
2. Amount of biosolids received
3. Name and ID number of source facility
4. Signature of hauler
5. Signature of responsible party at treatment facility

A copy of the source facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids treatment facility or treatment facility. The treatment facility Permittee shall report to the Department within 24 hours of discovery any discrepancy in the quantity of biosolids leaving the source facility and arriving at the biosolids treatment facility or treatment facility.

III. GROUND WATER REQUIREMENTS

A. Construction Requirements

1. Section Construction Requirements is not applicable this facility.

B. Operational Requirements

1. The ground water minimum criteria specified in Rule 62-520.400 F.A.C., shall be met within the zone of discharge. *[62-520.400 and 62-520.420(4)]*

2. Ground monitoring for U-001 shall be in accordance with permit number UO 50-194658.

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

A. Part III Public Access System(s)

1. Advisory signs shall be posted around the site boundaries to designate the nature of the project area. *[62-610.518]*

2. The maximum annual average loading rate to the an existing 0.08 MGD annual average daily flow (AADF) permitted capacity rapid infiltration basin system (R-001 shall be limited to 3 inches per day (as applied to the entire bottom area)). *[62-610.523(3)]*

3. Rapid infiltration basins shall be routinely maintained to control vegetation growth and to maintain percolation capability by scarification or removal of deposited solids. Basin bottoms shall be maintained to be level. *[62-610.523(6) and (7)]*

4. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. *[62-610.514 and 62-610.414]*

5. Overflows from emergency discharge facilities on storage ponds or on infiltration ponds, basins, or trenches shall be reported as abnormal events in accordance with Permit Condition IX.20. *[62-610.800(9)]*

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of a(n) operator(s) certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category II, Class B facility and, at a minimum, operators with appropriate certification must be on the site as follows:

2. A Class C or higher operator 16 hours/day for 7 days/week. The lead/chief operator must be a Class B operator, or higher. *[62-620.630(3]), [62-699.310], [62-610.462]*

3. The lead/chief operator shall be employed at the plant full time. "Full time" shall mean at least 4 days per week, working a minimum of 35 hours per week, including leave time. A licensed operator shall be on-site and in charge of each required shift for periods of required staffing time when the lead/chief operator is not on-site. An operator meeting the lead/chief operator class for the treatment plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(10), (6) and (1)]*

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

1. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. *[62-600.735(1)]*

C. Recordkeeping Requirements

1. The Permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.
    a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;
    b. Copies of all reports required by the permit for at least three years from the date the report was prepared;
    c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;
    d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the residuals use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least three years from the date of sampling or measurement;
    e. A copy of the current permit;
    f. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;
    g. A copy of any required record drawings;

h. Copies of the licenses of the current certified operators;

i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed; and

j. Records of biosolids quantities, treatment, monitoring, and hauling for at least five years.

[62-620.350, 62-602.650, 62-640.650(4)]

VI. SCHEDULES

1. In accordance with section 403.088(2)(e) and (f), Florida Statutes, a compliance schedule for this facility is contained in Consent Order No. OGC 11-1288 which is hereby incorporated by reference.

2. The following improvement actions shall be completed according to the following schedule:

Improvement Action	Completion Date
1. Lift station renewal and replacement	August 31, 2012
2. Collection system structural repairs as described in the Engineering Evaluation of the WWTF by Culpepper-Terpening, Inc , dated October 27, 2006	August 31, 2012
3. Submit to DEP the completed design and permits for the SLWSD Filtration System #3 and #4 Expansion	December 31, 2012
4. Construction completion for sand filter rehabilitation	December 31, 2013

[62-620.320(6)]

3. The following Biosolids Quantity Operating Protocol as require in Permit Condition II. 4. shall be completed according to the following schedule:

Item number	Improvement Action	Completion Date
a.	Submit a draft Biosolids Quantity Calculating Operating Protocol to determine the estimated Biosolids to be used for Biosolids Quantity DMR.	90 days after issuance of this permit
b.	Respond to Department's comments.	Within 30 days of the date of receipt of any Department comments
c.	Submit the Final Report to the Department.	Within 30 days of the date of receipt of the Department final comments
d.	The City shall submit permit revision application without fee to cover any changes in the permit required by the final report.	Within 90 days of receipt of the Department's final comments

4. The following Biosolids Routine Monitoring Plan as require in Permit Conditions II. 15. and 16.. shall be completed according to the following schedule:

Item number	Improvement Action	Completion Date
a.	Submit a draft Biosolids Routine Monitoring Plan to the Department.	90 days after issuance of this permit
b.	Respond to Department's comments.	Within 30 days of the date of receipt of any Department comments
c.	Submit the Final Report to the Department.	Within 30 days of the date of receipt of the Department final comments
d.	The operation and process parameters contained in the approved Biosolids Routine Monitoring Plan shall be routinely monitored to demonstrate compliance with pathogen reduction requirements specified in Rule 62-640.600, F.A.C. and to demonstrate compliance with vector attraction reduction requirements specified in Rule 62-640.600, F.A.C.	Within 30 days of the date of receipt of the Department final comments

5. The Permittee is not authorized to discharge to waters of the state after the expiration date of this permit, unless:

   a. The Permittee has applied for renewal of this permit at least 180 days before the expiration date of this permit using the appropriate forms listed in Rule 62-620.910, F.A.C., and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.; or

   b. The Permittee has made complete the application for renewal of this permit before the permit expiration date.

   [62-620.335(1) - (4)]

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

1. This facility is not required to have a pretreatment program at this time. *[62-625.500]*

VIII. OTHER SPECIFIC CONDITIONS

1. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the Permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. *[62-600.410(8) and 62-640.400(6)]*

2. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. *[62-604.130(3)]*

3. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. *[62-604.550] [62-620.610(20)]*

4. The operating authority of a collection/transmission system and the Permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):

   a. Which may cause fire or explosion hazards; or

   b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or

   c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or

   d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding $40^{o}C$ or otherwise inhibiting treatment; or

   e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

   [62-604.130(5)]

5. The treatment facility, storage ponds for Part II systems, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. *[62-600.400(2)(b)]*

6. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. *[62-701.300(1)(a)]*

7. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. *[62-620.310(4)]*

8. The Permittee shall provide verbal notice to the Department's Southeast District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The Permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Southeast District Office in a written report within 7 days of the sinkhole discovery. *[62-620.320(6)]*

9. The Permittee shall provide adequate notice to the Department of the following:

   a. Any new introduction of pollutants into the facility from an industrial discharger which would be subject to Chapter 403, F.S., and the requirements of Chapter 62-620, F.A.C., if it were directly discharging those pollutants; and

   b. Any substantial change in the volume or character of pollutants being introduced into that facility by a source which was identified in the permit application and known to be discharging at the time the permit was issued.

      Adequate notice shall include information on the quality and quantity of effluent introduced into the facility and any anticipated impact of the change on the quantity or quality of effluent or reclaimed water to be discharged from the facility.

   [62-620.625(2)]

IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1)]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2)]*

3. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3)]*

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. *[62-620.610(4)]*

5. This permit does not relieve the Permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the Permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The Permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5)]*

6. If the Permittee wishes to continue an activity regulated by this permit after its expiration date, the Permittee shall apply for and obtain a new permit. *[62-620.610(6)]*

7. The Permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the Permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7)]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8)]*

9. The Permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:

    a. Enter upon the Permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;

    b. Have access to and copy any records that shall be kept under the conditions of this permit;

    c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and

    d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules. *[62-620.610(9)]*

10. In accepting this permit, the Permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. *[62-620.610(10)]*

11. When requested by the Department, the Permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The Permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the Permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11)]*

12. Unless specifically stated otherwise in Department rules, the Permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the Permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12)]*

13. The Permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13)]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The Permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14)]*

15. The Permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15)]*

16. The Permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16)]*

17. The Permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The Permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:

    a. A description of the anticipated noncompliance;

    b. The period of the anticipated noncompliance, including dates and times; and

    c. Steps being taken to prevent future occurrence of the noncompliance.

    [62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-601, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.

b. If the Permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.

d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.

e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.

f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

[62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19)]*

20. The Permittee shall report to the Department's Southeast District District Office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the Permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the Permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    a. The following shall be included as information which must be reported within 24 hours under this condition:
        (1) Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
        (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
        (3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
        (4) Any unauthorized discharge to surface or ground waters.

    b. Oral reports as required by this subsection shall be provided as follows:
        (1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph (a)4. that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the STATE WARNING POINT TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the Permittee becomes aware of the discharge. The Permittee, to the extent known, shall provide the following information to the State Warning Point:
            (a) Name, address, and telephone number of person reporting;
            (b) Name, address, and telephone number of Permittee or responsible person for the discharge;
            (c) Date and time of the discharge and status of discharge (ongoing or ceased);
            (d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater);
            (e) Estimated amount of the discharge;
            (f) Location or address of the discharge;
            (g) Source and cause of the discharge;
            (h) Whether the discharge was contained on-site, and cleanup actions taken to date;
            (i) Description of area affected by the discharge, including name of water body affected, if any; and
            (j) Other persons or agencies contacted.

(2) Oral reports, not otherwise required to be provided pursuant to subparagraph b.1 above, shall be provided to the Department's Southeast District District Office within 24 hours from the time the Permittee becomes aware of the circumstances.

c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department's Southeast District District Office shall waive the written report.

[62-620.610(20)]

21. The Permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. *[62-620.610(21)]*

22. Bypass Provisions.

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.

b. Bypass is prohibited, and the Department may take enforcement action against a Permittee for bypass, unless the Permittee affirmatively demonstrates that:
(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(3) The Permittee submitted notices as required under Permit Condition IX.22.b. of this permit.

c. If the Permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The Permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the Permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.a.1. through 3. of this permit.

e. A Permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.a. through c. of this permit.

[62-620.610(22)]

23. Upset Provisions.

a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the Permittee.
(1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.
(2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

b. A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
(1) An upset occurred and that the Permittee can identify the cause(s) of the upset;
(2) The permitted facility was at the time being properly operated;

(3) The Permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and
(4) The Permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.

c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the Permittee.

d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review. *[62-620.610(23)]*

Executed in West Palm Beach, Florida.

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Linda A. Brien, P.G.
Water Facilities Administrator

DATE: 8/17/12

Attachment(s):
Fact Sheet
Consent Order No.OGC 11-1288
Process Flow diagramm
Discharge Monitoring Reports
"Pathogen Monitoring" Form

FACT SHEET
FOR
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMIT NUMBER: FLA136778-006
FACILITY NAME: GUA - Pahokee WWTF

FACILITY LOCATION: 1001 Rim Canal Road, Pahokee, FL 33476-2531
Palm Beach County

NAME OF PERMITTEE: Glades Utility Authority

PERMIT WRITER: Olga Sokolova

1. SUMMARY OF APPLICATION

a. Chronology of Application

Application Number: FLA136778-006-DW1P

Application Submittal Date: November 01, 2011

Response to RFI: January 30, 2012

b. Type of Facility

Domestic Wastewater Treatment Plant

Ownership Type: Municipal

SIC Code: 4952

c. Facility Capacity

Existing Permitted Capacity:	1.2 mgd Three Month Average Daily Flow
Proposed Increase in Permitted Capacity:	0 mgd Three Month Average Daily Flow
Proposed Total Permitted Capacity:	1.2 mgd Three Month Average Daily Flow

d. Description of Wastewater Treatment

A 1.2 mgd three-month average daily flow (TMADF) activated sludge wastewater treatment plant consisting of the following: a 0.50 mgd TMADF conventional WWTP (North Plant)and a 0.70 mgd TMADF complete mix WWTP (Walker Modular Plant). Major treatment plant components for the 0.50 conventional plant are: one (1) 53,000 gallon primary clarifier with 707 sq. ft. of surface area; two (2) 75,000 gallon aerobic digester and air requirements provided by one (1) 15 h.p. mechanical aerator (for digester); and two (2) 750 cfm blowers for the aeration basins. Major treatment components for the 0.70 mgd complete mix plant consist of: aerated grit removal; one (1) 123,000 gallon aeration basin; one (1) 172,000 gallon clarifier with 1,590 sq.ft. of surface area; one (1) 172,000 gallon aerobic digester; and air requirements provided by two (2) 1,500 cfm blowers. Common treatment plant components consist of an influent mechanical bar screen with a by-pass manually cleaned bar screen, an influent splitter box, and two (2) emegency generators. Residuals treatment includes a BIOSET Class A stabilization unit capable of processing 675 pounds per hour of dry solids (cake sludge) and consists of an input hopper with primary motive mixer, lime storage silo with feed assembly, sulfamic acid hopper and feed assembly, solids/lime/acid reactor, all mounted on a covered concrete containment pad with floor drains for spill control, washdown, and further treatment as necessary. Supernate from digesters will pass through the supernate disposal beds and will be collected at the bottom of the beds, which will be taken to the head of the plant for treatment.

e. Description of Effluent Disposal and Land Application Sites (as reported by applicant)

See attached map(s) for effluent disposal and land application site(s).

2. SUMMARY OF SURFACE WATER DISCHARGE

This facility does not discharge to surface waters.

3. BASIS FOR PERMIT LIMITATIONS AND MONITORING REQUIREMENTS

This facility is authorized to discharge reclaimed water to Underground Injection Well System U-001 which consists of 1 Class I injection wells discharging to Class G-IV ground water based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	4.0	Maximum Hourly Rate	62-600.400(3)(b) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC

This facility is authorized to direct reclaimed water to Reuse System R-001, a rapid infiltration basin system, based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	0.08	Annual Average	62-600.400(3)(b) & 62-610.810(5) FAC
		Max	Report	Monthly Average	62-600.400(3)(b) & 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.510 & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-610.510 & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Coliform, Fecal	#/100mL	Max	200	Annual Average	62-610.510 & 62-600.440(4)(c)1. FAC
		Max	200	Monthly Geometric Mean	62-600.440(4)(c)2. FAC
		Max	800	Single Sample	62-600.440(4)(c)4. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	62-610.510 & 62-600.440(4)(b) FAC
Nitrogen, Nitrate, Total (as N)	mg/L	Max	12.0	Single Sample	62-610.510(1) FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	1.2	Quarterly Average	
		Max	Report	Monthly Average	
BOD, Carbonaceous 5 day, 20C	mg/L	Max	Report	Weekly Average	
Solids, Total Suspended	mg/L	Max	Report	Weekly Average	
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	
Coliform, Fecal, % less than detection	percent	Max	75	Monthly Total	

4. DISCUSSION OF CHANGES TO PERMIT LIMITATIONS

The current wastewater permit for this facility FLA136778-006-DW1P expires on May 1, 2012

5. BIOSOLIDS MANAGEMENT REQUIREMENTS

Biosolids generated by this facility may be distributed and marketed and land applied or disposed of in a Class I solid waste landfill.

See the table below for the rationale for the Class A biosolids limits and monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	62-640.650(3)(a)3. & 700(5)(a) FAC
pH	s.u.	Max	Report	Single Sample	62-640.650(1)(b) FAC
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Calcium Carbonate Equivalent	percent	Max	Report	Single Sample	62-640.650(3)(a)3. FAC
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	62-640.600(1)(a) FAC
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	62-640.600(1)(a) FAC
Monitoring Frequency		All Parameters			62-640.650(3)(a)4. FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Pathogen and vector attraction reduction monitoring		All Parameters			62-640.600 & 650(3)(a)1. FAC

See the table below for the rationale for the Class AA biosolids limits and monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	41.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	75.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	39.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	85.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	1500.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	4300.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Lead, Dry Weight, Sludge	mg/kg	Max	300.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	840.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	17.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	57.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	420.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Selenium Sludge Solid	mg/kg	Max	100.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	100.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	2800.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
		Max	7500.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
pH	s.u.	Max	Report	Single Sample	62-640.650(3)(a)3. FAC
Solids, Total, Sludge, Percent	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
		Max	Report	Single Sample	62-640.650(3)(a)3. FAC
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	62-640.600(1)(a) FAC
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	62-640.600(1)(a) FAC
Calcium Carbonate Equivalent	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Monitoring Frequency		All Parameters			62-640.650(3)(a)4. & .850(4)(c) FAC
Pathogen and vector attraction reduction monitoring		All Parameters			62-640.600 & 650(3)(a)1. FAC

See the table below for the rationale for the biosolids quantities monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Biosolids Quantity (Distributed & Marketed in FL)	ton (d)	Max	Report	Monthly Total	62-640.650(5)(a)1. & 850(4)(a) FAC
Biosolids Quantity (Distributed & Marketed outside FL)	ton (d)	Max	Report	Monthly Total	62-640.650(5)(a)1. & 850(4)(a) FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Biosolids Quantity (Land-Applied)	ton (d)	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Biosolids Quantity (Landfilled)	ton (d)	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Monitoring Frequency		All Parameters			62-640.650(5)(a) FAC

6. GROUND WATER MONITORING REQUIREMENTS

This section is not applicable to this facility.

7. PERMIT SCHEDULES

1). The following improvement actions shall be completed according to the following schedule:

Improvement Action	Completion Date
1. Lift station renewal and replacement	August 31, 2012
2. Collection system structural repairs as described in the Engineering Evaluation of the WWTF by Culpepper-Terpening, Inc , dated October 27, 2006	August 31, 2012
3. Submit to DEP the completed design and permits for the SLWSD Filtration System #3 and #4 Expansion	December 31, 2012
4. Construction completion for sand filter rehabilitation	December 31, 2013

[62-620.320(6)]

2). The following Biosolids Quantity Operating Protocol as require in Permit Condition II. 4. shall be completed according to the following schedule:

Item number	Improvement Action	Completion Date
a.	Submit a draft Biosolids Quantity Calculating Operating Protocol to determine the estimated Biosolids to be used for Biosolids Quantity DMR.	90 days after issuance of this permit
b.	Respond to Department's comments.	Within 30 days of the date of receipt of any Department comments
c.	Submit the Final Report to the Department.	Within 30 days of the date of receipt of the Department final comments
d.	The City shall submit permit revision application without fee to cover any changes in the permit required by the final report.	Within 90 days of receipt of the Department's final comments

3). The following Biosolids Routine Monitoring Plan as require in Permit Conditions II. 15. and 16. shall be completed according to the following schedule:

Item number	Improvement Action	Completion Date
a.	Submit a draft Biosolids Routine Monitoring Plan to the Department.	90 days after issuance of this permit
b.	Respond to Department's comments.	Within 30 days of the date of receipt of any Department comments
c.	Submit the Final Report to the Department.	Within 30 days of the date of receipt of the Department final comments
d.	The operation and process parameters contained in the approved Biosolids Routine Monitoring Plan shall be routinely monitored to demonstrate compliance with pathogen reduction requirements specified in Rule 62-640.600, F.A.C. and to demonstrate compliance with vector attraction reduction requirements specified in Rule 62-640.600, F.A.C.	Within 30 days of the date of receipt of the Department final comments

8. INDUSTRIAL PRETREATMENT REQUIREMENTS

At this time, the facility is not required to develop an approved industrial pretreatment program. However, the Department reserves the right to require an approved program if future conditions warrant.

9. ADMINISTRATIVE ORDERS (AO) AND CONSENT ORDERS (CO)

This permit is accompanied by Consent Order No. OGC 11-1288, effective July 11, 2012, which includes a schedule of compliance. The OGC is hereby incorporated by reference. The OGC is establishing compliance schedule under section 403.088(2)(F).F.S. Glades Utility Authority shall implement the Minor Modification (0138286-035-UC) which is for the rehabilitation of the lower monitoring zone of monitoring well MW-1. Should the rehabilitation effort fail Utility shall implement Minor Modification (0138286-036-UC) which is for the construction of a new lower monitoring zone monitoring well; plugging and abandonment of the existing lower monitoring zone in monitoring well MW-1. Utility should be in full compliance with rule 62-528.425, F.A.C. by no later than June 30, 2013.

10. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

No variances were requested for this facility.

11. THE ADMINISTRATIVE RECORD

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received and additional information is available for public inspection during normal business hours at the location specified in item 13. Copies will be provided at a minimal charge per page.

12. PROPOSED SCHEDULE FOR PERMIT ISSUANCE

Notice of Intent to Issue _____

Notice of Permit Issuance _____

13. DEP CONTACT

Additional information concerning the permit and proposed schedule for permit issuance may be obtained during normal business hours from:

Olga Sokolova
Engineer I
Southeast District Office
400 N Congress Ave Suite 200
West Palm Beach, FL 33401-2913

Telephone No.: (561) 681-6685

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39800 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: GUA - Pahokee WWTF
LOCATION: 1001 Rim Canal Road
Pahokee, FL 33476-2531

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA136778-006-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: R-001
MONITORING GROUP DESCRIPTION: Reuse - percolation ponds
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-02	Permit Requirement		0.08 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-02	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Bi-Weekly	Grab
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Bi-Weekly	Grab
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Bi-Weekly	Grab
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Be-Weekly	Grab

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Pahokee WWTF MONITORING GROUP NUMBER: R-001 PERMIT NUMBER: FLA136778-006-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal	Sample Measurement										
PARM Code 74055 Y Mon. Site No. EFA-01	Permit Requirement					200 (An.Avg.)		#/100mL		Bi-Weekly	Grab
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement					200 (Mo.Geo.Mn.)	800 (Max.)	#/100mL		Bi-Weekly	Grab
pH	Sample Measurement										
PARM Code 00400 A Mon. Site No. EFA-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				0.5 (Min.)			mg/L		Daily	Grab
Nitrogen, Nitrate, Total (as N)	Sample Measurement										
PARM Code 00620 A Mon. Site No. EFA-01	Permit Requirement						12.0 (Max.)	mg/L		Bi-Weekly	Grab
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. CAL-01	Permit Requirement	Report (Mo.Avg.)	1.2 (3-Mo..Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Q Mon. Site No. INF-01	Permit Requirement						Report (Wk.Avg.)	mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Q Mon. Site No. INF-01	Permit Requirement						Report (Wk.Avg.)	mg/L		Weekly	16-hr FPC
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 P Mon. Site No. CAL-02	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Calculated
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 P Mon. Site No. CAL-03	Permit Requirement						75 (Mo.Total)	percent		Monthly	Calculated

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39800 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: GUA - Pahokee WWTF
LOCATION: 1001 Rim Canal Road
Pahokee, FL 33476-2531

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA136778-006-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: U-001
MONITORING GROUP DESCRIPTION: IW-1 Class I Injection Well (U001).
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-01	Permit Requirement		4.0 (Hr.Max)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Weekly	16-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFF-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 1 Mon. Site No. EFF-01	Permit Requirement				60.0 (Max.)	45.0 (Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Weekly	16-hr FPC
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFF-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39800 Hooker Highway
Belle Glade, Florida 33430-

FACILITY: GUA - Pahokee WWTF
LOCATION: 1001 Rim Canal Road
Pahokee, FL 33476-2531

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA136778-006-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: RMP-AA
MONITORING GROUP DESCRIPTION: Class AA Biosolids
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Sludge, Tot, Dry Wt (as N)	Sample Measurement										
PARM Code 78470 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Phosphorus, Sludge, Tot, Dry Wt (as P)	Sample Measurement										
PARM Code 78478 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Potassium, Sludge, Tot, Dry Wt (as K)	Sample Measurement										
PARM Code 78472 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. RMP-AA	Permit Requirement					41.0 (Mo.Avg.)	75.0 (Max.)	mg/kg		Monthly	Composite
Cadmium, Sludge, Tot, Dry Weight (as Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. RMP-AA	Permit Requirement					39.0 (Mo.Avg.)	85.0 (Max.)	mg/kg		Monthly	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. RMP-AA	Permit Requirement					1500.0 (Mo.Avg.)	4300.0 (Max.)	mg/kg		Monthly	Composite

*EITHER THE FECAL COLIFORM LIMIT OR SALMONELLA SP. LIMIT MUST BE MET.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Pahokee WWTF MONITORING GROUP NUMBER: RMP-AA PERMIT NUMBER: FLA136778-006-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-AA	Permit Requirement					300.0 (Mo.Avg.)	840.0 (Max.)	mg/kg		Monthly	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-AA	Permit Requirement					17.0 (Mo.Avg.)	57.0 (Max.)	mg/kg		Monthly	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-AA	Permit Requirement						75.0 (Max.)	mg/kg		Monthly	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-AA	Permit Requirement					420.0 (Mo.Avg.)	420.0 (Max.)	mg/kg		Monthly	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-AA	Permit Requirement					100.0 (Mo.Avg.)	100.0 (Max.)	mg/kg		Monthly	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-AA	Permit Requirement					2800.0 (Mo.Avg.)	7500.0 (Max.)	mg/kg		Monthly	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-AA	Permit Requirement						Report (Max.)	s.u.		Monthly	Grab
Solids, Total, Sludge, Percent	Sample Measurement										
PARM Code 61553 + Mon. Site No. RMP-AA	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	percent		Monthly	Composite
Coliform, Fecal	Sample Measurement										
PARM Code 74055 + Mon. Site No. RMP-AA	Permit Requirement		1000.0 (Max.)	MPN/g						Monthly	Grab
Salmonella Sludge	Sample Measurement										
PARM Code 71204 + Mon. Site No. RMP-AA	Permit Requirement		3.0 (Max.)	MPN/4g						Monthly	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Pahokee WWTF MONITORING GROUP NUMBER: RMP-AA PERMIT NUMBER: FLA136778-006-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Calcium Carbonate Equivalent	Sample Measurement										
PARM Code B0010 + Mon. Site No. RMP-AA	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Composite

ISSUANCE/REISSUANCE DATE:

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 400 N Congress Ave, Suite 200, West Palm Beach, FL 33401-2913

PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39800 Hooker Highway
Belle Glade, Florida 33430

FACILITY: GUA - Pahokee WWTF
LOCATION: 1001 Rim Canal Road
Pahokee, FL 33476-2531

COUNTY: Palm Beach
OFFICE: Southeast District

PERMIT NUMBER: FLA136778-006-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: RMP-Q
MONITORING GROUP DESCRIPTION: Biosolids Quantity
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Biosolids Quantity (Distributed & Marketed in FL)	Sample Measurement										
PARM Code B0004 Mon. Site No. RMP-Q-01	Permit Requirement		Report (Mo.Total)	ton (d)						Monthly	Calculated
Biosolids Quantity (Distributed & Marketed outside FL)	Sample Measurement										
PARM Code B0005 Mon. Site No. RMP-Q-02	Permit Requirement		Report (Mo.Total)	ton (d)						Monthly	Calculated
Biosolids Quantity (Land-Applied)	Sample Measurement										
PARM Code B0006 Mon. Site No. RMP-Q-03	Permit Requirement		Report (Mo.Total)	ton (d)						Monthly	Calculated
Biosolids Quantity (Landfilled)	Sample Measurement										
PARM Code B0008 Mon. Site No. RMP-Q-04	Permit Requirement		Report (Mo.Total)	ton (d)						Monthly	Calculated
Biosolids Quantity (Used as a Biofuel or for Bioenergy)	Sample Measurement										
PARM Code B0009 Mon. Site No. RMP-Q-05	Permit Requirement		Report (Mo.Total)	ton (d)						Monthly	Calculated

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA136778-006-DW1P Facility: GUA - Pahokee WWTF

Monitoring Period From: _____ To: _____

	Flow MGD	BOD, Carbonaceous 5 day, 20C mg/L	Chlorine, Total Residual (For Disinfection) mg/L	Coliform, Fecal #/100mL	Nitrogen, Nitrate, Total (as N) mg/L	Solids, Total Suspended mg/L	pH s.u. (Min.)	pH s.u. (Max.)	BOD, Carbonaceous 5 day, 20C mg/L	Solids, Total Suspended mg/L	
Code	50050	80082	50060	74055	00620	00530	00400	00400	80082	00530	
Mon. Site	CAL-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFF-01	EFF-01	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

ISSUANCE/REISSUANCE DATE:

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA136778-006-DW1P Facility: GUA - Pahokee WWTF
Monitoring Period From: _____ To: _____

	pH s.u. (Min.)	pH s.u. (Max.)	Flow MGD	Flow MGD	BOD, Carbonaceous 5 day, 20C mg/L	Solids, Total Suspended mg/L					
Code	00400	00400	50050	50050	80082	00530					
Mon. Site	EFF-01	EFF-01	FLW-01	FLW-02	INF-01	INF-01					
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
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22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

ISSUANCE/REISSUANCE DATE:

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28th of the month following the monitoring period. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the Permittee or authorized representative:

Resubmitted DMR: Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)
No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units.
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Time Sample Obtained: Enter the time the sample was taken.
Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that.
Detection Limits: Record the detection limits of the analytical methods used.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.
No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.
No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.
Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

PATHOGEN MONITORING

Part I - Instructions

1. Completion of this report is required by Rules 62-610.463(4), 62-610.472(3)(d), 62-610.525(13), 62-610.568(11), 62-610.568(12), and 62-610.652(6)(c), F.A.C., for all domestic wastewater facilities that provide reclaimed water to certain types of reuse activities. The schedule for sampling and reporting shall be in accordance with the permit for the facility. If a schedule for sampling or re-sampling is not included in the permit, the following schedule shall apply:

   a. Routine Sampling:

      If sampling is required once every two years, this report shall be submitted on or before November 28 of each even numbered year (2006, 2008, 2010, etc.).

      If sampling is required once every five years, this report shall be submitted with the application for permit renewal.

      If sampling is required quarterly, this report shall be submitted on or before February 28, May 28, August 28, and November 28 of each year.

   b. Subsequent Re-Sampling:

      If subsequent re-sampling is required by Item 9 in Part I of this form, this form shall be submitted for the subsequent re-sampling(s) in accordance with the schedule established in Item 9 in Part I of this form.

2. Submit one copy of this form and a copy of the laboratory's final report for the analysis of *Giardia* and *Cryptosporidium* to each of the following two addresses:

   a. The appropriate DEP district office (attention Domestic Wastewater Program). Addresses for the DEP district offices are available at www.dep.state.fl.us/secretary/dist/default.htm.

   b. DEP Water Reuse Coordinator
      Mail Station 3540
      2600 Blair Stone Road
      Tallahassee, Florida 32399-2400

3. Please type or print legibly.

4. In Part II, Items 7 through 12 need to be completed only if this is the first submittal of this report, if the information in Items 7 through 12 has changed since the last submittal, or if the information in any of these questions has not been previously provided.

5. Part III is to be used when sampling for *Giardia* and *Cryptosporidium* at the treatment plant. Part III is also to be used when sampling for *Giardia* and *Cryptosporidium* in a supplemental water supply (see Rule 62-610.472, F.A.C.).

6. For each sample, record the sample volume obtained in liters.

7. For *Giardia*, record the concentrations in cysts per 100 liters. For *Cryptosporidium*, record the concentrations in oocysts per 100 liters. Sufficient sample volumes shall be collected and processed such that the detection limit is no greater than 5 cysts or oocysts per 100 liters. Detection levels on the order of 1 cyst or oocyst per 100 liters are recommended. If an observation is less than the detection limit, make an entry in the form "<2" (where 2 per 100 liters is the detection limit in this example). The actual detection limit will be dictated by the volumes of sample obtained, filtered, and processed. Do NOT record nondetectable values as zero.

8. EPA Method 1623 or other approved methods for reclaimed water or nonpotable waters, adjusted appropriately to accommodate the detection limit requirements, shall be used. Methods previously allowed for EPA's Information Collection Rule (ICR) shall not be used. The full requirements of the approved method, including quality assurance and quality control, are to be met. Quality assurance and sampling requirements in Chapter 62-160, F.A.C., shall apply.

   Two concentrations of *Giardia* and *Cryptosporidium* shall be recorded on Part III of this form:

   a. Total cysts and oocysts shall be enumerated using EPA Method 1623 or other approved methods.

   b. Potentially viable cysts and oocysts shall be enumerated using the DAPI staining technique contained in EPA Method 1623 or similar enumeration techniques included in other approved methods. Cysts and oocysts that are stained DAPI positive or show internal structure by D.I.C. shall be considered as being potentially viable. If the laboratory reports separate values for DAPI positive and for cysts or oocysts having internal structure, the larger of the two concentrations will be reported as being potentially viable.

9. If the number of potentially viable cysts of *Giardia* reported exceeds 5 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. If the number of potentially viable oocysts of *Cryptosporidium* reported exceeds 22 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. This subsequent sample shall be collected within 90 days of the date the initial sample was taken, analyzed for both *Giardia* and *Cryptosporidium*, and the results of the subsequent analysis shall be submitted to DEP using this form within 60 days of sample collection.

10. Rule 62-160.300, F.A.C., requires that all laboratories generating environmental data for submission to the DEP shall hold certification from the Department of Health's (DOH) Environmental Laboratory Certification Program (ELCP). Certification by the ELCP for analysis of *Giardia* and *Cryptosporidium* using EPA Method 1623 for non-potable waters is required. If other approved methods are used, certification by the ELCP is required for the specific method and for the test matrix. Lists of certified laboratories can be found at www.dep.state.fl.us/labs/cgi-bin/aams/index.asp

11. Samples shall be collected during peak flow periods (normally between the hours of 8:00 a.m. and 6:00 p.m.).

12. Recognizing that concentrations of these pathogens generally increase during the late summer through fall period, it is recommended that utilities sample during the August through October time period.

13. If the wastewater treatment facility uses chlorination for disinfection, samples obtained for analysis of *Giardia* and *Cryptosporidium* shall be dechlorinated.

14. When sampling at the treatment facility, obtain a grab sample for total suspended solids (TSS) that is representative of the water leaving the filters at the treatment facility during the period when pathogen samples are being obtained. In addition, record the highest turbidity and the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

15. When sampling a supplemental water supply, obtain a grab sample for total suspended solids (TSS) that is representative of the surface water or treated stormwater as it is added to the reclaimed water system. This TSS sample shall be taken during the period when pathogen samples are being obtained. In addition, record the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

Part II - General Information

1. DEP wastewater facility identification number: **FLA136778**

   Wastewater facility name: GUA - Pahokee WWTF

   Permittee name: Glades Utility Authority

2. Person completing this form:

   Name: _____

   Telephone: (_____)_____

   Email address: _____

3. Sampling and analysis:

   Date samples were taken: _____

   Organization collecting the samples: _____

   Was the sample dechlorinated in the field? ☐ Yes ☐ No

   Was the sample refrigerated or kept on ice during shipment to the laboratory? ☐ Yes ☐ No

   Date samples delivered to laboratory: _____

   Date analytical work was done: _____

   Laboratory doing the analysis: _____

   Laboratory's DOH Identification Number: _____

   Approved method used:

   ☐ EPA Method 1623

   ☐ Other approved method: _____

   Contact person at the laboratory: _____

   Email address of the lab contact person: _____

4. Is this the first time that this form has been submitted for the facility?

   ☐ Yes [Please complete Questions 7 through 16.]

   ☐ No [Proceed to Question 5.]

5. Is this a report of "subsequent re-sampling" required by Item 9 in Part I of this form based on concentrations of potentially viable cysts or oocysts in a previous sampling?

☐ No [Proceed to Question 6.]

☐ Yes [Attach a description of any facility or operational changes made to the treatment facilities since the time of the previous sampling and proceed to Question 6.]

6. Has the information requested in Questions 7 through 12 (below) changed since the last submittal of this form?

☐ Yes [Please complete Questions 7 through 16.
☐ No [Proceed to Questions 13 through 16 of Part II of this form. You do not need to complete Questions 7 through 12.]

7. Type of secondary treatment system:

☐ Conventional activated sludge ☐ Extended aeration

☐ Contact stabilization ☐ Biological nutrient removal (such as Bardenpho)

☐ Other: _____

8. Does this treatment facility nitrify (convert ammonia nitrogen to nitrate)? ☐ Yes ☐ No

9. Filter type:

☐ Deep bed, single media ☐ Deep bed, multiple media

☐ Shallow bed, automatic backwash ☐ Upflow (including Dynasand)

☐ Slow rate sand filter ☐ Diatomaceous earth filter

☐ Fabric filter ☐ Cartridge filter

☐ Membranes (microfiltration, ultrafiltration, membrane bioreactor, reverse osmosis)

☐ Other: _____

10. Filter Media (complete for each type of media provided):

Top layer of media:
Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Middle layer of media:
Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Bottom layer of media:

Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

11. Filter backwash water:

☐ Backwash water is returned to the headworks of the treatment plant.

☐ Backwash water is returned to the aeration basin.

☐ Other. Please describe: _____

12. Disinfection system:

☐ Chlorination, gas ☐ Hypochlorite

☐ Chlorine dioxide ☐ Chlorination, other _____

☐ Ultraviolet ☐ Ozone

13. Is chlorine added before the filters? ☐ No ☐ Yes Dose: _____ mg/L

14. During the period that samples were taken, did you add a coagulant, coagulant aid, polyelectrolyte, or other chemical to enhance filtration?

☐ No

☐ Yes. Please list the chemicals being added and their dose.

Chemical 1 - Name: _____ Dose: _____ mg/L

Chemical 2 - Name: _____ Dose: _____ mg/L

Chemical 3 - Name: _____ Dose: _____ mg/L

15. Wastewater treatment plant permitted capacity: _____ mgd

16. Wastewater flow being treated at the time samples were collected: _____ mgd

PART III - PATHOGEN MONITORING REPORT

FACILITY ID: FLA136778
FACILITY NAME: GUA - Pahokee WWTF
FACILITY ADDRESS: 1001 Rim Canal Road, Pahokee, FL 33476
PERMITTEE NAME: Glades Utility Authority
MAILING ADDRESS: 39800 Hooker Highway, Belle Glade, FL 33430

DATE OF SAMPLING: _____

Parameter	Quantity or Loading		Quality or Concentration	
	Sample Measurement	Units	Sample Measurement	Units
Treatment Plant: After Filter Monitoring Site No.				
Turbidity PARM Code 00070				NTU
TSS PARM Code 00530				mg/L
Treatment Plant: After Disinfection Monitoring Site No.				
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia, total count * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L
Supplemental Water Supply (surface water or stormwater): After Treatment & Disinfection Monitoring Site No.				
TSS PARM Code 00530				mg/L
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia (total count) * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L

* Data entries must be made for both total and potentially viable cysts and oocysts.

PART IV - CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principle Executive Officer or Authorized Agent (Type or Print)	Signature of Principle Executive Officer or Authorized Agent	Telephone No.	Date (YY/MM/DD)
	Email Address		

Florida Department of
Environmental Protection
Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401
561-681-6600

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

JUL 11 2012

91 7108 2133 3938 2488 6428

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

James Stiles, Executive Director
Glades utility Authority
39800 Hooker Highway
Belle Glade, Florida 33430

Palm Beach County
Facility ID: 0138286-UO

Re: DEP vs. Glades Utility Authority, Consent Order No.: OGC 11-1288

Dear Mr. Stiles:

Enclosed for your review and signature is the Consent Order drafted by the Department in the above-styled case. The Consent Order represents a resolution acceptable to the Department in this matter.

Please review, sign and return the original Consent Order within 30 days from the date of receipt to this office for Department signature and execution. If you do not sign and return this letter to the Department within 30 days of your receipt of this letter, the Department will assume that you are not interested in settling this matted on the above described terms, and will proceed accordingly.

Should you have any questions concerning the Consent Order, please contact **Joe May** of this office at **561-681-6691**

Sincerely,

Jill S. Creech, P.E.
District Director
Southeast District

JC/lab/jm/fr

cc. Lea Crandell, FDEP/TLH lea.crandell@dep.state.fl.us
Bevin Beaudet, Palm Beach County bbeaudet@pbcwater.com

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION,

IN THE OFFICE OF THE SOUTHEAST DISTRICT

OGC FILE NO. 11-1288

vs.

GLADES UTILITY AUTHORITY,

Respondent.
_____/

CONSENT ORDER

This Consent Order is entered into between the State of Florida Department of Environmental Protection ("Department") and Glades Utility Authority ("Respondent") to reach settlement of certain matters at issue between the Department and Respondent. The Department finds and the Respondent admits the following:

1. The Department is the administrative agency of the State of Florida having the power and duty to protect Florida's air and water resources and to administer and enforce the provisions of Chapter 403, Florida Statutes ("F.S."), and the rules promulgated and authorized in Title 62, Florida Administrative Code ("F.A.C."). The Department has jurisdiction over the matters addressed in this Consent Order.

2. Respondent is a person within the meaning of Section 403.031(5), F.S.

3. Respondent is the owner and is responsible for the operation of the Pahokee Wastewater Treatment and Disposal Facility ("WWTF") and the associated wastewater collection and transmission system serving the City of Pahokee. The Pahokee WWTF is a 1.2 million gallons per day (three-month average daily flow) activated sludge wastewater treatment facility, with effluent disposal via one 4.0 million gallons per day (peak hourly flow) underground injection well discharging to Class G-IV groundwater. The underground injection well ("IW-1") and associated dual zone monitoring well ("MW-1") are located within the Pahokee WWTF site, which is located at 1001 Rim Canal Road, Pahokee, Palm Beach County, Florida, 33476. The Pahokee

WWTF, with its associated collection and transmission system, and the underground injection well are operated under Department permits FLA136778 and 0138286-017UO, respectively.

A. On June 1, 2010, the WWTF personnel reported an increase in pressure in the MW-1 lower monitor zone and a change in water quality. On June 4, 2010, WWTF personnel notified the Department of the monitoring well pressure and water quality changes.

B. On September 24, 2010, Respondent submitted a Monitoring Well Rehabilitation Plan to the Department.

C. On January 4, 2011, Respondent submitted a revised rehabilitation plan and an application for a Minor Modification for the monitoring well rehabilitation.

D. On January 14, 2011, the Department issued a minor modification to the Underground Injection Control (UIC) permit for the monitoring well rehabilitation.

E. On March 7, 2011, Respondent submitted an application for the replacement of the lower monitor interval of MW-1 with a new single zone monitoring well. The application was submitted in the event the repair of the MW-1 lower monitor interval was unsuccessful.

F. On May 20, 2011, the Department issued a warning letter to Respondent for the failure of MW-1. This letter was issued after the monitoring well's lower zone rehabilitation effort failed.

G. On June 22, 2011, (in the event the above referenced rehabilitation effort failed) the Department issued Minor Modification Permit 0138286-036-UC for the construction of a new monitoring well to replace the lower monitoring zone of MW-1. This permit modification also authorized the plugging and abandoning of the lower monitoring zone of MW-1. The permit did not authorize the construction of any other well.

H. On July 6, 2011, a further revised work plan for the rehabilitation of the monitoring well was submitted by the Palm Beach County Water Utilities

Department who is assisting the Respondent. The revised work plan does not provide adequate time for Respondent to collect required data for permit renewal prior to expiration of the existing injection well permit 0138286-017-UO.

I. As a result of further deterioration of MW-1 and lack of useful sampling data, the Department issued a letter to the Respondent on July 27, 2011 informing the Respondent that an amendment to an existing Consent Order or a separate Consent Order will be needed to address continuing use of the injection well without adequate monitoring.

J. From June 1, 2010 to, March 1, 2012, the Respondent failed to monitor the absence of fluid movement adjacent to the well bore and the long term effectiveness of the confining zone of MW-1, in violation of Rule 62-528.425(1)(g)(1), F.A.C.

K. From June 1, 2010 to, March 1, 2012, Respondent failed to sample periodically and provide representative data for MW-1, in violation of Rule 62-528.425(1)(g)(2), F.A.C.

L. The current permit for IW-1 expires August 22, 2012. A minimum of six months of representative data from MW-1 is required prior to the permit renewal, or a Consent Order must be executed to address the continued operation of IW-1.

M. From June 1, 2010 to March 1, 2012, Respondent failed to maintain MW-1, in violation of Specfic Condition 4.a of existing permit 0138286-017UO:

> "The integrity of the monitoring zone sampling systems shall be maintained at all times. Sampling lines shall be clearly and unambiguously identified by monitoring zone at the point at which samples are drawn. All reasonable and prudent precautions shall be taken to ensure that samples are properly identified by monitoring zone and that samples obtained are representative of those zones. Sampling lines and equipment shall be kept free of contamination with independent discharges and no interconnections with any other lines."

N. Currently MW-1 is out of service.

4. Having reached a resolution of the matter the Department and the Respondent mutually agree and it is

ORDERED:

5. Respondent shall comply with the following corrective actions within the stated time periods;

A. Within 30 days of the effective date of this Order, Respondent shall implement the Minor Modification (0138286-035-UC) which is for the rehabilitation of the lower monitoring zone of monitoring well MW-1. Should the rehabilitation effort fail Respondent shall implement Minor Modification (0138286-036-UC) which is for the construction of a new lower monitoring zone monitoring well; plugging and abandonment of the existing lower monitoring zone in monitoring well MW-1; and the upgrade of the instrumentation and controls of the new lower monitoring zone monitoring well in addition to the instrumentation and controls of the existing upper monitoring zone in monitoring well MW-1. Once work on existing monitoring well MW-1 has physically commenced, should revisions to the rehabilitation plan be deemed necessary, the proposed revisions shall be submitted to the Department within 24 hours. No changes to the rehabilitation plan shall be made unless approved in writing from the Department. This rehabilitation plan, hereafter called the "Plan".

B. Within 30 days of Respondent's receipt of Department approval, Respondent shall implement the Department approved Plan. After implementation, and until completed, Respondent shall submit monthly project progress reports to the Department no later than 15 days after the end of the preceding month.

C. Within 30 days of final completion of Plan, Respondent shall provide to the Department a Certificate of Completion signed and sealed by a Florida State Licensed Professional Engineer or Professional Geologist.

D. Once the monitoring well has been completed and background water quality is reestablished no later than December 2013, Respondent must then provide the Department with a minimum of six months of representative data to evaluate renewing the injection well permit.

E. An application to renew to current injection well permit must be received by the Department no later than 60 days prior to the August 22, 2012 expiration date.

6. Notwithstanding the time periods described in the paragraphs above, Respondent shall complete the approved Plan and provide 6 months of useful representative data as required in permit 0138286-017 UO and be in full compliance with Rule 62-528.425, F.A.C. by no later than June 30, 2014, regardless of any intervening events or alternative time frames imposed in this Order.

7. Within 30 days of the effective date of this Order, Respondent shall pay the Department $250.00 in settlement of the regulatory matters addressed in this Order. This amount includes $250.000 for costs and expenses incurred by the Department during the investigation of this matter and the preparation and tracking of this Order.

8. Respondent shall make all payments required by this Order by cashier's check or money order. Payment instruments shall be made payable to the "Department of Environmental Protection" and shall include both the OGC number assigned to this Consent Order and the notation "Ecosystem Management and Restoration Trust Fund."

9 Except as otherwise provided, all submittals required by this Order shall be sent to Water Facilities Compliance/Enforcement Section, Department of Environmental Protection, 400 North Congress Avenue, Suite 200, West Palm Beach, Florida, 33401.

10. Respondent shall allow all authorized representatives of the Department access to the Facility and the Property at reasonable times for the purpose of determining compliance with the terms of this Order and the rules and statutes administered by the Department.

11. In the event of a sale or conveyance of the Facility or of the Property upon which the Facility is located, if all of the requirements of this Order have not been fully satisfied, Respondent shall, at least 30 days prior to the sale or conveyance of the Facility or Property, (a) notify the Department of such sale or conveyance, (b) provide the name and address of the purchaser, operator, or person(s) in control of the Facility, and (c) provide a copy of this Order with all attachments to the purchaser, operator, or person(s) in control of the Facility. The sale or conveyance of the Facility or the Property does not relieve Respondent of the obligations imposed in this Order.

12. If any event, including administrative or judicial challenges by third parties unrelated to Respondent, occurs which causes delay or the reasonable likelihood of delay in complying with the requirements of this Order, Respondent shall have the burden of proving the delay was or will be caused by circumstances beyond the reasonable control of Respondent and could not have been or cannot be overcome by Respondent's due diligence. Neither economic circumstances nor the failure of a contractor, subcontractor, materialman, or other agent (collectively referred to as "contractor") to whom responsibility for performance is delegated to meet contractually imposed deadlines shall be considered circumstances beyond the control of Respondent (unless the cause of the contractor's late performance was also beyond the contractor's control). Upon occurrence of an event causing delay, or upon becoming aware of a potential for delay, Respondent shall notify the Department by the next working day and shall, within seven calendar days notify the Department in writing of (a) the anticipated length and cause of the delay, (b) the measures taken or to be taken to prevent or minimize the delay, and (c) the timetable by which Respondent intends to implement these measures. If the parties can agree that the delay or anticipated delay has been or will be caused by circumstances beyond the reasonable control of Respondent, the time for performance hereunder shall be extended. The agreement to extend compliance must identify the provision or provisions which extended the new compliance date or dates, and the additional measures Respondent must take to avoid

or minimize the delay, if any. Failure of Respondent to comply with the notice requirements of this paragraph in a timely manner constitute a waiver of Respondent's right to request an extension of time for compliance for those circumstances.

13. The Department, for and in consideration of the complete and timely performance by Respondent of all the obligations agreed to in this Order, hereby conditionally waives its right to seek judicial imposition of damages or civil penalties for the violations described above up to the date of the filing of this Order. This waiver is conditioned upon Respondent's complete compliance with all of the terms of this Order.

14. This Order is a settlement of the Department's civil and administrative authority arising under Florida law to resolve the matters addressed herein. This Order is not a settlement of any criminal liabilities which may arise under Florida law, nor is it a settlement of any violation which may be prosecuted criminally or civilly under federal law. Entry of this Order does not relieve Respondent of the need to comply with applicable federal, state, or local laws, rules, or ordinances.

15. The Department hereby expressly reserves the right to initiate appropriate legal action to address any violations of statutes or rules administered by the Department that are not specifically resolved by this Order.

16. Respondent is fully aware that a violation of the terms of this Order may subject Respondent to judicial imposition of damages, civil penalties up to $10,000.00 per day per violation, and criminal penalties.

17. Respondent acknowledges and waives its right to an administrative hearing pursuant to sections 120.569 and 120.57, F.S., on the terms of this Order. Respondent also acknowledges and waives its right to appeal the terms of this Order pursuant to section 120.68, F.S.

18. No modifications of the terms of this Order will be effective until reduced to writing, executed by both Respondent and the Department, and filed with the Clerk of the Department.

19. The terms and conditions set forth in this Order may be enforced in a court of competent jurisdiction pursuant to sections 120.69 and 403.121, F.S. Failure to comply with the terms of this Order constitutes a violation of section 403.161(1) (b), F.S.

20. This Consent Order is a final order of the Department pursuant to section 120.52(7), F.S., and it is final and effective on the date filed with the Clerk of the Department unless a Petition for Administrative Hearing is filed in accordance with Chapter 120, F.S. Upon the timely filing of a petition, this Consent Order will not be effective until further order of the Department.

21. Persons who are not parties to this Consent Order, but whose substantial interests are affected by it, have a right to petition for an administrative hearing under sections 120.569 and 120.57, Florida Statutes. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition concerning this Consent Order means that the Department's final action may be different from the position it has taken in the Consent Order.

The petition for administrative hearing must contain all of the following information:

A. The OGC Number assigned to this Consent Order;

B. The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding;

C. An explanation of how the petitioner's substantial interests will be affected by the Consent Order;

D. A statement of when and how the petitioner received notice of the Consent Order;

E. Either a statement of all material facts disputed by the petitioner or a statement that the petitioner does not dispute any material facts;

F. A statement of the specific facts the petitioner contends warrant reversal or modification of the Consent Order;

G. A statement of the rules or statutes the petitioner contends require reversal or modification of the Consent Order; and

H. A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the Department to take with respect to the Consent Order.

The petition must be filed (received) at the Department's Office of General Counsel, 3900 Commonwealth Boulevard, MS# 35, Tallahassee, Florida 32399-3000 within 21 days of receipt of this notice. A copy of the petition must also be mailed at the time of filing to the District Office at Water Facilities Compliance/Enforcement Section, Department of Environmental Protection, 400 North Congress Avenue, Suite 200, West Palm Beach, Florida, 33401. Failure to file a petition within the 21-day period constitutes a person's waiver of the right to request an administrative hearing and to participate as a party to this proceeding under sections 120.569 and 120.57, Florida Statutes. Before the deadline for filing a petition, a person whose substantial interests are affected by this Consent Order may choose to pursue mediation as an alternative remedy under section 120.573, Florida Statutes. Choosing mediation will not adversely affect such person's right to request an administrative hearing if mediation does not result in a settlement. Additional information about mediation is provided in section 120.573, Florida Statutes and Rule 62-110.106(12), Florida Administrative Code.

22. Rules referenced in this Order are available at http://www.dep.state.fl.us/legal/Rules/rulelistnum.htm.

FOR THE RESPONDENT:

_____ _____

DATE Executive Director

Glades Utility Authority

DONE AND ORDERED this __ day of _____, 2012, in West Palm Beach, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

_____

Jill S. Creech, P.E.
Southeast District Director

Filed, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

_____ _____

Clerk **Date**

Attachments:

Exhibit A: In-Kind Projects

Copies furnished to:

Lea Crandall, Agency Clerk, FDEP/TLH	lea.crandall@dep.state.fl.us
Joe Haberfeld, FDEP/TLH	joe.haberfeld@dep.state.fl.us
Joe May, FDEP/SED	joe.may@dep.state.fl.us
Jim Stiles, General Manager, Glades Utility Authority	jstiles@pbcwater.com
Bevin Beaudet, Director, Palm Beach County Water Utilities	bbeaudet@pbcwater.com
Hassan Hadjimiry, Palm Beach County Water Utilities Dept.	hhadjimiry@pbcwater.com
Darrel Graziani, Palm Beach County Health Department	darrel_graziani@doh.state.fl.us
Matthew Brock, City Manager, City of Pahokee	citymanager@cityofpahokee.com

Florida Department of
Environmental Protection

Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401
561-681-6600

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

ELECTRONIC CORRESPONDENCE

September 18, 2012

Mr. James Stiles, Executive Director
Glades Utility Authority (GUA)
39800 Hooker Highway
Belle Glade, Florida 33430
JStiles@pbcwater.com

Palm Beach County
Facility ID: 0138286-UO

Reference: **FDEP vs. GUA Consent Order Number OGC 11-1288.**

Dear Mr. Stiles:

The Florida Department of Environmental Protection (Department or FDEP) acknowledges the receipt of your check on September 7, 2012, for $250.00, to cover expenses incurred by the Department during the investigation of Consent Order OGC 11-1288, under the Section Ordered, Item Number Seven (7).

The Department also acknowledges the receipt of your request for extension of the expiration date, on September 6, 2012, of the Minor Modification to permit number 0138286-036-UC, for the construction of a new lower zone monitor well.

The Department also acknowledges the receipt of your summary report, on September 6, 2012, in reference to the minor modification, permit number 0138286-035-UC, for the rehabilitation of the existing lower zone monitor well.

In the reference to the minor modifications, 0138286-035-UC and 0138286-036-UC, within fifteen (15) days of receipt of this letter, please schedule a meeting to discuss the implementation of these minor modifications.

Thank you for your cooperation in this matter. If you have any questions, please contact Joseph R. May, P.G. at (561) 681-6691 or at joseph.may@dep.state.fl.us or J. Gardner Strasser, P.G. at (561) 681-6688 or at gardner.strasser@dep.state.fl.us.

Sincerely,

9/18/12

Joseph R. May, P.G. Date
Program Manager
Underground Injection Control

JRM/JGS

Cc: Joseph L. Haberfeld, P.G., FDEP/TLH
Cathy McCarty, P.G., FDEP/TLH
Nathan E. Nason, Esq., GUA General Counsel - nnason@nasonyeager.com
Surina Woodson, GUA – swoodson@pbcwater.com
Hassan Hadjimiry, Director, PBC Regulatory Compliance – hhadjimiry@pbcwater.com
Jocelyn Colon, GUA Clerk – jcolon@pbcwater.com
Bevin Beaudet, Palm Beach County – bbeaudet@pbcwater.com
Stephen McGrew, P.E., PBCWUD

Florida Department of Environmental Protection

Southeast District
400 North Congress Avenue, Suite 200
West Palm Beach, Florida 33401

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

ELECTRONIC CORRESPONDENCE **August 23, 2007**

NOTICE OF PERMIT

Ms. Lillie Latimore, City Manager
City of Pahokee
171 North Lake Avenue
Pahokee, Florida 33476

PALM BEACH COUNTY
UIC - City of Pahokee WWTP
Class I Injection Well IW-1
FILE: 0138286-017-UO

Dear Ms. Latimore:

Enclosed is Permit Number 0138286-017-UO, to operate the City of Pahokee Class I Injection Wells IW-1, with one associated Dual Zone Monitoring Well, MW-1. This permit issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-4, 62-520, 62-522, 62-528, 62-550, 62-600 and 62-601. The system is located at the City of Pahokee Wastewater Treatment Plant.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, Mail Stop 35, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Should you have any questions, please contact J. Gardner Strasser, P.G., or Joseph R. May, P.G., of this office at (561) 681-6688 or (561) 681-6691, respectively.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

_____

Jack Long
District Director
Southeast District

JL/LAB/JRM/jgs

Copies furnished to:
Richard Deuerling, FDEP/TLH
Steve Anderson, SFWMD/WPB
Nancy Marsh, USEPA/ATL
Tom Lefevre, PBCHD
Cathy McCarty, FDEP/TLH
Catherine E. Nance, City of Pahokee

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on _____ to the listed persons.
Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to the §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

_____ _____
Clerk Date

GENERAL CONDITIONS:

The following **General Conditions** are referenced in Florida Administrative Code Rule 62-528.307.

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to Section 403.141, F.S.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action.

3. As provided in Subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land, water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefrom; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, or are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

   a. Have access to and copy any records that must be kept under conditions of this permit;
   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

   Reasonable time will depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

   a. A description of and cause of noncompliance; and
   b. The period of noncompliance, including dates and times; or, if not corrected the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent the recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

GENERAL CONDITIONS:

18. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

19. This permit may be modified, revoked and reissued, or terminated for cause, as provided in 40 C.F.R. Sections 144.39(a), 144.40(a), and 144.41 (1998). The filing of a request by the permittee for a permit modification, revocation or reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

20. The permittee shall retain all records of all monitoring information concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under Rule 62-528.435, F.A.C. The permittee shall deliver the records to the Department office that issued the permit at the conclusion of the retention period unless the permittee elects to continue retention of the records.

21. All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C. All reports shall contain the certification required in Rule 62-528.340(4), F.A.C.

22. The permittee shall notify the Department as soon as possible of any planned physical alterations or additions to the permitted facility. In addition, prior approval is required for activities described in Rule 62-528.410(1)(h).

23. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or injection activity which may result in noncompliance with permit requirements.

24. The permittee shall report any noncompliance which may endanger health or the environment including:

    a. Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water; or
    b. Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

    All information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

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SPECIFIC CONDITIONS:

f. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water.

g. Only non-hazardous secondary treated domestic wastewater (effluent) from the City of Pahokee WWTP and purge water from the on-site monitoring well (associated with the injection well system at the City of Pahokee WWTP) may be discharged into this well.

h. The wastewater stream shall be non-hazardous in nature at all times, as defined in 40-CFR, Part 261 and as adopted in Chapter 62-730, F.A.C.

3. Testing and Reporting Requirements

a. Any failure of Class I injection well monitoring and recording equipment for a period of more than 48 hours shall be reported to the Department within 24 hours. A written report describing the incident shall also be submitted to the Department within five days of the start of the event. The written report shall contain a complete description of the occurrence, a discussion of its cause(s), and the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

b. The permittee shall report any noncompliance which may endanger health or the environment, including:

1) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or

2) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

All information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

c. The injection system shall be monitored in accordance with Rules 62-528.425(1)(g) and 62-528.430(2), F.A.C. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The following injection well performance and monitoring zone data shall be collected and reported to the Department in Monthly Operating Reports (MORs) as indicated below.

1) Injection well performance:

a) Physical characteristics of injection well IW-1:

<u>Flow rate parameters</u>:

- average daily flow rate to injection well (MGD)
- daily maximum sustained (15 minutes minimum) flow rate to injection well (MGD)
- daily minimum sustained (15 minutes minimum) flow rate to injection well (MGD)
- monthly average of the daily flow rates to injection well (MGD)
- monthly maximum (peak hour) flow rate to injection well (MGD)
- monthly minimum flow rate to injection well (MGD)

SPECIFIC CONDITIONS:

b) Chemical characteristics of the upper and lower monitoring zones:

Monthly sampling:

- residue, total filterable (total dissolved solids, TDS) (mg/L)
- chloride (mg/L)
- specific conductance (temperature compensated, μmho/cm or μS/cm)
- nitrogen, ammonia, total as N (ammonia) (mg/L)
- nitrogen, total Kjeldahl as N (TKN) (mg/L)
- nitrogen, nitrate, total as N (nitrate) (mg/L)
- phosphorous, total as P (mg/L)
- pH (standard units)
- sulfate, total as SO_4 (mg/L)

d. A minimum of three well volumes of fluid shall be evacuated from the monitoring systems prior to sampling for the chemical parameters listed above. A State-certified laboratory shall analyze all samples. Sufficient purging shall have occurred when either of the following have occurred:

1) pH, specific conductivity and temperature when sampled, upon purging the third or subsequent well volume, each vary less than 5% from that sampled upon purging the previous well volume; or
2) upon purging the fifth well volume

e. All samples must be collected and analyzed in accordance with the quality assurance/quality control (QA/QC) requirements of Rule 62-160, F.A.C.

f. Controlled monthly injectivity tests (rate/pressure) shall be conducted on IW-1 in accordance with Rule 62-528.430(2)(d), F.A.C. These tests shall be conducted at a rate that approaches the maximum design flow but which can be repeated on a monthly basis. The injectivity test results shall be reported to the Department in the MORs. The following data shall be recorded and reported:

Parameters pertinent to flow rate:

- injection flow rate (MGD)
- initial totalizer reading (gallons)
- final totalizer reading (gallons)
- time (minutes) from initial to final totalizer readings

Pressure parameters:

- static injection wellhead pressure (psig)
- wellhead injection pressure fall-off — every 30 seconds until again static (psig)
- final pressure upon test cessation — approximately 10-15 minutes (psig)
- wellhead pressure with no flow (shut-in pressure in psig)
- monitoring zone pressures (psig)

Specific Injectivity shall be reported in gpm/psig.
All readings shall be taken after a minimum 5-minute period of stabilized flow.
Pursuant to Rule 62-528.430(2)(d), F.A.C., as part of the specific injectivity test, each well shall be shut-in for a period of time necessary to conduct a valid observation of pressure fall-off.

g. All injection well data submissions, including MORs, shall be clearly identified on each page with: facility name, I.D. Number, permit number, operator's name, license number, daytime phone number, date of sampling/recording and type of data. Monitoring zones shall be identified by well number and depth interval. The lead plant operator or higher official shall sign and date each submittal.

SPECIFIC CONDITIONS:

b. The surface equipment for the injection well system shall maintain compliance with Chapter 62-528.450(2)(j), F.A.C. for water hammer control, screening, access for logging and testing, and reliability and flexibility in the event of damage to the well and effluent piping. A regular program of exercising the valves integral to the well head shall be instituted. At a minimum, all valves integral to the well head shall be exercised during the regularly scheduled monthly injectivity testing.

c. The surface equipment and piping for the injection and monitoring wells shall be kept free of corrosion at all times.

d. Spillage onto the injection well pad during construction activities, and any waters spilled during mechanical integrity testing, other maintenance, testing or repairs to the system shall be contained on the pad and directed to a sump which in turn discharges to the pumping station wet well or via other approved means to the injection well system.

e. The injection well pad shall be maintained and retained in service for the life of the injection wells. The injection and monitoring well pad are not, unless specific approval is obtained from the Department, to be used for storage of any material or equipment at any time.

5. Financial Responsibility

a. The permittee shall maintain the resources necessary to close, plug and abandon the injection and associated monitoring wells, at all times [Rule 62-528.435(9), F.A.C.].

b. The permittee shall review annually the plugging and abandonment cost estimates. An increase of 10 percent or more over the cost estimate upon which financial responsibility is based shall require the permittee to submit documentation to obtain an updated Certificate of Demonstration of Financial Responsibility.

c. In the event the mechanism used to demonstrate financial responsibility should become invalid for any reason, the permittee shall notify the Department of Environmental Protection in writing within 14 days of such invalidation. The permittee shall then within 30 days of said notification submit to the Department for approval new financial documentation in order to comply with Rule 62-528.435(9), F.A.C., and the conditions of this permit.

6. Emergency Disposal

a. All applicable federal, state, and local permits shall be in place to allow for any alternate discharges due to emergency or planned outage conditions.

b. The primary disposal method consists of injection of the highly treated domestic wastewater (effluent) to injection well IW-1. When the capacity of IW-1 is exceeded, or the well is out-of–service, flow may be diverted to the surge tanks, empty treatment units, and effluent storage tanks have been filled, the overflow will be directed to the polishing ponds that has a capacity of approximately One (1) million gallons. Emergency disposal is by gravity slow of highly treated disinfected effluent to the polishing ponds.

c. Any proposed changes in emergency disposal methods shall be submitted for Departmental and USEPA review for approval prior to implementation.

d. Abnormal Events

1) In the event the permittee is temporarily unable to comply with any of the conditions of a permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind, or by other cause, the permittee of the facility shall notify the Department. Notification shall be made in person, by telephone, or by telegraph within 24 hours of breakdown or malfunction to the Department.

2) A written report of any noncompliance referenced in S.C. **6.d.1)** above shall be submitted to the Department within five days after its occurrence. The report shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated May 6, 2002

PRIMARY DRINKING WATER STANDARDS

PARAMETER

Alachlor (Polychlorinated Biphenyl or PCB)
Aldicarb
Aldicarb sulfoxide
Aldicarb sulfone
Aroclors (Polychlorinated Biphenyls or PCBs)
Alpha, Gross
Antimony
Arsenic
Atrazine
Barium
Benzene
Benzo(a)pyrene
Beryllium
Bis(2-ethylhexyl) adipate (Di(2-ethylhexyl) adipate)
Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)
Cadmium
Carbofuran
Carbon Tetrachloride (Tetrachloromethane)
Chlordane
Chlorobenzene (Monochlorobenzene)
Chloroethylene (Vinyl Chloride)
Chromium
Coliforms, Total
Cyanide
2,4-D (2,4-Dichlorophenoxyacetic acid)
Dalapon (2,2-Dichloropropionic acid)
Dibromochloropropane (DBCP)
1,2-Dibromoethane (EDB, Ethylene Dibromide)
1,2-Dichlorobenzene (o-Dichlorobenzene)
1,4-Dichlorobenzene (p-Dichlorobenzene or Para Dichlorobenzene)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (Vinylidene chloride)
1,2-Dichlorethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)
cis-1,2-Dichloroethylene (1,2-Dichlorethylene)
trans-1,2-Dichloroethylene (1,2-Dichlorethylene)
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
Dinoseb
Diquat
EDB (Ethylene dibromide, 1,2-Dibromoethane)
Endothall
Endrin
Ethylbenzene
Ethylene dichloride (1,2-Dichloroethane)
Fluoride
Glyphosate (Roundup)
Gross Alpha
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
gamma-Hexachlorocyclohexane (Lindane)
Hexachlorocyclopentadiene
Lead

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated May 6, 2002

MUNICIPAL WASTEWATER MINIMUM CRITERIA
GROUND WATER MONITORING PARAMETERS

INORGANICS

Ammonia
Nitrogen (organic)
Total Kjeldahl Nitrogen
Total Phosphorus (phosphate)

VOLATILE ORGANICS

Chloroethane
Chloroform
para-Dichlorobenzene (1,4 Dichlorobenzene)
1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)

BASE/NEUTRAL ORGANICS

Anthracene
Butylbenzylphthalate
Dimethylphthalate
Naphalene
Phenanthrene

PESTICIDES AND PCBs

Aldrin
Dieldrin

ACID EXTRACTABLES

2-chlorophenol
Phenol
2,4,6-trichlorophenol

OTHER

Specific Conductance
Biological Oxygen Demand
Chemical Oxygen Demand
Temperature

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SOUTHEAST DISTRICT
400 NORTH CONGRESS AVENUE, 3rd FLOOR
WEST PALM BEACH, FL 33401
561-681-6600

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

ELECTRONIC CORRESPONDENCE

April 24, 2013

James C. Stiles
Executive Director
Glades Utility Authority
39800 Hooker Highway
Belle Glade, Florida 33430

County: Palm Beach
UIC – GUA – Pahokee WWTP
Permit Number: 0138286-035-UO
Dual Zone Monitor Well Rehabilitation

Reference: Request to **REVISE the MINOR MODIFICATION** to FDEP Operation Permits 0138286-016-UO for IW-1 and associated Monitor Well MW-1 under **Permit Modification Number 0138286-035-UC**, for Monitor Well (MW-1) Rehabilitation.

Dear Mr. Stiles:

This letter acknowledges the receipt of your request to revise the Minor Modification to FDEP Permit No. 0138286-016-UO issued January 14, 2011 under FDEP File No. **0138286-035-UO**, for the rehabilitation of the existing dual zone monitor well at the Glades Utility Authority (GUA) City of Pahokee WWTP. This revision to the existing Minor Modification is based on findings ascertained during a cleaning operation of the 6-inch diameter final steel casing in the dual zone monitor well, MW-1.

On May 23, 2012, while cleaning the final steel casing which extends to the lower monitor zone in MW-1, a 431 foot section of this casing separated and fell into the upper monitoring zone. Following completion of a video survey on the monitor well, all rehabilitation activity ceased until a revised plan could be developed and submitted to the Department.

On March 29, 2013, GUA submitted a revised plan and associated plan drawings for the rehabilitation of MW-1. On this date, GUA also submitted correspondence indicating a change of the engineer of record.

The letter requesting a change in the engineer of record was signed by the Executive Director of GUA, Mr. James C. Stiles. . The letter indicated that the new engineer of record is Heath R. Wintz, P.E., of MWH Americas, Inc. The former engineer of record for the GUA City of Pahokee WWTP Dual Zone Monitor Well Rehabilitation was Stephen McGrew, P.E., Manager of Plant Design, for Palm Beach County Water Utilities Department. The professional geologist for the project will be Neil Johnson, P.G., of MWH Americas, Inc.

The reason for submitting the request to revise the Minor Modification issued January 14, 2011, was the separation of the final, 6-inch diameter steel casing in the lower monitor well during the cleaning process. Following several meetings with FDEP (West Palm Beach and Tallahassee

offices), GUA and the Palm Beach County Water Utilities Department developed a revised plan to ensure the continued monitoring of the GUA City of Pahokee WWTP Injection Well System. The revised rehabilitation plan includes the measures for the following: removal of the separated (431-foot section) 6-inch diameter steel casing from the monitor well; completing the cleaning of the remaining 6-inch diameter steel casing; installation of the fiberglass reinforced pipe (FRP) to replace and retain the lower monitoring interval; and abandonment of the upper monitoring zone.

The Revision of the Minor Modification complies with Consent Order OGC 11-1288, dated August 16, 2012, and shall follow the corrective action required within the Consent Order. If it is determined, by FDEP and GUA, that the rehabilitation of the lower zone monitor well is not feasible, then the dual zone monitor well will be plugged and abandoned. A new lower monitor well shall then be installed, in accordance with the Permit Number 0138286-036-UC, issued on June 23, 2011.

The revised rehabilitation plan for the lower monitor well and plugging and abandonment of the upper monitor zone is briefly described as follows:

1. Introduce a brine solution into the well to reduce the natural head within the well casing (kill the well) and remove the well head assembly, in order to implement the following measures.

    a. Remove the well head and attached 6-inch diameter steel casing (275 feet);
    b. Conduct video survey;
    c. Remove separated 6-inch diameter casing (fish) and clean, scrape, or brush remaining 6-inch steel casing to 1915 feet below land surface (bls);
    d. Conduct video survey of 16-inch steel casing and remaining 6-inch steel casing to determine condition of both casings, and the open hole section; and
    e. Collect thief sample(s) from the lower zone.

2. Install Fiberglass Reinforced Pipe (FRP) tubing to approximately 1915 bls with packer, cementing sleeve, and knock-out plug, and pressure test the FRP tubing.

3. Pressure grout the FRP tubing in place with neat cement grout from 1910 to 1147 feet bls, perform temperature logging of FRP tubing to determine the top of the cement grout.

4. Remove knock-out plug and cementing sleeve and reverse air develop the lower monitor zone from 1915 to 2008 feet bls; conduct video survey of FRP tubing to total depth.

5. Plug and abandon upper monitor interval to land surface.

6. Install new well head assembly and develop the lower monitor zone. During the development the following parameters shall be sampled for: Total Dissolved Solid (TDS), Conductivity, Chloride, pH, and Temperature.

7. Survey the new instrumentation and gauges to the North American Vertical Datum (NAVD) of 1988 and submit a report of the monitor well rehabilitation to the Department within 30 days of completion.

8. The remaining lower monitoring zone shall be continuously purged and water samples collected weekly until the water quality returns to normal background condition prior to the failure of the lower monitor zone steel casing. The monitoring zone shall be sampled for the list of parameters listed in item 6 above and the results submitted along with the monthly operating report for the wastewater treatment plant.

It shall be understood that if the rehabilitation of the lower zone of the dual zone monitor well does not prove to be successful, a new lower monitoring zone shall be constructed.

This revised minor modification to permit is subject to the following conditions::

- The Department shall be notified at least 72 hours prior to start of the rehabilitation work on the lower monitoring well.
- The County shall provide the Department with weekly updates on the progress of the lower monitoring well rehabilitation.
- The GUA shall also provide the Department with a final report within 30 days of completion of the lower monitoring well zone rehabilitation.

Based on information provided, the Department hereby approves the above Revised Minor Modification to Operation Permit 0138286-016-UO.

This minor modification becomes a part of and must be attached to Permit 0138286-016-UO. All other permit conditions and specifications remain in effect.

A person whose substantial interests are affected by the Department's proposed action may petition for an administrative proceeding (hearing) in accordance with Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Department's Office of General Counsel, 3900 Commonwealth Blvd., Mail Station 35, Tallahassee, Florida 32399-3000. Petitions filed by the permit applicant, any of the parties listed below or by any other person must be filed within 14 days of receipt of this intent. Petitions filed by other persons must be filed within 14 days of their receipt of this intent. A petitioner other than the applicant must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will only be at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.
A Petition must contain the following information:

(a) The name, address, and telephone number of each petitioner, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301 of the Florida Administrative Code.

Because the administrative hearing process is designed to formulate agency action, the filing of a petition means that the Department final action may be different from the position taken by it in this order. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Sections 120.569 and 120.57 of the Florida Statutes, and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-106.205 of the Florida Administrative Code.

If you have any questions, please contact Mark Silverman, PG, at (561) 681-6778.

Sincerely,

Linda A. Brien, PG
Water Facilities Program Administrator
Southeast District

LAB/MS

Copies furnished to:

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Emily Richardson, SFWMD/WPB	*EHopkins@sfwmd.gov*

CERTIFICATE OF SERVICE

The undersigned duly designated Deputy Clerk hereby certifies that this REVISED MINOR MODIFICATION TO PERMIT and all copies were mailed before the close of business on 4/24/13 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

4/24/13
Clerk

4/24/13
Date

APPENDIX 2-2

Glades Utility Authority Belle Glade WWTP Structural Evaluation Oxidation Ditch No. 1
(AECOM March 2011)

AECOM

Prepared for: Glades Utility Authority
Prepared by: AECOM Orlando, FL
Project No. : 60185970
Date: March 01, 2011

Glades Utility Authority

Belle Glade
Wastewater Treatment Plant

Structural Evaluation
Oxidation Ditch No. 1

Technical Memorandum

Contents

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2.0 Background 2

3.0 Structural Inspection 3

4.0 Structural Evaluations 4

5.0 Recommendation 5

6.0 Photographs 6

List of Appendices

Appendix A – March 1985 Record Drawings by Briley, Wild & Associates

Appendix B – January 2000 Record Drawings by Montgomery Watson and Barker, Osha & Anderson, Inc.

Appendix C – Structural Strengthening

Submitted By

_____

Khalid Motiwala, PE
Florida PE # 50633

1.0 Purpose and Scope

The Glades Utility Authority (GUA) wishes to determine the structural integrity of the existing Oxidation Ditch No. 1 at the Belle Glade WWTP. The Authority requested AECOM to provide services to perform the following:

- Structural inspection of Oxidation Ditch No.1.
- Evaluate structural integrity of the Oxidation Ditch No.1 based on:
    - Structural inspection.
    - Review of record drawings by Briley, Wild & Associates, Inc., dated March 1985.
    - Review of record drawings by Montgomery Watson and Baker, Osha & Anderson, Inc., dated January 2000.
- Recommend methods to raise the walls to minimize the risk of accidental overflow and increase freeboard for splash protection.

2.0 Background

Currently, the Belle Glade WWTP has two Oxidization Ditches. Both Oxidation Ditches are constructed with reinforced cast-in place concrete and utilize a carousel process with semi-circular and straight walls to control flow. Oxidation Ditch No.1 was constructed in 1985. In January 2000, the plant was expanded, which included the construction of Oxidation Ditch No. 2, modifications to Oxidation Ditch No.1, and construction of a new flow splitter box to hydraulically link the two Oxidation Ditches keeping the same water elevation in both Oxidation Ditches.

The wall elevations of Oxidation Ditch No. 2 are 18-inches higher than Oxidation Ditch No.1. The 1985 record drawings for Oxidation Ditch No.1 indicate a freeboard of 1.75 feet. As a result of hydraulically linking the oxidation ditches in the expansion, the water level in Oxidation Ditch No.1 increased to elevation 22.65 feet and a freeboard approximately 10 inches during peak flow.

Oxidation Ditch No.1 (See Appendix A for record Drawings):

Record drawings by Briley, Wild & Associates, Inc., dated March 1985 show the Oxidation Ditch No.1 to be approximately 217 feet long by 108 feet wide. The aerator units are mounted on a concrete support platform on the north end of the Oxidation Ditch and fiberglass covers are shown around the platform. The wall height is 13'-8" on the south end and increases to 18'-0" on the north end. The perimeter straight walls and the curved wall on the south end are 14-inches thick at the base and steps down to 12-inch thickness at 3'-8" above the base slab. The north end curved walls are 16-inches thick at the base and steps down to 12-inch thickness at 4'-5" above the base slab. The interior partition walls are 8-inches thick. The base is slab is generally 12-inches thick except at the north end, where it transitions to a thickness of 18-inches.

Elevations for Oxidation Ditch No. 1 are as follows:

Elevation 23.50: Top of wall elevation of straight walls and south end curved walls

Elevation 27.77: Top of wall elevation of north end and aerator support platform/walkway

Elevation 9.90: Top of base slab elevation

Elevation 8.60; Top of base slab elevation at north end

Elevation 15.0: Approximate finish grade

Oxidation Ditch No.1 Modifications (See Appendix B for record Drawings):

Record drawings by Montgomery Watson and Baker, Osha & Anderson, Inc., dated January, 2000, show the modifications to Oxidation Ditch No. 1. These drawings indicate that the modifications included removal of fiberglass covers and demolition of concrete platform supporting the aerator units on the north end, demolition of a section of the partition walls on the north end and raising the curved walls on the north end to accommodate a concrete slab at elevation 30.15. This slab serves to cover the north end of the Oxidation ditch and has integral concrete framing members to support the new aerator units.

3.0 Structural Inspection

On October 21, 2010, a site inspection was conducted to evaluate the structural integrity of Oxidation Ditch No 1. At the time of the inspection, the water level in the Oxidation Ditch was at normal operation level.

Diagonal cracks in parallel succession were observed on the walls of north end of Oxidation Ditch No. 1 at the transition from the straight run of the wall to the semi-circular ends. This transition corresponds to the point at which the structural behavior changes from a pure cantilever scenario (one directional stress distribution) to one of bending in the horizontal as well as vertical directions (two way stress distribution) (see photographs 1 and 2). On the north-east transition side, the cracks are not as noticeable because of the concrete stairs and effluent box. These structures interrupt the cracks and prevent them from propagating and widening. Similar diagonal cracks were also observed at the south end transitions (see photograph 3, 4, 5 and 6).

Vertical cracks were observed along the west wall (see photographs 7 and 8) and the east wall (see photographs 9 and 10). Most vertical cracks originate at the base of the wall and propagate to about two-thirds to full height of the wall. Minor seepage was observed through some of the vertical cracks at the base of walls (see photograph 11). There are several locations where there is evidence of past attempts to prevent fluid from seeping through the cracks. Excessive out-of-plane deflection of the walls was not observed and no concrete spalls were observed.

The height of the walls above grade was measured in several locations and compared with record drawings. According to the record drawings, the top of the walls should be 8'-6" above finish grade (AFG). The actual measurements taken were as follows:

Location	Height of wall AFG
West	7' 3"
North-East	7' 10"
South-East	7' 9"

The interior surface of the walls and slab could not be observed because the Oxidation Ditch was in operation.

4.0 Structural Evaluations

In general, two types of cracks were observed at Oxidation Ditch No.1, diagonal cracks and vertical cracks.

Diagonal cracks are a typical structural crack. Diagonal cracks on walls develop when there are deflection differences between structural elements. In the case of this Oxidation ditch it was determined that the base slab top reinforcement was insufficient to transfer structural forces. As a result, some rotation of the base slab caused diagonal cracks to develop near the restrained edge of the walls.

Vertical cracks in walls are generally shrinkage cracks and are non-structural. They are often the result of volumetric changes. They usually start at the restrained end at the base of the walls and propagate towards the top of the walls. Because the entire plane of the crack is in direct tension, vertical cracks tend to leak at the base where the fluid pressure is greatest.

According to record drawings, the 12-inch thick base slab is generally reinforced with a top steel mat of #5 bars at 12-inch spacing in two directions. Bottom mat reinforcement is provided in the base slab under the straight section of partition walls. This reinforcement is #5 bars at 12-inch spacing parallel to the walls and #5x12'-0" long perpendicular bars under the outer partition walls and #6x12'-0" long perpendicular bar under the center partition wall. No bottom mat of steel is provided under the perimeter walls.

The fluid inside the tank creates a tension force on the interior face of the perimeter walls. This tension force is resisted by the wall reinforcement vertical dowels (#8 at 6-inch spacing) at the base of the perimeter straight walls. Our calculations show that this reinforcement is sufficient to transfer the bending stresses to the base slab of the Oxidation Ditch. However, the top mat of #5 bars at 12-inch spacing in the base slab are not adequate to resist the transferred bending stresses developed and thus allow the base slab to rotate about the inside face of the wall. The elastic soil under the toe of the slab either compresses or sustains high bearing pressures to prevent rotation. Our experience has been that native Florida soils are generally not able to sustain such high soil bearing pressures unless soil improvement or over excavation and compaction is performed or if bedrock is in close proximity to the base of the slab. No geotechnical report of the soils below the structure was available for review.

The soil mass on the exterior of the wall helps to counteract the bending stresses on the wall from the internal fluid. Although current concrete codes allow the use of exterior soil mass to resist the internal fluid pressure, it is considered good practice not to rely on soil to counteract the applied fluid forces as the soil adjacent to structures may be excavated.

As a comparison, the drawings for Oxidation Ditch No.2 shows the steel in the top mat of the base slab as #8 at 6-inch spacing matching the wall inside vertical (tension) face steel.

5.0 Recommendation

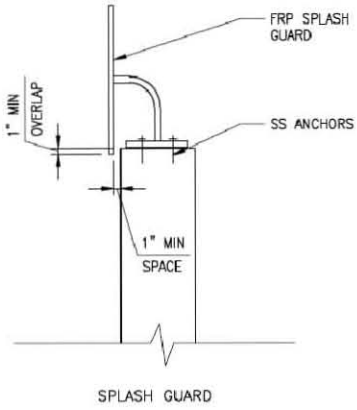
The Oxidation Ditch has been operating successfully without major structural issues for over 24 yrs. Though there is concern over the lack of adequate top steel reinforcement in the base slab under the perimeter walls, no significant wall cracking was observed indicating that the rotation at the base slab is minimal and soils are able to sustain the higher bearing pressures.

It is recommended not to increase the height of the wall for accidental overflow because of the current structural condition and the concerns with the limited steel reinforcement in the base slab. To address the splashing issues at Oxidation Ditch No. 1, it is recommended to install a non-hydrostatic fiber glass (FRP) splash guard around the exterior walls of the tank. Space should be left between the splash guards to allow for any accidental overflow to pass over the wall (see Sketch No. 1).

It is also recommended that excavation adjacent to Oxidation Ditch No.1 should not be performed when the fluid level is at or near normal operation levels.

If it is necessary to increase the height of the perimeter walls, structural strengthening of the base slab will be required. Analysis and recommended method of structural strengthening of the base slab is provided in Appendix C of this report.

Where seepage is present in vertical cracks, these cracks should be injected with a hydrophilic polyurethane grout such as Prime Flex 900 XLV manufactured by Prime Resin or an acceptable equivalent product. Diagonal cracks exceeding 0.020 inches should be injected with a two component epoxy crack repair adhesive such as Sikadur 52 by Sika Corporation or an acceptable equivalent product.



SKETCH NO. 1
SCALE: NONE

6.0 Photographs

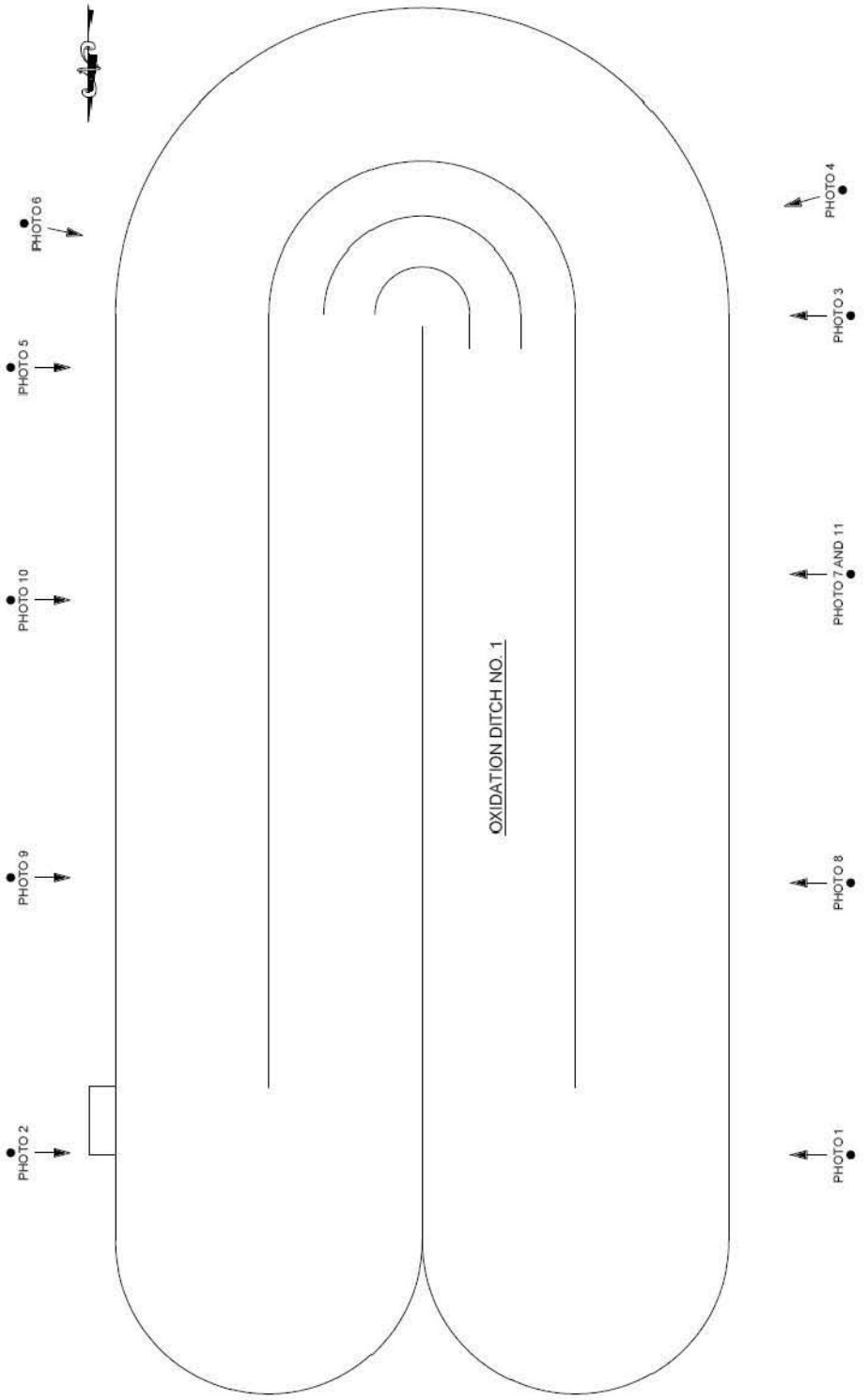


Figure 1: PHOTO LOCATIONS

Photo 1

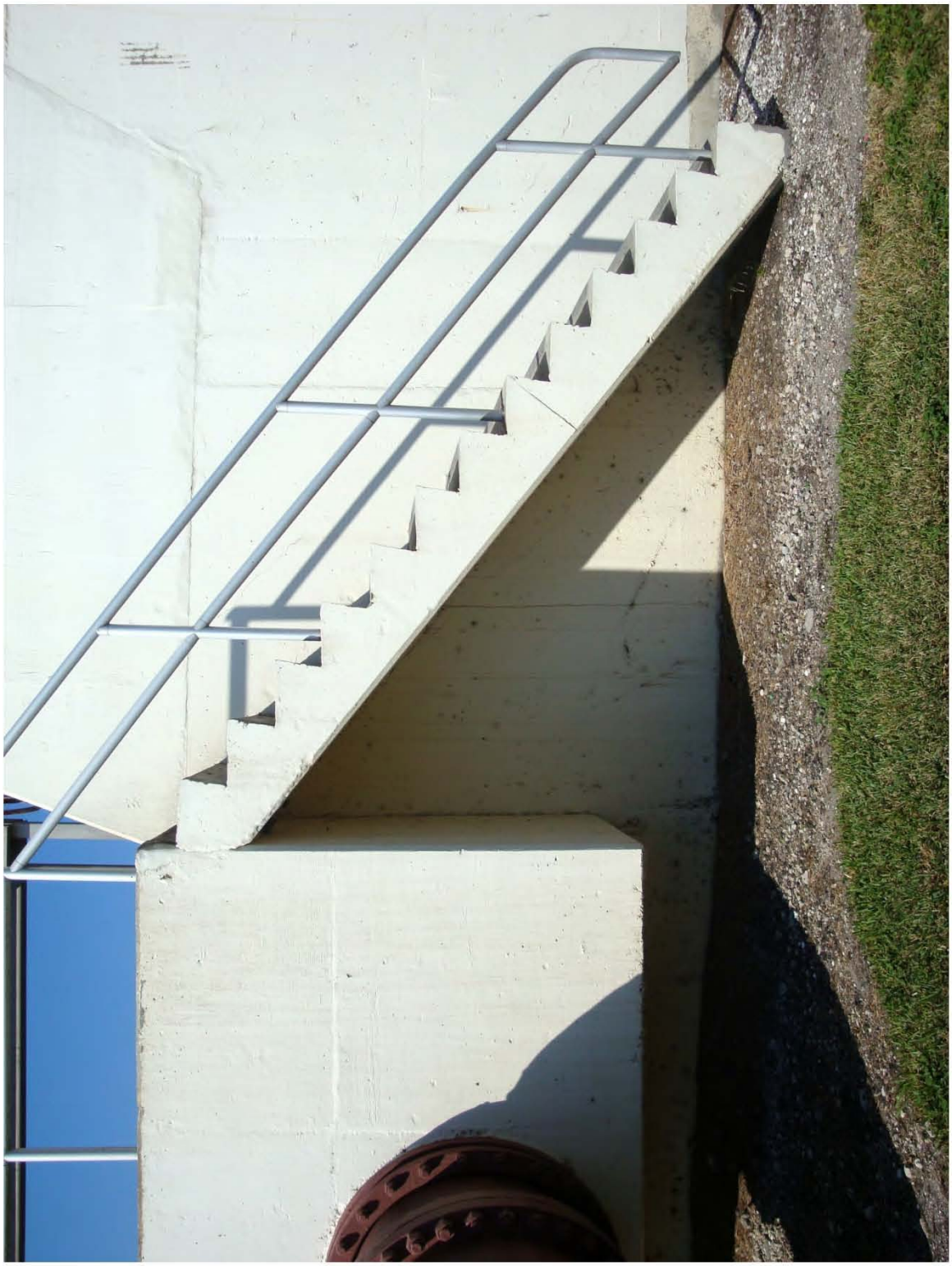


Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

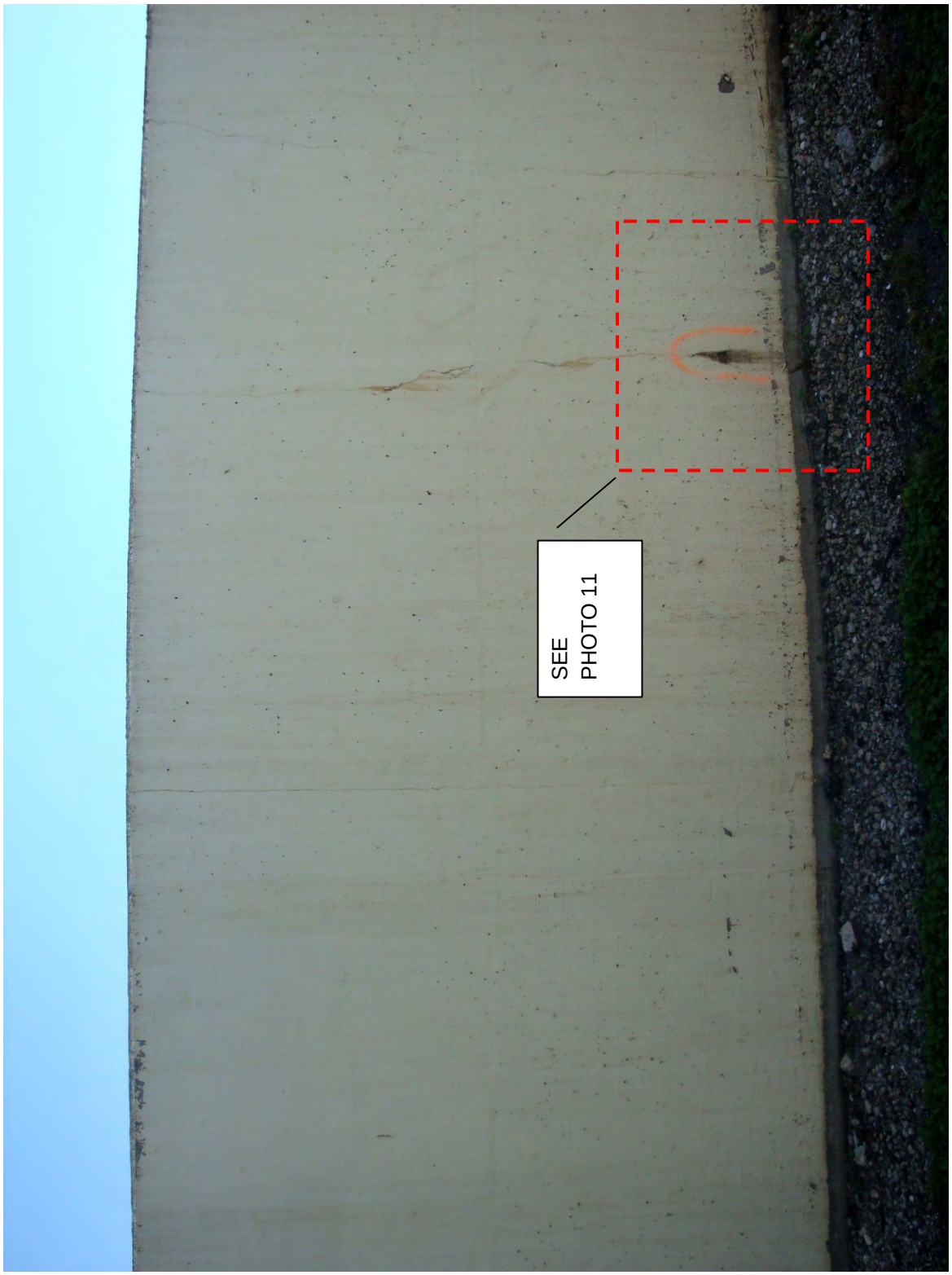


Photo 7

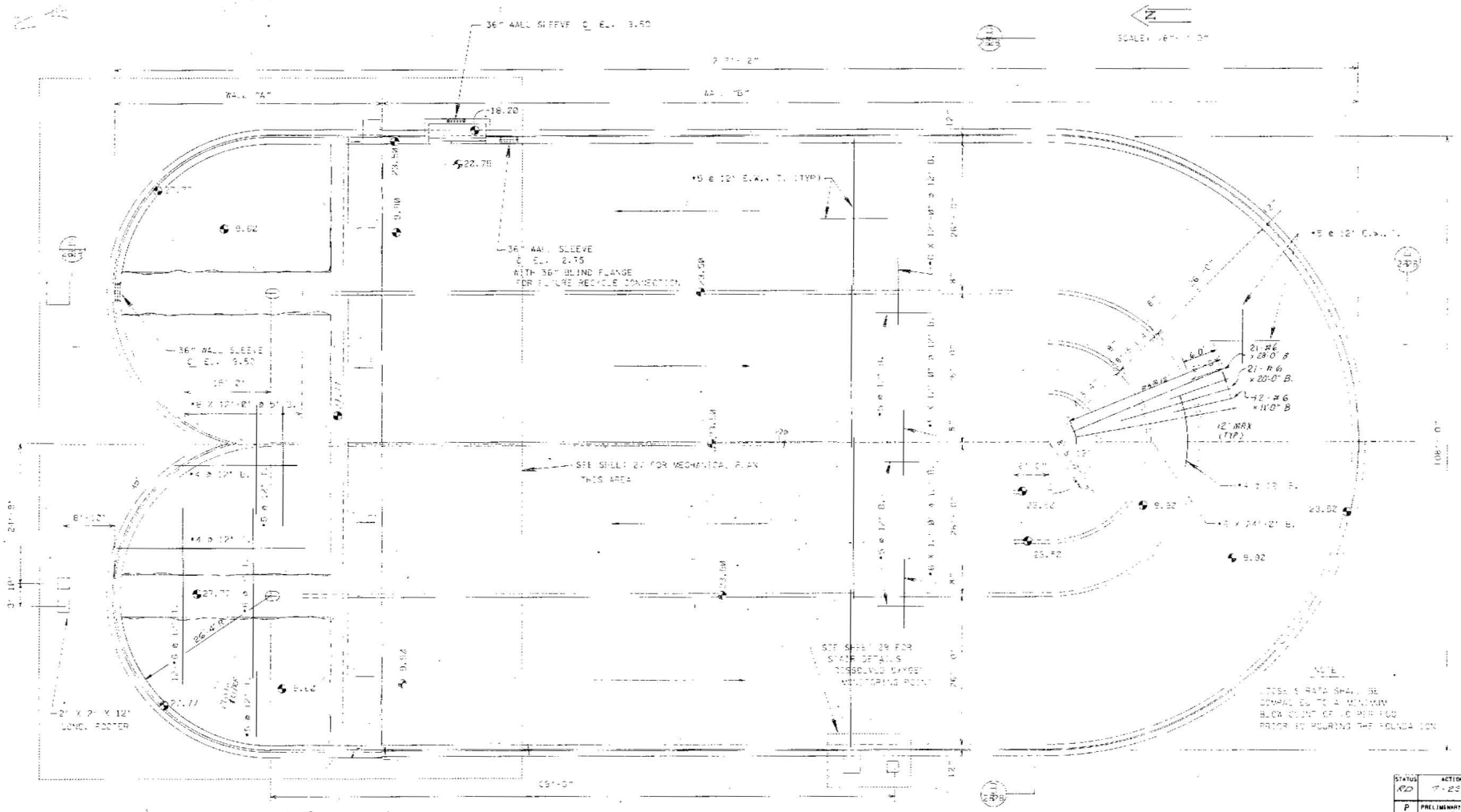
Photo 8

Photo 9

Photo 10

Photo 11

Appendix A – March 1985 Record Drawings by Briley, Wild & Associates



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E	FOR ESTIMATING ONLY
B	FOR BIDDING ONLY
O	RELEASED FOR CONSTRUCTION
R	REVISED DESTROY PREVIOUS PRINTS
H	PORTION(S) BEING HELD
A	APPROVAL
C	CHECK PRINT
RD	RECORD DRAWING

REV. NO.	DATE	REVISION	BY	CHECKED
2	7-23-85	INCORPORATED ADM #003	TWD	
1	5-8-85	REVISED TO RECORD DRAWINGS	KRM	

DESIGNED
DRAWN KRM
CHECKED

SUBMITTED: BRILEY, WILD & ASSOCIATES
PRINCIPAL
PROJECT ENGINEER
APPROVED

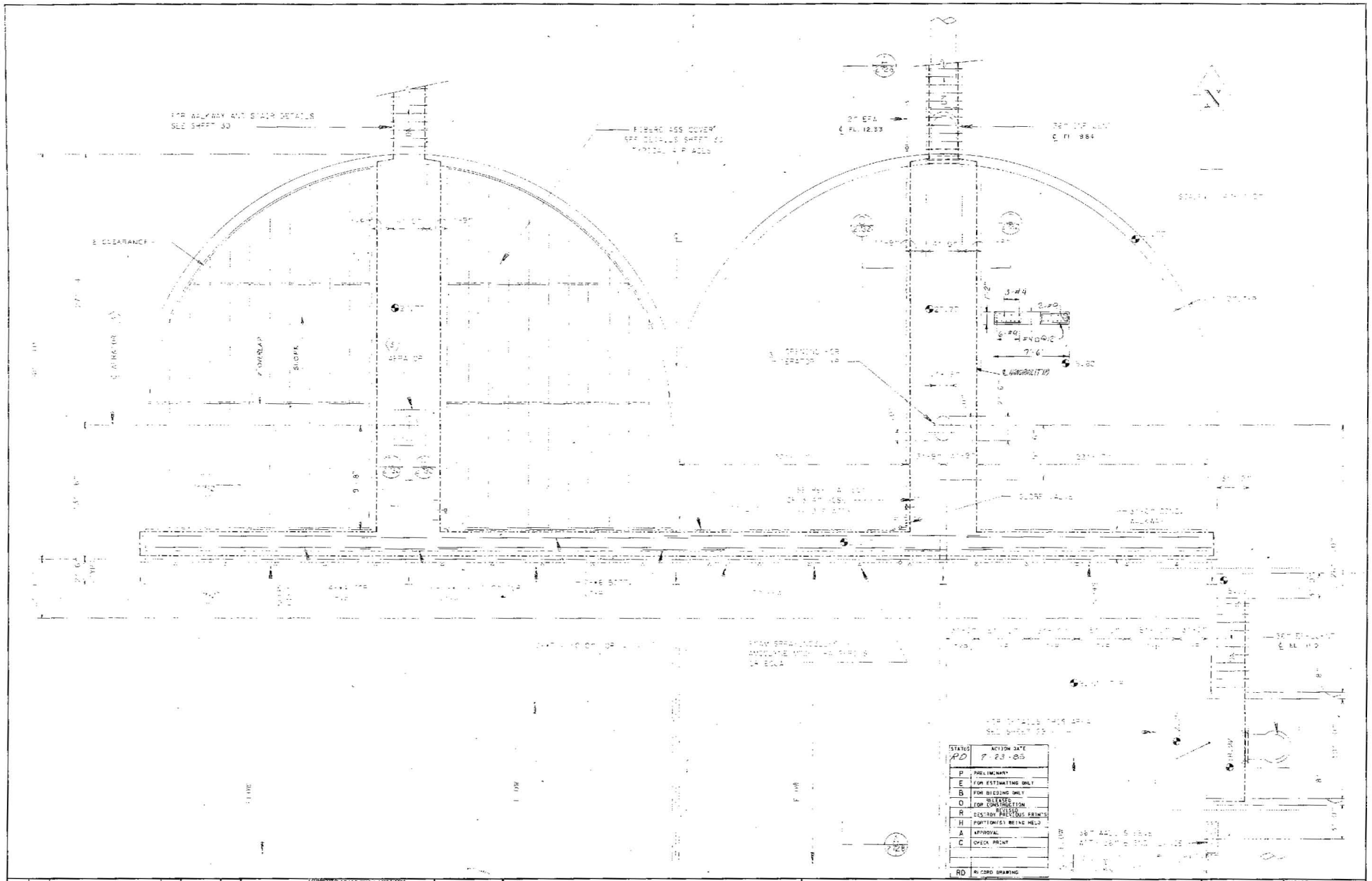
BWA Briley, Wild & Associates, Inc.
CONSULTING ENGINEERS
ORMOND BEACH, FLA. RIVIERA BEACH, FLA. CLEARWATER, FLA.

POLLUTION CONTROL FACILITY EXPANSION
OXIDATION DITCH - PLAN
BELLE GLADE, FLORIDA

DATE: NOV. 1982
SCALE: 1/8" = 1'-0"
SHEET NO. 26 OF 58

PROJ. NO. 81119-2
FILE NO. 10781

JAN 10 1983



REV. NO.	DATE	REVISION	BY	CHECKED
2	9-23-85	INCORPORATED ROW 003	TWD	
1	9-28-85	REVISED TO RECORD DRAWINGS	VRM	

DESIGNED
DRAWN RCH
CHECKED

SUBMITTED BY B.W.& ASSOCIATES
PRINCIPAL
PROJECT ENGINEER
APPROVED

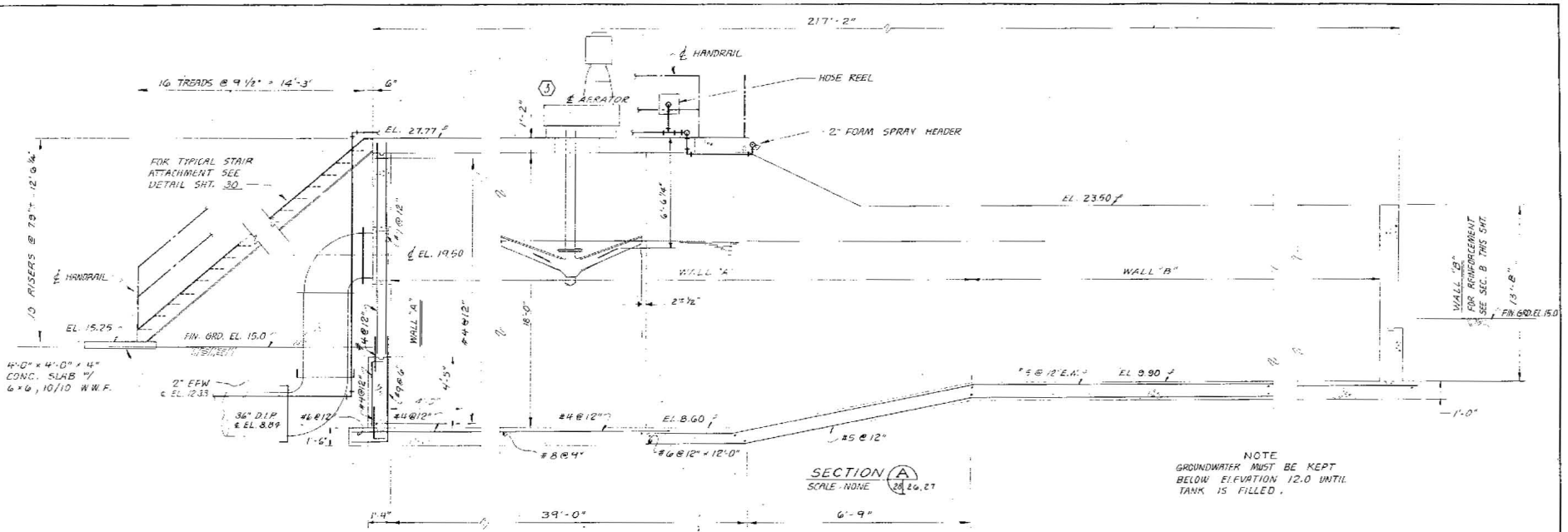
BWA Briley, Wild & Associates, Inc.
CONSULTING ENGINEERS
ORMOND BEACH, FLA. - RIVIERA BEACH, FLA - CLEARWATER, FLA.

POLLUTION CONTROL FACILITY EXPANSION
OXIDATION DITCH - PARTIAL PLAN
BELLE GLADE, FLORIDA

DATE: NOV. 1982
SCALE: 1/4"=1'-0"
SHEET NO. 27 OF 58

PROJ. NO. 81119-2
FILE NO. 10782

JAN 10 1992



SECTION (A)
SCALE: NONE
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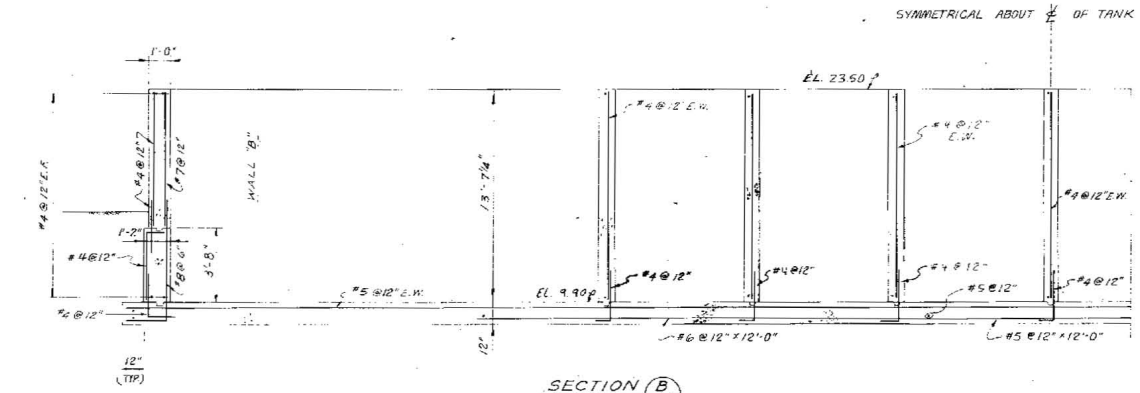
NOTE
GROUNDWATER MUST BE KEPT BELOW ELEVATION 12.0 UNTIL TANK IS FILLED.



SECTION (B)
SCALE: NONE
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E	FOR ESTIMATING ONLY
B	FOR BIDDING ONLY
O	RELEASED FOR CONSTRUCTION
R	REVISED DISTRIBUTE PRINTING PRINTS
H	PORTION(S) BEING HELD
A	APPROVAL
C	CHECK PRINT
RD	RECORD DRAWING

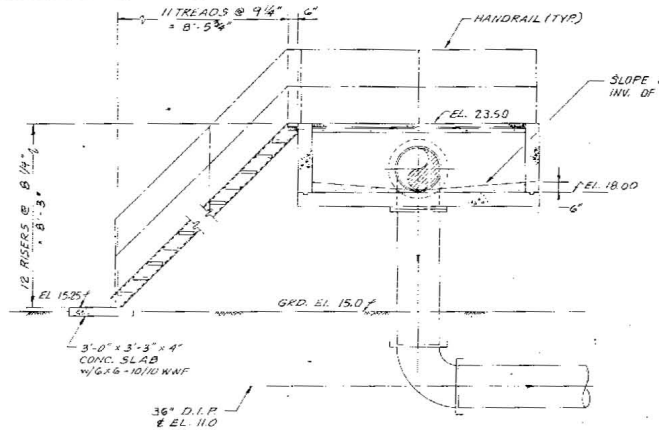
NO.	DATE	REVISION	BY	CHK'D
2	7-23-85	INCORPORATED DCN # 003	TWD	
1	12-13-83	PER DCN # 001	TWD	

DESIGNED
DRAWN
CHECKED
QUANTITIES
APPROVED

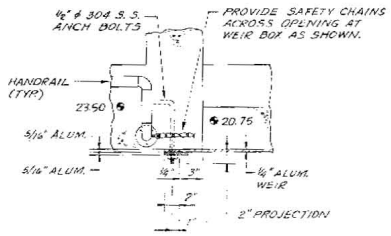
BWA Bailey, Wild & Associates, Inc
CONSULTING ENGINEERS
BRADENTON-CLEARWATER-ORMOND BEACH-RIVIERA BEACH, FLORIDA

POLLUTION CONTROL FACILITY EXPANSION
OXIDATION DITCH – SECTIONS
BELLE GLADE, FLORIDA

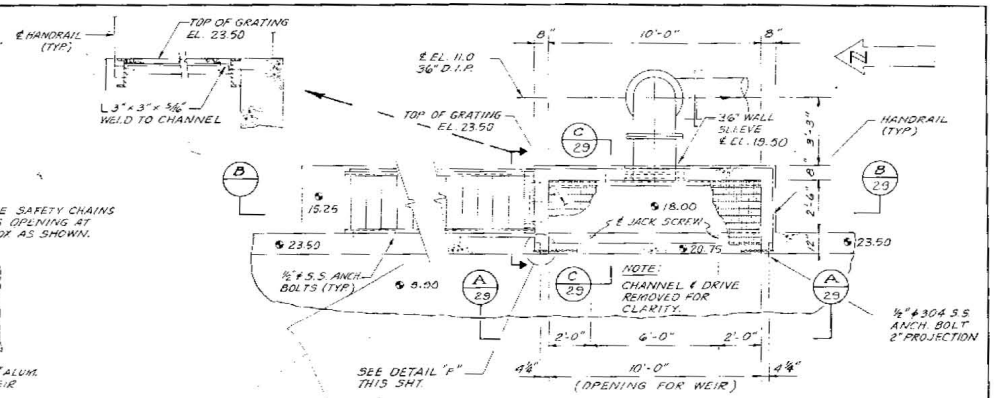
DATE NOV. 1982
SCALE AS SHOWN
SHEET NO. 28 OF 58
PROJ. NO. 81119-2
FILE NO. 10783 JAN 10 1986



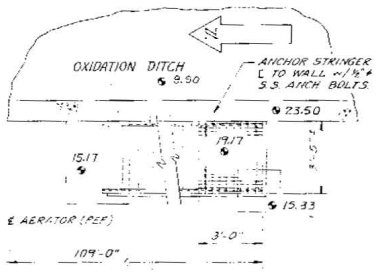
SECTION (B/29)



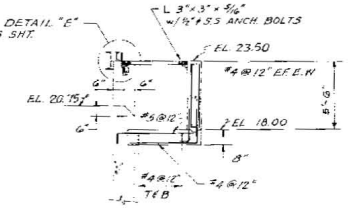
DETAIL "F"



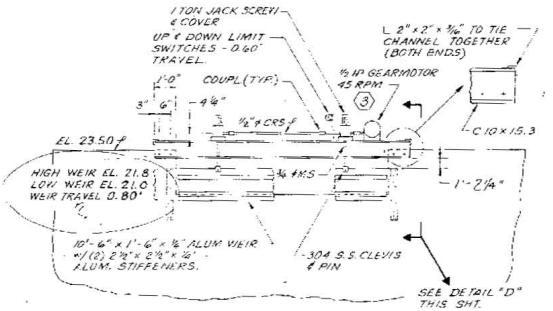
PARTIAL PLAN @ WEIR BOX



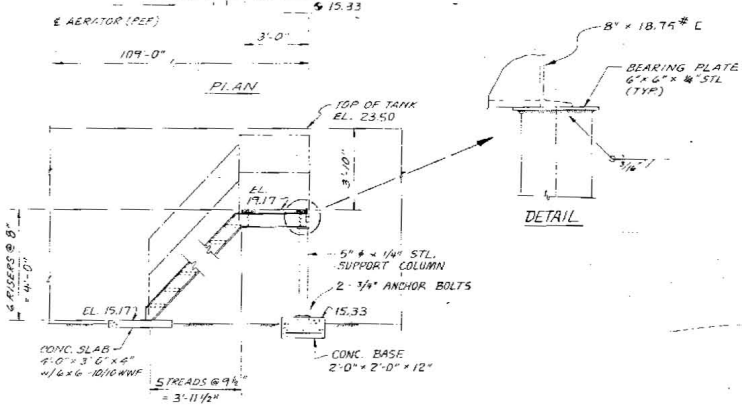
PLAN



SECTION (C/29)

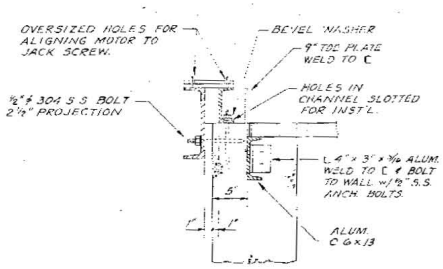


MOTORIZED WEIR ELEVATION (A/29)



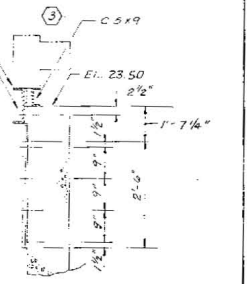
ELEVATION

D.O. MONITORING POINT - STAIR DETAIL



DETAIL "E"

STATUS	ACTION DATE
RD	7-23-85
P	PRELIMINARY
E	FOR ESTIMATING ONLY
B	FOR BIDDING ONLY
C	RELEASED FOR CONSTRUCTION
R	REVISED - DESTROY PRINTING PRINTS
H	PORTION(S) BEING HELD
A	APPROVAL
C	CHECK PRINT
RD	RECORD DRAWING



DETAIL "D"

REV. NO.	DATE	REVISION	BY	CHECKED
1	1-85	REVISED TO AS RECORD DRAWINGS		CJF

DESIGNED
DRAWN FRK
CHECKED CJF

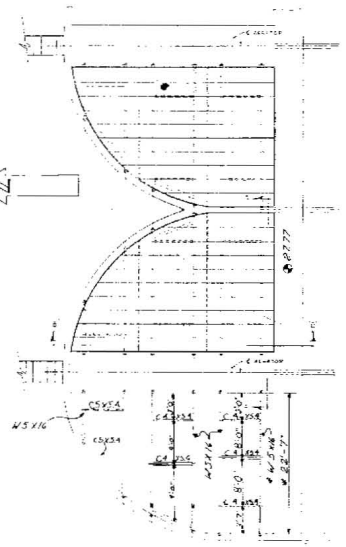
SUBMITTED BRILEY, WILD & ASSOCIATES
APPROVED

BWA Briley, Wild & Associates, Inc.
CONSULTING ENGINEERS & PLANNERS
BRADENTON-CLEARWATER-ORMOND BEACH-RIVIERA BEACH, FLORIDA

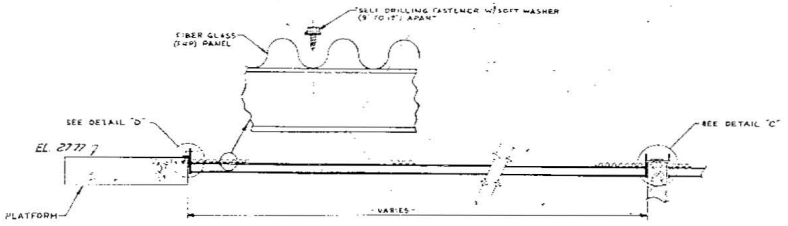
POLLUTION CONTROL FACILITY EXPANSION
OXIDATION DITCH - DETAILS
BELLE GLADE, FLORIDA

DATE NOV. 1982
SCALE NONE
SHEET NO. 29 OF 58

PROJECT NO. 81119-2
FILE NO. 10784 JAN 10



PLAN



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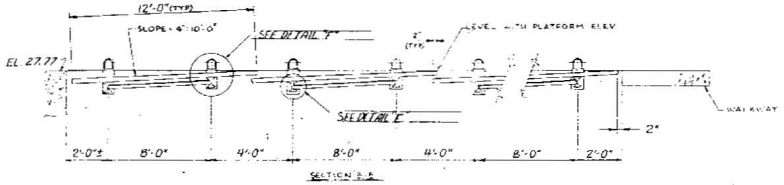

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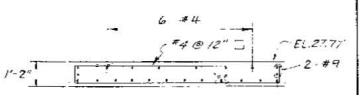
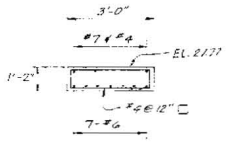


SECTION (C 27.77)
SCALE: NONE



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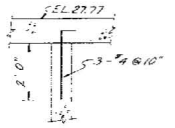

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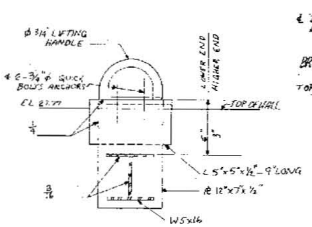

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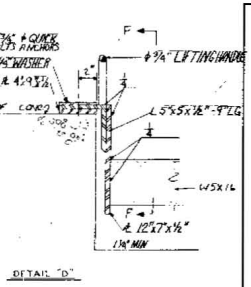

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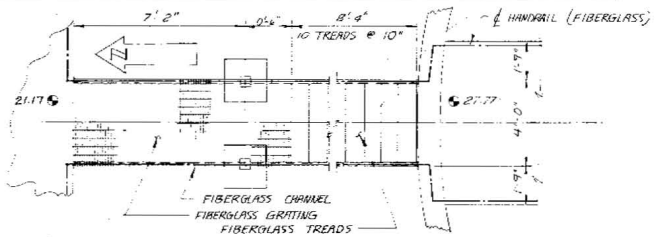
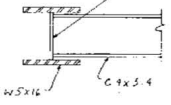


PLAN

FIBERGLASS COVER - DETAILS

SCALE : NONE



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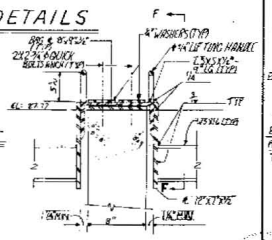

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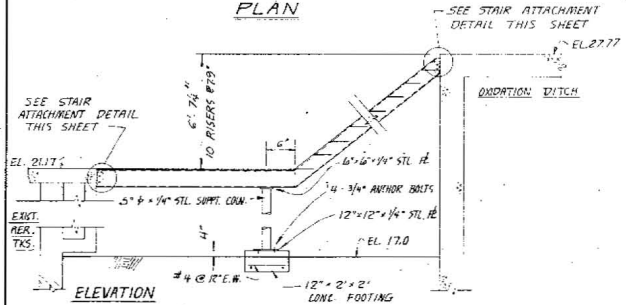
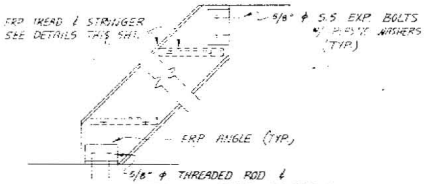


ELEVATION

WALKWAY & STAIR DETAIL SCALE: NONE

STATUS	ACTION DATE
ED	9: 23 :85
P	PRELIMINARY
E	FOR ESTIMATING ONLY
B	FOR BIDDING ONLY
O	FOR RELEASE FOR CONSTRUCTION
R	REVISED DESTROY PREVIOUS PRINTS
H	PORTION(S) BEING HELD
A	APPROVAL
C	CHECK PRINT
RD	RECORD DRAWING



STAIR ATTACHMENT DETAIL
SCALE : NONE

REV NO.	DATE	REVISION	BY	CHECKED
3	7-25-85	INCORPORATED BCM # 375	TWD	DESIGNED
2	7-29-85	INCORPORATED C.O. # 001	TWD	DRAWN
1	8-28-85	REVISED TO AS-BUILT DIMENSIONS	TWD	CHECKED

SUBMITTED: BRILEY, WILD & ASSOCIATES
APPROVED:

BWA Briley, Wild & Associates, Inc.
CONSULTING ENGINEERS & PLANNERS
BRADENTON-CLEARWATER-ORMOND BEACH-RIVIERA BEACH, FLORIDA

POLLUTION CONTROL FACILITY EXPANSION
OXIDATION DITCH - DETAILS
BELLE GLADE, FLORIDA

DATE: NOV. 1982
SCALE: AS SHOWN
SHEET NO. 30 OF 58

JOB NO. 81119-2
FILE NO. 10785
JAN 10 1992

A. CONCRETE CONSTRUCTION

1. ALL CONCRETE SHALL BE CLASS AA, HAVING A MINIMUM COMPRESSIVE STRENGTH OF 4000PSI AT THE END OF 28 DAYS, UNLESS OTHERWISE NOTED.
2. CONCRETE FILL TO BE CLASS B UNLESS OTHERWISE NOTED.
3. CONCRETE EXPOSED TO THE ELEMENTS SHALL BE AIR-ENTRAINED CONCRETE.
4. ALL CONCRETE CONSTRUCTION AND REINFORCING BAR DETAILS SHALL CONFORM TO THE LATEST A.C.I. CODE AND MANUAL.
5. ALL REINFORCING SHALL BE A615 GRADE 60 EXCEPT HOOPS AND STIRRUPS WHICH MAY BE A615 GRADE 40.
6. UNLESS OTHERWISE NOTED, CONTINUOUS REINFORCEMENT SHALL BE LAPPED 30 BAR DIAMETERS FOR NO. 8 BARS AND SMALLER, 35 DIAMETERS FOR NO. 9 BARS AND SPLICES OF ADJACENT BARS SHALL BE STAGGERED.
7. VERTICAL REINFORCEMENT IN COLUMN SPLICES SHALL BE LAPPED A MINIMUM OF 20 DIAMETERS.
8. SPACERS OR TIE BARS SHALL BE AS NOTED ON DRAWINGS OR A MINIMUM OF NO. 4 AT 16".
9. FOR BEAMS AND GIRDERS PROVIDE NO. 8 SPACER BARS AT 5'-0" ON CENTER WHERE TWO LAYERS OF REINFORCEMENT ARE USED.
10. FOR CONCRETE BEAMS AND GIRDERS DEEPER THAN 20 INCHES, THE CONTRACTOR SHALL PROVIDE CONTINUOUS NO. 5 TIE BARS AT 12 INCHES ON CENTERS ON EACH FACE, UNLESS OTHERWISE SHOWN.
11. UNLESS OTHERWISE NOTED, MAIN REINFORCING STEEL SHALL BE PLACED AND MAINTAINED AT THE MINIMUM CLEAR DISTANCES FROM SURFACE OF CONCRETE AS SHOWN IN TABLE BELOW. TIES, STIRRUPS AND SPACER BARS NO. 4 AND SMALLER ARE NOT CONSIDERED AS MAIN REINFORCING STEEL AND MAY PROJECT INTO THE MINIMUM CLEAR DISTANCES GIVEN.
12. ALL CONCRETE WALLS, SLABS AND BEAMS SHALL BE BUILT TO MINIMIZE THE EFFECT OF CONCRETE SHRINKAGE, BY PLACING ALTERNATING SECTIONS OR PLACING SLABS IN CHECKER BOARD STYLE. ALLOW SUFFICIENT CURING TIME FOR INITIAL CONCRETE SHRINKAGE BEFORE PLACING SKIPPED SECTIONS.
13. AT LEAST TWO HOURS SHALL ELAPSE AFTER DEPOSITING CONCRETE IN PIERS, WALLS AND COLUMNS BEFORE DEPOSITING IN BEAMS OR SLABS SUPPORTED THEREON.
14. CONSTRUCTION JOINTS SHALL BE LOCATED WHERE SHOWN ON THE DRAWINGS.
15. CONTRACTOR SHALL PROVIDE ALL OPENINGS REQUIRED BY EQUIPMENT AND PIPING WHETHER OR NOT INDICATED ON THE DRAWINGS.
16. WATERSTOPS SHALL BE PROVIDED IN ALL JOINTS WHETHER INDICATED OR NOT WHEN SUCH JOINTS SEPARATE A DRY STRUCTURE AND A SOURCE OF WATER (A TANK WHICH CAN BE EMPTIED SHALL BE CONSIDERED A DRY STRUCTURE) WATERSTOPS SHALL BE P.V.C. OF THE SIZE AND SHAPE INDICATED ON THIS SHEET.
17. EXPOSED CONCRETE EDGES SHALL HAVE A ¾" CHAMFER, SUCH AS COLUMNS, PILASTERS, BEAMS, CURBS AND EQUIPMENT PADS.
18. DOWELS TO BE SET IN EXISTING CONCRETE SHALL BE BONDED WITH EPOXY GROUT AS DETAILED ON THIS SHEET. THE EPOXY GROUT SHALL CONSIST OF EPOXY RESIN AND FEDERAL FINE SAND MIXED IN RATIO OF 1:1. THE EPOXY RESIN SHALL BE COLMA PATCHING COMPOUND AS MANUFACTURED BY SIKA CHEMICAL COMPANY, PERMAGILE AS MANUFACTURED BY THE PERMAGILE CORPORATION OF AMERICA OR APPROVED EQUAL.
19. ALL FOOTINGS AND SLABS ON SOIL SHALL BE PLACED ON UNDISTURBED SOIL OR ON FILL COMPACTED TO 95% DENSITY PER ASTM D-1557.
20. FOUNDATIONS ON SOIL ARE DESIGNED BASED ON A MAXIMUM ALLOWABLE SOIL BEARING VALUE OF 1.5 TONS PER SQ. FT.
21. THE CONTRACTOR SHALL PROVIDE SUPPORT FOR WALLS WITH FILL ON ONE SIDE BY SHORING OR PLACEMENT OF EARTH AS APPROVED BY THE ENGINEER UNTIL THE FLOOR SLAB IS IN PLACE. BACKFILL AGAINST CANTILEVER WALLS SHALL NOT BE PLACED UNTIL CONCRETE HAS GAINED ITS 28 DAY STRENGTH.
22. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT ALL STRUCTURES AGAINST FLOATATION DURING CONSTRUCTION. COMPLETED STRUCTURES HAVE BEEN DESIGNED AGAINST FLOATATION WITH BACKFILL IN PLACE.

B. CONCRETE EXCAVATION

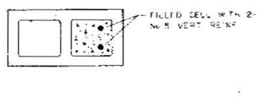
1. THE CONTRACTOR SHALL BE RESPONSIBLE, TO SATISFACTION OF THE ENGINEER, FOR TAKING ALL NECESSARY MEASURES TO PREVENT DAMAGE TO EXISTING STRUCTURES DURING CONCRETE EXCAVATION.
2. IN CUTTING AND CHIPPING OF EXISTING CONCRETE, THE CONTRACTOR SHALL REMOVE ANY REINFORCING OR OTHER EMBEDDED ITEMS WHICH CANNOT BE BENT INTO AREAS WHERE NEW CONCRETE WOULD FULLY COVER THEM.
3. THE CONTRACTOR SHALL PATCH AND FINISH, AFTER CONCRETE EXCAVATION, ALL EXPOSED SURFACES TO MATCH EXISTING AREAS TO A SATISFACTORY AND WORKMANLIKE MANNER.

C. STEEL CONSTRUCTION

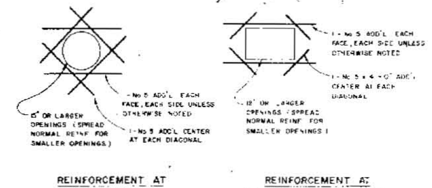
1. ALL STRUCTURAL STEEL SHALL BE ASTM-A36 AND SHALL BE DETAILED AND ERECTED IN ACCORDANCE WITH THE LATEST "A.I.S.C. MANUAL AND SPECIFICATIONS FOR BUILDING CONSTRUCTION".
2. SHOP AND FIELD WELDING SHALL BE IN ACCORDANCE WITH THE "CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION" OF THE AMERICAN WELDING SOCIETY.
3. SHOP CONNECTIONS, UNLESS NOTED SPECIFICALLY, SHALL BE MADE WITH ¾" DIAMETER (FRICTION TYPE) HIGH STRENGTH BOLTS, ¾" DIAMETER RIVETS OR BY WELDING. GIRTS SHALL BE CONNECTED WITH A MINIMUM OF TWO UNFINISHED BOLTS WITH SUITABLE LOCK WASHERS AND HEX NUTS.
4. FIELD CONNECTIONS, UNLESS NOTED SPECIFICALLY, SHALL BE MADE WITH ¾" FRICTION TYPE HIGH STRENGTH BOLTS A-325; BRACING AND BRIDGING MEMBERS MAY BE CONNECTED WITH UNFINISHED BOLTS, USING SUITABLE LOCK WASHERS.
5. ALL BRACING SHALL BE DETAILED TO AVOID ECCENTRIC CONNECTIONS.
6. THE CONTRACTOR SHALL FURNISH AND INSTALL ONE WASHER AND ONE HEX NUT WITH ALL ANCHOR BOLTS.
7. ELEVATIONS OF TOP OF STEEL NOTED ON THE DRAWINGS REFER TO TOP OF FLANGE.
8. PROVIDE TEMPORARY TIES AND BRACING WHERE NECESSARY DURING CONSTRUCTION, AND UNTIL THE BUILDING IS COMPLETED.

D. ALUMINUM CONSTRUCTION

1. STRUCTURAL ALUMINUM SHALL BE ALLOY 6061-T6 AND SHALL BE DETAILED AND FABRICATED IN ACCORDANCE WITH THE LATEST "SPECIFICATIONS FOR STRUCTURES OF ALUMINUM ALLOY 6061-T6" AS PUBLISHED BY A.S.C.E.
2. FIELD CONNECTIONS, UNLESS NOTED SPECIFICALLY, SHALL BE MADE WITH STAINLESS STEEL BOLTS AS NOTED ON THE DRAWINGS AND IN THE SPECIFICATION.
3. ALUMINUM IN CONTACT WITH CONCRETE SHALL BE PAINTED WITH ASPHALTIC VARNISH 15 MIL DRY FILM THICKNESS.



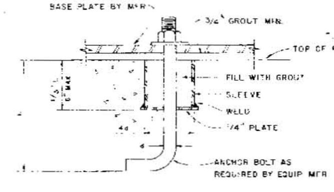
CONCRETE BLOCK DETAILS AT OPENINGS
SCALE: 1½" = 1'-0"



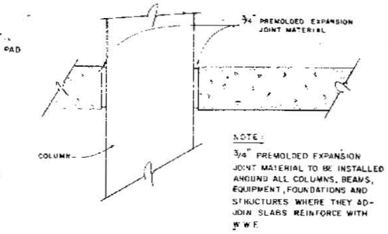
REINFORCEMENT AT ROUND OPENINGS
NO SCALE

REINFORCEMENT AT RECTANGULAR OPENINGS
NO SCALE

WALL PENETRATION DETAILS



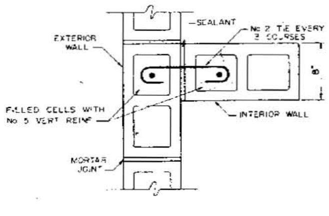
ANCHOR BOLT DETAIL
NO SCALE



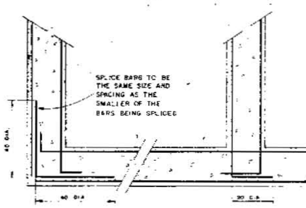
NOTE:
3/4" PREMOLDED EXPANSION JOINT MATERIAL TO BE INSTALLED AROUND ALL COLUMNS, BEAMS, EQUIPMENT, FOUNDATIONS AND STRUCTURES WHERE THEY ADJOIN SLABS. REINFORCE WITH W.W.F.

EXPANSION JOINT DETAIL
SCALE: 1½" = 1'-0"

STATUS	ACTION DATE
RO	3-28-85
P	PRELIMINARY
E	FOR ESTIMATING ONLY
B	FOR BIDDING ONLY
O	RELEASED FOR CONSTRUCTION
R	REVISED DESTROY PREVIOUS PRINTS
H	PORTION(S) BEING HELD
A	APPROVAL
C	CHECK PRINT
RO	RECORD DRAWING



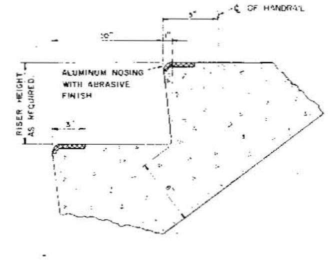
WALL INTERSECTION DETAIL
SCALE: 1½" = 1'-0"



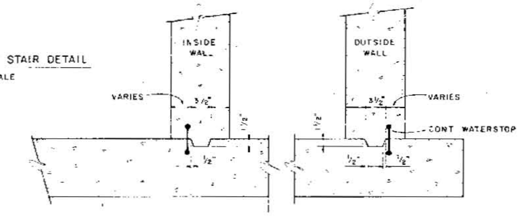
CORNER

INTERSECTION

WALL REINFORCING DETAIL
NO SCALE



TYPICAL CONCRETE STAIR DETAIL
NO SCALE

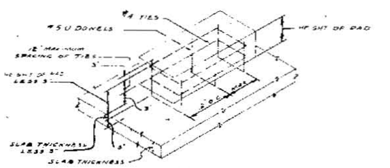


NOTES:
CONSTRUCTION JOINT CENTERED ON WALL
WATERSTOP SET TO OUTSIDE ON OUTSIDE WALLS & SET ON EITHER SIDE ON INSIDE WALLS

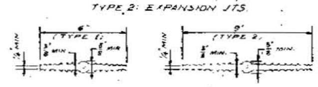
CONSTRUCTION JOINT & WATERSTOP DETAIL
NO SCALE

CLEAR CONCRETE COVER OVER REINFORCEMENT						
STRUCTURAL ELEMENT	EXPOSURE					
	AIR	WATER	SEWAGE	AIR OVER LIQUID	EARTH ON FORMED SURFACES	EARTH ON UNFORMED SURFACES
SLABS	3/4"	1"	2"	1½"	—	3"
BEAMS	1½"	2"	2"	1½"	2"	3"
COLUMNS	1½"	1½"	2"	1½"	1½"	3"
WALLS	1"	1½"	2"	1½"	1½"	3"
FOOTINGS	—	2"	—	—	2"	3"

TYPE 1: CONSTRUCTION & CONTROL JTS.
TYPE 2: EXPANSION JTS.

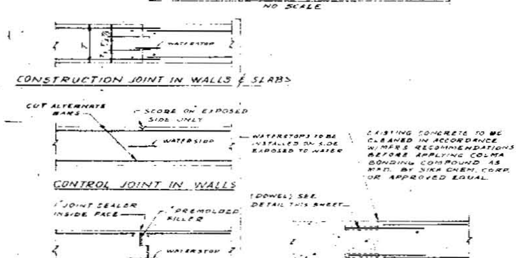


TYPICAL EQUIPMENT PAD DETAIL
NO SCALE



TYPICAL WATERSTOP DETAILS
NO SCALE

NOTE: ALL WATERSTOPS SHALL BE P.V.C. OF THE MULTI RIB TYPE W/CENTER BULB. DURING CONC. PLACEMENT W.S. SHALL BE SECURELY HELD IN PLACE TO PREVENT BENDING OR DISPLACEMENT BY WIRING TO REINF. OR OTHER ACCEPTABLE METHOD.



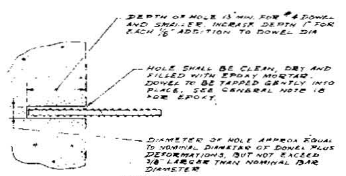
CONSTRUCTION JOINT IN WALLS & SLABS

CONTROL JOINT IN WALLS

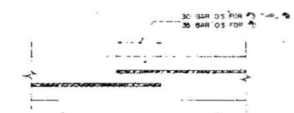
EXPANSION JOINT

DETAIL
BONDING TO EXIST. CONC.
NO SCALE

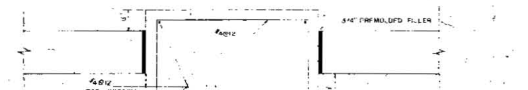
TYPICAL JOINT DETAILS
NO SCALE



DETAIL
DOWEL SET INTO EXIST. CONCRETE
NO SCALE



RE-BAR LAP
NO SCALE



HEAVY EQUIPMENT FOUNDATION
VIBRATION ISOLATION
SEISMIC
NO SCALE

RECORD DRAWING

REV. NO.	DATE	REVISION	BY
△	3-28-85	REVISED TO RECORD DRAWINGS	KRM

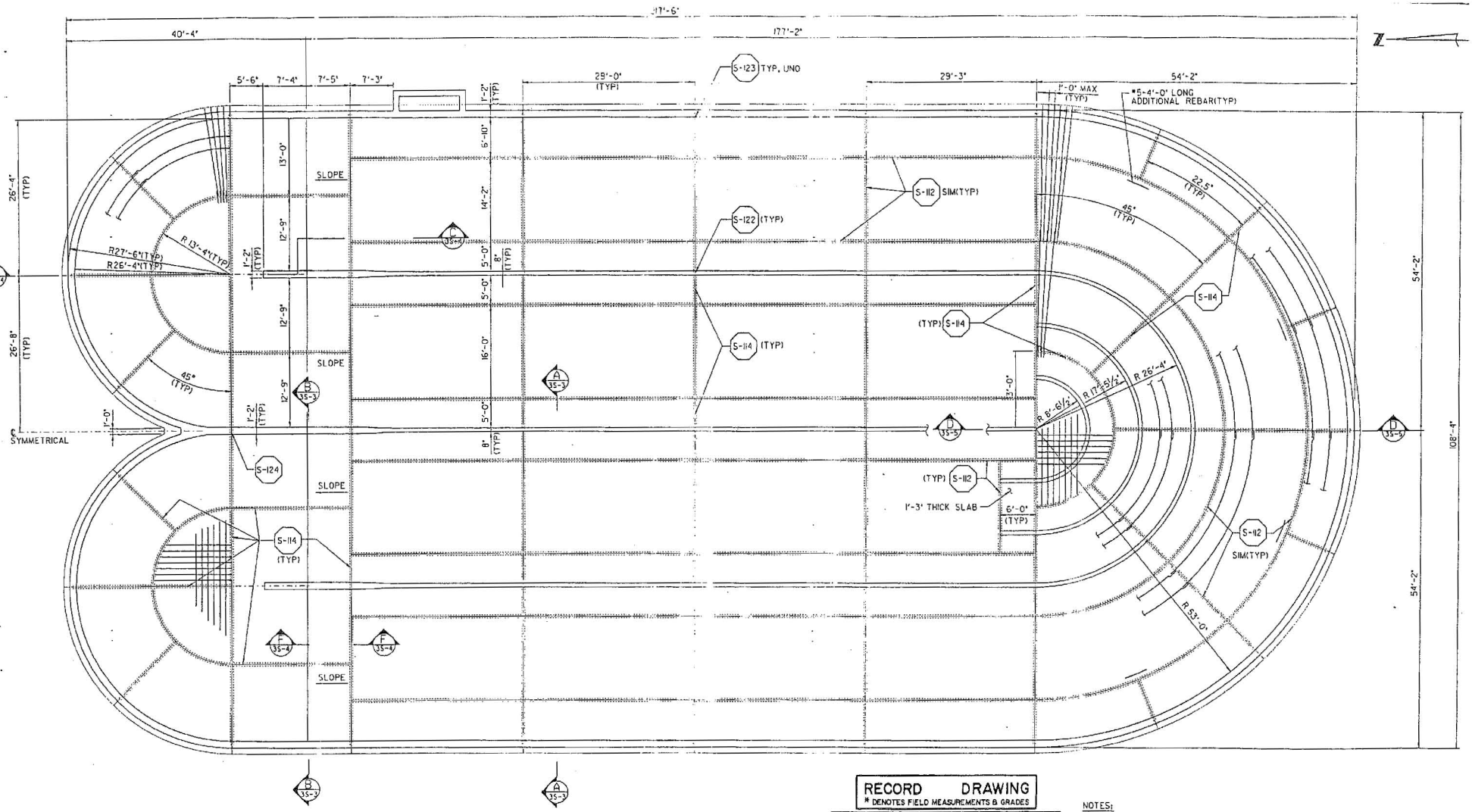
DESIGNED / DRAWN: RDW / CHECKED: GTK

BWA Briley, Wild & Associates, Inc.
CONSULTING ENGINEERS
ORMOND BEACH, FLA. • RIVIERA BEACH, FLA. • CLEARWATER, FLA.

POLLUTION CONTROL FACILITY EXPANSION
STANDARD STRUCTURAL DETAILS
BELLE GLADE, FLORIDA

DATE: NOV. 1982
SCALE: NONE
SHEET NO. 49 OF 58
PROJ. NO. 81119-2
FILE NO. 10804
JAN 10 1992

Appendix B – January 2000 Record Drawings by Montgomery Watson and Barker, OSHA & Anderson, Inc.



OXIDATION DITCH BOTTOM PLAN

RECORD DRAWING
* DENOTES FIELD MEASUREMENTS & GRADES

DATE	INITIAL		DATE	INITIAL	
12/99	ANA	IN PROGRESS	12/99	JDR	REVIEW
01/00	ANA	DRAFTING COMPLETED	01/00	JDR	APPROVED

THIS INFORMATION FOR THIS RECORD DRAWING WAS FURNISHED BY THE CONTRACTOR FOR THIS PROJECT IN ACCORDANCE WITH THE EXECUTED CONTRACT DOCUMENTS.

NAME OF CONTRACTOR: B.J. NICHOLS, INC.

DATE OF CONSTRUCTION: MARCH 1999 TO JANUARY 2000

THE RECORD DRAWING INFORMATION INDICATED ON THIS DRAWING IS CONSIDERED PRELIMINARY UNTIL THE ABOVE FOUR STEPS HAVE BEEN COMPLETED.

NOTES:

1. FOR INFORMATION ON EXCAVATION AND BACKFILLING AT THIS STRUCTURE, SEE ITEM 6A AND 6B OF CONTRACTOR NOTES ON SHEET C-1.

DATE	DESCRIPTION	BY
	REVISIONS	

WARNING
0 1/2 1"
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGN: D. WIDJAJA
DRAWN: A. BACHTIAR
CHECKED: D. WIDJAJA

MONTGOMERY WATSON
Lake Worth, Florida

SEAL

BARKER, OSHA & ANDERSON, INC.
PROFESSIONAL ENGINEERS
NORTH PALM BEACH, FLORIDA
MELBOURNE, FLORIDA

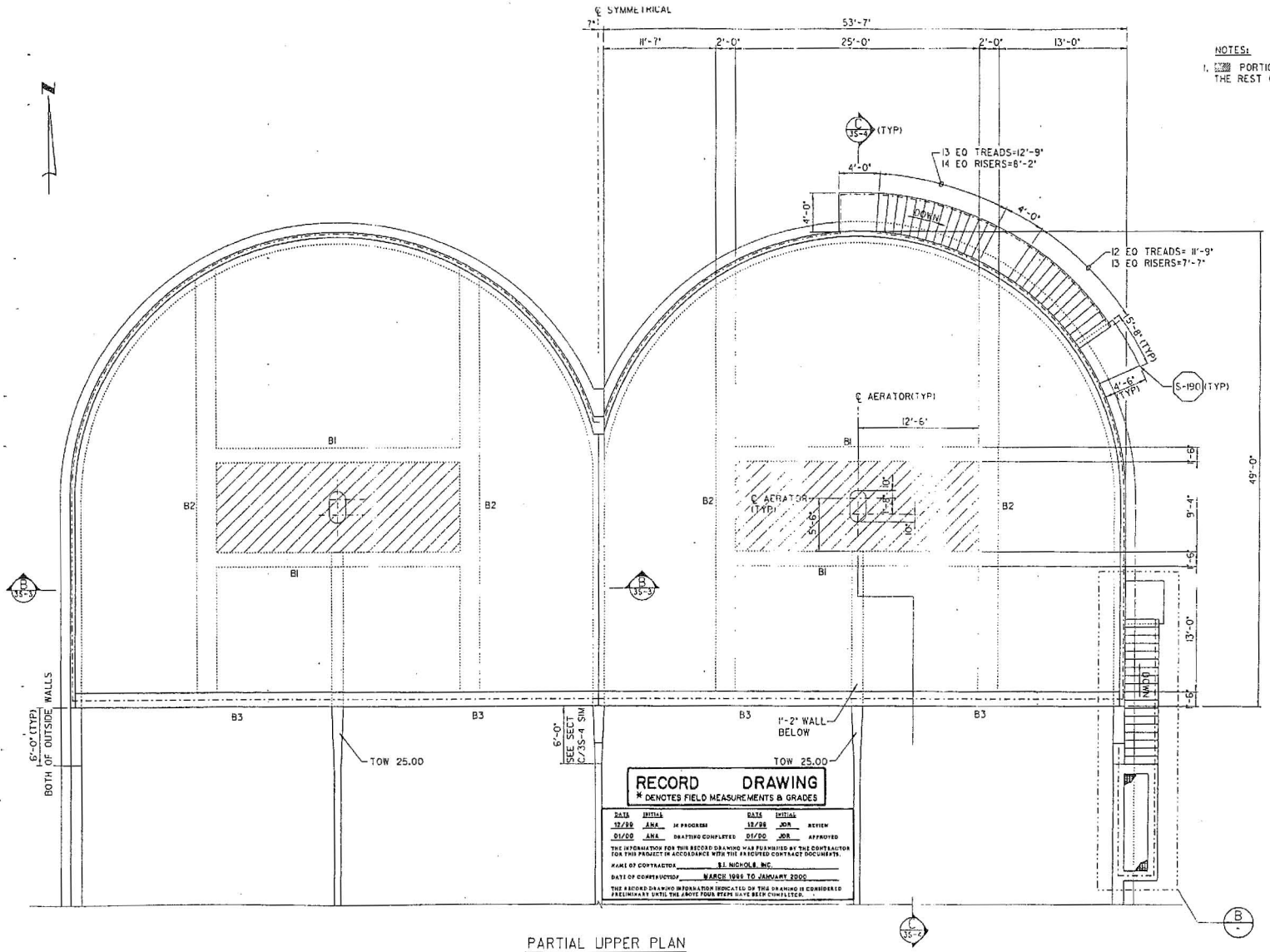
NOT TO BE USED FOR CONSTRUCTION UNTIL APPROVED
APPROVED
DATE: JULY, 1998

OXIDATION DITCH NO. 2: FOUNDATION AND FLOOR PLANS

WASTEWATER TREATMENT FACILITY EXPANSION AND IMPROVEMENTS FOR THE CITY OF BELLE GLADE, FLORIDA

PROJECT NO. 95-1044
SCALE 1/8"=1'
SHEET 3S-
OF 34
FILE NO. D-5265-0

JOB No. ____ FILE No. ?:\pro\belglade\wrtp\str\bm03s01.dgn Rev. Date 23-OCT-1997 8:51



NO.	DATE	DESCRIPTION	BY
1	9-97	REVISE SEC & ARROWS AS PER ADDENDUM NO.1	SEL

REVISIONS

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGN D. WIDJAJA
DRAWN A. BACHTIAR
CHECKED D. WIDJAJA

MONTGOMERY WATSON
Lake Worth, Florida

SEAL

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PROFESSIONAL ENGINEERS
NORTH PALM BEACH, FLORIDA
MELBOURNE, FLORIDA
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APPROVED
DATE JULY, 1998

OXIDATION DITCH NO. 2:
ROOF PLAN AND DETAIL

WASTEWATER TREATMENT FACILITY
EXPANSION AND IMPROVEMENTS
FOR THE
CITY OF BELLE GLADE, FLORIDA

PROJECT NO. 95-1044
SCALE AS NOTED
SHEET 3S-2
OF
FILE NO. D-5265-018

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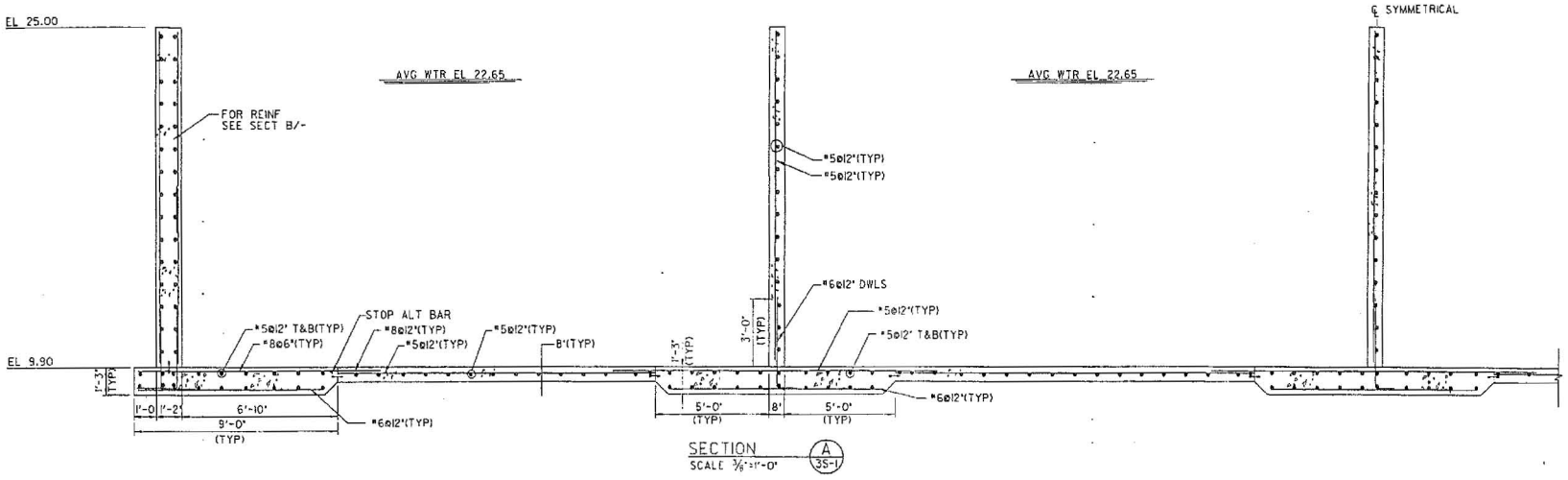

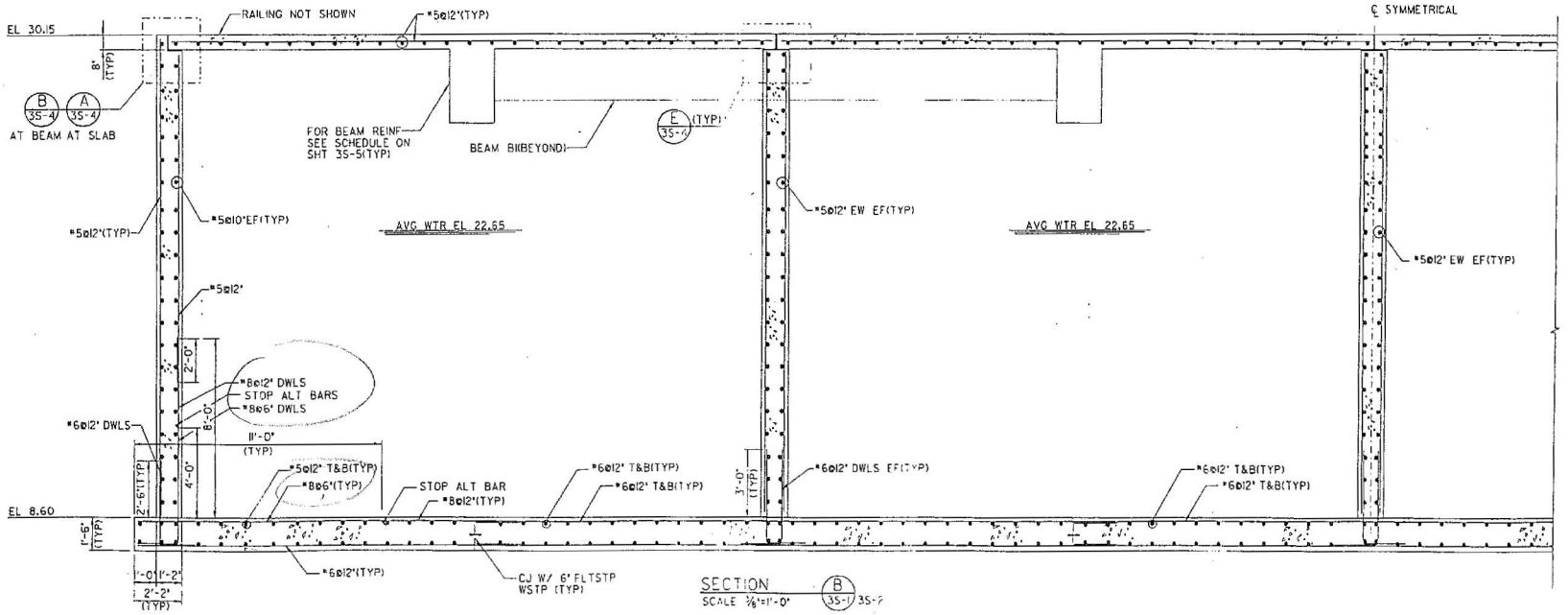

RECORD DRAWING
* DENOTES FIELD MEASUREMENTS & GRADES

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12/98	AMA	W PROCESS
01/00	AMA	DRAFTING COMPLETED
01/00	JDF	JDF
		APPROVED

THE INFORMATION FOR THIS RECORD DRAWING WAS FURNISHED BY THE CONTRACTOR AND THE ENGINEER ASSUMES NO RESPONSIBILITY FOR ITS ACCURACY

DATE	DESCRIPTION	BY
	REVISIONS	

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGN D. WIDJAJA
DRAWN A. BACHTIAR
CHECKED D. WIDJAJA

MONTGOMERY WATSON
Lake Worth, Florida

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NORTH PALM BEACH, FLORIDA
MELBOURNE, FLORIDA

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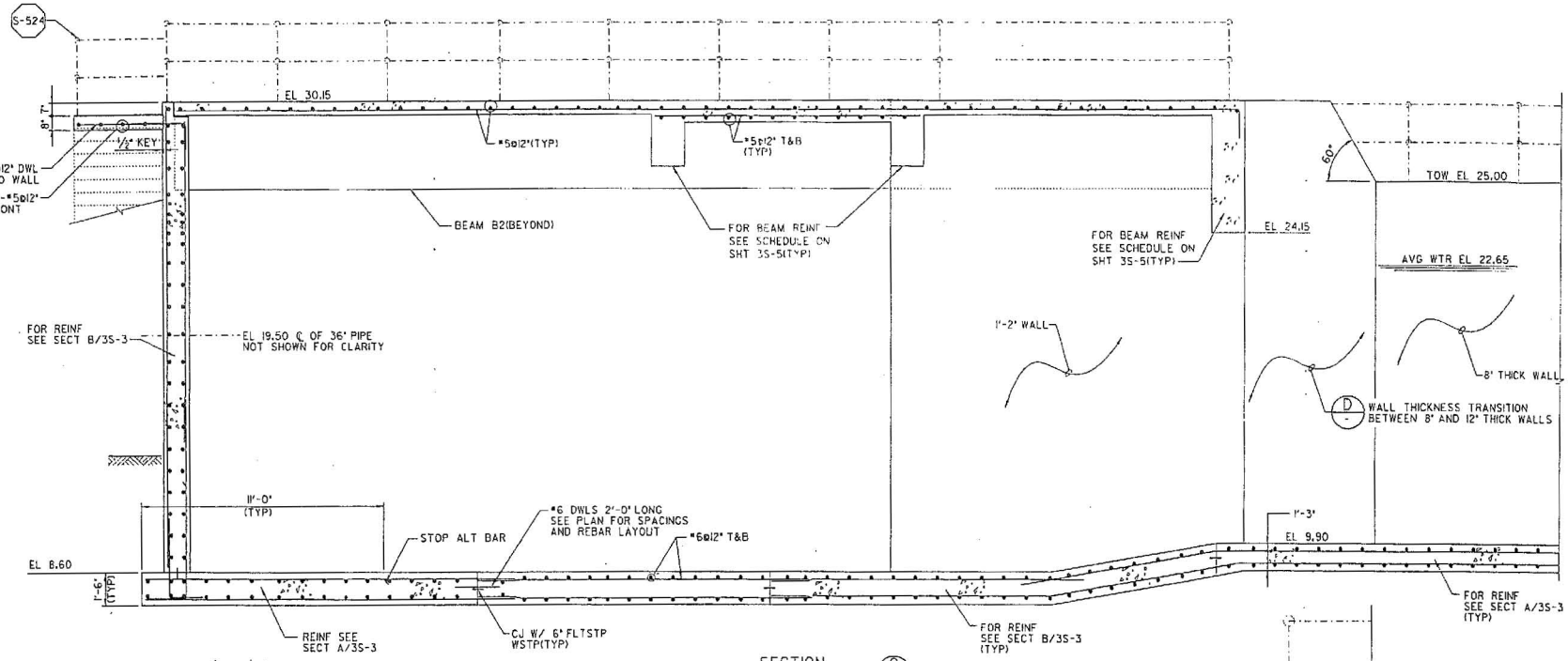
APPROVED
DATE JULY, 1998

OXIDATION DITCH NO. 2: SECTIONS

WASTEWATER TREATMENT FACILITY
EXPANSION AND IMPROVEMENTS
FOR THE
CITY OF BELLE GLADE, FLORIDA

PROJECT 95-
SCALE AS
SHEET OF 34
FILE NO. D-521

JOB No. FILE No. I:\src\fl\belglade\wwtp\str\be803s03.dgn Rev. Date 23-OCT-1997 09:51



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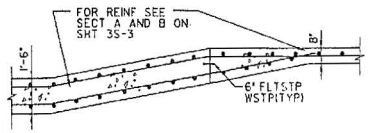

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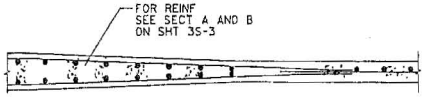

DETAIL D
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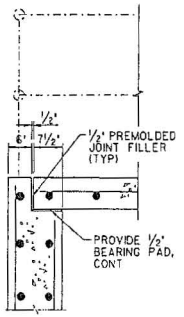

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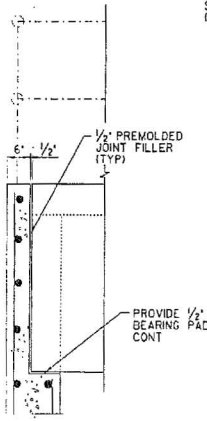

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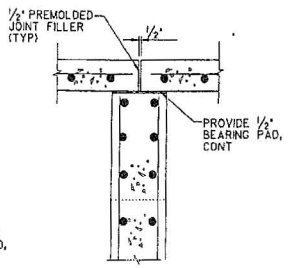

DETAIL E 3S-3 2S-2
SCALE 3/4"=1'-0"

DATE	INITIAL		DATE	INITIAL	
12/98	ANA	IN PROGRESS	12/98	JDR	REVIEW
01/00	ANA	DRAFTING COMPLETED	01/00	JDR	APPROVED

THE INFORMATION FOR THIS RECORD DRAWING WAS FURNISHED BY THE CONTRACTOR FOR THIS PROJECT IN ACCORDANCE WITH THE EXECUTED CONTRACT DOCUMENTS.

NAME OF CONTRACTOR: B.I. NICHOLS, INC.

DATE OF CONTRACTION: MARCH 1999 TO JANUARY 2000

THE RECORD DRAWING INFORMATION INDICATED ON THIS DRAWING IS CONSIDERED PRELIMINARY UNTIL THE ABOVE FOUR ITEMS HAVE BEEN COMPLETED.

RECORD DRAWING
* DENOTES FIELD MEASUREMENTS & GRADES

DATE	DESCRIPTION	BY
	REVISIONS	

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGN: D. WIDJAJA
DRAWN: A. BACHTIAR
CHECKED: D. WIDJAJA

MONTGOMERY WATSON
Lake Worth, Florida

SEAL

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MELBOURNE, FLORIDA
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APPROVED
DATE JULY, 1998

OXIDATION DITCH NO. 2: SECTIONS AND DETAILS-I

WASTEWATER TREATMENT FACILITY EXPANSION AND IMPROVEMENTS FOR THE CITY OF BELLE GLADE, FLORIDA

PROJECT NO. 95-1044
SCALE AS NOTED
SHEET 3S-4 OF 34
FILE NO. D-5265-018

JOB No. _____ FILE No. h:\proj\belglade\wwtp\str\bd03s04.dgn Rev. Date 23-OCT-1997 09:51

Appendix C – Structural Strengthening

One option currently being evaluated is to increase the plant capacity to 16.9 mgd. This will require raising the perimeter walls of Oxidation Ditch No.1 by 18-inches to elevation 25.00 ft. to accommodate a maximum fluid elevation of 23.06 ft.

As explained in Section 4.0 of this report, there is a structural deficiency in the load resisting capacity of the existing base slab. The existing slab is currently under-reinforced which forces the top reinforcement steel to yield and allow rotation of the base slab about the inside face of the perimeter wall. This rotation induces a high bearing pressure on the soil under the toe. Figures C-4 through C-7 show the finite element model of the structure and results of the model.

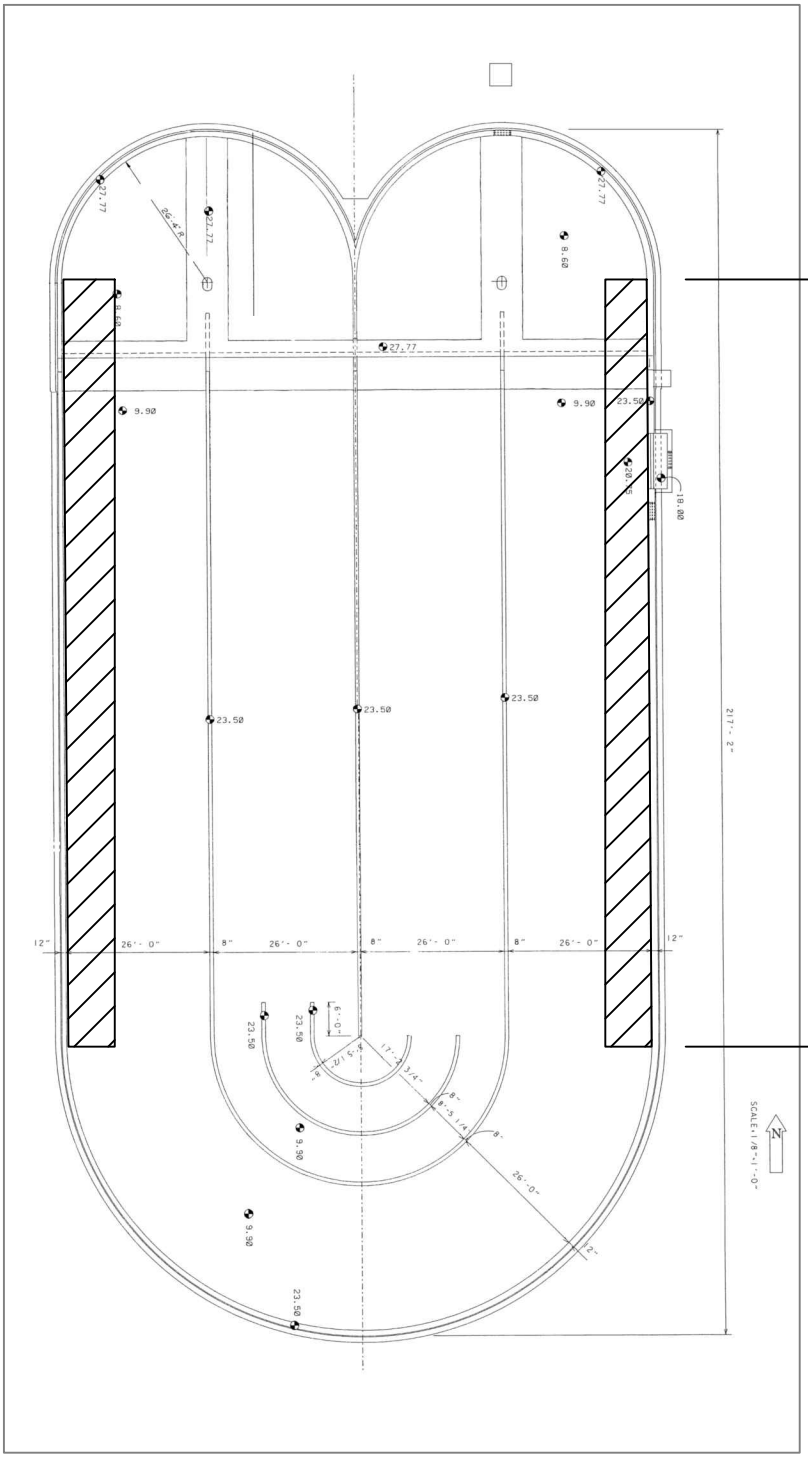
The existing base slab will be required to be strengthened to resist bending stresses transferred from the perimeter walls to minimize rotation of the base slab and limit soil bearing pressures under the toe of the base slab. Figures C-1 and C-2 show the proposed strengthening method.

It should be noted that record drawings by Briley, wild & Associates do not fully detail the connection of the base slab and the perimeter wall. A 6-inch PVC waterstop is depicted at this connection on Sheet 49. In addition, 2-inch concrete cover is required over the base slab top reinforcement steel per “Clear Cover Over Reinforcing” table on Sheet 49. These requirements cause a conflict between the PVC waterstop and the top reinforcement steel of the base slab. To avoid this conflict three possible scenarios would have been employed in the field. All three scenarios would further decrease the bending stress capacity of the base slab at the joint location. The three scenarios are shown in Figure C3.

Table T-1 below tabulates the design parameters, assumptions, applied loads, existing load carrying capacity of the wall and base slab and the strengthened load carrying capacity of the base slab.

Table T-1	
Concrete Strength	4,000 psi
Steel Yield Strength	60,000 psi
Fluid Density (assumed)	63 pcf
Load factors	ACI 350-06, Appendix C
Applied Maximum Moment from Fluid at Current Max Operating Level El 22.65 (LF 1.3 x 1.7)	48.10 kip-ft
Applied Maximum Moment from Fluid at Elevation 23.50, Top of existing wall height (LF 1.7)	44.90 kip-ft
Applied Moment from Fluid at Proposed Max Operating Level El 23.06 (LF 1.3 x 1.7)	52.89 kip-ft
Applied Moment from Fluid at Elevation 25.00, Top of proposed wall height (LF 1.7)	61.46 kip-ft
Capacity of Existing Wall at Base	73.50 kip-ft
Capacity of Existing Slab at critical section	13.20 kip-ft
Capacity of proposed strengthened slab at critical section	74.37 kip-ft

Note: Resisting load from exterior grade is neglected.



EXTENTS OF STRUCTURAL STRENGTHENING

SCALE: NONE

NOTE:
BASE DRAWING INFORMATION IS TAKEN FROM RECORD DRAWINGS BY BRILEY, WILD & ASSOCIATES, INC DATED MARCH 1985.

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ORLANDO, FLORIDA 32801
PHONE (407) 425-1100

CERTIFICATE OF AUTHORIZATION NO. EB 8115

GLADES UTILITY AUTHORITY
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C1

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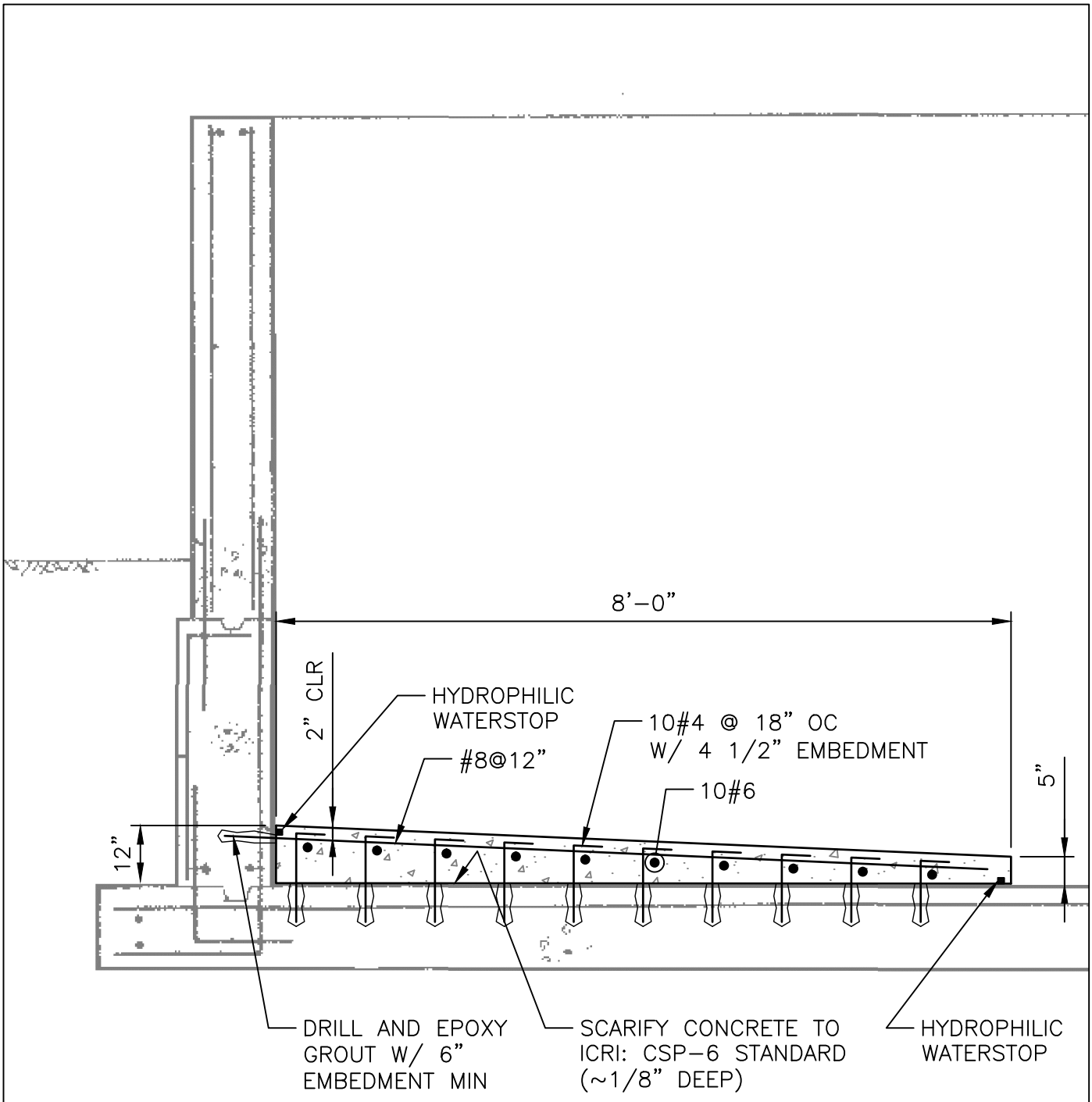

WALL SECTION

SCALE: NONE

NOTE:
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BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C2

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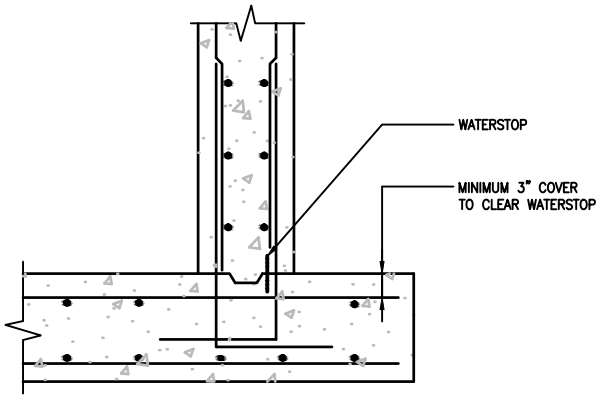

INCREASED CLEAR COVER FOR TOP REINF.

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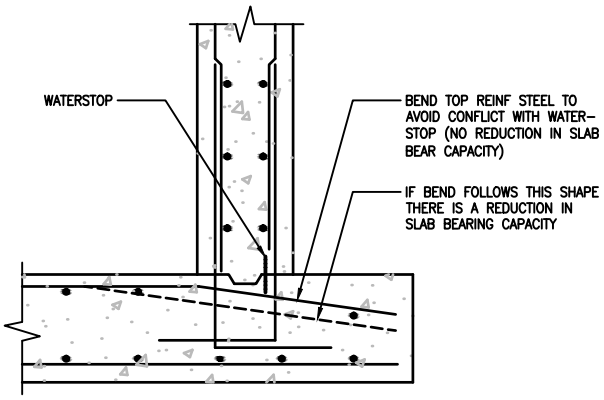

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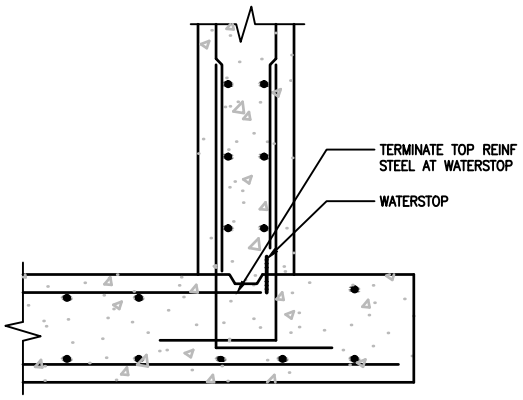

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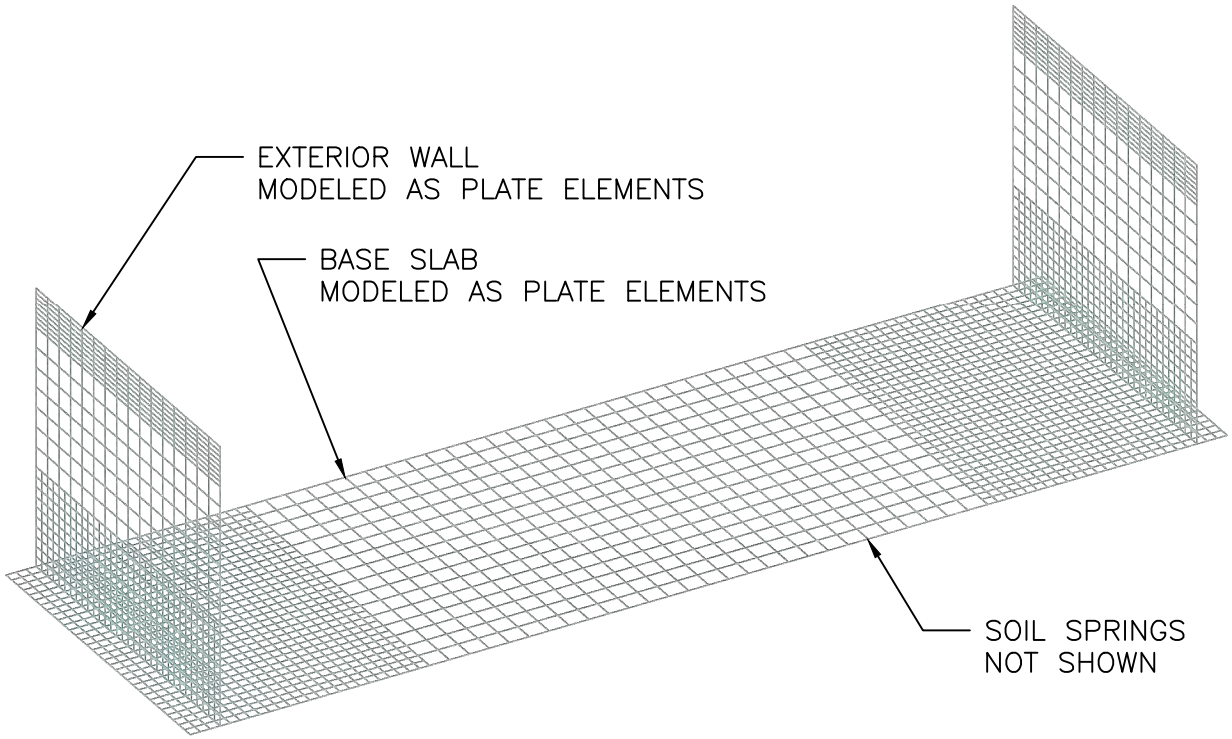
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C3



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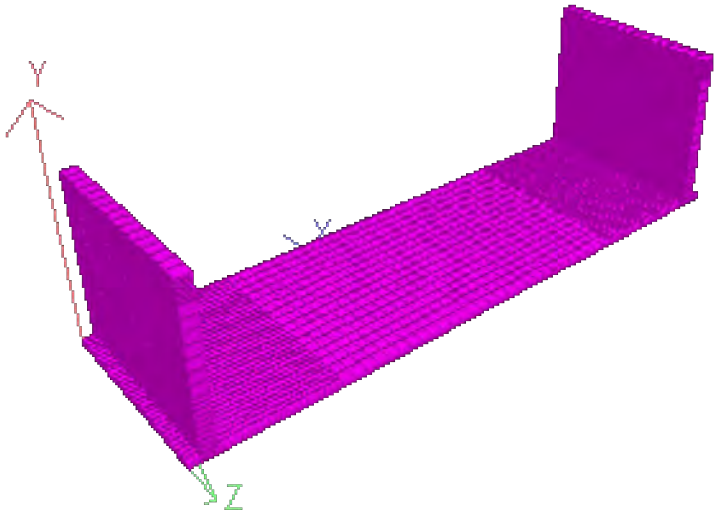

3D RENDERING

SCALE: NONE

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GLADES UTILITY AUTHORITY
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C4

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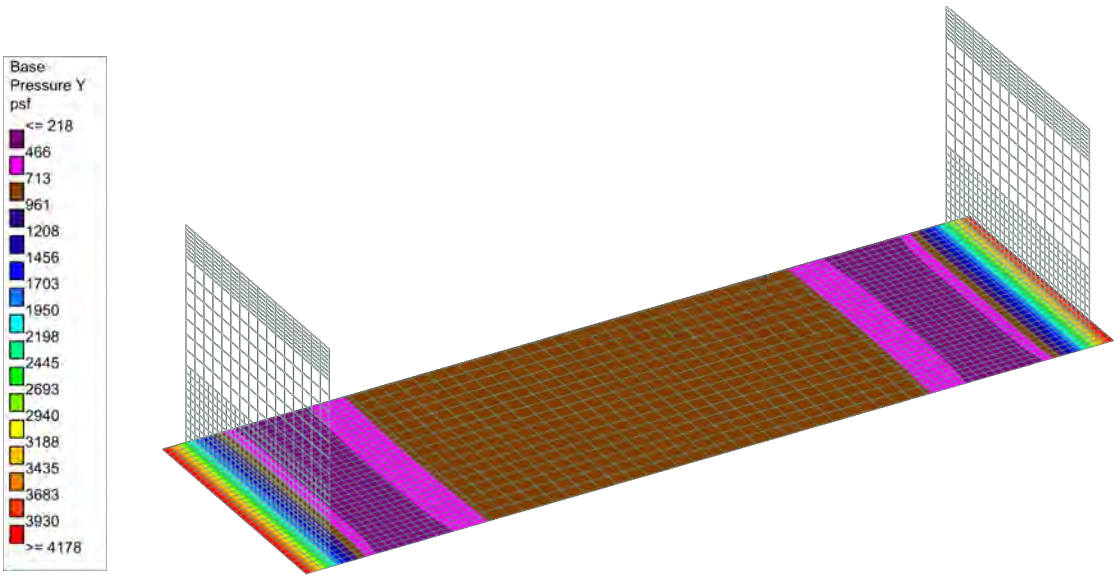

WATER LEVEL AT TOP OF WALL

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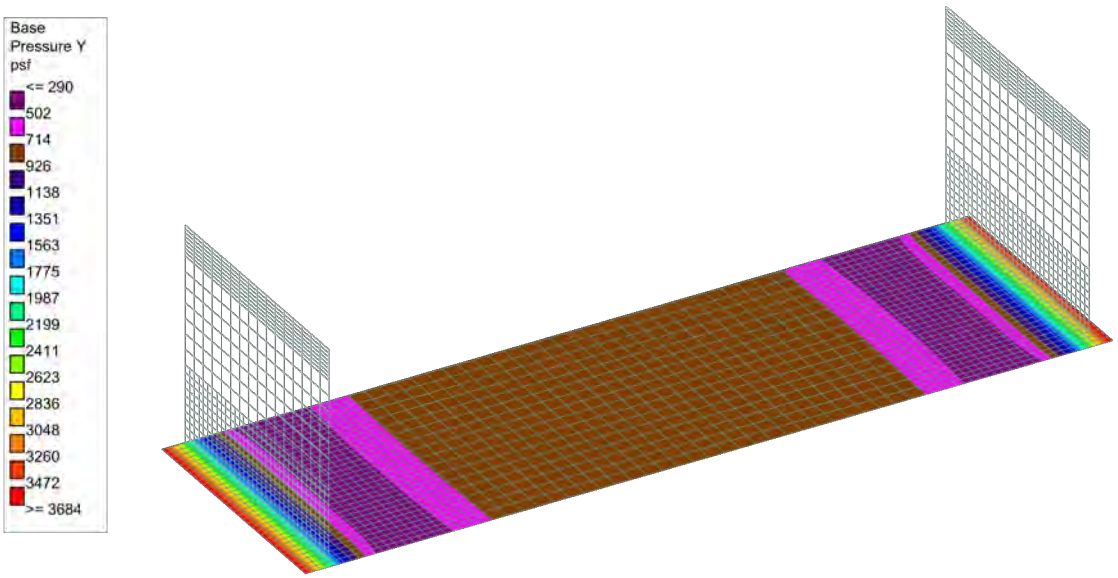

OPERATING LEVEL

SCALE: NONE

NOTE:
BASE PRESSURES CALCULATED FOR EXISTING WALL HEIGHT AND SLAB CONDITIONS.

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SUITE 200
ORLANDO, FLORIDA 32801
PHONE (407) 425-1100

CERTIFICATE OF AUTHORIZATION NO. EB 8115

GLADES UTILITY AUTHORITY
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C5

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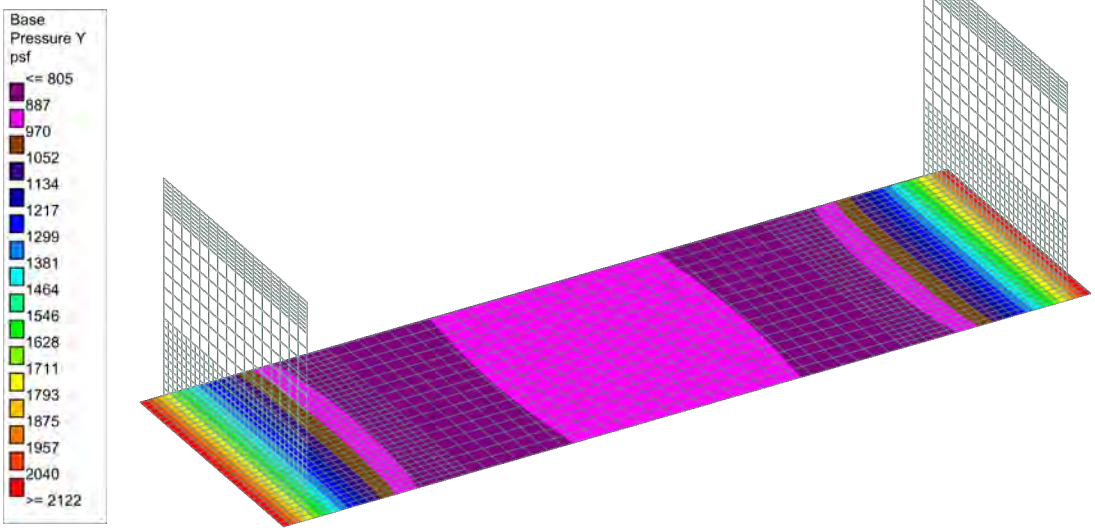

WATER LEVEL AT TOP OF WALL

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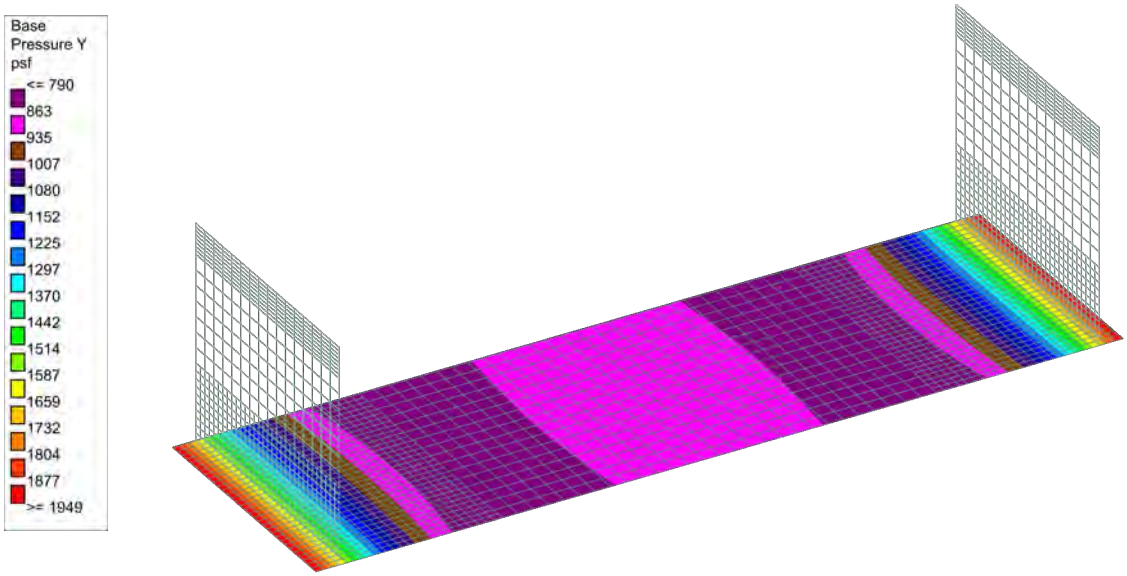

OPERATING LEVEL

SCALE: NONE

NOTE:
BASE PRESSURES CALCULATED FOR EXISTING WALL HEIGHT AND STRENGTHENED SLAB CONDITIONS.

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GLADES UTILITY AUTHORITY
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C6

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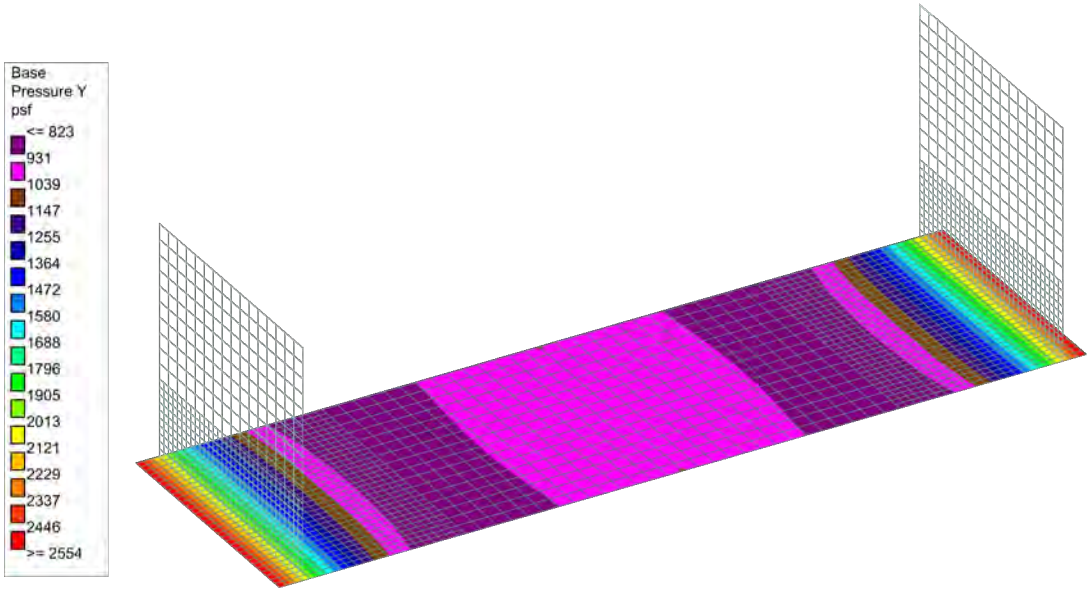

WATER LEVEL AT TOP OF WALL

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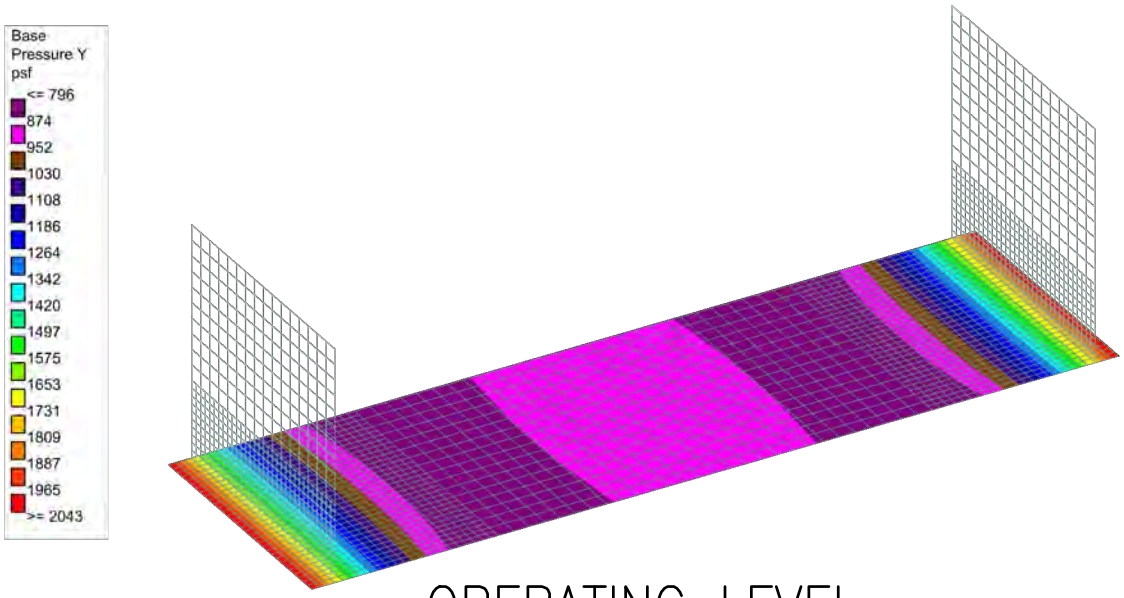

OPERATING LEVEL

SCALE: NONE

NOTE:
BASE PRESSURES CALCULATED FOR PROPOSED WALL HEIGHT AND STRENGTHENED SLAB CONDITIONS.

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CERTIFICATE OF AUTHORIZATION NO. EB 8115

GLADES UTILITY AUTHORITY
BELLE GLADE WASTEWATER TREATMENT PLANT

OXIDATION DITCH NO. 1
STRUCTURAL STRENGTHENING

AECOM PROJECT NO.
60185970

FIGURE
C7

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APPENDIX 2-3
Florida Bearings Report on Belle Glade WWTF

Florida Bearings

A KAMAN COMPANY

www.floridabearings.com

Thermography Inspection at

Belle Glade Waste Water Treatment Facility

2055 West Canal St.

5/4/2013

By

Ray Gretzinger

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Summary of Inspection

This is a report of a Thermographic survey of the electrical equipment in you facility. Below is a list of items inspected separated by location and equipment. Below this section you will find the faults that were found. These faults were found using these guidelines:

0 – 30 Degree F Rise: Risk Factor = Very Minor
31 – 99 Degree F Rise: Risk Factor = Schedule Repair When Convenient
100 + Degree F Rise: Risk Factor = Critical-Repair ASAP!

Lift Station 1	Pump #1
	Pump#2

Thicker Drum	Thickener Drum #2
	Thickener Drum #1
	Thickened Sludge Pump #2
	Thickened Sludge Pump #1

MCC3	Ditch 1 Aerator 1
	Ditch 1 Aerator 2

MCC1	Grit Separator #1
	MCB
	Clarifier #3
	Bar Screen #1
	Grit Classifier #1
	Grit Blower #1
	RAS #1-Load Reactor
	RAS#1-Line Reactor
	RAS#1
	RAS#2-Load Reactor
	RAS#2-Line Reactor
	RAS#2
	WAS#1
	WAS#1-Load Reactor
	WAS#1-Line Reactor
	Transfer Pump

MCC2	Bar Screen #2
	Grit Separator #2
	MCB
	Clarifier #4
	Bar Screen #1
	Grit Blower #2
	Grit Blower #2
	Grit Classifier #2

MCC2	RAS#3
	RAS#3-Load Reactor
	RAS#3-Line Reactor
	WAS#2
	WAS#2-Line Reactor
	WAS#2-Load Reactor
	Rotary Drum #2
	Rotary Drum #1
	Transformer

Roto Screens	Roto Screen #4
	Roto Screen #3
	Roto Screen #2
	Roto Screen #1

Injection Well Pumps	Injection Well Pump #2
	Injection Well Pump #3
	Injection Well Pump #4
	Injection Well Pump #1

SWBD-IWA	AR-SS-1
	Injection Well Pump #3
	Injection Well Pump #2
	MCC2
	Power Panel IWHA
	Existing Panel RS

AR-SS-2	Oxidation Ditch 2-Aerator 2

AR-SS-1	Oxidation Ditch 2-Aerator 1

SWBD-IWB	AR-SS-2
	Injection Well Pump #4
	Injection Well Pump #1
	MCC1
	Power Panel IWB
	Spare

300 KW Generator	Existing Load/Blowers
	MCC3
	MMC1
	Sludge Thickener
	Centrifuge
	Utility Circuit Breaker
	Generator Circuit Breaker

Faults

Location	Equipment	Recommendation	Page Number
MCC3	Ditch 1 - Aerator 1	Inspect	5
MCC1	Grit Classifier #1	Inspect	6
MCC1	RAS #1	Inspect	7
MCC1	RAS #1	Inspect	8
MCC1	WAS #1	Inspect	9
MCC1	WAS #1	Inspect	10
MCC2	RAS #3	Inspect	11
MCC2	WAS #2	Inspect	12
MCC2	WAS #2	Inspect	13
Injection Well Pump	Injection Well #2	Inspect	14
Injection Well Pump	Injection Well Pump #2	Inspect	15
Injection Well Pump	Injection Well Pump #2	Inspect	16
300KW Generator Room	MCC3	Inspect	17

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

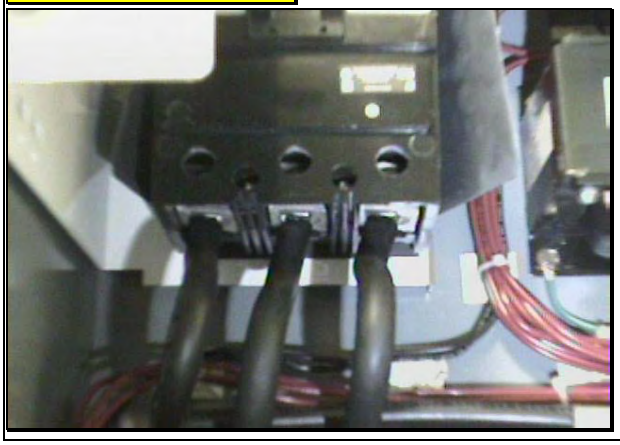
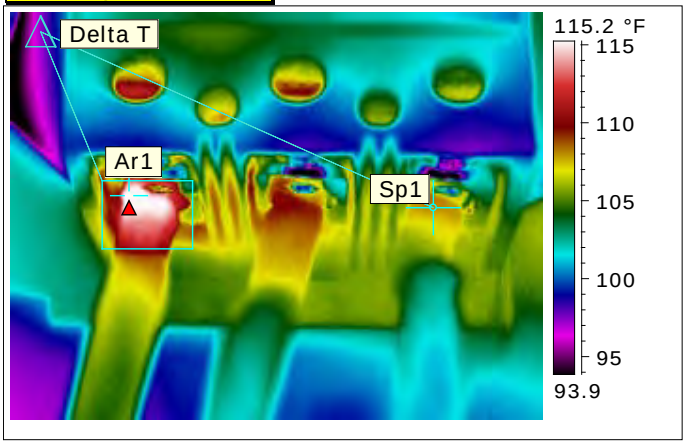


Image Time	8:58:18 AM
Image Date	5/2/2013
Location	MCC3
Equipment	Ditch 1 - Aerator 1
Type	Breaker
Fault	L1 Load Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	116.4 °F
Sp1 Temperature	108.1 °F
Delta T Value	8.4

Analysis & Recommended action:

Inspect breaker L1 breaker connection on the load side of the breaker. There is a 8.4 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

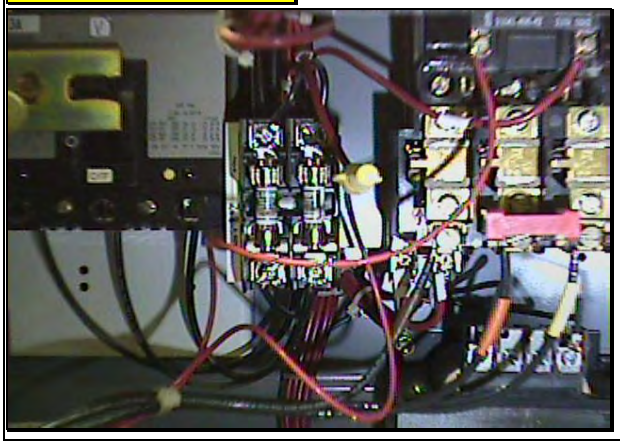
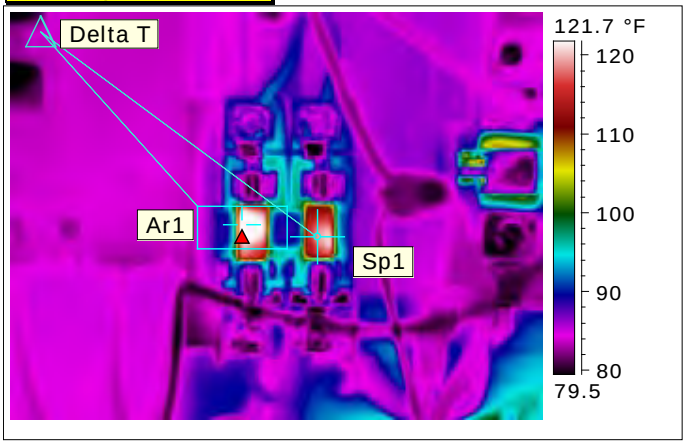


Image Time	9:16:14 AM
Image Date	5/2/2013
Location	MCC1
Equipment	Grit Classifier #1
Type	Fuse
Fault	Fuse
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	126.3 °F
Sp1 Temperature	119.3 °F
Delta T Value	7.0

Analysis & Recommended action:

Inspect fuse for Grit Classifier. There is a 7 degree temperature difference between fuses. Inspect fuse and replace if necessary.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

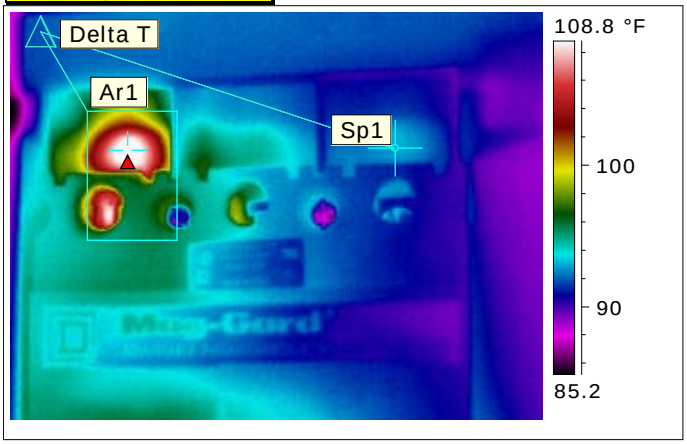
Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

Image Time	9:24:14 AM
Image Date	5/2/2013
Location	MCC1
Equipment	RAS #1
Type	Breaker
Fault	L1 Line side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	110.2 °F
Sp1 Temperature	92.9 °F
Delta T Value	17.3

Analysis & Recommended action:

Inspect L1 connection on line side of breaker. There is a 17.3 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

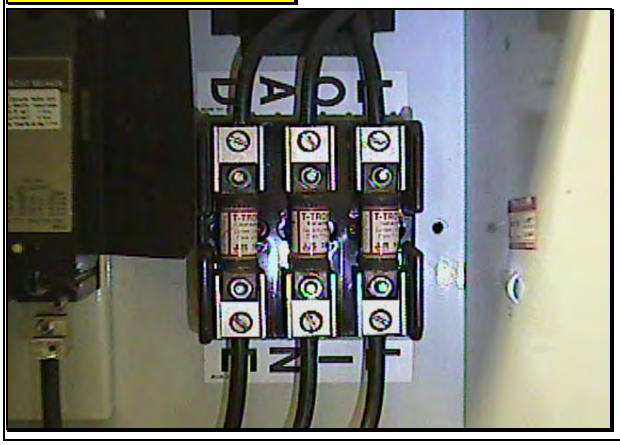
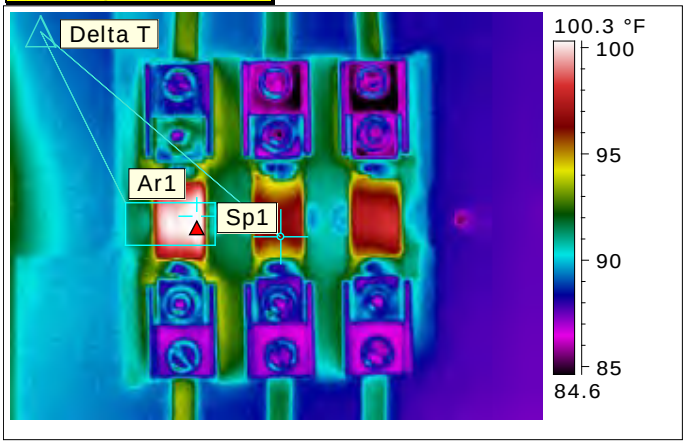


Image Time	9:25:19 AM
Image Date	5/2/2013
Location	MCC1
Equipment	RAS #1
Type	Fuses
Fault	L1 Fuse
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	101.5 °F
Sp1 Temperature	96.1 °F
Delta T Value	5.4

Analysis & Recommended action:

Inspect L1 fuse. There is a 5.4 degree temperature difference between fuses. Inspect fuse and replace if necessary.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

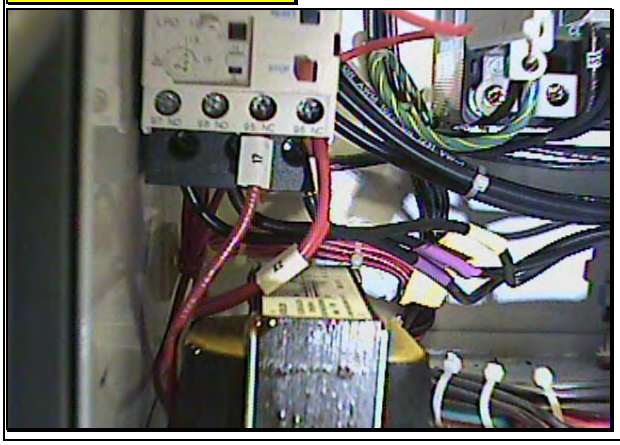
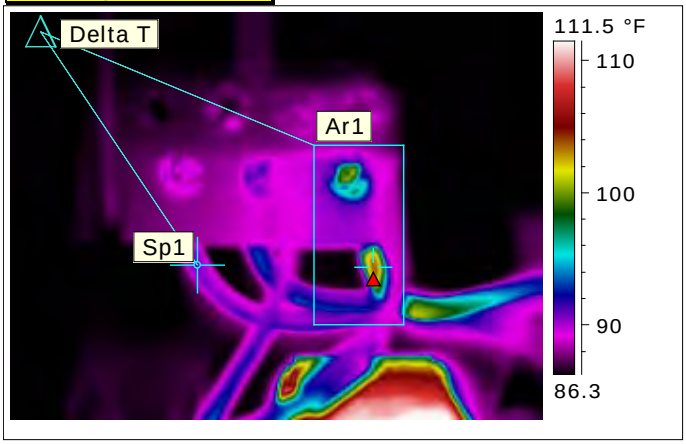


Image Time	9:38:42 AM
Image Date	5/2/2013
Location	MCC1
Equipment	WAS #1
Type	Starter
Fault	L3 Load Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	103.6 °F
Sp1 Temperature	90.9 °F
Delta T Value	12.8

Analysis & Recommended action:

Inspect L3 connection on load side of breaker. There is a 12.8 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

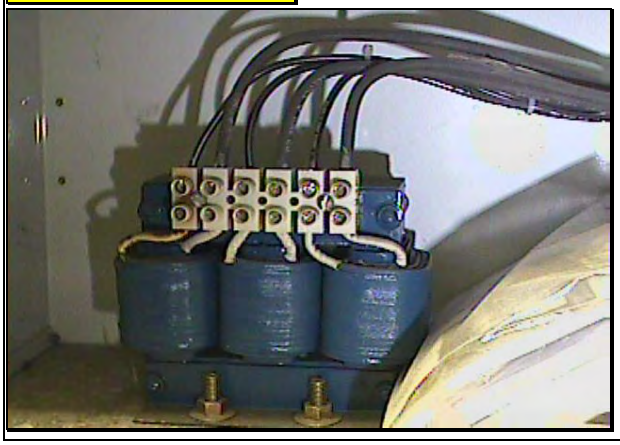
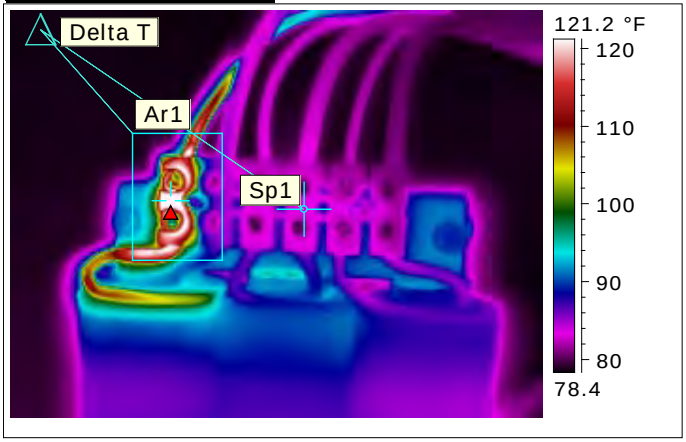


Image Time	9:41:26 AM
Image Date	5/2/2013
Location	MCC1
Equipment	WAS #1
Type	Load Reactor
Fault	Connection
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	134.2 °F
Sp1 Temperature	84.0 °F
Delta T Value	50.2

Analysis & Recommended action:

Inspect connection on load reactor. There is a 50.2 degree temperature difference between connections. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

Comment:……..

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Belle Glade Waste Water Treatment Facility**	**Date: 5/4/2013**

Photo and Identification

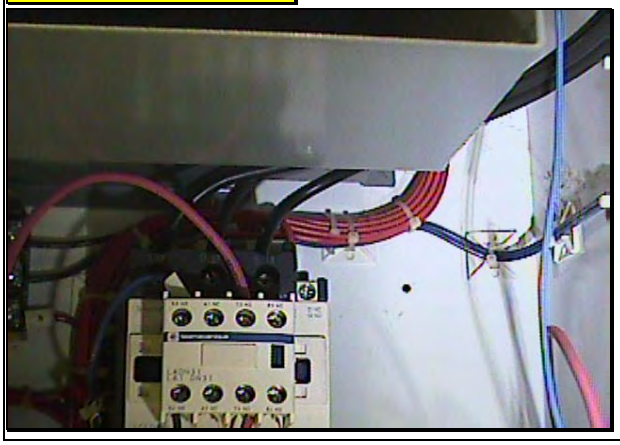
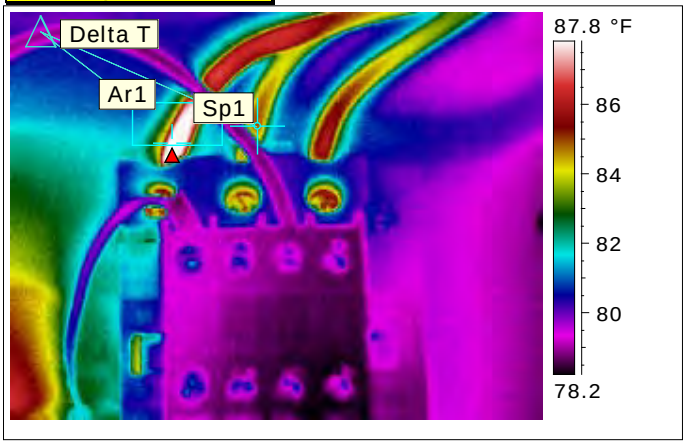


Image Time	10:04:35 AM
Image Date	5/2/2013
Location	MCC2
Equipment	RAS #3
Type	Starter
Fault	L1 Line Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	89.2 °F
Sp1 Temperature	84.9 °F
Delta T Value	4.3

Analysis & Recommended action:

Inspect L1 connection on line side of breaker. There is a 4.3 degree temperature difference between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Belle Glade Waste Water Treatment Facility**	**Date: 5/4/2013**

Photo and Identification

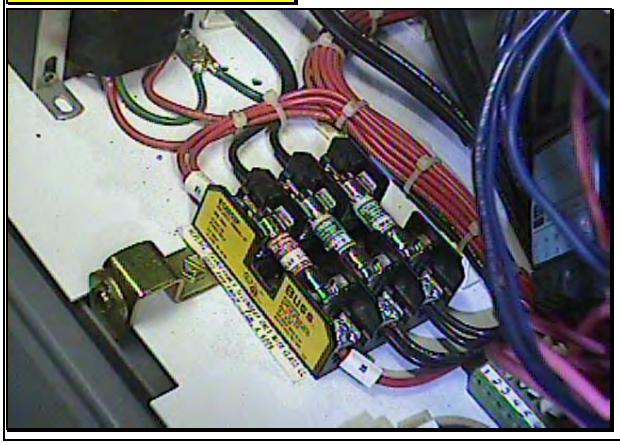
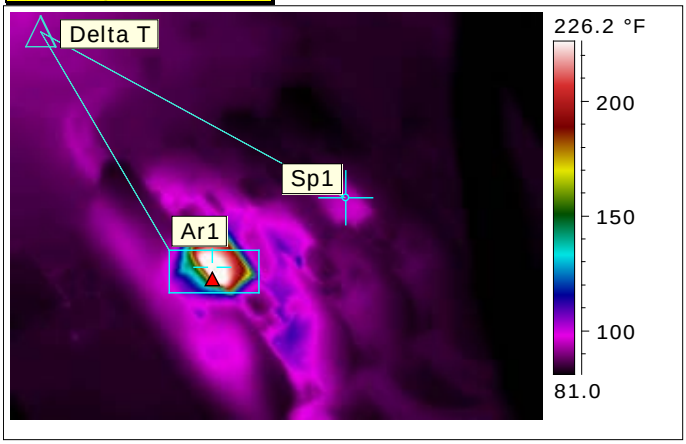


Image Time	10:08:05 AM
Image Date	5/2/2013
Location	MCC2
Equipment	WAS #2
Type	Fuse
Fault	L1 Fuse
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	239.5 °F
Sp1 Temperature	95.7 °F
Delta T Value	143.8

Analysis & Recommended action:

Inspect L1 fuse ASAP. There is a 143.8 degree temperature difference between fuses. Inspect and replace fuse if necessary.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

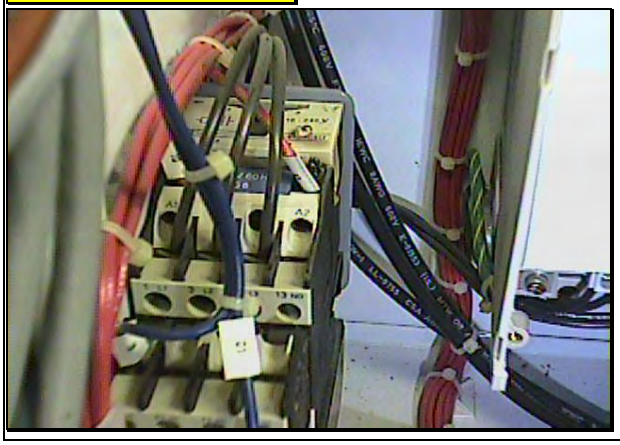
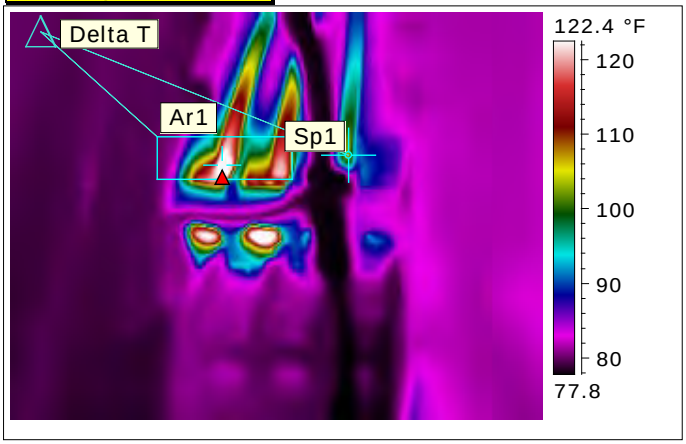


Image Time	10:09:50 AM
Image Date	5/2/2013
Location	MCC2
Equipment	WAS #2
Type	Starter
Fault	L1 & L2 Line Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	127.0 °F
Sp1 Temperature	101.5 °F
Delta T Value	25.5

Analysis & Recommended action:

Inspect L1 & L2 connections on line side of breaker. There is a 25.5 degree temperature difference between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…….…… Date: **5/4**/2013

Repaired by: ……. Date:

Comment:……..

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Belle Glade Waste Water Treatment Facility**	**Date: 5/4/2013**

Photo and Identification

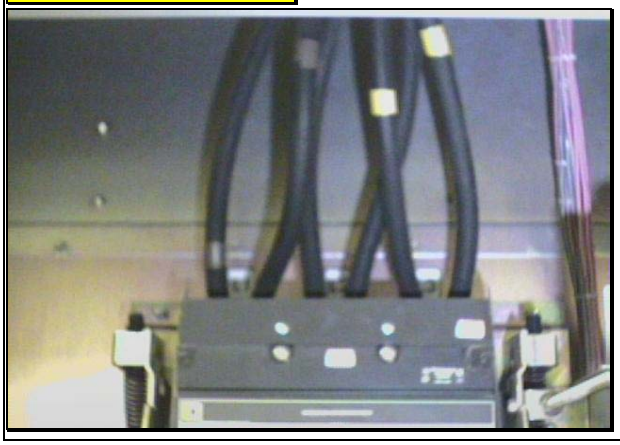
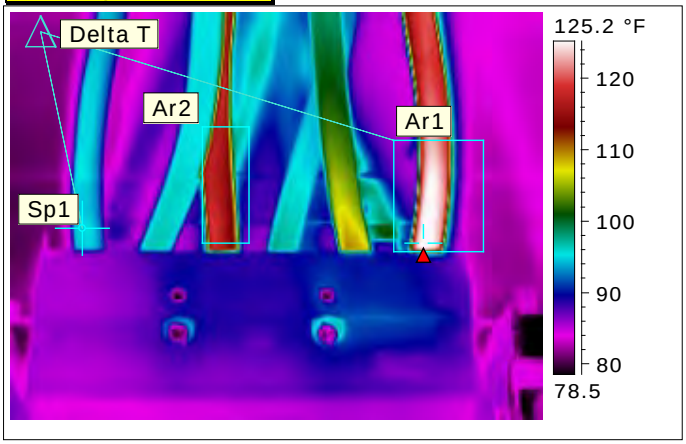


Image Time	10:50:30 AM
Image Date	5/2/2013
Location	Injection Well Pump
Equipment	Injection Well #2
Type	Breaker
Fault	L2 & L3 Line Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	126.8 °F
Ar2 Max. Temperature	118.9 °F
Sp1 Temperature	95.0 °F
Delta T Value	31.8

Analysis & Recommended action:

Inspect L1 & L2 on line side of breaker. There is a 31.8 degree temperature between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

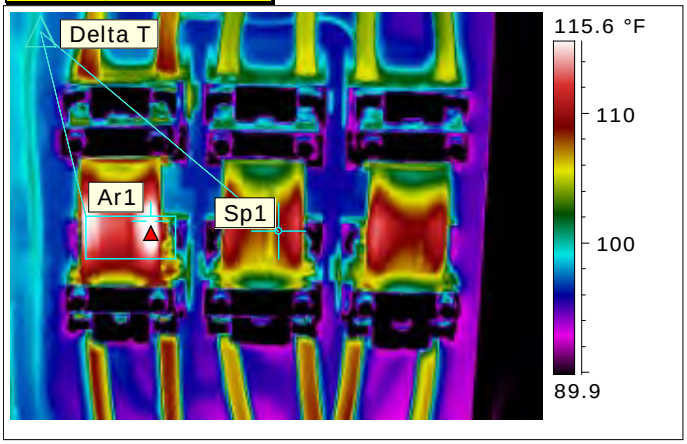
Comment:……..

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Belle Glade Waste Water Treatment Facility**	**Date: 5/4/2013**

Photo and Identification

Image Time	10:53:54 AM
Image Date	5/2/2013
Location	Injection Well Pump
Equipment	Injection Well Pump #2
Type	Fuse
Fault	L1 Fuse
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	117.0 °F
Sp1 Temperature	109.2 °F
Delta T Value	7.8

Analysis & Recommended action:

Inspect L1 fuse. There is a 7.8 degree temperature difference between fuses. Inspect fuse and replace if necessary.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings	Thermography Inspection at Belle Glade Waste Water Treatment Facility	Date: 5/4/2013

Photo and Identification

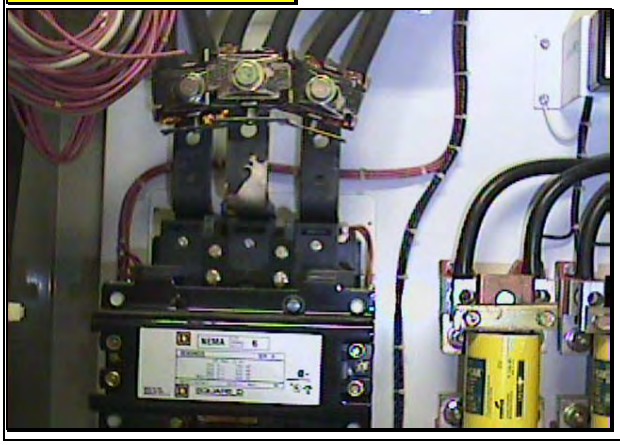
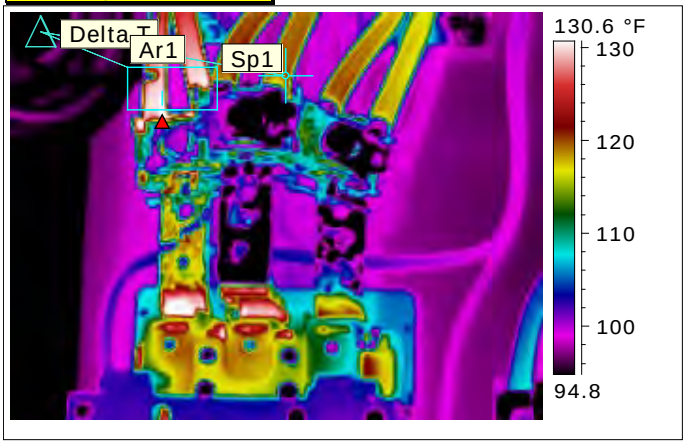


Image Time	10:55:11 AM
Image Date	5/2/2013
Location	Injection Well Pump
Equipment	Injection Well Pump #2
Type	Starter
Fault	L1 Line Side
Recommendation	Inspect

Thermogram 5/2/2013



Ar1 Max. Temperature	131.9 °F
Sp1 Temperature	119.6 °F
Delta T Value	12.3

Analysis & Recommended action:

Inspect L1 on line side of starter. There is a 12.3 degree temperature difference between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…… Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Belle Glade Waste Water Treatment Facility**	**Date: 5/4/2013**

Photo and Identification

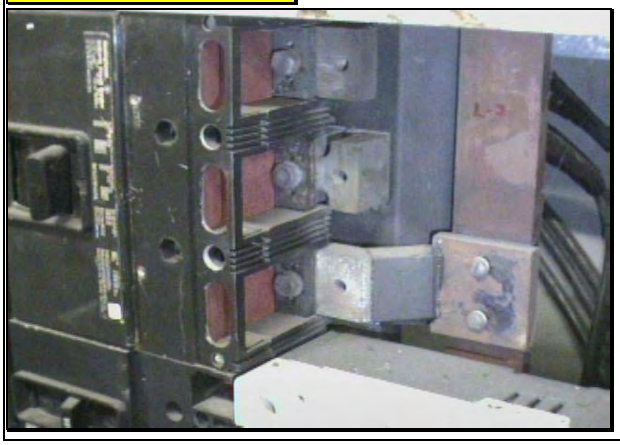
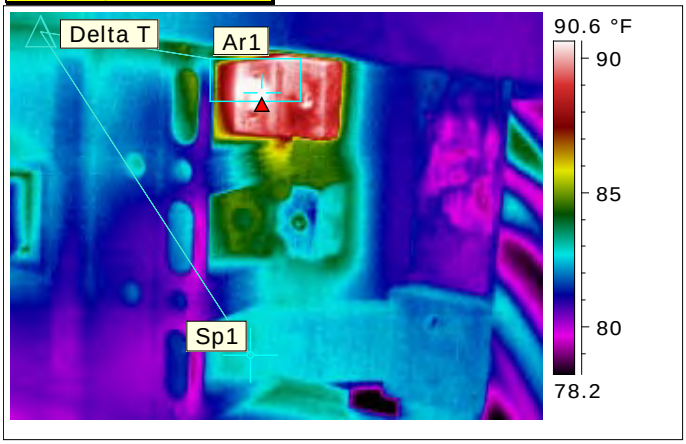


Image Time	8:17:24 AM
Image Date	5/3/2013
Location	300KW Generator Room
Equipment	MCC3
Type	Breaker
Fault	L1 Line Side
Recommendation	Inspect

Thermogram 5/3/2013



Ar1 Max. Temperature	91.5 °F
Sp1 Temperature	82.8 °F
Delta T Value	8.7

Analysis & Recommended action:

Inspect L1 connections on line side of breaker. There is a 8.7 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:…….. Date: **5/4**/2013

Repaired by: …… Date:

Comment:……..

Florida Bearings. Inc.
3164 N. Miami Avenue
Miami, FL 33127

VIBRATION ANALYSIS REPORT

Belle Glade

Waste Water Treatment Plant

May 2013

Visit us at: www.floridabearings.com

SKF Certified Maintenance Partner

Vibration Schedule for Belle Glade - Waste Water Treatment Plant

SKF Priority Codes	
1	Imminent Failure; Shut Down as Necessary
2	Immediate Attention; Action Required
3	Fault Detected; Plan for Action
4	Non-urgent Recommendation
5	Baseline Analysis - Work was Performed
	Acceptable Operating Conditions
	Not up for inspection

Reasons for Uncollected Data	
A	Unsafe to collect data
B	Not Running
C	Out of Service
D	No Manpower(No one to start eqp.)
E	Unloaded (Produces unreliable data)
F	Standby (Spare/Cannot be started)

#	Asset Name	Machinery Asset ID	Last Inspected	May '13											Notes
	BELLE GLADE WWTP														
1	TRUCK LOADING PUMP #1 - MOTOR		05/08/13												
2	TRUCK LOADING PUMP #1 - GB		05/08/13												
3	TRUCK LOADING PUMP #1 - PUMP		05/08/13												
4	BLOWER #1 - MOTOR		05/08/13												
5	BLOWER #1 - BLOWER		05/08/13												
6	BLOWER #2 - MOTOR		05/08/13	4											
7	BLOWER #2 - BLOWER		05/08/13												
8	THICKENED SLUDGE #1 - MOTOR		05/09/13												
9	THICKENED SLUDGE #1 - GB		05/09/13												
10	THICKENED SLUDGE #1 - PUMP		05/09/13												
11	THICKENED SLUDGE #2 - MOTOR		05/09/13												
12	THICKENED SLUDGE #2 - GB		05/09/13												
13	THICKENED SLUDGE #2 - PUMP		05/09/13												
14	ROTARY DRUM #1 - MOTOR		05/08/13												
15	ROTARY DRUM #1 - GB		05/08/13												
16	ROTARY DRUM #1 - MOTOR		05/08/13												
17	ROTARY DRUM #1 - GB		05/08/13												
18	RAS #1 - MOTOR		05/09/13												
19	RAS #2 - MOTOR		05/09/13												
20	RAS #3 - MOTOR		05/09/13												
21	WAS #1 - MOTOR		05/09/13												
22	WAS #1 - GB		05/09/13												
23	WAS #1 - PUMP		05/09/13	3											
24	WAS #2 - MOTOR		05/09/13												
25	WAS #2 - GB		05/09/13												
26	WAS #2 - PUMP		05/09/13												
27	CLARIFIER #3 - MOTOR		05/08/13												
28	CLARIFIER #3 - 1ST GB		05/08/13												
29	CLARIFIER #3 - 2ND GEARBOX		05/08/13												
30	CLARIFIER #4 - MOTOR		05/08/13												
31	CLARIFIER #4 - 1ST GB		05/08/13												
32	CLARIFIER #4 - 2ND GEARBOX		05/08/13												
33	EFFLUENT DISPERSION PUMP #1 - MOTOR		05/08/13	4											
34	EFFLUENT DISPERSION PUMP #1 - PUMP		05/08/13												
35	EFFLUENT DISPERSION PUMP #2 - MOTOR		05/08/13												
36	EFFLUENT DISPERSION PUMP #2 - PUMP		05/08/13												
37	EFFLUENT DISPERSION PUMP #3 - MOTOR		05/08/13												
38	EFFLUENT DISPERSION PUMP #3 - PUMP		05/08/13												
39	EFFLUENT DISPERSION PUMP #4 - MOTOR		05/08/13	4											
40	EFFLUENT DISPERSION PUMP #4 - PUMP		05/08/13												
41	ROTO SCREEN #1 - MOTOR		05/08/13												
42	ROTO SCREEN #1 - GB		05/08/13												
43	ROTO SCREEN #2 - MOTOR		05/08/13												
44	ROTO SCREEN #2 - GB		05/08/13												
45	ROTO SCREEN #3 - MOTOR		05/08/13												
46	ROTO SCREEN #3 - GB		05/08/13												
47	ROTO SCREEN #4 - MOTOR		05/08/13												

Vibration Schedule for Belle Glade - Waste Water Treatment Plant

SKF Priority Codes	
1	Imminent Failure; Shut Down as Necessary
2	Immediate Attention; Action Required
3	Fault Detected; Plan for Action
4	Non-urgent Recommendation
5	Baseline Analysis - Work was Performed
	Acceptable Operating Conditions
	Not up for inspection

Reasons for Uncollected Data	
A	Unsafe to collect data
B	Not Running
C	Out of Service
D	No Manpower(No one to start eqp.)
E	Unloaded (Produces unreliable data)
F	Standby (Spare/Cannot be started)

#	Asset Name	Machinery Asset ID	Last Inspected	May '13											Notes
48	ROTO SCREEN #4 - GB		05/08/13												
49	OXIDATION DITCH #2-1 - MOTOR		05/08/13												
50	OXIDATION DITCH #2-1 - GB		05/08/13												
51	OXIDATION DITCH #2-2 - MOTOR		05/08/13												
52	OXIDATION DITCH #2-2 - GB		05/08/13												
53	OXIDATION DITCH #1-1 - MOTOR		05/08/13												
54	OXIDATION DITCH #1-1 - GB		05/08/13												
55	OXIDATION DITCH #1-2 - MOTOR		05/08/13												
56	OXIDATION DITCH #1-2 - GB		05/08/13												
57	GRIT CLASSIFIER #1 - MOTOR		05/08/13												
58	GRIT CLASSIFIER #1 - GB		05/08/13												
59	GRIT CLASSIFIER #2 - MOTOR		05/08/13												
60	GRIT CLASSIFIER #2 - GB		05/08/13												
61	PISTA GRIT SEPERATOR #1 - MOTOR		05/08/13												
62	PISTA GRIT SEPERATOR #1 - GB		05/08/13												
63	PISTA GRIT SEPERATOR #1 - GEARHEAD		05/08/13												
64	PISTA GRIT SEPERATOR #2 - MOTOR		05/08/13												
65	PISTA GRIT SEPERATOR #2 - GB		05/08/13												
66	PISTA GRIT SEPERATOR #2 - GEARHEAD		05/08/13												
67	PISTA GRIT AIR COMP #1 - MOTOR		05/08/13												
68	PISTA GRIT AIR COMP #1 - COMP		05/08/13	4											
69	PISTA GRIT AIR COMP #2 - MOTOR		05/08/13												
70	PISTA GRIT AIR COMP #2 - COMP		05/08/13												
71	BAR SCREEN #1 - MOTOR		05/08/13												
72	BAR SCREEN #1 - GB		05/08/13												
73	BAR SCREEN #2 - MOTOR		05/08/13												
74	BAR SCREEN #2 - GB		05/08/13												

“PREDICTIVE DETAILED REPORT”

Area: **BELLE GLADE WWTP**
Asset Name: **WAS #1 - PUMP**

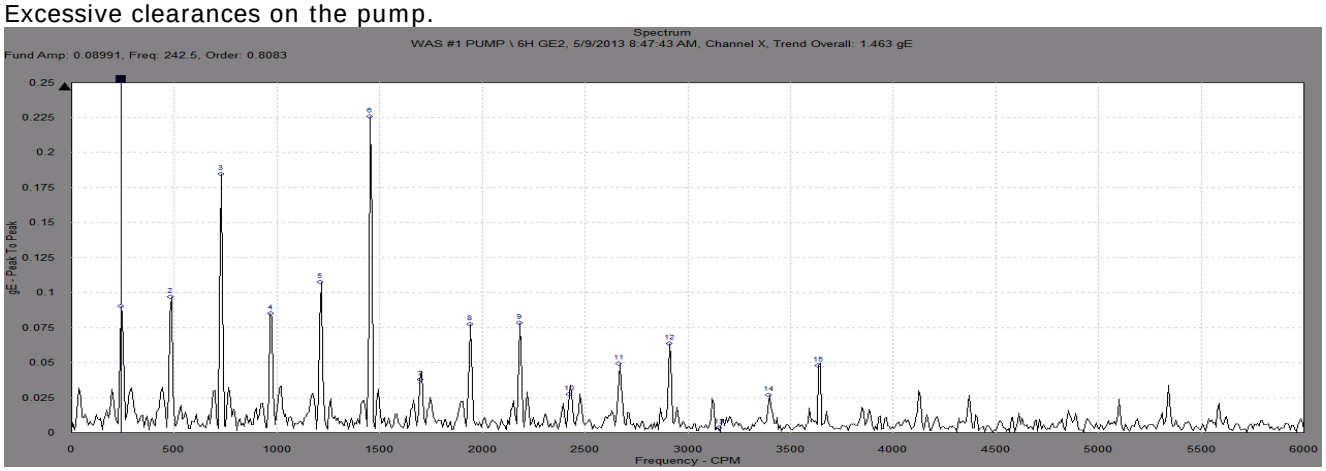
Current Priority-3
Fault Detected; Plan for Action

Other Info:
Inspected on: 05/09/2013
Past Priority = 0
First Reported on: 05/09/2013

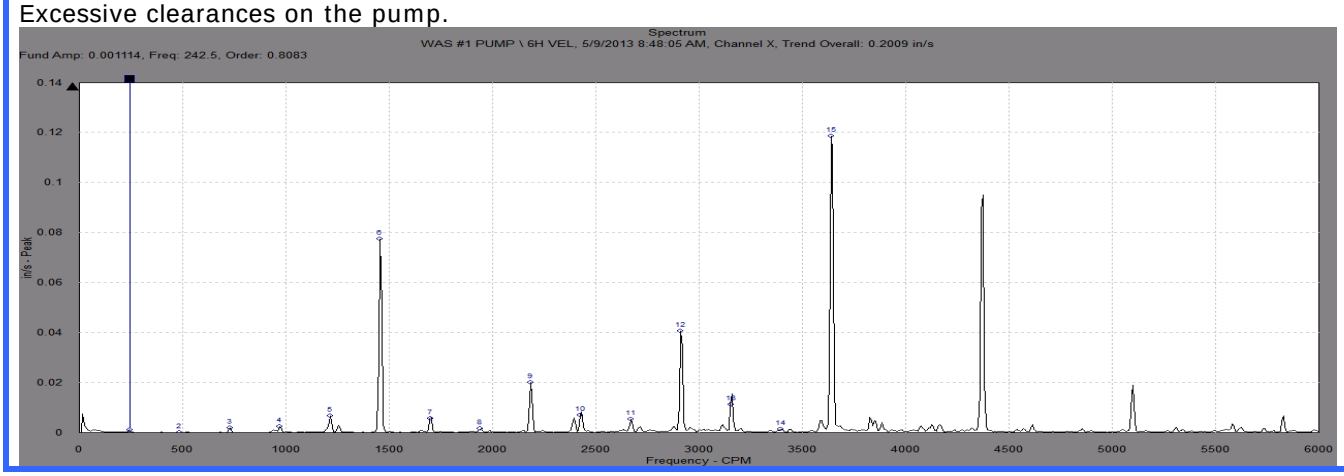
Recommendations: 1) Inspect pump bearings for proper fit on the shaft and within the housings and repair or replace as necessary.

Observations: 1) Internal looseness (excessive clearances) is present on the pump.

Excessive clearances on the pump.



Excessive clearances on the pump.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
WAS #1 MOTOR	1H ACC	5/9/2013 8:40:01 AM	0.359	g
WAS #1 MOTOR	1H GE3	5/9/2013 8:40:04 AM	1.143	gE
WAS #1 MOTOR	1H VEL	5/9/2013 8:40:09 AM	0.149	in/s
WAS #1 MOTOR	1H VEL LO	5/9/2013 8:40:16 AM	0.163	in/s
WAS #1 MOTOR	1V ACC	5/9/2013 8:40:33 AM	0.327	g
WAS #1 MOTOR	1V VEL	5/9/2013 8:40:37 AM	0.154	in/s
WAS #1 MOTOR	2H ACC	5/9/2013 8:40:59 AM	0.648	g
WAS #1 MOTOR	2H GE3	5/9/2013 8:41:01 AM	2.854	gE
WAS #1 MOTOR	2H VEL	5/9/2013 8:41:06 AM	0.139	in/s
WAS #1 MOTOR	2H VEL LO	5/9/2013 8:41:13 AM	0.142	in/s
WAS #1 MOTOR	2V ACC	5/9/2013 8:41:27 AM	0.641	g
WAS #1 MOTOR	2V VEL	5/9/2013 8:41:31 AM	0.142	in/s
WAS #1 GEARBOX	3H ACC	5/9/2013 8:42:05 AM	1.224	g
WAS #1 GEARBOX	3H GE3	5/9/2013 8:42:08 AM	5.929	gE
WAS #1 GEARBOX	3H VEL	5/9/2013 8:42:11 AM	0.151	in/s
WAS #1 GEARBOX	3H VEL LO	5/9/2013 8:42:18 AM	0.156	in/s
WAS #1 GEARBOX	3V ACC	5/9/2013 8:42:38 AM	0.890	g
WAS #1 GEARBOX	3V VEL	5/9/2013 8:42:41 AM	0.163	in/s
WAS #1 GEARBOX	3V VEL LO	5/9/2013 8:42:48 AM	0.161	in/s
WAS #1 GEARBOX	4H ACC	5/9/2013 8:43:09 AM	0.359	g
WAS #1 GEARBOX	4H GE2	5/9/2013 8:43:27 AM	1.019	gE
WAS #1 GEARBOX	4H VEL	5/9/2013 8:44:09 AM	0.157	in/s
WAS #1 GEARBOX	4V ACC	5/9/2013 8:44:36 AM	0.490	g
WAS #1 GEARBOX	4V VEL	5/9/2013 8:45:16 AM	0.112	in/s
WAS #1 PUMP	5H ACC	5/9/2013 8:45:42 AM	0.280	g
WAS #1 PUMP	5H GE2	5/9/2013 8:45:51 AM	1.545	gE
WAS #1 PUMP	5H VEL	5/9/2013 8:46:13 AM	0.235	in/s
WAS #1 PUMP	5V ACC	5/9/2013 8:46:48 AM	0.377	g
WAS #1 PUMP	5V VEL	5/9/2013 8:47:09 AM	0.461	in/s
WAS #1 PUMP	6H ACC	5/9/2013 8:47:34 AM	0.238	g
WAS #1 PUMP	6H GE2	5/9/2013 8:47:43 AM	1.463	gE
WAS #1 PUMP	6H VEL	5/9/2013 8:48:05 AM	0.201	in/s
WAS #1 PUMP	6V ACC	5/9/2013 8:48:17 AM	0.342	g
WAS #1 PUMP	6V VEL	5/9/2013 8:48:38 AM	0.467	in/s
WAS #1 PUMP	6AACC	5/9/2013 8:49:02 AM	0.183	g
WAS #1 PUMP	6AVEL	5/9/2013 8:49:23 AM	0.213	in/s

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“PREDICTIVE DETAILED REPORT”

Area: **BELLE GLADE WWTP**
Asset Name: **BLOWER #2 - MOTOR**

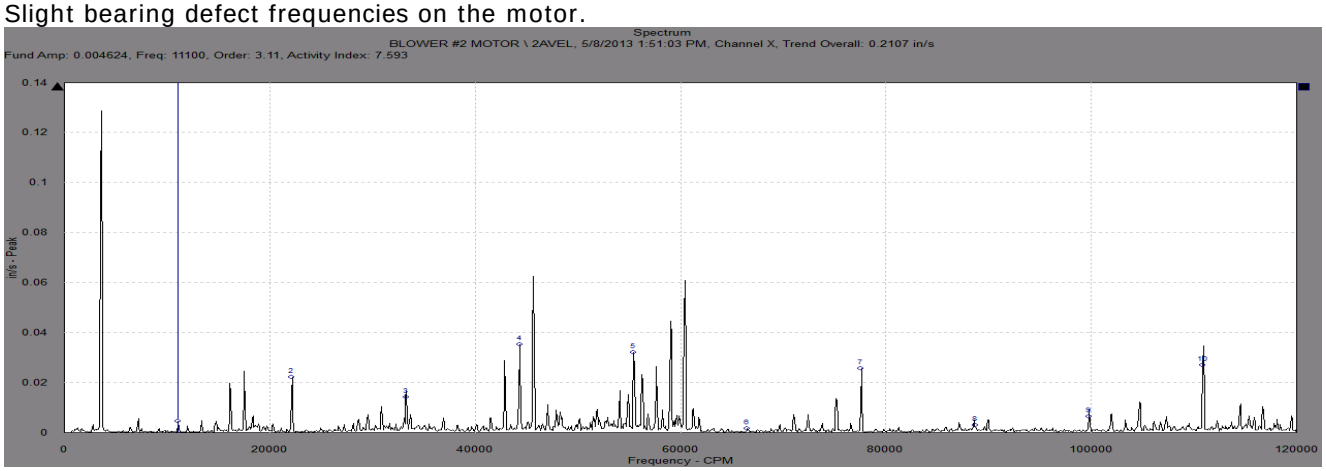
Current Priority-4
Non-urgent Recommendation

Other Info:
Inspected on: 05/08/2013
Past Priority =0
First Reported on: 05/08/2013

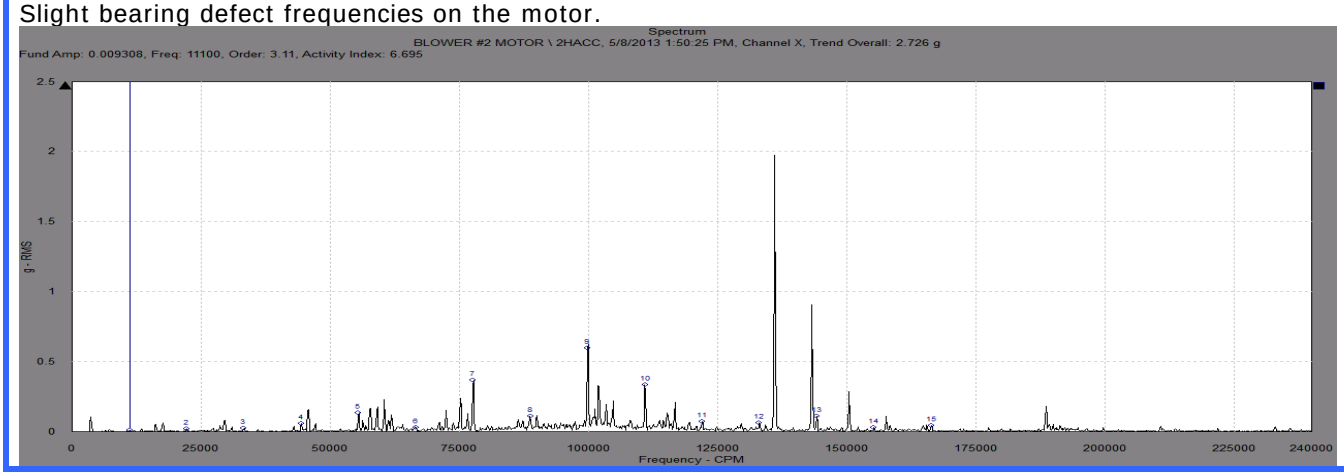
Recommendations: 1) Closely monitor motor for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) Slight bearing defect frequencies are present on the motor drive end bearing at a low amplitude of vibration.

Slight bearing defect frequencies on the motor.



Slight bearing defect frequencies on the motor.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
BLOWER #2 MOTOR	1HACC	5/8/2013 1:49:31 PM	1.023	g
BLOWER #2 MOTOR	1HGE3	5/8/2013 1:49:33 PM	4.648	gE
BLOWER #2 MOTOR	1HVEL	5/8/2013 1:49:36 PM	0.107	in/s
BLOWER #2 MOTOR	1VVEL	5/8/2013 1:50:01 PM	0.053	in/s
BLOWER #2 MOTOR	2HACC	5/8/2013 1:50:25 PM	2.726	g
BLOWER #2 MOTOR	2HGE3	5/8/2013 1:50:27 PM	10.121	gE
BLOWER #2 MOTOR	2HVEL	5/8/2013 1:50:31 PM	0.178	in/s
BLOWER #2 MOTOR	2VVEL	5/8/2013 1:50:51 PM	0.335	in/s
BLOWER #2 MOTOR	2AVEL	5/8/2013 1:51:03 PM	0.211	in/s
BLOWER #2 BLOWER	3HACC	5/8/2013 1:51:15 PM	0.779	g
BLOWER #2 BLOWER	3HGE3	5/8/2013 1:51:17 PM	3.966	gE
BLOWER #2 BLOWER	3HVEL	5/8/2013 1:51:21 PM	0.245	in/s
BLOWER #2 BLOWER	3VACC	5/8/2013 1:51:50 PM	0.714	g
BLOWER #2 BLOWER	3VVEL	5/8/2013 1:51:53 PM	0.154	in/s
BLOWER #2 BLOWER	3AACC	5/8/2013 1:52:08 PM	0.903	g
BLOWER #2 BLOWER	3AVEL	5/8/2013 1:52:11 PM	0.100	in/s
BLOWER #2 BLOWER	4HACC	5/8/2013 1:52:27 PM	0.722	g
BLOWER #2 BLOWER	4HGE3	5/8/2013 1:52:29 PM	2.786	gE
BLOWER #2 BLOWER	4HVEL	5/8/2013 1:52:33 PM	0.151	in/s
BLOWER #2 BLOWER	4VACC	5/8/2013 1:52:49 PM	0.572	g
BLOWER #2 BLOWER	4VVEL	5/8/2013 1:52:52 PM	0.082	in/s

“PREDICTIVE DETAILED REPORT”

Area: **BELLE GLADE WWTP**
Asset Name: **EFFLUENT DISPERSION PUMP #1 - MOTOR**

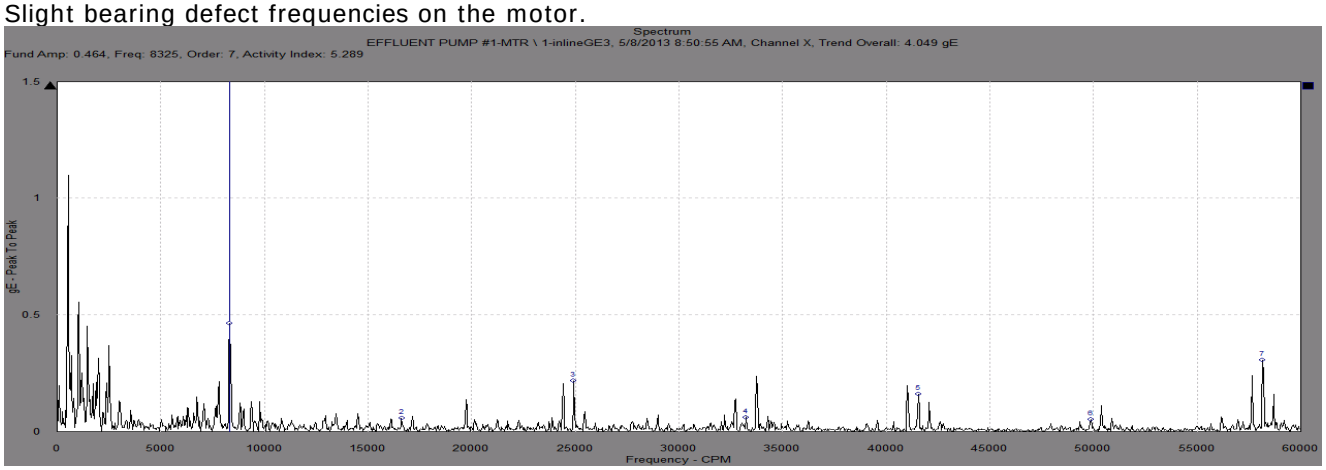
Current Priority-4
Non-urgent Recommendation

Other Info:
Inspected on: 05/08/2013
Past Priority =0
First Reported on: 05/08/2013

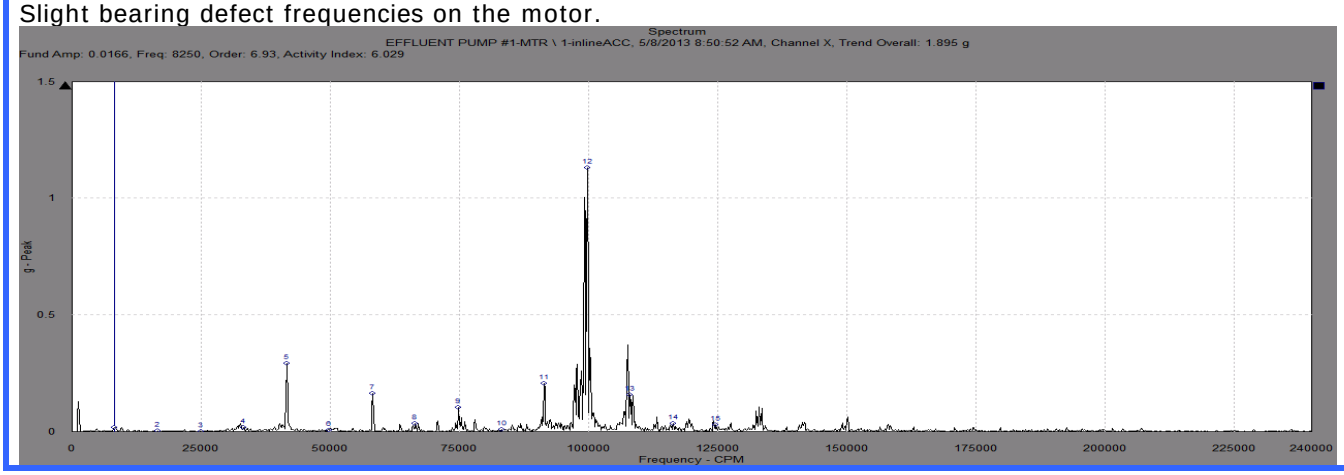
Recommendations: 1) Closely monitor motor for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) Slight bearing defect frequencies are present on the motor non drive end bearing at a low amplitude of vibration.

Slight bearing defect frequencies on the motor.



Slight bearing defect frequencies on the motor.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
EFFLUENT PUMP #1-MTR	1-inlineACC	5/8/2013 8:50:52 AM	1.895	g
EFFLUENT PUMP #1-MTR	1-inlineGE3	5/8/2013 8:50:55 AM	4.049	gE
EFFLUENT PUMP #1-MTR	1-inlineVEL	5/8/2013 8:51:01 AM	0.397	in/s
EFFLUENT PUMP #1-MTR	1-90degVEL	5/8/2013 8:51:22 AM	0.253	in/s
EFFLUENT PUMP #1-MTR	1AVEL	5/8/2013 8:51:40 AM	0.102	in/s
EFFLUENT PUMP #1-MTR	2-inlineACC	5/8/2013 8:52:02 AM	0.722	g
EFFLUENT PUMP #1-MTR	2-inlineGE3	5/8/2013 8:52:04 AM	1.581	gE
EFFLUENT PUMP #1-MTR	2-inlineVEL	5/8/2013 8:52:10 AM	0.172	in/s
EFFLUENT PUMP #1-MTR	2-90degVEL	5/8/2013 8:52:31 AM	0.118	in/s
EFFLUENT PUMP #1-MTR	2AVEL	5/8/2013 8:52:49 AM	0.060	in/s
EFFLUENT PUMP #1-PMP	3-inlineACC	5/8/2013 8:53:04 AM	0.345	g
EFFLUENT PUMP #1-PMP	3-inlineGE3	5/8/2013 8:53:06 AM	0.948	gE
EFFLUENT PUMP #1-PMP	3-inlineVEL	5/8/2013 8:53:12 AM	0.051	in/s
EFFLUENT PUMP #1-PMP	3-90degACC	5/8/2013 8:53:36 AM	0.396	g
EFFLUENT PUMP #1-PMP	3-90degVEL	5/8/2013 8:53:41 AM	0.029	in/s
EFFLUENT PUMP #1-PMP	3AACC	5/8/2013 8:53:55 AM	0.528	g
EFFLUENT PUMP #1-PMP	3AVEL	5/8/2013 8:54:00 AM	0.045	in/s

“PREDICTIVE DETAILED REPORT”

Area: **BELLE GLADE WWTP**
Asset Name: **EFFLUENT DISPERSION PUMP #4 - MOTOR**

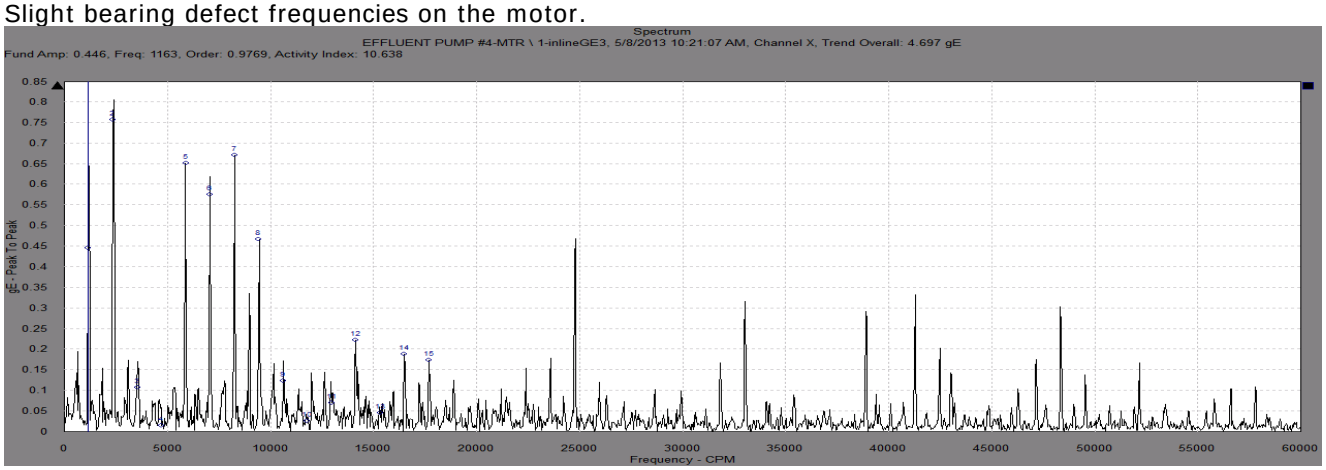
Current Priority-4
Non-urgent Recommendation

Other Info:
Inspected on: 05/08/2013
Past Priority =0
First Reported on: 05/08/2013

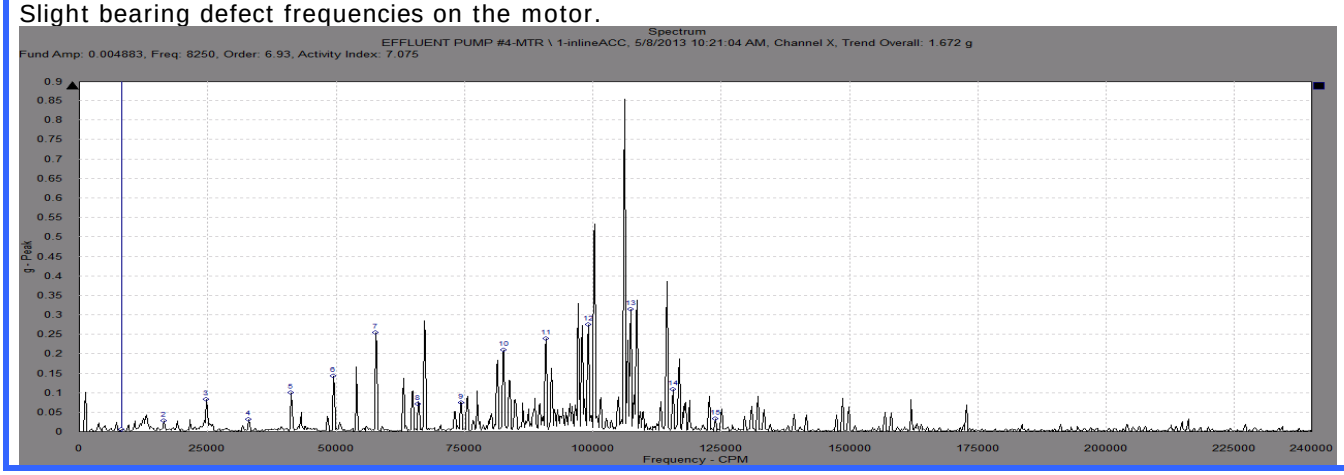
Recommendations: 1) Closely monitor motor for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) Slight bearing defect frequencies are present on the motor non drive end bearing at a low amplitude of vibration.

Slight bearing defect frequencies on the motor.



Slight bearing defect frequencies on the motor.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
EFFLUENT PUMP #4-MTR	1-inlineACC	5/8/2013 10:21:04 AM	1.672	g
EFFLUENT PUMP #4-MTR	1-inlineGE3	5/8/2013 10:21:07 AM	4.697	gE
EFFLUENT PUMP #4-MTR	1-inlineVEL	5/8/2013 10:21:12 AM	0.286	in/s
EFFLUENT PUMP #4-MTR	1-90degVEL	5/8/2013 10:21:36 AM	0.146	in/s
EFFLUENT PUMP #4-MTR	1AVEL	5/8/2013 10:22:21 AM	0.108	in/s
EFFLUENT PUMP #4-MTR	2-inlineACC	5/8/2013 10:22:49 AM	1.452	g
EFFLUENT PUMP #4-MTR	2-inlineGE3	5/8/2013 10:22:52 AM	3.394	gE
EFFLUENT PUMP #4-MTR	2-inlineVEL	5/8/2013 10:22:58 AM	0.139	in/s
EFFLUENT PUMP #4-MTR	2-90degVEL	5/8/2013 10:23:25 AM	0.078	in/s
EFFLUENT PUMP #4-MTR	2AVEL	5/8/2013 10:23:47 AM	0.036	in/s
EFFLUENT PUMP #4-PMP	3-inlineACC	5/8/2013 10:24:11 AM	0.212	g
EFFLUENT PUMP #4-PMP	3-inlineGE3	5/8/2013 10:24:14 AM	0.537	gE
EFFLUENT PUMP #4-PMP	3-inlineVEL	5/8/2013 10:24:19 AM	0.045	in/s
EFFLUENT PUMP #4-PMP	3-90degACC	5/8/2013 10:24:43 AM	0.248	g
EFFLUENT PUMP #4-PMP	3-90degVEL	5/8/2013 10:24:48 AM	0.028	in/s
EFFLUENT PUMP #4-PMP	3AACC	5/8/2013 10:25:01 AM	1.076	g
EFFLUENT PUMP #4-PMP	3AVEL	5/8/2013 10:25:06 AM	0.056	in/s

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“PREDICTIVE DETAILED REPORT”

Area: **BELLE GLADE WWTP**
Asset Name: **PISTA GRIT AIR COMP #1 - COMPRESSOR**

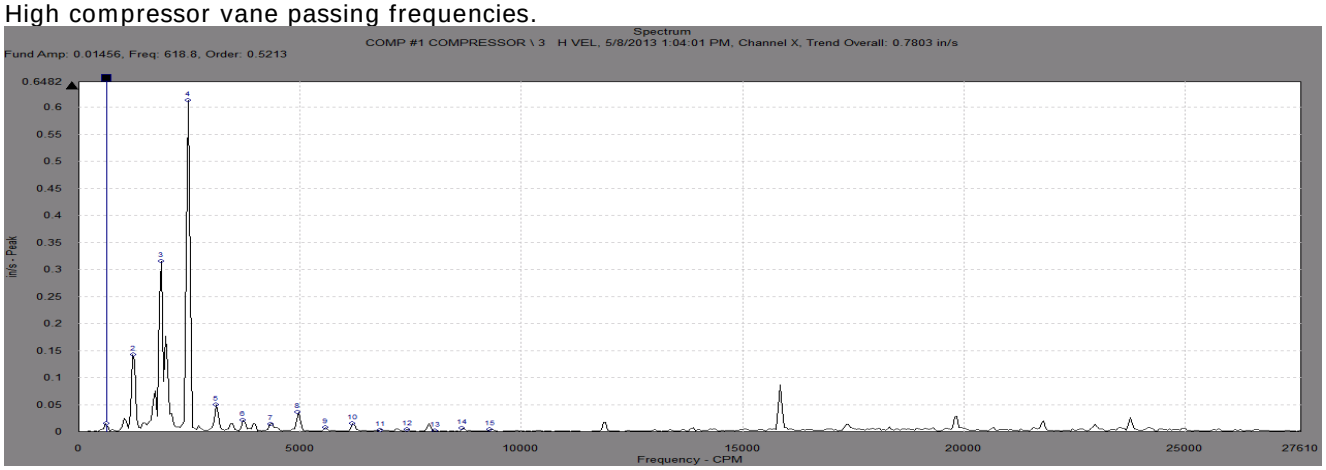
Current Priority- 4
Fault Detected; Plan for Action

Other Info:
Inspected on: 05/08/2013
Past Priority = 0
First Reported on: 05/08/2013

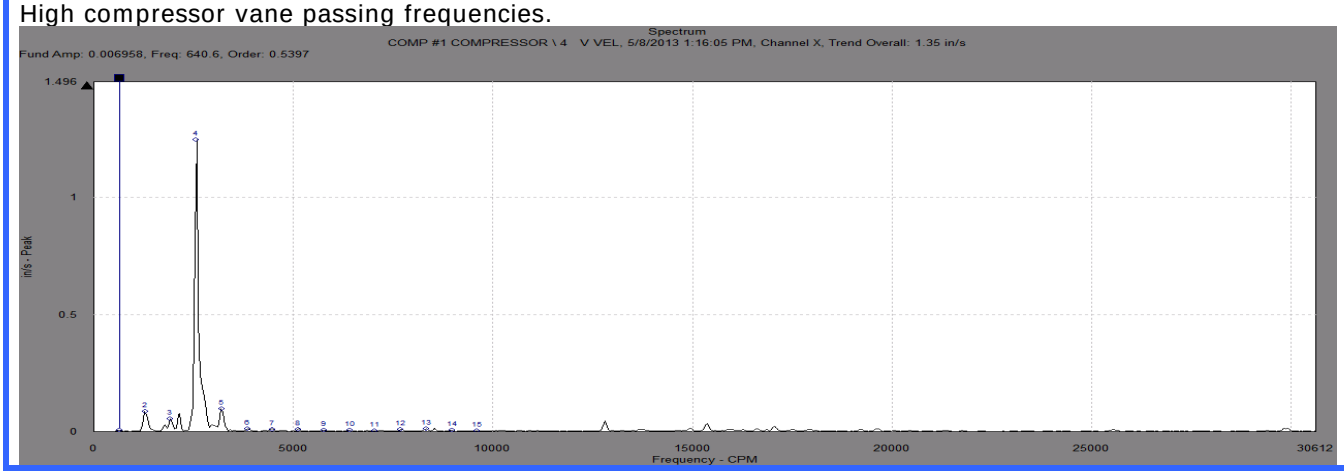
Recommendations: 1) Closely monitor compressor for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) High compressor vane passing frequencies are present indicating excessive clearances are present.

High compressor vane passing frequencies.



High compressor vane passing frequencies.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
COMP #1 MOTOR	1 H E3	5/8/2013 1:00:27 PM	3.080	gE
COMP #1 MOTOR	1 H E4	5/8/2013 1:00:29 PM	0.193	gE
COMP #1 MOTOR	1 H VEL	5/8/2013 1:00:34 PM	0.904	in/s
COMP #1 MOTOR	1 H ACC	5/8/2013 1:00:35 PM	1.170	g
COMP #1 MOTOR	1 H ACC 2	5/8/2013 1:00:38 PM	0.925	g
COMP #1 MOTOR	1 V VEL	5/8/2013 1:00:53 PM	1.032	in/s
COMP #1 MOTOR	2 H E3	5/8/2013 1:01:15 PM	4.288	gE
COMP #1 MOTOR	2 H E4	5/8/2013 1:01:17 PM	0.201	gE
COMP #1 MOTOR	2 H ACC	5/8/2013 1:01:18 PM	2.059	g
COMP #1 MOTOR	2 H ACC 2	5/8/2013 1:01:22 PM	1.640	g
COMP #1 MOTOR	2 H VEL	5/8/2013 1:01:26 PM	1.129	in/s
COMP #1 MOTOR	2 V VEL	5/8/2013 1:01:44 PM	1.070	in/s
COMP #1 COMPRESSOR	1 H E3	5/8/2013 1:02:19 PM	9.136	gE
COMP #1 COMPRESSOR	1 H E4	5/8/2013 1:02:22 PM	0.809	gE
COMP #1 COMPRESSOR	1 H VEL	5/8/2013 1:02:25 PM	0.432	in/s
COMP #1 COMPRESSOR	1 H ACC	5/8/2013 1:02:26 PM	2.305	g
COMP #1 COMPRESSOR	1 H ACC 2	5/8/2013 1:02:29 PM	2.220	g
COMP #1 COMPRESSOR	1 V VEL	5/8/2013 1:02:41 PM	1.321	in/s
COMP #1 COMPRESSOR	2 H E3	5/8/2013 1:02:57 PM	8.560	gE
COMP #1 COMPRESSOR	2 H E4	5/8/2013 1:02:59 PM	1.758	gE
COMP #1 COMPRESSOR	2 H ACC	5/8/2013 1:03:00 PM	2.209	g
COMP #1 COMPRESSOR	2 H ACC 2	5/8/2013 1:03:04 PM	1.559	g
COMP #1 COMPRESSOR	2 H VEL	5/8/2013 1:03:07 PM	1.032	in/s
COMP #1 COMPRESSOR	2 V VEL	5/8/2013 1:03:24 PM	1.233	in/s
COMP #1 COMPRESSOR	2 A VEL	5/8/2013 1:03:38 PM	0.232	in/s
COMP #1 COMPRESSOR	3 H E3	5/8/2013 1:03:54 PM	7.375	gE
COMP #1 COMPRESSOR	3 H E4	5/8/2013 1:03:57 PM	1.846	gE
COMP #1 COMPRESSOR	3 H VEL	5/8/2013 1:04:01 PM	0.780	in/s
COMP #1 COMPRESSOR	3 H ACC	5/8/2013 1:04:02 PM	2.315	g
COMP #1 COMPRESSOR	3 H ACC 2	5/8/2013 1:04:05 PM	1.824	g
COMP #1 COMPRESSOR	3 V VEL	5/8/2013 1:04:15 PM	0.819	in/s
COMP #1 COMPRESSOR	4 H E3	5/8/2013 1:04:30 PM	7.015	gE
COMP #1 COMPRESSOR	4 H E4	5/8/2013 1:04:33 PM	1.598	gE
COMP #1 COMPRESSOR	4 H ACC	5/8/2013 1:04:34 PM	2.217	g
COMP #1 COMPRESSOR	4 H ACC 2	5/8/2013 1:04:37 PM	1.820	g
COMP #1 COMPRESSOR	4 H VEL	5/8/2013 1:04:40 PM	1.038	in/s
COMP #1 COMPRESSOR	4 V VEL	5/8/2013 1:16:05 PM	1.350	in/s
COMP #1 COMPRESSOR	4 A VEL	5/8/2013 1:16:18 PM	0.247	in/s

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APPENDIX 2-4
Florida Bearings Report on Pahokee WWTF

Florida Bearings

A KAMAN COMPANY

www.floridabearings.com

Thermography Inspection at

Pahokee Waste Water Treatment Facility

5/3/2013

By

Ray Gretzinger

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Pahokee Waste Water Treatment Facility**	**Date: 5/3/2013**

Summary of Inspection

This is a report of a Thermographic survey of the electrical equipment in you facility. Below is a list of items inspected separated by location and equipment. Below this section you will find the faults that were found. These faults were found using these guidelines:

0 – 30 Degree F Rise: Risk Factor = Very Minor
31 – 99 Degree F Rise: Risk Factor = Schedule Repair When Convenient
100 + Degree F Rise: Risk Factor = Critical-Repair ASAP!

Location	Equipment
Blower House #1	Blower #1
	Blower #2

Blower House #3	Blower #1
	Blower #2
	Main-Blower House #2
	Main-Blower House #3

Blower House #2	Blower #2
	Blower #1
	Effluent Pump #3
	Effluent Pump #1
	Effluent Pump #2
	Head works-Grinder
	MCC2
	ATS
	400 AMP Main
	RAS Pump East
	RAS Pump West
	Secondary Clarifier East
	Secondary Clarifier West
	Primary Clarifier
	600 AMP Lugs
	600 AMP Lugs

Head Works	Grinder
	Auger

Primary Sludge	Primary Sludge Pump

Walker	Walker Drive

Bio Solids	JWC Grinder
	High Service Pump
	High Service Feed Pump
	Belt Drive Assembly
	Hydraulic Power Unit
	Sludge Feed Pump

Bio Solids	Auger #1
	Auger #2
	Lime Auger
	Bio Solids Pump

Faults

Location	Equipment	Recommendation	Page Number
Blower House #3	Blower #2	Inspect	4
Blower House #2	Effluent Pump #3	Inspect	5
Blower House #2	Blower #1	Inspect	6
Primary Sludge	Primary Sludge Pump	Inspect	7

Florida Bearings	Thermography Inspection at Pahokee Waste Water Treatment Facility	Date: 5/3/2013

Photo and Identification

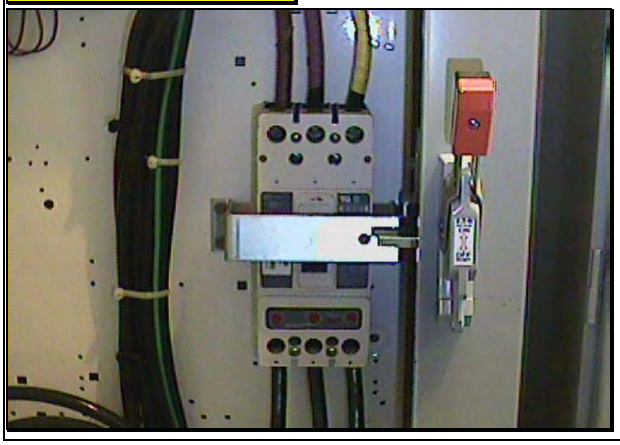
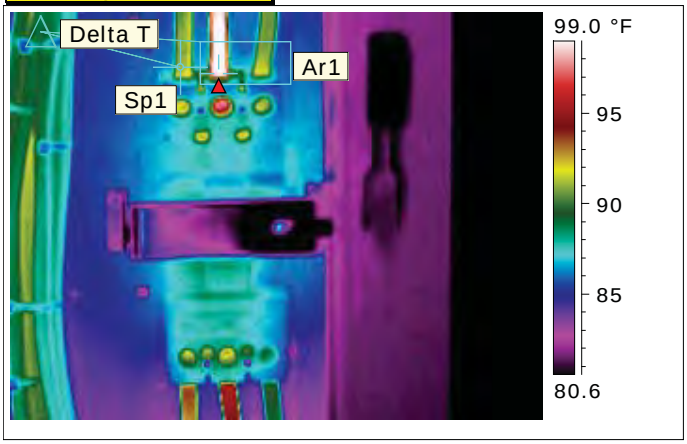


Image Time	9:54:53 AM
Image Date	5/3/2013
Location	Blower House #3
Equipment	Blower #2
Type	Breaker
Fault	L2 Line Side
Recommendation	Inspect

Thermogram 5/3/2013



Ar1 Max. Temperature	100.9 °F
Sp1 Temperature	91.1 °F
Delta T Value	9.8

Analysis & Recommended action:

Inspect L2 on line side of breaker. There is a 9.8 degree temperature difference between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:..... Date: **5/3**/2013

Repaired by: ..... Date:

Comment:.....

Florida Bearings	Thermography Inspection at Pahokee Waste Water Treatment Facility	Date: 5/3/2013

Photo and Identification

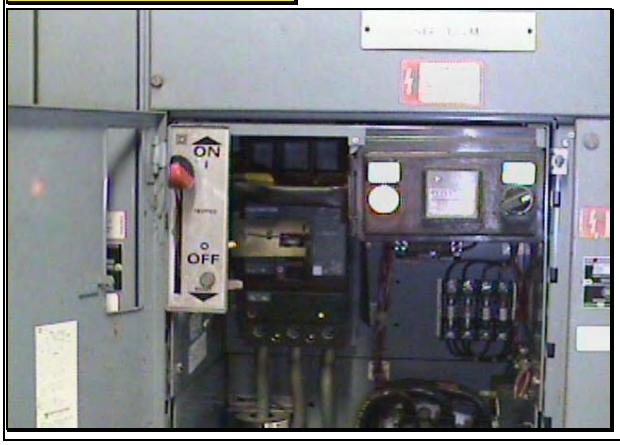
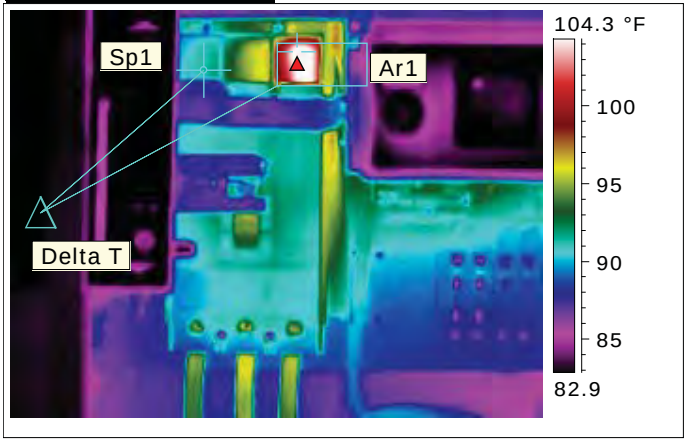


Image Time	10:21:50 AM
Image Date	5/3/2013
Location	Blower House #2
Equipment	Effluent Pump #3
Type	Breaker
Fault	L3 Line Side
Recommendation	Inspect

Thermogram 5/3/2013



Ar1 Max. Temperature	106.4 °F
Sp1 Temperature	91.5 °F
Delta T Value	14.9

Analysis & Recommended action:

Inspect L3 on the line side of the breaker. There is a 14.9 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:..... Date: **5/3**/2013

Repaired by: ..... Date:

Comment:.....

Florida Bearings	Thermography Inspection at Pahokee Waste Water Treatment Facility	Date: 5/3/2013

Photo and Identification

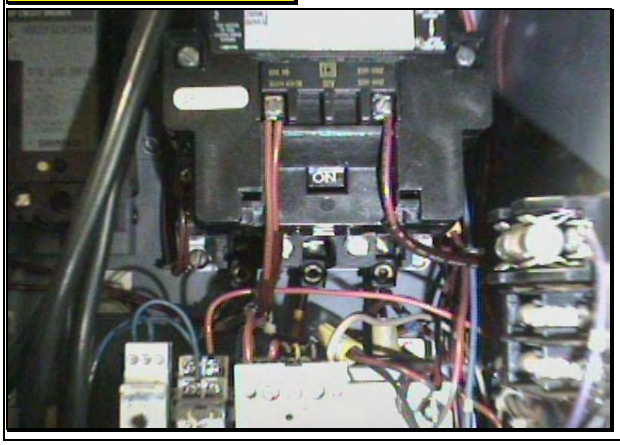
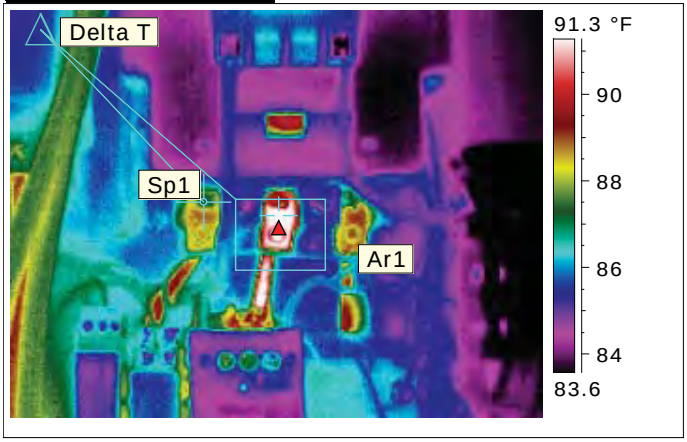


Image Time	10:26:14 AM
Image Date	5/3/2013
Location	Blower House #2
Equipment	Blower #1
Type	Starter
Fault	L2 Load Side
Recommendation	Inspect

Thermogram 5/3/2013



Ar1 Max. Temperature	91.9 °F
Sp1 Temperature	87.0 °F
Delta T Value	4.9

Analysis & Recommended action:

Inspect L2 on load side of starter. There is a 4.9 degree temperature difference between legs. Inspect connections and check amp readings.

Inspected by : **Ray Gretzinger** Signature:..... Date: **5/3**/2013

Repaired by: ..... Date:

Comment:.....

Florida Bearings A KAMAN COMPANY	**Thermography Inspection at Pahokee Waste Water Treatment Facility**	**Date: 5/3/2013**

Photo and Identification

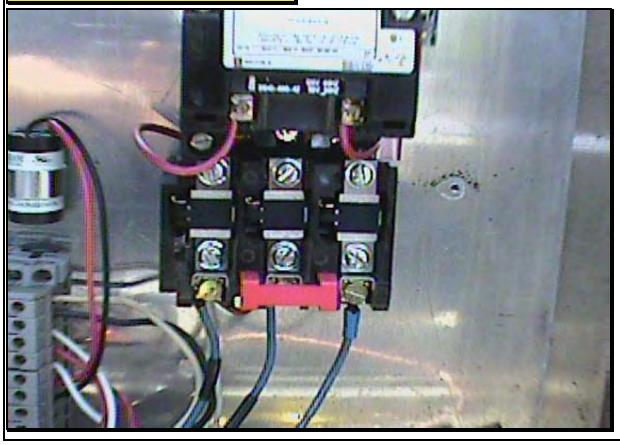
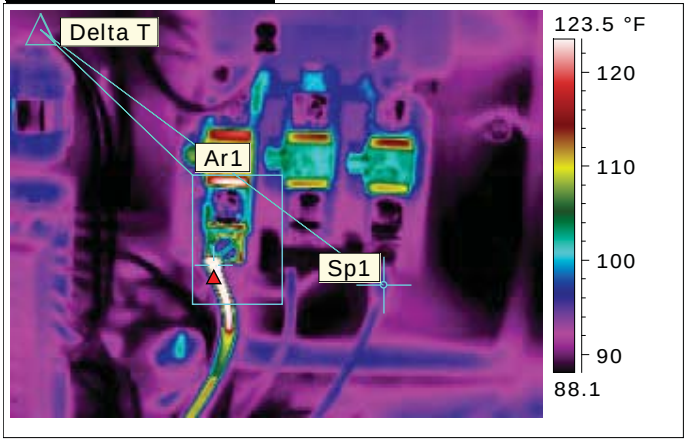


Image Time	11:21:25 AM
Image Date	5/3/2013
Location	Primary Sludge
Equipment	Primary Sludge Pump
Type	Starter
Fault	L1 Load Side
Recommendation	Inspect

Thermogram 5/3/2013



Ar1 Max. Temperature	144.0 °F
Sp1 Temperature	95.3 °F
Delta T Value	48.6

Analysis & Recommended action:

Inspect L1 on the load side of the starter. There is a 48.6 degree temperature difference between legs. Inspect connection and check amp readings.

Inspected by : **Ray Gretzinger** Signature:..... Date: **5/3**/2013

Repaired by: ..... Date:

Comment:.....

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Florida Bearings. Inc.
3164 N. Miami Avenue
Miami, FL 33127

VIBRATION ANALYSIS REPORT

Pahokee

Waste Water Treatment Plant

09 May 2013

Visit us at: www.floridabearings.com

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Vibration Schedule for Pahokee - Waste Water Treatment Plant

SKF Priority Codes	
1	Imminent Failure; Shut Down as Necessary
2	Immediate Attention; Action Required
3	Fault Detected; Plan for Action
4	Non-urgent Recommendation
6	Baseline Analysis - Work was Performed
	Acceptable Operating Conditions
	Not up for inspection

Reasons for Uncollected Data	
A	Unsafe to collect data
B	Not Running
C	Out of Service
D	No Manpower(No one to start eqp.)
E	Unloaded (Produces unreliable data)
F	Standby (Spare/Cannot be started)

#	Asset Name	Machinery Asset ID	Last Inspected	May '13												Notes
	PAHOKEE WWTP															
1	BLOWER HOUSE #1-BLOWER #1-MOTOR		5/9/2013													
2	BLOWER HOUSE #1-BLOWER #1-BLOWER		5/9/2013													
3	BLOWER HOUSE #1-BLOWER #2-MOTOR		5/9/2013	4												
4	BLOWER HOUSE #1-BLOWER #2-BLOWER		5/9/2013													
5	BLOWER HOUSE #2-BLOWER #1-MOTOR		5/9/2013													
6	BLOWER HOUSE #2-BLOWER #1-BLOWER		5/9/2013													
7	BLOWER HOUSE #2-BLOWER #2-MOTOR		5/9/2013													
8	BLOWER HOUSE #2-BLOWER #2-BLOWER		5/9/2013													
9	BLOWER HOUSE #3-BLOWER #1-MOTOR		5/9/2013													
10	BLOWER HOUSE #3-BLOWER #1-BLOWER		5/9/2013													
11	BLOWER HOUSE #3-BLOWER #2-MOTOR		5/9/2013													
12	BLOWER HOUSE #3-BLOWER #2-BLOWER		5/9/2013													
13	DIGESTER TRANSFER PUMP - MOTOR		5/9/2013													
14	DIGESTER TRANSFER PUMP - GB		5/9/2013													
15	DIGESTER TRANSFER PUMP - PUMP		5/9/2013													
16	GRINDER HEADWORKS - MOTOR		5/9/2013													
17	GRINDER HEADWORKS - GB		5/9/2013													
18	GRINDER HEADWORKS - AUGER															
19	PRIMARY CLARIFIER - MOTOR		5/9/2013													
20	PRIMARY CLARIFIER - 1ST GB		5/9/2013													
21	PRIMARY CLARIFIER - 2nd GB		5/9/2013													
22	BELT PRESS JWC GRINDER - MOTOR		5/9/2013													
23	BELT PRESS JWC GRINDER - GB		5/9/2013													
24	WACKER DRIVE - MOTOR		5/9/2013													
25	WACKER DRIVE - GB		5/9/2013													
26	EFFLUENT PUMP #1 - MOTOR		5/9/2013													
27	EFFLUENT PUMP #1 - PUMP		5/9/2013													
28	EFFLUENT PUMP #2 - MOTOR		5/9/2013													
29	EFFLUENT PUMP #2 - PUMP		5/9/2013	4												
30	EFFLUENT PUMP #3 - MOTOR		5/9/2013													
31	EFFLUENT PUMP #3 - PUMP		5/9/2013													
32	SLUDGE FEED PUMP - MOTOR															
33	SLUDGE FEED PUMP - GB															
34	SLUDGE FEED PUMP - PUMP															
35	BIOSOLIDS PUMP - MOTOR		5/9/2013													
36	BIOSOLIDS PUMP - GB		5/9/2013													
37	BIOSOLIDS PUMP - PUMP		5/9/2013													
38	SECONDARY CLARIFIER EAST - MOTOR		5/9/2013													
39	SECONDARY CLARIFIER EAST - 1ST GB		5/9/2013													
40	SECONDARY CLARIFIER EAST - 2ND GB		5/9/2013													
41	SECONDARY CLARIFIER WEST - MOTOR		5/9/2013													
42	SECONDARY CLARIFIER WEST - 1ST GB		5/9/2013													
43	SECONDARY CLARIFIER WEST - 2ND GB		5/9/2013													

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Vibration Schedule for Pahokee - Waste Water Treatment Plant

SKF Priority Codes	
1	Imminent Failure; Shut Down as Necessary
2	Immediate Attention; Action Required
3	Fault Detected; Plan for Action
4	Non-urgent Recommendation
6	Baseline Analysis - Work was Performed
	Acceptable Operating Conditions
	Not up for inspection

Reasons for Uncollected Data	
A	Unsafe to collect data
B	Not Running
C	Out of Service
D	No Manpower(No one to start eqp.)
E	Unloaded (Produces unreliable data)
F	Standby (Spare/Cannot be started)

#	Asset Name	Machinery Asset ID	Last Inspected	May '13												Notes
44	HYDRAULIC POWER UNIT - MOTOR		5/9/2013													
45	AUGER #1 - MOTOR		5/9/2013													
46	AUGER #1 - GEARBOX		5/9/2013													
47	AUGER #2 - MOTOR		5/9/2013													
48	AUGER #2 - GEARBOX		5/9/2013													
49	HIGH SERVICE PUMP - MOTOR		5/9/2013													
50	HIGH SERVICE FEED PUMP - MOTOR		5/9/2013													
51	HIGH SERVICE FEED PUMP - PUMP		5/9/2013	3												
52	LIME AUGER - MOTOR															
53	LIME AUGER - GB															
54	BELT DRIVE ASSEMBLY - MOTOR		5/9/2013													
55	BELT DRIVE ASSEMBLY - GB		5/9/2013													

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“PREDICTIVE DETAILED REPORT”

Area: **PAHOKEE WWTP**
Asset Name: **HIGH SERVICE FEED PUMP - PUMP**

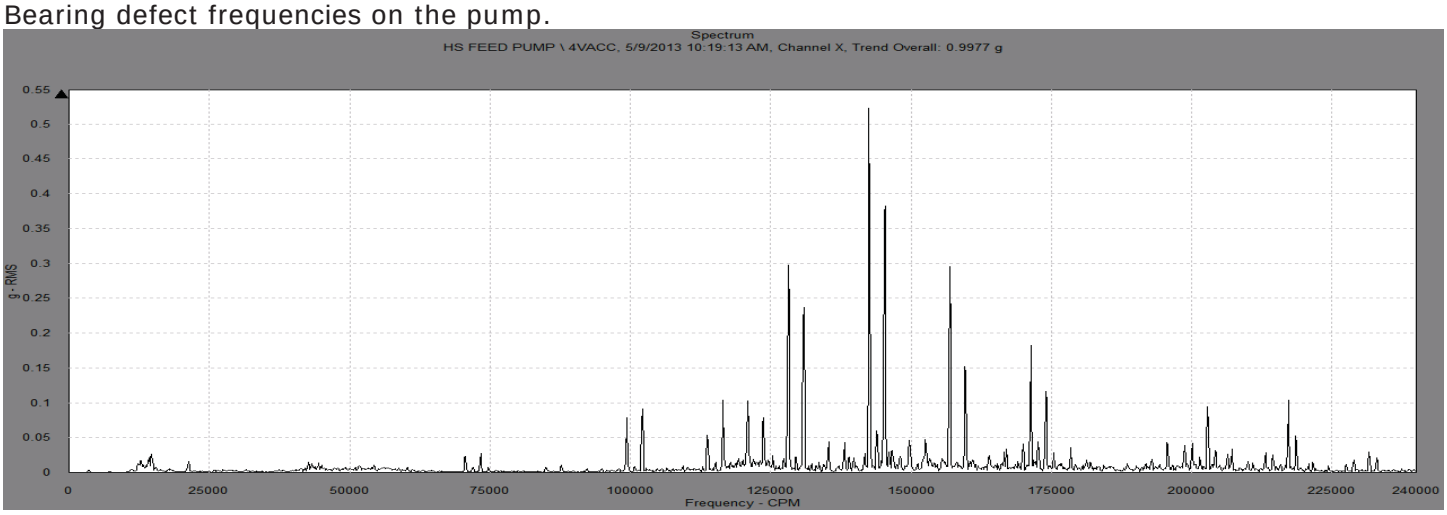
Current Priority-3
Fault Detected; Plan for Action

Recommendations: 1) Replace pump bearings.

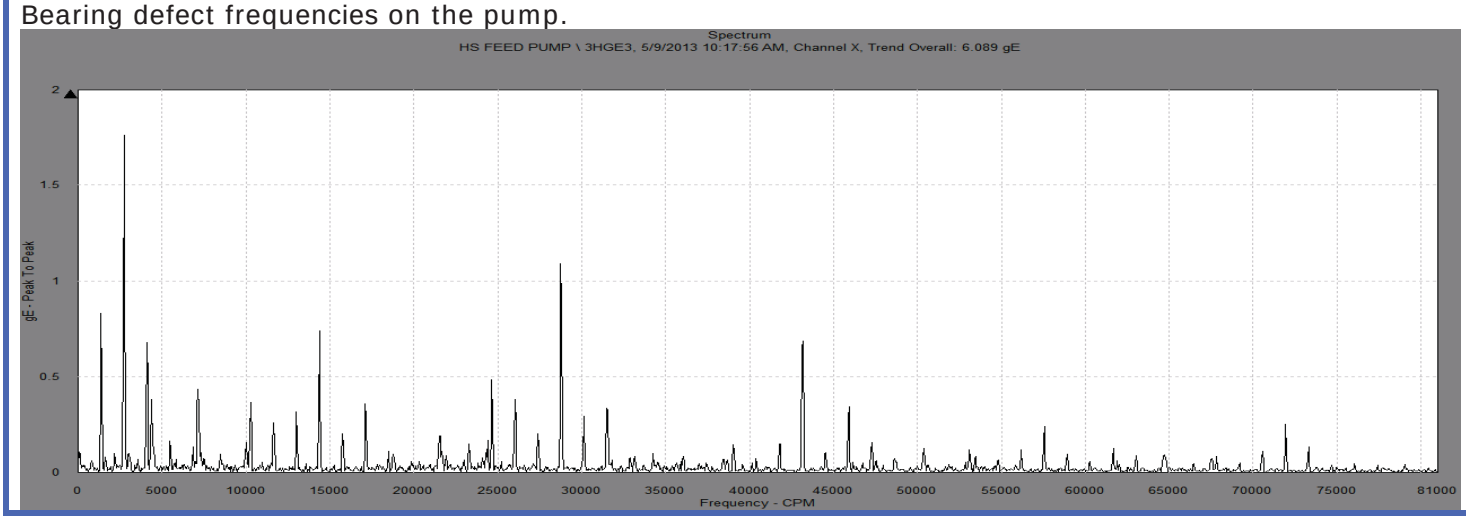
Observations: 1) Bearing defect frequencies are present on the pump.

Other Info:
Inspected on: 05/09/2013
Past Priority = 0
First Reported on: 05/09/2013

Bearing defect frequencies on the pump.



Bearing defect frequencies on the pump.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
HS FEED MOTOR	1HACC	5/9/2013 10:16:30 AM	0.374	g
HS FEED MOTOR	1HGE3	5/9/2013 10:16:32 AM	1.293	gE
HS FEED MOTOR	1HVEL	5/9/2013 10:16:37 AM	0.045	in/s
HS FEED MOTOR	1VVEL	5/9/2013 10:16:59 AM	0.034	in/s
HS FEED MOTOR	2HACC	5/9/2013 10:17:09 AM	0.495	g
HS FEED MOTOR	2HGE3	5/9/2013 10:17:11 AM	2.013	gE
HS FEED MOTOR	2HVEL	5/9/2013 10:17:15 AM	0.039	in/s
HS FEED MOTOR	2VVEL	5/9/2013 10:17:30 AM	0.024	in/s
HS FEED MOTOR	2AVEL	5/9/2013 10:17:42 AM	0.032	in/s
HS FEED PUMP	3HACC	5/9/2013 10:17:54 AM	1.564	g
HS FEED PUMP	3HGE3	5/9/2013 10:17:56 AM	6.089	gE
HS FEED PUMP	3HVEL	5/9/2013 10:18:01 AM	0.037	in/s
HS FEED PUMP	3HVEL LO	5/9/2013 10:18:08 AM	0.035	in/s
HS FEED PUMP	3VACC	5/9/2013 10:18:18 AM	1.004	g
HS FEED PUMP	3VVEL	5/9/2013 10:18:22 AM	0.027	in/s
HS FEED PUMP	4HACC	5/9/2013 10:18:40 AM	1.341	g
HS FEED PUMP	4HGE3	5/9/2013 10:18:42 AM	4.744	gE
HS FEED PUMP	4HVEL	5/9/2013 10:18:47 AM	0.027	in/s
HS FEED PUMP	4HVEL LO	5/9/2013 10:18:53 AM	0.020	in/s
HS FEED PUMP	4VACC	5/9/2013 10:19:13 AM	0.998	g
HS FEED PUMP	4VVEL	5/9/2013 10:19:16 AM	0.024	in/s

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“PREDICTIVE DETAILED REPORT”

Area: **PAHOKEE WWTP**
Asset Name: **BLOWER HOUSE #1-BLOWER #2-MOTOR**

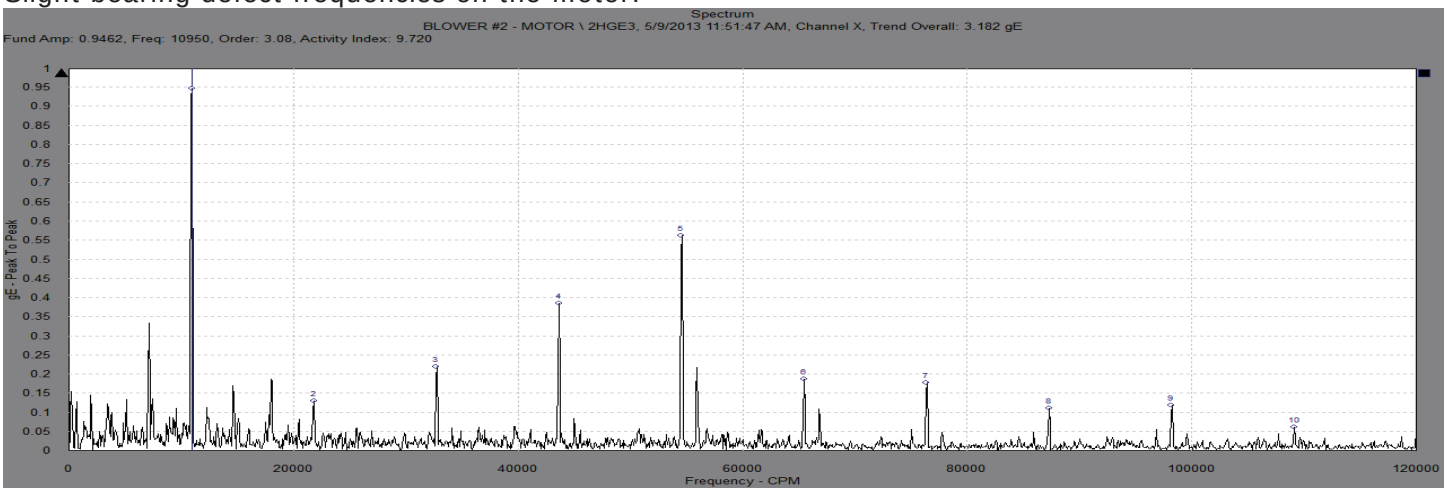
Current Priority-4
Non-urgent Recommendation

Other Info:
Inspected on: 05/09/2013
Past Priority =0
First Reported on: 05/09/2013

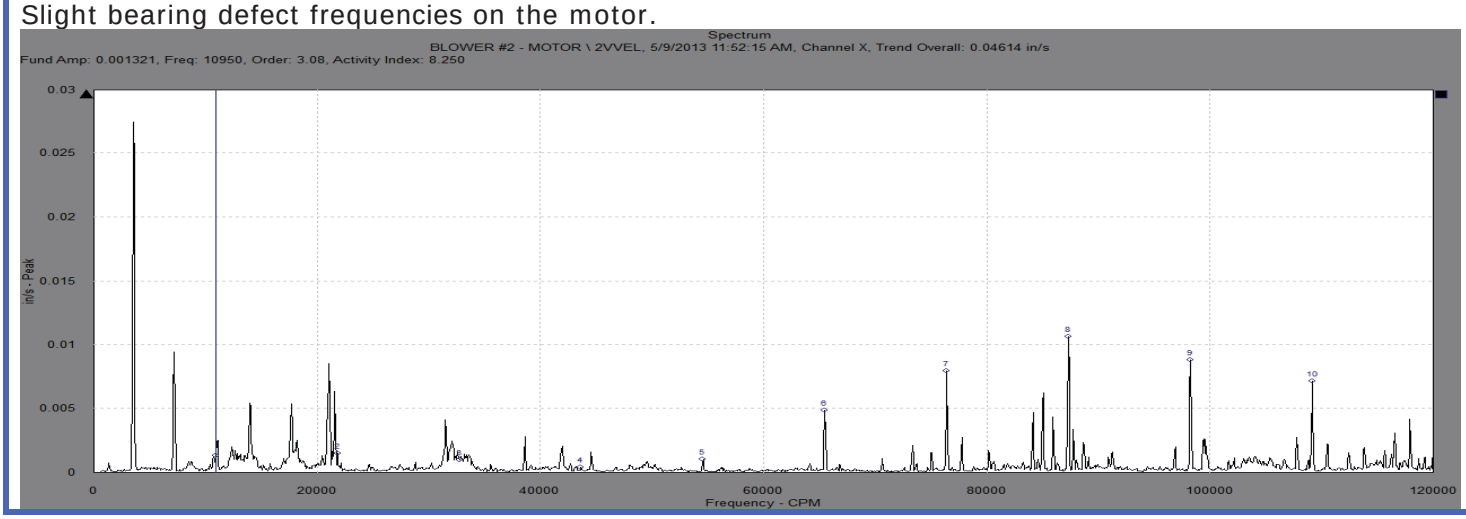
Recommendations: 1) Closely monitor motor for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) Slight bearing defect frequencies are present on the motor drive end bearing at a low amplitude of vibration.

Slight bearing defect frequencies on the motor.



Slight bearing defect frequencies on the motor.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
BLOWER #2 - MOTOR	1HACC	5/9/2013 11:50:39 AM	0.556	g
BLOWER #2 - MOTOR	1HGE3	5/9/2013 11:50:41 AM	1.517	gE
BLOWER #2 - MOTOR	1HVEL	5/9/2013 11:50:44 AM	0.074	in/s
BLOWER #2 - MOTOR	1VVEL	5/9/2013 11:51:16 AM	0.052	in/s
BLOWER #2 - MOTOR	2HACC	5/9/2013 11:51:45 AM	1.101	g
BLOWER #2 - MOTOR	2HGE3	5/9/2013 11:51:47 AM	3.182	gE
BLOWER #2 - MOTOR	2HVEL	5/9/2013 11:51:51 AM	0.090	in/s
BLOWER #2 - MOTOR	2VVEL	5/9/2013 11:52:15 AM	0.046	in/s
BLOWER #2 - MOTOR	2AVEL	5/9/2013 11:52:35 AM	0.074	in/s
BLOWER #2 - BLOWER	3HACC	5/9/2013 11:52:48 AM	0.621	g
BLOWER #2 - BLOWER	3HGE3	5/9/2013 11:52:50 AM	1.857	gE
BLOWER #2 - BLOWER	3HVEL	5/9/2013 11:52:54 AM	0.057	in/s
BLOWER #2 - BLOWER	3VACC	5/9/2013 11:53:14 AM	0.710	g
BLOWER #2 - BLOWER	3VVEL	5/9/2013 11:53:17 AM	0.074	in/s
BLOWER #2 - BLOWER	4HACC	5/9/2013 11:53:30 AM	1.074	g
BLOWER #2 - BLOWER	4HGE3	5/9/2013 11:53:32 AM	3.570	gE
BLOWER #2 - BLOWER	4HVEL	5/9/2013 11:53:36 AM	0.076	in/s
BLOWER #2 - BLOWER	4VACC	5/9/2013 11:53:57 AM	1.265	g
BLOWER #2 - BLOWER	4VVEL	5/9/2013 11:54:00 AM	0.105	in/s

“PREDICTIVE DETAILED REPORT”

Area: **PAHOKEE WWTP**
Asset Name: **EFFLUENT PUMP #2 - PUMP**

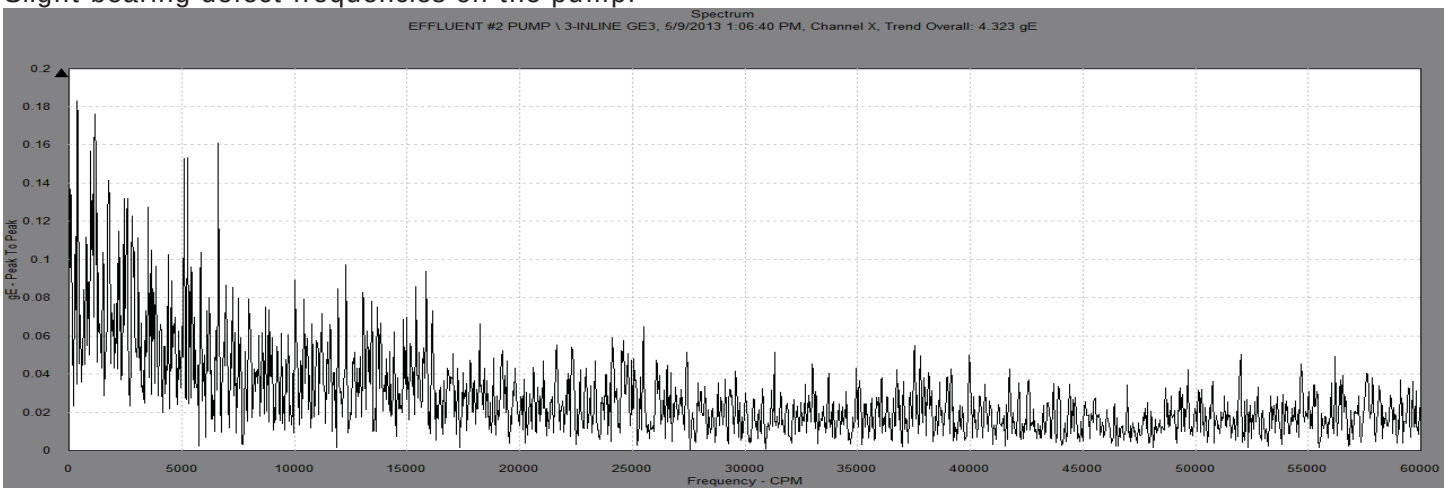
Current Priority-4
Non-urgent Recommendation

Other Info:
Inspected on: 05/09/2013
Past Priority =0
First Reported on: 05/09/2013

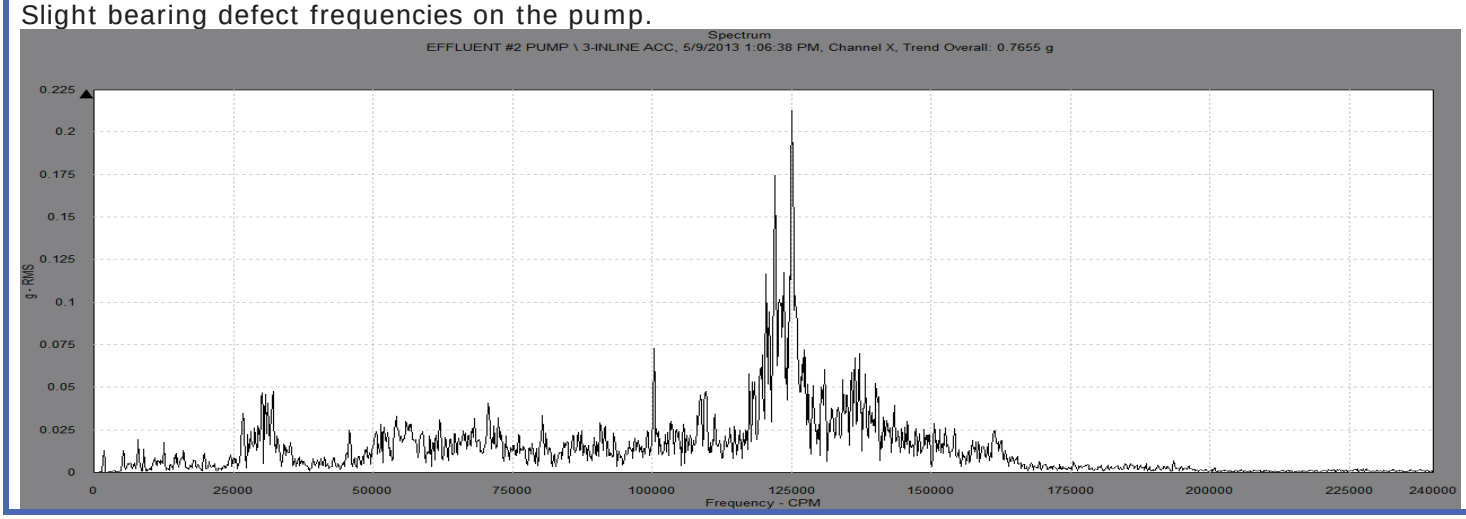
Recommendations: 1) Closely monitor pump for any increase in vibration amplitude and/or noise. 2) Perform another vibration survey in 6 months to evaluate rate of degradation.

Observations: 1) Slight bearing defect frequencies are present on the pump at low amplitude of vibration.

Slight bearing defect frequencies on the pump.



Slight bearing defect frequencies on the pump.



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“LAST MEASUREMENT REPORT”

Machine name	POINT name	Date/Time	Last value	Units
EFFLUENT #2 MOTOR	1-INLINE ACC	5/9/2013 1:04:43 PM	0.464	g
EFFLUENT #2 MOTOR	1-INLINE GE3	5/9/2013 1:04:46 PM	1.354	gE
EFFLUENT #2 MOTOR	1-INLINE VEL	5/9/2013 1:04:51 PM	0.160	in/s
EFFLUENT #2 MOTOR	1-INLINE VEL LO	5/9/2013 1:05:03 PM	0.159	in/s
EFFLUENT #2 MOTOR	1-90DEG ACC	5/9/2013 1:05:19 PM	0.321	g
EFFLUENT #2 MOTOR	1-90DEG VEL	5/9/2013 1:05:23 PM	0.364	in/s
EFFLUENT #2 MOTOR	2-INLINE ACC	5/9/2013 1:05:38 PM	0.216	g
EFFLUENT #2 MOTOR	2-INLINE GE3	5/9/2013 1:05:41 PM	0.888	gE
EFFLUENT #2 MOTOR	2-INLINE VEL	5/9/2013 1:05:45 PM	0.098	in/s
EFFLUENT #2 MOTOR	2-90DEG ACC	5/9/2013 1:06:01 PM	0.444	g
EFFLUENT #2 MOTOR	2-90DEG VEL	5/9/2013 1:06:05 PM	0.199	in/s
EFFLUENT #2 MOTOR	2-90DEG VEL LO	5/9/2013 1:06:18 PM	0.200	in/s
EFFLUENT #2 PUMP	3-INLINE ACC	5/9/2013 1:06:38 PM	0.766	g
EFFLUENT #2 PUMP	3-INLINE GE3	5/9/2013 1:06:40 PM	4.323	gE
EFFLUENT #2 PUMP	3-INLINE VEL	5/9/2013 1:06:45 PM	0.054	in/s
EFFLUENT #2 PUMP	3-INLINE VEL LO	5/9/2013 1:06:58 PM	0.046	in/s
EFFLUENT #2 PUMP	3-90DEG ACC	5/9/2013 1:07:13 PM	0.499	g
EFFLUENT #2 PUMP	3-90DEG VEL	5/9/2013 1:07:17 PM	0.072	in/s
EFFLUENT #2 PUMP	3AACC	5/9/2013 1:07:28 PM	0.455	g
EFFLUENT #2 PUMP	3AVEL	5/9/2013 1:07:32 PM	0.066	in/s

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APPENDIX 2-5
Belle Glade WWTF Photographs

Appendix 2-5a
Belle Glade WWTF
Structural Photos

Site Visit

December 4, 2012

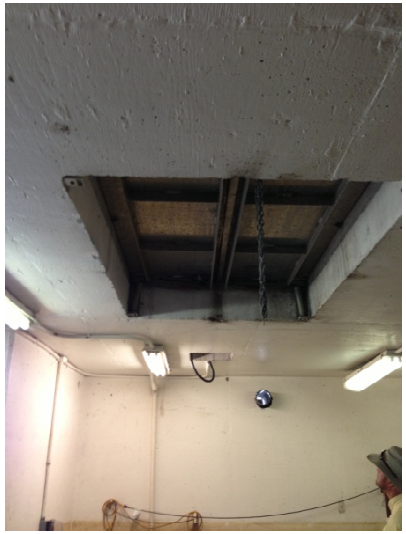
BGWWTP - Abandoned EQ Tank 01

BGWWTP - Abandoned EQ Tank 02

BGWWTP - Chlorine Handling 01

BGWWTP - Clarifier 1&2 01

BGWWTP - Clarifier 1&2 02



BGWWTP - Clarifier 1&2 03

BGWWTP - Clarifier 1&2 04

BGWWTP - Clarifier 1&2 05

BGWWTP - Clarifier 1&2 06

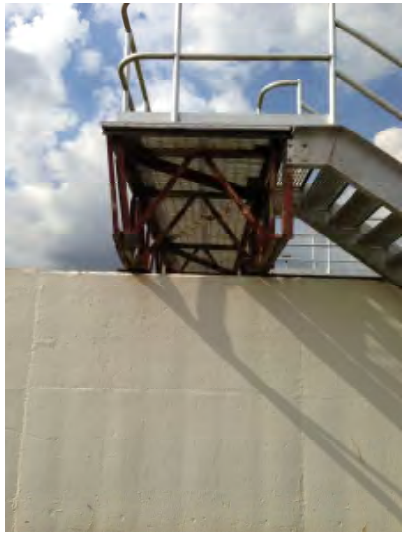
BGWWTP - Clarifier 1&2 07

BGWWTP - Clarifier 1&2 08

BGWWTP - Clarifier 1&2 09

BGWWTP - Clarifier 1&2 10

BGWWTP - Clarifier 1&2 11



BGWWTP - Clarifier 1&2 12

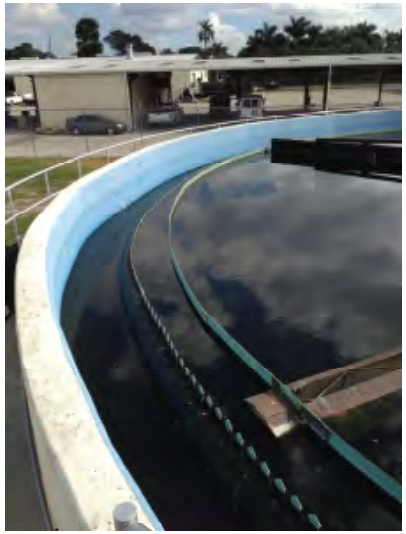
BGWWTP - Clarifier 1&2 13

BGWWTP - Clarifier 1&2 14

BGWWTP - Clarifier3 01

BGWWTP - Clarifier3 02

BGWWTP - Clarifier3 03



BGWWTP - Clarifier3 04

BGWWTP - Clarifier4 01

BGWWTP - Clarifier4 02

BGWWTP - Digester 01

BGWWTP - Digester 02

BGWWTP - Digester 03

BGWWTP - Digester 04

BGWWTP - Digester 05

BGWWTP - Digester 06

BGWWTP - Generator Bldg 01

BGWWTP - Headworks 01

BGWWTP - Headworks 02

BGWWTP - Headworks 03

BGWWTP - Headworks 04

BGWWTP - Headworks 05

BGWWTP - Headworks 06

BGWWTP - Headworks 07

BGWWTP - Headworks 08

BGWWTP - Headworks 09

BGWWTP - Headworks 10

BGWWTP - Headworks 11

BGWWTP - Headworks 12

BGWWTP - Headworks 13

BGWWTP - Headworks 14

BGWWTP - Headworks 15

BGWWTP - Headworks 16

BGWWTP - Headworks 17

BGWWTP - Headworks 18

BGWWTP - Headworks 19

BGWWTP - Headworks 20

BGWWTP - Headworks 21

BGWWTP - Headworks 22

BGWWTP - Headworks 23

BGWWTP - Headworks 24

BGWWTP - Maintenance Bldg 01

BGWWTP - MCC Bldg 01

BGWWTP - Ops Building 01

BGWWTP - Ops Building 02

BGWWTP - Ops Building 03

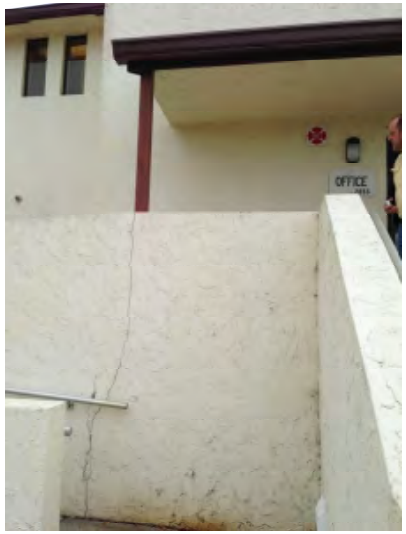
BGWWTP - Ops Building 04

BGWWTP - Ops Building 05

BGWWTP - Ops Building 06

BGWWTP - Ops Building 07

BGWWTP - Ops Building 08



BGWWTP - Ops Building 09

BGWWTP - Ops Building 10

BGWWTP - Ops Building 11

BGWWTP - Ops Building 12

BGWWTP - Ops Building 13

BGWWTP - Ops Building 14

BGWWTP - Ops Building 15

BGWWTP - Ops Building 16

BGWWTP - Ops Building 17

BGWWTP - Ops Building 18

BGWWTP - Ops Building 19

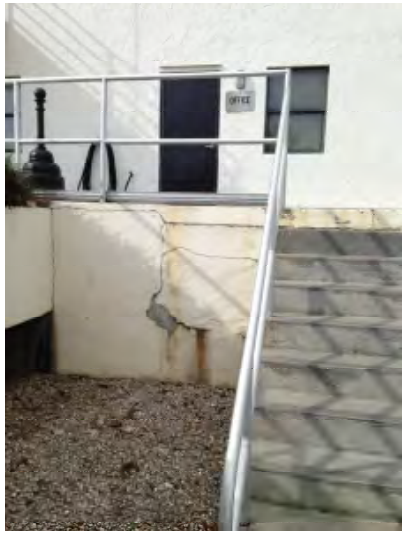
BGWWTP - Ops Building 20

BGWWTP - Ops Building 21

BGWWTP - Ops Building 22

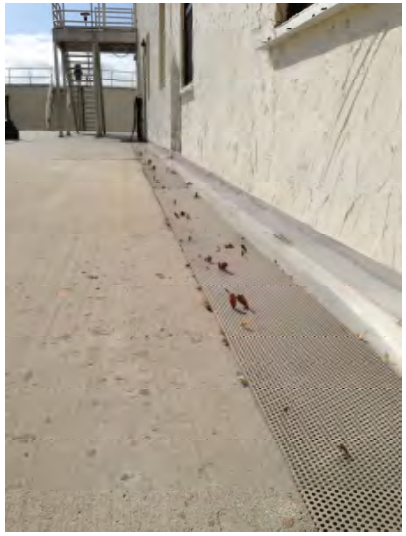
BGWWTP - Ops Building 23

BGWWTP - Ops Building 24



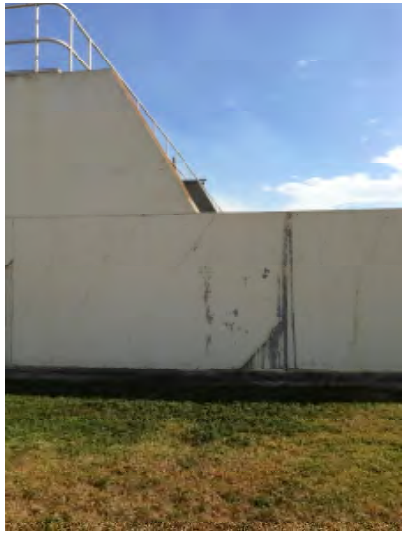
BGWWTP - Ops Building 25

BGWWTP - Ops Building 26



BGWWTP - Ops Building 27

BGWWTP - Ox Ditch1 01



BGWWTP - Ox Ditch1 02

BGWWTP - Ox Ditch1 03

BGWWTP - Ox Ditch1 04

BGWWTP - Ox Ditch1 05

BGWWTP - Ox Ditch2 01

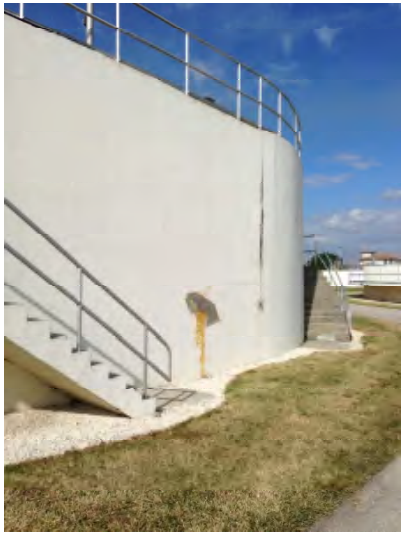
BGWWTP - Ox Ditch2 02

BGWWTP - Ox Ditch2 03

BGWWTP - Ox Ditch2 04

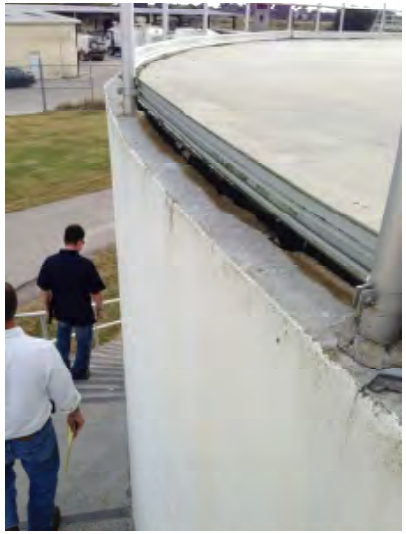
BGWWTP - Ox Ditch2 05

BGWWTP - Ox Ditch2 06



BGWWTP - Ox Ditch2 07

BGWWTP - Ox Ditch2 08



BGWWTP - Ox Ditch2 09

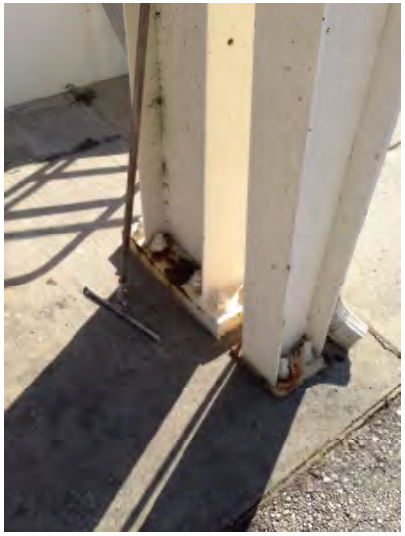
BGWWTP - RASWAS 01

BGWWTP - RASWAS 02

BGWWTP - Roto Screen 01

BGWWTP - Roto Screen 02

BGWWTP - Roto Screen 03



BGWWTP - Roto Screen 04

BGWWTP - Roto Screen 05

BGWWTP - Roto Screen 06

BGWWTP - Roto Screen 07

BGWWTP - Roto Screen 08

BGWWTP - Sludge Thickening 01

BGWWTP - Splitter Box2 01

BGWWTP - Splitter Box2 02

BGWWTP - Well Pad 01

Appendix 2-5b
Belle Glade WWTF
Mechanical Photos

Site Visits

December 4, 2012 / April 29, 2013 /
May 15, 2013

Aerobic Digester 001

Aerobic Digester 002

Aerobic Digester 003

Chlorine Storage 001

Chlorine Storage 002

Chlorine Storage 003

Chlorine Storage 004

Clarifier Nos. 1 and 2 001

Clarifier Nos. 1 and 2 002

Clarifier Nos. 1 and 2 003

Clarifier Nos. 1 and 2 004

Clarifier Nos. 1 and 2 005

Clarifier Nos. 1 and 2 006

Clarifier Nos. 1 and 2 007

Clarifier Nos. 1 and 2 008

Clarifier Nos. 1 and 2 009

Clarifier Nos. 1 and 2 010

Clarifier Nos. 3 and 4 001

Clarifier Nos. 3 and 4 002

Clarifier Nos. 3 and 4 003

Clarifier Nos. 3 and 4 004

Clarifier Nos. 3 and 4 005

Effluent Wet Well Slide Gate 001

Effluent Wet Well Slide Gate 002

Effluent Wet Well Slide Gate 003

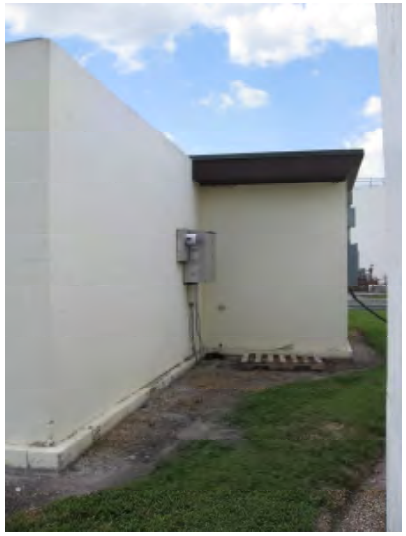
Equalization (EQ) Tank 001

Equalization (EQ) Tank 002

Generator Building No. 1 001

Generator Building No. 1 002

Generator Building No. 1 003



Generator Building No. 1 004

Generator Building No. 2

Headworks 001

Headworks 002

Headworks 003

Headworks 004

Headworks 005

Headworks 006

Headworks 007

Headworks 008

Headworks 009

Headworks 010

Headworks 011

Headworks 012

Headworks 013

Headworks 014

Headworks 015

Headworks 016

Headworks 017

Headworks 018

Headworks 019

Headworks 020

Headworks 021

Headworks 022

Headworks 023

Headworks 024

Headworks 025

Headworks 026

Headworks 027

Headworks 028

Injection Well Pump Station 001

Injection Well Pump Station 002

Injection Well Pump Station 003

Injection Well Pump Station 004

Injection Well Pump Station 005

Injection Well Pump Station 006

Injection Well Pump Station 007

Injection Well Pump Station 008

Injection Well Pump Station 009

Injection Well Pump Station 010

Lift Station No. 1 001

Lift Station No. 1 002

Lift Station No. 1 003

Lift Station No. 1 004

Lift Station No. 1 005

Lift Station No. 2 001

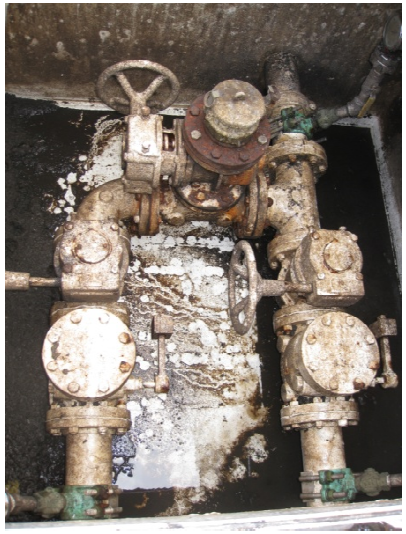
Lift Station No. 2 002

Lift Station No. 2 003

Lift Station No. 2 004

Lift Station No. 2 005

Lift Station No. 2 006



Lift Station No. 2 007

Lift Station No. 2 008

Lift Station No. 2 009

Maintenance Building

Operations Building 001

Operations Building 002

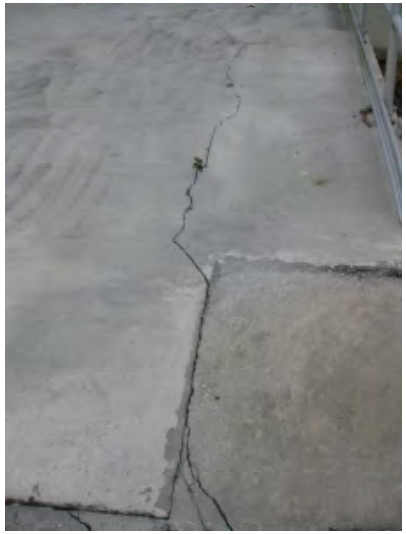
Operations Building 003

Operations Building 004

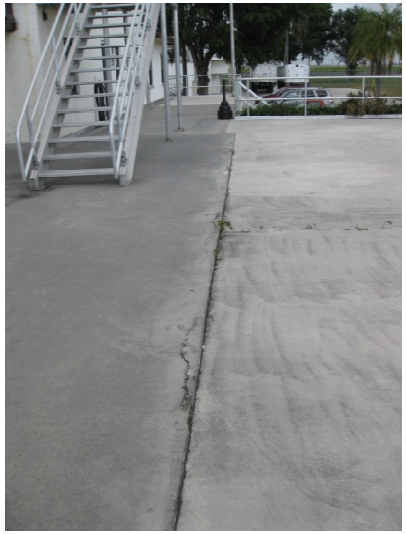
Operations Building 005

Operations Building 006

Operations Building 007



Operations Building 008



Operations Building 009

Oxidation Ditch Nos. 1 and 2 001

Oxidation Ditch Nos. 1 and 2 002

Oxidation Ditch Nos. 1 and 2 003

Oxidation Ditch Nos. 1 and 2 004

Oxidation Ditch Nos. 1 and 2 005

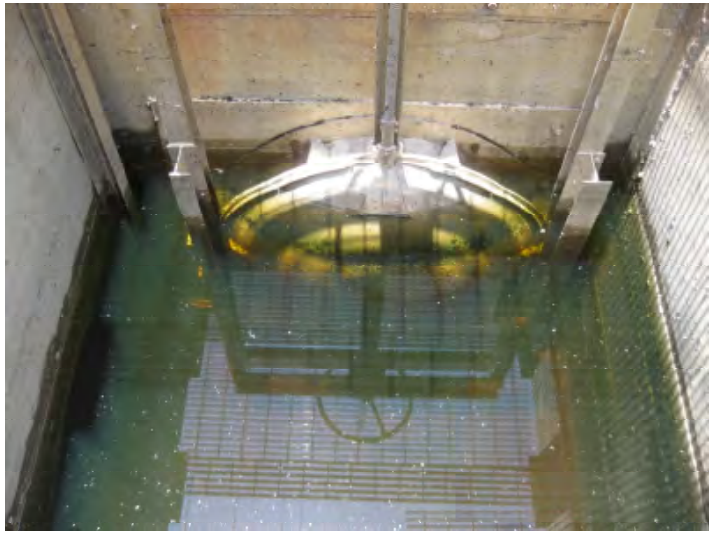
Oxidation Ditch Nos. 1 and 2 006

Oxidation Ditch Nos. 1 and 2 007

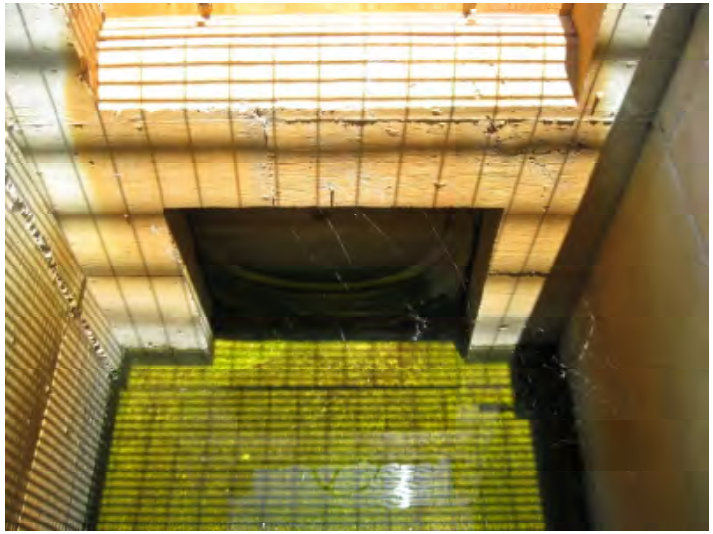
Oxidation Ditch Nos. 1 and 2 008

Oxidation Ditch Nos. 1 and 2 009

Oxidation Ditch Nos. 1 and 2 010



Pond By-Pass Gate 001



Pond By-Pass Gate 002

Portable Dewatering Operations 1

Portable Dewatering Operations 2

Portable Dewatering Operations 3

Portable Dewatering Operations 4

Portable Dewatering Operations 5

Portable Dewatering Operations 6

RAS and WAS 001

RAS and WAS 002

RAS and WAS 003

RAS and WAS 004

RAS and WAS 005

RAS and WAS 006

Roto-Screens 001

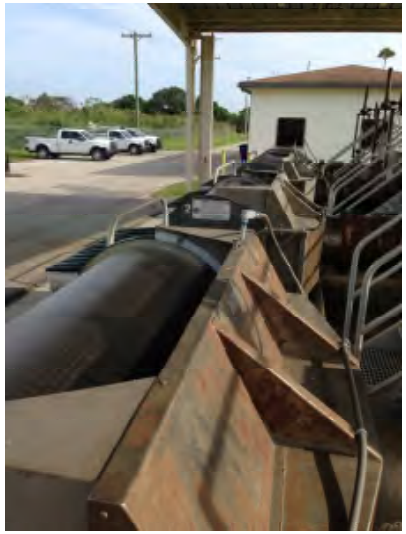
Roto-Screens 002

Roto-Screens 003

Roto-Screens 004

Roto-Screens 005

Roto-Screens 006



Roto-Screens 007

Sludge Thickening Facility 001

Sludge Thickening Facility 002

Sludge Thickening Facility 003

Sludge Thickening Facility 004

Sludge Thickening Facility 005

Sludge Thickening Facility 006

Sludge Thickening Facility 007

Splitter Box No. 2 001

Splitter Box No. 2 002

Splitter Box No. 2 003

Thickener Polymer Facility 1

Thickener Polymer Facility 2

Thickener Polymer Facility 3

Thickener Polymer Facility 4

Thickener Polymer Facility 5

APPENDIX 2-6
Pahokee WWTF Photographs

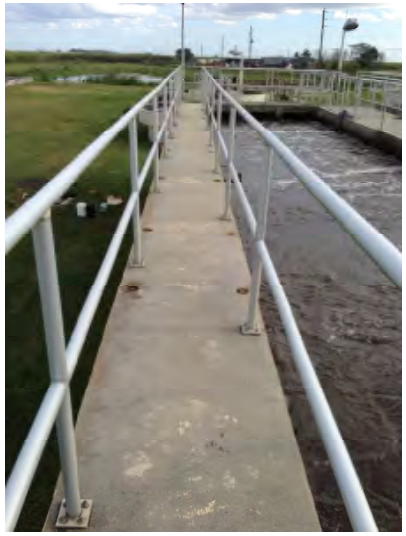
Appendix 2-6a
Pahokee WWTF
Structural Photos

Site Visit

December 4, 2012

PWWTP - Aeration Tanks 01

PWWTP - Aeration Tanks 02



PWWTP - Aeration Tanks 03

PWWTP - Aeration Tanks 04

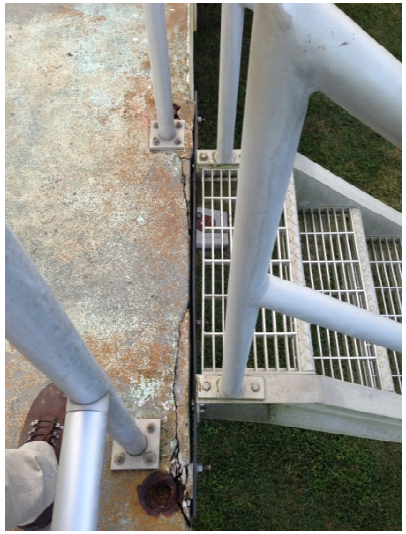
PWWTP - Aeration Tanks 05

PWWTP - Aeration Tanks 06

PWWTP - Aeration Tanks 07

PWWTP - Aeration Tanks 08

PWWTP - Aeration Tanks 09



PWWTP - Aeration Tanks 10

PWWTP - Aeration Tanks 11

PWWTP - Aeration Tanks 12

PWWTP - Blower House 1 01

PWWTP - Blower House 1 02

PWWTP - Blower House 1 03

PWWTP - Blower House 2 01

PWWTP - Blower House 2 02

PWWTP - Blower House 2 03

PWWTP - Blower House 2 04

PWWTP - Blower House 3 01

PWWTP - Blower House 3 02

PWWTP - Blower House 3 03

PWWTP - Chlorine Contact 1 01

PWWTP - Chlorine Contact 2 01

PWWTP - Chlorine Contact 2 02

PWWTP - Chlorine Contact 2 03

PWWTP - Conduit Supports 01

PWWTP - Digester1 01

PWWTP - Elevated Pipe Supports 01

PWWTP - Elevated Pipe Supports 02

PWWTP - Grit Chamber 01

PWWTP - Grit Chamber 02

PWWTP - Grit Chamber 03

PWWTP - Grit Chamber 04

PWWTP - Headworks 01

PWWTP - Headworks 02

PWWTP - Headworks 03

PWWTP - Ops Bldg 01

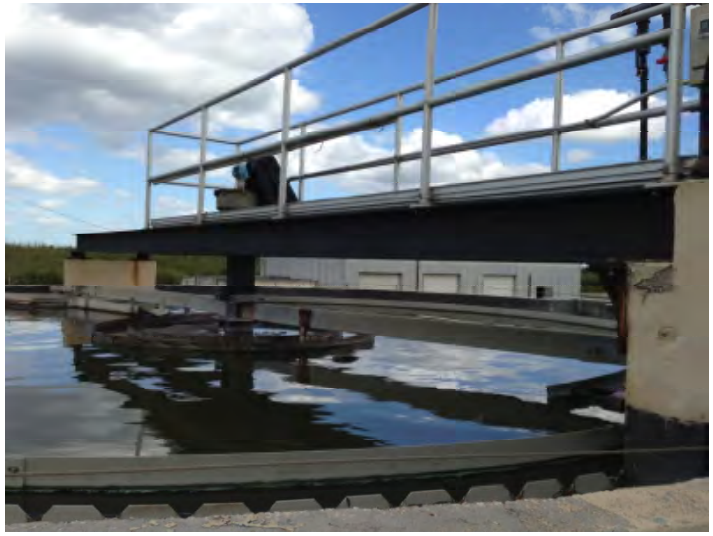
PWWTP - Ops Bldg 02

PWWTP - Ops Bldg 03

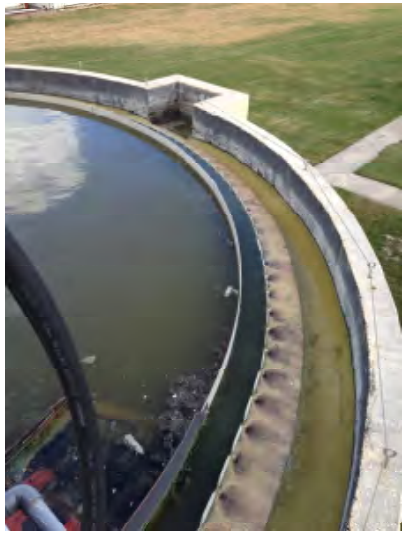
PWWTP - Ops Bldg 04

PWWTP - Ops Bldg 05

PWWTP - Primary Clarifier1 01



PWWTP - Primary Clarifier1 02



PWWTP - Primary Clarifier1 03

PWWTP - Reuse Pumps 01

PWWTP - Secondary Clarifier 1 01

PWWTP - Secondary Clarifier 1 02

PWWTP - Secondary Clarifier 2 01

PWWTP - Secondary Clarifier 2 02

PWWTP - Secondary Clarifier 2 03

PWWTP - Sludge Facility 01

PWWTP - Sludge Facility 02

PWWTP - Splitter Box 01

PWWTP - Tertiary Filter 01

PWWTP - Tertiary Filter 02

PWWTP - Walker Treatment & Grit Chamber 01

PWWTP - Walker Treatment 01

PWWTP - Walker Treatment 02

Appendix 2-6b
Pahokee WWTF
Mechanical Photos

Site Visits

December 4, 2012 / April 29, 2013 /
May 15, 2013

Aeration Tank Nos. 1 and 2 001

Aeration Tank Nos. 1 and 2 002

Aeration Tank Nos. 1 and 2 003

Aeration Tank Nos. 1 and 2 004

Aeration Tank Nos. 1 and 2 005

Aeration Tank Nos. 1 and 2 006

Aeration Tank Nos. 1 and 2 007

Belt Press Feed Line and Grinder

Blower House No. 1 001

Chlorine and Operations Building 001

Chlorine and Operations Building 002

Chlorine and Operations Building 003

Chlorine Contact Chamber No. 1 001

Chlorine Contact Chamber No. 1 002

Chlorine Contact Chamber No. 2 001

Chlorine Contact Chamber No. 2 002

Control Building and Blower House No. 3 001

Control Building and Blower House No. 3 002

Control Building and Blower House No. 3 003

Control Building and Blower House No. 3 004

Digester No. 1 001

Digester No. 1 002

Digester No. 1 003

Digester No. 1 004

Digester No. 1 005

Digester No. 1 006

Elevated Piping

Equipment Building and Blower House No. 2 001

Equipment Building and Blower House No. 2 002

Equipment Building and Blower House No. 2 003

Headworks 001

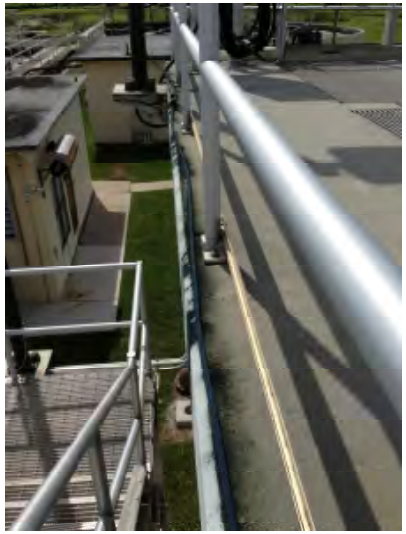
Headworks 002

Headworks 003

Headworks 004

Headworks 005

Headworks 006



Headworks 007

Influent Pump Station

Injection Well

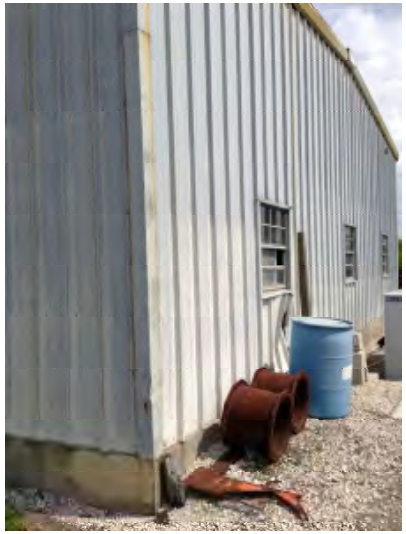
Maintenance Building 001

Maintenance Building 002

Maintenance Building 003

Maintenance Building 004

Maintenance Building 005



Maintenance Building 006

Maintenance Building 007

On-site Lift Station

Primary Clarifier 001

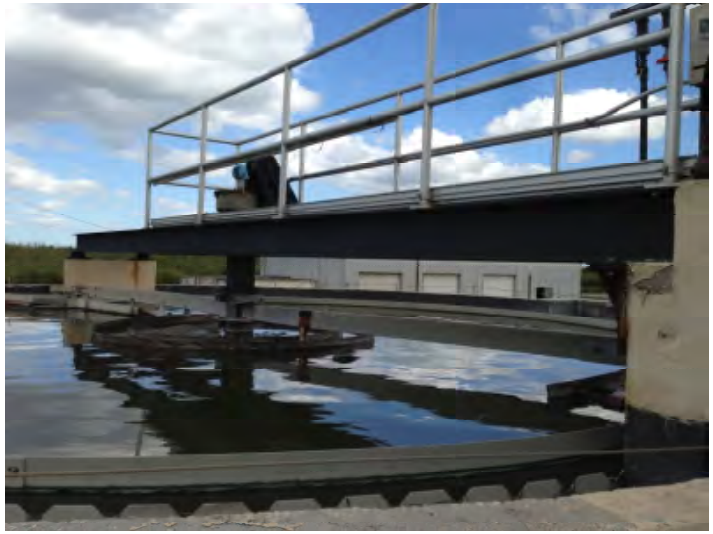
Primary Clarifier 002

Primary Clarifier 003

Primary Clarifier 004

Primary Clarifier 005

Primary Clarifier 006



Primary Clarifier 007

RAS and WAS 001

RAS and WAS 002

Secondary Clarifiers - East and West 001

Secondary Clarifiers - East and West 002

Secondary Clarifiers - East and West 003

Secondary Clarifiers - East and West 004

Secondary Clarifiers - East and West 005

Secondary Clarifiers - East and West 006

Sidewalks

Sludge Thickening Bisolids Facility 001

Sludge Thickening Bisolids Facility 002

Sludge Thickening Bisolids
Facility 003

Sludge Thickening Bisolids
Facility 004

Tertiary Filter and Effluent Pump Station 001

Tertiary Filter and Effluent Pump Station 002

Tertiary Filter and Effluent Pump Station 003

Tertiary Filter and Effluent Pump Station 004

Tertiary Filter and Effluent Pump Station 005

Walker Unit and Grit Chamber 001

Walker Unit and Grit Chamber 002

Walker Unit and Grit Chamber 003

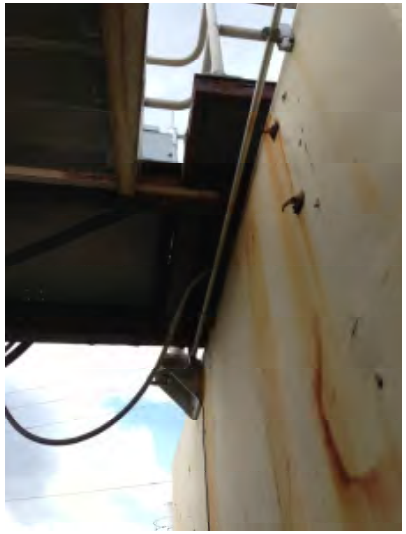
Walker Unit and Grit Chamber 004

Walker Unit and Grit Chamber 005

Walker Unit and Grit Chamber 006

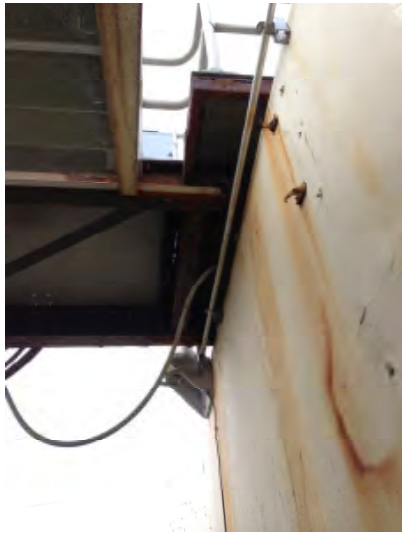
Walker Unit and Grit Chamber 007

Walker Unit and Grit Chamber 008



Walker Unit and Grit Chamber
009

Walker Unit and Grit Chamber
010



Walker Unit and Grit Chamber
011

Walker Unit and Grit Chamber 012

Walker Unit Influent Pipe Supports

Washwater Pumps 001

Washwater Pumps 002

APPENDIX 2-7
Belle Glade WWTF Equipment List

APPENDIX 2-7
PALM BEACH COUNTY
GLADES UTILITY AUTORITY - BELLE GLADES WWTF
EQUIPMENT LIST

Asset #	Location	Description	Man.	Serial #	Model #	Type/Size	HP	Frame	RPM	Volts	Amps	Input RPM	Output RPM	Service Factor	Phase	Class	Ratio	Oil Cap.	In HP	Peak Eff	Shaft Brg	Opp End Brg	Spec #	Cat #	Comments
1	Headworks	Barscreen #1 Motor	Baldor	W0210011258			0.5	56C	1725	460	1			1.25	3					68%			34A63-872	VN 3538	Re-built on 2010
2	Headworks	Barscreen #2 Motor	Baldor	W1104110843			0.5	56C	1725	460	1			1.25	3					68%			34A63-872	VN 3538	Re-built on 2010
3	Headworks	Barscreen #1 Intermediate Reducer		A610CL0116918	BM847LGE																				Re-built on 2010
4	Headworks	Barscreen #2 Intermediate Reducer		A610CL0199835	BM847LGE																				Re-built on 2010
5	Headworks	Barscreen #1 Reducer	Sumitomo Drive Tech	VA0354532	EHYJS-A610DAY-F3-809							1750	2.12	1.0			809		0.307					PA138919	Re-built on 2010
6	Headworks	Barscreen #2 Reducer	Sumitomo Drive Tech	VA0393475	EHYJS-A610DAY-F3-809							1750	2.12	1.0			809		0.307					PA145920	Re-built on 2010
7	Headworks	Barscreen #1	Parkson Aqua Guard	200014-L	AG-MN-A	6 mm																			Re-built on 2010
8	Headworks	Barscreen #2	Parkson Aqua Guard	200014-R	AG-MN-A	6 mm																			Re-built on 2010
9	Headworks	Pista Grit Seperator #1 Motor	Baldor	F0910152207	VEM3581T		1	143TC	1765	460	1.5			1.15	3										Re-built on 2010
10	Headworks	Pista Grit Seperator #2 Motor	Baldor	F0910152217	VEM3581T		1	143TC	1765	460	1.5			1.15	3										Re-built on 2010
11	Headworks	Pista Grit Seperator #1 Reducer	Nord Gear Corp.		SK32F-140TC	Helical Gear											57.53:1								Re-built on 2010
12	Headworks	Pista Grit Seperator #2 Reducer	Nord Gear Corp.		SK32F-140TC	Helical Gear											57.53:1							967738	Re-built on 2010
13	Headworks	Pista Grit Seperator #1 Gearhead	Jones and Attwood			550 Jeta Grit Trap						30	11				2.67:1							967738	Re-built on 2010
14	Headworks	Pista Grit Seperator #2 Gearhead	Jones and Attwood			550 Jeta Grit Trap						30	11				2.67:1								Re-built on 2010
15	Headworks	Pista Grit Air Compressor #1 Motor	US Elec. Motors	B09-T747-M	T747A		5	184T	1750	460	6.4			1.15	3					87.50%	6206-2Z-J/C3	6205-2Z-J/C3			Re-built on 2010
16	Headworks	Pista Grit Air Compressor #2 Motor	US Elec. Motors	B09-T747-M	T747A		5	184T	1750	460	6.4			1.15	3					87.50%	6206-2Z-J/C3	6205-2Z-J/C3			Re-built on 2010
17	Headworks	Pista Grit Air Compressor #1	Tuthill Corp	33119 9806	3003-2162																				Re-built on 2010
18	Headworks	Pista Grit Air Compressor #2	Tuthill Corp	36554 9810	3003-2162																				Re-built on 2010
19	Headworks	Grit Classifier #1 Motor	US Motor/ Emerson		BK19	SSNF	0.5	56C	1755	460	0.9			1.15						78.50%				WDS12S2ACR	Installed on 2010
20	Headworks	Grit Classifier #2 Motor	US Motor/ Emerson		BK19	SSNF	0.5	56C	1755	460	0.9			1.15						78.50%				WDS12S2ACR	Installed on 2010
21	Headworks	Grit Classifier Gear Reducer #1	SEW Eurodrive	01.1323746301.002.10	FAF67 R37 AM56	Helical - Worm Gear						1700/5.6													Installed on 2010
22	Headworks	Grit Classifier Gear Reducer #2	SEW Eurodrive	01.1323746301.001.10	FAF67 R37 AM56	Helical - Worm Gear						1700/5.6													Installed on 2010
23	Headworks	Gritt Mitt Classifier #1	Westech	20866A-D102	20866A	GF3																			Installed on 2010
24	Headworks	Gritt Mitt Classifier #2	Westech	20866A-D103	20866A	GF3																			Installed on 2010
25	Oxidation Ditch #1	Oxi Ditch #1 Motor #1	Reliance Electric	01MAN59269G003MA			100/75	447 LP	1190/890	460	121/97.6			1.15						97.60%	65BC03JP30X	70BT03JR00X			
26	Oxidation Ditch #1	Oxi Ditch #1 Motor #2	Reliance Electric	01MAN59269G004MA			100/75	447 LP	1190/890	460	121/97/6			1.15						97.60%	65BC03JP30X	70BT03JR00X			
27	Oxidation Ditch #1	Oxi Ditch #1 Gear Reducer #1	Flender	302316-1-4	XSBN 360							1190/890	33.90/25.35				35.102.1	7.7 Gal							
28	Oxidation Ditch #1	Oxi Ditch #1 Gear Reducer #2	Flender	302316-1-3	XSBN 360							1190/890	33.90/25.35				35.102.1	7.7 Gal							
29	Oxidation Ditch #2	Oxi Ditch #2 Motor #1	Reliance Electric	01MAN59269 G 002 KA			100/75	447 LP	1190/890	460	121/97.6			1.15						97.60%	65BC03JP30X	70BT03JR00X			
30	Oxidation Ditch #2	Oxi Ditch #2 Motor #2	Reliance Electric	01MAN 59269 G 001 KA			100/75	447 LP	1190/890	460	121/97.6			1.15						97.60%	65BC03JP30X	70BT03JR00X			
31	Oxidation Ditch #2	Oxi Ditch #2 Gear Reducer #1	Flender	302316-1-1	XSBN 360							1190/890	33.90/25.35												
32	Oxidation Ditch #2	Oxi Ditch #2 Gear Reducer #2	Flender	302316-1-2	XSBN 360							1190/890	33.90/25.35												
33	Clarifier #1	Clarifier #1 Motor	Leeson Elec. Corp.		C42017FK4A		0.33	MSS56C	1750	90	3.5														
34	Clarifier #1	Clarifier #1 Reducer	Browning	262DOR-L1__E V99					1750																
35	Clarifier #1	Scum Pump #1 Motor	US Electric	A09A163R056F	5830A	TCE	3.0	213T	1175		9.4/4,7				3					89.50%	6208-27-J/C3	6206-27-J/C3			
36	Clarifier #1	Scum Pump #1	Haywood Gordon Limited	277048-4	RS2-7-8								1150										50 USGPM		
37	Clarifier #2	Clarifier #2 Motor	Leeson Elec. Corp.		C42017FK4A		0.33	MSS56C	1750	90	3.5														
38	Clarifier #2	Clarifier #2 Reducer	Browning	no tag																					
39	Clarifier #2	Scum Pump #2 Motor	US Electric	A12A265R063F	5830A	TCE	3	213T	1175		9.4/4,7				3					89.50%	6208-27-J/C3	6206-27-J/C3			
40	Clarifier #2	Scum Pump #2	Haywood Gordon Limited	277048-1	RS2-7-8								1150										50 USGPM		
41	Clarifier #3	Clarifier #3 Motor	Emerson Browning	R09258986-0002M0001																					
42	Clarifier #3	Clarifier #3 Reducer	Browning		E463/R09144663N																				
43	Clarifier #3	Scum Pump #3 Motor	Emerson	P107383661-0025M0001	BM58A																				
44	Clarifier #3	Scum Pump #3	AMT		316A-95																				
45	Clarifier #4	Clarifier #4 Motor	Emerson Browning	R05238887-0002M0001																					
46	Clarifier #4	Clarifier #4 Reducer	Browning		E463/R07141713N																				
47	Clarifier #4	Scum Pump #4 Motor	Emerson	R017399792-0024 M 0001																					
48	Clarifier #4	Scum Pump #4	AMT		316A-95																				
49	RAS / WAS Building	RAS Motor #1	Flygt	S9840009 606	3170.090.9330		25		1170	480	34														
50	RAS / WAS Building	RAS Motor #2	Flygt	S9840007 606	3170.090.9330		25		1170	480	34														
51	RAS / WAS Building	RAS Motor #3	Flygt	S9840008 606	3170.090.9330		25		1170	480	34														
52	RAS / WAS Building	WAS Motor #1	US Elec. Motors	B10 01023621 001 F																					Installed on October 2012
53	RAS / WAS Building	WAS Motor #2	US Elec. Motors																						
54	RAS / WAS Building	WAS Reducer #1	US Elec. Motors	RB10-97092272-6T 02																				CBN2302SB3C1215T	
55	RAS / WAS Building	WAS Reducer #2	US Elec. Motors																						
56	RAS / WAS Building	WAS Pump #1	Borger	982134 1 1	G11FTCC003-S	PL 400																			Installed on October 2012
57	RAS / WAS Building	WAS Pump #2	Borger			PL 400																			Re-built on October 2012
58	Roto Screen Building	Roto Screen Motor #1	SEW Eurodrive		DTF80N6-KS									1.15	3										Re-built on 2010
59	Roto Screen Building	Roto Screen Motor #2	SEW Eurodrive	870255300.10.10.002	DTF80N6-KS									1.15	3										Re-built on 2010
60	Roto Screen Building	Roto Screen Motor #3	SEW Eurodrive	870255300.10.10.001	DTF80N6-KS									1.15	3										Re-built on 2010
61	Roto Screen Building	Roto Screen Motor #4	SEW Eurodrive	870228015.09.09.001	DTF80N6-KS									1.15	3										Re-built on 2010
62	Roto Screen Building	Roto Screen Gear Reducer #1	SEW Eurodrive		FA77DT80N6-KS							1120	7.9	2.2											Re-built on 2010
63	Roto Screen Building	Roto Screen Gear Reducer #2	SEW Eurodrive	870255300.10.10.002	FA77DT80N6-KS							1120	7.9	2.2											Re-built on 2010
64	Roto Screen Building	Roto Screen Gear Reducer #3	SEW Eurodrive	870255300.10.10.001	FA77DT80N6-KS							1120	7.9	2.2											Re-built on 2010
65	Roto Screen Building	Roto Screen Gear Reducer #4	SEW Eurodrive	870228015.09.09.001	FA77DT80N6-KS							1120	7.9	2.2											Re-built on 2010
66	Injection Well	Injection Well Motor #1	US Motors	C0198022861-001R-01			300	5009P		460	343	120	1200	1.15				12 Qt			6219-J	7226-BCB			Scheduled to be re-built on December 2012
67	Injection Well	Injection Well Motor #2	US Motors	C0198022861-001R-02			300	5009P		460	343	120	1200	1.15				12 Qt			6219-J	7226-BCB			
68	Injection Well	Injection Well Motor #3	Emerson	P0420082905-0001 R 0001			300	5009P		460	343	120	1200	1.15				12 QT			6219-JC3	7228-BCBM			
69	Injection Well	Injection Well Motor #4	US Motors	C0198022861-001R-03			300	5009P		460	343	120	1200	1.15				12 Qt			6219-J	7226-BCB			
70	Injection Well	Injection Well Pump #1	Peerless Pump Co.	221412D	18XHB							1190											345 GPM		
71	Injection Well	Injection Well Pump #2	Peerless Pump Co.	221412C	18XHB							1190											345 GPM		
72	Injection Well	Injection Well Pump #3	Peerless Pump Co.	no data																					
73	Injection Well	Injection Well Pump #4	Peerless Pump Co.	221412A	18XHB							1190											345 GPM		
74	Sludge Handling Building	Rotary Drum Thickener #1 Motor	Reliance Electric				2	FE145TC	1750	230/460	5.8/2.9			1.25											Re-built on 2011
75	Sludge Handling Building	Rotary Drum Thickener #1 Gear Reducer	Nord Gear Corp.	(no plate)																					Re-built on 2011
76	Sludge Handling Building	Thickened Sludge Pump #1 Motor	US Electric		VT15	TCIP	5	184T	1755	460	6.4									88.50%				B10 01023619 001 F	Re-built on 2011
77	Sludge Handling Building	Thickened Sludge Pump #1 Gear Reducer	Browning	RB10-97092274-6T 01	Series 2000				1750								7.1							CBN2202SV3CI184T	Re-built on 2011
78	Sludge Handling Building	Thickened Sludge Pump #1	Borger	23112733 11		P200																	EADCCCCAA4		Re-built on 2011
79	Sludge Handling Building	Rotary Drum Thickener #2 Motor	Baldor				2	145TC	1740	480	80			1.45						84%			35A002T585H1	3M3558T	Re-built on 2010
80	Sludge Handling Building	Rotary Drum Thickener #2 Gear Reducer	Nord Gear Corp.	982520144 01	32-14OTC								62				27.64								Re-built on 2010
81	Sludge Handling Building	Thickened Sludge Pump #2 Motor	US Elec. Motors		VT15	TCIP	5	184T	1755	460	6.4	5								88.5%				B10 01023619 001 F	Re-built on 2010
82	Sludge Handling Building	Thickened Sludge Pump #2 Gear Reducer	Browning	RB10-97092274-6T 02	Series 2000				1750								7.1							CBN2202SV3CI184T	Re-built on 2010
83	Sludge Handling Building	Thickened Sludge Pump #2	Borger	9821342.2		P200																			Re-built on 2010
84	Digester Building	Blower #1 Motor	Toshiba	980805951	B1252FLG3USW	11KK	125	44415	3565	460	141			1.15						94.5%	6313C3	6313C3			
85	Digester Building	Blower #2 Motor	Toshiba	980803394	B1252FLG3USW	11KK	125	44415	3565	460	141			1.15						94.5%	6313C3	6313C3			
86	Digester Building	Blower #1	Hoffman	M091820	74107A																			C005322	
87	Digester Building	Blower #2	Hoffman	M091810	74107A																			C005322	
88	Digester Building	Truck Loading Pump #1 Motor																							Re-built on October 2012
89	Digester Building	Truck Loading Pump #1 Gear Reducer																							Re-built on October 2012

APPENDIX 2-7
PALM BEACH COUNTY
GLADES UTILITY AUTORITY - BELLE GLADES WWTF
EQUIPMENT LIST

Asset #	Location	Description	Man.	Serial #	Model #	Type/Size	HP	Frame	RPM	Volts	Amps	Input RPM	Output RPM	Service Factor	Phase	Class	Ratio	Oil Cap.	In HP	Peak Eff	Shaft Brg	Opp End Brg	Spec #	Cat #	Comments
90	Disinfection Building	Bleach Pump #1 Motor	ATB	229749301H0252																					Installed 2012
91	Disinfection Building	Bleach Pump #2 Motor	ATB	229749301H0249																					Installed 2012
92	Disinfection Building	Bleach Pump #3 Motor	ATB	229749301H0275																					Installed 2012
93	Disinfection Building	Bleach Pump #1	Prominent Fluid Control	2712019564		S2CAHM16130PVT8070UD5100C					3.2-2												34.3 GPH		Installed 2012
94	Disinfection Building	Bleach Pump #2	Prominent Fluid Control	2712019563		S2CAHM16130PVT8070UD5100C																			Installed 2012
95	Disinfection Building	Bleach Pump #3	Prominent Fluid Control	2712019565		S2CAHM16130PVT8070UD5100C																			Installed 2012
96	Disinfection Building	Batching Pump Motor	Finish Thompson Inc.	89642 B12	YY5622	TEFC	0.12			115	1.55			1.1										107597-4	Installed 2012
97	Disinfection Building	Batching Pump	Finish Thompson Inc.	103722 F12	DB3V-T-M619																				Installed 2012
98	Liftstation #1	Pump #1					5			460	6.5		1715	1.15	3										
99	Liftstation #1	Pump #2					5			460	6.5		1715	1.15	3										
100	Liftstation #2	Pump #1																							
101	Liftstation #2	Pump #2																							
102	Truckwash Liftstation	Pump #1																							
103	Truckwash Liftstation	Pump #2																							

APPENDIX 2-8
Pahokee WWTF Equipment List

APPENDIX 2-8
PALM BEACH COUNTY
GLADES UTILITY AUTORITY - PAHOKEE WWTF
EQUIPMENT LIST

Asset #	Location	Description	Man.	Serial #	Model #	Type/Size	HP	Frame	RPM	Volts	Amps	KW	Input RPM	Output RPM	Service Factor	Phase	Class	Ratio	Oil Cap.	In HP	Peak Eff	Shaft Brg	Opp End Brg	Spec #	Cat #	Replaced
1	Headworks	Muffin Auger Gear Box	Nord Gear	218209339543.00 002	4382AZSH N140TC				11																	
2	Headworks	Grinder Electric Motor	Baldor/Reliance	XO 904			5	184TC	1725	208/230	15-13				1.1	3							6206			
3	Headworks	Grinder Gearbox		CLO-125955	CNVJS-6125Y-29-182T				1750				5.06												31313-0029-182T	
4	Primary Clarifier	Primary Clarifier Motor	SEW Eurodrive	870098603.08.001		DFT7-104-KS	0.5		1700	230/460																
5	Primary Clarifier	Primary Clarifier Gearbox	SEW Eurodrive	850133073.99.99.002		R63R42DT71D4-KS							1700	6.9	1			246								
6	Primary Clarifier	Primary Sludge Pump	Homa			4"	11.4		1750	480	13					3										2010
7	Blower House 2	Blower #1	Hoffman	289073	4205																					
8	Blower House 2	Blower #1 Electric Motor	Toshiba/Houston	9600153B	B0302FLG3UL	TTKK	30	286TS	3530	230/460	7.2/3.6				1.2	3	F				88.5					
9	Blower House 2	Blower #2	Hoffman	289074	4205																				G5-35712	
10	Blower House 2	Blower #2 Electric Motor	Toshiba /Houston	9600154B	B0302FLC3UL	TTKK	30	286TS	3530	230/460	7.2/3.6				1.15	3					88.5					
11	Blower House 2	Generator	Kohler	250534	230R07271	Cummins			1800		346	230														2006
12	WALKER PLANT	Drive Motor	Boston Gear										0.73	1128				60:16:00							F724-60-B5-6	
13	WALKER PLANT	Drive gear box	O/s																							
14	WALKER PLANT	Degritter motor	O/S																							
15	WALKER PLANT	Degritter classifier																								
16	Blower House 3	Blower #1	Hoffman	97495	38406A4																					
17	Blower House 3	Blower #1 Electric Motor	Baldor	706092Q0035			100																			
18	Blower House 3	Blower #2	Hoffman	97496	38406A4																					
19	Blower House 3	Blower #3 Electric Motor	General Electric	LK015032	5K365AK170	K	100	365TS	3550	460	113					3										
20	Blower House 3	Generator	Kohler	280060	200R0ZD71	Detroit			1800			200												132411-71		2005
21	Secondary Clarifier	East Clarifier Motor	SEW Eurodrive	870172104.06.06.001		DFT71D4-KS	0.5		1700	230/460	2.0/1.0					3										
22	Secondary Clarifier	East Clarifier Gearbox	SEW Eurodrive	850133078.99.99.001		R63R420T71D4-KS																				
23	Secondary Clarifier	West Clarifier Motor	Siemens/Allis		108		5	215T	1165	230/460	14.5-7.3				1.15	3										
24	Secondary Clarifier	West Clarifier Gearbox	SEW Eurodrive			R57R37DRS71S4DH																				
25	Plant One	Ras Pumps																								
26	Plant One	Ras Pump Motors																								
27	Blower House 1	Blower #1	Hoffman	M012010	4207A																			C000733		
28	Blower House 1	Blower #1 Electric Motor	Toshiba/Houston	90704302	B0402FLG3UM	TIKK	40	324TS	3520	230/460	96/48					3										
29	Blower House 1	Blower #2	Hoffman	M012000	4207A																			C000733		
30	Blower House 1	Blower #2 Electric Motor	Toshiba/Houston		B0402FLG30M	TIKK	40	324TS	3530	230/460						3										
31	Effluent Pumpstation	Pump #1	Byron-Jackson																							
32	Effluent Pumpstation	Pump #1 Motor	US Electric Motors	50751940099 GT			60	364TPTE	1780	460																
33	Effluent Pumpstation	Pump #2	Byron-Jackson																							
34	Effluent Pumpstation	Pump #2 Motor	US Electric Motors	508591CCC17GT			60	364TPTE	1780	460																
35	Effluent Pumpstation	Pump #3	Byron-Jackson																							
36	Effluent Pumpstation	Pump # 3 Motor	US Electric Motors																							
37	Digestor 1	Transfer Motor	General Electric	6110/B0412961-ST-005F		TCEP TE	7.5	213T	1760	230/460	19.0-9.5					3										
38	Digestor 1	Transfer Pump	Borger	982134 3.2	G11PCC003 "46325"	PL-400																				
39	Belt Press	JWC Grinder	Muffin Monster JWC	25450	20000-a4																					
40	Belt Press	JWC Cycloidal Speed Reduser	JWC	11018024	TDVC611-29-1-182-TC								5					29.1								
41	Belt Press	High Service Pump	PACO	2031001														GPM=150		TDH=35					16-30707-130101-2622	
42	Belt Press	High Service Pump Motor	Baldor	F0208161503			3	182JM	1725	230/480					1.15	3						6207	6203	35M537Y334	VJMM3611T	
43	Belt Press	High Service Feed Pump Motor	Baldor		3CP3769T-4		7.50	213T	3525	460	8.6				1.15	3								07H003W384		
44	Belt Press	High Service Feed Pump Pump	GOULDS		SSH	1.5X2.5-8																			4SHFPMB0-UCD	
45	Belt Press	Belt Press Kompress	Komline-Sanderson		GRSL-1.5 SERIES III	1.5 METER																				
46	Belt Press	Belt Drive Assembly Motor	Baldor	F1101041558			3.00	182 TC	1760	460	4				1.15	3					89.50%	6206	6205	06H016W356	VEM3661T	
47	Belt Press	Belt Drive Assembly Reducer	Eurodrive	890298293.01.01.001	KA 97 R57AM184-KS	Helical-Bevel												232:01:00								
48	Belt Press	Hydraulic Power Unit Motor	Baldor	F0104035156			1.5	145TC	1725	460	2.1				1.15	3					82.50%	6205	6203	35H809X623	VW0M3551T	
49	Belt Press	Polymer Mix and Feed System	Fluid Dynamics Dynablend		L4-1200-4.5D																					
50	Belt Press	SLUDGE FEED PUMP	SEEPEX		823416.2	40-6LT BN			300									75-150GPM								
51	Belt Press	Sludge Feed Pump Gear box		8.00143E+11					224									7.9								
52	Belt Press	SLUDGE FEED PUMP Motor	tag not readable				7.5																			
53	Belt Press	Auger 1 Motor	NORD		NM34712192/0139	90LH/4	2		1745	460	3.15					3					84					
54	Belt Press	Auger 1 Gearbox		3282AZBH-90LH/4	1001393902																					
55	Belt Press	Auger 2 Motor																								
56	Belt Press	Auger 2 Gearbox																								
57	Biosolids	Lime Auger				4"																				
58	Biosolids	Lime Auger Motor	WEG	08M9R111011000603	7518EP3EAL80	S21 40 080 ES0	0.75	A180	1730	460	1.41				1.15	3					82.5					
59	Biosolids	Bisolids Pump Motor	RELIANCE	44GP25111101G 4 LB	P25C1111B	P	20	256TC	1760	460	23.5				1.15	3					91.7	45BC03J30X	45BC03J30X			
60	Biosolids	BIOSOLIDS Pump gearbox	DODGE	079163-74-1	M85031TAC	250-D-M-5-A-1-11.4-A1							1750	154				11.4								
61	Biosolids	Biosolids Pump	ROPER		70700																					

APPENDIX 2-9
Belle Glade WWTF Electrical Equipment

Appendix 2-9
Belle Glade WWTF Electrical Equipment

Equipment Name	Tag Number	Location	Year Installed	Expected Life Span	Remaining Life	Replacement Cost	Condition / Recommendation
Main Switchboard #1	MSB-1/GSB-1	Gen Bldg #1	1982	20-25	(-11)-(-6)	$65,000.00	Poor/Replace
300kW Generator		Gen Bldg #1	1982	20-25	(-11)-(-6)	$90,000.00	Poor/Replace
Digester Blower 1 Starter		MCC Building	1996	20-25	3-8	$8,500.00	Good/None
Digester Blower 2 Starter		MCC Building	1996	20-25	3-8	$8,500.00	Good/None
MCC-3	MCC-3	Operations Building Electric Room	1996	20-25	3-8	$25,000.00	Good/None
Panel C 480V	Panel C	Chlorine Fac.	1996	20-25	3-8	$5,600.00	Good/None
Transformer for Panel D 25KVA 120/208V 1PH		Chlorine Fac.	1996	20-25	3-8	$4,500.00	Good/None
Panel D 120/240V	Panel D	Chlorine Fac.	1996	20-25	3-8	$3,200.00	Good/None
Transformer for Panel E 15KVA 120/240V 1PH		Polymer Bldg	1996	20-25	3-8	$3,500.00	Good/None
Panel E 120/240V	Panel E	Polymer Bldg	1996	20-25	3-8	$1,800.00	Good/None
Panel LP 120/208	LP-1	Operations Buildir	1996	20-25	3-8	$2,200.00	Good/None
Main Switchboard #2	MSB-2	Gen Bldg #2	1994	20-25	1-6	$125,000.00	Good/None
1500kW Generator		Gen Bldg #2	1994	20-25	1-6	$425,000.00	Good/None
Main-Tie-Main Switchboard	MTM Switchboard	MCC Bldg Ext.	2012	20-25	19-24	$50,000.00	Excellent/None
Transformer for Panel LP-1 15KVA 480-120/208 3PH		Operations Building Electric Room	1996	20-25	3-8	$5,200.00	Good/None
Transformer for Panel PP-1 225KVA 480-120/240V 3PH		Operations Building Electric Room	1996	20-25	3-8	$35,000.00	Good/None
Distribution Switchboard	SWBD-IWA	MCC Building	1994	20-25	1-6	$110,000.00	Good/None
Injection Well Pump #1 VFD	IWP-VFD1	MCC Building	1994	20-25	1-6	$28,000.00	Good/None
Injection Well Pump #3 VFD	IWP-VFD3	MCC Building	2012	20-25	19-24	$28,000.00	Excellent/None
Aerator #1 Soft Start	AR-SS1	MCC Building	1996	20-25	3-8	$6,500.00	Excellent/None
Motor Control Center #1	MCC-1	Operations Buildir	1996	20-25	3-8	$45,000.00	Good/None
Panel IWHA 480V	Panel IWHA	MCC Building	1994	20-25	1-6	$5,600.00	Good/None
Transformer for Panel IWLA 25KVA 480-120/240V 1PH		MCC Building	1994	20-25	1-6	$4,500.00	Good/None

Appendix 2-9
Belle Glade WWTF Electrical Equipment

Equipment Name	Tag Number	Location	Year Installed	Expected Life Span	Remaining Life	Replacement Cost	Condition / Recommendation
Panel IWLA 120/240	Panel IWLA	MCC Building	1994	20-25	1-6	$6,500.00	Good/None
Panel PP-1 480V	PP-1	Operations Building Electric Room	1996	20-25	3-8	$6,500.00	Good/None
Distribution Switchboard	SWBD-IWB	MCC Building	1994	20-25	1-6	$110,000.00	Good/None
Injection Well Pump #2 VFD	IWP-VFD2	MCC Building	1994	20-25	1-6	$28,000.00	Good/None
Injection Well Pump #4 VFD	IWP-VFD4	MCC Building	2012	20-25	19-24	$28,000.00	Excellent/None
Aerator #2 Soft Start	AR-SS2	MCC Building	1996	20-25	3-8	$6,500.00	Good/None
Motor Control Center #2	MCC-2	Operations Buildir	1996	20-25	3-8	$45,000.00	Good/None
Panel IWHB 480V	Panel IWHB	Gen Bldg #2	1994	20-25	1-6	$6,500.00	Good/None
Transformer for Panel IWLB 15KVA 480-120/208 3PH		Gen Bldg #2	1994	20-25	1-6	$3,500.00	Good/None
Panel IWLB 120/208V	Panel IWLB	Gen Bldg #2	1994	20-25	1-6	$3,800.00	Good/None
PLC-1 (Main Control Panel)	PLC-1	Operations Building Electric Room	1998	15-20	0-5	$75,000.00	Good/None
PLC-2	PLC-2	MCC Building	1996	15-20	(-2)-3	$65,000.00	Good/None
PLC-3	PLC-3	Chlorine Fac.	2012	15-20	14-19	$35,000.00	Excellent/None

APPENDIX 2-10
Pahokee WWTF Electrical Equipment

Appendix 2-10
Pahokee WWTF Electrical Equipment

Equipment Name	Tag Number	Location	Year Installed	Expected Life Span (years)	Remaining Life	Replacement Cost	Condition / Recommendation
Main 1 of 2 (600A) (480V)		Blower House #3	2009	20-25	16-21	$8,500.00	Excellent/None
Emergency Generator #1 (200KW)		Blower House #3	2005	20-25	12-17	$75,000.00	Poor/Replace
Transfer Switch		Blower House #3	2009	20-25	16-21	$13,500.00	Excellent/None
DP-1 480V 3PH Panelboard	DP-1	Blower House #3	2009	20-25	16-21	$5,600.00	Excellent/None
Blower No.1 SSRVS		Blower House #3	2009	20-25	16-21	$3,500.00	Excellent/None
Blower No.2 SSRVS		Blower House #3	2009	20-25	16-21	$3,500.00	Excellent/None
7.5kVA Transformer	T-2	Blower House #3	2009	20-25	16-21	$2,600.00	Excellent/None
Panel LP-1 240V 1PH		Blower House #3	2005	20-25	12-17	$1,200.00	Fair/Replace at end of normal lif span
Main 2 of 2 (400A) (480V)		Blower House #3	2005	20-25	12-17	$6,500.00	Fair/Replace at end of normal lif span
Emergency Generator #2 (230KW)		Blower House #2	2006	20-25	13-18	$80,000.00	Poor/Replace
MCC-3 with 400A ATS		Blower House #2	2005	20-25	12-17	$27,000.00	Poor/Replace
DP-2		Blower House #2	2009	20-25	16-21	$5,600.00	Excellent/None
Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH	T-1	Blower House #2	2005	20-25	12-17	$7,500.00	Fair/Replace at end of normal lif span
Size 1 Combination Starter (RAS Pump West)		Blower House #2	2009	20-25	16-21	$850.00	Excellent/None
Size 1 Combination Starter (RAS Pump East)		Blower House #2	2009	20-25	16-21	$850.00	Excellent/None
Size 1 Combination Starter (Secondary Clarifier East)		Blower House #2	2009	20-25	16-21	$850.00	Excellent/None
Size 1 Combination Starter (Secondary Clarifier West)		Blower House #2	2009	20-25	16-21	$850.00	Excellent/None
Size 1 Combination Starter (Primary Clarifier)		Blower House #2	2009	20-25	16-21	$850.00	Excellent/None
Size 3 Starter (Blower #1)		Blower House #1	2009	20-25	16-21	$1,200.00	Excellent/None
Size 3 Starter (Blower #2)		Blower House #1	2009	20-25	16-21	$1,200.00	Excellent/None
Size 1 Combination Starter (Primary Sludge Pump)		Pump Pad	2005	20-25	12-17	$850.00	Fair/Replace at end of normal lif span
Size 1 Combination Starter (Wash Water Pump North)		Pump Pad	2005	20-25	12-17	$850.00	Fair/Replace at end of normal lif span

Appendix 2-10
Pahokee WWTF Electrical Equipment

Equipment Name	Tag Number	Location	Year Installed	Expected Life Span (years)	Remaining Life	Replacement Cost	Condition / Recommendation
Size 1 Combination Starter (Wash Water Pump South)		Pump Pad	2005	20-25	12-17	$850.00	Fair/Replace at end of normal lif span
60A NEMA 1 480V 3PH Safety Switch (Blower #1)		Blower House #2	2009	20-25	16-21	$450.00	Excellent/None
60A NEMA 1 480V 3PH Safety Switch (Blower #2)		Blower House #2	2009	20-25	16-21	$450.00	Excellent/None
LP-2 Main Breaker (40A)		Blower House #2	2005	20-25	12-17	$375.00	Fair/Replace at end of normal lif span
LP-3 Main Breaker (125A)		Blower House #2	2005	20-25	12-17	$650.00	Fair/Replace at end of normal lif span
LP-3 120/240V 1PH	LP-3	Operations Bldg	2005	20-25	12-17	$750.00	Good/Replace at end of normal life span
LP-2 120/240V 1PH	LP-2	Blower House #2	2005	20-25	12-17	$750.00	Good/Replace at end of normal life span
P1 480V Panelboard	P1	Dewatering Facility	2001	20-25	8-13	$6,500.00	Good/Replace at end of normal life span
Transformer for Panel LP-1 30KVA 480-120/208 3PH		Dewatering Facility	2001	20-25	8-13	$5,500.00	Good/Replace at end of normal life span
Panel LP-1 120/208V 3PH		Dewatering Facility	2001	20-25	8-13	$3,800.00	Good/Replace at end of normal life span
100A NEMA 4X S.S. Safety Switch (Effluent Pump #1)		Effluent Pump Station	2009	20-25	16-21	$6,500.00	Good/Replace at end of normal life span
100A NEMA 4X S.S. Safety Switch (Effluent Pump #2)		Effluent Pump Station	2009	20-25	16-21	$6,500.00	Good/Replace at end of normal life span
100A NEMA 4X S.S. Safety Switch (Effluent Pump #3)		Effluent Pump Station	2009	20-25	16-21	$6,500.00	Good/Replace at end of normal life span
PLC-1		Operations Building	2011	15-20	13-18	$65,000.00	Excellent/None

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TECHNICAL MEMORANDUM No. 3 – Wastewater Service Area

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Mark Drummond / C Solutions

FROM: Chris Meline / Hazen and Sawyer

DATE: April 28, 2014

FILE: 45103-004.3.1

SUBJECT: Palm Beach County Water Utilities Department
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 3 (TM-3) addresses the Palm Beach County Water Utilities Department (PBCWUD) area known as the Glades Region Urban Service Area. For the purpose of this technical memorandum, the area will be referred to as the Glades Region Wastewater Service Area. The scope of work in *Task 3 – Wastewater Service Area* is as follows.

> *The CONSULTANT will assist the COUNTY in performing the following tasks related to review and evaluation of wastewater service area boundaries:*
>
> a. *COUNTY will provide a GIS map depicting the existing wastewater service area which highlights areas currently without wastewater service.*
>
> b. *COUNTY and CONSULTANT will meet to clearly identify boundaries for collection / conveyance of wastewater, and jointly establish future expansion and growth areas for consideration in the Master Plan.*

INTRODUCTION

Data and other information concerning the wastewater service area were gathered from interviews with PBCWUD staff and from GIS data provided by PBCWUD staff.

EXISTING WASTEWATER SERVICE AREA

The overall Glades Region Wastewater Service Area shown in **Figure 1** encompasses approximately 43.5 square miles (27,878 acres) in northwest Palm Beach County. The PBCWUD currently provides both potable water and wastewater services in both incorporated and unincorporated areas of the region. This memorandum only addresses the wastewater component of the utilities. There are three municipalities in the PBCWUD Glades Region Wastewater Service Area. **Table 1** lists the incorporated communities. Unincorporated communities depend on Palm Beach County for police and other services.

Table 1
Incorporated Communities
within the PBCWUD Glades Region Wastewater Service Area

Incorporated Community	Designation	Year incorporated
Belle Glade	City	1918
Pahokee	City	1922
South Bay	City	1941

The wastewater service area is made up of two adjacent sub-areas with a common boundary slightly north of Paul Rardin Park. The 16.5 square mile (10,569 acres) service area to the north of Paul Rardin Park is comprised of collection basins whose flows are treated at the Pahokee Wastewater Treatment Plant (WWTP), and extends north to Canal Point. The 27 square mile (17,313 acre) service area to the south, extending to the G2 Canal, includes the collection and transmission system providing flows to the Belle Glade WWTP. The two wastewater service areas and associated with the Glades WWTP and Pahokee WWTP are shown in **Figure 2**. **Figures 3 and 4** illustrate each of the Pahokee WWTP service sub-area and the Belle Glade WWTP sub-area, respectively. There are currently no interconnections between the two collection/treatment systems.

Within the wastewater collection network, small capacity lift stations receive wastewater from defined areas or developments and pump it through a network of force mains to the larger master stations. Typically, the flows from master stations are re-pumped to either WWTP. Wastewater transmitted to either the Pahokee WWTP or the Belle Glade WWTP are directed from master pump stations as described below and shown in **Figure 5**.

Table 2 summarizes the extent of both gravity sewers and pressurized force mains within both the Pahokee WWTP and Belle Glade WWTP portions of the service area. There are a total of 69 miles of gravity sewers and 54 miles of pressurized force mains in active service within the PBCWUD Glades Region Urban Service Area system.

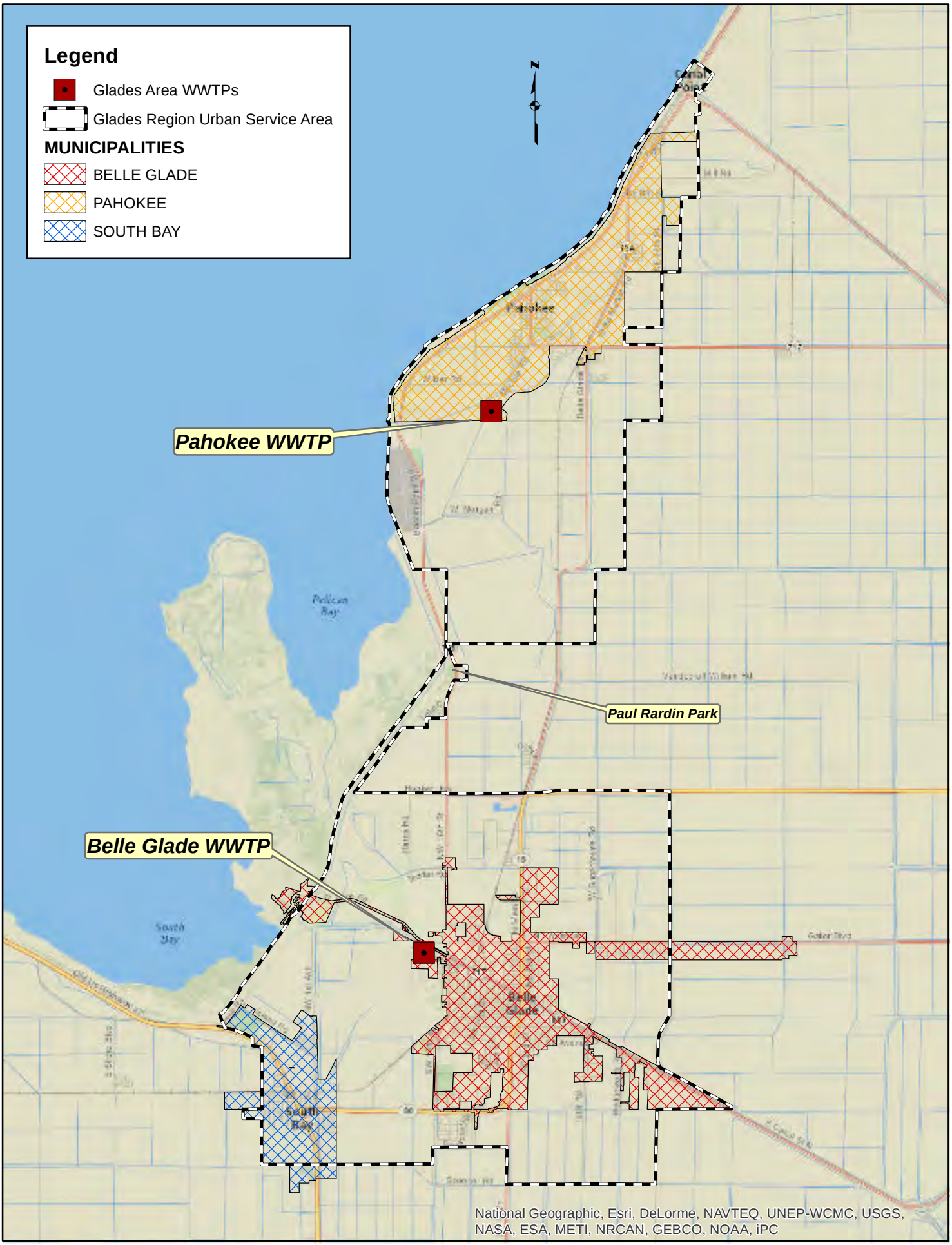

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Figure 3-1 - Glades Region Urban Service Area

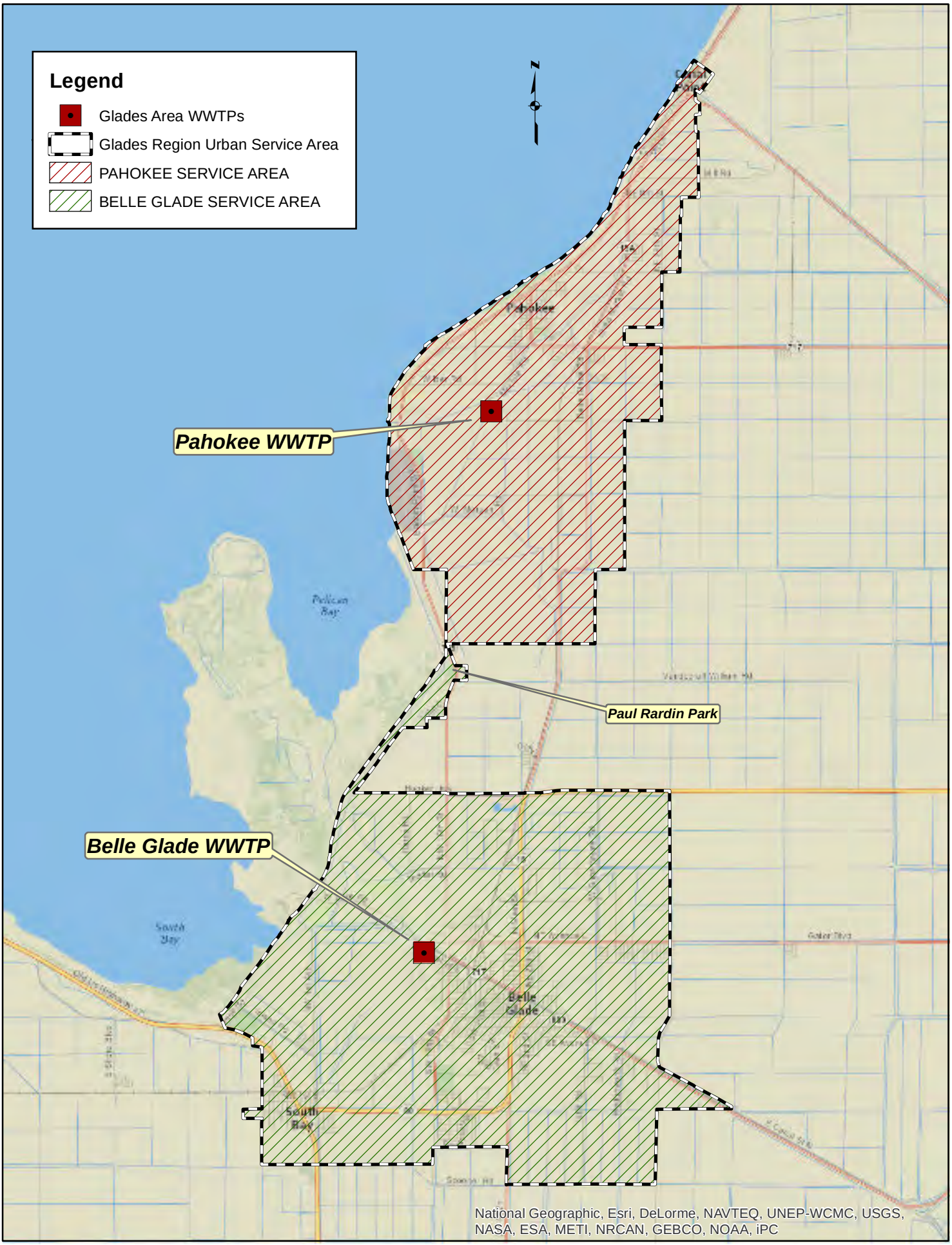

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Figure 3-2 - Glades Region Wastewater Service Sub-areas

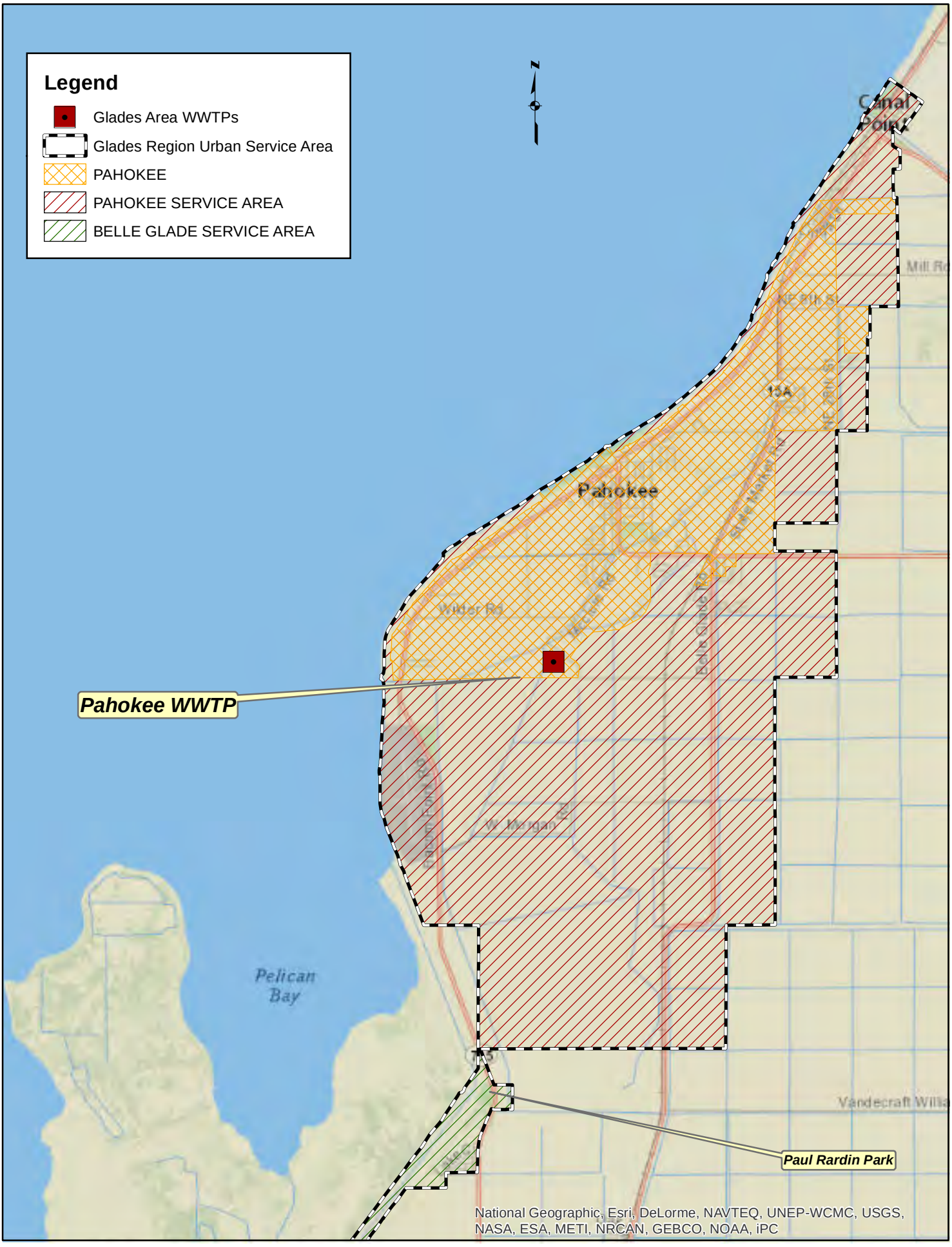

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Figure 3-3 - Pahokee WWTP Service Sub-area

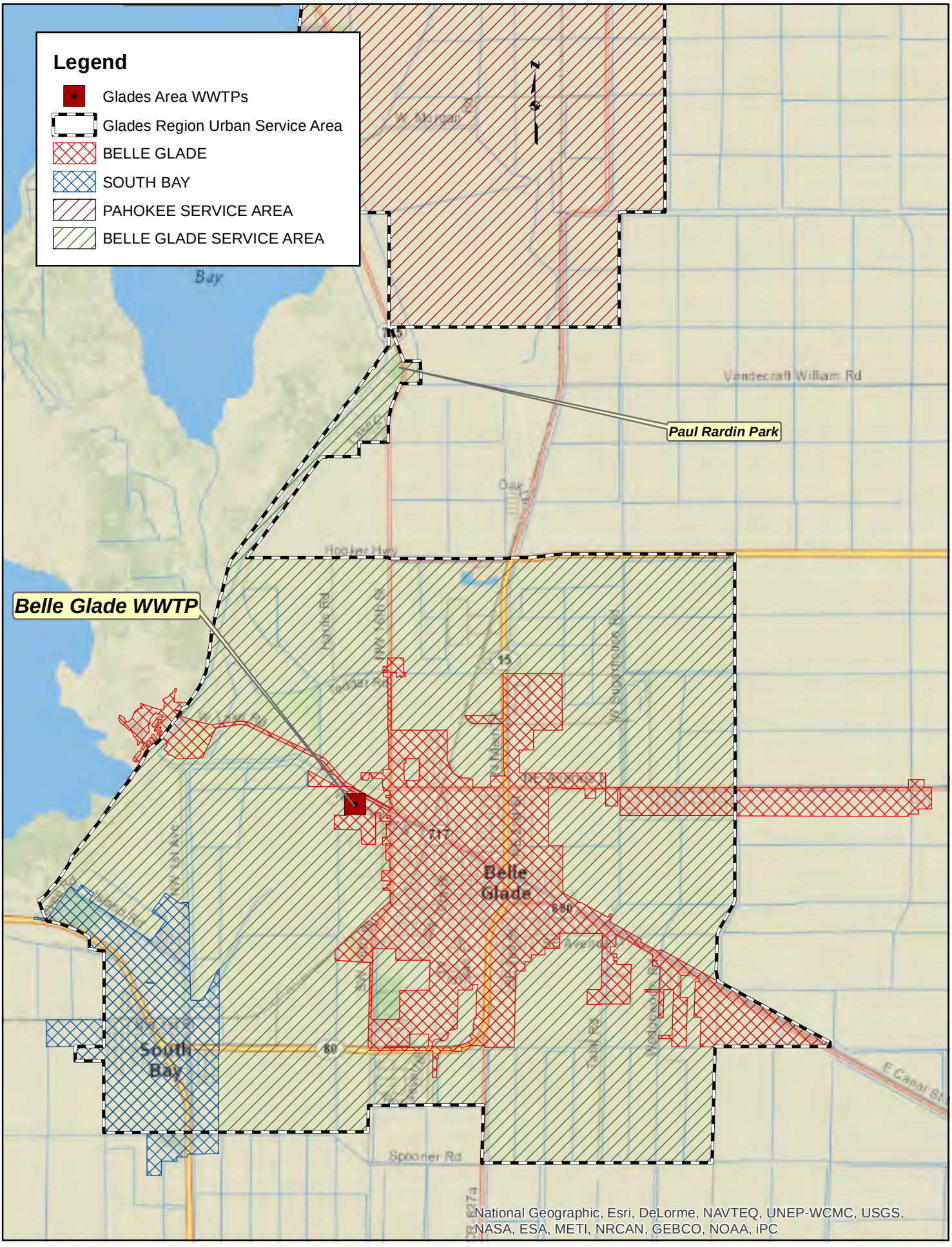

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Figure 3-4 - Belle Glade WWTP Service Sub-area

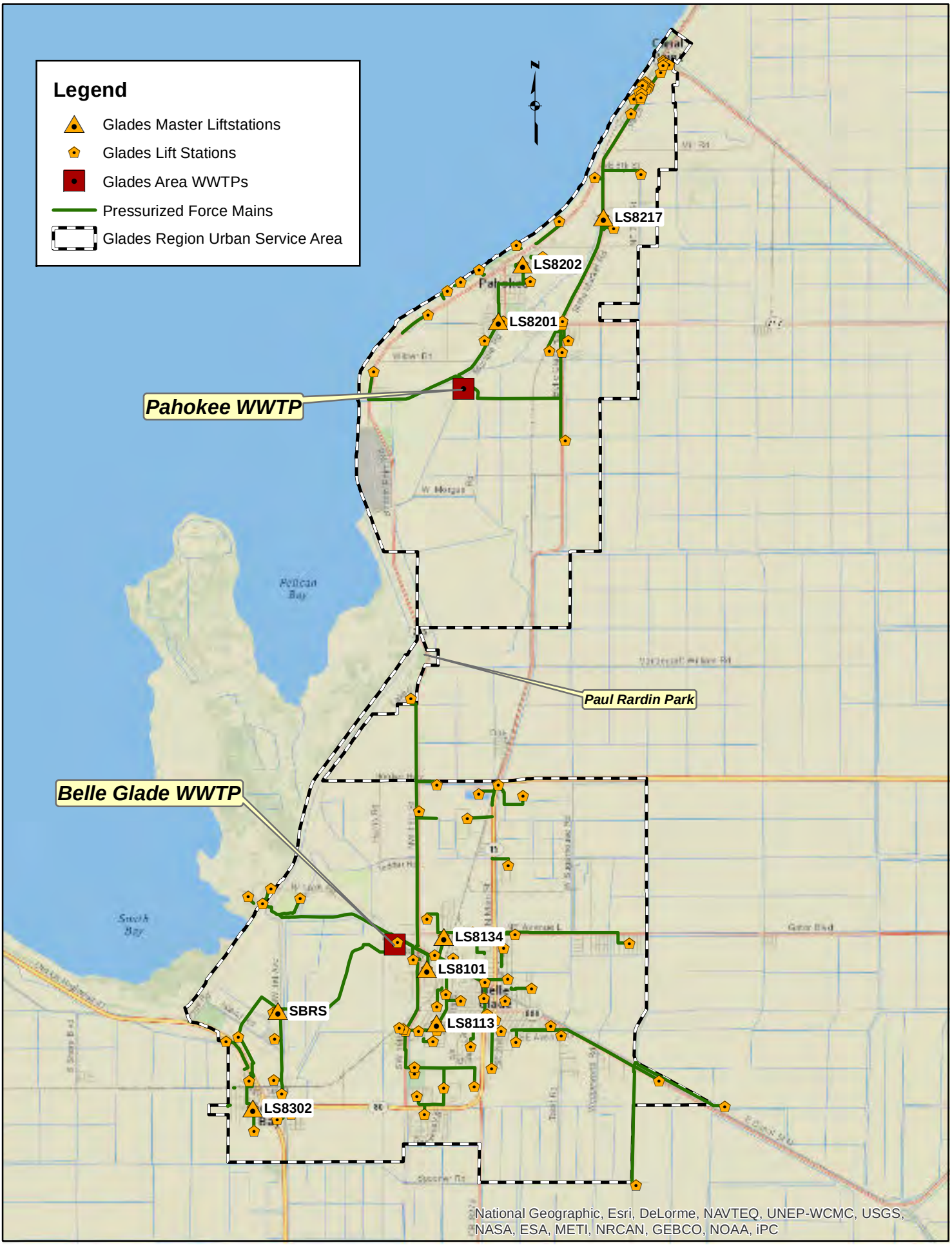

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Figure 3-5 - Lift Stations and Master Stations

Table 2
Summary of Palm Beach County Piping
within the PBCWUD Glades Region Wastewater Service Area

Description	Gravity Sewers (miles)	Pressurized Force Mains (miles)
Total	69	54
Pahokee WWTP	21	16
Belle Glade WWTP	48	38

Table 3 provides a summary of lift stations operating within the PBCWUD Glades Region wastewater service area collection network. The system utilizes a total of 92 lift stations and 7 master pump stations.

Table 3
Summary of Lift Stations and
Master Pump Stations within the PBCWUD Glades Region Wastewater Service Area

Description	# Lift Stations	# Master Pump Stations
Total	92	7
Pahokee WWTP	37	3
Belle Glade WWTP	55	4

SERVICE AREA BOUNDARIES

The southernmost boundary of the service area is the G2 Canal. The northern boundary is defined by the northern boundary of the Canal Point Recreation Area. The western and northwestern boundaries are defined by the southeastern Lake Okeechobee shoreline and the L16 Canal to the south. The eastern boundary follows a meandering path that runs as far east as the University of Florida Everglades Research and Education Center, and as far west as the Lake Okeechobee shoreline at Hooker Highway. This service area boundary is very large relative to the actual area where wastewater collection services are provided. Currently the distribution of wastewater services is limited to the developed areas within each of the area's three municipalities, or about 30 percent of the Glades Region Urban Service Area.

AREAS WITHOUT SERVICE

Areas within the PBCWUD Glades Region Wastewater Service Area currently not being served by the PBCWUD are also shown in **Figure 6**. **Figure 6** shows areas currently without PBCWUD wastewater service in grey.

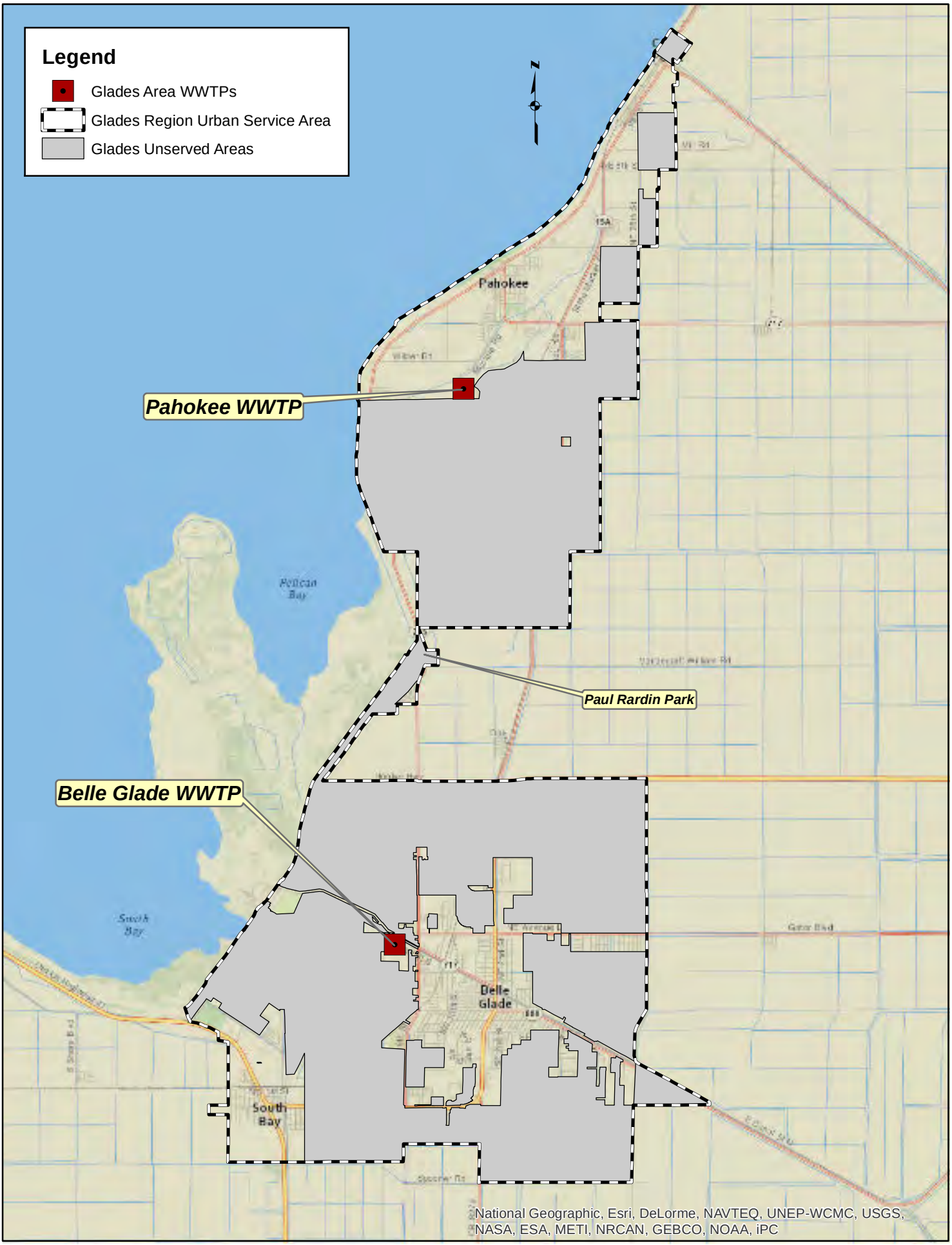

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Figure 3-6 - Glades Region - Areas Without Wastewater Service

FUTURE EXPANSION OF WASTEWATER SERVICE AREA

Future expansion of the wastewater service area is not planned by PBCWUD. However, PBCWUD staff has indicated that expansion of the wastewater service area could occur under the following two conditions:

- When requested by a home owners association or similar entity (only if the full cost of the expansion is funded through a special assessment); and
- Where infrastructure is provided for new development by a developer

In practice, PBCWUD staff have indicated that owner initiated service area expansion occurs rarely and is typically the result of a Palm Beach Health Department order imposed in response to a septic system failure within a multi-family community. To aid in locating areas of potential future expansion, all areas within the wastewater service area will be considered. PBCWUD staff has indicated that it is very unlikely that expansion of the existing collection system would occur outside of the grey area highlighted in **Figure 6**.

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TECHNICAL MEMORANDUM No. 4 – Population Projections

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Mark Drummond / C Solutions

FROM: Chris Meline / Hazen and Sawyer

DATE: April 28, 2014

FILE: 45103-004.3.0

SUBJECT: Palm Beach County Water Utilities Department (PBCWUD)
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 4 (TM-4) addresses the historical population data and projected population growth for the existing wastewater service area within the Glades Region Urban Service Area of Palm Beach County through the year 2035. For the purpose of this technical memorandum, the area will be referred to as the Glade Region Wastewater Service Area. This work is associated with *Task 4 – Population Projections* and has a scope as follows.

> *The COUNTY will evaluate the present population and future service area and provide a population forecast for the planning horizons in the Years 2015, 2020, 2025, 2030, and 2035. Population forecasts will be prepared based on Palm Beach County Planning Department and University of Florida Bureau of Economic and Business Research (BEBR) population estimates and forecasts as divided into Traffic Analysis Zones (TAZs) within the service areas.*

INTRODUCTION

Glades Region population data were supplied to Hazen and Sawyer in electronic format (MS Excel - .xls) by PBCWUD staff (see **Appendix 1)**. These data were based on 2010 US Census data, updated by the University of Florida's BEBR with estimates at the county level for future years, in 5 year time increments, to 2030. The BEBR population data for Palm Beach County

was processed by the Palm Beach County Planning Division using its Population Allocation Model that spatially distributes the County's population by TAZs. The Planning Division reports that the model incorporates the following:

- 2010 Census populations and related information (Summary File 1, released in August 2011) such as persons per household, group quartered populations, vacancy and seasonal rates by TAZs. Henceforth the baseline for future population models will be the year 2010.

- Latest BEBR projections, released in June 2011. These projections are based on the 2010 Census released in late March of 2011.

- Land use density changes, approved or expired residential projects, annexations and BEBR Municipal population estimates, adopted up to 2011.

POPULATION FORECAST ANALYSIS

Population projections provided by TAZs were grouped into either the Pahokee Wastewater Treatment Plant (WWTP) Service Area or the Belle Glade WWTP Service Area by associating the Planning Division's tabular data with TAZ polygons within the GIS environment, then selecting TAZs that lie within either of two wastewater service areas. The PBCWUD Glades Region Urban Service Area (addressed in Technical Memorandum No. 3 – Glades Region Wastewater Service Area) represents the current collection areas for the two wastewater treatment facilities: the Pahokee WWTP and the Belle Glade WWTP. PBCWUD Glades Region service area TAZs are shown in **Figure 1**.

Population projections for each wastewater service area were developed by summing the future population estimates of the individual TAZs within the service area. Detailed service area population by TAZ is provided in **Appendix 1**.

ANALYTICAL ASSUMPTIONS

The following assumptions were assumed in preparation of the population projections:

- Expansion of service within the current wastewater service area will be relative to estimated growth in population within each existing service area TAZ.

- The census data are based on permanent residents and do not reflect possible seasonal changes associated with agricultural workers. For the purposes of this Master

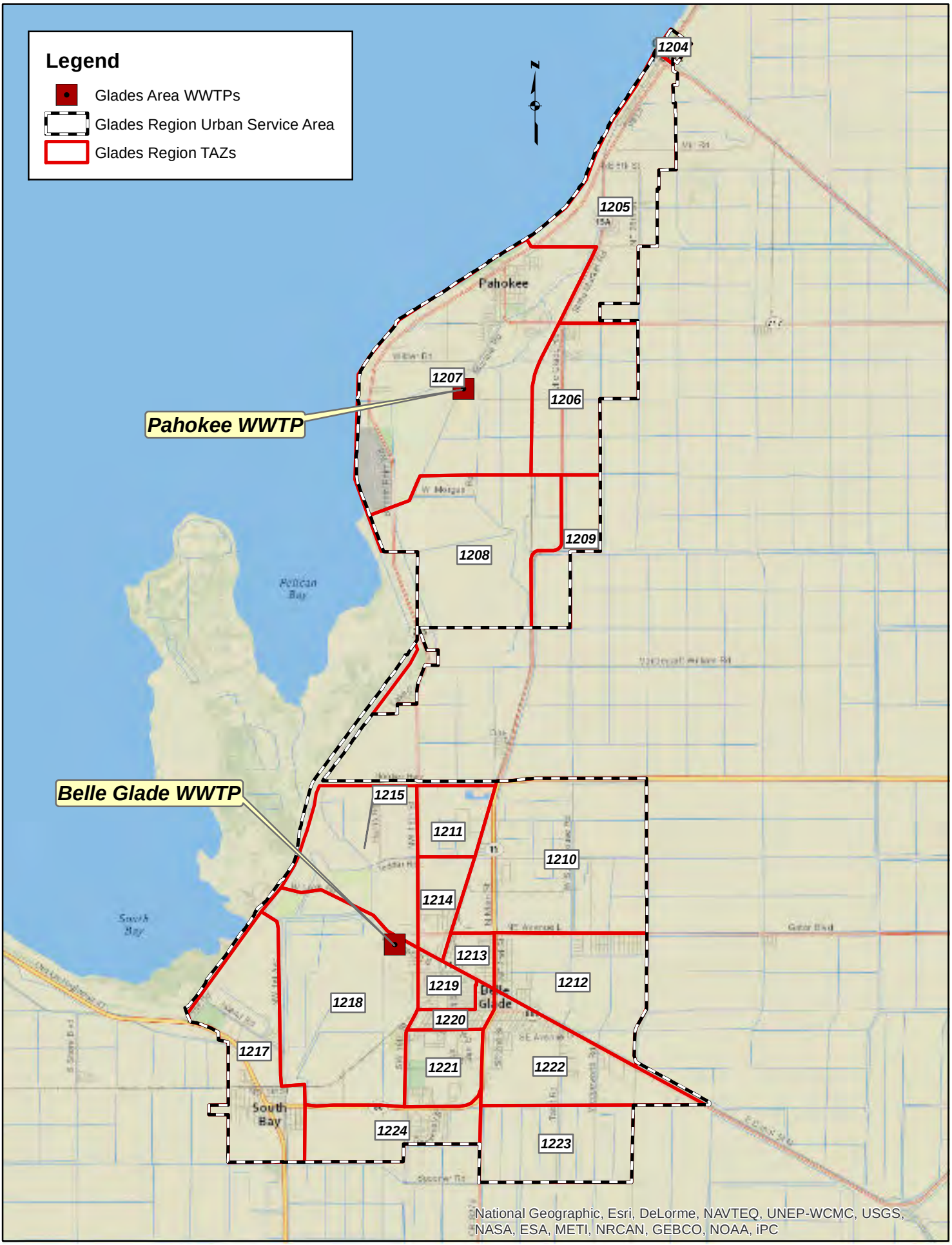

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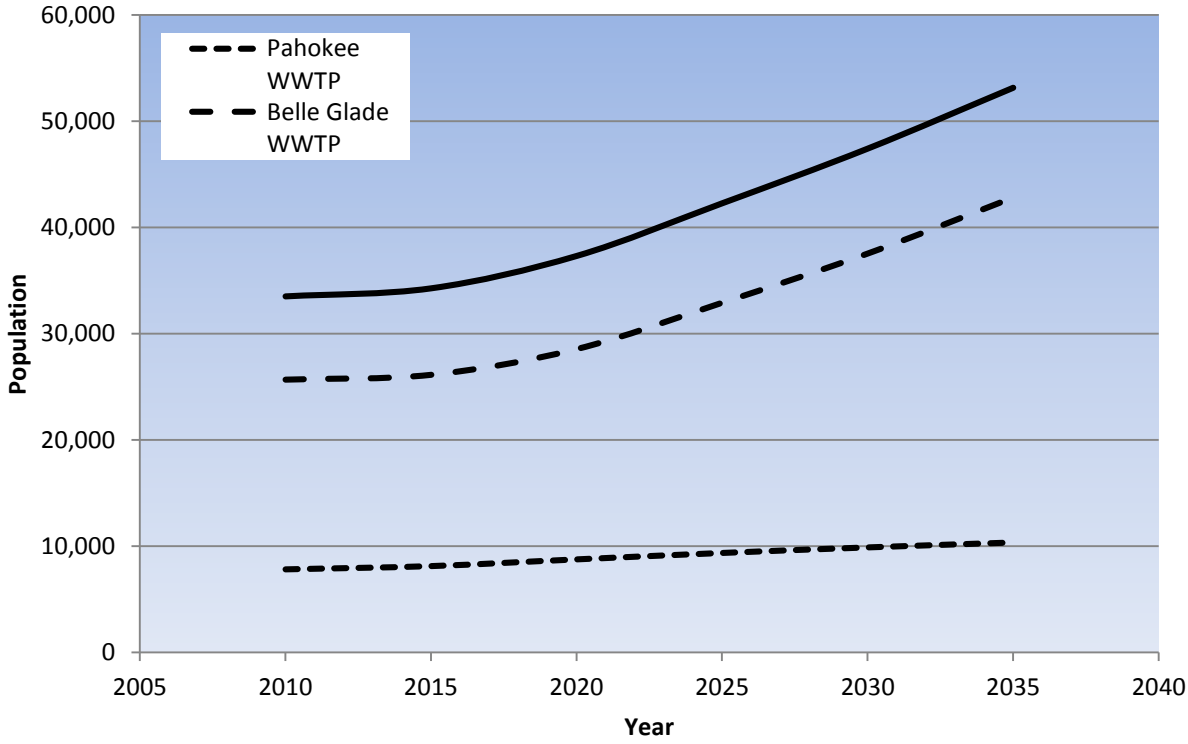
Figure 4-1 - Glades Region Traffic Analysis Zones (TAZ)

- Plan, all data is based on permanent populations and addresses seasonal fluctuations using peaking factors.

POPULATION PROJECTION RESULTS

The PBCWUD populations by service area are summarized in **Table 1** and **Figure 2,** and include only those TAZs that fall within the Glades Region Urban Service Area boundary. The

Figure 2
Wastewater Service Area Population Projections



2010 service area population is estimated to be approximately 33,506 with 23 percent, or 7,836 in the Pahokee WWTP service area and 77 percent, or 25,671 in the Belle Glade WWTP service area. The Pahokee WWTP service area population is expected to increase by nearly 32 percent by 2035 to just over 10,347. By comparison the Belle Glade WWTP population is expected to grow by about 67 percent to nearly 42,816. The entire service area is expected to grow to about 53,136 by 2035, or just over 59 percent.

Table 1
Population Summary

Area	Projected Population					
	2010 (Base Year)	2015	2020	2025	2030	2035
Palm Beach County	1,320,134	1,325,743	1,394,300	1,482,900	1,568,500	No Data
Change from base year (%)		0%	6%	12%	19%	No Data
Belle Glade Service Area	25,671	26,125	28,547	32,909	37,539	42,816
Change from base year (%)		2%	11%	28%	46%	67%
Pahokee Service Area	7,836	8,140	8,767	9,368	9,887	10,347
Change from base year (%)		4%	12%	20%	26%	32%
Glades Region Urban Service Area	33,506	34,266	37,314	42,278	47,426	53,163
Change from base year (%)		2%	11%	26%	42%	59%

Table 1 also includes the percent change in population calculated by TAZ for each time step relative to the base year (2010). The percent change in population is important because of its relationship to percent change in water demand which ultimately drives wastewater generation. **Figures 3 through 7** show a progression of population percent change, grouped in 20 percent increments, from 2015 to 2035. **Figure 7** in particular shows some areas within the wastewater service area anticipated to grow at a disproportionately higher rate than other areas resulting in an uneven distribution of population change over the planning horizon based on population data provided the County. Population growth is expected to occur within and in areas that are adjacent to currently developed areas in Pahokee, South Bay and Belle Glade. **Table 2** provides the percent change in population in the PBCWUD wastewater services area by TAZ.

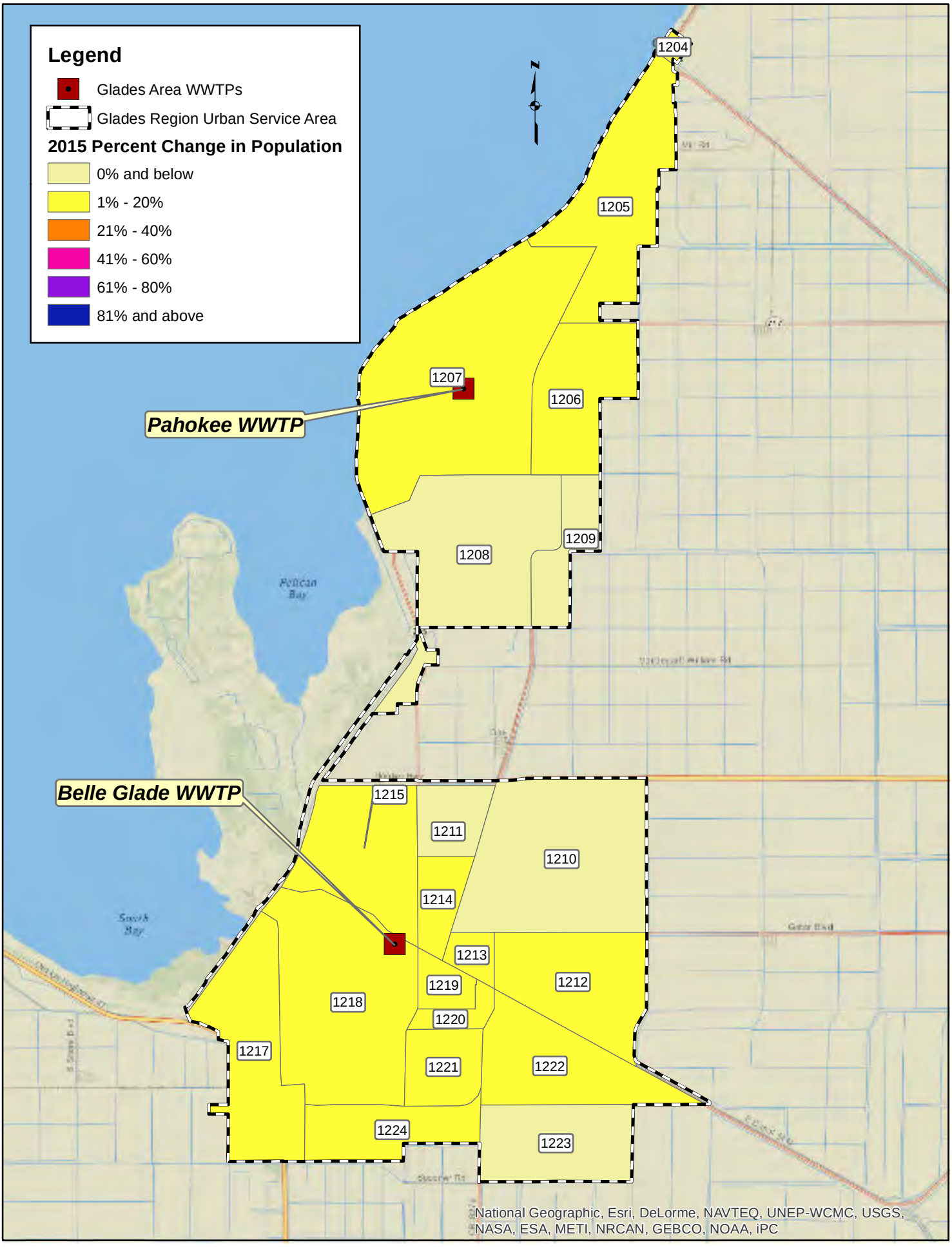


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Figure 4-3 - Percent Change in Population Between 2010 and 2015 by TAZ

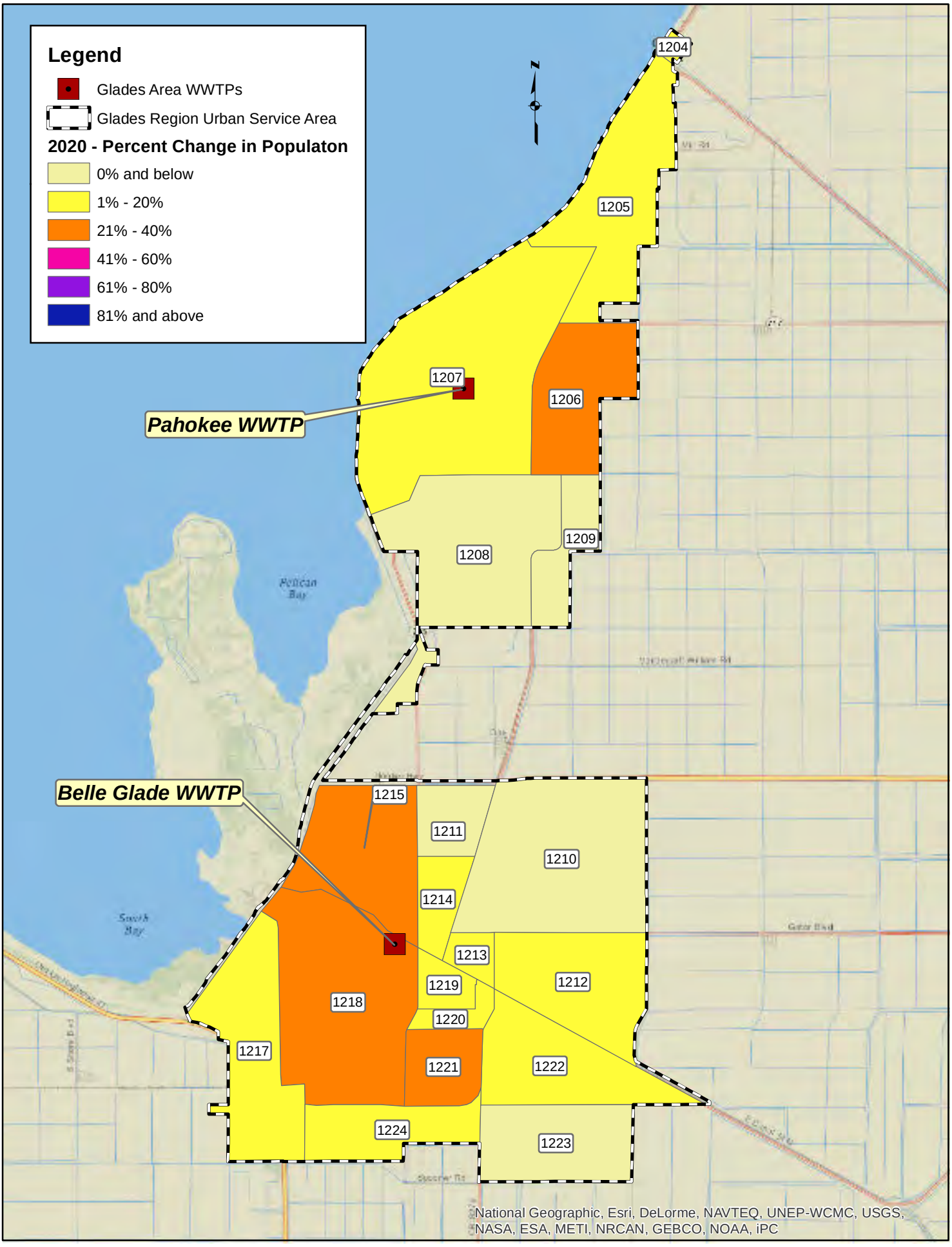

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Figure 4-4 - Percent Change in Population Between 2010 and 2020 by TAZ

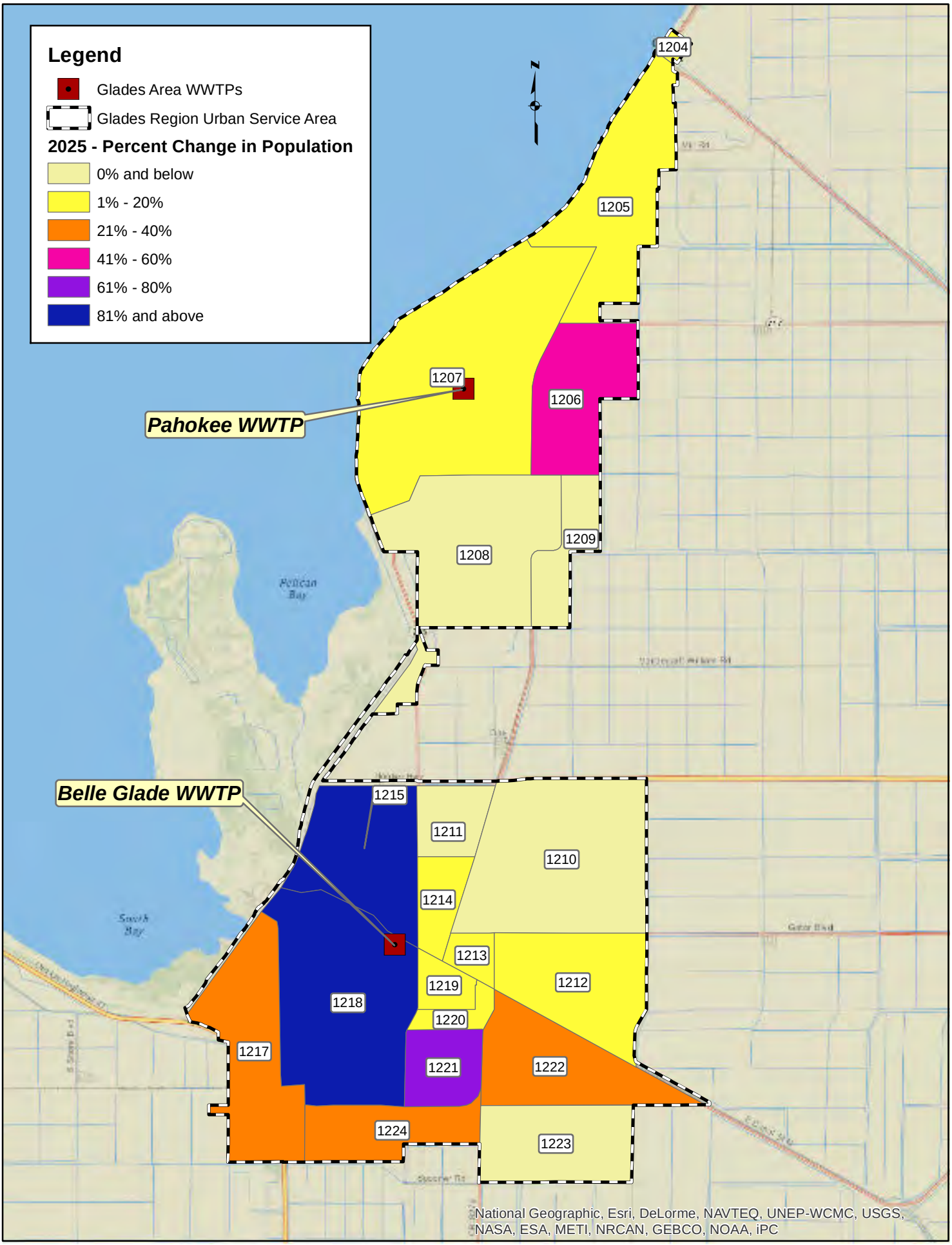

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Figure 4-5 - Percent Change in Population Between 2010 and 2025 by TAZ

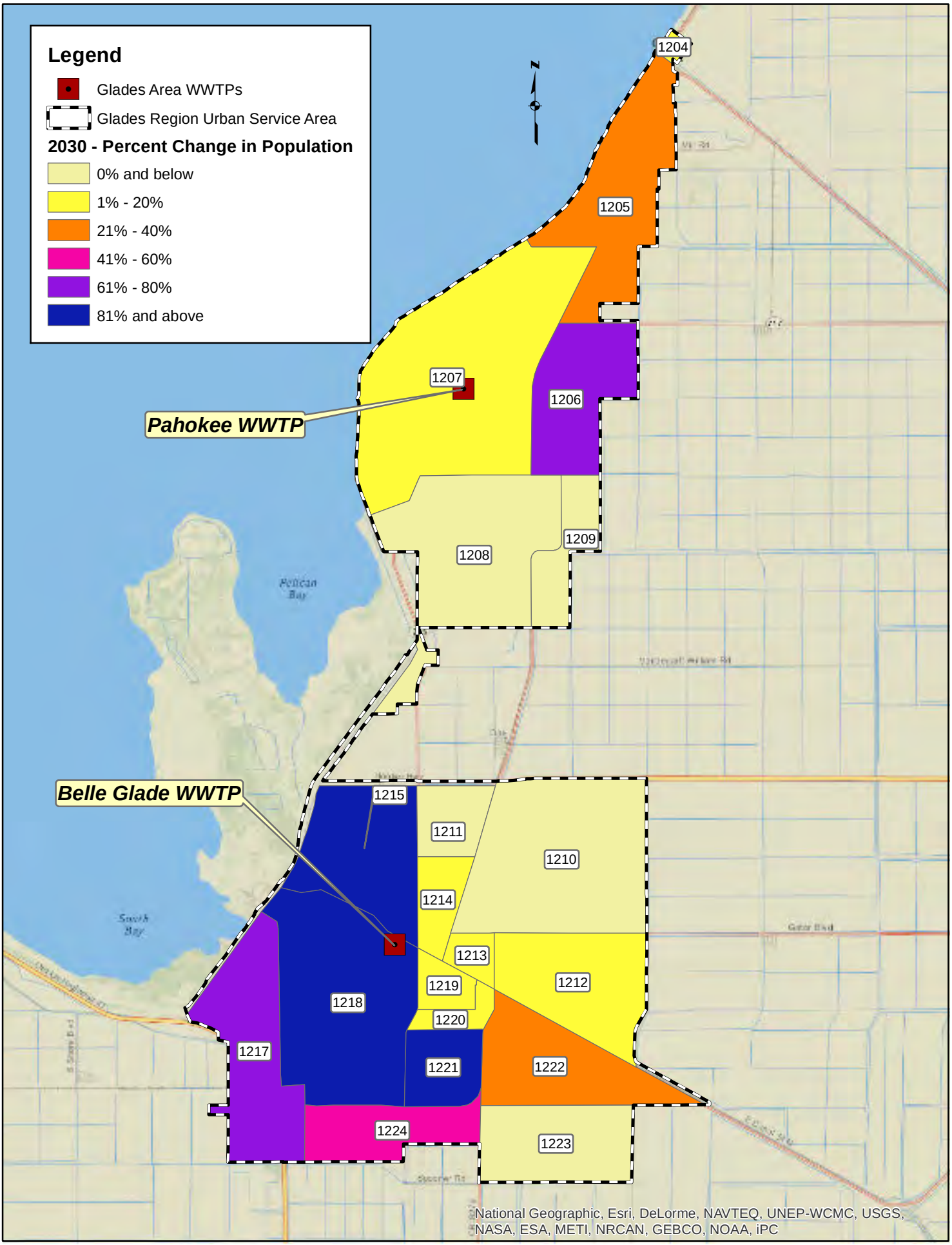

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Figure 4-6 - Percent Change in Population Between 2010 and 2030 by TAZ

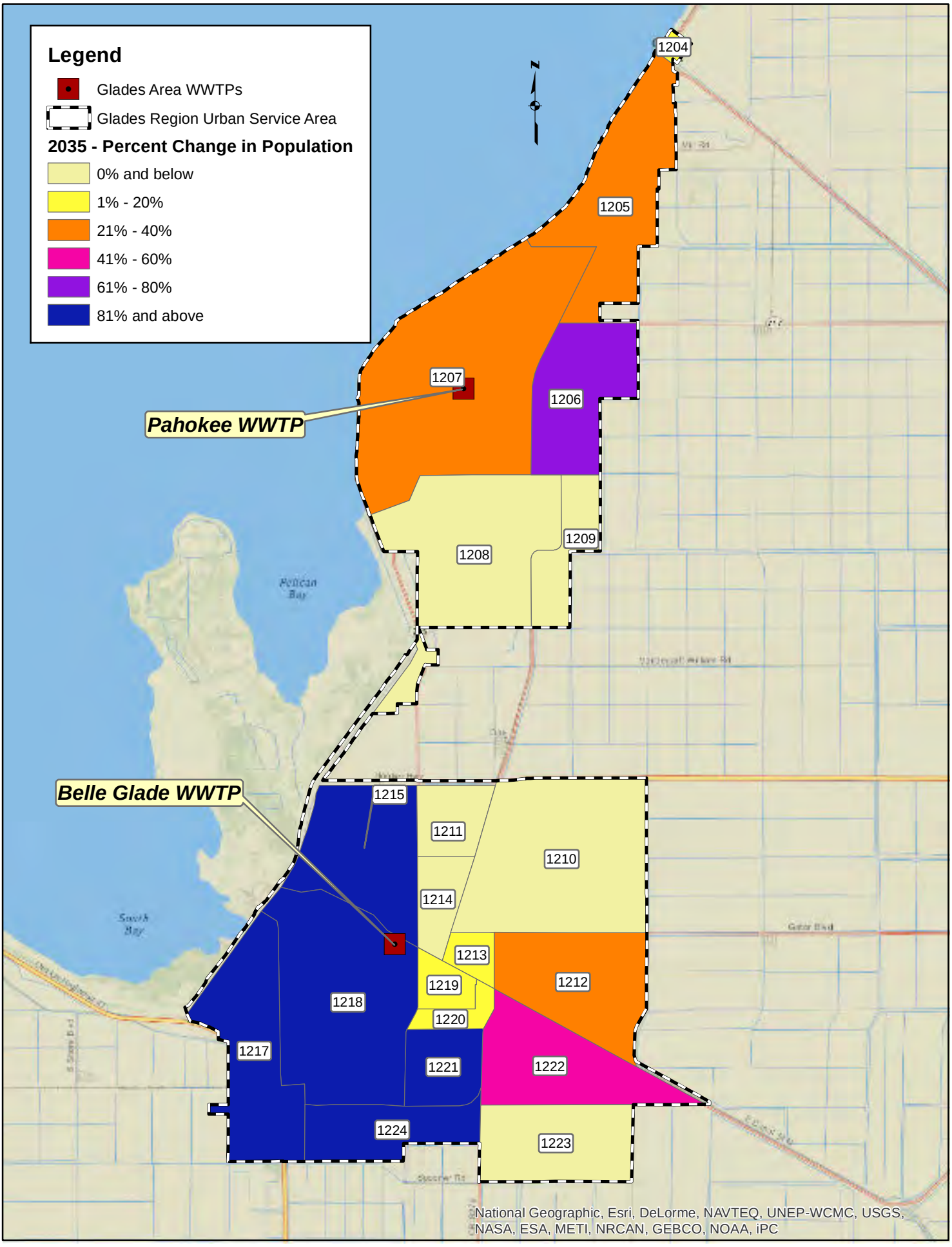

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Figure 4-7 - Percent Change in Population Between 2010 and 2035 by TAZ

Table 2
Glades Region Service Area Population Projections by TAZ

TAZ ID	Population (Raw Data from County)						Percent Change from 2010				
	2010	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
1204	256	258	268	276	289	293	0.8	4.8	8.1	12.9	14.5
1205	1,612	1,666	1,762	1,852	1,936	2,013	3.3	9.3	14.8	20.0	24.8
1206	1,236	1,348	1,603	1,839	2,048	2,213	9.0	29.7	48.7	65.6	78.9
1207	4,731	4,869	5,134	5,402	5,615	5,829	2.9	8.5	14.2	18.7	23.2
1208	576	576	576	576	576	576	0.0	0.0	0.0	0.0	0.0
1209	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
1210	483	483	483	483	483	483	0.0	0.0	0.0	0.0	0.0
1211	672	672	672	672	672	672	0.0	0.0	0.0	0.0	0.0
1212	3,062	3,163	3,377	3,542	3,665	3,755	3.3	10.3	15.7	19.7	22.6
1213	703	705	716	722	726	731	0.2	1.8	2.7	3.2	3.9
1214	1,224	1,227	1,227	1,227	1,227	1,123	0.2	0.2	0.2	0.2	-8.3
1215	70	72	91	395	870	1,345	2.7	30.0	466.3	1,148.1	1,829.9
1217	4,743	4,755	5,343	6,489	7,847	9,170	0.3	12.6	36.8	65.4	93.3
1218	499	517	608	1,673	2,511	3,271	3.5	21.9	235.2	403.4	555.6
1219	3,980	4,021	4,112	4,176	4,222	4,253	1.0	3.3	4.9	6.1	6.9
1220	2,708	2,755	2,836	2,887	2,920	2,940	1.7	4.7	6.6	7.8	8.5
1221	2,767	2,878	3,766	4,674	5,790	7,829	4.0	36.1	68.9	109.2	183.0
1222	2,485	2,596	2,885	3,171	3,443	3,715	4.5	16.1	27.6	38.5	49.5
1223	208	208	208	208	208	208	0.0	0.0	0.0	0.0	0.0
1224	1,490	1,497	1,647	2,013	2,379	2,745	0.5	10.6	35.1	59.7	84.3
All TAZs	33,506	34,266	37,314	42,278	47,426	53,163	2.3	11.4	26.2	41.5	58.7

APPENDIX 1

Population Projections

Appendix 1 - Raw Population Projections from Palm Beach County

TAZ	JUR	Population Statistics: Maximum Capacity	2010 Pop	Grpqtr Pop	Occupancy Rate	Seasonal %	Vacant %	Est pph	Vacant	Under utilized	Approved Unbuilt
1200	00	5	48		83.3%	16.7%	0.0%	4.80	0		
1202	00	116	157		81.2%	0.9%	17.9%	1.65	0		
1202	04	95	312		85.6%	0.0%	14.4%	3.09	0		
1203	00	35	59		94.4%	5.6%	7.6%	3.47	17		
1204	00	171	270		81.7%	0.8%	17.6%	2.52	43	4	
1205	00	7,203	181		63.8%	0.0%	36.2%	2.45	232	6854	
1205	48	1,467	1,252	136	83.0%	0.4%	16.6%	3.20	233	747	
1206	00	8,080	1,112		83.7%	0.2%	16.1%	3.01	228	7326	96
1206	48	107	157		70.1%	0.0%	29.9%	3.34	41		
1207	00	7,050	628		90.8%	1.7%	7.4%	3.02	265	6556	
1207	48	3,957	4,281	115	83.0%	0.4%	16.6%	3.20	520	1935	
1208	00	7,245	576		88.6%	0.0%	11.4%	3.24	113	6931	
1209	00	3,089	-			7.4%	7.6%	2.48	0	3089	
1210	00	60	483	384	63.3%	3.3%	33.3%	2.61	0		
1211	00	142	672	672		7.4%	7.6%	2.48	142		
1212	00	8,580	-			7.4%	7.6%	2.48	0	8579	
1212	04	1,246	3,027		96.6%	0.3%	3.1%	3.30	30	255	
1213	04	269	695		92.5%	0.4%	7.1%	2.97	13		
1214	00	38	96		71.4%	0.0%	28.6%	3.84	1		
1214	04	387	1,181		97.3%	0.5%	2.2%	2.98	0		
1215	00	10,895	76		90.0%	0.0%	10.0%	2.11	36	10830	
1215	04	6	17		100.0%	-	0.0%	2.43	0		
1217	00	1,570	41		100.0%	7.4%	7.6%	3.15	1	1557	
1217	58	3,054	4,876	1,871	72.7%	0.0%	27.3%	3.40	253	1655	
1218	00	4,315	237		97.4%	0.0%	2.6%	3.12	560	3677	
1218	04	226	268		87.5%	0.0%	12.5%	3.48	33	106	
1218	58	54	-			-	27.3%	3.40	54		
1219	04	1,930	3,984	155	76.0%	0.3%	23.7%	2.84	159		
1220	04	1,231	2,725		86.4%	0.7%	12.8%	2.79	108		
1221	00	1,554	4		100.0%	7.4%	7.6%	4.00	1553		
1221	04	1,745	2,760		89.5%	0.4%	10.1%	3.21	474	54	256
1222	00	5,263	51		87.0%	0.0%	13.0%	2.55	94	4860	
1222	04	1,591	2,457	7	95.0%	0.1%	4.9%	3.40	157	683	
1223	00	7,471	273		54.2%	25.2%	20.6%	3.85	0	7371	
1224	00	6,099	1,497		98.5%	0.0%	1.5%	3.71	76	5615	
1224	04	11									
1225	00	4	10		83.3%	16.7%	0.0%	2.00	0		
1226	00	53	60		58.8%	2.9%	38.2%	3.00	19		
1228	00	232	204		36.4%	0.5%	63.2%	2.55	13		
		96,361									
		8,737	Belle Glade								
		3,108	South Bay								
		5,531	Pahokee								
		78,985	Uninc. County								
		16,780	Inland Port TAZ								

Appendix 1, cont'd - Raw Population Projections from Palm Beach County

TAZ	Housing Units												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1200	5	5	5	5	5	5	5	5	5	5	5	5	5
1202	116	116	116	116	116	116	116	116	116	116	116	116	116
1202	5	5	95	95	95	95	95	95	95	95	95	95	95
1203	16	16	16	16	17	17	18	18	18	18	18	18	18
1204	122	122	122	123	124	124	124	124	124	124	124	124	124
1205	115	115	116	116	116	116	117	117	117	117	117	117	117
1205	450	455	464	470	478	480	482	485	486	486	487	487	487
1206	430	430	430	430	430	430	430	430	430	430	430	430	430
1206	66	66	66	66	66	66	66	66	66	66	66	66	66
1207	229	229	229	229	229	229	229	229	229	229	229	229	229
1207	1430	1434	1436	1443	1467	1490	1496	1498	1499	1500	1501	1502	1502
1208	201	201	201	201	201	201	201	201	201	201	201	201	201
1209	0	0	0	0	0	0	0	0	0	0	0	0	0
1210	60	60	60	60	60	60	60	60	60	60	60	60	60
1211	0	0	0	0	0	0	0	0	0	0	0	0	0
1212	1	1	1	1	1	1	1	1	1	1	1	1	1
1212	910	914	915	925	927	940	948	950	953	954	961	961	961
1213	254	254	254	254	254	254	254	254	255	255	256	256	256
1214	36	36	36	36	36	37	37	37	37	37	37	37	37
1214	387	387	387	387	387	387	387	387	387	387	387	387	387
1215	29	29	29	29	29	29	29	29	29	29	29	29	29
1215	6	6	6	6	6	6	6	6	6	6	6	6	6
1217	12	12	12	12	12	12	12	12	12	12	12	12	12
1217	1106	1109	1114	1118	1121	1128	1135	1142	1143	1145	1146	1146	1146
1218	78	78	78	78	78	78	78	78	78	78	78	78	78
1218	84	85	85	85	85	85	85	85	86	86	86	87	87
1218	0	0	0	0	0	0	0	0	0	0	0	0	0
1219	1740	1740	1740	1740	1740	1752	1758	1760	1766	1771	1771	1771	1771
1220	1089	1089	1089	1113	1117	1119	1119	1119	1119	1119	1122	1123	1123
1221	1	1	1	1	1	1	1	1	1	1	1	1	1
1221	941	941	941	941	942	944	944	955	958	960	961	961	961
1222	22	22	22	22	22	22	22	23	23	23	23	23	23
1222	730	730	732	735	738	741	749	749	751	751	751	751	751
1223	100	100	100	100	100	100	100	100	100	100	100	100	100
1224	406	406	406	406	406	406	406	406	407	407	407	408	408
1224	0	0	0	0	0	0	0	0	0	0	1	1	1
1225	4	4	4	4	4	4	4	4	4	4	4	4	4
1226	33	33	33	33	33	33	33	34	34	34	34	34	34
1228	219	219	219	219	219	219	219	219	219	219	219	219	219
Units by year	11035	11052	11072	11127	11173	11238	11276	11304	11324	11335	11351	11355	11355
Annual growth		0.2%	0.2%	0.5%	0.4%	0.6%	0.3%	0.2%	0.2%	0.1%	0.1%	0.04%	0.00%
Belle Glade	6141	6151	6244	6281	6291	6323	6345	6360	6376	6384	6397	6399	6399
South Bay	1106	1109	1114	1118	1121	1128	1135	1142	1143	1145	1146	1146	1146
Pahokee	1946	1955	1966	1979	2011	2036	2044	2049	2051	2052	2054	2055	2055
Uninc. County	1842	1837	1748	1749	1750	1751	1752	1753	1754	1754	1754	1755	1755
Inland Port TAZ	119	119	119	119	119	119	119	119	119	119	119	119	119

Appendix 1, cont'd - Raw Population Projections from Palm Beach County

TAZ	Housing Units																						
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1200	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1202	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
1202	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
1203	19	19	19	20	20	20	20	21	21	21	21	22	22	22	22	23	23	23	24	24	25	25	25
1204	124	125	125	127	127	129	129	130	130	132	132	134	134	136	136	138	138	140	140	141	141	142	142
1205	120	122	124	127	129	131	134	136	138	141	143	146	148	151	154	156	159	162	164	167	170	172	175
1205	490	497	503	509	515	521	526	532	538	543	548	554	559	564	569	573	578	582	587	591	595	599	603
1206	432	450	470	490	510	529	548	567	585	602	619	636	652	667	681	695	708	721	733	744	756	768	780
1206	67	70	70	72	72	74	74	76	76	80	80	85	85	90	90	95	95	100	100	105	105	107	107
1207	230	230	232	232	240	240	250	250	260	260	270	270	280	280	290	290	300	300	310	310	320	320	330
1207	1514	1532	1550	1567	1584	1600	1616	1631	1646	1660	1674	1688	1701	1714	1726	1738	1749	1760	1771	1781	1791	1801	1810
1208	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201
1209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1210	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
1211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1212	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1212	970	977	993	1007	1021	1035	1048	1060	1071	1082	1093	1102	1112	1120	1129	1136	1144	1150	1157	1163	1168	1174	1179
1213	256	256	256	257	258	259	260	261	261	262	262	262	263	263	263	264	264	264	265	265	265	266	266
1214	37	37	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	0
1214	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387
1215	29	30	30	31	31	31	32	40	60	80	100	150	200	250	300	350	400	450	500	550	600	650	700
1215	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
1217	12	12	12	12	12	12	12	20	40	60	100	150	200	250	300	350	400	450	500	550	600	650	700
1217	1146	1148	1151	1195	1240	1286	1332	1378	1425	1472	1519	1565	1612	1659	1705	1752	1797	1842	1887	1931	1974	2017	2059
1218	78	79	79	80	82	83	84	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
1218	90	90	91	91	92	92	93	100	120	140	160	180	200	220	226	226	226	226	226	226	226	226	226
1218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1219	1775	1780	1790	1800	1809	1817	1825	1832	1839	1845	1851	1857	1862	1867	1871	1876	1879	1883	1886	1889	1892	1895	1898
1220	1128	1133	1142	1149	1157	1163	1169	1175	1180	1185	1189	1193	1196	1199	1202	1205	1207	1210	1212	1213	1215	1217	1218
1221	1	1	1	20	50	80	110	140	170	200	230	260	290	320	350	380	410	500	590	680	770	860	950
1221	967	976	1000	1023	1047	1070	1093	1115	1137	1159	1181	1202	1222	1242	1262	1281	1300	1318	1336	1353	1370	1386	1401
1222	23	23	24	24	24	25	25	25	26	26	27	27	28	28	29	29	30	30	32	34	36	38	40
1222	755	767	785	802	820	838	856	873	891	908	926	943	960	977	993	1010	1026	1043	1058	1074	1090	1105	1120
1223	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1224	408	409	409	410	410	411	411	450	470	490	510	530	550	570	590	610	630	650	670	690	710	730	750
1224	1	3	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
1225	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1226	34	35	35	35	36	36	36	37	37	37	38	38	38	39	39	39	40	40	40	41	41	41	41
1228	219	219	220	220	222	222	223	223	224	224	225	225	226	226	227	227	228	228	230	230	231	231	232
Units by year	11409	11502	11634	11830	12033	12230	12429	12695	13017	13331	13668	14037	14408	14771	15121	15458	15795	16186	16578	16962	17349	17726	18069
Annual growth	0.5%	0.8%	1.2%	1.7%	1.7%	1.6%	1.6%	2.1%	2.5%	2.4%	2.5%	2.7%	2.6%	2.5%	2.4%	2.2%	2.2%	2.5%	2.4%	2.3%	2.3%	2.2%	1.9%
Belle Glade	6430	6470	6549	6630	6703	6774	6842	6915	6999	7080	7160	7238	7314	7388	7446	7497	7546	7593	7639	7683	7725	7767	7806
South Bay	1146	1148	1151	1195	1240	1286	1332	1378	1425	1472	1519	1565	1612	1659	1705	1752	1797	1842	1887	1931	1974	2017	2059
Pahokee	2072	2099	2123	2148	2170	2194	2216	2239	2259	2283	2302	2326	2344	2367	2384	2406	2422	2443	2458	2477	2492	2507	2521
Uninc. County	1761	1785	1812	1857	1920	1977	2039	2162	2334	2496	2687	2908	3137	3357	3585	3803	4030	4307	4594	4871	5158	5435	5684
Inland Port TAZ	119	121	121	123	125	126	128	160	250	340	450	600	750	900	1050	1200	1350	1500	1650	1800	1950	2100	2250

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TECHNICAL MEMORANDUM NO. 5 – Wastewater Flow and Loading Projections

To: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

Copy: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Rosalyn Mathews / Hazen and Sawyer
Ron Latimer / Hazen and Sawyer
Eric Stanley / Hazen and Sawyer
Mark Drummond / C Solutions

From: Chris Meline / Hazen and Sawyer

Date: May 1, 2014

File: 45103-004.3.1

Subject: Palm Beach County Water Utilities Department
Glades Region Wastewater Master Plan
Project Number: WUD 11-143

Technical Memorandum No. 5 (TM-5) presents historical collection system flows to the Glades Region's two wastewater reclamation facilities, provides projected future collection system flows to the individual pump/lift stations, and provides estimates of future wastewater constituent concentrations and loadings through the planning year 2030 for the Pahokee WWTP (PWWTP) and Belle Glade WWTP (BGWWTP). Additionally, this chapter provides an evaluation of peaking factors within the Glades Region wastewater service area. The wastewater flow forecast presented herein is based upon the population forecast information presented in Technical Memorandum No. 4 (TM-4) and will be used as the principal driver of the wastewater hydraulic model to be addressed in Technical Memorandum No. 6. Current and projected collection and transmission system wastewater flows and loadings were estimated for the Glades Region service area based on data provided by County staff including SCADA, laboratory and utility billing data as well as regulatory and operational reports.

INTRODUCTION

The County's Glades Region wastewater master planning effort includes an evaluation of its wastewater collection and conveyance system through the use of hydraulic modeling methods. A collection and transmission system hydraulic model is being developed that, when fully configured and calibrated, will provide a medium for simulating current and future system performance based on physical and operational characteristics of the system. This chapter provides several data elements required to configure the Glades

Region hydraulic model so to enable its use as a planning tool. To this end, Hazen and Sawyer has executed the following scope of services:

The CONSULTANT will determine current system-wide flows using a combination of available historical data, current water billing data, flow monitoring data, pump station flow records and treatment plant flow records which will be provided by COUNTY. The future wastewater flows will be developed in conjunction with the water demand projections in the COUNTY's most recent water system master plan. CONSULTANT will develop wastewater flow projections for 2015, 2020, 2025, 2030 and 2035 using the following methodology:

1. *The COUNTY will delineate the wastewater service area boundaries by each pump station collection basin and create a basin boundary layer shape file in GIS format which will be provided to the CONSULTANT.*

2. *The CONSULTANT will perform an evaluation by linking wastewater flow generation to projected population growth patterns. CONSULTANT will use historical per capita wastewater flow rates associated with different types of development and land use as provided by the COUNTY. For the undeveloped areas, the future wastewater flows will be estimated using future land use data within their respective municipal jurisdictions complied and prepared by COUNTY.*

The CONSULTANT will generate system-wide wastewater flow WWTP peaking factors from the historical flow data. The CONSULTANT will prepare aggregate wastewater flow and loading forecasts for the wastewater service area for the years 2015, 2020, 2025, 2030 and 2035. Forecasts will be derived considering population growth forecasts from previous tasks along with the anticipated schedule for providing wastewater service (i.e., sewer) to existing septic tank areas, and will reflect base wastewater flow and infiltration and inflow. The CONSULTANT will develop flow projections for individual sewer subsystem drainage areas as identified by the COUNTY for current and build-out conditions.

The CONSULTANT will estimate future wastewater constituent concentrations and loads based on a statistical analysis of daily historical flow data and influent concentration data at the Belle Glade and Pahokee WWTPs. Parameters to be analyzed include BOD_5, $cBOD_5$, COD, TSS, VSS, TKN, and TP. Daily flow and concentration data will be analyzed over the same time increments to develop concentration and load projections for the years 2015, 2020, 2025, 2030 and 2035.

HISTORICAL WASTEWATER FLOWS

Table 1 summarizes historical wastewater flow to the PWWTP and the BGWWTP as measured by the influent flow meters for the period from October 1, 2010 through September 30, 2011. Over this period, the wastewater flow being conveyed to the PWWTP has averaged about 0.77 MGD and the BGWWTP has averaged about 2.6 MGD.

Table 1
Historical Monthly Average Daily Flow to the Pahokee WWTP and the Belle Glade WWTP

Month	Pahokee WWTP (mgd)	Belle Glade WWTP (mgd)
Oct-10	0.77	1.87
Nov-10	0.80	1.91
Dec-10	0.83	2.18
Jan-11	0.85	2.17
Feb-11	0.75	1.98
Mar-11	0.84	2.64
Apr-11	0.83	2.20
May-11	0.68	2.39
Jun-11	0.68	1.98
Jul-11	0.78	4.77
Aug-11	0.69	2.74
Sep-11	0.74	4.32
Average	0.77	2.60

DATA USED FOR ESTIMATIONS

Principal data used for estimating and assigning flows to collection system lift stations and pump stations, and their sources, are shown in **Table 2**. Data used to complete this Task was obtained from PBCWUD sources using Traffic Analysis Zones (TAZs).

Table 2
Wastewater Flow Data and Sources

Data Item	Source	Filename
Population by TAZ to 2030	Palm Beach County Planning Division Population Allocation Model (via PBCWUD)	Glades Population Analysis.xlsx
Glades Region Monthly Water Meter Flow	PBCWUD Utility Billing Section	gua_usage_fy_2011.xlsx
PWWTP Influent Flow	PWWTP SCADA Historical Data	PAHOKEE WW PLANT DATA WORKSHEET -1-xlsx.xlsx
BGWWTP Influent Flow	BGWWTP SCADA Historical Data	BelleGlade_WWTP_Flows.xlsx
Lift Station/Pump Station Collection Basin Polygons	PBCWUD	LSParcels.shp
Public and Private Lift Station Points	PBCWUD	PBCWUD_SewerNetwork_Structure_Glades.shp

ESTIMATION OF INDIVIDUAL LIFT / PUMP STATION FLOWS

Flows for individual lift stations were estimated for the current period using potable water metered flow data obtained from utility billing summary data spreadsheet file. This dataset provided billing summary information for utility accounts within the Glades Region billing database as of September 2011. The datasets provided identification and location information as well as monthly water meter flow for each account. Each account record was spatialized within a GIS environment to distribute water demands to the sites where they occurred. Account spatialization was achieved in one of two ways, depending on the data quality of individual billing account records.

- The majority of account records included an entry for the Parcel ID number. With this number, a water account record could be attached to its associated parcel using a GIS table joining technique. As many account records shared the same Parcel ID number, duplicate records with a usable Parcel ID were combined and monthly meter flow values summed using a dissolve technique within a Microsoft Access database prior to the GIS join. Once water meter flow data was attached to associated parcels, parcel polygons were converted to points.

- Accounts that did not have a usable Parcel ID number were spatialized using GIS geocoding techniques that located individual accounts using the service address field of the account record. A composite address locator was created that used the parcel polygon layer (noted previously) as the primary locator and a road centerline layer as a secondary locator.

With water meter flow data distributed across the service area, individual meter flow records were associated with a service area lift station or pump station. This was accomplished in GIS by overlaying

spatialized water account point data on wastewater collection basin polygons, such that each account received a lift station identifier. Water account points that did not fall within a collection basin polygon was given the lift station identifier of the closest basin.

The County's pump station point file was edited to provide Station ID numbers to the 15 private stations without identification.

Individual water meter account flows were subtotaled based on each accounts lift station basin affiliation to calculate total monthly water demands for each basin.

FLOW PROJECTIONS

This section presents the methodology used to estimate the theoretical wastewater generated from the Glades Region wastewater service area. The 2011 station flows, described previously, were converted from thousand gallons per month (kgal/mo) to gallons per minute (gpm). For developed areas, flow projections for 2015, 2020, 2025 and 2030 were calculated for each basin, based on expected population growth, as discussed below.

Future station flows were derived with the assumption that system-wide water consumption grows at a rate that is consistent with that of population. Hence, the percent change in population for each service area TAZ between the 2011 (the base year) and each of the time step years (2015, 2020, 2025, 2030, 2035) was calculated as a water demand growth coefficient. Each wastewater collection basin was assigned a TAZ identifier for the TAZ in which it resides. Three basins spanned more than a single basin and were assigned a TAZ identifier for the TAZ where the majority of its area was found. Each lift station basin's average meter flow (gpm) was multiplied by its TAZ growth coefficient for each time step to produce an array of five future meter flows. Each lift station potable water meter flow subtotal includes a value for 2011 and each future time step.

The 2011 and future potable water meter flow values associated with each lift station were then multiplied by a Wastewater Generation Coefficient used to convert water consumed to wastewater generated. The Wastewater Generation Coefficient is a calculated value that represents the ratio of the PWWTP and BGWTP influent flows (0.77 mgd and 2.60 mgd, respectively) divided by the total potable water sold (excluding accounts without sewer service) (0.37 mgd and 1.91 mgd, respectively) plus sewer only account flows in each service area. The calculated general Wastewater Generation Coefficients for the Pahokee and Belle Glade service areas are 5.61 and 1.21 (gallons of WRF influent per gallon of potable water sold), respectively. The Wastewater Generation Coefficients fully and simultaneously account for both the impacts of irrigation water use (water use without a direct path into the wastewater stream), and inflow and infiltration of groundwater within the gravity portion of the system.

Base year and future station flow estimates for public and private lift / pump stations are presented in **Appendix A**. The overall wastewater flow forecast (on an annual average daily flow basis) for the entire Glades Region service area is presented in **Table 3.**

Table 3
Annual Average Day
Forecasted Wastewater Flow

Year	Belle Glade (mgd)	Pahokee (mgd)	Combined Flow (mgd)
2015	2.57	0.77	3.34
2020	2.69	0.80	3.49
2025	2.89	0.83	3.72
2030	3.09	0.84	3.93
2035	3.35	0.89	4.24

WASTEWATER INFLUENT FLOW PEAKING FACTORS

Historical wastewater flow data were evaluated to determine the historical maximum day flow (MDF) and the peak hour flow (PHF) and their associated individual peaking factors (PFs) for 2011, for each of the Glades Region's two wastewater treatment plants. The maximum day flow peaking factor is defined as the MDF divided by the annual average daily flow (AADF) (i.e., MDF PF = MDF/AADF). The peak hour flow peaking factor is defined as the PHF divided by the AADF (i.e., PHF PF = PHF/AADF). Wastewater influent flow peaking factors were calculated from 2011 SCADA historical data for both SRWRF and ECRWRF (provided by County staff). Maximum Day and Peak Hour peaking factors for each plant, and composite peaking factors (the weighted average of the peaking factors of both plants) are provided in **Table 4**. For this Master Plan, the composite average MDF Peaking Factor and PHF Peaking Factor for 2011 are 3.00 and 4.13, respectively.

Table 4
Wastewater Reclamation Facilities Peaking Factors

Description	Pahokee WWTP	Belle Glade WWTP	Composite
Maximum Day Influent Flow	2.19	7.91	10.10
Average Day Influent Flow	0.77	2.60	3.37
Maximum Day Flow Peaking Factor	**2.84**	**3.04**	**3.00**
Peak Hour Flow	3.49	10.91	14.40
Average Hour Flow	0.89	2.60	3.49
Peak Hour Flow Peaking Factor	**3.93**	**4.20**	**4.13**

WASTEWATER CONSTITUENT CONCENTRATIONS AND LOADINGS

Wastewater influent concentrations and loads for the Pahokee WWTP and Belle Glade WWTP were calculated from the 2011 to 2012 historical influent data provided by County staff. Three parameters, Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), and Total Kjeldahl Nitrogen (TKN) were not included in this analysis as the available data was insufficient.

Pahokee WWTP and Belle Glade WWTP historical annual average influent concentrations and loadings can be found in **Tables 5 and 6**, respectively. The daily and 30-day moving average influent concentrations and loads were plotted for 2011 to 2012 to determine if the loadings are increasing over time and to determine loading trends and estimate future loadings to the facilities. Pahokee WWTP carbonaceous Biochemical Oxygen Demand ($CBOD_5$) loadings remained steady and Total Suspended Solids (TSS) loadings increased by about 12% over the two year period from 2011 to 2012. The $CBOD_5$ and TSS concentrations are measured daily. Over the same 2-year period the flow increased by approximately 15%. Therefore from the data is appears that TSS loading is increasing at about the same rate as is flow, indicating a wastewater that is consistent in the strength. It was assumed that additional future flow will have the same trend in loadings as the 2010 through 2012 time period for $CBOD_5$ and TSS.

Belle Glade WWTP carbonaceous Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS) loadings have decreased over the two year period from 2011 to 2012 by approximately 22% and 21%, respectively. The $CBOD_5$ and TSS concentrations are measured daily. Over the same 2-year period the flow decreased by approximately 5%. Therefore from the data is appears that loading is decreasing at a greater rate than flow indicating a gradual decrease in the strength of the wastewater. It was assumed that additional future flow will have the same incremental decrease in load as the 2010 through 2012 time period for $CBOD_5$ and TSS.

The predicted future influent loadings can be found in **Table 7** and **Table 8**.

Table 5.5
Historical Pahokee WWTP Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	0.78		0.90	
Parameter and Concentration	Conc. (mg/L)	Load (ppd)	Conc. (mg/L)	Load (ppd)
CBOD*	129	840	111	837
TSS	117	767	114	860

**Adjusted CBOD (lab data is inhibited, ratio used = 0.84)*

Table 5.6
Historical Belle Glade WWTP Influent Concentration and Load Summary
(Based on Screened Data for 2011 - 2012)

Year	2011		2012	
Flow (mgd)	2.77		2.61	
Parameter and Concentration	Conc. (mg/L)	Load (ppd)	Conc. (mg/L)	Load (ppd)
CBOD*	137	3,121	111	2,422
TSS	125	2,854	103	2,250

**Adjusted CBOD (lab data is inhibited, ratio used = 0.84)*

Table 5.7
Predicted Pahokee WWTP Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	**0.80**	**0.86**	**0.92**	**0.97**	**1.02**
Parameter and Concentration	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**
CBOD*	943	1,016	1,086	1,145	1,199
TSS	861	967	991	1,045	1,044

**Estimated concentrations for predicting future loads:*
CBOD in mg/L - 141 (highest year of historical data +10%)
TSS in mg/L - 129 (highest year of historical data +10%)

Table 5.8
Predicted Belle Glade WWTP Influent Load Summary

Year	2015	2020	2025	2030	2035
Flow (mgd)	**2.62**	**2.80**	**3.18**	**3.58**	**4.01**
Parameter and Concentration	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**	**Load (ppd)**
CBOD*	3,285	3,514	3,980	4,482	5,021
TSS	3,004	3,213	3,639	4,098	4,591

** Estimated concentrations for predicting future loads:*
CBOD in mg/L - 150
TSS in mg/L - 137

APPENDIX A

Wastewater Flow Projections

Appendix A
Lift / Pump Staton Estimated Flows 2011 - 2035

Lift / Pump Station ID	2011 FLOW (gpm)	2011 ADJUSTED FLOW[1] (gpm)	2015 FLOW (gpm)	2020 FLOW (gpm)	2025 FLOW (gpm)	2030 FLOW (gpm)	2035 FLOW (gpm)
LS6044	13.13	19.44	20.22	26.46	32.84	40.68	55.01
LS8101	69.45	102.83	103.90	106.24	107.91	109.08	109.89
LS8102	28.31	41.92	43.60	57.06	70.81	87.71	118.61
LS8103	4.32	6.40	6.58	8.32	36.26	79.91	123.56
LS8104	6.66	9.87	9.89	10.05	10.13	10.19	10.25
LS8105	18.83	27.88	27.93	28.38	28.62	28.77	28.96
LS8106	22.30	33.01	33.08	33.61	33.89	34.08	34.30
LS8107	19.57	28.98	29.93	31.96	33.52	34.69	35.54
LS8108	16.03	23.73	24.52	26.18	27.46	28.41	29.11
LS8109	7.96	11.79	12.32	13.68	15.04	16.33	17.62
LS8110	22.20	32.86	34.33	38.14	41.93	45.53	49.12
LS8111	28.00	41.45	42.18	43.41	44.20	44.69	45.00
LS8112	32.68	48.38	49.22	50.66	51.58	52.16	52.51
LS8113	89.35	132.28	134.59	138.53	141.04	142.61	143.59
LS8114	37.20	55.07	55.65	56.90	57.79	58.42	58.86
LS8115	17.58	26.02	27.19	30.20	33.20	36.05	38.90
LS8116	9.30	13.76	14.32	18.73	23.25	28.80	38.94
LS8117	34.99	51.81	54.12	60.13	66.11	71.77	77.44
LS8118	15.50	22.95	23.70	25.31	26.54	27.47	28.14
LS8119	15.01	22.22	22.45	22.95	23.31	23.57	23.74
LS8120	4.88	7.23	7.55	8.39	9.22	10.01	10.80
LS8121	3.75	5.55	5.78	7.56	9.38	11.62	15.72
LS8123	8.37	12.39	12.83	15.11	41.53	62.36	81.22
LS8126	29.21	55.55	57.38	61.27	64.26	66.50	68.13
LS8127	5.48	8.12	8.48	9.42	10.36	11.25	12.13
LS8128	1.34	1.99	2.06	2.42	6.66	10.00	13.02
LS8130	0.14	0.21	0.21	0.21	0.21	0.21	0.21
LS8132	7.78	11.52	11.98	15.68	19.46	24.10	32.59
LS8133	4.63	6.85	7.09	8.35	22.97	34.48	44.91
LS8134	6.04	8.94	8.96	8.96	8.96	8.96	8.20
LS8136	1.88	2.79	2.88	3.08	3.23	3.34	3.42
LS8137	2.52	3.73	3.73	3.73	3.73	3.73	3.73
LS8138	0.87	1.28	1.33	1.56	4.30	6.45	8.40
LS8140	0.83	1.23	1.25	1.28	1.31	1.32	1.33
LS8141	36.02	53.33	53.45	53.45	53.45	53.45	48.91
LS8142	32.38	47.95	47.95	47.95	47.95	47.95	47.95
LS8143	0.37	1.08	1.08	1.08	1.08	1.08	1.08
LS8146	8.35	12.37	12.86	16.83	20.89	25.88	34.99
LS8148	3.64	5.38	5.60	7.33	9.09	11.26	15.23
LS8149	6.62	9.80	10.19	13.34	16.56	20.51	27.73
LS8152	0.08	0.12	0.12	0.14	0.39	0.58	0.76
LS8155	9.82	14.53	15.05	17.72	48.73	73.16	95.29

Lift / Pump Station ID	2011 FLOW (gpm)	2011 ADJUSTED FLOW[1] (gpm)	2015 FLOW (gpm)	2020 FLOW (gpm)	2025 FLOW (gpm)	2030 FLOW (gpm)	2035 FLOW (gpm)
LS8157	41.83	61.93	61.93	61.93	61.93	61.93	61.93
LS8201	40.82	60.44	62.20	65.58	69.01	71.73	74.47
LS8202	2.97	4.39	4.52	4.77	5.01	5.21	5.41
LS8203	0.69	1.03	1.06	1.12	1.18	1.23	1.28
LS8204	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LS8205	0.18	0.26	0.27	0.28	0.30	0.31	0.32
LS8207	3.76	5.56	5.72	6.03	6.35	6.60	6.85
LS8210	7.25	10.74	11.05	11.65	12.26	12.75	13.23
LS8211	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LS8213	5.63	8.34	8.58	9.05	9.52	9.90	10.27
LS8214	9.81	14.53	15.83	18.84	21.60	24.06	25.99
LS8216	11.35	16.81	18.32	21.79	24.99	27.84	30.07
LS8217	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LS8219	3.89	5.76	5.93	6.25	6.58	6.84	7.10
LS8220	0.14	0.21	0.22	0.23	0.24	0.25	0.26
LS8221	0.49	0.73	0.75	0.80	0.84	0.88	0.91
LS8222	2.37	3.51	3.63	3.83	4.03	4.21	4.38
LS8223	0.09	0.13	0.14	0.17	0.19	0.21	0.23
LS8225	0.02	0.03	0.03	0.03	0.04	0.04	0.04
LS8226	0.12	0.18	0.19	0.20	0.21	0.22	0.23
LS8227	0.06	0.08	0.09	0.09	0.10	0.10	0.11
LS8228	0.52	0.77	0.79	0.84	0.88	0.92	0.96
LS8229	0.13	0.20	0.20	0.22	0.23	0.24	0.25
LS8230	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LS8231	0.19	0.28	0.29	0.31	0.33	0.34	0.36
LS8232	0.02	0.03	0.03	0.03	0.03	0.03	0.04
LS8233	0.41	0.60	0.62	0.66	0.69	0.72	0.75
LS8235	0.51	0.75	0.78	0.82	0.87	0.91	0.94
LS8236	0.40	0.59	0.61	0.65	0.68	0.71	0.74
LS8237	2.53	3.75	3.75	3.75	3.75	3.75	3.75
LS8239	0.40	0.59	0.61	0.65	0.68	0.71	0.74
LS8240	0.56	0.83	0.86	0.90	0.95	0.99	1.03
LS8301	7.76	11.48	11.51	12.94	15.71	19.00	22.20
LS8302	64.65	95.72	95.96	107.81	130.95	158.35	185.05
LS8303	16.54	24.49	24.55	27.58	33.51	40.52	47.35
LS8304	5.54	8.20	8.22	9.24	11.22	13.57	15.86
LS8305	5.02	7.43	7.45	8.37	10.16	12.29	14.36
LS8306	3.28	4.86	4.87	5.48	6.65	8.04	9.40
LS8307	6.41	9.48	9.51	10.68	12.98	15.69	18.34
LS8308	5.91	8.75	8.78	9.86	11.98	14.48	16.93
LS8309	3.72	5.51	5.53	6.21	7.54	9.12	10.66
LSP001	169.81	251.41	252.05	283.18	343.96	415.93	486.05
LSP003	8.83	13.07	13.07	13.07	13.07	13.07	13.07
LSP004	10.50	15.55	16.24	18.04	19.84	21.54	23.24

Lift / Pump Station ID	2011 FLOW (gpm)	2011 ADJUSTED FLOW[1] (gpm)	2015 FLOW (gpm)	2020 FLOW (gpm)	2025 FLOW (gpm)	2030 FLOW (gpm)	2035 FLOW (gpm)
LSP005	20.18	29.87	32.56	38.74	44.42	49.48	53.45
LSP006	139.86	207.07	213.11	224.69	236.43	245.74	255.14
LSP007	2.34	3.47	3.47	3.47	3.47	3.47	3.47
LSP008	234.29	346.88	346.88	346.88	346.88	346.88	346.88
LSP009	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LSP011	0.14	0.21	0.21	0.21	0.21	0.21	0.21
LSP013	11.47	16.99	16.99	16.99	16.99	16.99	16.99
LSP014	8.73	12.93	12.93	12.93	12.93	12.93	12.93
LSP015	35.19	52.10	52.10	52.10	52.10	52.10	52.10
Total Flow	**1,580.68**	**2,353.09**	**2,392.48**	**2,561.70**	**2,873.57**	**3,202.12**	**3,551.14**
Glades (mgd)	**2.28**	**3.39**	**3.45**	**3.69**	**4.14**	**4.61**	**5.11**
Pahokee (mgd)	**0.14**	**0.20**	**0.21**	**0.23**	**0.25**	**0.26**	**0.27**
Belle Glade (mgd)	**2.14**	**3.19**	**3.23**	**3.46**	**3.89**	**4.35**	**4.84**

1 Wastewater Generation Coefficient = 1.48 (gallons wastewater generated per gallon water consumed)

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TECHNICAL MEMORANDUM NO. 6 – Hydraulic Model

To: Maurice Tobon / Palm Beach County Water Utilities Department
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From: Chris Meline / Hazen and Sawyer

Date: April 30, 2014

File: 45103-004.3.0

Subject: Palm Beach County Water Utilities Department (PBCWUD)
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 6 (TM-6) presents the wastewater collection and transmission system hydraulic model. The model includes elements representing the network of master pump stations, lift stations, and pressurized force mains that are owned and operated by PBCWUD. Private lift stations and associated force mains that contribute flow through the PBCWUD network are also represented in the model. This technical memorandum focuses on the general specification and calibration of the model, and on model scenarios configured to identify the hydraulic deficiencies present in the network. It also identifies and evaluates proposed transmission system improvements designed to address hydraulic deficiencies.

INTRODUCTION

The County's wastewater master planning effort includes an evaluation of its wastewater collection and conveyance system through the use of hydraulic modeling methods. Accordingly, Hazen and Sawyer developed, calibrated and deployed a Glades Region wastewater transmission system hydraulic model using the County's preferred modeling platform, InfoWater®. The hydraulic model encompasses individual transmission systems associated with both the Pahokee WWTP and the Belle Glade WWTP. Transmission system elements (i.e., pipes, pumps, and wetwells) were evaluated against a set of performance criteria approved by County staff. Improvements needed to address system hydraulic deficiencies surfaced by the modeling

process were proposed and tested for efficacy. To this end, Hazen and Sawyer has executed the following scope of services:

The CONSULTANT will develop a wastewater hydraulic model for evaluating major network capacity improvements, using scaled dimensions of force mains and lift stations utilizing the InfoWater application.

The CONSULTANT will obtain data from the COUNTY related to the collection and transmission systems that will be compiled to perform a hydraulic evaluation. In addition to the data collected in Task 1, the following is a list of data (where available) that the COUNTY will provide:

- *Geographic information system (GIS) shape files that depict wastewater system infrastructure (including pump stations, valves, manholes, pipes, etc.);*
- *Pump station record drawings, including wet well dimensions, pump control elevations, pump model numbers, and pump curves;*
- *SCADA data (pressures, flows, levels, etc.) for the master pumps, individual lift station pumps and all wastewater transmission system pressure monitoring stations for the years 2008, 2009 and 2010, if available;*
- *SCADA data of all pump station pump on/off events records for the year 2011, if available;*
- *Field operation log records on known valve closures for the year 2011; and*
- *Provide information on pumping stations that have known areas of concern, such as overflows, surcharges, and/or extended pump runtimes.*

The CONSULTANT will import the GIS pipe network layer into the Infowater model. Pump station nodes will be created based on sewer atlas and pump station as built drawings which have been provided by the COUNTY.

The current pump station dry weather flows will be calculated from the water billing data provided by the COUNTY and converted to wastewater flows using a computed ratio. Flow diurnal patterns will developed for each pump station based as described in the paragraphs below.

The wet weather flows will be determined by reviewing available historical rainfall and flow records of pump stations and flow records from the Belle Glade and Pahokee WWTPs. Peak flow factors will be determined for pump stations where adequate flow records are available.

CONSULTANT will develop a model verification plan that includes:

- *A list of up to 15 pump stations for discharge pressures monitoring locations in addition to the current permanent pressure monitoring stations,*
- *A list of up to 15 flow monitoring locations, and*
- *The time periods and time steps of the system flow and pressure monitoring data collections*

Field data will be collected and compiled to support model calibration procedures. CONSULTANT will coordinate with COUNTY to install COUNTY provided Telog digital pressure recorders. Designated locations will be monitored simultaneously for a period of eight days. COUNTY staff will install and relocate the recorders in accordance with the location and data collection schedule provided by the CONSULTANT.

CONSULTANT will develop the following model scenarios to evaluate the network based on the above specified criteria:

- *Maximum daily flow for current flow condition (Extended Period Simulation)*
- *Maximum daily flow for future flow conditions through the planning period year 2035 (Extended Period Simulation), using 5-year increments*
- *Maximum daily flow for future flow conditions with proposed improvements (Extended Period Simulation) through the planning period year 2035, using 5-year increments*

CONSULTANT will run each of the above listed model scenarios to identify system capacity deficiencies such as limitations with transmission pump station capacity, wet well capacity, and pressure related hydraulic constraints. Using the results of the modeling effort, CONSULTANT will propose network improvements including new pipes, new pump stations or required upgrades of existing pump stations, and/or new operation strategies to resolve identified network deficiencies.

CONSULTANT will prepare a listing of force main and pump station improvements. Improvement locations will be illustrated on a map of the service area. CONSULTANT will provide opinions of probable costs and the timing required for the recommended improvements.

WASTEWATER TRANSMISSION SYSTEM MODEL CONFIGURATION

The model is constructed using the *InfoWater® v10.0* hydraulic modeling platform and is configured with the model elements shown in **Table 6.1**:

Table 6.1
Inventory of Model Elements

Model Element	Quantity
Pipes	229
Junctions	124
Reservoirs	2
Pumps	48
Existing Stations	29
Non-Manifolded Lift Stations	91
In-line Booster Stations	1
PBCWUD Owned Lift Stations	99
Private Lift Stations	15
Pahokee Service Area Lift Stations	45
Belle Glade Service Area Lift Stations	69

Model elements, including piping, lift stations and wastewater treatment plants were added to the model from GIS data provided by PBCWUD. As PBCWUD's Glades region GIS is in the development phase, several modifications to model topology were required to enable it to conform to actual network conditions. As **Table 6.1** indicates, only about 25 percent of system-wide lift stations are manifolded to their respective wastewater treatment plants. It is these lift stations which constitute the Glades Region wastewater transmission network, and which are modeled under this task. The remainder of network lift stations, either directly or indirectly, pump to a downstream lift station or a gravity line, and are therefore, hydraulically disconnected from the primary transmission system.

Pipes

There are a total of 229 pipe segments making up the model's wastewater transmission network. Pipe diameters range from 2 to 18 inches. The total length of model pressurized mains 162,012 feet, or approximately 30.7 miles. Model pipe configuration settings are provided in **Table 6.2**.

Table 6.2
Model Pipe Summary

Pipe Diameter (inches)	Number of Pipes	Total Length (feet)
2	6	3,863
4	79	12,555
6	38	30,108
8	16	33,378
10	17	30,189
12	56	32,672
14	3	6,771
16	12	10,537
18	2	1,937
Total	**229**	**162,842**

As transmission network pipe material and age information was generally not available, the following initial material and friction coefficient assumptions were integrated into the model.

- Force main pipe material – PVC
- Force main friction coefficient – 120

Figure 6-1 presents the Glades Region hydraulic model Belle Glade / South Bay wastewater transmission network and lift stations. There are twenty-two lift stations included in the wastewater transmission network in the Belle Glade / South Bay region. The Pahokee wastewater transmission network includes seven lift stations as shown in **Figure 6-2**.

Lift Stations

Each of the modeled lift stations have been configured with an appropriate array of pumps. These stations are configured as duplex stations except LS8101 and LS8146, each of which has four pumps, and the South Bay In-line booster station, which also has four. Modeled lift station pumps have been configured with pump curves supplied by PBCWUD or obtained from applicable pump manufacturers. Other lift station attributes, such as wet well dimensions and pump control elevations, were obtained from PBCWUD and were based on record drawings or direct field measurements by PBCWUD staff. Technical Memorandum No. 7 provides detailed evaluations of the Glades Region lift stations.

The Belle Glade WWTP wastewater transmission network has one in-line booster pump station which supports wastewater transmission from the South Bay service area during periods of high flow. As previously noted, the South Bay Booster Station has a total of 4 pumps.

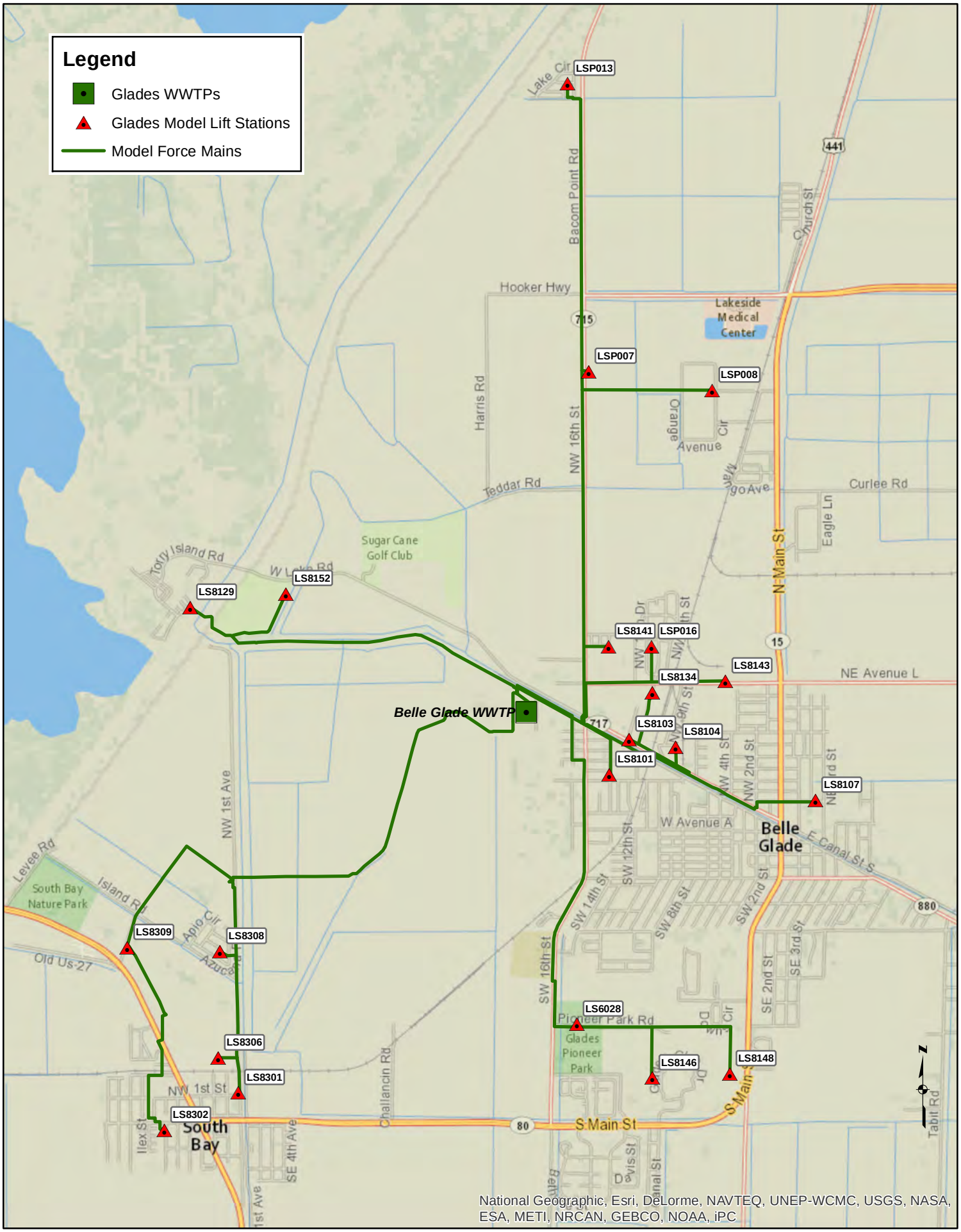

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Figure 6-1 - Belle Glade / South Bay Wastewater Transmission Network

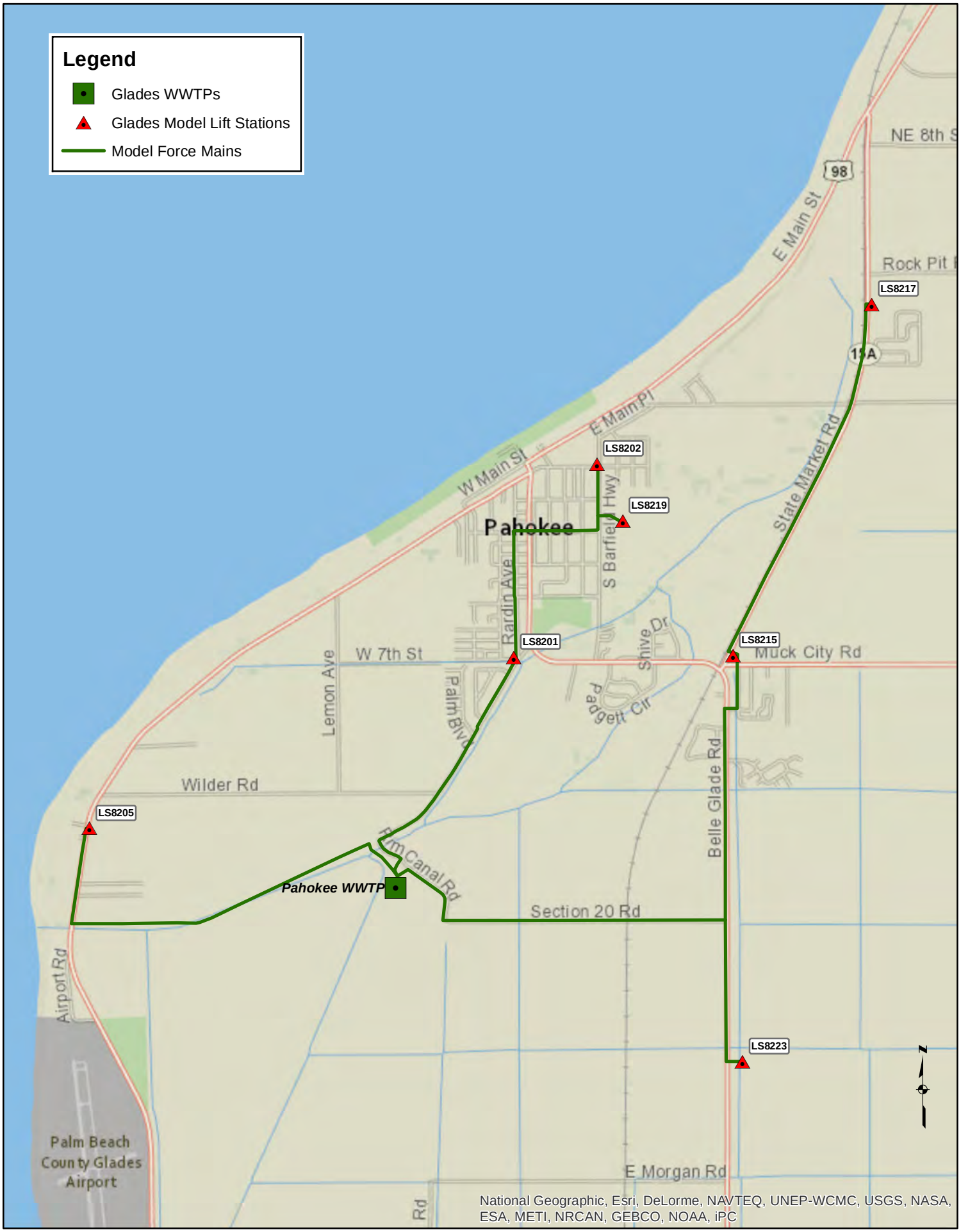

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Figure 6-2 - Pahokee Wastewater Transmission Network

The model includes four private lift stations located in the north Belle Glade service area (LSP007, LSP008, LSP013 and LSP016). As information regarding these stations was not available, they are represented in the model with associated diurnal flow curves as continuous flows, rather than regulated flows provided by a fully configured lift stations.

Extended Period Simulation

The two basic types of hydraulic models are:

- Steady-State Simulation
- Extended Period Simulation

Steady-state simulation computes the state of the system (i.e., flows, pressures, lift station operating status, wet well sewage levels) assuming that neither the wastewater generation rate nor the system state change with time. Steady-state simulation is a snap shot of system performance at a particular time.

Extended Period Simulation determines the dynamic behavior of the system, computing the state of the system as wastewater generation rate, lift station operating status, wet well level, force main pressure, etc. vary over time. Extended Period Simulation allows the model to evaluate wet well level, daily pump run time, along with force main pressures and flow rates throughout the system. The Glades Region wastewater transmission system was modeled utilizing the Extended Period Simulation technique.

Extended Period Simulation requires that flows at each pump station be regulated throughout each 24 hour period in a manner that reflects the wastewater generation behavior of customers found with in a station's wastewater collection basin. To achieve a dynamic lift station wastewater flow, a diurnal curve is assigned that reflects the ups and downs of potable water use and wastewater generation. Diurnal curves for each of the model's lift stations were derived from pump operations data using recorders that were deployed at many of PBCWUD's Glades area lift stations. The recorders collected pump run/off information for several weeks from October 2012 to January 2013. Using lift station wetwell operating volume information, variable time step flows were derived over the course of each day of deployment, then normalized for a fixed time step. The flows were then indexed to the average flow for specific days, to produce a unique 24 hour diurnal curve for each station.

Current and Projected Flows

Current and projected wastewater average daily flow (ADF) rates assigned to lift stations in the model are those presented in Technical Memorandum No. 5 – Wastewater Flows and Loadings. Because only a fraction of the Glades Region lift stations are represented in the model (manifolded stations pumping into a force main terminating at a wastewater treatment plant)

wastewater flows estimated for non-manifolded stations were concentrated in their first respective downstream manifolded station. For example, LS8101, the primary master station serving the Belle Glade area, has been assigned flows from 25 upstream lift stations.

As required by the scope of services, model scenarios were developed using Maximum Daily Flows (MDF). Due to the large but unevenly distributed contribution of Inflow and Infiltration (I/I) to MDF, individual lift station MDF flows were not assigned to individual lift stations using the peaking factors presented in **Table 6.3**. Rather, I/I flows (essentially the difference between billed potable water and the measured wastewater treatment plant measured inflows) were distributed to lift stations based on their I/I potential. That is, in proportion to each lift station's inch – feet of upstream gravity piping. Hence, lift stations with the largest gravity collection basins were assigned the greatest amount of I/I flow in addition to their metered potable water flow. The MDF flows moving to the two wastewater treatment plants conformed to those shown in **Table 6.3**.

Table 6.3
Wastewater Reclamation Facilities Peaking Factors

Description	Pahokee WWTP	Belle Glade WWTP	Composite
Maximum Day Influent Flow	2.19	7.91	10.10
Average Day Influent Flow	0.77	2.60	3.37
Maximum Day Flow Peaking Factor	**2.85**	**3.04**	**3.00**

Future flows for lift stations to which I/I flows have been assigned were adjusted to reflect the impacts of expected improvements associated with PBCWUD's ongoing I/I remediation program. Accordingly, I/I flows associated with lift stations having upstream gravity collection systems were reduced at a rate of one percent per year through the year 2030. After 2030, it was assumed that I/I reductions associated with ongoing remediation measures would be balanced by increasing I/I flow in non-improved areas of the collection network.

Appendix 6-1 provides MDF lift station inflows for both Belle Glade/South Bay and Pahokee service area model lift stations. Inflows are presented for each station as "Base Flow", flow associated with consumption/disposal of metered potable water, and "I/I Flow". The separation of these two flow components is significant within the Glades Region model configuration as the Base Flow fraction of total wetwell inflow is regulated by individual lift station diurnal curves, while I/I inflows are not (I/I flows represent a constant inflow). In addition to the distinction between Base Flow and I/I Flow, the period of record evaluated extends from the baseline in 2011 through 2035. A total of 22 lift stations were assigned flows in the Belle Glade/South Bay service area as shown in **Table 6-1.1** (**Appendix 6-1**).

Seven lift stations were included in the Pahokee service area. Base Flow and I/I Flow was distributed using similar techniques to those used for the Belle Glade/South Bay service area (See **Table 6-1.2** of **Appendix 6-1**).

Field Data Collection

The project team installed digital pressure recorders on the discharge side of the pumps at 17 PBCWUD owned lift stations, sixteen of which were verified as part of the primary wastewater transmission network. The 17 locations were monitored in three groups. The first group was monitored from November 29 through December 12, 2012 in the South Bay and Belle Glade areas. The second group was monitored from December 20, 2012 through January 3, 2013 in the Belle Glade area. The third group was monitored from January 4 through January 19, 2013 and included locations in the Pahokee area. It should be noted that LS8101 was included as part of the first tier of lift stations that were equipped with data loggers. Unfortunately, the first attempt was unsuccessful due to logger malfunction. This station was monitored successfully with the second group.

Figure 6-3 presents the locations where temporary pressure recorders were installed. **Table 6.4** provides a summary of the locations where pressure recorders were deployed.

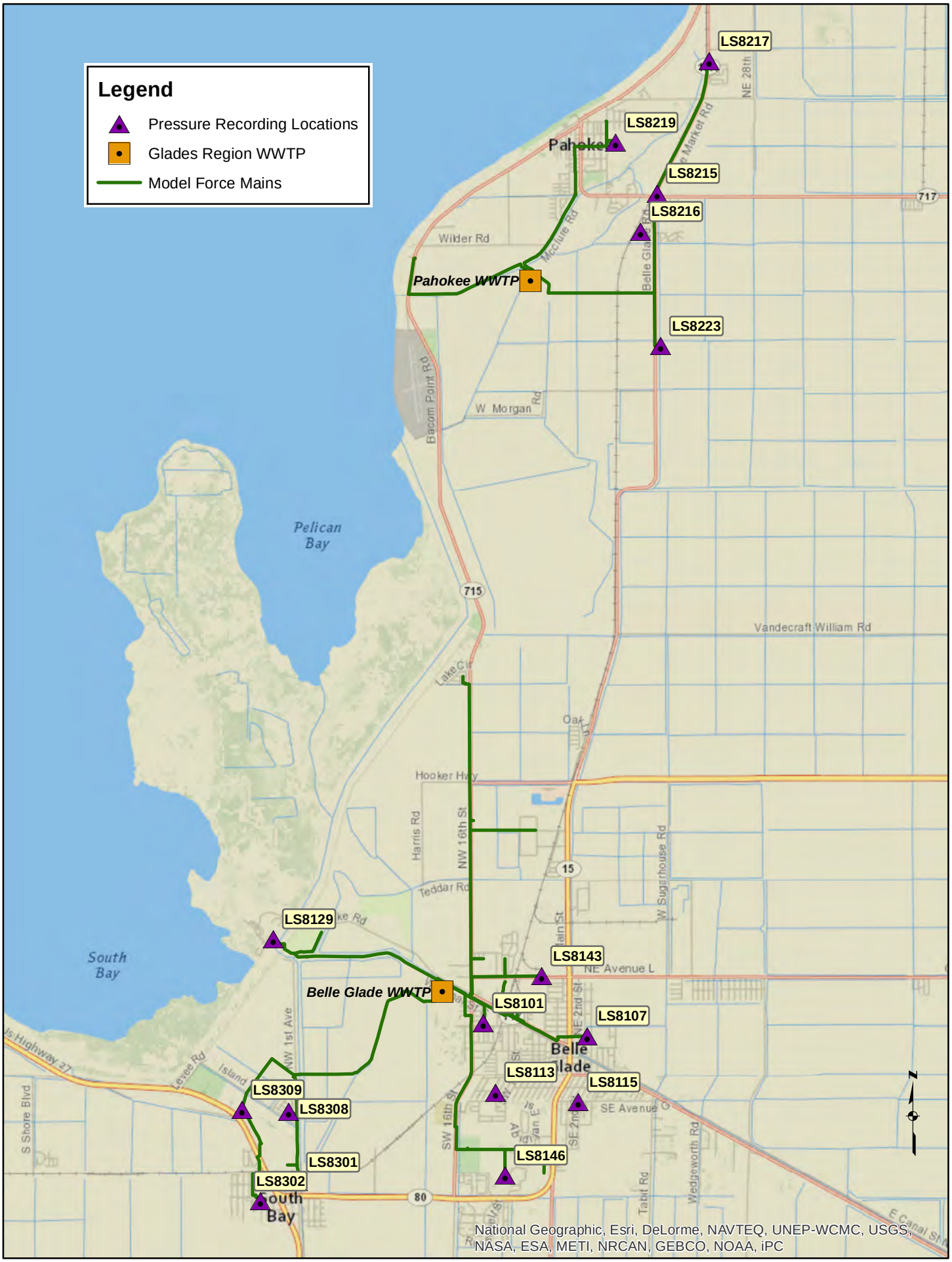

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Figure 6-3 - Field Pressure Recording Locations

Table 6.4
Temporary Pressure Recorder Installation Locations

	Recording Period		
Station	**11/29-12/12**	**12/20-1/3**	**1/4-1/19**
LS8101	X[B]	X	
LS8107		X	
LS8113[A]		X	
LS8115		X	
LS8129	X		
LS8143 [A]		X	
LS8146		X	
LS8215			X
LS8216[A]			X
LS8217			X
LS8219			X
LS8222[A]			X
LS8223			X
LS8301	X		
LS8302	X		
LS8308	X		
LS8309	X		

[A] Based on the field pressure recording data collected, these lift station discharge to downstream gravity collection basins. Hence, these data could not be used for calibration of the transmission system hydraulic model

[B] The data logger malfunctioned and this station was re-monitored during the second monitoring event

It should be noted that field investigations revealed that lift stations LS8113, LS8143, LS8216 and LS8222 discharge to downstream gravity collection basins and not to the force main network as originally anticipated. As a result, the wastewater transmission piping in the model was adjusted accordingly.

Calibration

The wastewater transmission system hydraulic model was designed to predict the system's present and future operational parameters under specific demand scenarios. The key parameters are pressure, velocity and flow. Verification of the accuracy of these is required to gain confidence in using the model to make long term predictions.

Model calibration was accomplished by comparing pressure records obtained from field measurements and wastewater treatment plant inflow data to model predictions. Friction coefficient factors were adjusted as needed to match actual data measured. It should be noted that only minor adjustments were required to effectively calibrate the model once pipe and pump capacity specifications issues were resolved.

To assess the accuracy of the model, the average of the peak field measured pressure conditions (over a selected 24-hour period) were compared to the peak pressures in the model pressure predictions over the same time period. Industry standards require that model calibration is considered successfully achieved when an overall average of ten percent difference between measured and predicted system pressures is achieved for a 24-hour period at each of the "calibration" model lift stations (16 of the model's 29 stations). This goal was achieved.

Model Calibration Results

The wastewater transmission system model performance was verified by comparing the model generated pump discharge pressures versus the field measured pressures in the transmission system over a 24-hour period. **Table 6.5** summarizes the model calibration results. As shown in this table, the average of the differences (error) between pressures measured in the field and the model output was 5.9 percent across the modeled lift stations. The American Water Works Association Manual M32, Distribution *Network Analysis for Water Utilities*, states that a model can be considered calibrated acceptably if it predicts performance within ten percent of the observed performance. Hence, the calibration results for this model, which had an average error of approximately 5.9 percent, are well within the recommended range of accuracy for the analysis of model scenarios. The wastewater transmission system hydraulic model was considered acceptable for master planning transmission system improvement needs.

Table 6-5
Wastewater Model Calibration Results

Lift Station ID	Telog	Model	Difference	% Difference
LS8101	11.0	10.0	-1.0	9.1
LS8107	36.0	36.0	0.0	0.0
LS8129	39.0	33.5	-5.5	14.1
LS8146	16.0	14.7	-1.3	8.1
LS8215	17.0	18.7	1.7	10.0
LS8217	26.5	27.0	0.5	1.9
LS8223	14.0	15.5	1.5	10.7
LS8301	37.0	37.5	0.5	1.4
LS8302	51.0	51.0	0.0	0.0
LS8308	43.0	40.5	-2.5	5.8
LS8309	47.0	45.0	-2.0	4.3
			Average	**5.9**

MODEL EXECUTION

Once fully specified and calibrated, model scenarios were developed and executed to evaluate several model elements, piping, lift station pumps, and lift station wetwells, against an array of performance criteria. Five performance criteria were used for the evaluated as shown below:

1. Pump run time – to evaluate pump capacity
2. Pump starts – to evaluate wetwell capacity
3. Pipe velocity – to evaluate force main capacity
4. Pipe head-loss gradient – to evaluate force main capacity
5. Wetwell surcharge – to evaluate pump capacity

Model scenarios for the above performance evaluation were executed under MDF flow conditions. An additional scenario was run under Average Day Flow (ADF) conditions for the purpose of determining the extent to which lift station pumps remain on their respective pump curves under low flow conditions. Finally, separate model scenarios were developed using projected wastewater flows associated with each of the required six time steps, 2011, 2015, 2020, 2025, 2030 and 2035.

Performance Criteria

The criteria used to assess the adequacy of the Glades Region wastewater transmission system relative to lift station run time, pump starts, force main flow velocity and head-loss, and wetwell surcharging are described in the following paragraphs.

Pump Run Time Performance Criteria

Pump run time is the hours of operation per day per duty pump in a lift station (assuming one pump is out of service). For example, given a quadplex stations on with the first duty pump running 12 hours per day and the second duty pump running 2 hours per day, the run time would be 7 hours per day per duty pump. The run time analysis is based upon annual average day wastewater flow conditions. The criteria in **Table 6.6** were used to assess the capacity of the pumps in each lift station relative to run time. Run times for duty pumps of 10 hours per day or less for duplex or quadplex stations were considered acceptable.

Table 6.6
Duty Pump Run Time Performance Criteria

Type	Run Time per Duty Pump	Assessment
Duplex (1 duty + 1 backup)	10 hours per day or less	Acceptable
Duplex (1 duty + 1 backup)	Greater than 10 hours per day	Not Acceptable
Quadplex (3 duty + 1 backup)	10 hours per day or less	Acceptable
Quadplex (3 duty + 1 backup)	Greater than 10 hours per day	Not Acceptable

If the model predicted that run time for a lift station would be greater than 10 hours per day per duty pump then a capital project to upgrade the size of the pumps was identified to bring lift station run time into the acceptable range.

Pump Starts Performance Criteria

The number of pump starts provides a measure of the capacity of a lift station's wet well. An excessive number of starts indicates that a lift station's volume is inadequate to accommodate its rate of inflow. For duplex lift stations, which have 1 duty pump and one backup pump, 20 or less starts per hour were deemed acceptable. Stations with over 20 starts per hour are not acceptable. The same criteria was also applied to quadplex lift stations which have three duty pumps and one backup pump. Wetwell capacity (pump starts) performance criteria are presented in **Table 6.7**.

Table 6.7
Duty Pump Starts Performance Criteria

Type	Run Time per Duty Pump	Assessment
Duplex (1 duty + 1 backup)	20 starts per hour or less	Acceptable
Duplex (1 duty + 1 backup)	Greater than 20 starts per hour	Not Acceptable
Quadplex (3 duty + 1 backup)	20 starts per hour or less	Acceptable
Quadplex (3 duty + 1 backup)	Greater than 20 starts per hour	Not Acceptable

Force Main Flow Velocity and Head-loss Gradient Performance Criteria

The diameter of the force main should be sized such that the velocity during pumping will be neither too low (less than two feet per second) such that deposits build-up (potentially clogging the pipeline), nor too high (greater than ten feet per second) resulting in excessive energy consumption and possible scouring of mains. The head-loss gradient in pressurized force mains should be less than 0.010 feet/feet. A force main is considered transmission piping outside of the lift station; piping internal to the lift station is not considered force main. **Table 6.8** presents the criteria utilized to assess the capacity of force mains relative to flow velocity and head-loss.

Table 6.8
Force Main Flow Velocity and Head-loss Gradient Performance Criteria

Flow Velocity (fps)	Head-loss Gradient (feet/feet)	Assessment
less than 2	-	Not Acceptable
2 to 8	Less than 0.010	Acceptable
greater than 8	Greater than 0.010	Not Acceptable

A capital project to upgrade the size of the force main was identified to bring velocity into the acceptable range if the model indicated that the flow velocity in the existing force main piping was not acceptable.

Wet Well Surcharge Performance Criteria

Surcharge refers to an overload of sewer system where the wastewater flow is greater than the system is capable of conveying per unit of time resulting in wastewater being stored within system piping and wetwells. The result of a surcharge is the sewage level in the wet well rises. If sewage rises above the top of the wet well slab, it will overflow (potentially causing an environmental and /or health hazard). **Table 6.9** presents the criteria used to assess the capacity of the system relative to wet well surcharge. The criteria established assumes that water levels up to one foot above the lead pump on set-point is acceptable. Lift station wetwell levels that rise one foot or more above the lead pump on set-point were considered to be unacceptable.

Table 6.9
Wet Well Surcharge Performance Criteria

Sewage Level in Wet Well	Assessment
above the lead pump on set-point + 1.00	Not Acceptable
below the lead pump on set-point + 1.00	Acceptable

If the model predicted that the sewage level in the wet well would be above the lead pump on set-point level plus one foot, then a capital project was identified to reduce the likelihood of surcharging the system.

MODEL RESULTS

This section summarizes the results of scenario runs of the wastewater transmission system hydraulic model. The model was run as an extended period simulation under MDF flow conditions for 2012, 2015, 2020, 2025, 2030 and 2035. Modeling results relative to each of the five performance criteria discussed above are presented below.

Pipe Velocity

Other than piping added to the model to support the placement of pumps at model lift station assemblies, all network piping presented velocities in the acceptable range for all six model time steps. The high velocity pipes were not part of the GIS transmission piping dataset that was provided by PBCWUD for configuration of the hydraulic model. As they are very short pipes, elevated velocities have no hydraulic impact on model hydraulics.

Pipe Head-loss Gradient

Table 6.10 summarizes the model results for existing force mains that exhibited head-loss gradient issues under maximum day flow conditions. Maps indicting the locations of pipes with high head-loss gradients are provided in **Appendix 6-2**. Model run results indicate that there were 15 violations of the 0.010 feet/feet maximum head-loss gradient threshold under 2011 and future MDF flow conditions.

The highest head-loss gradient was found in the 8 inch diameter force main into which LS8107 discharges its flow. While this head-loss gradient was significantly above the performance threshold, a pipe upgrade was not fully investigated as it does not induce performance problems at LS8107. It is very likely, however, that the high head-loss conditions in this force main result in elevated power consumption at LS8107. Further review of this condition is recommended with respect to the cost of a pipe diameter upgrade (to 10 inches) and the expected energy cost savings.

Table 6.10
Force Mains with Inadequate Capacity Due to High Hydraulic Grade Line Loss

Description	Length (feet)	Diameter (inches)	Hydraulic Grade Line Loss (feet/feet)					
			2011	2015	2020	2025	2030	2035
Pipe 15409 downstream of LS8107	1,796	8	0.023	0.024	0.024	0.024	0.024	0.024
Pipe P715 between SBPS and Belle Glade WWTP	6,499	10	0.019	0.018	0.018	0.020	0.021	0.021
Pipe 18618 between SBPS and Belle Glade WWTP	885	10	0.019	0.018	0.018	0.020	0.021	0.021
Pipe 27896 between SBPS and Belle Glade WWTP	522	10	0.017	0.016	0.017	0.017	0.018	0.018
Pipe 18619 between SBPS and Belle Glade WWTP	4,121	10	0.017	0.016	0.016	0.017	0.018	0.018
Pipe 21819 between LS8201 and Rardin Avenue force main	41	8	0.018	0.018	0.018	0.018	0.018	0.018
Pipe 15085 between LS8103 and LS8104 along N. Canal Street	1,145	6	0.018	0.017	0.017	0.018	0.020	0.022
Pipe 15086 between LS8104 and N. Canal Street force main	483	6	0.016	0.017	0.018	0.016	0.017	0.014
Pipe 30457 between LS8152 and LS8128 to Belle Glade WWTP force main	2,150	2	0.016	0.016	0.016	0.016	0.016	0.016
Pipe 21818 between LS8219 and Barfield Hwy force main	562	4	0.016	0.016	0.015	0.016	0.016	0.015
Pipe 14460 Between LS8306 and NW 1st Avenue force main	514	4	0.014	0.015	0.015	0.015	0.015	0.014
Pipe 15421 between NW 16th Street canal crossing and Belle Glade WWTP along S Canal Street	2,167	16	0.012	0.011	0.011	0.011	0.011	0.009
Pipe 15090 between LS8103 and N Canal Street force main	289	6	0.011	0.010	0.007	0.011	0.014	0.015
Pipe P29, along N Canal Street between LS8104 and connection to 12 in N Canal St force main	499	8	0.011	0.011	0.011	0.011	0.012	0.012
Pipe 15088 between LS8134 and N Canal Street FM	1,469	6	0.010	0.012	0.012	0.012	0.012	0.012

Of immediate significance are the elevated head-losses in pipes P715, 27896, 18619, and 21819, with head-loss gradients between 0.015 and 0.021 feet/feet. Elevated head-losses occur in all model time periods. The combination of these four pipes constitute the force main that connects the South Bay Booster Pump Station (SBPS) and the Belle Glade WWTP. The significance of these elevated head-losses lies in the fact that, during high rainfall/high flow periods, the SBPS must produce very high discharge pressures (80 to 90 psi) to pump the required wastewater volumes from the South Bay service area. These high discharge pressures result in a SBPS intake manifold pressure to be in the range of 35 to 45 psi. This, in turn, causes lift station pumps upstream of the SBPS to struggle, especially LS8301, LS8306 and LS8308, causing wetwell overflows and extreme pump runtimes. Upgrades for these pipes were investigated due to the consequences of these elevated head-loss gradients.

Head-loss gradients in pipe 15085 ranged from 0.0165 to 0.0215 feet/feet between 2011 and 2035. As the elevated head-loss gradient in this force main causes pump runtimes in LS8103 to be above the performance threshold, a pipe upgrade was investigated.

Upgrades of the remaining force mains exhibiting elevated head-loss gradients were not investigated if:

- they did not result in a performance issue in an upstream lift station
- the head-loss exceedance was mitigated by another improvement;
- the exceedance was small and was reduced in the future by anticipated I/I remediation improvements

Wetwell Surcharging

Table 6.11 summarizes the model results for lift stations that exhibited capacity issues relative to surcharging of the wet well. Graphical results of model lift station levels relative to the surcharge performance criteria are presented in **Appendix 6-3**. The figures in **Appendix 6-3** show anticipated surcharge amounts for the period of record simulated (i.e., 2011, 2015, 2015, 2020, 2025, and 2035).

Wetwell surcharging, defined here as a wetwell exhibiting water levels 1.0 foot above the lead pump start elevation, was shown to occur at LS8103 (in 2011, 2030 and 2035), and at LS8301, LS8306 and LS8308 at all model time steps. In each case, surcharging was shown to be caused by high head conditions in the associated downstream force mains. These high head conditions, for which installed pumps had difficulty overcoming, were the result of elevated head-loss gradients discussed in the previous section. Pump capacity improvements for these lift stations were not investigated, given that surcharging was caused by the head-loss characteristics of the associated force mains.

Table 6.11
Lift Stations with Surcharge Based on Model Output [A]

Lift Station	Wetwell Surcharge					
	2011	2015	2020	2025	2030	2035
LS6028	-	-	-	-	-	-
LS8101	-	-	-	-	-	-
LS8103	S[A]	-	-	-	S[A]	S[A]
LS8104	-	-	-	-	-	-
LS8107	-	-	-	-	-	-
LS8129	-	-	-	-	-	-
LS8134	-	-	-	-	-	-
LS8141	-	-	-	-	-	-
LS8146	-	-	-	-	-	-
LS8148	-	-	-	-	-	-
LS8152	-	-	-	-	-	-
LS8201	-	-	-	-	-	-
LS8202	-	-	-	-	-	-
LS8205	-	-	-	-	-	-
LS8215	-	-	-	-	-	-
LS8217	-	-	-	-	-	-
LS8219	-	-	-	-	-	-
LS8223	-	-	-	-	-	-
LS8301	S[A]	S[A]	S[A]	S[A]	S[A]	S[A]
LS8302	-	-	-	-	-	-
LS8306 [B]	S[B]	S[B]	S[B]	S[B]	S[B]	S[B]
LS8308 [B]	S[B]	S[B]	S[B]	S[B]	S[B]	S[B]
LS8309	-	-	-	-	-	-

[A] *S = maximum day flow wet well surcharge*

[B] *maximum day flow wetwell overflow*

Pump Run Time

Table 6.12 summarizes the model results for lift stations that exhibited capacity issues relative to run time. Eight lift stations exhibited average daily pump runtimes greater than 10 hours, the performance criteria maximum threshold, during the six model time steps. At LS8101, LS8103, LS8134 and LS8143, pump run times fell below the performance threshold at a point in the future due to the reduced flow impacts of anticipated I/I remediation improvements.

Table 6-12
Lift Station Pump Run Time Based on Model Output

Lift Station	Number of Pumps	Run Time (Hours per day per Duty Pump) [A]					
		2011	2015	2020	2025	2030	2035
LS6044	2	2.2	2.0	2.3	2.8	3.7	6.8
LS8101	4	10.9	10.6	10.2	9.8	9.4	9.4
LS8103	2	20.4	14.6	10.2	7.8	6.5	6.3
LS8104	2	9.1	8.5	7.9	7.2	6.9	7.1
LS8107	2	4.8	4.7	4.6	4.4	4.2	4.4
LS8129	2	1.4	1.4	1.3	1.2	1.2	1.2
LS8134	2	11.4	10.7	9.9	9.4	9.1	9.5
LS8141	2	7.8	6.6	5.9	5.0	4.6	4.5
LS8143	2	11.2	10.7	10.2	9.7	9.2	9.2
LS8146	4	4.7	4.4	4.4	4.4	4.4	4.8
LS8148	2	5.6	5.4	5.1	5.0	4.7	4.9
LS8152	2	0.2	0.2	0.2	0.3	0.4	0.5
LS8201	2	6.0	6.0	6.1	6.3	6.4	6.6
LS8202	2	1.1	1.1	1.0	0.9	0.9	0.9
LS8205	2	3.1	3.0	2.8	2.6	2.5	2.5
LS8215	2	0.5	0.6	0.6	0.6	0.7	0.7
LS8217	2	1.5	1.4	1.4	1.4	1.3	1.4
LS8219	2	0.5	0.5	0.6	0.6	0.6	0.6
LS8223	2	0.1	0.1	0.1	0.1	0.1	0.1
LS8301	2	24.0	24.0	24.0	24.0	23.9	24.0
LS8302	2	11.1	10.6	10.8	11.8	13.9	16.9
LS8306[B]	2	24.0	24.0	24.0	24.0	24.0	24.0
LS8308[B]	2	24.0	24.0	24.0	24.0	24.0	24.0
LS8309	2	4.7	4.4	4.3	4.5	4.7	5.3

[A] *Values highlighted indicate performance criteria is exceeded*

[B] *Experiences max day MDF wetwell overflow*

Pumps at several lift stations in the South Bay service area however, have unacceptably high runtimes in all model time periods (LS8301, LS8302, LS8306, LS8308). Pumps associated with lift stations LS8301, LS8306 and LS8308 operate continuously over the 24 hour simulation period under MDF flow conditions. Lift stations LS8306 and LS8308 experienced periods of overflow throughout the day.

While the high pump runtimes noted here would typically call for pump capacity improvements, such improvements were not considered justified for the following reasons.

- Runtimes at LS8101 and LS8143 were only slightly above the performance threshold for the first three time periods, then fell below the threshold in 2025 onward (due to anticipated I/I remediation improvements).
- Elevated runtimes at LS8103, and LS8134, while very severe, would be reduced by a proposed downstream force main upgrade along North Canal Street.
- Elevated runtimes at LS8301, and LS8306 and LS8308 would be reduced by a proposed upgrade to the South Bay Booster Pump Station / Belle Glade WWTP force main.

Pump Starts

Table 6.13 summarizes the model results relative to pump starts. None of the modeled lift stations experienced pump starts greater than the 20 starts/hour performance threshold within any of the model's six time steps, indicating that wetwell capacities are likely adequate for projected lift station inflows.

Table 6.13
Lift Stations Pump Starts Based on Model Output

Lift Station	Number of Pumps	Starts (Starts per hour per Duty Pump)					
		2012	2015	2020	2025	2030	2035
LS6044	2	2	2	2	3	3	3
LS8101	4	4	5	6	7	8	7
LS8103	2	2	4	5	8	10	10
LS8104	2	12	15	16	18	18	18
LS8107	2	11	11	11	11	11	11
LS8129	2	2	2	2	2	1	1
LS8134	2	3	6	8	11	12	10
LS8141	2	2	2	2	3	3	3
LS8143	2	4	6	8	10	12	12
LS8146	4	7	7	7	7	7	6
LS8148	2	4	4	4	3	3	3
LS8152	2	0	0	0	0	1	1
LS8201	2	13	13	13	13	13	13
LS8202	2	4	4	4	4	3	3
LS8205	2	3	3	3	3	3	3
LS8215	2	1	1	1	1	1	1
LS8217	2	2	2	2	2	2	2
LS8219	2	1	1	1	1	1	1
LS8223	2	0	0	0	0	0	0
LS8301	2	0	0	0	0	0	0
LS8302	2	4	5	5	4	5	5
LS8306	2	0	0	0	0	0	0
LS8308	2	0	0	0	0	0	0
LS8309	2	2	2	2	2	2	1

Performance Summary

Table 6.14 presents a summary of performance criteria exceedances by modeled lift stations prior to implementation of improvements. Exceedances of performance criteria were limited to head-loss gradient, surcharge and pump runtime. No exceedances of velocity or pump starts criteria were found within the modeled system and in any of the six model time periods. Pipe head-loss gradient problems were assigned in **Table 6.14** to upstream lift stations that would be hydraulically impacted by the associated elevated head-loss gradients.

Table 6.14
Occurrences of Performance Criteria Exceeded with Existing Conditions

Lift Station	Performance Criteria				
	Run Time	Pump Starts	Pipe Velocity	Pipe Head-loss Gradient	Wetwell Surcharge
LS6044					
LS8101	X				
LS8103	X			X	
LS8104				X	
LS8107				X	
LS8129					
LS8134	X				
LS8141					
LS8143	X				
LS8146					
LS8148					
LS8152				X	
LS8201				X	
LS8202					
LS8205					
LS8215					
LS8217					
LS8219				X	
LS8223					
LS8301	X			X	X
LS8302	X			X	
LS8306	X			X	X
LS8308	X			X	X
LS8309				X	

In addition to the performance evaluations discussed above, lift station pumps were evaluated to determine if, during average daily flow (ADF) conditions, they would run off of their pump curves during periods of low flow. The evaluation showed that the lift station pumps remained within the confines of their respective pump curves, indicating that none of the pumps in the network are likely oversized.

PROPOSED IMPROVEMENTS

Hydraulic Improvements

Based upon the above findings, recommended improvements were identified and are discussed below. Improvements for all violations of performance criteria were not identified and tested if:

- The violation was slightly above the performance threshold and was not sustained over the entire 2011 to 2035 study period. For example pump runtime at LS8134 which had exceeded the performance threshold for the 2011 and 2015 simulation periods, but was below the threshold for the future time-steps, the result of anticipated I/I improvements. A re-evaluation should be performed if the anticipated I/I improvements are not implemented.

- The violation did not cause a significant impairment of the transmission network. An example would be pipe head-loss gradient of the force main downstream of LS8107. This section of force main has the highest head-loss calculated in the entire network. However, the existing pump is capable of pumping flows without high run times, high number of pump starts, or surcharging. Therefore, even though there is concern with respect to the head-loss, this station is capable of meeting projected demands. The section of force main creating the high head-loss is an 8-inch diameter line with a length of approximately 1,800 feet. It is recommended that this station be monitored closely and improvements considered should the assumed conditions change. Upgrading this section of force main to a 10-inch diameter line would reduce the head-loss gradient to 0.009 feet/feet under 2011 MDF conditions.

Belle Glade – North Canal Street Force Main Upgrade: Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade between LS8103 and LS8104 and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS8103 pump runtime is reduced below the performance criteria threshold and surcharging is eliminated. Model runtime performance results for the upgraded 8-inch diameter force main are presented in **Table 6.15**. Model wetwell surcharge results for the proposed force main are presented in **Appendix 6-4**.

Belle Glade – South Bay Booster Pump Station (SBBPS) to Belle Glade WWTP Force Main Upgrade: Take existing 10-inch diameter force main out of service (for possible maintenance as a standby force main or removal) and replace with approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump runtime and wet well surcharging at LS8201, LS8302, LS8306 and LS8308 by reducing extreme head-loss in the upgraded force main this supports a reduction of the SBBPS suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS8301, LS8302, LS8306 and LS8308, thereby eliminating surcharging and reducing run times below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which

is well above the 2 feet/second minimum velocity requirement. An alternative 16-inch diameter force main was tested in place of the 12-inch diameter to determine the feasibility of deploying the larger pipe, that increases the system's ability to accommodate South Bay wastewater flows that are greater than anticipated by those driven by population projections (e.g., an inland port facility were to be constructed in the South Bay area). The larger 16-inch diameter force main further improves the performance of upstream lift stations while maintaining a target pipe average velocity (i.e., 2.3 feet/second) that is above the minimum velocity criteria. Model runtime results for the proposed 12 inch force main are presented in **Table 6.15**. Model wetwell surcharge results for the proposed force main are presented in **Appendix 6-4**. Given the substantial inflow and infiltration flows in the South Bay service area, this improvement is considered essential for the reliable operation of the wastewater transmission system in that area. It is recommended that it be added to the 5-year capital improvement plan for the Glades Region and be implemented in the near term. The locations of proposed improvements are shown in **Figure 6-4**.

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Figure 6-4 - Proposed Improvments

Table 6.15
Lift Station Pump Run Time with Improvements Based on Model Output

Lift Station	Run Time (Hours per day per Duty Pump) [A]											
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
	2012		2015		2020		2025		2030		2035	
LS8103	20.4	7.7	14.6	7	10.2	6.7	7.8	6.2	6.5	5.9	6.3	5.8
LS8301	24	4.4	24	4.2	24	4.2	24	4.1	23.9	4.2	24	4.5
LS8302	11.1	7	10.6	6.7	10.8	6.8	11.8	7.1	13.9	7.5	16.9	8.2
LS8306	24	2.1	24	2.1	24	2	24	2	24	2	24	2
LS8308	24	9.6	24	9.3	24	9	24	8.6	24	8.2	24	8.5

[A] *Values in boldface type indicate exceedances of performance criteria.*

Pumping Infrastructure Improvements

The hydraulic model was used to analyze the capacity of lift station pumping systems by focusing on both pump run times and lift station wet well levels (surcharges). The most problematic violations of both pump runtime and surcharging were at LS8103, LS8301, LS8302, LS8306 and LS8308, and were addressed effectively through the implementation of the pipe improvements discussed above, without the need for increases in pump capacity (and the attendant increases in operating costs)). While three additional lift stations presented pump runtime exceedances under MDF conditions (LS8101, LS8134 and LS8143), pump capacity improvements are not recommended, as those exceedances are minor (less than 2 hours/day), and fell below the performance criteria threshold of 10 hours/day in the future under the assumption that I/I improvements reduce MDF flows through 2030. No pump infrastructure improvements are recommended.

Wetwell Capacity Improvements

The identification of wetwell capacity deficiencies was conducted by calculating the average hourly number of pump starts at each lift station throughout the course of a 24 hour simulation. Lift stations with an average number of hourly pump starts greater than 20 would be flagged for possible wetwell capacity improvements. However, model results in all six time steps found no lift stations with excessive pump starts. Therefore, no wetwell capacity improvements are recommended.

Table 6-16 presents a summary of performance criteria exceedances by modeled lift station after proposed improvements have been put in place. The table shows that surcharge problems are eliminated from the network and runtime violations are significantly reduced. As without the

proposed improvements, exceedances of velocity or pump starts criteria were found within the modeled system and in any of the six model time periods. Pipe head-loss gradient problems were assigned in **Table 6.16** to upstream lift stations that would be hydraulically impacted by the associated elevated head-loss gradients.

Table 6.16
Occurrences of Performance Criteria Exceeded after Improvements [A]

Lift Station	Performance Criteria							
	Pump Run Time		Pump Starts	Pipe Velocity	Pipe Head-loss Gradient		Wetwell Surchage	
	Before	After			Before	After	Before	After
LS6044								
LS8101	X	X					X	X
LS8103	X	√			X	X	X	√
LS8104					X	X		
LS8107					X	X		
LS8129								
LS8134	X	X					X	X
LS8141								
LS8143	X	X					X	X
LS8146								
LS8148								
LS8152					X	X		
LS8201					X	X		
LS8202								
LS8205								
LS8215								
LS8217								
LS8219					X	X		
LS8223								
LS8301					X	√	X	√
LS8302					X	√		
LS8306					X	X	X	√
LS8308					X	√	X	√
LS8309					X	√		

[A] *X - indicates threshold exceeded; √ - indicates criteria is been met after improvement*

Operational Improvements

An essential element for the management of a wastewater collection system is a reliable telemetric SCADA system. Such a system allows for the monitoring of lift station status and the control of basic facility functions such as disabling pumps and adjusting of pump start/stop set points, and the processing of high wetwell and other alarms. It also provides the basis for the processing and collection of historical operational data that is essential when analyzing system performance, as was done in preparing the master plan hydraulic model. Such information as pump run time, wetwell inflow (based on pump start/stop data recorded by a station's telemetry RTU), pump starts and wetwell level data are all valuable in the process of developing and vetting a hydraulic model, but also in the day to day evaluation and operation of the system. These data will also prove themselves invaluable in support of ongoing inflow and infiltration remediation efforts.

A lift station telemetry system has been established within the Belle Glade/South Bay collection network with a telemetry base station and SCADA server located at WTP 11 on Hooker Highway and a remote RTU monitoring the South Bay Booster Pump Station (SBBPS). This system has been in place for about one year and, besides enabling remote adjustment of station control parameters, has provided useful process data needed for the configuration of the wastewater collection system hydraulic mode. The Pahokee WWTP collection system does not currently have telemetry facilities in place.

The current Belle Glade/South Bay telemetry system was installed by PBCWUD and but is not based on the extensive TIMS telemetry network that supports lift station remote monitoring and control functions across PBCWUD entire eastern wastewater operations service area.

We recommend that PBCWUD develop a Belle Glade WWTP based telemetry system for the monitoring and control coverage initially to the following remote facilities.

- LS8101
- LS8107
- LS8113
- LS8115
- LS8143
- LS8146
- LS8301
- LS8302
- LS8308
- LS8309

We also recommend that a similar telemetry base station and SCADA server system be established at the Pahokee WWTP, with the following initial remote facilities initially supported.

- LS8201
- LS8202
- LS8205
- LS8207
- LS8215
- LS8217

Subsequent to these initial stations, we recommend that PBCWUD increase the number of lift stations supported by telemetry in both service areas by several sites per year until all County owned lift stations are fully monitored.

SUMMARY AND RECOMMENDATIONS

Summary

This technical memorandum presents the results of the hydraulic model prepared by Hazen and Sawyer to evaluate the pressurized wastewater transmission system for the Glades Region (Belle Glade / South Bay and Pahokee). Model development was based on facility and operational data provide by PBCWUD staff. The model is based on the *InfoWater® v10.0* hydraulic modeling platform, and transmission network elements that includes pipes, pumps, and wetwells. Hydraulic analyses were performed over a series of time steps in 5 year increments, which included 2011, 2015, 2020, 2025, 2030, and 2035. Assigned model lift station inflows were based on potable water account (consumption) data presented in Technical Memorandum 5, and estimates of local inflow and infiltration based on the inch-feet of upstream gravity main. Model runs were executed with lift station inflows set to maximum daily flow (MDF) levels (7.91 mgd – Belle Glade, 2.16 – Pahokee). Future flows were derived using estimated changes in population at associated with each model time step. Estimated future lift station inflows were adjusted to reflect an anticipated 1 percent per year reduction in I/I flows through 2030 due to I/I remediation efforts by PBCWUD.

Following a successful model calibration, model scenarios were developed and executed to evaluate the capacity of model piping, lift station pumps, and lift station wetwells, against an array of performance criteria. The five performance criteria used for the evaluation included:

1. Pump run time – to evaluate pump capacity
2. Pump starts – to evaluate wetwell capacity
3. Pipe velocity – to evaluate force main capacity
4. Pipe head-loss gradient – to evaluate force main capacity
5. Wetwell surcharge – to evaluate pump capacity

An additional scenario was run under Average Day Flow (ADF) conditions for the purpose of determining the extent to which lift station pumps remain on their respective pump curves under low flow conditions.

Network deficiencies were identified with respect to pump capacities (pump runtime and wetwell surcharge) and force main capacities (head-loss gradient) at several locations in the system.

There were no wetwell capacity (pump starts) or force main velocity problems found in the transmission network for the current time period of 2011, nor at any future time period.

It was found that high head-loss gradients in the 10 inch diameter force main between the South Bay booster pump station and the Belle Glade WWTP was responsible for elevated pump run times and wetwell surcharge conditions at several South Bay lift stations (LS8301, LS8302, LS8306 and LS8308). Wetwell overflows were shown to occur at LS8306 and LS8308. Likewise, high head-loss gradient conditions in the 6-inch diameter force main along North Canal Street caused wetwell surcharging at LS8103, and elevated pump run times at LS8103 and LS8134. Pipe replacements were proposed for each affected force mains to increase their respective capacities, the South Bay force main from 10 to 12 inches in diameter, and the North Canal Street force main from 6 to 8 inches in diameter. These improvements successfully addressed each of these run time and surcharge related capacity deficiencies.

Improvements were not identified or tested for the remainder of force main capacity deficiencies because:

- they did not cause a performance issue in an upstream lift station
- the head-loss exceedance was mitigated by another improvement;
- the exceedance was small and was reduced in the future by anticipated I/I remediation improvements

Improvements were not identified or tested for the remainder of pump capacity deficiencies because:

- Run times at LS8101 and LS8143 were only slightly above the performance threshold for the first three time periods, then fell below the threshold in 2025 onward (due to anticipated I/I remediation improvements).
- Elevated run times at LS8103 and LS8134, while initially very severe, would be reduced to adequate levels by the proposed force main upgrade along North Canal Street. Surcharging at LS8103 is also eliminated by this same improvement.
- Elevated run times and wetwell surcharging at LS8301, LS8306 and LS8308 would be reduced or eliminated by the proposed upgrade to the South Bay Booster Pump Station / Belle Glade WWTP force main.

Recommendations

The following is a listing of the recommended improvements:

- Belle Glade – North Canal Street Force Main Upgrade: Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade

between LS8103 and LS8104, and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS8103 pump run time is reduced below the performance criteria threshold and surcharging is eliminated. It is recommended that this improvement be implemented within the current 5 year planning horizon.

- Belle Glade – South Bay Booster Pump Station to Belle Glade WWTP Force Main Upgrade: Replace the existing 10-inch diameter force main and replace with approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump run time and wet well surcharging at LS8201, LS8302, LS8306 and LS8308 by reducing high head-loss in the upgraded force main which supports a reduction of the South Bay Booster Pump Station suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS8301, LS8302, LS8306 and LS8308, thereby eliminating surcharging and reducing run time below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which is well above the 2 feet/second minimum velocity requirement. Because this improvement successfully address several serious deficiencies at upstream lift stations, including overflows at LS8306 and LS8308, it is recommended that this proposed improvement be implemented as soon as is practical within the current 5-year planning horizon.

- Pump capacity upgrades improvements are NOT recommended at LS8101 or LS8143 as modeled run time exceedances are small (less than 2 hours per day) and are expected to fall below the performance criteria threshold with anticipated improvements to upstream I/I. This recommendation may need to be revisited when I/I mitigation planning for the Glades region comes into better focus.

- Pump capacity upgrade improvements are NOT recommended for LS8134 as excessive pump run times were sufficiently reduced to just 0.3 hours per day above the performance threshold by the proposed pipe improvement along North Canal Street, and is reduced below the threshold through the impacts of anticipated upstream I/I improvements.

- Pipe capacity improvements are NOT recommended for force mains down stream of LS8103, LS8104 and LS8152 in Belle Glade as the high head-loss gradients identified through model simulations were relatively minor and were not shown to negatively impact the performance of these lift stations with respect to pump run time or wetwell surcharging.

- Pipe capacity improvements are NOT recommended for force main down stream of LS8107 in Belle Glade, despite it having the highest head-loss gradient in the entire network as it was not shown to negatively impact the performance of the lift station with respect to pump run time or wetwell surcharging. However, a single preliminary model

run did show that increasing the diameter of this force main from 8 inches to 10 inches would reduce the head-loss gradient from around 0.022 feet/feet to around 0.009 feet/feet, just below the performance threshold.

- Pipe capacity improvements are NOT recommended for force mains down stream of LS8201 and LS8219 in Pahokee as the high head-loss gradients identified through model simulations were not shown to negatively impact the performance of these lift stations with respect to pump run time or wetwell surcharging.

- Pipe capacity improvements are NOT recommended for the force main connecting LS8306 in South Bay as this line is short and was not shown to negatively impact the performance of the lift station with respect to pump runtime or wetwell surcharging after the implementation of the pipe capacity upgrade to the existing 10 inch force main connecting the South Bay booster pump station and the Belle Glade WWTP.

- It is recommended a lift stations telemetry system be developed for both the Belle Glade and Pahokee service areas in accordance with the County's TIMS telemetry performance standards. This improvements should be implemented in a phased approach during the next 5 years.

APPENDIX 6-1

Model Lift Station Inflows

Table 6-1.1 - Model Belle Glade / South Bay Lift Station Base and I/I Inflow

Station	2011 Base	2011 I/I	2015 Base	2015 I/I	2020 Base	2020 I/I	2025 Base	2025 I/I	2030 Base	2030 I/I	2035 Base	2035 I/I
LS6028	7.6	0.0	7.9	0.0	10.4	0.0	12.9	0.0	15.9	0.0	21.5	0.0
LS8101	533.2	1172.4	538.8	1113.8	550.9	1055.2	559.6	996.5	565.6	937.9	569.9	937.9
LS8103	5.0	40.9	5.2	38.8	5.0	36.8	5.0	34.7	5.0	32.7	96.8	32.7
LS8104	7.7	175.5	7.7	166.7	7.9	157.9	7.9	149.1	8.0	140.4	8.0	140.4
LS8107	94.8	247.1	97.9	234.8	104.5	222.4	109.6	210.1	113.5	197.7	116.2	197.7
LS8129	0.2	28.2	0.2	26.8	0.2	25.4	0.2	24.0	0.2	22.6	0.2	22.6
LS8134	7.8	195.6	7.8	185.9	7.8	176.1	7.8	166.3	7.8	156.5	7.1	156.5
LS8141	9.8	27.5	9.8	26.1	9.8	24.8	9.8	23.4	9.8	22.0	9.0	22.0
LS8143	102.8	476.0	102.8	452.2	102.8	428.4	102.8	404.6	102.8	380.8	102.8	380.8
LS8146	80.1	600.9	83.3	570.9	109.0	540.8	135.3	510.8	167.5	480.7	226.6	480.7
LS8148	4.2	127.2	4.4	120.8	5.7	114.4	7.1	108.1	8.8	101.7	11.9	101.7
LS8152	0.1	0.0	0.1	0.0	0.1	0.0	0.3	0.0	0.5	0.0	0.6	0.0
LS8155	11.4	0.0	11.8	0.0	13.9	0.0	38.2	0.0	57.3	0.0	74.6	0.0
LS8301	35.6	163.8	35.7	155.6	40.1	147.4	48.7	139.2	58.9	131.0	68.8	131.0
LS8302	271.9	533.3	272.6	506.7	306.2	480.0	372.0	453.3	449.8	426.7	525.6	426.7
LS8306	3.8	29.5	3.8	28.0	4.3	26.5	5.2	25.0	6.3	23.6	7.4	23.6
LS8308	6.9	132.0	6.9	125.4	7.7	118.8	9.4	112.2	11.3	105.6	13.3	105.6
LS8309	16.6	95.9	16.6	91.1	18.7	86.3	22.7	81.5	27.4	76.7	32.0	76.7
LSP007	2.9	0.0	2.9	0.0	2.9	0.0	2.9	0.0	2.9	0.0	2.9	0.0
LSP008	128.2	0.0	128.2	0.0	128.2	0.0	128.2	0.0	128.2	0.0	128.2	0.0
LSP013	13.3	103.5	13.3	98.3	13.3	93.1	13.3	88.0	13.3	82.8	13.3	82.8
LSP016	9.3	0.0	9.3	0.0	9.3	0.0	9.3	0.0	9.3	0.0	8.5	0.0

Table 6-1-2 - Model Pohokee Lift Station Base and I/I Inflow

Station	2011 Base	2011 I/I	2015 Base	2015 I/I	2020 Base	2020 I/I	2025 Base	2025 I/I	2030 Base	2030 I/I	2035 Base	2035 I/I
LS8201	288.4	118.5	296.9	112.6	313.0	106.7	329.3	100.7	342.3	94.8	355.4	94.8
LS8202	4.7	34.5	4.9	32.8	5.1	31.1	5.4	29.3	5.6	27.6	5.8	27.6
LS8205	0.2	37.4	0.2	35.5	0.2	33.6	0.3	31.8	0.3	29.9	0.3	29.9
LS8215	12.7	0.0	13.1	0.0	13.9	0.0	14.6	0.0	15.2	0.0	15.8	0.0
LS8217	8.2	24.8	8.5	23.6	9.0	22.4	9.4	21.1	9.9	19.9	10.3	19.9
LS8219	5.0	0.0	5.2	0.0	5.5	0.0	5.7	0.0	6.0	0.0	6.2	0.0
LS8223	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.2	0.0	0.2	0.0

APPENDIX 6-2

Locations of Elevated Pipe Head-loss Gradients

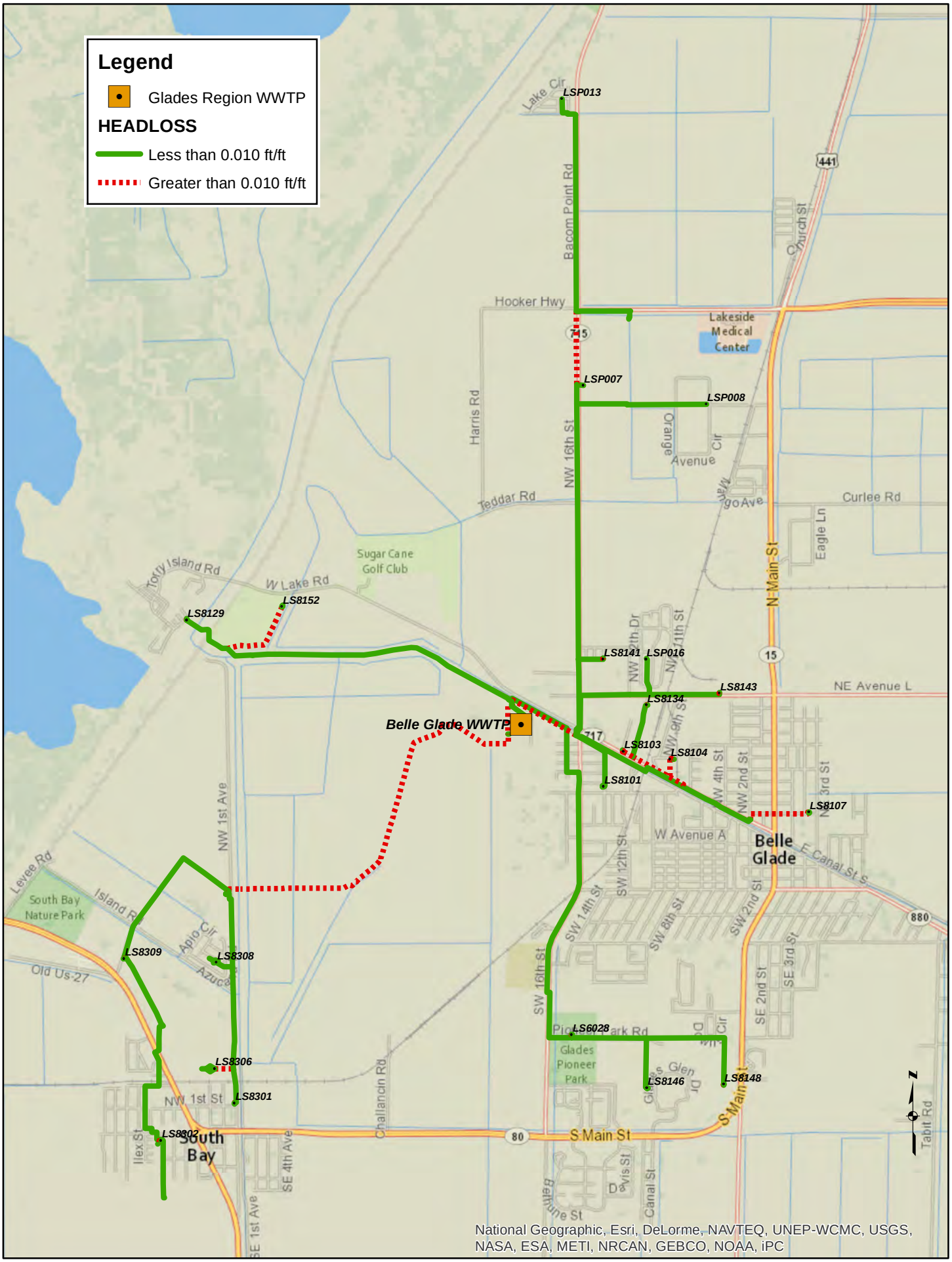

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Figure 6-2.1 - 2011 Belle Glade / South Bay Headloss Gradients

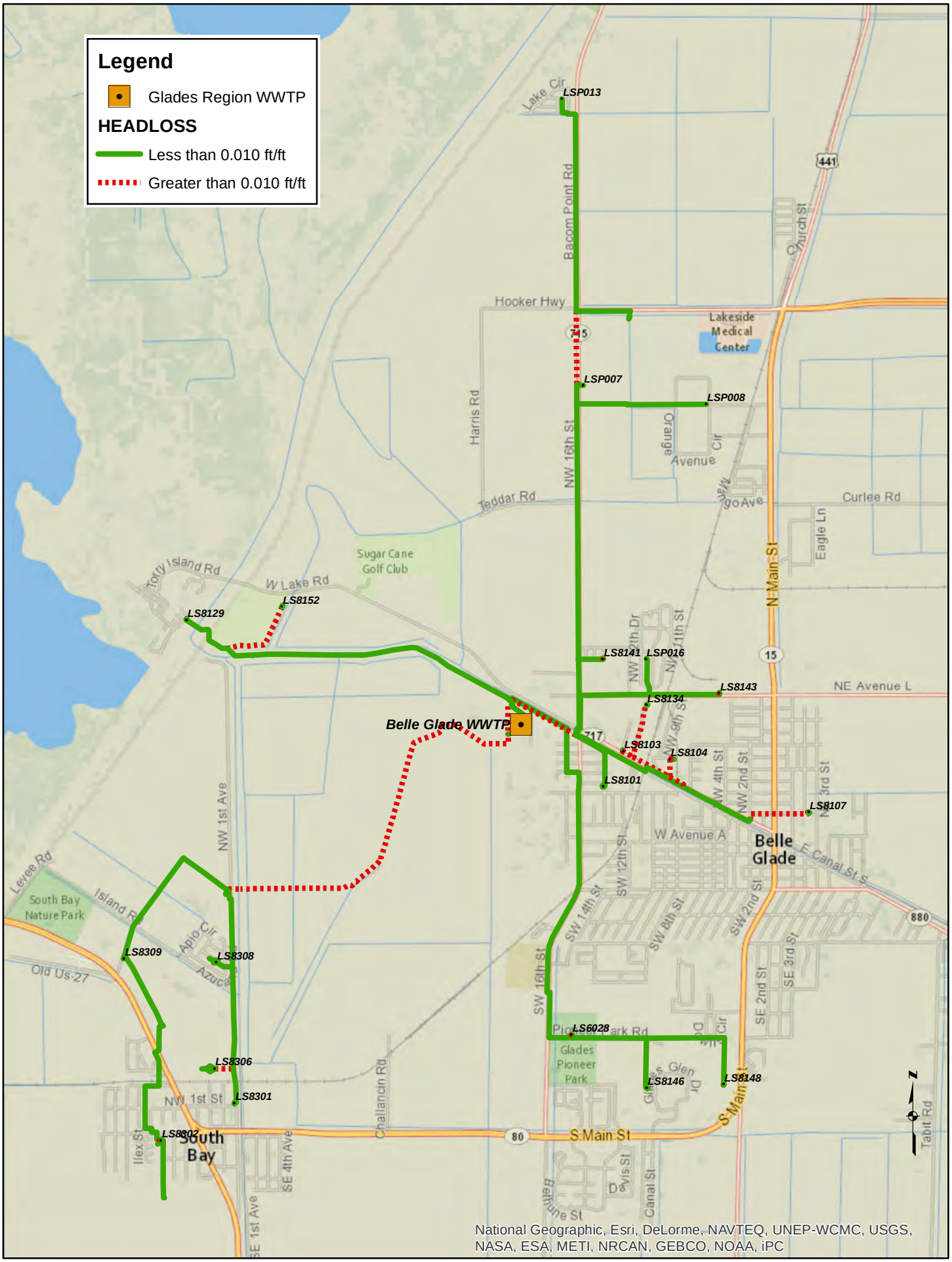

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Figure 6-2.2 - 2015 Belle Glade / South Bay Headloss Gradients

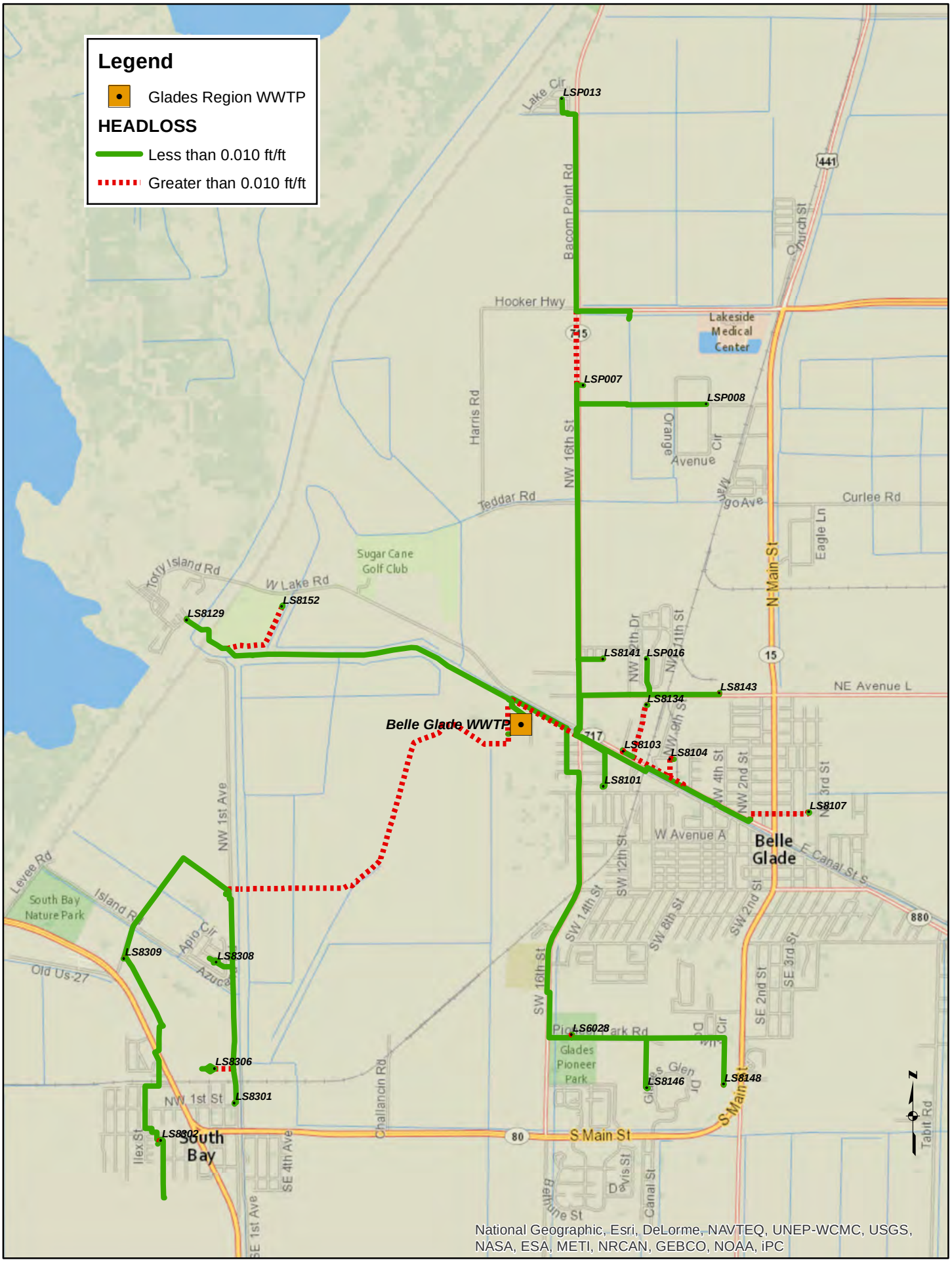

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Figure 6-2.3 - 2020 Belle Glade / South Bay Headloss Gradients

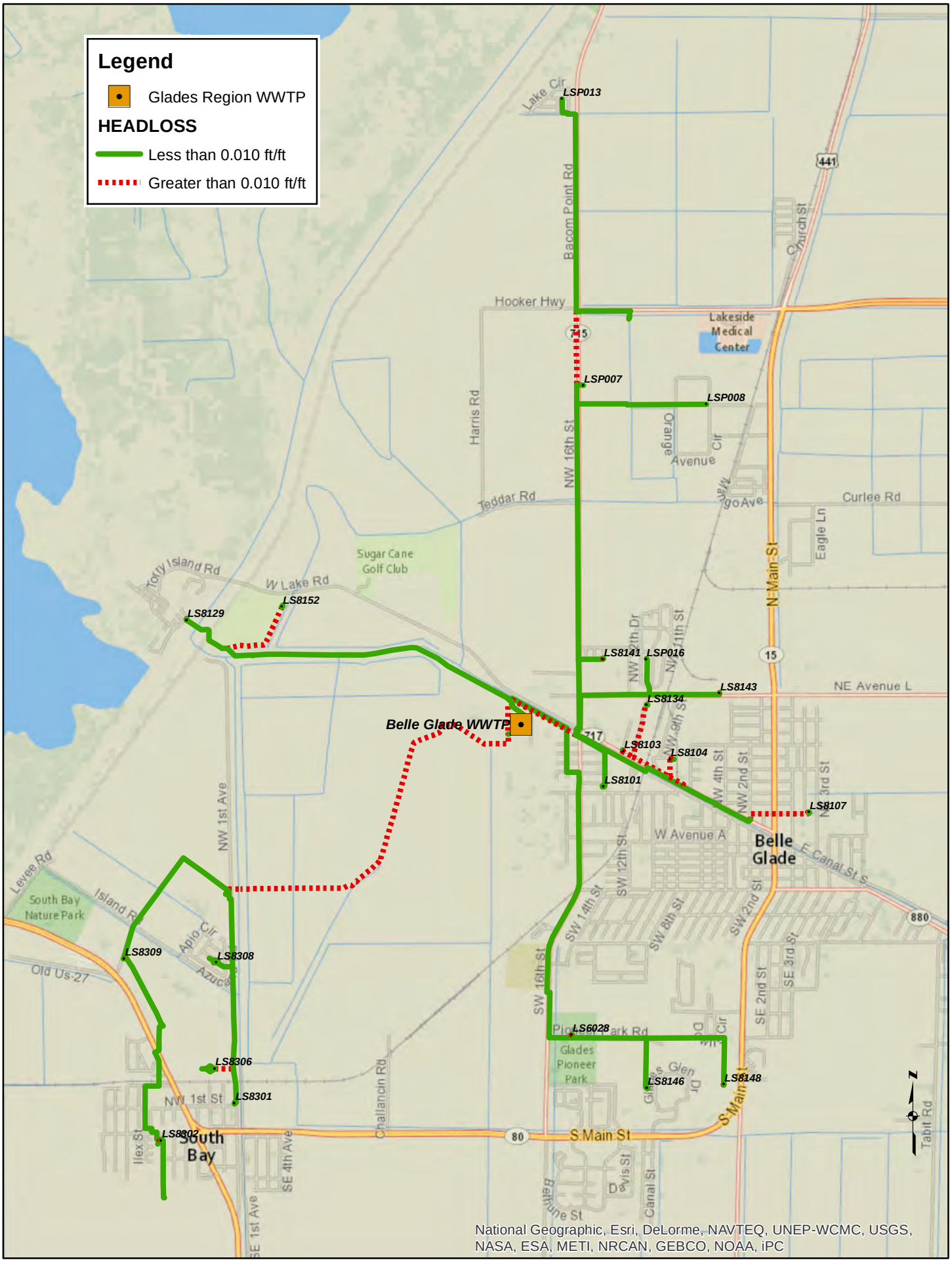

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Figure 6-2.4 - 2025 Belle Glade / South Bay Headloss Gradients

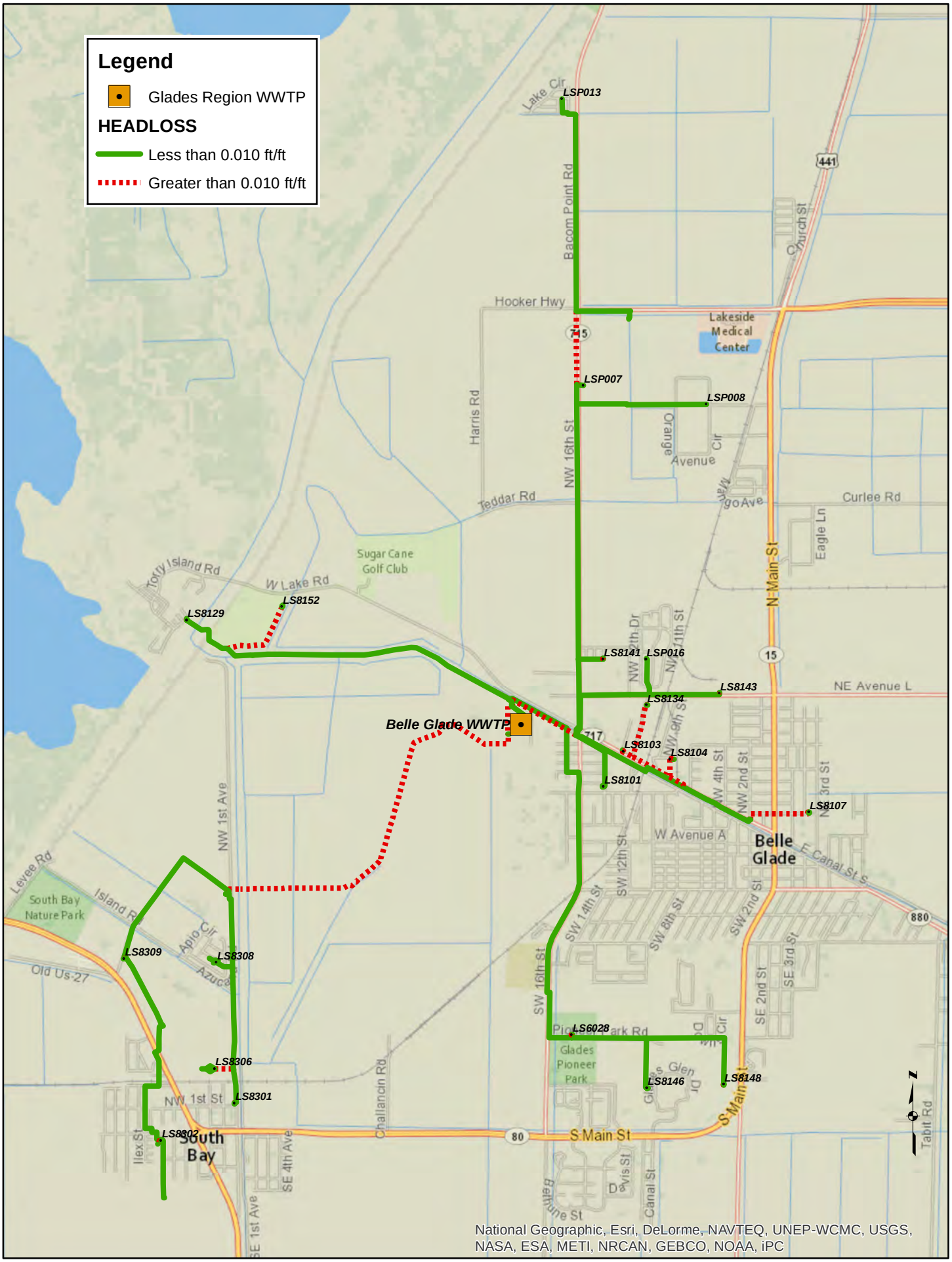

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Figure 6-2.5 - 2030 Belle Glade / South Bay Headloss Gradients

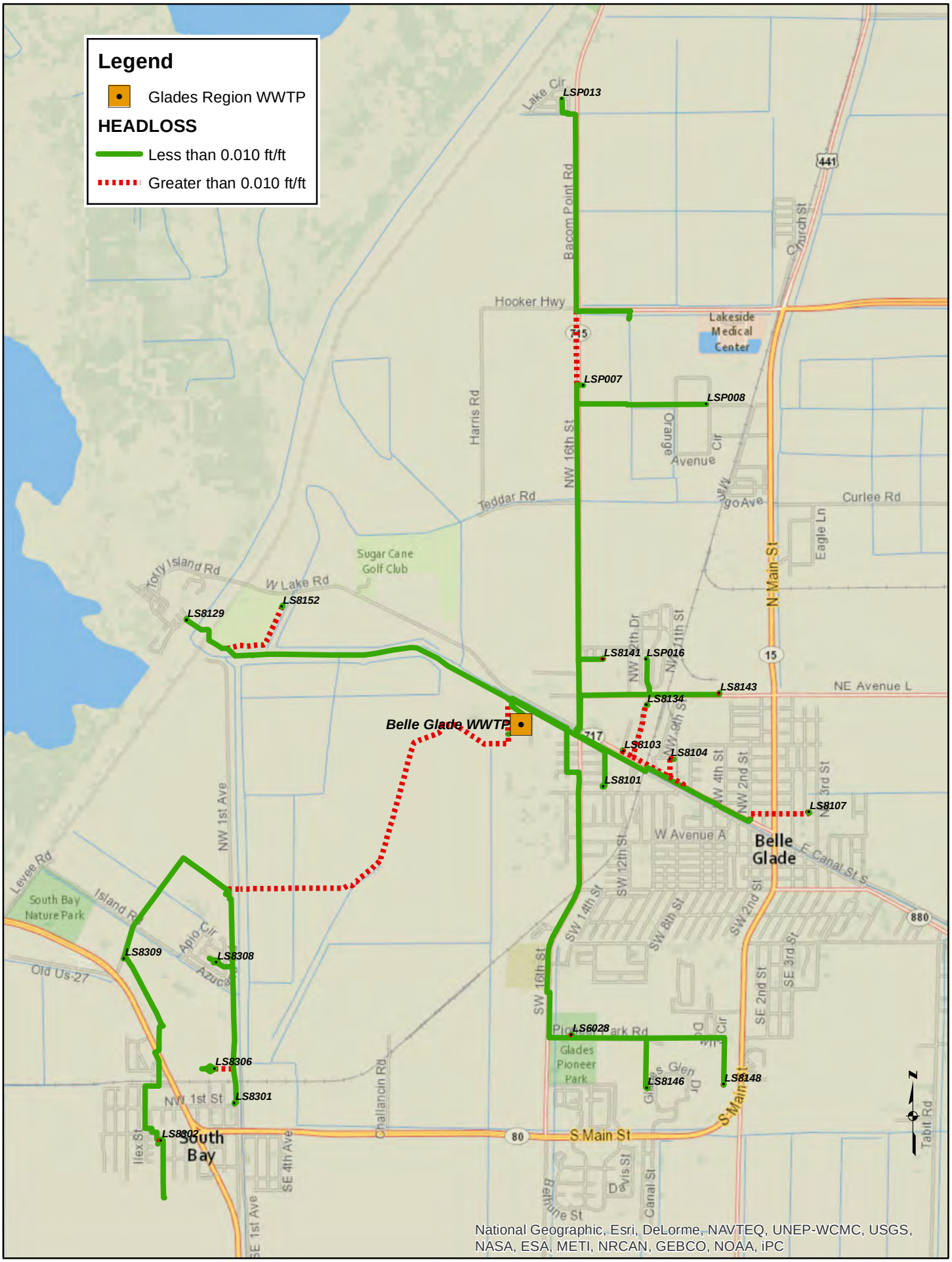

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Figure 6-2.6 - 2035 Belle Glade / South Bay Headloss Gradients

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Figure 6-2.7 - 2011 Pahokee Headloss Gradients

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Figure 6-2.8 - 2015 Pahokee Headloss Gradients

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Figure 6-2.9 - 2020 Pahokee Headloss Gradients

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Figure 6-2.10 - 2025 Pahokee Headloss Gradients

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Figure 6-2.11 - 2030 Pahokee Headloss Gradients

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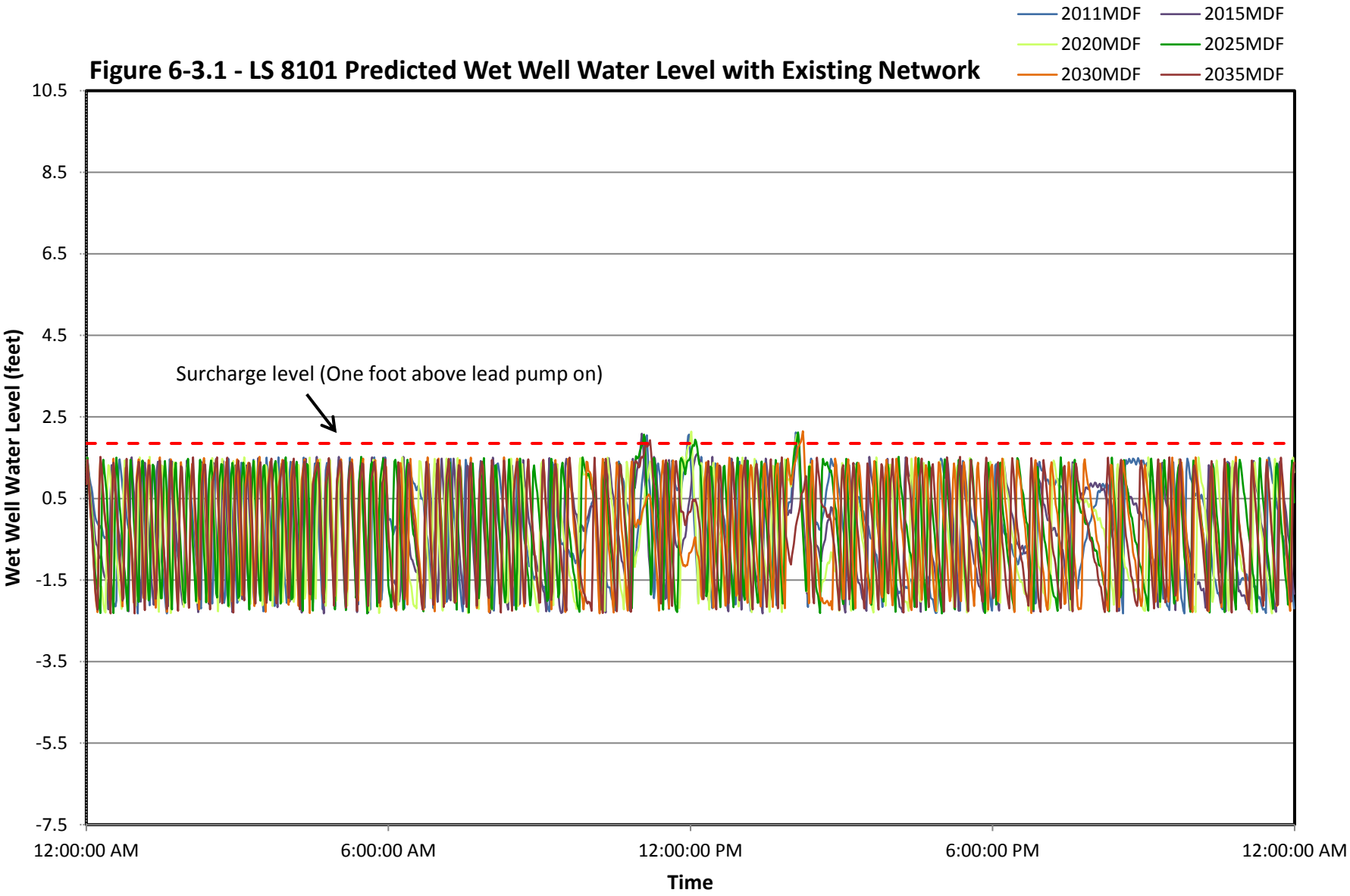
Figure 6-2.12 - 2035 Pahokee Headloss Gradients

APPENDIX 6-3

Results of Wetwell Surcharge Evaluation

Figure 6-3.1 - LS 8101 Predicted Wet Well Water Level with Existing Network



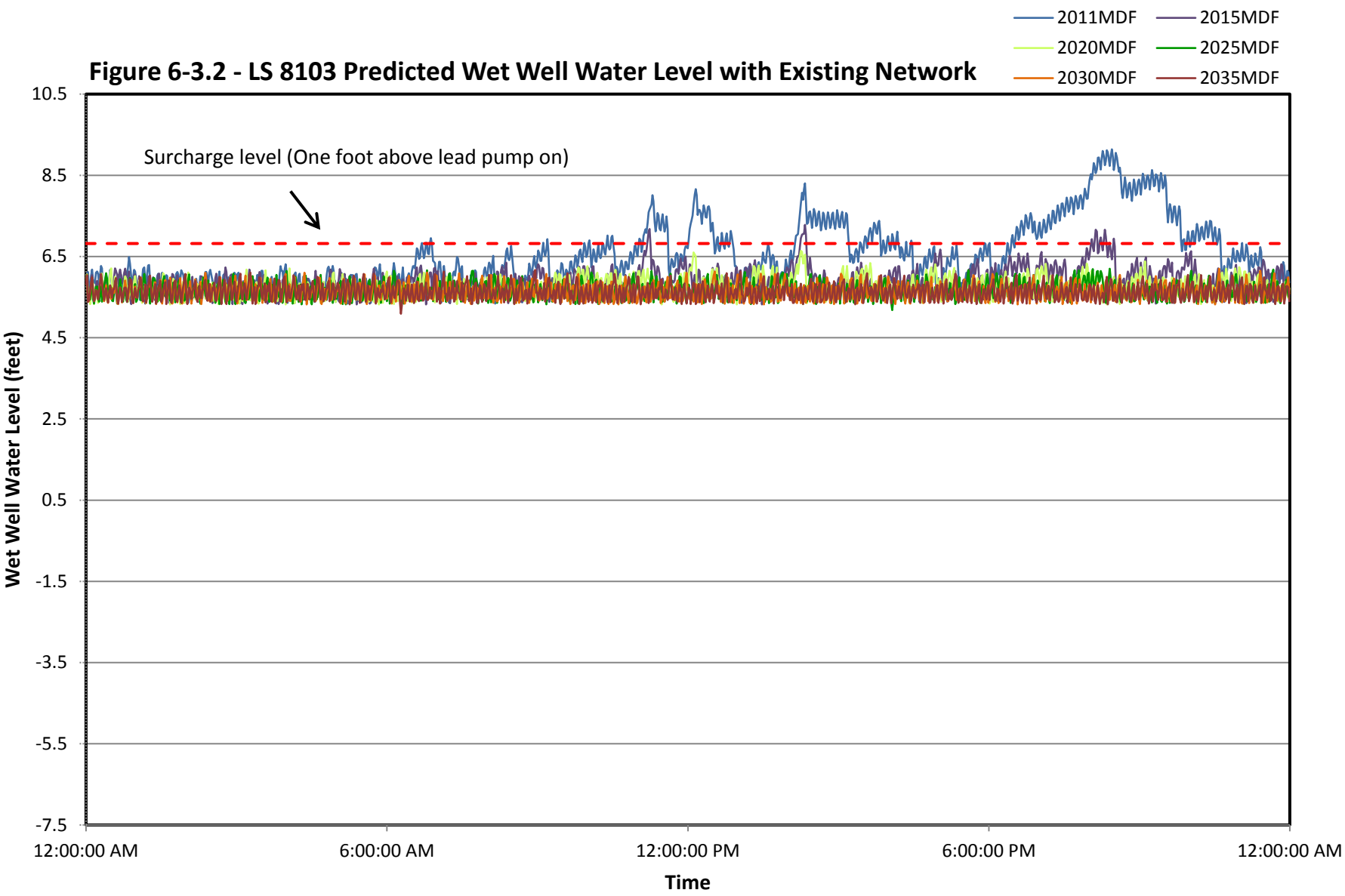


Figure 6-3.2 - LS 8103 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
Wet Well Water Level (feet)
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

Figure 6-3.3 - LS 8104 Predicted Wet Well Water Level with Existing Network

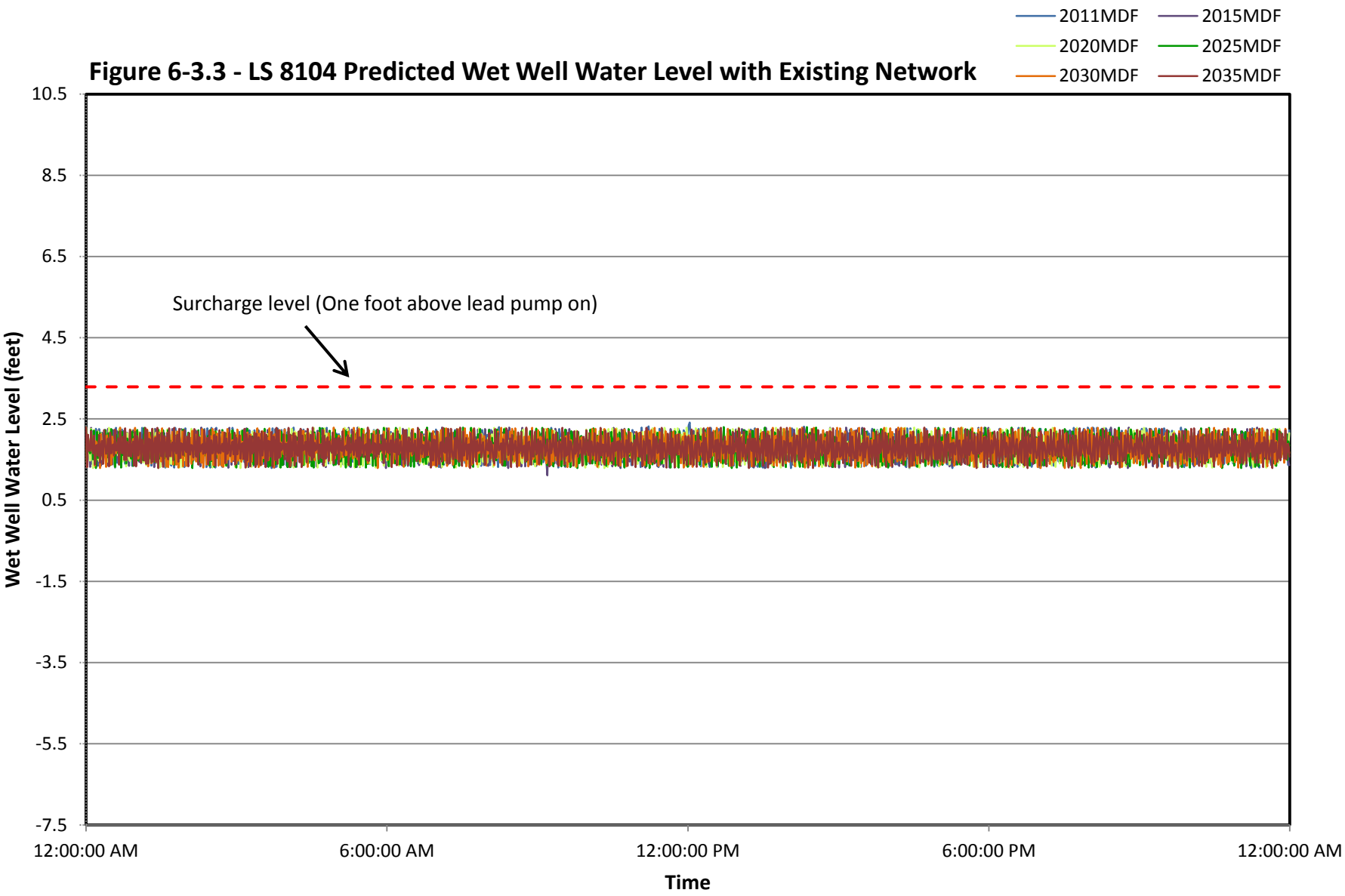
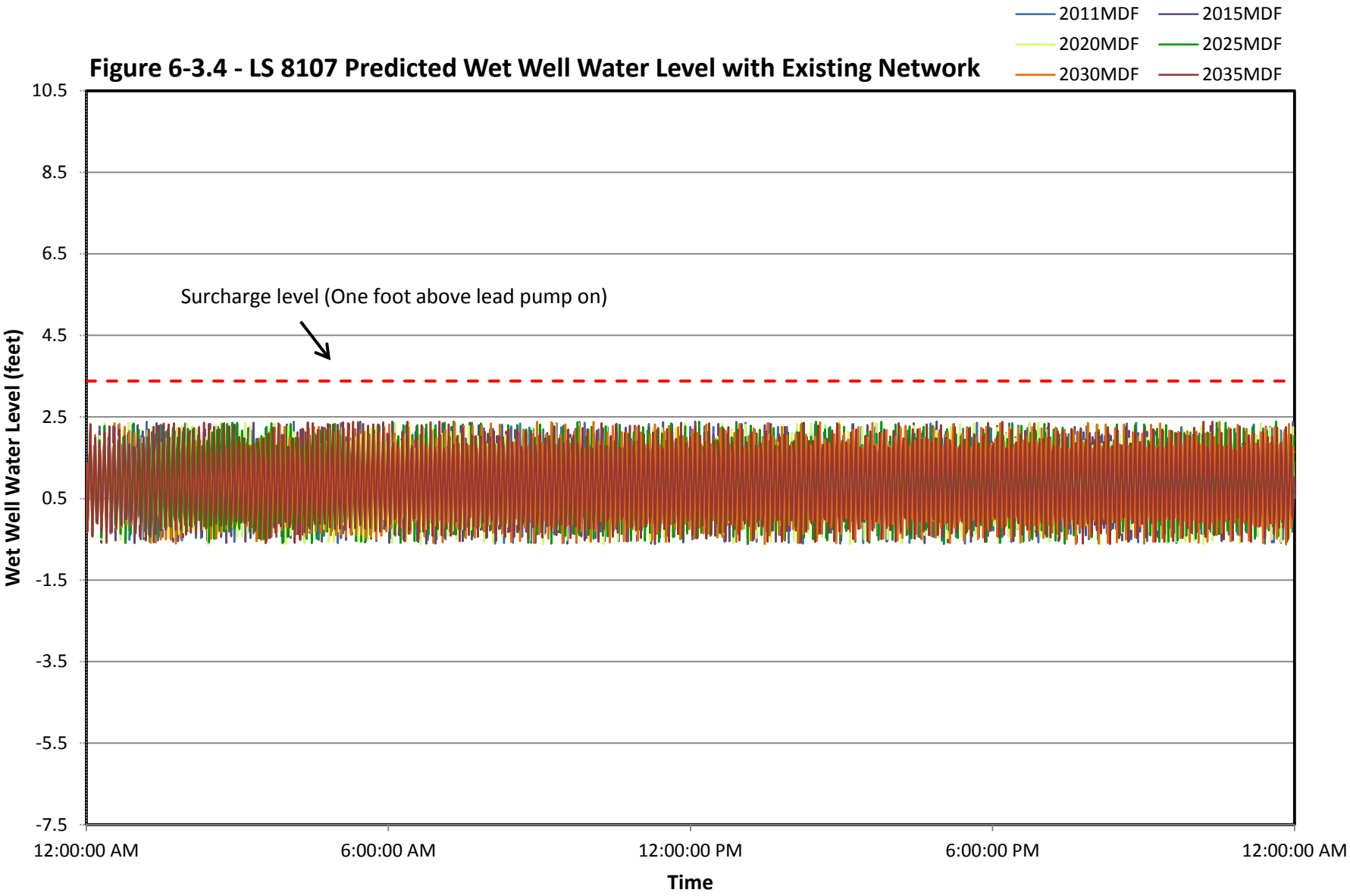


Figure 6-3.4 - LS 8107 Predicted Wet Well Water Level with Existing Network



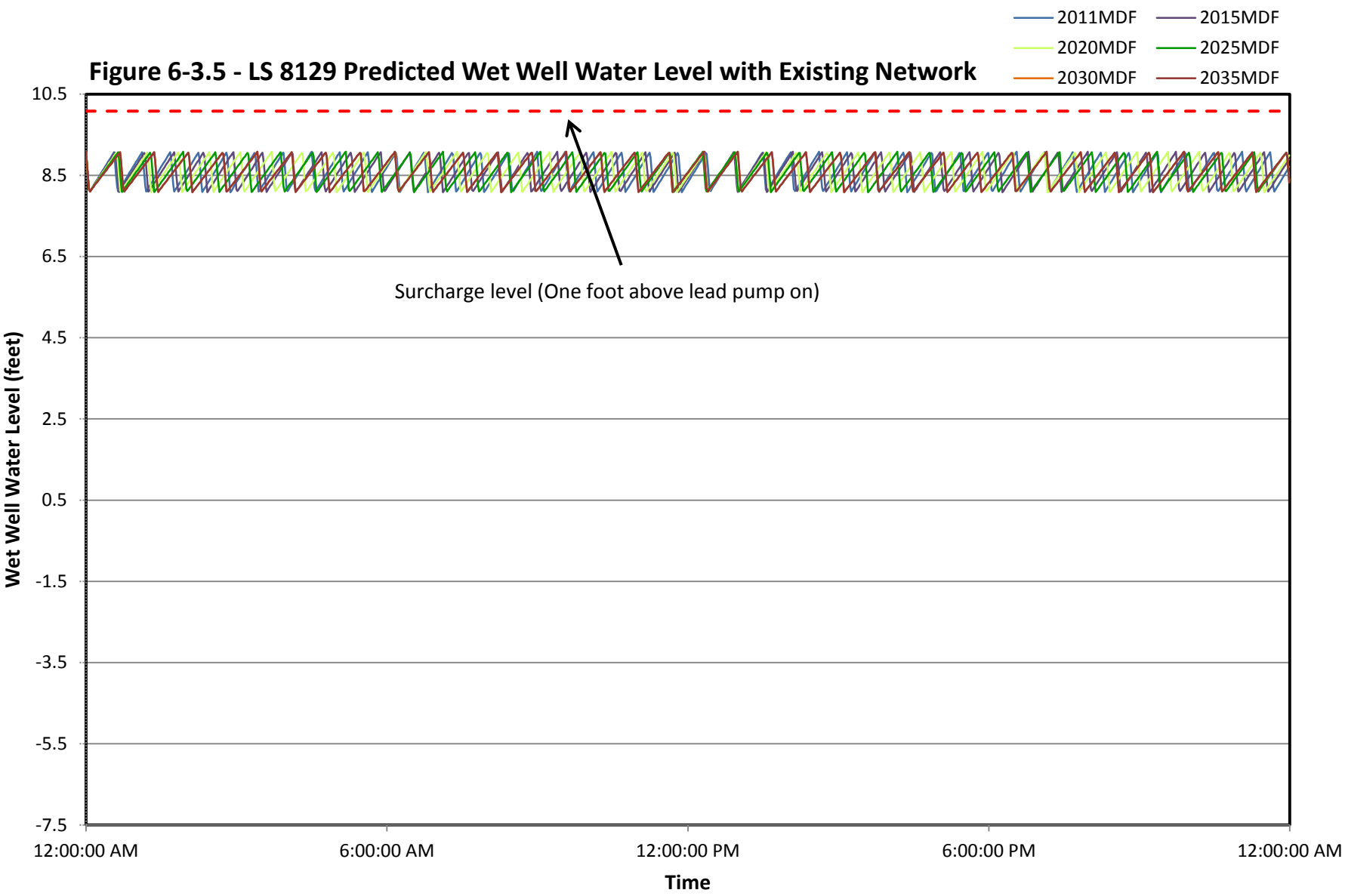


Figure 6-3.5 - LS 8129 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
Wet Well Water Level (feet)
Surcharge level (One foot above lead pump on)
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

Figure 6-3.6 - LS 8134 Predicted Wet Well Water Level with Existing Network

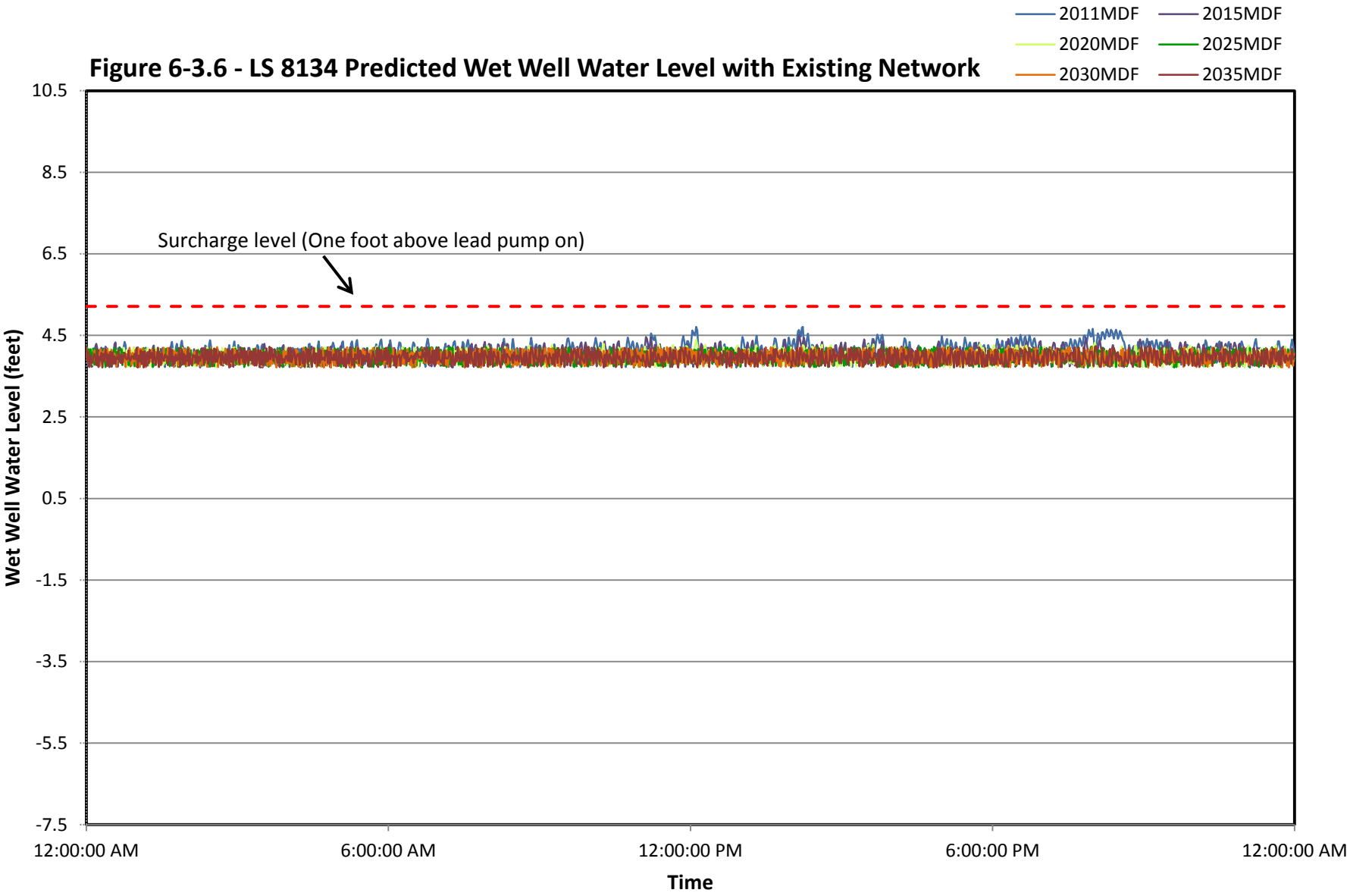


Figure 6-3.7 - LS 8141 Predicted Wet Well Water Level with Existing Network

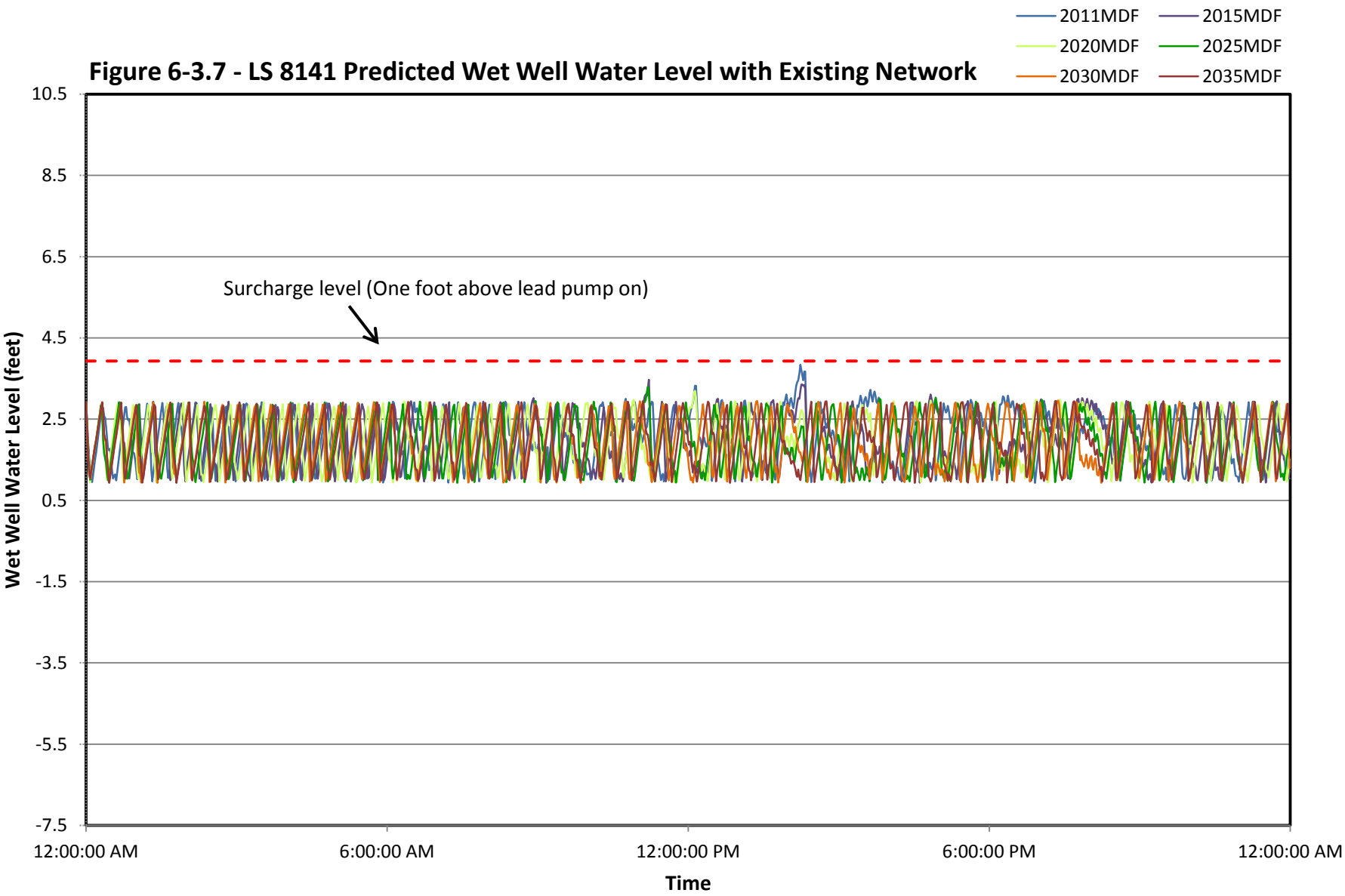


Figure 6-3.8 - LS 8143 Predicted Wet Well Water Level with Existing Network

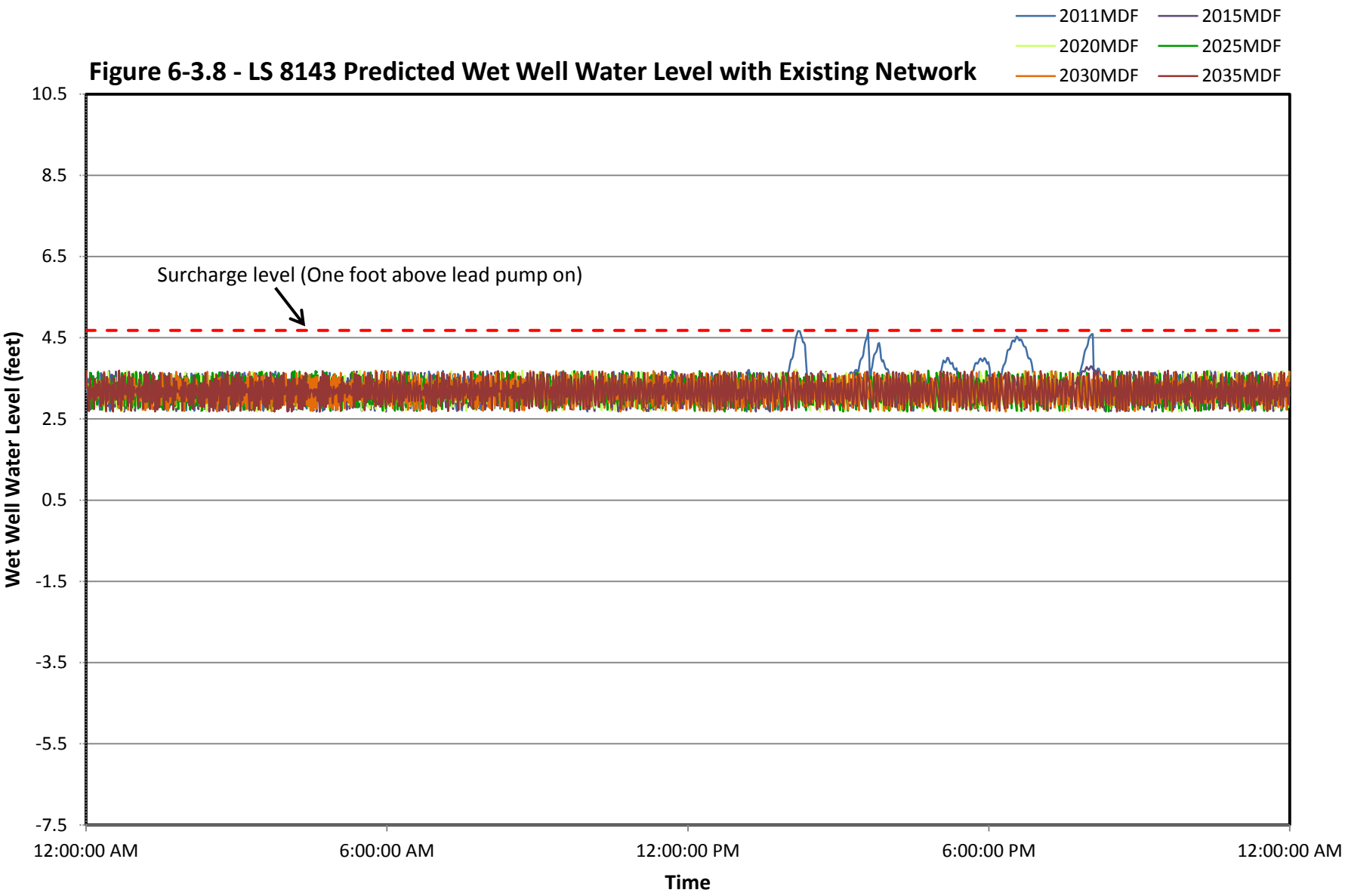
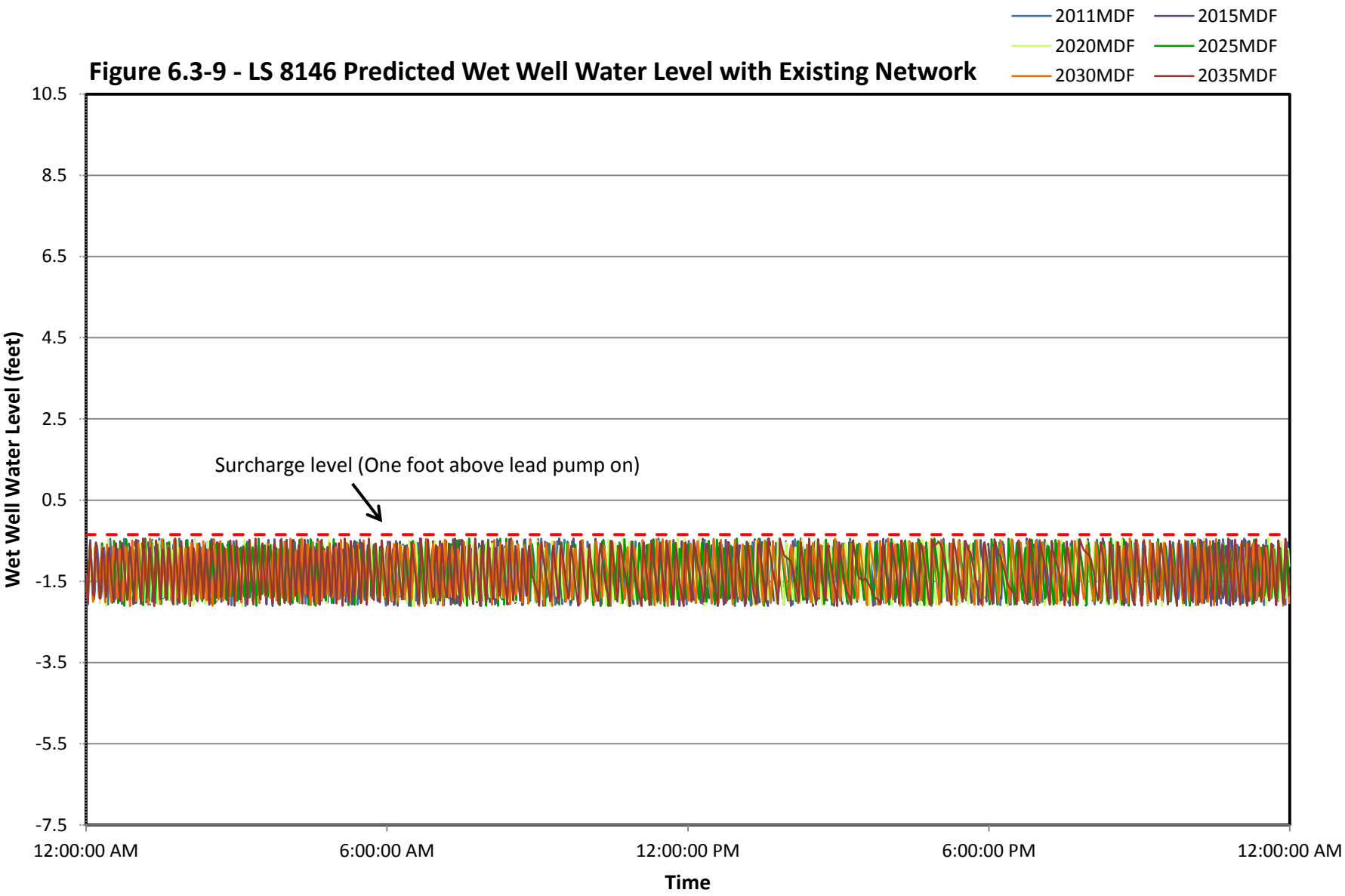


Figure 6.3-9 - LS 8146 Predicted Wet Well Water Level with Existing Network



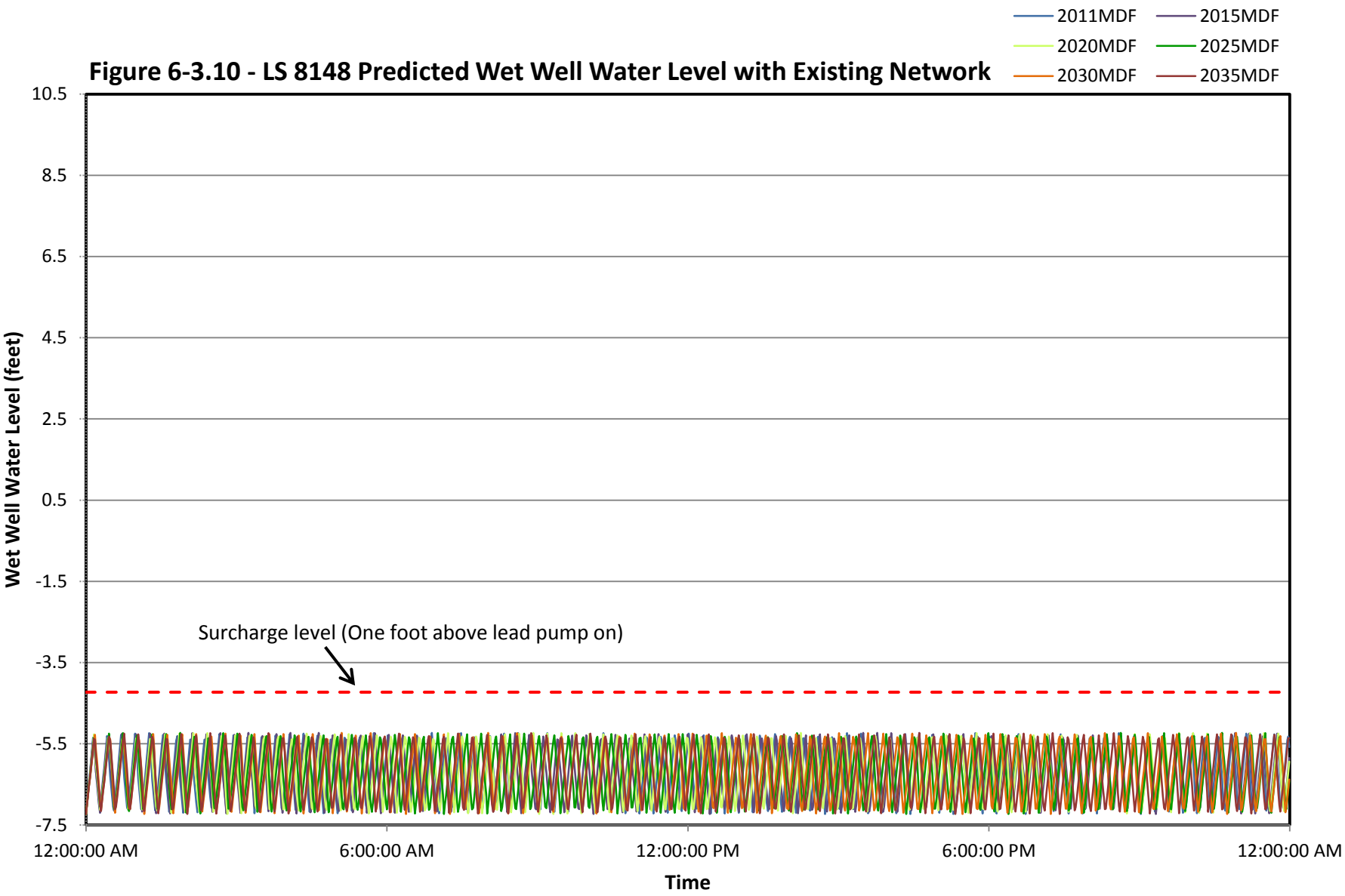


Figure 6-3.10 - LS 8148 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
Wet Well Water Level (feet)
Surcharge level (One foot above lead pump on)
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

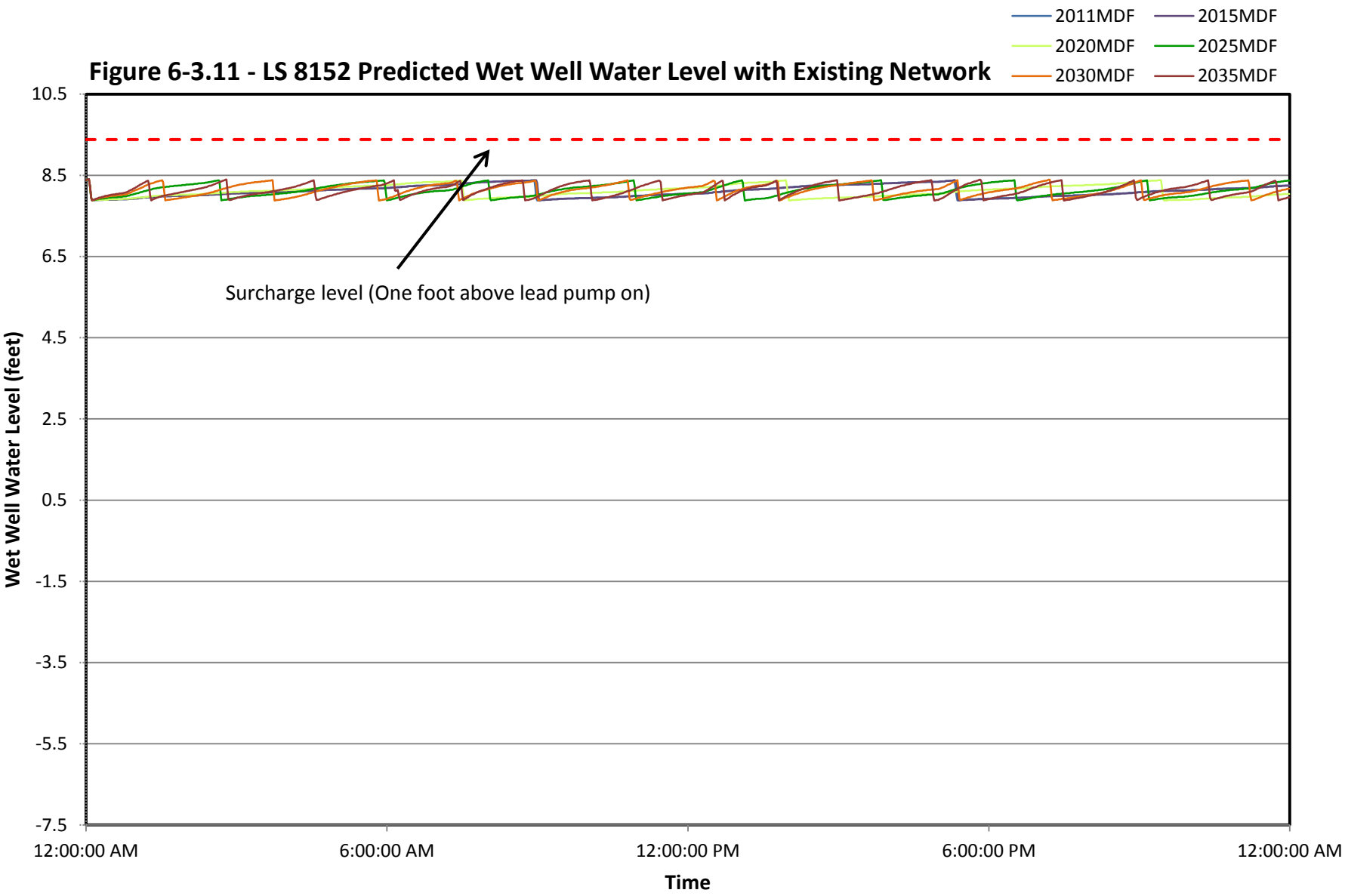


Figure 6-3.11 - LS 8152 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
Wet Well Water Level (feet)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

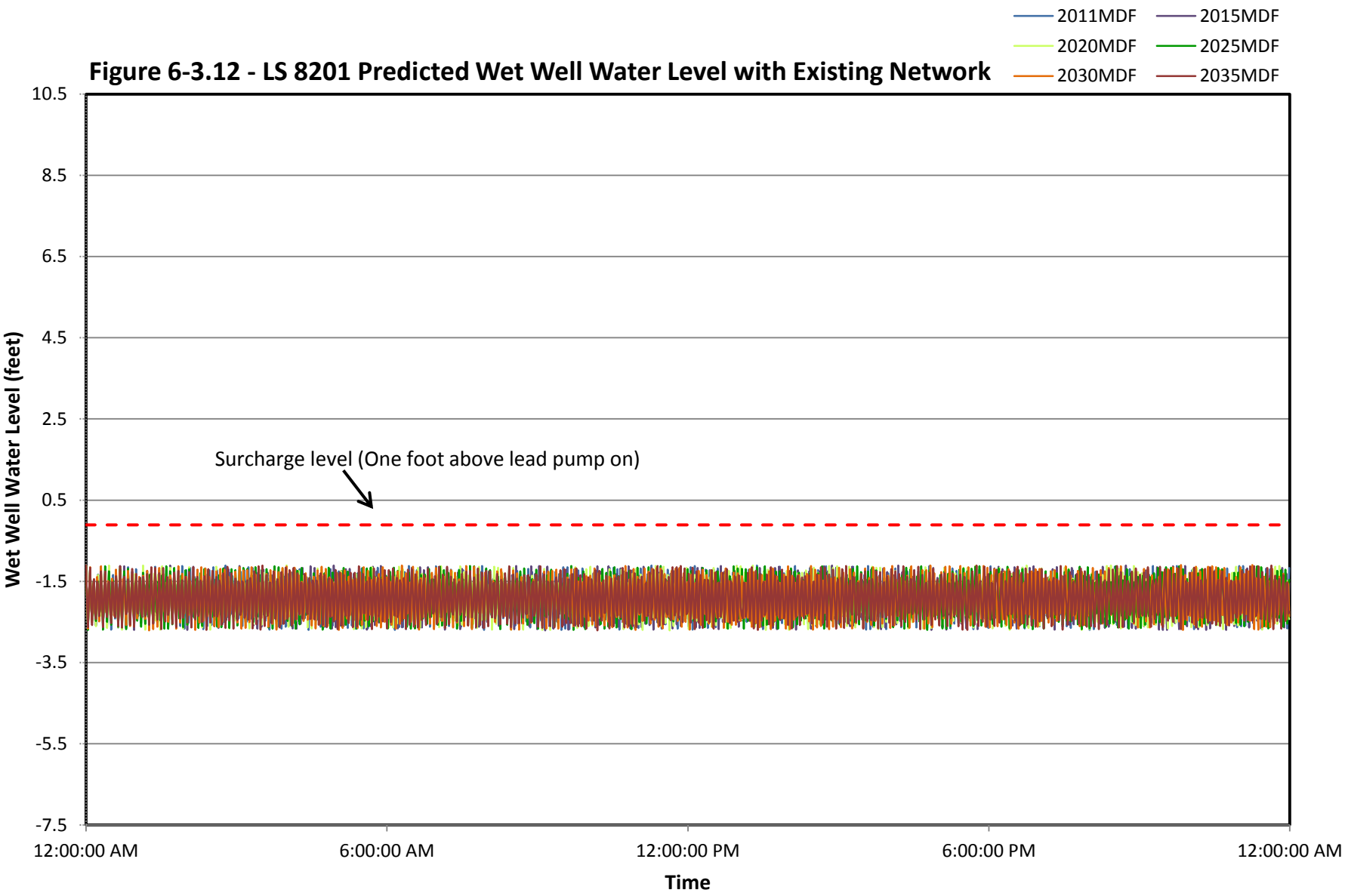


Figure 6-3.12 - LS 8201 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
Wet Well Water Level (feet)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

Figure 6-3.13 - LS 8202 Predicted Wet Well Water Level with Existing Network

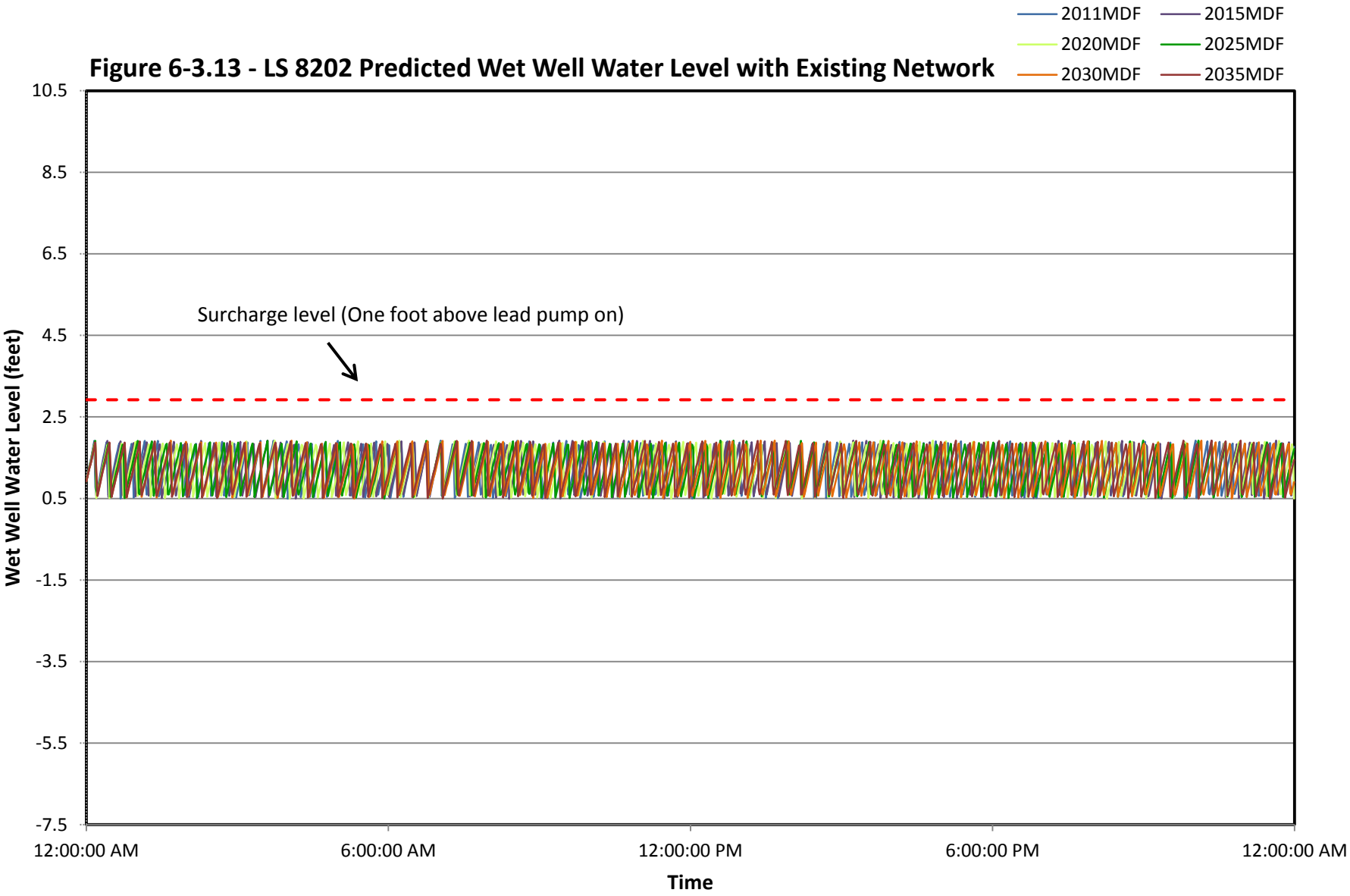


Figure 6-3.14 - LS 8205 Predicted Wet Well Water Level with Existing Network

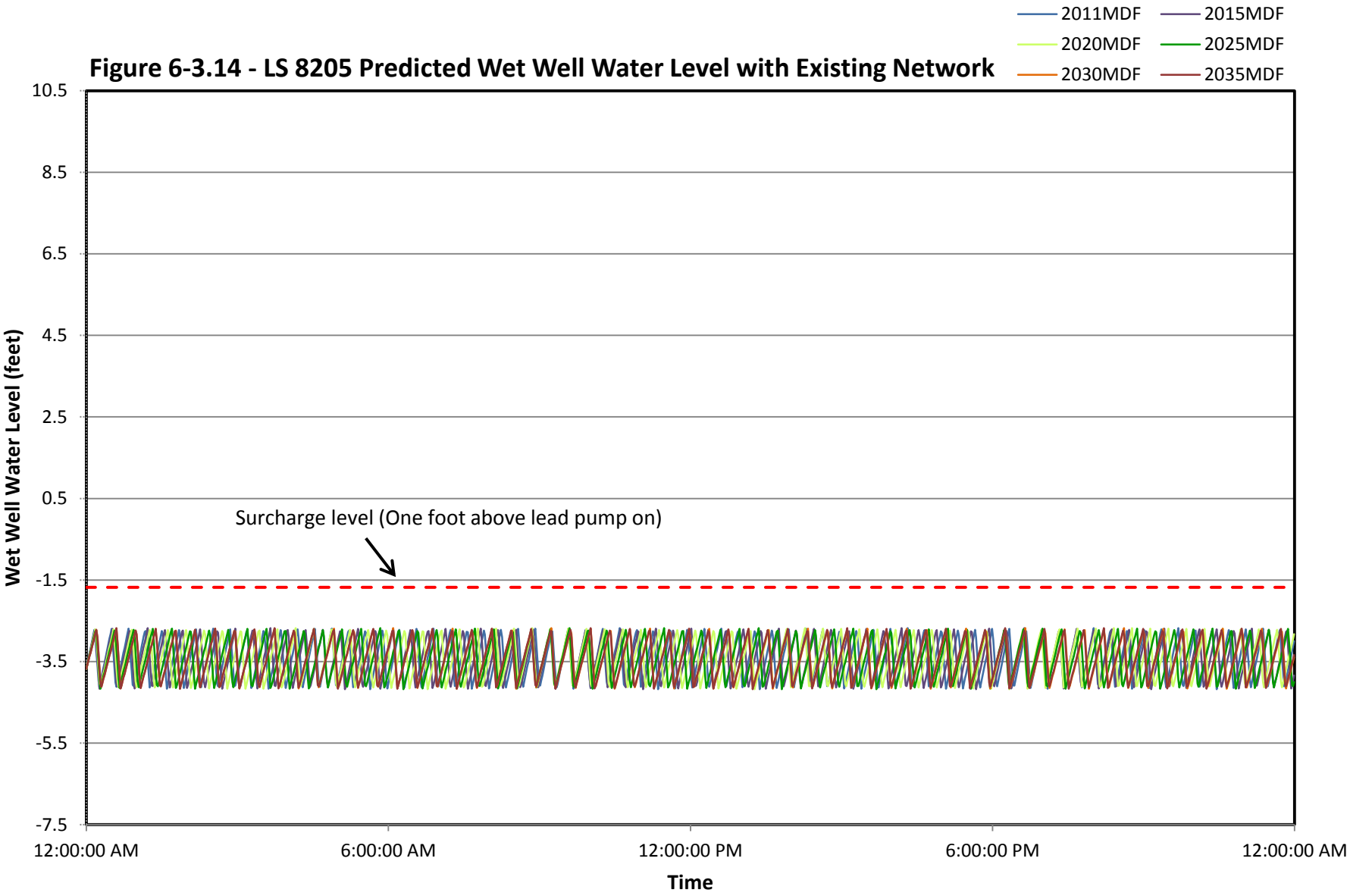
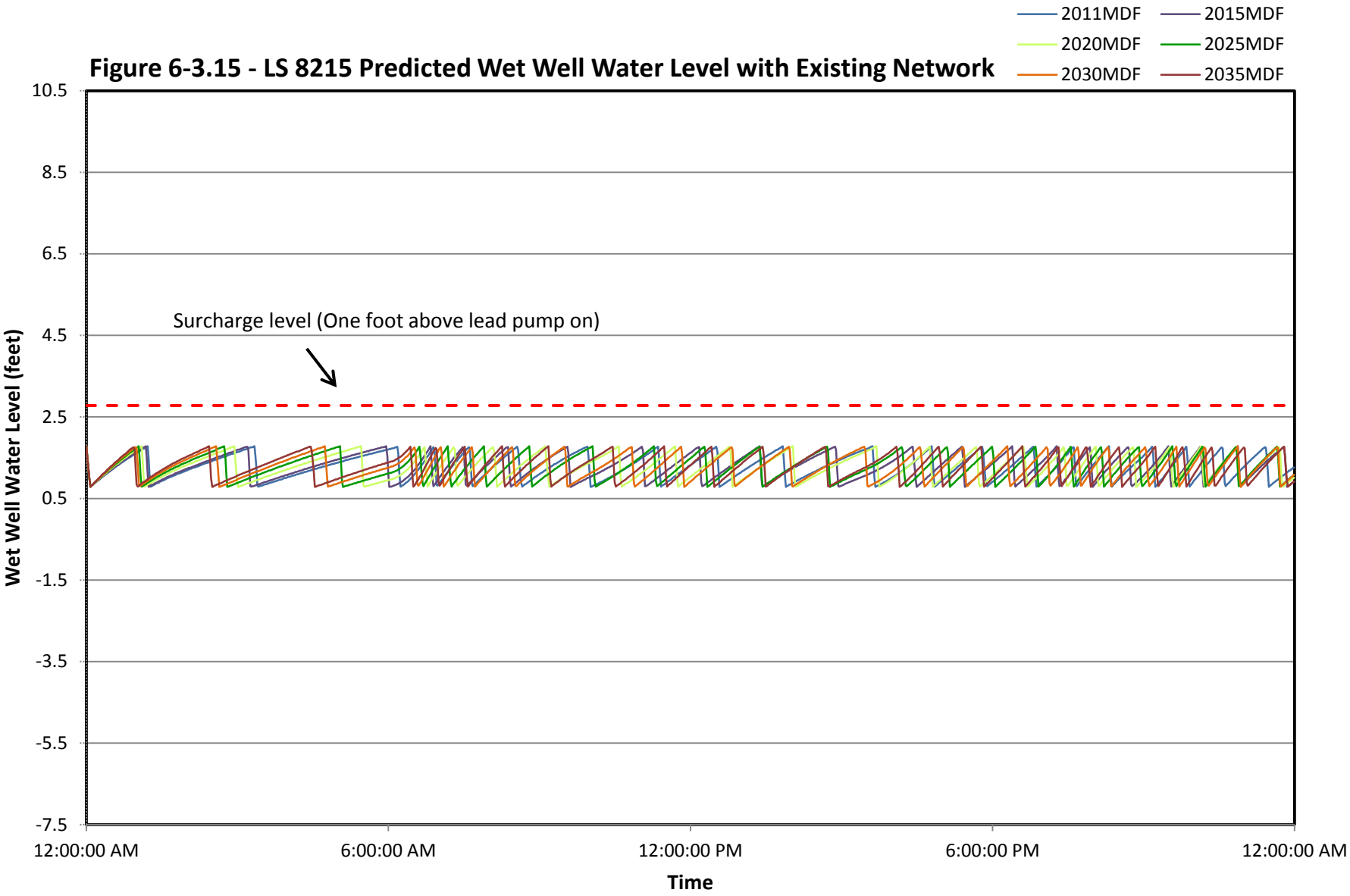


Figure 6-3.15 - LS 8215 Predicted Wet Well Water Level with Existing Network



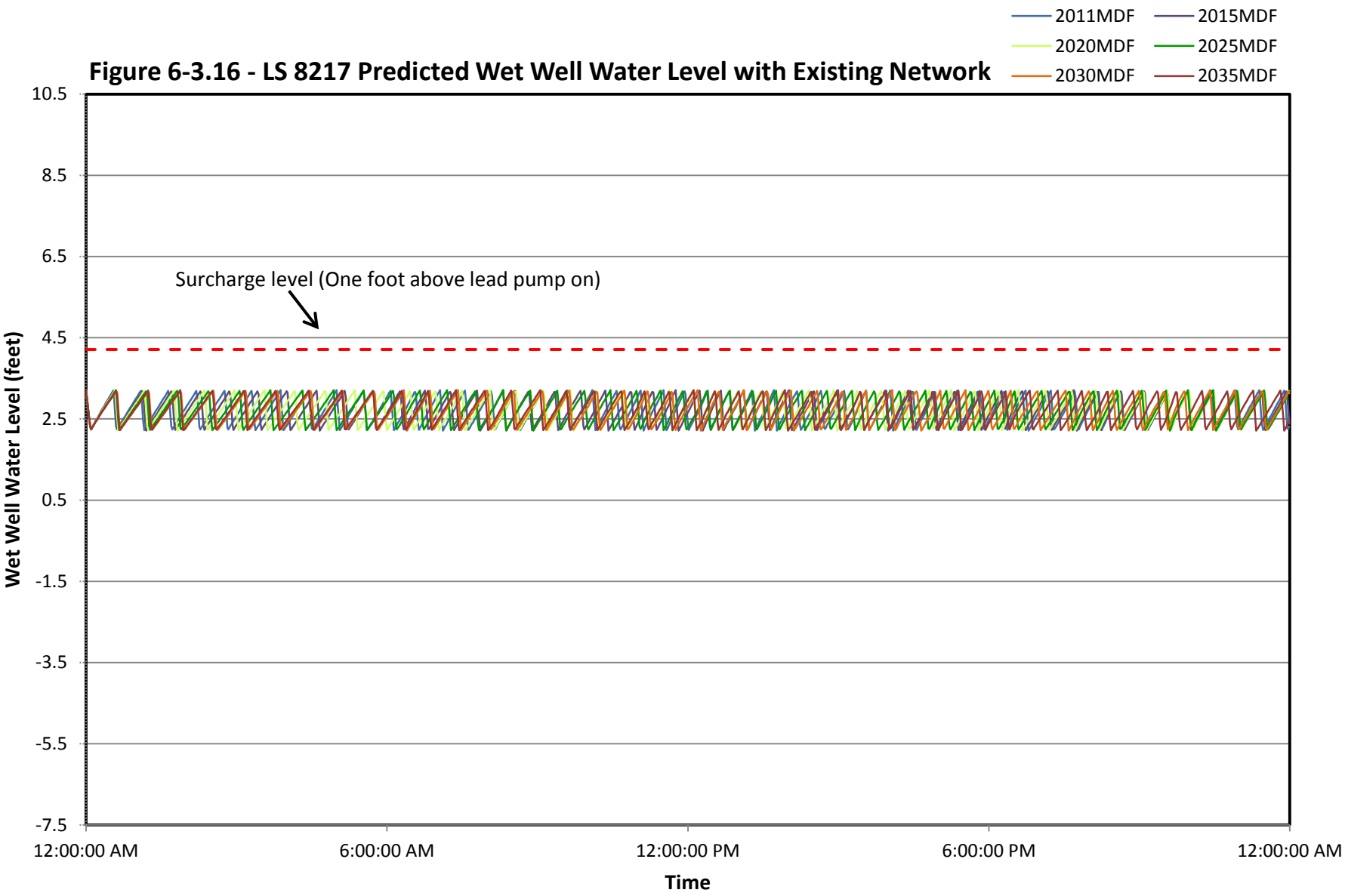


Figure 6-3.16 - LS 8217 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
Wet Well Water Level (feet)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

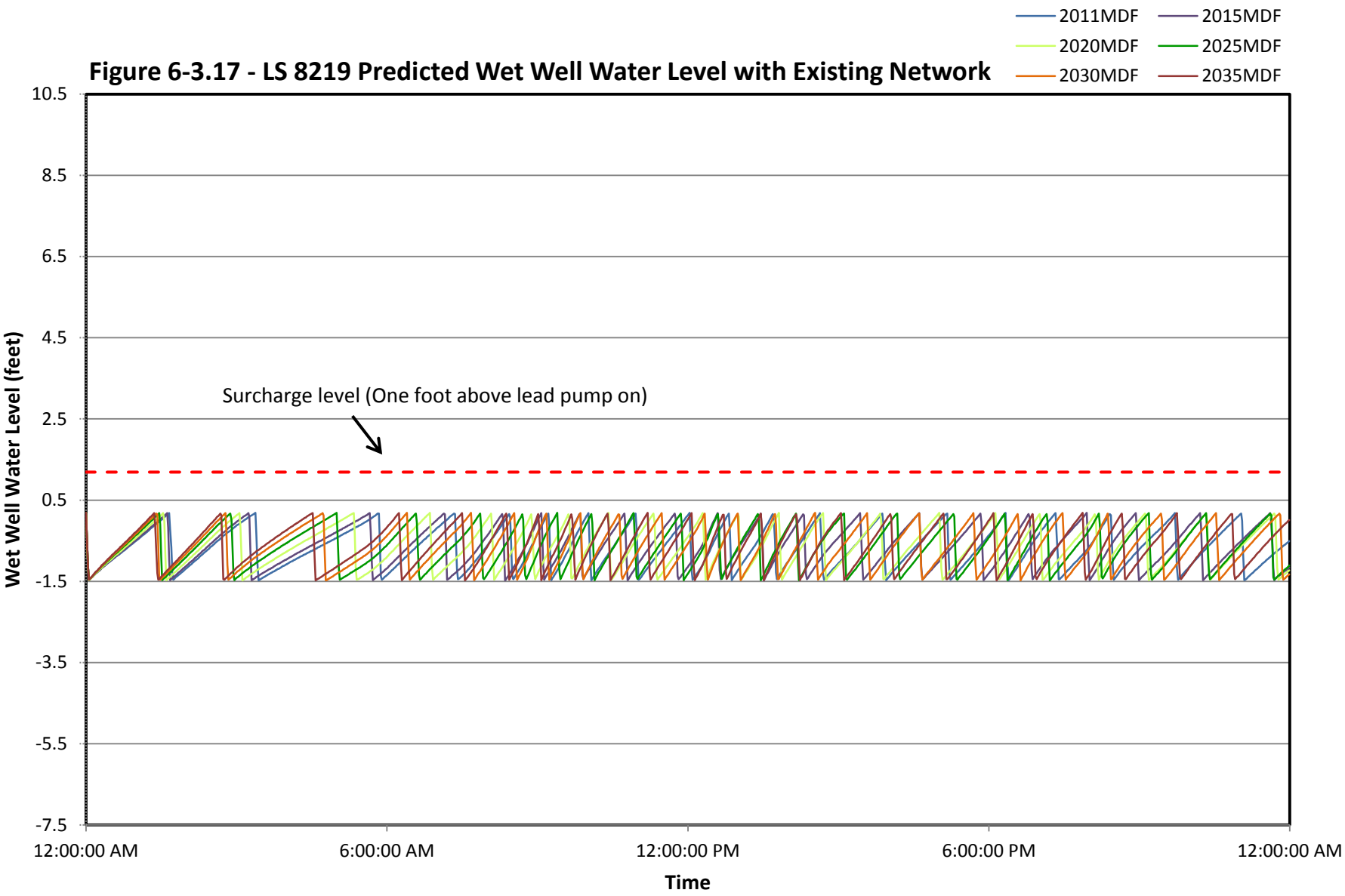


Figure 6-3.17 - LS 8219 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
Wet Well Water Level (feet)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

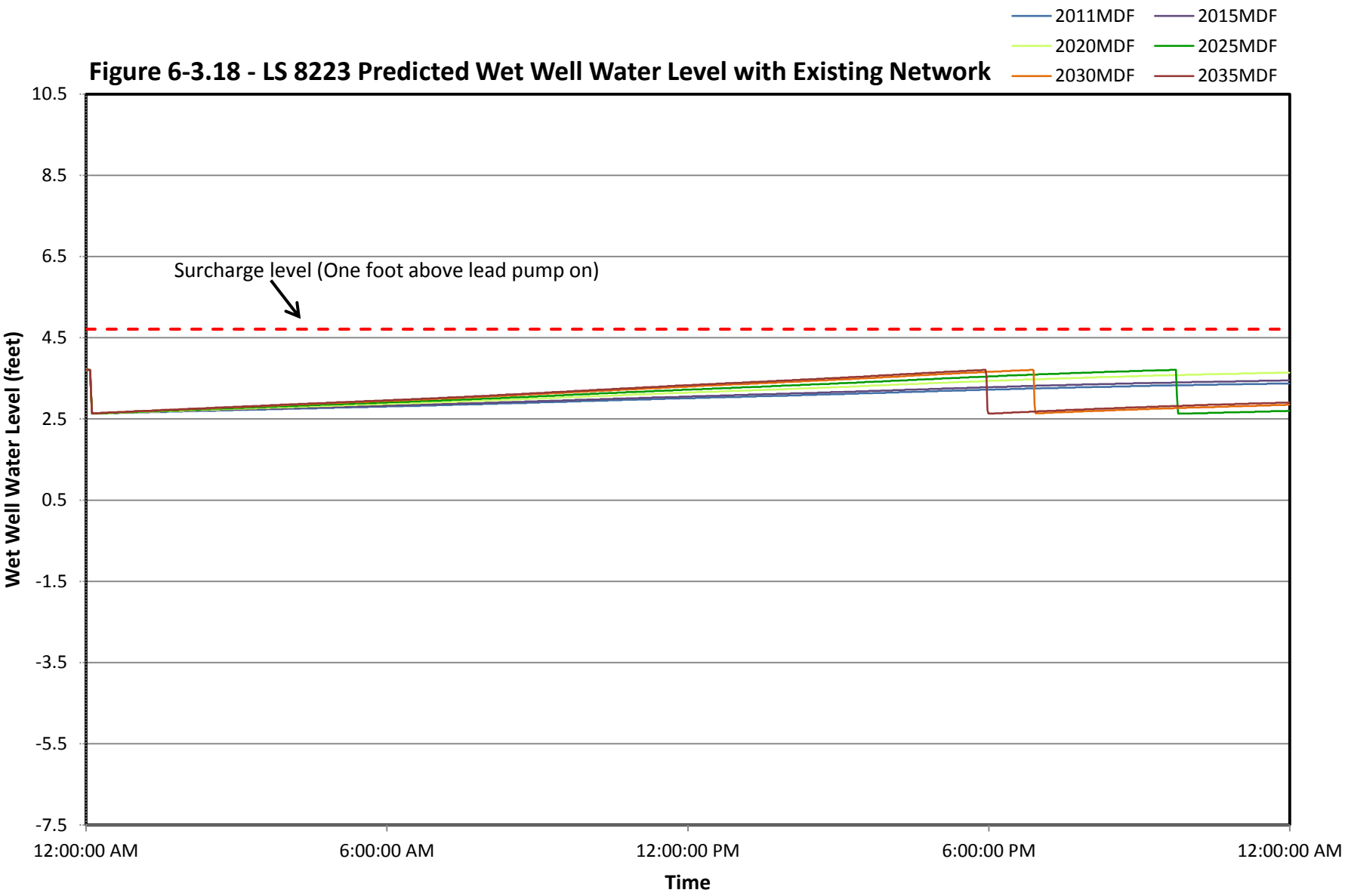


Figure 6-3.18 - LS 8223 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
Surcharge level (One foot above lead pump on)
Wet Well Water Level (feet)
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

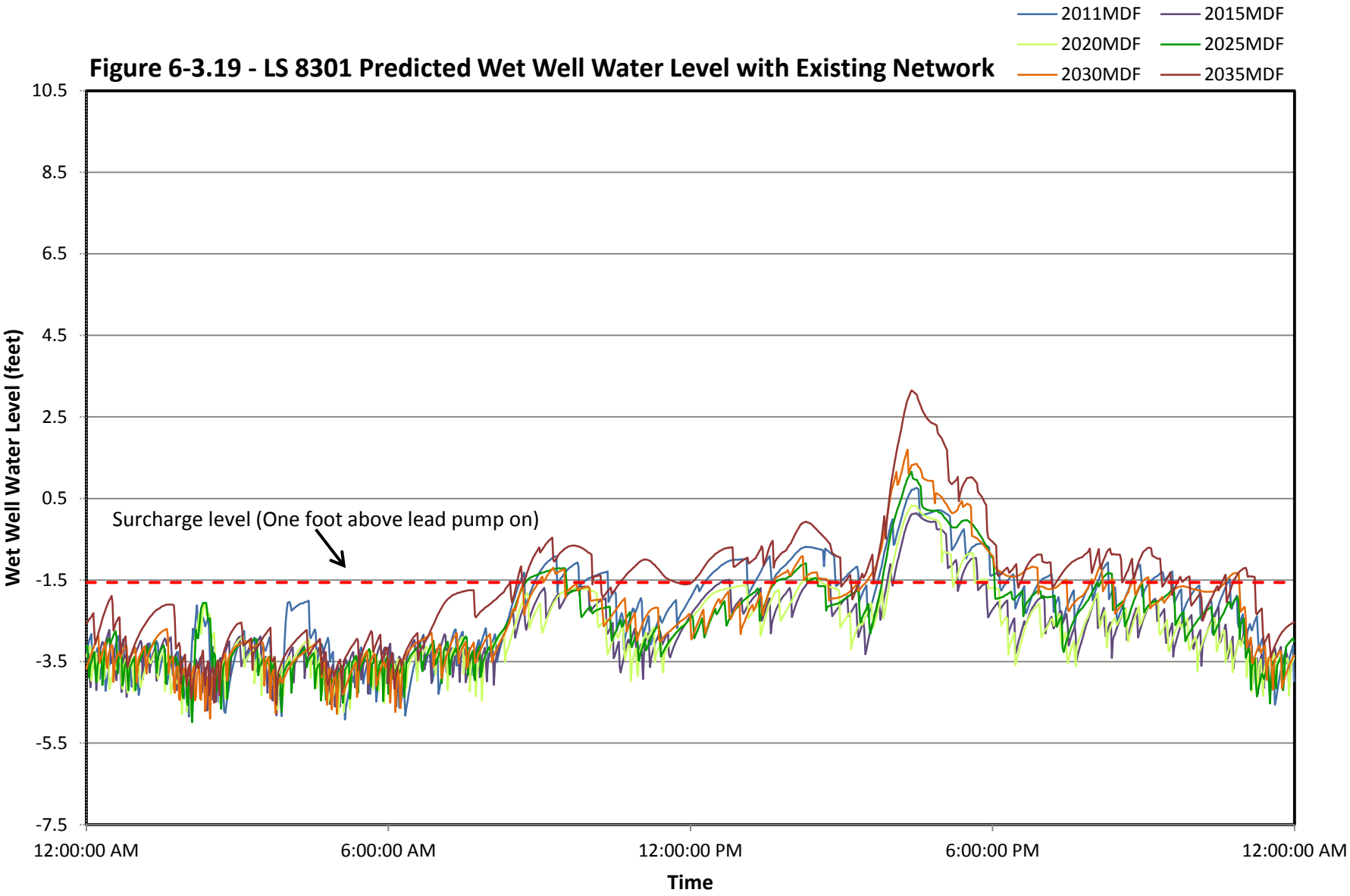


Figure 6-3.19 - LS 8301 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
Wet Well Water Level (feet)
Surcharge level (One foot above lead pump on)
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

Figure 6-3.20 - LS 8302 Predicted Wet Well Water Level with Existing Network

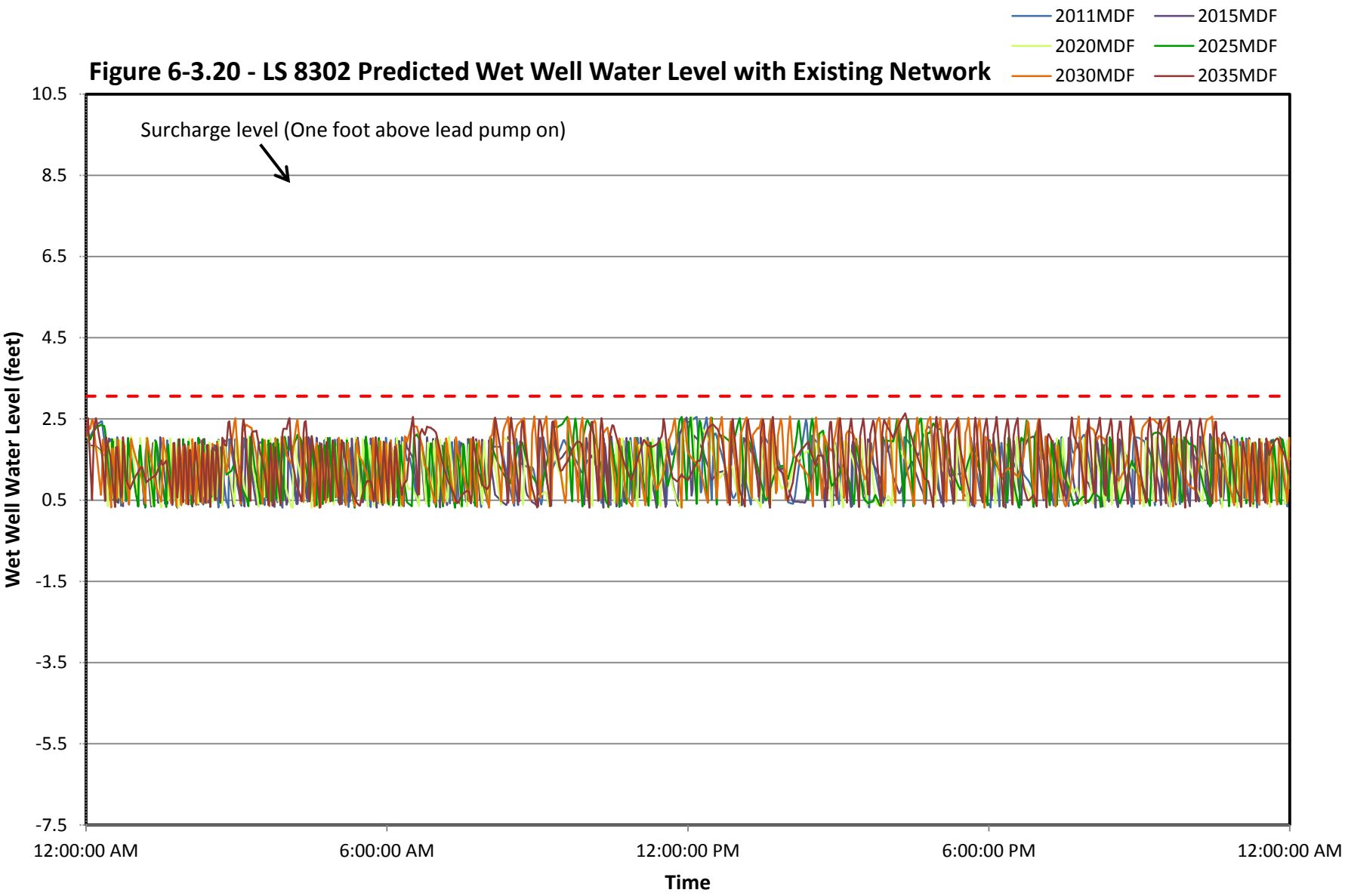
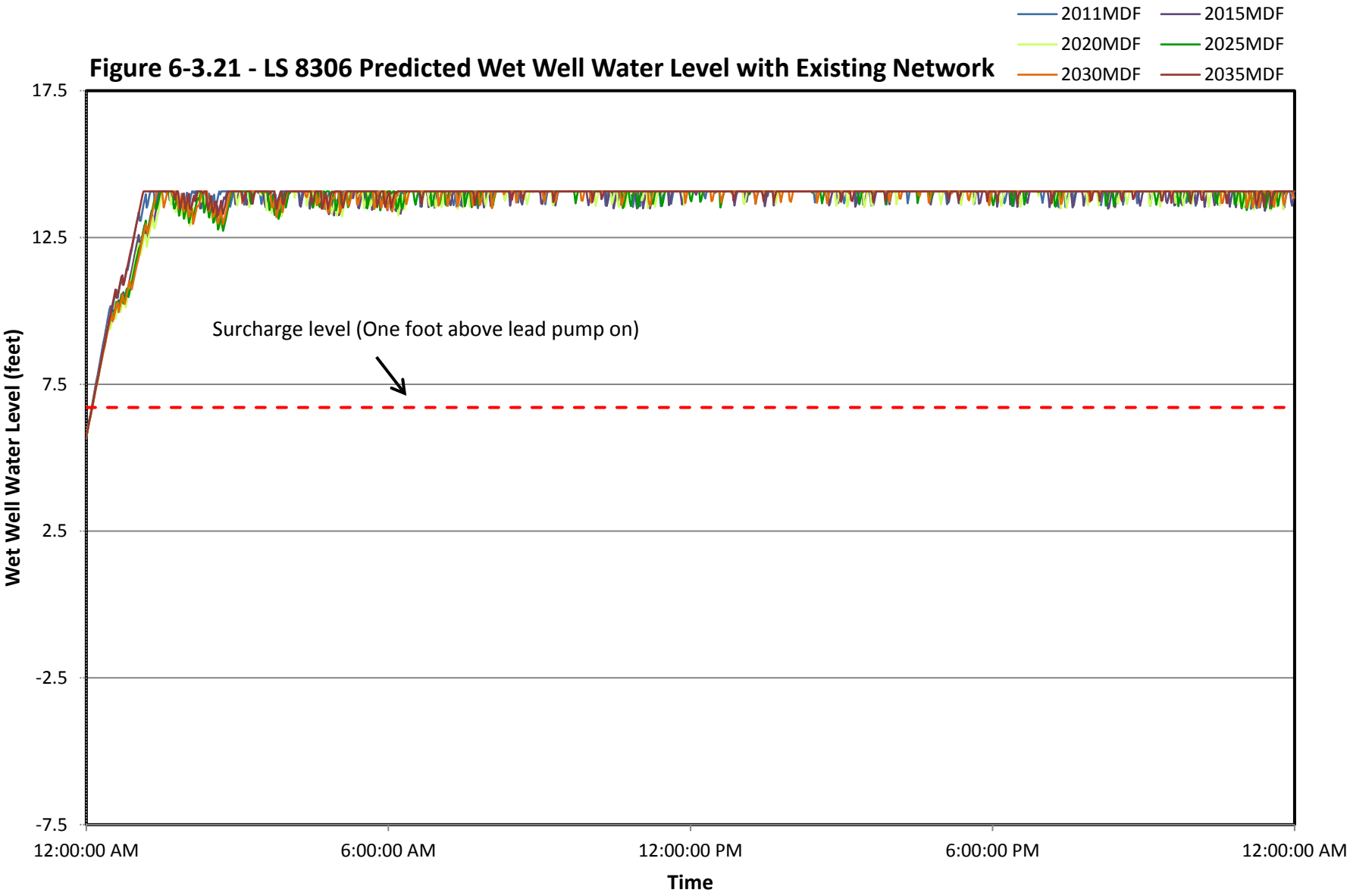


Figure 6-3.21 - LS 8306 Predicted Wet Well Water Level with Existing Network



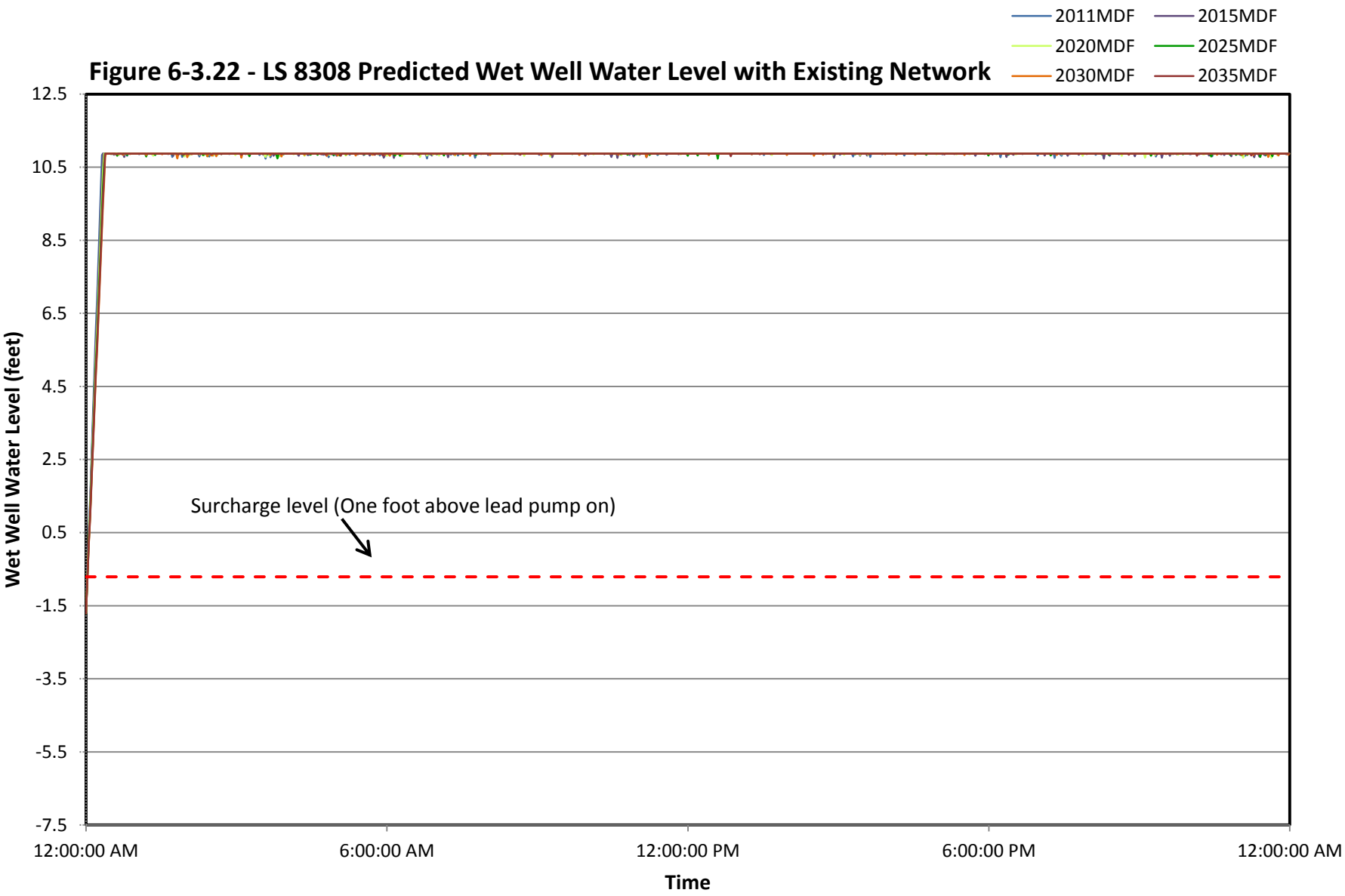
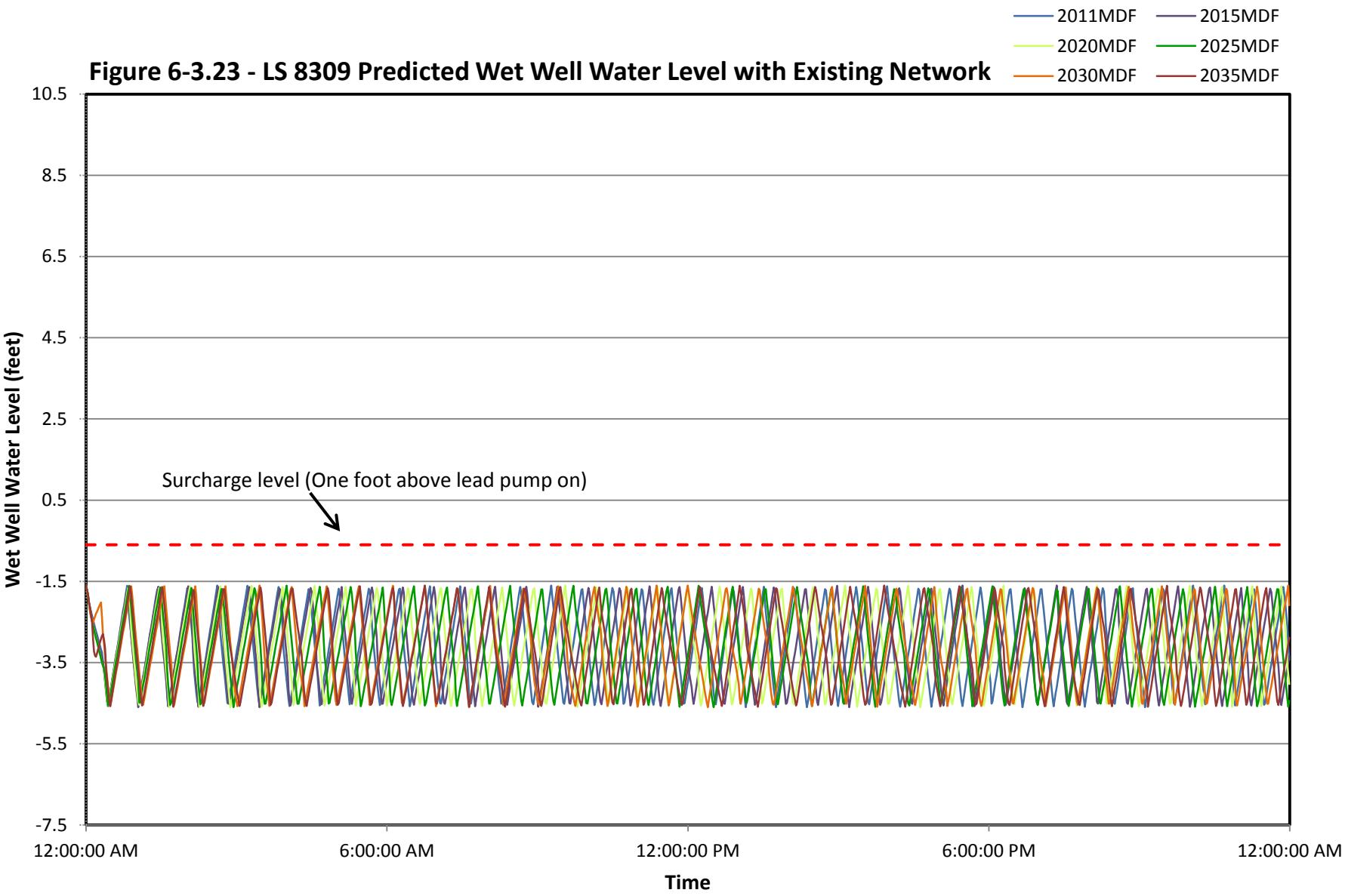


Figure 6-3.22 - LS 8308 Predicted Wet Well Water Level with Existing Network
2011MDF
2015MDF
2020MDF
2025MDF
2030MDF
2035MDF
12.5
10.5
8.5
6.5
4.5
2.5
0.5
-1.5
-3.5
-5.5
-7.5
Wet Well Water Level (feet)
Surcharge level (One foot above lead pump on)
12:00:00 AM
6:00:00 AM
12:00:00 PM
6:00:00 PM
12:00:00 AM
Time

Figure 6-3.23 - LS 8309 Predicted Wet Well Water Level with Existing Network



APPENDIX 6-4

Results of Wetwell Surcharge Evaluation with Improvements

Figure 6-4.1 - LS 8103 Predicted Wet Well Water Level with Proposed Improvements

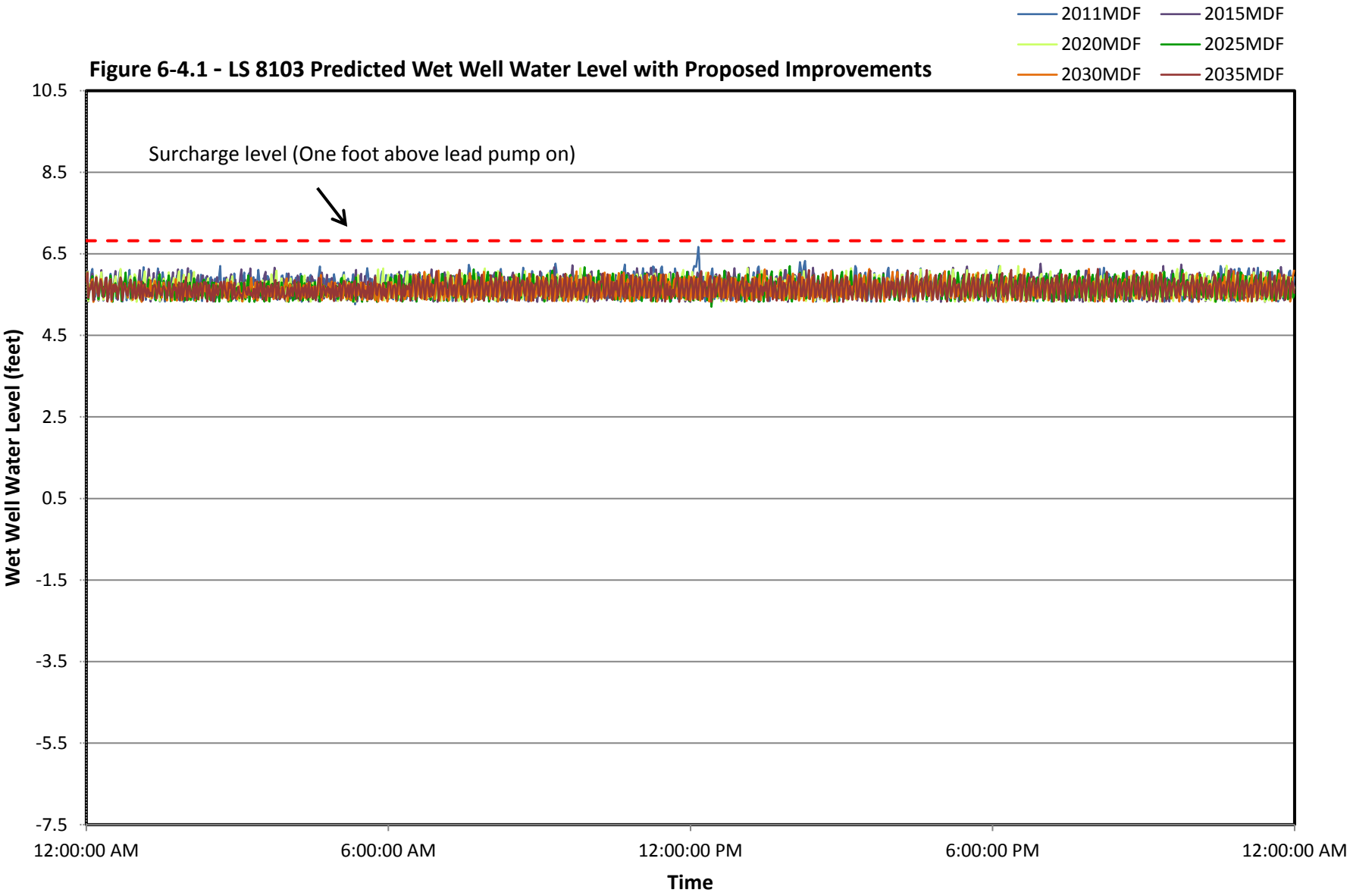


Figure 6-4.2 - LS 8301 Predicted Wet Well Water Level with Proposed Improvements

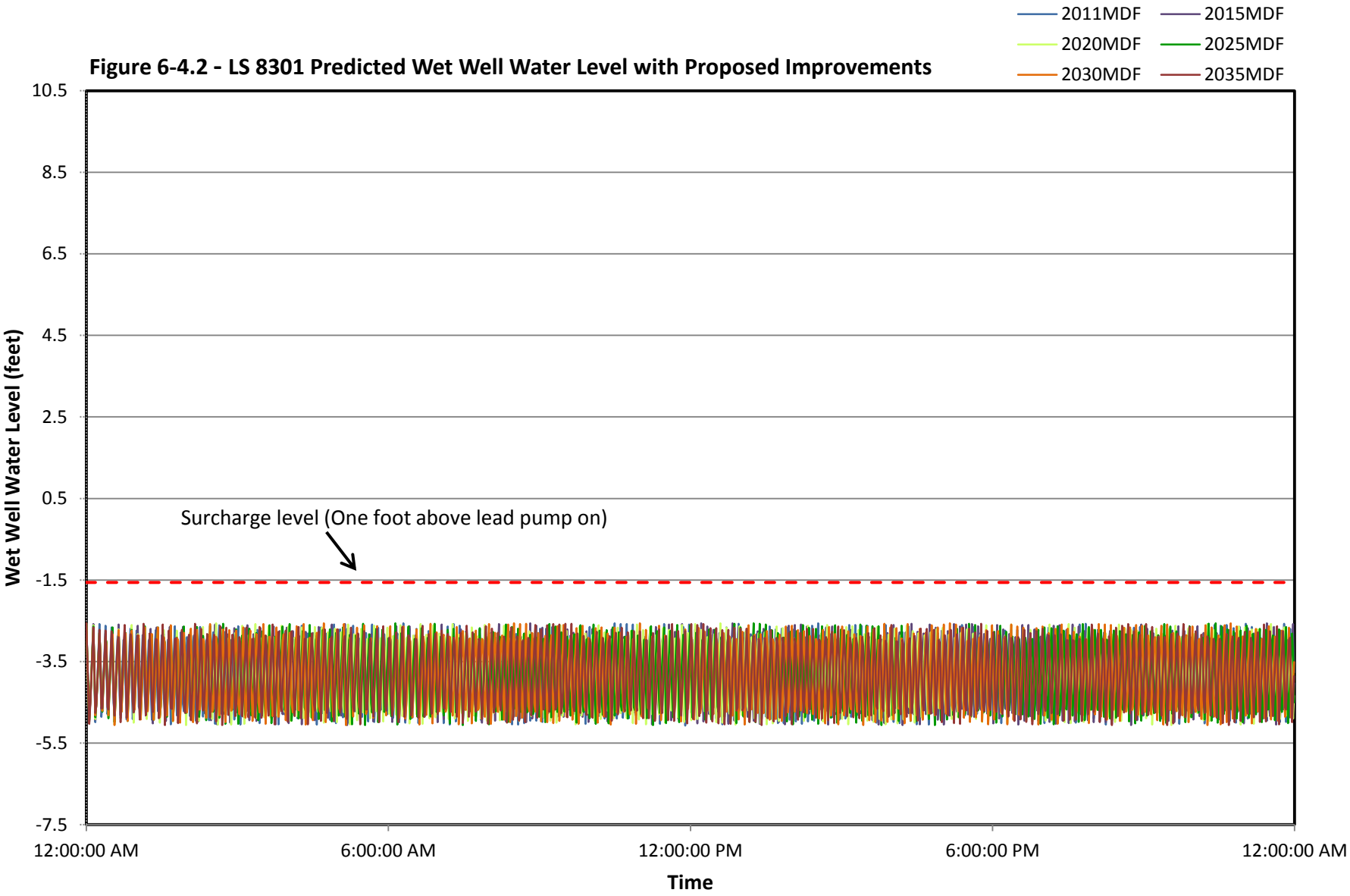


Figure 6-4.3 - LS 8306 Predicted Wet Well Water Level with Proposed Improvements

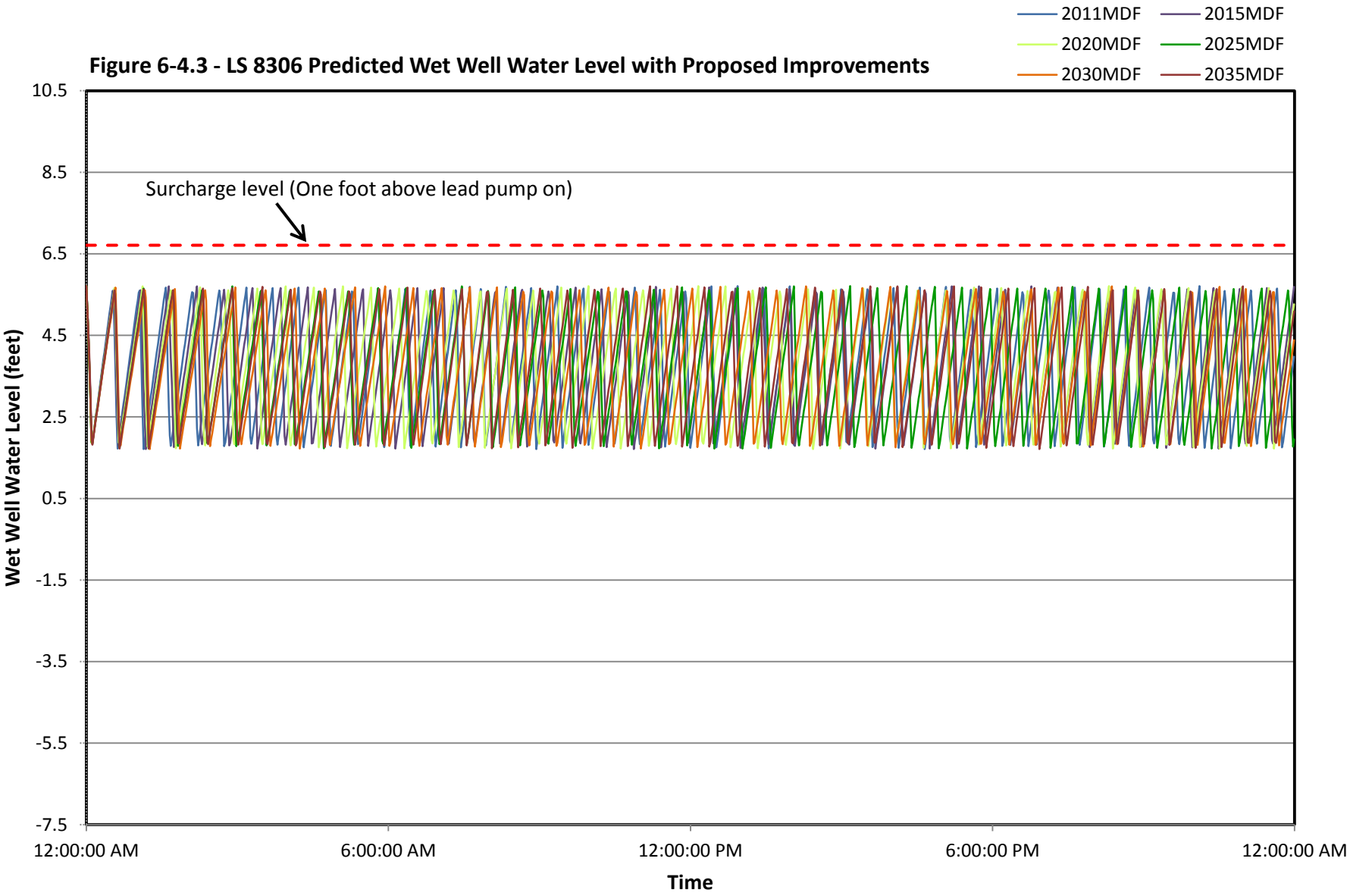
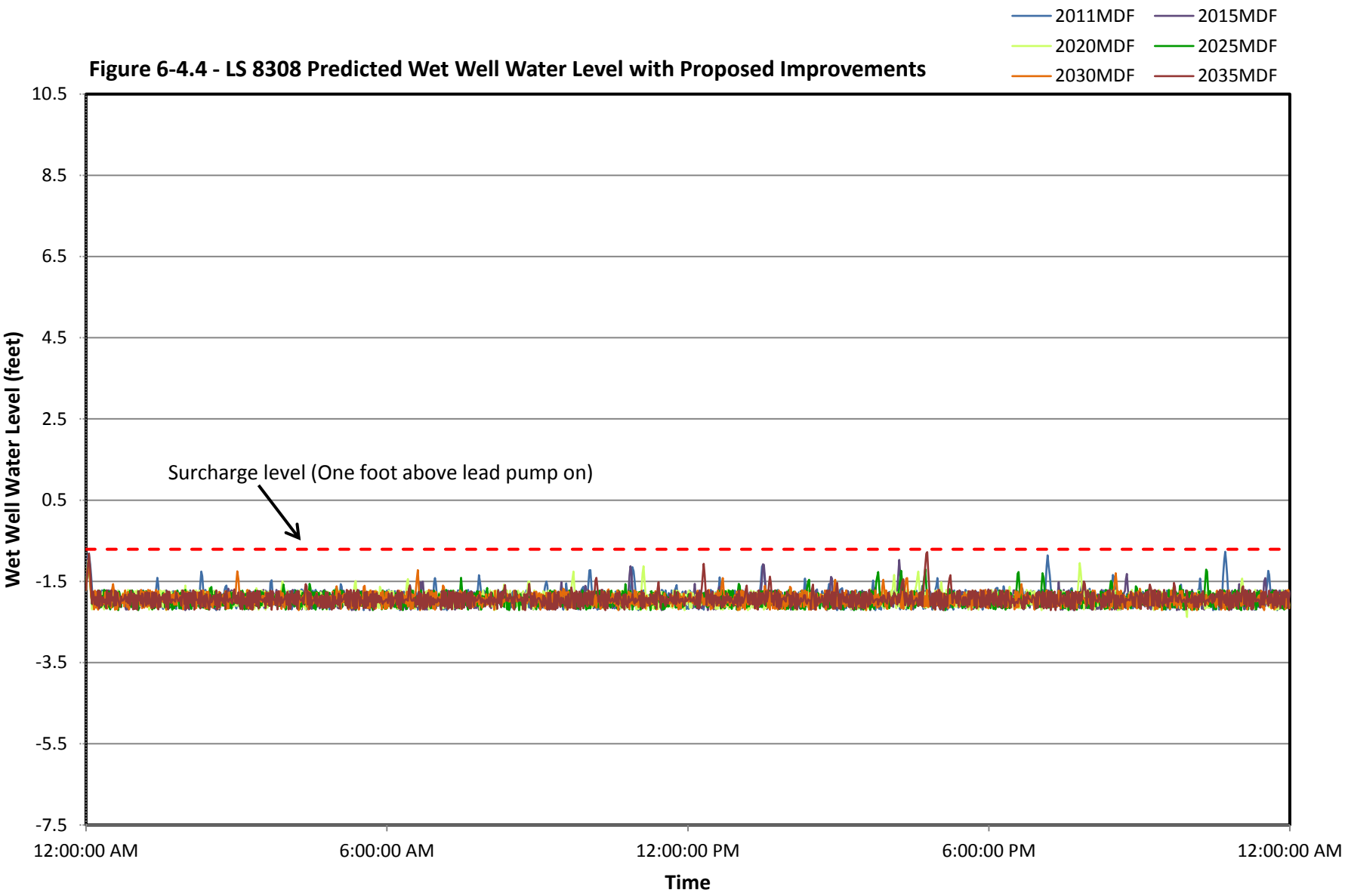


Figure 6-4.4 - LS 8308 Predicted Wet Well Water Level with Proposed Improvements



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Fax (561) 997-8159

TECHNICAL MEMORANDUM No. 7 – Collection and Transmission System Capacity and Reliability Analysis

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: John Koroshec / Hazen and Sawyer
Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Mark Drummond / C Solutions

FROM: Joe Franko / Hazen and Sawyer

DATE: May 5, 2014

FILE: 45103-004.3.1

SUBJECT: Palm Beach County Water Utilities Department
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 7 (TM-7) presents the evaluation conducted by Hazen & Sawyer and sub-consultant Hillers Electrical Engineering Inc. (HEE), of the Palm Beach County Water Utilities Department (PBCWUD) Glades Wastewater Collection and Transmission System that is outlined as Task 7 – Collection and Transmission System Capacity and Reliability Analysis to be included in the proposed Glades Wastewater Master Plan. Specific items that are included as part of this task include:

1. *Conduct a walkthrough with County staff of all lift stations and master pump stations within the Glades service area.*

2. *Document the general physical condition of lift stations and master pump stations to assess general conditions of structures; mechanical (i.e., pumps, pipe, and valves), electrical and telemetry equipment; operational evaluation of pumping equipment; odor and noise levels. Assessment of the lift stations and master pump stations are based on visual observations where accessible.*

3. *Prepare a summary of recommended pump station improvements over the PBCWUD's planning horizon for inclusion in the Glades Wastewater Master Plan.*

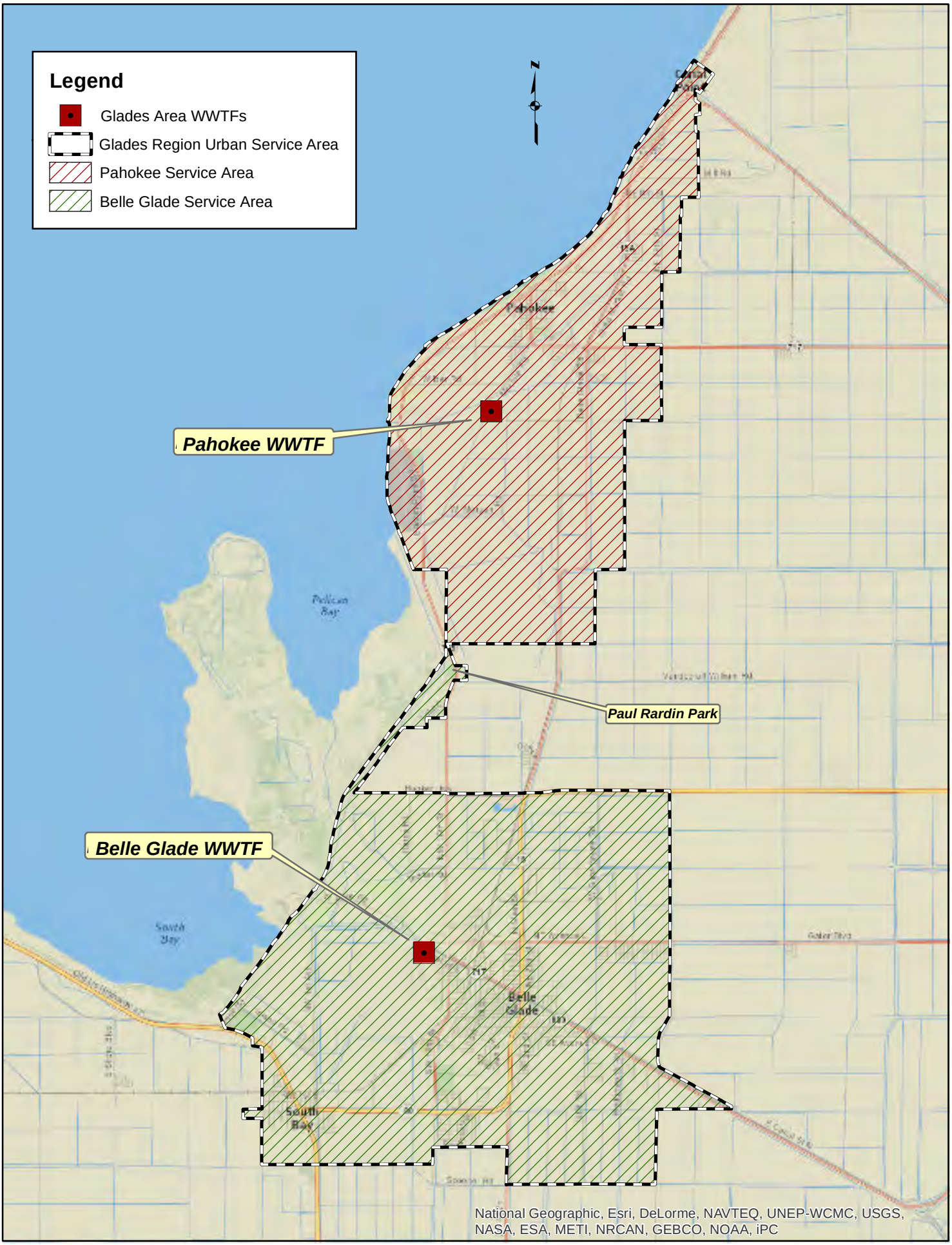
BACKGROUND

The PBCWUD's Glades wastewater collection system currently serves the West Central Region of the PBCWUD's service area and is divided into two service areas as shown in **Figure 7.1**. The service areas are Belle Glade which includes the South Bay area and Pahokee which includes the Canal Point area.

The PBCWUD's wastewater collection system is comprised of gravity mains, force mains, lift stations and master pump stations located throughout its service area. There are a total of 101 stations in the Glades Service Area. There are a total of 95 lift stations (submersible) in the PBCWUD's Belle Glade and Pahokee service areas as shown in **Figure 7.2**. In addition to the 95 lift stations, there are two plant site lift stations at the Belle Glade Wastewater Treatment Facility (WWTF) and one plant site lift station at the Pahokee WWTF, an in-line booster (re-pump station) in South Bay and lift station No. 6069 that services the Palm Beach County Police Training Facility. Lift Station No. 6069 is located in the Belle Glade service area and is maintained by the Police Department. Palm Beach County Utilities Collection staff will make periodic station checks and advise the Police Department of needed repairs. Inspection of lift station No. 6069 was conducted to determine if the facility meets current Palm Beach County code requirements.

The 95 lift stations that make-up the majority of the Glade's Region wastewater collection system service area are broken out into four separate regions. The Belle Glade service area has a total of 46 lift stations in the Belle Glade region and nine lift stations in the South Bay region. The nine lift stations in the South Bay Region pump to a common in-line booster re-pump station that pumps directly to the Belle Glade WWTF. The Pahokee service area has 23 lift stations in the Pahokee Region and 17 grinder stations in the Canal Point Region.

Lift station types and sizes vary throughout the Glades Region collection system. Lift station capacities range from small 1-Hp simplex grinder pumps stations (8-gpm at 80 psi); up to 88-Hp submersible pumps capable of pumping 1,320 gpm at 50 psi. The majority of the stations located in the Glades Region wastewater collection service area are of the submersible or grinder type. Small capacity lift stations (satellite stations) collect wastewater from a particular building, strip center, or small development and pump it through a force main to larger stations (master stations). In both the Belle Glade and Pahokee service areas the flow from the satellite stations can be re-pumped up to four times before it is delivered to the Belle Glade WWTF or the Pahokee WWTF for treatment as shown in **Appendix 7-1** (diagram of lift station network).



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Environmental Engineers & Scientists

Figure 7.1 - Glades Region Wastewater Service Areas

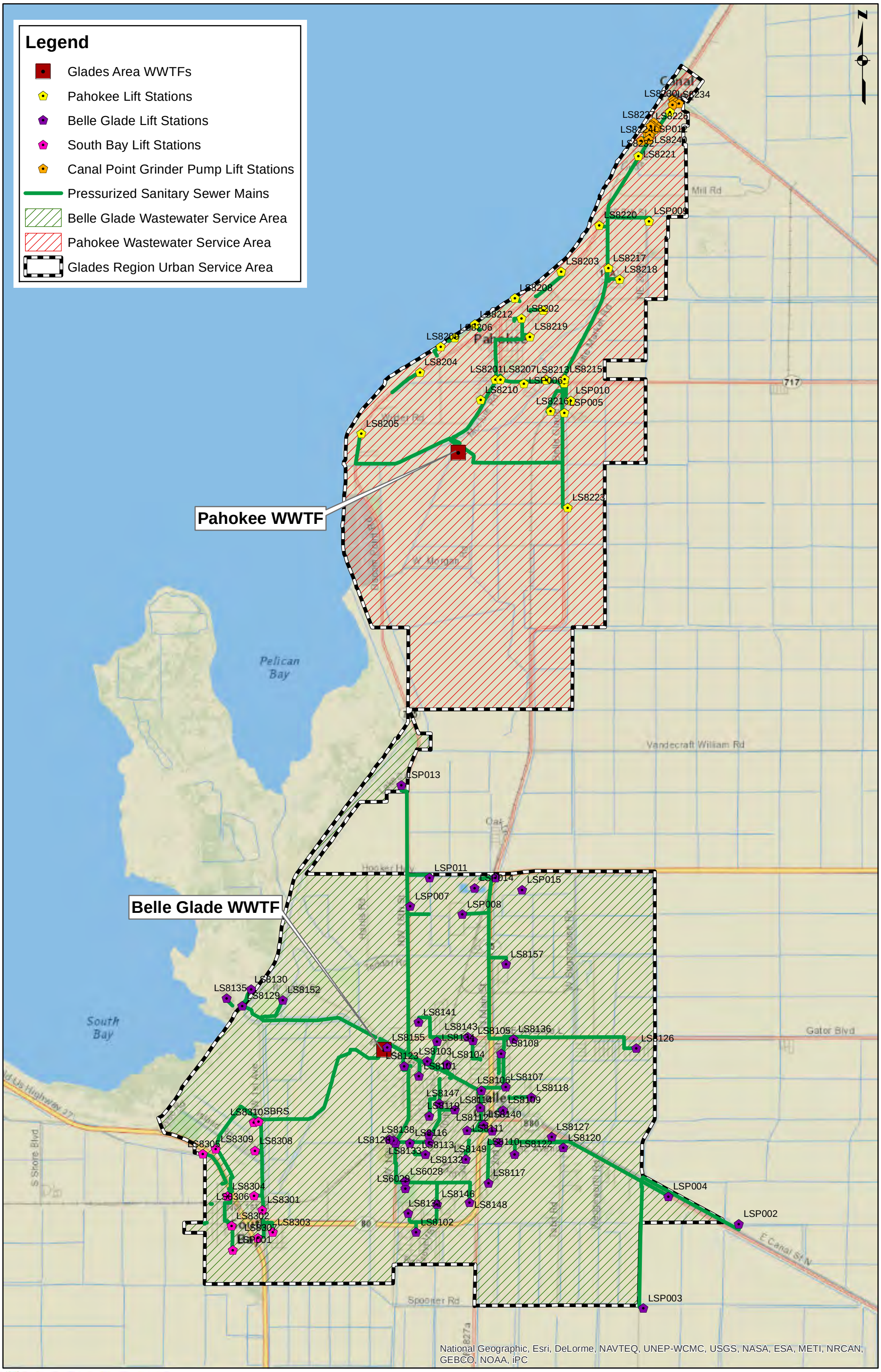

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Figure 7.2- Glades Region Lift Stations

LIFT STATION ANALYSIS

As discussed above, there are currently 95 lift stations located within the four regions (Canal Point, Pahokee, South Bay and Belle Glade) of the Belle Glade and Pahokee wastewater collection service areas. The analysis of these lift stations is presented with a general assessment of the lift station within each of the four regions followed by a detailed analysis based on the risk of failure.

Canal Point

The 17 Canal Point lift stations consist of two types of stations and are either simplex or duplex 1-Hp D-Series or W-Series grinder type lift stations manufactured by Environment One. The D-Series stations are self-contained grinder stations typically with small HDPE collection tanks of approximately 150 gallons that receives gravity flow from up to four sources. The pumps have internal check valves and there is a seal between the pumps / wet well and the top compartment of the tank. Most of these stations have been installed within the last five years and are in good mechanical and structural condition.

Environment One D-Series Grinder Station

D-Series Grinder Upper Compartment

The other type of grinder station is the W-Series stations manufactured by Environment One. These stations consist of a four foot diameter fiberglass wet well with one or two 4-inch inlets, two 1-Hp grinder submersible pumps and an aluminum wet well cover and access hatch. The wet wells of these stations are in good condition mechanically and structurally as they have typically been replaced within the last five years. The biggest problem with these stations (other than grease buildup) is the carbon steel 2-inch vents are rusted or missing from some of the stations.

Station power is provided by the local utility via a utility meter and a main circuit breaker. The control panel for these stations is provided by the packaged pump system supplier. The controls

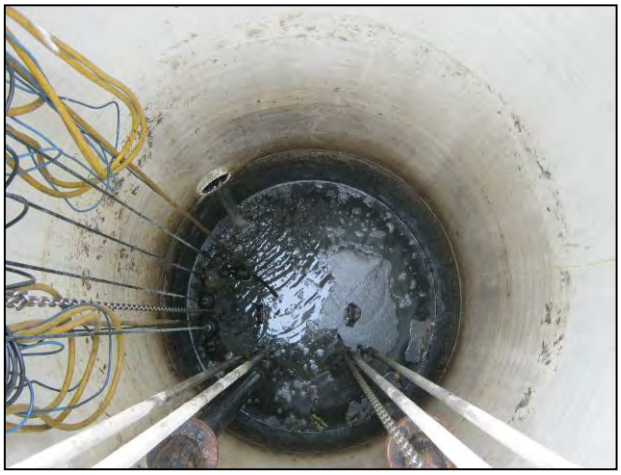
are housed in a fiber reinforced plastic (FRP) enclosure and are equipped with 30-Amp emergency generator receptacles, high level alarm beacons, motor starters and printed circuit boards for level control are housed in the control panels. Pump controls (on/off) are provided by internal pressure switches. The control panels were found to be in good condition although there are some minor issues with conduit separating from connectors and shrubs growing in front of the control panels.

Environment One W-Series FRP Lift Station

Typical FRP Lift Station Control Panel

Pahokee

There are a total of 23 lift stations in the Pahokee wastewater collection system. The wet wells range in size from four feet up to nine feet in diameter and are typically concrete except for some of the 4-foot diameter stations that have fiberglass wet wells. These lift stations are duplex stations with pumps ranging from 2-Hp up to 25-Hp. Some of the wet wells are in good condition because they are either fiberglass, or have a good liner or coating system. However, the majority of the wet wells have a coating or liner system that has failed and there is exposed concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete or exposed steel was observed during our inspections of the Pahokee lift stations. The top slabs of the wet wells appear to be in good condition. Lift station 8210 was observed to have a steady inflow of approximately 10 gpm. Utility staff reported that this station always has approximately the same inflow.



Typical Wet Well with Good Coating

Typical Wet Well with No Liner or Coating

The lift station pumps within the Pahokee stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. The discharge piping and valves appear to be in good condition. Most of the lift stations in the Pahokee collection system have aboveground discharge piping and no associated valve vault. Only stations 8204, 8208, 8212, and 8213 have valve vaults. Most of the piping systems appear to have a good protective coating on them with only minor rust on the discharge piping that is located aboveground. Most of the rust and corrosion on the discharge piping is on the piping inside the wet wells. Although most of the discharge piping systems have a coating system there was evidence of some rust and corrosion inside the wet wells. Most of the pipe supports are not actually supporting the discharge piping however the supports appear to be in good condition.

Station power is provided by the local utility via a utility meter and a main circuit breaker. All control panels for lift stations are custom made and constructed of stainless steel except station 8223. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters. Floats are used at the stations for pump on/off control and to monitor high wet well levels. The control panels are in good condition. Station 8223 control panel is constructed of FRP and is in fair condition. The control panel is installed 24 inches from the wet well opening. This is a code violation and needs to be relocated to provide the 36 inches of clearance required. It is recommended that this control panel be replaced and installed to meet national electrical code (NEC) requirements. Gas seal-off fittings at stations 8201, 8208, 8210, and 8214 are either missing or not filled and need to be corrected. Other minor issues include gaskets on main breaker enclosures in several lift stations are compromised allowing water intrusion and broken alarm lights.

Typical Lift Station in Good Condition

Lift Station with Fall Protection

South Bay

There are a total of nine lift stations and one in-line booster re-pump station in the South Bay wastewater collection system. The wet wells range in size from 5 feet up to 10 feet in diameter and are all concrete. These lift stations are duplex stations with pumps ranging from 5 Hp up to 88 Hp. Some of the wet wells have a liner or coating system and some have no coating or liner. Most of the coating or liner systems that do exist have failed and there is exposed aggregate in the concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete was observed during our inspections of the South Bay lift stations. However, several of the lift stations have exposed steel near the top slab or in the top slab of the wet well. Some of the valve vaults are in very bad condition due to differential settlement and have started to break apart.

Valve Vault that has Failed in South Bay

Failing Wet Well Top Slab in South Bay

The lift station pumps within the South Bay stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. It was reported that typical past problems were associated with electrical issues and not mechanical related issues. The discharge piping and valves appear to be in bad condition. Most of the lift stations have valve vaults and the only station with aboveground discharge piping is station 8304. The aboveground discharge piping and valve system appears to have a good protective coating with only minor rust. However, most of the rust and corrosion on the discharge piping and valves occurs on the piping inside the wet wells or inside the valve vaults. This piping does not have a coating system or it has failed and the piping and valves are rusted and corroded badly.

Failed Liner and Severe Pipe Corrosion

Failing Control Panel in South Bay

Station power is provided by the local utility via a utility meter and a main circuit breaker. The control panels for lift stations are custom made and constructed of stainless steel. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters. Floats are used at the stations for pump on/off control and to monitor high wet well levels. The control panels are in good condition with the exception of stations 8303, 8305, and 8307. The control panels for these stations are old painted sheet steel and are rusted. It is highly recommended that these panels be replaced. Other issues include gas seal-off fittings are either not filled or missing at several stations. At station 8305, the pump power cable is lying on top of the ground and passes through a hole in the wet well access hatch.

The South Bay in-line booster station re-pumps all of the South Bay wastewater collection system flow from the nine lift stations directly to the Belle Glade WWTF. It is equipped with three 60 Hp vertical non-clog pumps. The booster station was placed into operation August 25th, 2010 and is in good condition. There is no wet well and only minor rust on the suction and discharge piping.

Mechanically, the biggest issue is the pump suction reducers are concentric instead of eccentric. However, no operational issues were reported with this station.

It should be noted that lift stations 8302, 8303, 8304 and 8307 are in the process of being upgraded.

South Bay In-line Booster Repump Station

South Bay In-line Booster Control Panels

Belle Glade

There are a total of 46 lift stations in the Belle Glade wastewater collection system. The wet wells range in size from 3.5 feet up to 11 feet in diameter and are all concrete. Lift station 8101 is a master station that is rectangular, 10 feet by 12 feet, and is equipped with four 20-Hp submersible pumps. The rest of the lift stations are duplex stations with pumps ranging in size from 2-Hp up to 51-Hp. Some of the wet wells have a liner or coating system but most have no coating or liner system. Most of the wet wells with a coating or liner systems have failed and there is exposed aggregate in the concrete. Soundings were done on exposed concrete to check for soft concrete. No evidence of soft concrete was observed during our inspections of the Belle Glade lift stations. However, several of the lift stations have exposed steel in the walls, and near the top slab or in the top slab of the wet well. Exposed brick and mortar was observed in several wet wells mainly at pipe penetrations and near the top of the wet well. Some of the valve vaults are in bad condition due to differential settlement and have started to break apart or do not have any protective coating on the exposed concrete. During our field inspections (May 1st through May 3rd 2013) of the Belle Glade collection system, 25 lift stations were observed to have some steady clear inflow. The inflow rate was estimated to range from approximately 5 gpm up to 200 gpm with several stations having an inflow of roughly 100 gpm.

Typical Exposed Steel and Corrosion in Wet Well

Failing Guide Rails and Wet Well Inflow

The lift station pumps within the Belle Glade lift stations are generally in good working order. Most of the stations don't have detailed information so the age of the pumps could not be determined during our inspections. It was reported that typical past problems were associated with only a few stations and they were both mechanical and electrical in nature. The discharge piping and valves appear to be in bad condition. Most of the lift stations have valve vaults; only stations 8112 and 8129 have discharge piping aboveground. The aboveground discharge piping and valve systems appear to have some protective coating on them but still have some minor rust and corrosion. Most of the rust and corrosion on the discharge piping and valves occurs on the piping inside the wet wells or inside the valve vaults. Most of the piping inside the wet wells or value vaults does not have a coating system, or the coating system has failed and the piping and valves are rusted and corroded badly.

Failing Brick and Mortar around Discharge Pipes

Discharge Pipe Leaking due to Corrosion

It should be noted that several of the existing lift stations in the Belle Glade collection system are in the process of being upgraded, they include; lift stations 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, and 8149.

Station power is provided by the local utility via a utility meter and a main circuit breaker. All control panels for lift stations are custom made and constructed of stainless steel. The controls are housed within the enclosures and are equipped with emergency generator receptacles, high level alarm beacons, and motor starters for level control. Floats are predominantly used at the stations for pump on/off control and to monitor for high wet well levels, however, a few stations use ultrasonic level controllers and others use conductive probe level controllers. Most of the existing control panels are in bad condition and have been replaced or are currently being replaced. Therefore, most of the control panels will be in good condition as soon as the new panels are placed into service. There are code issues with respect to working clearance in front of control panels at stations 8110, 8111, 8122, 8120. Minor issues also include gas seal-off fittings are either not filled or missing, ventilation fans added without louvers, and open unused holes in control panels.

Lift Station Rankings

To create a ranked or prioritized list of submersible lift station rehabilitation over the planning horizon, a method similar to the one used for the PBCWUD's wastewater master plan was utilized. A copy of the methodology used in included in **Appendix 7-2**. The method establishes a consequence of failure (COF) and the possibility of failure (POF) for each lift station. The total risk is then the product of the COF and the POF (Risk = COF x POF). In this evaluation the COF would be the sum total of the risk assessment factors, as the evaluated criteria shows the importance of each station as it relates to what would be the impact if it were to become non-operational. The POF would be the sum total of all the condition assessment factors as it provides a representation as to the condition of the lift station and probability that the station may become non-operational due to the physical condition of the station.

Results of the assessment suggest that 27 lift stations should be scheduled for rehabilitation / replacement within the next five years as shown in **Table 7.1**

Table 7.1
Summary of Lift Stations Scheduled for Rehabilitation / Replacement

Combined Risk and Condition Score	R&R Planning Year	Number of Lift Stations
110,000 to 60,000	2015	27
59,900 to 45,000	2020	27
44,900 to 30,000	2025	16
29,900 to 20,000	2030	23
19,000 to 17,000	2035	4

A cost estimate was prepared to assess the capital dollars needed for the planning horizon with emphasis on the next five years. **Table 7.2** presents a listing of stations and associated costs for rehabilitation / replacement over the next five years. Lift stations scheduled for rehabilitation / replacement beyond the next five years are grouped as shown.

Table 7.2

Capital Improvement Schedule thru 2030

PROJECT DESCRIPTION		IMPLEMENTATION SCHEDULE							
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
1.0 - Lines and Lifts			**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Years 6-10**	**Years 11-22**
7.1	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	**$4,111,250**	$4,111,250	$0	$0	$0	$0	$0	$0
7.2	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	**$5,692,500**	$0	$5,692,500	$0	$0	$0	$0	$0
7.3	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	**$2,530,000**	$0	$0	$2,530,000	$0	$0	$0	$0
7.4	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	**$2,530,000**	$0	$0	$0	$2,530,000	$0	$0	$0
7.5	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	**$2,530,000**	$0	$0	$0	$0	$2,530,000	$0	$0
7.6	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	**$4,743,750**	$0	$0	$0	$0	$0	$4,743,750	$0
7.7	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	**$4,117,000**	$0	$0	$0	$0	$0	$0	$4,117,000
Total Estimated Annual Costs		***$26,254,500***	*$4,111,250*	*$5,692,500*	*$2,530,000*	*$2,530,000*	*$2,530,000*	*$4,743,750*	*$4,117,000*

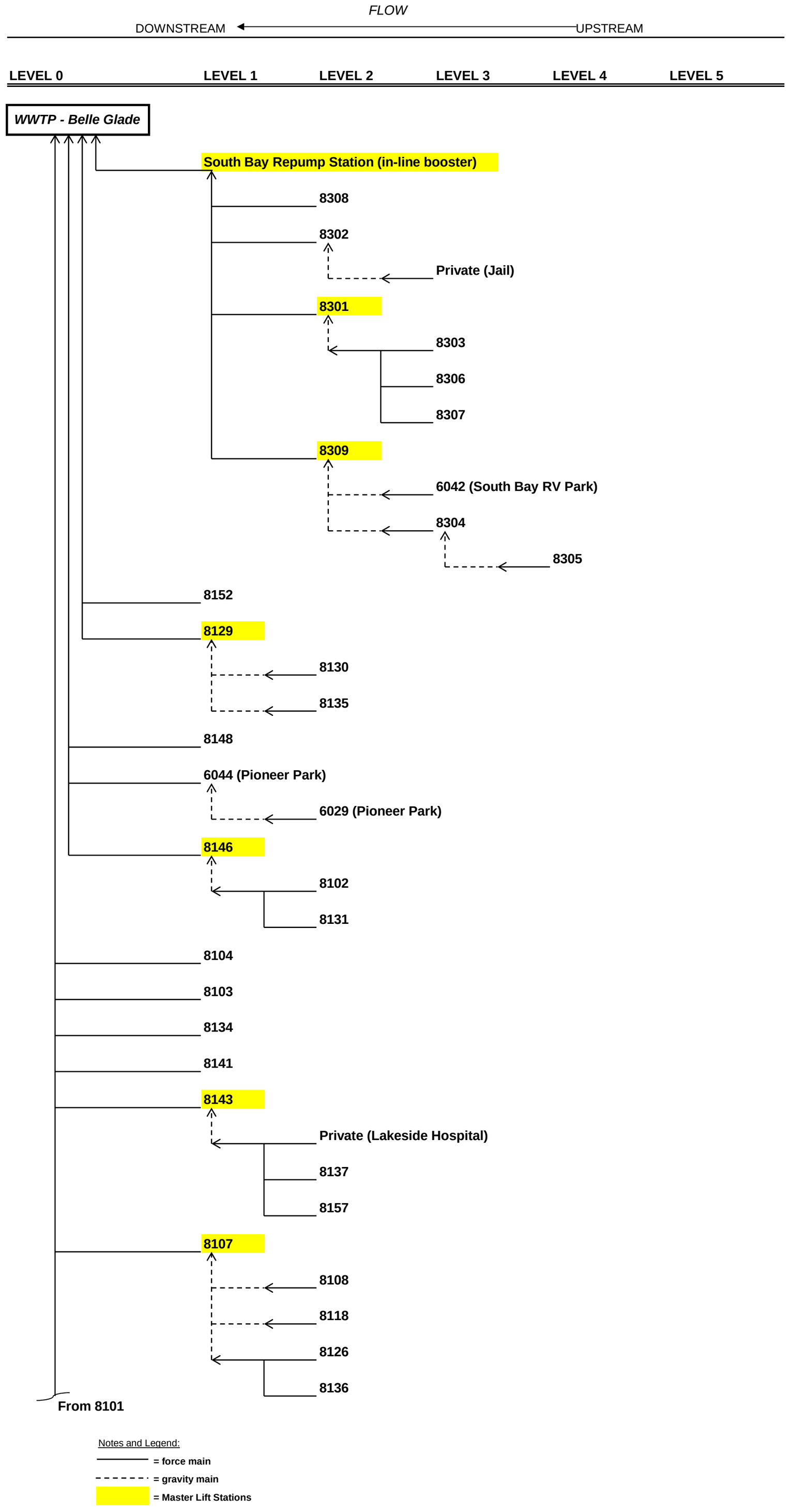
Costs based on an estimated cost of $275,000 for construction and $41,250 for engineering services ($316,250 per lift station)

Costs for Grinder Lift Stations estimated at $65,000 for construction and $9,750 for engineering services ($74,750 per grinder station)

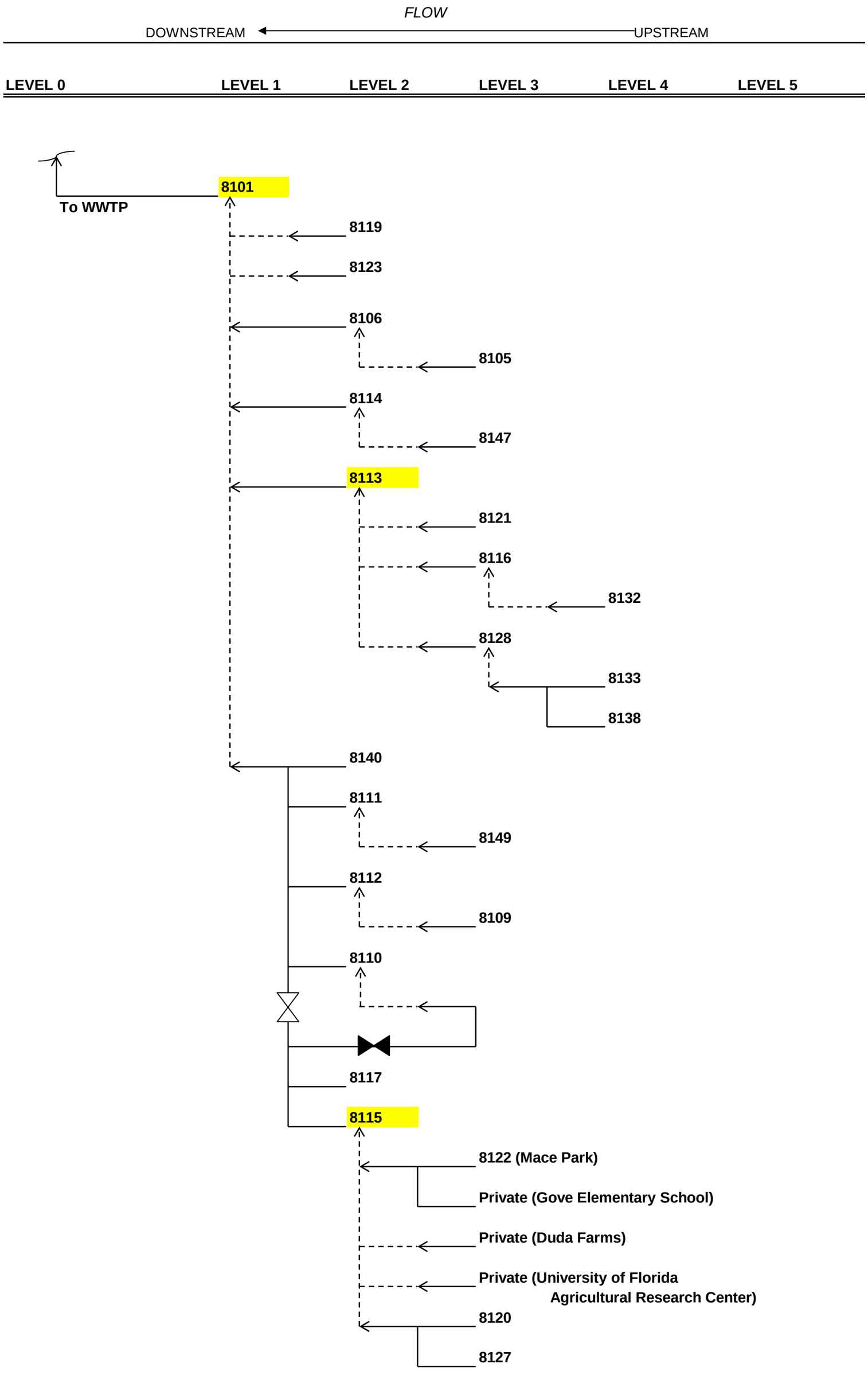
APPENDIX 7-1

Glades Region Lift Station Schematic

Belle Glade Wastewater Collection and Pumping Schematic



Belle Glade Wastewater Collection and Pumping Schematic



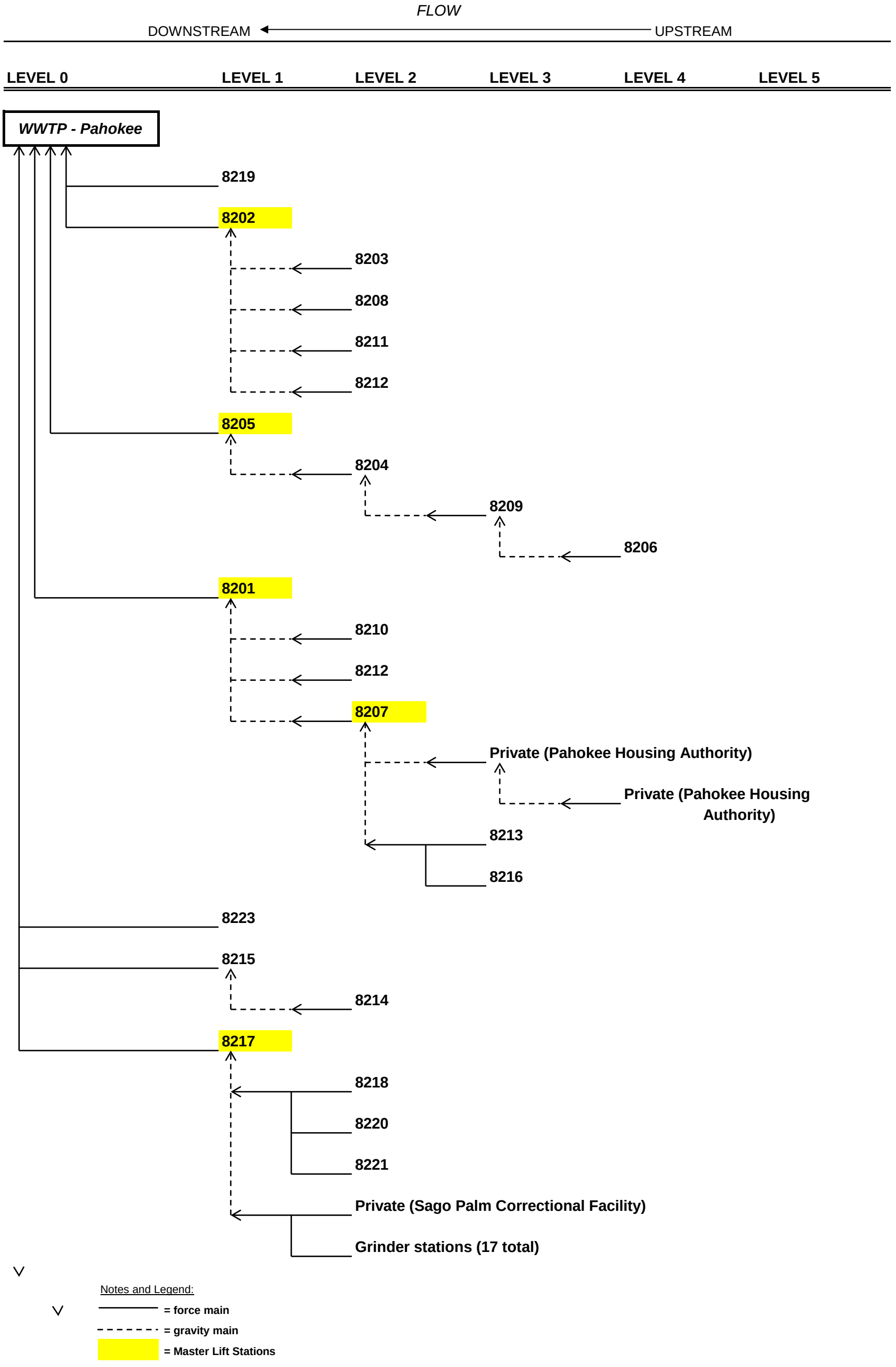
Notes and Legend:

= force main

= gravity main

= Master Lift Stations

Figure 7.3
Pahokee Wastewater Collection and Pumping Schematic



APPENDIX 7-2

Glades Region Lift Station Assessment Data

Lift Station Assessment

Lift Station Rankings

To create a ranked or prioritized list of submersible lift station rehabilitation over the planning horizon, a method similar to the one used for the PBCWUD'S wastewater master plan was utilized. This method establishes a consequence of failure (COF) and the possibility of failure (POF) for each lift station. The total risk is then the product of the COF and the POF (Risk = COF x POF). In this evaluation the COF would be the sum total of the risk assessment factors, as the evaluated criteria shows the importance of each station as it relates to what would be the impact if it were to become non-operational. The POF would be the sum total of all the condition assessment factors as it provides a representation as to the condition of the lift station and probability that the station may become non-operational due to the physical condition of the station. This assessment was used to rank the lift stations in order of priority of need of rehabilitation. This ranking formulation for the lift stations has been established to quickly assess the condition and need of rehabilitation for each lift station within the Glade's Region service area.

The following categories and associated weighted scoring was evaluated for each of the lift stations as it relates to risk:

Classification and Scoring of Risk Assessment (COF)

1. Service Area Risk Classifications: (90 points)
   - Low = Satellite Station that services residential area only.
   - Medium = Satellite Station that services residential and some small commercial facilities.
   - High = Master Lift Station or Satellite Station that services large commercial facilities, hotels, hospitals, nursing homes, schools, or correctional facilities.
2. Environmental Risk Classifications: (90 points)
   - Low = An overflow would cause Low environmental impact.
   - Medium = An overflow would result in medium environmental impact (i.e. could potentially enter storm system, etc.).
   - High = An overflow would result in a major environmental impact (i.e. directly adjacent to surface waters, protected wetlands, etc.
3. Wet Well Overflow Risk: This is the approximate time before an overflow would occur if there is no power to the lift station during peak flows. (30 points)
   - Low = Overflow would occur after 60 minutes.
   - Medium = Overflow would occur between 30 and 60 minutes.
   - High = Overflow would occur in less than 30 minutes.
4. Pump Failure Risk: This risk assessment takes into consideration two questions. What is the age of the pumps vs. the estimated useful life? Does the pump station have a standby pump waiting on a shelf? The pump failure risk has been classified as follow. Useful life of pump shall be assumed to be 10 years: (30 points)
   - Low = Has a standby pump and the pumps have at least 80% of useful life left (Pumps are less than two years old - either purchased as new or from last refurbishment).
   - Medium = No standby pump and/or pumps have more than 50% of useful life left (Pumps are less than five years old - either purchased as new or from last refurbishment).
   - High = No standby pump and pumps have less than 50% of useful life left (Are more than five years old - either purchased as new or from last refurbishment) or pumps have condition (high head/high torque) that substantially decrease life expectancy of pump.

5. Power Outage Risk Classifications: (30 points)
    - Low = Has a permanent skid mounted backup generator that is in good condition.
    - Medium = Has a generator receptacle and a portable generator available for use.
    - High = Has a permanent skid mounted backup generator that is in poor condition.
6. Security Risk: This assessment takes into account the condition of security fencing, adequate lighting, generator in enclosure, controls in enclosure, and locks where applicable. The security risk has been classified as follows (30 points)
    - Low = Has all of these features where applicable and all are in good condition.
    - Medium = Either is missing one or more security features if should be applicable OR the security features are inadequate or in poor condition.
    - High = Is both missing security features and has security features that are inadequate or in poor condition.
7. Safety Risk: This assessment takes into account station features that could potentially create unsafe conditions for operators and maintenance staff. Examples include: appropriate signage, adequate fall protection provisions, and space to maneuver maintenance vehicle, fencing, trip hazards and overhead power lines. The safety risk has been classified as follows: (60 points)
    - Low = No station features create an unsafe working environment. All features are in good condition.
    - Medium = Only two station features create an unsafe working environment.
    - High = More than two station feature creates and unsafe working environment.
8. Maintenance Risk: This assessment takes into account environmental features that could potentially decrease the useful life of equipment. Examples are overhead tree canopies, roots from trees, overgrown vegetation nearby, rats causing damage to equipment, and exposed items that are subject to corrosion. Maintenance risk has been classified as follows: (30 points)
    - Low = No environmental features create a maintenance risk.
    - Medium = Only one environmental feature creates a maintenance risk.
    - High = More than one environmental feature creates a maintenance risk.
9. Community Impact Risk: This assessment takes into account political impacts associated in the event of an overflow, odor issues, or a service interruption. (60 points)
    - Low = An overflow or service interruption would have little or no impact.
    - Medium = An overflow or service interruption would have medium impact.
    - High = An overflow or service interruption would have high impact (news coverage, etc.).

Risk Score: The risk score is the product of the assessment category importance and the assessment rating. Each assessment category was assigned an importance. The importance is the maximum "score" any one lift station can get for that category. The amount of points per category is determined using a ratio based on the risk assessment.

- A High risk ranking yields the highest score, which is 3/3 or all of the total allowable points for that category.
- A Medium risk ranking yields 2/3 of the allowable points.
- A Low risk ranking yields 1/3 of the allowable points

Thus, the higher the score means there is more risk associated with that lift station.

Assessment Category	Relative Importance of Assessment Category (30-90 points)
Service Area Risk	90
Environmental Risk	90
Wet Well Overflow Risk	30
Pump Failure Risk	30
Power Outage Risk	30
Security Risk	30
Safety Risk	60
Maintenance Risk	30
Community Impact Risk	60
Risk Total Possible Score	**450**

The following categories and associated weighted scoring was evaluated for each of the lift stations as it relates to condition assessment:

Classification and Scoring of Condition Assessment (POF)

1. Wet Well Condition: (60 points)
   - Good = No visible peeling of the coating and no visible leaks.
   - Fair = No visible leaks. Up to 20% of the coating shows peeling.
   - Poor = At least two or more of the following conditions: Extensive peeling of wet well coating or no coating at all, no drop pipe for invert with turbulent conditions, grout is visible, rebar exposed, joints exposed, visible holes, root intrusion.
2. Panel Condition: (60 points)
   - Good = Control panel is in good condition and meets current standards.
   - Fair = Not up to current standards but still functioning properly.
   - Poor = At least two or more of the following conditions: Not made of stainless steel, rust visible, leaks, panel is undersized/oversized, extensive corrosion, supports in poor condition, conduit undersized, slab cracked, conduit cracked, obsolete parts for older control panels.
3. Valve Vault Condition: (30 points)
   - Good = No visible peeling of the coating and no visible leaks.
   - Fair = No visible leaks. Up to 20% of the coating shows peeling.
   - Poor = At least two or more of the following conditions: Extensive peeling of coating or no coating at all, pump out is in valve vault, rebar exposed, joints exposed, visible holes, root intrusion.
4. Discharge Pipe Condition: (90 points)
   - Good = Pipes are new (less than 2 years old) in non-corrosive environment.
   - Fair = Coating is intact, pipes are under 20 years old.
   - Poor = At least one or more of the following conditions: No coating on metal pipes in corrosive environment, gasket failure, loose or missing rails and supports, pumping conditions can cause damage to pipe.

5. Valves Condition: (60 points)
    - Good = Valves working as intended, exterior free of corrosion.
    - Fair = Valves working as intended, some corrosion visible on exterior of valves.
    - Poor = One or more of the following conditions: No isolation valve, excessive play in check valve arms, valves visibly leaking, short circuiting back into wet well.

Condition Score: The condition score is the product of the assessment category importance and the assessment rating. Each assessment category was assigned an importance. The importance is the maximum "score" any one lift station can get for that category. The amount of points per category is determined using a ratio based on the condition assessment.

- A Poor Condition ranking yields the highest score, which is 3/3 or all of the total allowable points for that category.
- A Fair Condition ranking yields 2/3 of the allowable points.
- A Good Condition ranking yields 1/3 of the allowable points.

Assessment Category	**Relative Importance of Assessment Category (30-90 points)**
Wet Well Condition	60
Panel Condition	60
Valve Vault Condition	30
Discharge Pipe Condition	90
Valves Condition	60
Condition Total Possible Score	**300**

Table 1 reflects the populated risk and condition assessment and associated total scoring for each of the submersible stations. The worst case score, in which a station that has the highest consequence of failure and also has the worst physical condition, would be 135,000, Lift stations that have a higher score consequently have a higher rank and therefore, the higher the rehabilitation priority.

Table 2 reflects the sorted and ranked assessment for all of the submersible stations. Based on this ranking we have prioritized the lift stations for rehabilitation in each of the four Glade's service area regions. **Tables 3, 4, 5 and 6** show the prioritized ranking of the lift stations for the four collection areas, Belle Glade, Pahokee, Canal Point and South Bay, respectively.

Based on the total combined score, "Risk" of failure, we have established a baseline repair and replacement (R&R) schedule for the PBCWUD'S planning horizon; 2015, 2020, 2025, 2030, and 2035. A range of scores was used to prioritize the R&R schedule in an effort to spread out the repair work over the planning horizon. **Table 7** reflects the R&R planning year schedule for all of the lift stations in the four collection areas and are summarized as follows:

Table 7.1
Summary of Lift Stations Scheduled for Rehabilitation / Replacement

Combined Risk and Condition Score	R&R Planning Year	Number of Lift Stations
110,000 to 60,000	2015	27
59,900 to 45,000	2020	27
44,900 to 30,000	2025	16
29,900 to 20,000	2030	23
19,000 to 17,000	2035	4

It should be noted that of the 13 lift stations that the PBCWUD is currently repairing in the South Bay and Belle Glade collection systems, lift stations 8303, 8304, 8113 and 8129 were not ranked in the top tier (planning year 2015). Lift Stations 8303, 8304 and 8129 are scheduled for repair in the 2020 Planning year. Lift station 8113, a master lift station, was under construction during our inspection and is scheduled for upgrade in 2025.

TABLE 1
Risk and Condition Assessment for Palm Beach County Glades Submersible Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8101	1	1401 NW Ave D/NW 14th Street	Submersible	H	M	H	M	M	H	H	M	H	390	F	P	P	P	P	280	109,200
8102	1	Raderville (cross the ditch)	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000
8103	1	West Canal St. North/NW 13th St.	Submersible	M	L	L	M	M	H	M	L	L	240	P	F	P	P	P	280	67,200
8104	1	NW 9th St. - by Wedgworth Fertilizer Plant	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000
8105	1	NW 4th Street (dead end)	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000
8106	1	NW 2nd Street/West Canal Street North	Submersible	M	M	M	M	M	H	M	L	M	300	P	P	P	P	P	300	90,000
8107	1	NE Ave B - between NE 2nd Street/North Main Street	Submersible	H	L	L	M	M	L	L	L	H	270	G	G	G	G	G	100	27,000
8108	1	NE 1st Street/NE Ave I (dead end)	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8109	1	SE 2nd Street/SE Ave B - cross front Dentist Office	Submersible	L	L	L	M	M	H	M	L	L	210	F	P	P	P	P	280	58,800
8110	1	SE Ave F - between SE 2nd Street/SE 3rd Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	P	P	260	49,400
8111	1	SW Ave F - between SW 3rd Street/SW 4th Street	Submersible	L	L	L	M	M	H	M	L	L	210	F	F	P	F	F	210	44,100
8112	1	SW 2nd Street/SW Ave B - rear of Haitian Church	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	P	F	200	38,000
8113	1	SW Ave F - between 10th St/SW 11th St - rear of Ms. Maude Vereen's house	Submersible	H	L	H	L	M	H	M	L	H	320	G	G	G	G	G	100	32,000
8114	1	SW Ave C- between SW 8th Street/SW 6th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	F	P	P	P	280	58,800
8115	1	Comer of SE Ave G/SE 4th Street	Submersible	H	L	H	M	M	H	M	L	H	330	P	P	P	P	P	300	99,000
8116	1	Front of 1300 SW Ave G (Mr. Butts house)	Submersible	L	L	L	M	M	H	M	L	M	230	P	P	P	P	P	300	69,000

TABLE 1
Risk and Condition Assessment for Palm Beach County Glades Submersible Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8117	1	SE Ave K/SE 2nd Street - rear of old Glades General Hospital	Submersible	L	M	L	M	M	H	L	L	L	220	P	G	P	P	P	260	57,200
8118	1	East Ave A (dead end/ off SE 7th Street)	Submersible	L	M	L	M	M	H	L	L	L	220	P	P	P	P	F	280	61,600
8119	1	Corner of SW Ave D/SW 12th Street	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	G	P	G	200	48,000
8120	1	Tillman Trailer Park - SE Ave G	Submersible	L	M	L	M	M	H	M	L	L	240	P	P	P	P	P	300	72,000
8121	1	SW Ave G (by canal) - off SW 10th Street	Submersible	L	M	L	M	M	L	M	L	L	220	P	F	G	P	G	220	48,400
8122	1	Mace Park (SE Avenue G)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	P	P	300	57,000
8123	1	NW Ave F Place/NW 17th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8126	1	NE Ave I/NE 28th Street (Arrowhead Estates)	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	F	F	F	200	38,000
8127	1	Comer of Ranchero Road /El Prado Road	Submersible	L	L	L	M	M	H	L	L	L	190	P	G	G	P	G	200	38,000
8128	1	SR 715 - east comer of Palm Beach Community College	Submersible	M	M	L	M	M	H	H	L	M	310	P	F	P	P	P	280	86,800
8129	1	Marina - rear	Submersible	M	M	L	M	M	H	M	L	L	270	G	F	G	F	F	170	45,900
8130	1	Marina - cross from Slim Fish camp	Submersible	M	M	L	M	M	M	M	L	M	280	P	F	P	P	P	280	78,400
8131	1	715 Trailer Park	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	P	P	P	260	49,400
8132	1	SW Ave I/SW 10th Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	F	P	P	P	280	53,200
8133	1	Rear of Diana's apt - off SR 715	Submersible	L	M	M	M	M	H	M	M	M	280	P	F	P	P	P	280	78,400
8134	1	NW 12th Street - front of ABC Bag & Crate Co	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8135	1	Marina- down from office	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8136	1	Glades Day School	Submersible	H	M	M	M	M	L	M	L	H	330	P	F	P	P	F	260	85,800

TABLE 1
Risk and Condition Assessment for Palm Beach County Glades Submersible Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8137	1	Glades Office building - off SR 715	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	F	F	210	39,900
8138	1	Rear of Gladeview Trailer Park (800 SW 16tn Street)	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	F	P	F	230	55,200
8140	1	City Hall - front	Submersible	H	M	M	M	M	H	L	L	H	330	P	P	G	G	G	180	59,400
8141	1	Crosby Mobile Home Park (rear)	Submersible	L	L	L	M	M	H	H	M	M	260	P	G	P	P	F	240	62,400
8143	1	NW Ave L - by Trade School	Submersible	H	M	H	M	M	H	M	L	H	360	P	P	F	P	F	270	97,200
8146	1	2601 South Main Street (rear of Glades Glenn)	Submersible	H	L	H	M	L	L	M	L	H	300	P	F	P	P	P	280	84,000
8147	1	SW 10th Street (Crossroad Academy Cafeteria)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	F	P	270	51,300
8148	1	Rear of Texaco - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000
8149	1	Rear of Winn Dixie - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	P	P	P	P	300	60,000
8150	1	Pistol range - rear of Public Services	Submersible	L	L	L	M	M	H	L	L	L	190	G	G	G	G	G	100	19,000
8152	1	Rear of old Drawbridge Rest	Submersible	L	L	L	M	M	M	L	L	L	180	G	F	F	G	G	130	23,400
8155	1	By truck wash in rear of Water Dist office	Submersible	M	L	L	M	M	M	L	L	L	210	P	F	F	F	F	220	46,200
8157	1	Business Park - US 441 North	Submersible	M	L	L	M	M	L	M	L	L	220	G	G	G	G	G	100	22,000
8201	2	East 7th Street/McClure Road	Submersible	H	L	H	M	M	L	M	L	H	310	F	P	G	F	G	190	58,900
8202	2	East 1st Street/Barfield Highway	Submersible	H	L	H	M	M	L	L	L	H	290	G	F	G	F	G	150	43,500
8203	2	1381 East Main Street	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8204	2	Good Shepherd Church, Bacom Point Road	Submersible	M	L	L	M	M	M	M	L	M	250	P	G	P	G	F	180	45,000
8205	2	Home Place/Bacom Point Road	Submersible	H	L	M	M	M	L	L	L	H	280	G	G	G	F	F	150	42,000

TABLE 1
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Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8206	2	Pahokee County Park Middle Camp Ground	Submersible	L	H	L	M	M	M	M	L	L	260	G	P	G	P	F	220	57,200
8207	2	McClure Road/Lake Avenue	Submersible	H	M	H	M	M	L	M	L	M	320	G	G	P	F	F	170	54,400
8208	2	Pahokee County Park (north of picnic area)	Submersible	L	H	L	M	M	H	M	L	L	270	P	P	P	P	P	300	81,000
8209	2	Pahokee County Park (south camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	G	G	G	P	F	180	48,600
8210	2	McClure Road/South Coconut Road	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	F	F	170	32,300
8211	2	Pahokee High School/Fern Street	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	G	G	100	33,000
8212	2	Pahokee County Park (north camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	P	G	F	G	F	170	45,900
8213	2	East 7tll Street/ Apple A venue	Submersible	L	L	L	M	M	H	L	L	L	190	G	F	G	P	F	200	38,000
8214	2	Muck City/Seville Streamline Road	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8215	2	State Market Road (Streamline Water Tower)	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	F	G	130	26,000
8216	2	86th Street North/Glades Drive	Submersible	L	L	M	M	M	L	M	L	L	200	G	G	G	F	F	150	30,000
8217	2	640 Market Road/County Barn	Submersible	H	M	M	H	H	L	M	L	H	350	G	G	G	F	G	130	45,500
8218	2	Boone A venue	Submersible	M	M	M	M	M	L	M	L	M	280	G	G	G	G	G	100	28,000
8219	2	260 Barfield Highway (Nursing Home)	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	F	G	130	42,900
8220	2	2500 East Main Street (Pedestal Water Tower)	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8221	2	Keen Mobile Home Park	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	G	G	100	20,000
8222	2	Canal Point Elementary School	Submersible	H	H	M	M	M	L	M	L	H	360	G	G	G	G	G	100	36,000
8223	2	7450 US Highway 441 (New Hope Charities)	Submersible	M	L	M	M	M	L	M	M	M	260	P	F	G	P	F	240	62,400
8224	3	12101 US HWY 441 (Apt. Bldg)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000

TABLE 1
Risk and Condition Assessment for Palm Beach County Glades Submersible Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8225	3	12065 Lakeshore Dr (Ferguson Towing)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8226	3	12209 Lakeshore Dr (Trailer Park)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8227	3	12225 Lakeshore Dr {Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	F	G	G	G	G	120	24,000
8228	3	12275 Lakeshore Dr (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8229	3	12570 US Hwy 441 (Post Office)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8230	3	37040 Old Conner Hwy (Old Fire Station)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8231	3	37071 US Hwy 441/98 (Store On The Corner)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8232	3	12165 Lakesore Dr (Packing House)	Submersible	M	L	M	L	M	M	M	L	L	230	G	F	G	G	G	120	27,600
8233	3	12531 Everglades St (Fruit Stand)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8234	3	12509 US Hwy 441 (Granados Furniture Store)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8235	3	37280 Okeechobee Ave (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8236	3	37300 Okeechobee Ave (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8237	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8238	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8239	3	12147 US Hwy 441 (Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8240	3	12133 US Hwy 441 (Trailer Park Beside Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000

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Risk and Condition Assessment for Palm Beach County Glades Submersible Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8301	4	NW 1st Avenue (Water Tower adjacent to Master Water Meter)	Submersible	H	M	H	M	M	L	M	H	H	360	G	G	G	P	F	180	64,800
8302	4	SW 7th Avenue	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8303	4	SE 2nd Avenue	Submersible	L	L	L	M	M	M	M	M	L	210	P	P	P	P	F	280	58,800
8304	4	Jimmie Lou Court	Submersible	M	M	M	M	M	M	M	H	M	310	P	F	G	F	G	190	58,900
8305	4	Henderson's Trailer Park	Submersible	L	M	M	M	M	M	H	H	M	300	P	P	P	P	P	300	90,000
8306	4	Glades Pre-cooler (South Bay Growers)	Submersible	M	M	M	M	M	M	M	L	H	310	P	G	P	P	P	260	80,600
8307	4	City Hall (South Bay)	Submersible	M	L	M	M	M	M	H	H	H	320	P	P	P	P	F	280	89,600
8308	4	Villa Lago	Submersible	L	L	L	M	M	L	M	L	M	210	G	G	F	P	P	210	44,100
8309	4	Adjacent to GR's Truck Stop	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8310	4	Repump	Submersible	H	H	L	M	M	L	L	L	H	330	G	G	G	G	G	100	33,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8101	1	1401 NW Ave D/NW 14th Street	Submersible	H	M	H	M	M	H	H	M	H	390	F	P	P	P	P	280	109,200
8115	1	Comer of SE Ave G/SE 4th Street	Submersible	H	L	H	M	M	H	M	L	H	330	P	P	P	P	P	300	99,000
8143	1	NW Ave L - by Trade School	Submersible	H	M	H	M	M	H	M	L	H	360	P	P	F	P	F	270	97,200
8305	4	Henderson's Trailer Park	Submersible	L	M	M	M	M	M	H	H	M	300	P	P	P	P	P	300	90,000
8106	1	NW 2nd Street/West Canal Street North	Submersible	M	M	M	M	M	H	M	L	M	300	P	P	P	P	P	300	90,000
8307	4	City Hall (South Bay)	Submersible	M	L	M	M	M	M	H	H	H	320	P	P	P	P	F	280	89,600
8128	1	SR 715 - east comer of Palm Beach Community College	Submersible	M	M	L	M	M	H	H	L	M	310	P	F	P	P	P	280	86,800
8136	1	Glades Day School	Submersible	H	M	M	M	M	L	M	L	H	330	P	F	P	P	F	260	85,800
8309	4	Adjacent to GR's Truck Stop	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8302	4	SW 7th Avenue	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8146	1	2601 South Main Street (rear of Glades Glenn)	Submersible	H	L	H	M	L	L	M	L	H	300	P	F	P	P	P	280	84,000
8135	1	Marina- down from office	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8134	1	NW 12th Street - front of ABC Bag & Crate Co	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8208	2	Pahokee County Park (north of picnic area)	Submersible	L	H	L	M	M	H	M	L	L	270	P	P	P	P	P	300	81,000
8306	4	Glades Pre-cooler (South Bay Growers)	Submersible	M	M	M	M	M	M	M	L	H	310	P	G	P	P	P	260	80,600
8133	1	Rear of Diana's apt - off SR 715	Submersible	L	M	M	M	M	H	M	M	M	280	P	F	P	P	P	280	78,400
8130	1	Marina - cross from Slim Fish camp	Submersible	M	M	L	M	M	M	M	L	M	280	P	F	P	P	P	280	78,400
8105	1	NW 4th Street (dead end)	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000
8104	1	NW 9th St. - by Wedgworth Fertilizer Plant	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8120	1	Tillman Trailer Park - SE Ave G	Submersible	L	M	L	M	M	H	M	L	L	240	P	P	P	P	P	300	72,000
8116	1	Front of 1300 SW Ave G (Mr. Butts house)	Submersible	L	L	L	M	M	H	M	L	M	230	P	P	P	P	P	300	69,000
8103	1	West Canal St. North/NW 13th St.	Submersible	M	L	L	M	M	H	M	L	L	240	P	F	P	P	P	280	67,200
8301	4	NW 1st Avenue (Water Tower adjacent to Master Water Meter)	Submersible	H	M	H	M	M	L	M	H	H	360	G	G	G	P	F	180	64,800
8223	2	7450 US Highway 441 (New Hope Charities)	Submersible	M	L	M	M	M	L	M	M	M	260	P	F	G	P	F	240	62,400
8141	1	Crosby Mobile Home Park (rear)	Submersible	L	L	L	M	M	H	H	M	M	260	P	G	P	P	F	240	62,400
8118	1	East Ave A (dead end/ off SE 7th Street)	Submersible	L	M	L	M	M	H	L	L	L	220	P	P	P	P	F	280	61,600
8149	1	Rear of Winn Dixie - off South Main	Submersible	L	L	L	M	M	M	M	L	L	200	P	P	P	P	P	300	60,000
8140	1	City Hall - front	Submersible	H	M	M	M	M	H	L	L	H	330	P	P	G	G	G	180	59,400
8304	4	Jimmie Lou Court	Submersible	M	M	M	M	M	M	M	H	M	310	P	F	G	F	G	190	58,900
8201	2	East 7th Street/McClure Road	Submersible	H	L	H	M	M	L	M	L	H	310	F	P	G	F	G	190	58,900
8303	4	SE 2nd Avenue	Submersible	L	L	L	M	M	M	M	M	L	210	P	P	P	P	F	280	58,800
8114	1	SW Ave C- between SW 8th Street/SW 6th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	F	P	P	P	280	58,800
8109	1	SE 2nd Street/SE Ave B - cross front Dentist Office	Submersible	L	L	L	M	M	H	M	L	L	210	F	P	P	P	P	280	58,800
8206	2	Pahokee County Park Middle Camp Ground	Submersible	L	H	L	M	M	M	M	L	L	260	G	P	G	P	F	220	57,200
8117	1	SE Ave K/SE 2nd Street - rear of old Glades General Hospital	Submersible	L	M	L	M	M	H	L	L	L	220	P	G	P	P	P	260	57,200
8122	1	Mace Park (SE Avenue G)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	P	P	300	57,000
8148	1	Rear of Texaco - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8102	1	Raderville (cross the ditch)	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000
8138	1	Rear of Gladeview Trailer Park (800 SW 16tn Street)	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	F	P	F	230	55,200
8123	1	NW Ave F Place/NW 17th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8108	1	NE 1st Street/NE Ave I (dead end)	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8207	2	McClure Road/Lake Avenue	Submersible	H	M	H	M	M	L	M	L	M	320	G	G	P	F	F	170	54,400
8132	1	SW Ave I/SW 10th Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	F	P	P	P	280	53,200
8147	1	SW 10th Street (Crossroad	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	F	P	270	51,300
8131	1	715 Trailer Park	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	P	P	P	260	49,400
8110	1	SE Ave F - between SE 2nd Street/SE 3rd Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	P	P	260	49,400
8209	2	Pahokee County Park (south camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	G	G	G	P	F	180	48,600
8121	1	SW Ave G (by canal) - off SW 10th Street	Submersible	L	M	L	M	M	L	M	L	L	220	P	F	G	P	G	220	48,400
8119	1	Corner of SW Ave D/SW 12th Street	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	G	P	G	200	48,000
8155	1	By truck wash in rear of Water Dist office	Submersible	M	L	L	M	M	M	L	L	L	210	P	F	F	F	F	220	46,200
8212	2	Pahokee County Park (north camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	P	G	F	G	F	170	45,900
8129	1	Marina - rear	Submersible	M	M	L	M	M	H	M	L	L	270	G	F	G	F	F	170	45,900
8217	2	640 Market Road/County Barn	Submersible	H	M	M	H	H	L	M	L	H	350	G	G	G	F	G	130	45,500
8204	2	Good Shepherd Church, Bacom Point Road	Submersible	M	L	L	M	M	M	M	L	M	250	P	G	P	G	F	180	45,000
8308	4	Villa Lago	Submersible	L	L	L	M	M	L	M	L	M	210	G	G	F	P	P	210	44,100

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8111	1	SW Ave F - between SW 3rd Street/SW 4th Street	Submersible	L	L	L	M	M	H	M	L	L	210	F	F	P	F	F	210	44,100
8202	2	East 1st Street/Barfield Highway	Submersible	H	L	H	M	M	L	L	L	H	290	G	F	G	F	G	150	43,500
8219	2	260 Barfield Highway (Nursing Home)	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	F	G	130	42,900
8205	2	Home Place/Bacom Point Road	Submersible	H	L	M	M	M	L	L	L	H	280	G	G	G	F	F	150	42,000
8137	1	Glades Office building - off SR 715	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	F	F	210	39,900
8213	2	East 7tll Street/ Apple A venue	Submersible	L	L	L	M	M	H	L	L	L	190	G	F	G	P	F	200	38,000
8127	1	Comer of Ranchero Road /El Prado Road	Submersible	L	L	L	M	M	H	L	L	L	190	P	G	G	P	G	200	38,000
8126	1	NE Ave I/NE 28th Street (Arrowhead Estates)	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	F	F	F	200	38,000
8112	1	SW 2nd Street/SW Ave B - rear of Haitian Church	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	P	F	200	38,000
8222	2	Canal Point Elementary School	Submersible	H	H	M	M	M	L	M	L	H	360	G	G	G	G	G	100	36,000
8310	4	Repump	Submersible	H	H	L	M	M	L	L	L	H	330	G	G	G	G	G	100	33,000
8211	2	Pahokee High School/Fern Street	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	G	G	100	33,000
8210	2	McClure Road/South Coconut Road	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	F	F	170	32,300
8113	1	SW Ave F - between 10th St/SW 11th St - rear of Ms. Maude Vereen's house	Submersible	H	L	H	L	M	H	M	L	H	320	G	G	G	G	G	100	32,000
8216	2	86th Street North/Glades Drive	Submersible	L	L	M	M	M	L	M	L	L	200	G	G	G	F	F	150	30,000
8218	2	Boone A venue	Submersible	M	M	M	M	M	L	M	L	M	280	G	G	G	G	G	100	28,000

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8232	3	12165 Lakesore Dr (Packing House)	Submersible	M	L	M	L	M	M	M	L	L	230	G	F	G	G	G	120	27,600
8107	1	NE Ave B - between NE 2nd Street/North Main Street	Submersible	H	L	L	M	M	L	L	L	H	270	G	G	G	G	G	100	27,000
8215	2	State Market Road (Streamline Water Tower)	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	F	G	130	26,000
8235	3	37280 Okeechobee Ave (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8234	3	12509 US Hwy 441 (Granados Furniture Store)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8227	3	12225 Lakeshore Dr {Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	F	G	G	G	G	120	24,000
8225	3	12065 Lakeshore Dr (Ferguson Towing)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8152	1	Rear of old Drawbridge Rest	Submersible	L	L	L	M	M	M	L	L	L	180	G	F	F	G	G	130	23,400
8157	1	Business Park - US 441 North	Submersible	M	L	L	M	M	L	M	L	L	220	G	G	G	G	G	100	22,000
8240	3	12133 US Hwy 441 (Trailer Park Beside Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8239	3	12147 US Hwy 441 (Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8238	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8237	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8236	3	37300 Okeechobee Ave (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8233	3	12531 Everglades St (Fruit Stand)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000

TABLE 2
Ranking by total score

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8231	3	37071 US Hwy 441/98 (Store On The Corner)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8230	3	37040 Old Conner Hwy (Old Fire Station)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8229	3	12570 US Hwy 441 (Post Office)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8228	3	12275 Lakeshore Dr (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8226	3	12209 Lakeshore Dr (Trailer Park)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8224	3	12101 US HWY 441 (Apt. Bldg)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8221	2	Keen Mobile Home Park	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	G	G	100	20,000
8150	1	Pistol range - rear of Public Services	Submersible	L	L	L	M	M	H	L	L	L	190	G	G	G	G	G	100	19,000
8220	2	2500 East Main Street (Pedestal	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8214	2	Muck City/Seville Streamline Road	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8203	2	1381 East Main Street	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 3
Ranking For Belle Glade Lift Ststions

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8101	1	1401 NW Ave D/NW 14th Street	Submersible	H	M	H	M	M	H	H	M	H	390	F	P	P	P	P	280	109,200
8115	1	Comer of SE Ave G/SE 4th Street	Submersible	H	L	H	M	M	H	M	L	H	330	P	P	P	P	P	300	99,000
8143	1	NW Ave L - by Trade School	Submersible	H	M	H	M	M	H	M	L	H	360	P	P	F	P	F	270	97,200
8106	1	NW 2nd Street/West Canal Street North	Submersible	M	M	M	M	M	H	M	L	M	300	P	P	P	P	P	300	90,000
8128	1	SR 715 - east comer of Palm Beach Community College	Submersible	M	M	L	M	M	H	H	L	M	310	P	F	P	P	P	280	86,800
8136	1	Glades Day School	Submersible	H	M	M	M	M	L	M	L	H	330	P	F	P	P	F	260	85,800
8146	1	2601 South Main Street (rear of Glades Glenn)	Submersible	H	L	H	M	L	L	M	L	H	300	P	F	P	P	P	280	84,000
8134	1	NW 12th Street - front of ABC Bag & Crate Co	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8135	1	Marina- down from office	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200
8130	1	Marina - cross from Slim Fish camp	Submersible	M	M	L	M	M	M	M	L	M	280	P	F	P	P	P	280	78,400
8133	1	Rear of Diana's apt - off SR 715	Submersible	L	M	M	M	M	H	M	M	M	280	P	F	P	P	P	280	78,400
8104	1	NW 9th St. - by Wedgworth Fertilizer Plant	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000
8105	1	NW 4th Street (dead end)	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000
8120	1	Tillman Trailer Park - SE Ave G	Submersible	L	M	L	M	M	H	M	L	L	240	P	P	P	P	P	300	72,000
8116	1	Front of 1300 SW Ave G (Mr. Butts house)	Submersible	L	L	L	M	M	H	M	L	M	230	P	P	P	P	P	300	69,000
8103	1	West Canal St. North/NW 13th St.	Submersible	M	L	L	M	M	H	M	L	L	240	P	F	P	P	P	280	67,200
8141	1	Crosby Mobile Home Park (rear)	Submersible	L	L	L	M	M	H	H	M	M	260	P	G	P	P	F	240	62,400
8118	1	East Ave A (dead end/ off SE 7th Street)	Submersible	L	M	L	M	M	H	L	L	L	220	P	P	P	P	F	280	61,600
8149	1	Rear of Winn Dixie - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	P	P	P	P	300	60,000

TABLE 3
Ranking For Belle Glade Lift Ststions

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8140	1	City Hall - front	Submersible	H	M	M	M	M	H	L	L	H	330	P	P	G	G	G	180	59,400
8109	1	SE 2nd Street/SE Ave B - cross front Dentist Office	Submersible	L	L	L	M	M	H	M	L	L	210	F	P	P	P	P	280	58,800
8114	1	SW Ave C- between SW 8th Street/SW 6th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	F	P	P	P	280	58,800
8117	1	SE Ave K/SE 2nd Street - rear of old Glades General Hospital	Submersible	L	M	L	M	M	H	L	L	L	220	P	G	P	P	P	260	57,200
8122	1	Mace Park (SE Avenue G)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	P	P	300	57,000
8102	1	Raderville (cross the ditch)	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000
8148	1	Rear of Texaco - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000
8138	1	Rear of Gladeview Trailer Park (800 SW	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	F	P	F	230	55,200
8108	1	NE 1st Street/NE Ave I (dead end)	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8123	1	NW Ave F Place/NW 17th	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600
8132	1	SW Ave I/SW 10th Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	F	P	P	P	280	53,200
8147	1	SW 10th Street (Crossroad Academy Cafeteria)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	F	P	270	51,300
8110	1	SE Ave F - between SE 2nd Street/SE 3rd Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	P	P	260	49,400
8131	1	715 Trailer Park	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	P	P	P	260	49,400
8121	1	SW Ave G (by canal) - off SW 10th Street	Submersible	L	M	L	M	M	L	M	L	L	220	P	F	G	P	G	220	48,400
8119	1	Corner of SW Ave D/SW 12th Street	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	G	P	G	200	48,000
8155	1	By truck wash in rear of Water Dist office	Submersible	M	L	L	M	M	M	L	L	L	210	P	F	F	F	F	220	46,200
8129	1	Marina - rear	Submersible	M	M	L	M	M	H	M	L	L	270	G	F	G	F	F	170	45,900

TABLE 3
Ranking For Belle Glade Lift Ststions

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8111	1	SW Ave F - between SW 3rd Street/SW 4th Street	Submersible	L	L	L	M	M	H	M	L	L	210	F	F	P	F	F	210	44,100
8137	1	Glades Office building - off SR 715	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	F	F	210	39,900
8112	1	SW 2nd Street/SW Ave B - rear of Haitian Church	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	P	F	200	38,000
8126	1	NE Ave I/NE 28th Street (Arrowhead Estates)	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	F	F	F	200	38,000
8127	1	Comer of Ranchero Road /El Prado Road	Submersible	L	L	L	M	M	H	L	L	L	190	P	G	G	P	G	200	38,000
8113	1	SW Ave F - between 10th St/SW 11th St - rear of Ms. Maude Vereen's house	Submersible	H	L	H	L	M	H	M	L	H	320	G	G	G	G	G	100	32,000
8107	1	NE Ave B - between NE 2nd Street/North Main Street	Submersible	H	L	L	M	M	L	L	L	H	270	G	G	G	G	G	100	27,000
8152	1	Rear of old Drawbridge Rest	Submersible	L	L	L	M	M	M	L	L	L	180	G	F	F	G	G	130	23,400
8157	1	Business Park - US 441 North	Submersible	M	L	L	M	M	L	M	L	L	220	G	G	G	G	G	100	22,000
8150	1	Pistol range - rear of Public Services	Submersible	L	L	L	M	M	H	L	L	L	190	G	G	G	G	G	100	19,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 4
Ranking For Pahokee Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8208	2	Pahokee County Park (north of picnic area)	Submersible	L	H	L	M	M	H	M	L	L	270	P	P	P	P	P	300	81,000
8223	2	7450 US Highway 441 (New Hope Charities)	Submersible	M	L	M	M	M	L	M	M	M	260	P	F	G	P	F	240	62,400
8201	2	East 7th Street/McClure Road	Submersible	H	L	H	M	M	L	M	L	H	310	F	P	G	F	G	190	58,900
8206	2	Pahokee County Park Middle Camp Ground	Submersible	L	H	L	M	M	M	M	L	L	260	G	P	G	P	F	220	57,200
8207	2	McClure Road/Lake Avenue	Submersible	H	M	H	M	M	L	M	L	M	320	G	G	P	F	F	170	54,400
8209	2	Pahokee County Park (south camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	G	G	G	P	F	180	48,600
8212	2	Pahokee County Park (north camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	P	G	F	G	F	170	45,900
8217	2	640 Market Road/County Barn	Submersible	H	M	M	H	H	L	M	L	H	350	G	G	G	F	G	130	45,500
8204	2	Good Shepherd Church, Bacom Point Road	Submersible	M	L	L	M	M	M	M	L	M	250	P	G	P	G	F	180	45,000
8202	2	East 1st Street/Barfield Highway	Submersible	H	L	H	M	M	L	L	L	H	290	G	F	G	F	G	150	43,500
8219	2	260 Barfield Highway (Nursing Home)	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	F	G	130	42,900
8205	2	Home Place/Bacom Point Road	Submersible	H	L	M	M	M	L	L	L	H	280	G	G	G	F	F	150	42,000
8213	2	East 7tll Street/ Apple A venue	Submersible	L	L	L	M	M	H	L	L	L	190	G	F	G	P	F	200	38,000
8222	2	Canal Point Elementary School	Submersible	H	H	M	M	M	L	M	L	H	360	G	G	G	G	G	100	36,000
8211	2	Pahokee High School/Fern Street	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	G	G	100	33,000
8210	2	McClure Road/South Coconut Road	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	F	F	170	32,300
8216	2	86th Street North/Glades Drive	Submersible	L	L	M	M	M	L	M	L	L	200	G	G	G	F	F	150	30,000
8218	2	Boone A venue	Submersible	M	M	M	M	M	L	M	L	M	280	G	G	G	G	G	100	28,000

TABLE 4
Ranking For Pahokee Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8215	2	State Market Road (Streamline Water Tower)	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	F	G	130	26,000
8221	2	Keen Mobile Home Park	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	G	G	100	20,000
8203	2	1381 East Main Street	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8214	2	Muck City/Seville Streamline Road	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000
8220	2	2500 East Main Street (Pedestal Water Tower)	Submersible	L	L	L	M	M	L	L	L	L	170	G	G	G	G	G	100	17,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 5
Ranking For Canal Point Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8232	3	12165 Lakesore Dr (Packing House)	Submersible	M	L	M	L	M	M	M	L	L	230	G	F	G	G	G	120	27,600
8235	3	37280 Okeechobee Ave (Apt Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8234	3	12509 US Hwy 441 (Granados Furniture Store)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8227	3	12225 Lakeshore Dr (Apt Building)	Submersible	L	L	M	L	M	M	M	L	L	200	F	G	G	G	G	120	24,000
8225	3	12065 Lakeshore Dr (Ferguson Towing)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000
8224	3	12101 US HWY 441 (Apt. Bldg)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8240	3	12133 US Hwy 441 (Trailer Park By Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8239	3	12147 US Hwy 441 (Jones Fish House)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8238	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8237	3	12181 US Hwy 441 (Pelican Pumps)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8236	3	37300 Okeechobee Ave (Apt Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8233	3	12531 Everglades St (Fruit Stand)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8231	3	37071 US Hwy 441/98 (Store On The Corner)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8230	3	37040 Old Conner Hwy (Old Fire Station)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8229	3	12570 US Hwy 441 (Post Office)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8228	3	12275 Lakeshore Dr (Apt Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000
8226	3	12209 Lakeshore Dr (Trailer Park)	Submersible	L	L	M	L	M	M	M	L	L	200	G	G	G	G	G	100	20,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 6
Ranking For South Bay Lift Stations

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition		
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)						
8305	4	Henderson's Trailer Park	Submersible	L	M	M	M	M	M	H	H	M	300	P	P	P	P	P	300	90,000
8307	4	City Hall (South Bay)	Submersible	M	L	M	M	M	M	H	H	H	320	P	P	P	P	F	280	89,600
8302	4	SW 7th Avenue	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8309	4	Adjacent to GR's Truck Stop	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000
8306	4	Glades Pre-cooler (South Bay Growers)	Submersible	M	M	M	M	M	M	M	L	H	310	P	G	P	P	P	260	80,600
8301	4	NW 1st Avenue (Water Tower adjacent to Master Water Meter)	Submersible	H	M	H	M	M	L	M	H	H	360	G	G	G	P	F	180	64,800
8304	4	Jimmie Lou Court	Submersible	M	M	M	M	M	M	M	H	M	310	P	F	G	F	G	190	58,900
8303	4	SE 2nd Avenue	Submersible	L	L	L	M	M	M	M	M	L	210	P	P	P	P	F	280	58,800
8308	4	Villa Lago	Submersible	L	L	L	M	M	L	M	L	M	210	G	G	F	P	P	210	44,100
8310	4	Repump	Submersible	H	H	L	M	M	L	L	L	H	330	G	G	G	G	G	100	33,000

Note (1) Area:
1 = Belle Glade
2 = Pahokee
3 = Canal Point
4 = South Bay

TABLE 7
Planning Year R&R Schedule

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score	R & R Planning Year
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition			
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)							
8101	1	1401 NW Ave D/NW 14th Street	Submersible	H	M	H	M	M	H	H	M	H	390	F	P	P	P	P	280	109,200	2015
8115	1	Comer of SE Ave G/SE 4th Street	Submersible	H	L	H	M	M	H	M	L	H	330	P	P	P	P	P	300	99,000	2015
8143	1	NW Ave L - by Trade School	Submersible	H	M	H	M	M	H	M	L	H	360	P	P	F	P	F	270	97,200	2015
8305	4	Henderson's Trailer Park	Submersible	L	M	M	M	M	M	H	H	M	300	P	P	P	P	P	300	90,000	2015
8106	1	NW 2nd Street/West Canal Street North	Submersible	M	M	M	M	M	H	M	L	M	300	P	P	P	P	P	300	90,000	2015
8307	4	City Hall (South Bay)	Submersible	M	L	M	M	M	M	H	H	H	320	P	P	P	P	F	280	89,600	2015
8128	1	SR 715 - east comer of Palm Beach Community College	Submersible	M	M	L	M	M	H	H	L	M	310	P	F	P	P	P	280	86,800	2015
8136	1	Glades Day School	Submersible	H	M	M	M	M	L	M	L	H	330	P	F	P	P	F	260	85,800	2015
8309	4	Adjacent to GR's Truck Stop	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000	2015
8302	4	SW 7th Avenue	Submersible	H	M	M	M	M	L	M	M	H	340	P	F	F	P	F	250	85,000	2015
8146	1	2601 South Main Street (rear of Glades Glenn)	Submersible	H	L	H	M	L	L	M	L	H	300	P	F	P	P	P	280	84,000	2015
8135	1	Marina- down from office	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200	2015
8134	1	NW 12th Street - front of ABC Bag & Crate Co	Submersible	M	M	L	M	M	H	M	L	M	290	P	F	P	P	P	280	81,200	2015
8208	2	Pahokee County Park (north of picnic area)	Submersible	L	H	L	M	M	H	M	L	L	270	P	P	P	P	P	300	81,000	2015
8306	4	Glades Pre-cooler (South Bay Growers)	Submersible	M	M	M	M	M	M	M	L	H	310	P	G	P	P	P	260	80,600	2015
8133	1	Rear of Diana's apt - off SR 715	Submersible	L	M	M	M	M	H	M	M	M	280	P	F	P	P	P	280	78,400	2015
8130	1	Marina - cross from Slim Fish camp	Submersible	M	M	L	M	M	M	M	L	M	280	P	F	P	P	P	280	78,400	2015
8105	1	NW 4th Street (dead end)	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000	2015
8104	1	NW 9th St. - by Wedgworth Fertilizer Plant	Submersible	M	L	L	M	M	H	M	L	M	260	P	P	P	P	P	300	78,000	2015
8120	1	Tillman Trailer Park - SE Ave G	Submersible	L	M	L	M	M	H	M	L	L	240	P	P	P	P	P	300	72,000	2015

TABLE 7
Planning Year R&R Schedule

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score	R & R Planning Year
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition			
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)							
8116	1	Front of 1300 SW Ave G (Mr. Butts house)	Submersible	L	L	L	M	M	H	M	L	M	230	P	P	P	P	P	300	69,000	2015
8103	1	West Canal St. North/NW 13th St.	Submersible	M	L	L	M	M	H	M	L	L	240	P	F	P	P	P	280	67,200	2015
8301	4	NW 1st Avenue (Water Tower adjacent to Master Water Meter)	Submersible	H	M	H	M	M	L	M	H	H	360	G	G	G	P	F	180	64,800	2015
8223	2	7450 US Highway 441 (New Hope Charities)	Submersible	M	L	M	M	M	L	M	M	M	260	P	F	G	P	F	240	62,400	2015
8141	1	Crosby Mobile Home Park (rear)	Submersible	L	L	L	M	M	H	H	M	M	260	P	G	P	P	F	240	62,400	2015
8118	1	East Ave A (dead end/ off SE 7th Street)	Submersible	L	M	L	M	M	H	L	L	L	220	P	P	P	P	F	280	61,600	2015
8149	1	Rear of Winn Dixie - off South Main	Submersible	L	L	L	M	M	M	M	L	L	200	P	P	P	P	P	300	60,000	2015
8140	1	City Hall - front	Submersible	H	M	M	M	M	H	L	L	H	330	P	P	G	G	G	180	59,400	2020
8304	4	Jimmie Lou Court	Submersible	M	M	M	M	M	M	M	H	M	310	P	F	G	F	G	190	58,900	2020
8201	2	East 7th Street/McClure Road	Submersible	H	L	H	M	M	L	M	L	H	310	F	P	G	F	G	190	58,900	2020
8303	4	SE 2nd Avenue	Submersible	L	L	L	M	M	M	M	M	L	210	P	P	P	P	F	280	58,800	2020
8114	1	SW Ave C- between SW 8th Street/SW 6th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	F	P	P	P	280	58,800	2020
8109	1	SE 2nd Street/SE Ave B - cross front Dentist Office	Submersible	L	L	L	M	M	H	M	L	L	210	F	P	P	P	P	280	58,800	2020
8206	2	Pahokee County Park Middle Camp Ground	Submersible	L	H	L	M	M	M	M	L	L	260	G	P	G	P	F	220	57,200	2020
8117	1	SE Ave K/SE 2nd Street - rear of old Glades General Hospital	Submersible	L	M	L	M	M	H	L	L	L	220	P	G	P	P	P	260	57,200	2020
8122	1	Mace Park (SE Avenue G)	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	P	P	300	57,000	2020
8148	1	Rear of Texaco - off South Main Street	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000	2020
8102	1	Raderville (cross the ditch)	Submersible	L	L	L	M	M	M	M	L	L	200	P	F	P	P	P	280	56,000	2020
8138	1	Rear of Gladeview Trailer Park (800 SW 16tn Street)	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	F	P	F	230	55,200	2020

TABLE 7
Planning Year R&R Schedule

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score	R & R Planning Year
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition			
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)							
8123	1	NW Ave F Place/NW 17th Street	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600	2020
8108	1	NE 1st Street/NE Ave I (dead end)	Submersible	L	L	L	M	M	H	M	L	L	210	P	G	P	P	P	260	54,600	2020
8207	2	McClure Road/Lake Avenue	Submersible	H	M	H	M	M	L	M	L	M	320	G	G	P	F	F	170	54,400	2020
8132	1	SW Ave I/SW 10th Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	F	P	P	P	280	53,200	2020
8147	1	SW 10th Street (Crossroad Academy	Submersible	L	L	L	M	M	L	M	L	L	190	P	P	P	F	P	270	51,300	2020
8131	1	715 Trailer Park	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	P	P	P	260	49,400	2020
8110	1	SE Ave F - between SE 2nd Street/SE 3rd Street	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	P	P	260	49,400	2020
8209	2	Pahokee County Park (south camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	G	G	G	P	F	180	48,600	2020
8121	1	SW Ave G (by canal) - off SW 10th Street	Submersible	L	M	L	M	M	L	M	L	L	220	P	F	G	P	G	220	48,400	2020
8119	1	Corner of SW Ave D/SW 12th Street	Submersible	L	M	L	M	M	H	M	L	L	240	P	G	G	P	G	200	48,000	2020
8155	1	By truck wash in rear of Water Dist office	Submersible	M	L	L	M	M	M	L	L	L	210	P	F	F	F	F	220	46,200	2020
8212	2	Pahokee County Park (north camp ground)	Submersible	L	H	L	M	M	H	M	L	L	270	P	G	F	G	F	170	45,900	2020
8129	1	Marina - rear	Submersible	M	M	L	M	M	H	M	L	L	270	G	F	G	F	F	170	45,900	2020
8217	2	640 Market Road/County Barn	Submersible	H	M	M	H	H	L	M	L	H	350	G	G	G	F	G	130	45,500	2020
8204	2	Good Shepherd Church, Bacom Point Road	Submersible	M	L	L	M	M	M	M	L	M	250	P	G	P	G	F	180	45,000	2020
8308	4	Villa Lago	Submersible	L	L	L	M	M	L	M	L	M	210	G	G	F	P	P	210	44,100	2025
8111	1	SW Ave F - between SW 3rd Street/SW 4th Street	Submersible	L	L	L	M	M	H	M	L	L	210	F	F	P	F	F	210	44,100	2025
8202	2	East 1st Street/Barfield Highway	Submersible	H	L	H	M	M	L	L	L	H	290	G	F	G	F	G	150	43,500	2025
8219	2	260 Barfield Highway (Nursing Home)	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	F	G	130	42,900	2025

TABLE 7
Planning Year R&R Schedule

Lift Station Number	Area (1)	Address	Type	Risk Assessment Factors (COF)									Total Risk Score	Condition Assessment Factors (POF)					Total Condition Score	Combined Risk and Condition Score	R & R Planning Year
				Service Area Risk	Environ-mental Risk	Wet Well Overflow Risk	Pump Failure Risk	Power Outage Risk	Security Risk	Safety Risk	Maint-enance Risk	Community Impact		Wet Well Condition	Panel Condition	Valve Vault Condition	Discharge Pipe Condition	Valves Condition			
				Rank as Low (L), Medium (M), or High (H)										Rank as Poor (P), Fair (F), or Good (G)							
8205	2	Home Place/Bacom Point Road	Submersible	H	L	M	M	M	L	L	L	H	280	G	G	G	F	F	150	42,000	2025
8137	1	Glades Office building - off SR 715	Submersible	L	L	L	M	M	L	M	L	L	190	P	G	P	F	F	210	39,900	2025
8213	2	East 7tll Street/ Apple A venue	Submersible	L	L	L	M	M	H	L	L	L	190	G	F	G	P	F	200	38,000	2025
8127	1	Comer of Ranchero Road /El Prado Road	Submersible	L	L	L	M	M	H	L	L	L	190	P	G	G	P	G	200	38,000	2025
8126	1	NE Ave I/NE 28th Street (Arrowhead Estates)	Submersible	L	L	L	M	M	L	M	L	L	190	F	F	F	F	F	200	38,000	2025
8112	1	SW 2nd Street/SW Ave B - rear of Haitian Church	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	P	F	200	38,000	2025
8222	2	Canal Point Elementary School	Submersible	H	H	M	M	M	L	M	L	H	360	G	G	G	G	G	100	36,000	2025
8310	4	Repump	Submersible	H	H	L	M	M	L	L	L	H	330	G	G	G	G	G	100	33,000	2025
8211	2	Pahokee High School/Fern Street	Submersible	H	M	M	M	M	L	M	L	H	330	G	G	G	G	G	100	33,000	2025
8210	2	McClure Road/South Coconut Road	Submersible	L	L	L	M	M	L	M	L	L	190	F	G	G	F	F	170	32,300	2025
8113	1	SW Ave F - between 10th St/SW 11th St - rear of Ms. Maude Vereen's house	Submersible	H	L	H	L	M	H	M	L	H	320	G	G	G	G	G	100	32,000	2025
8216	2	86th Street North/Glades Drive	Submersible	L	L	M	M	M	L	M	L	L	200	G	G	G	F	F	150	30,000	2025
8218	2	Boone A venue	Submersible	M	M	M	M	M	L	M	L	M	280	G	G	G	G	G	100	28,000	2030
8232	3	12165 Lakesore Dr (Packing House)	Submersible	M	L	M	L	M	M	M	L	L	230	G	F	G	G	G	120	27,600	2030
8107	1	NE Ave B - between NE 2nd Street/North Main Street	Submersible	H	L	L	M	M	L	L	L	H	270	G	G	G	G	G	100	27,000	2030
8215	2	State Market Road (Streamline Water Tower)	Submersible	L	M	L	M	M	L	L	L	L	200	G	G	G	F	G	130	26,000	2030
8235	3	37280 Okeechobee Ave (Apartment Building)	Submersible	L	L	M	L	M	M	M	L	L	200	G	F	G	G	G	120	24,000	2030

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TECHNICAL MEMORANDUM No. 8 – Infiltration and Inflow

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Mark Drummond / C Solutions

FROM: Ethan Heijn / Hazen and Sawyer

DATE: May 5, 2014

FILE: 45103-004.3.0

SUBJECT: Palm Beach County Water Utilities Department (PBCWUD)
Glades Wastewater Master Plan
Project Number: WUD 12-068

The Palm Beach County Water Utilities Department (PBCWUD) has been awarded a grant from the United States Department of Housing and Urban Development (HUD) for water and wastewater master planning in the Glades Region, which consists of the communities of Belle Glade, Pahokee, and South Bay. Technical Memorandum No. 8 (TM-8) addresses the study of Infiltration and Inflow (I-I) for the gravity sewer systems in these communities. This work is associated with *Task 8 – Infiltration and Inflow Study* and has included the below-listed subtasks.

- Analyze the system and select locations requiring new flow data.
- Install flow monitoring data loggers at selected locations. Access the installations to download accumulated data.
- Analyze wastewater flow data considering selected wet weather events and periods of high groundwater level, as well as the so-called “night flow” time period between 1:00 AM and 5:00 AM when actual wastewater flow is minimal and the majority of flow is infiltration.
- Compare system-wide water usage and wastewater flow records for the most recent available 12-month period.

- Characterize the overall system based on I-I severity and the approximate proportions of infiltration, inflow, and wastewater.
- Convert basin-level flow data into units of gallons per day-inch-mile (using a breakdown of piping lengths and diameters for each basin to be provided by COUNTY).
- Prioritize basins by I-I severity so that follow-up inspection and rehabilitation work can be focused on those areas where the greatest I-I reduction potential exists.
- Analyze videotapes (using a representative sample of video provided by COUNTY forces). Record and document the location and nature of obstructions such as dropped joints, protruding service connections and broken pipe; as well as cracks, separated joints, and other pipe defects that may permit groundwater infiltration. Develop repair recommendations and estimated costs.
- Assess the physical condition of manholes (using a representative sample of inspection reports provided by COUNTY forces). Estimate rehabilitation costs for selected methods.
- Assess the nature and extent of inflow-related defects detected through smoke testing (using a representative sample of smoke test reports provided by COUNTY forces). Select applicable repair methods. Estimate rehabilitation costs for selected methods.
- Develop a report to document the tasks performed, provide a summary of findings, and recommend applicable repair technologies with projected costs for the elimination of I-I sources.

SYSTEM DESCRIPTION

The communities of Belle Glade, Pahokee, and South Bay were settled in the early 1900s and owe their subsequent development and expansion in part to the federal project of draining the land around Lake Okeechobee. The gravity collection systems in these areas were reportedly installed from the 1950s through the 1990s, although some pipes are of unknown age. Pipe materials consist primarily of vitrified clay pipe and newer, PVC pipe. Key information for the Glades Region wastewater collection and transmission system is summarized below in **Table 8.1**.

Appendix A contains a schematic showing how wastewater moves through each of the three collection systems via gravity and pressure piping.

Table 8.1 – Glades Region Wastewater System

Collection System	Number of Pump Stations	Number of Pump Stations with Gravity Systems	Linear Feet of Gravity Mains	Number of Manholes [1]	2012 Average Annual Daily Flow (MGD)	Wastewater Treatment Plant (WWTP)
Belle Glade	46	26	174,697	781	2.05 [2]	Belle Glade
Pahokee	40	12	91,145	415	0.91 [3]	Pahokee
South Bay	10	7	47,360	188	0.56 [4]	Belle Glade
SUM	**96**	**45**	**313,202**	**1,384**	**3.52**	**---**

[1] Based on the number of pipe segments in GIS

[2] Obtained by subtracting South Bay in-line booster station flow from total flow to Belle Glade WWTP

[3] Total flow to Pahokee WWTP

[4] South Bay in-line booster station flow

EXISTING INFILTRATION AND INFLOW REDUCTION PROGRAM

Documentation available for review as part of this I-I study is as listed below.

- City of Pahokee Smoke Test Inspection Report, JCC Enterprises, Inc. (March, 2013).
- City of Belle Glade Sewer Main Video Logs and CDs, Lanzo Lining Services, Inc. (January – March, 2013).
- City of Belle Glade Smoke Test Inspection Report, FloTech Environmental, LLC (January, 2013).
- City of Belle Glade Sewer Manhole Inspection Forms and Photographs (November, 2012).
- Pahokee and South Bay repair location maps, PBCWUD (December, 2009).
- Pahokee Infiltration and Inflow Study, AECOM (October, 2009).
- City of Pahokee, Study of the Existing Gravity Sewer System, Craig Smith and Associates (April, 1999).

Based on the available documentation, the Utility has undertaken several targeted efforts at investigation and rehabilitation related to the reduction of I-I, but has not previously performed a comprehensive, system-wide analysis and prioritization of pump station collection areas (basins) to identify those basins most susceptible to I-I. It should be noted that Utility personnel have communicated a clear understanding of where the most severe problems appear to exist; moreover, as part of its day-to-day operation and maintenance responsibilities the Utility routinely performs investigative field activities and repairs to sewer mains, manholes, and laterals to address priority issues.

SYSTEM-LEVEL EVALUATION

A series of exhibits, listed below, were developed to assess and illustrate the effects of potable water usage, rainfall, and groundwater elevation on total WWTP flows. Observations concerning the relationships among these variables for the overall system, and for Belle Glade, Pahokee, and South Bay individually are presented in the subsequent text.

Figure 8.1 System-Level Water Usage and Rainfall
Figure 8.2 Groundwater Elevation and Rainfall
Figure 8.3 Groundwater Elevation, Rainfall, and Wastewater Flow
Figure 8.4 Groundwater Elevation, Rainfall, and Wastewater Flow - Belle Glade
Figure 8.5 Groundwater Elevation, Rainfall, and Wastewater Flow - South Bay
Figure 8.6 Groundwater Elevation, Rainfall, and Wastewater Flow - Pahokee
Figure 8.7 Estimated Infiltration and Inflow
Figure 8.8 Estimated Infiltration and Inflow - Belle Glade
Figure 8.9 Estimated Infiltration and Inflow - South Bay
Figure 8.10 Estimated Infiltration and Inflow - Pahokee
Figure 8.11 Service Area Map with Gauge Locations

Potable Water

Figure 8-1 provides a graphical illustration (on a monthly basis) of total potable water produced and monthly rainfall between January 2012 and February 2013. Potable water production appears to be generally higher during the dry winter season and lower during the wet summer season, most likely due to decreased irrigation during periods with higher rainfall.

Wastewater

A graphical illustration on a monthly basis of rainfall and groundwater elevation between January 2012 and February 2013 is presented in **Figure 8-2**. It can be seen that groundwater elevation shows a consistent and direct correlation with rainfall. This relationship will be seen more clearly at smaller data intervals in the basin-level evaluation.

It should be noted that while multiple sources for groundwater elevation were researched, including United States Geological Survey, South Florida Water Management District (SFWMD), and Army Corps of Engineers, the nearest location with available data was found to be SFWMD PB685, located some 23 miles from the study area adjacent to State Road 80 near Lion Country

Figure 8-1
System-Level Water Usage and Rainfall (January 2012 – February 2013)

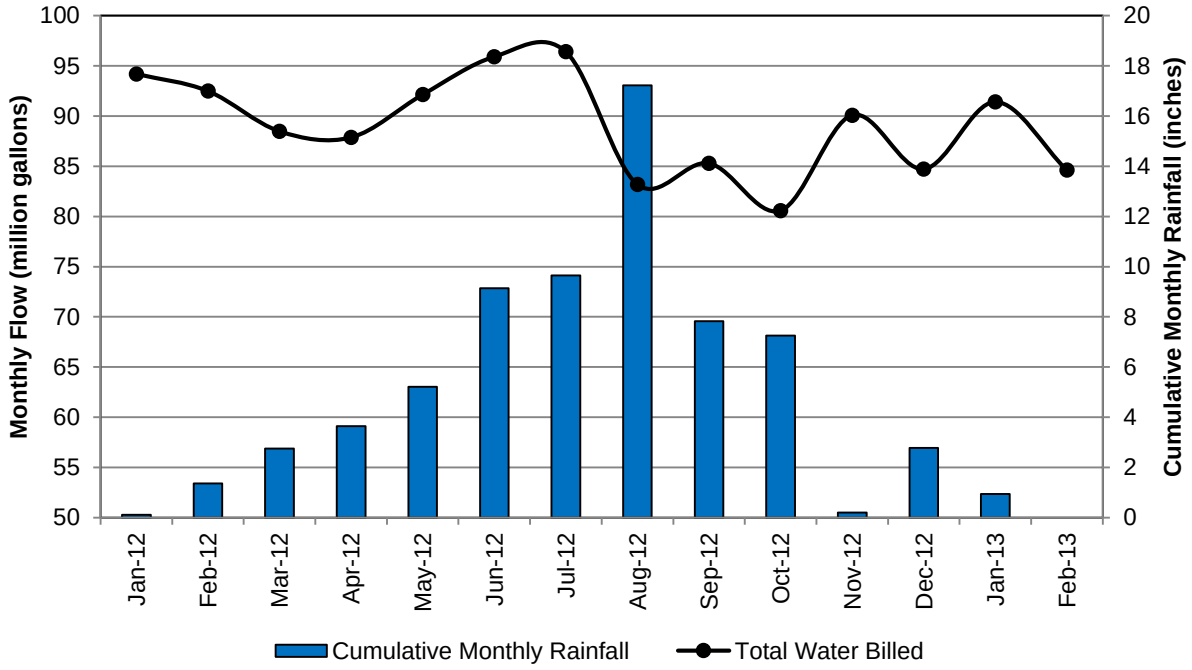
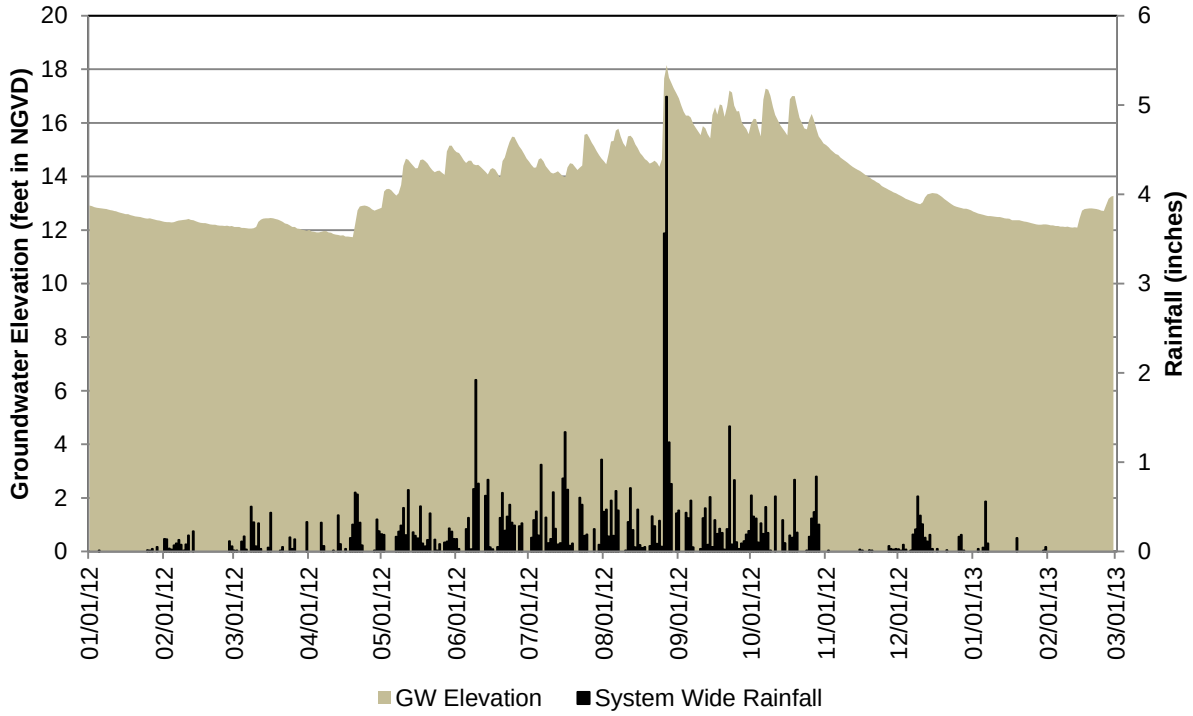


Figure 8-2
Groundwater Elevation and Rainfall for Gauge PB 685
(January 2012 through February 2013)



Safari. For this reason, an effort was made to use readily available local canal elevation data in place of groundwater elevations. However, since the canal elevations are actively managed for purposes of flood control, it was found that these elevations did not provide a useful surrogate for groundwater levels, and ultimately the analysis was conducted using the SFWMD PB685 groundwater gauge despite its distance from the study area.

Figure 8-3 provides a graphical illustration on a monthly basis of rainfall, groundwater elevation, and wastewater production between January 2012 and February 2013. It can be seen that increases in wastewater production clearly follow increases in rainfall and groundwater elevation. These relationships will also be seen at smaller data intervals in the basin-level evaluation.

Figure 8-4, **Figure 8-5**, and **Figure 8-6** provide the same illustration as Figure 8-3 but for the individual systems of Belle Glade, South Bay, and Pahokee respectively. These figures show that flow in all three systems is directly influenced by rainfall and elevated groundwater conditions.

Infiltration and Inflow

An estimate on a monthly basis of the total volume of I-I entering the system between January of 2012 and February of 2013 is shown in **Figure 8-7**. This graph was arrived at by assuming that a specified percentage (75 percent) of potable water produced ultimately enters the sewer through sinks, toilets, and showers. This quantity is titled "*Sanitary Flow*" in the graph, and "*Infiltration and Inflow*" is calculated to be the difference between total wastewater production and "*Sanitary Flow*". It must be emphasized that the I-I calculated in this fashion is highly dependent on the percent of potable water assumed to enter the sewer, and while 75 percent is within the range of typical estimates, this estimate should be refined if data are available to permit the assumed percentage to be more reliably quantified.

Figure 8-8, **Figure 8-9**, and **Figure 8-10** provide the same illustration as **Figure 8-7** but for the individual systems of Belle Glade, South Bay, and Pahokee respectively.

The system-level monthly data do not allow I-I to be separately quantified with much confidence. It should be noted that a significant portion of the infiltration that affects South Florida's gravity collection systems is in fact rainfall-dependent infiltration (RDI) that results from a temporarily higher groundwater table due to rainfall percolating through pervious surfaces into the groundwater. In general, however, the level of baseline, dry weather infiltration should correspond to the difference between sanitary flow and the minimum levels of wastewater flow seen during the time period depicted in **Figure 8-7**. Inflow and rainfall-dependent infiltration generally align with the wet months. The data presented in **Figures 8-7 through 8-10** suggest that I-I for the three systems combined ranges from approximately 20 percent of total flows in

Figure 8-3
Groundwater Elevation, Rainfall, and Wastewater Flow (January 2012 – February 2013)

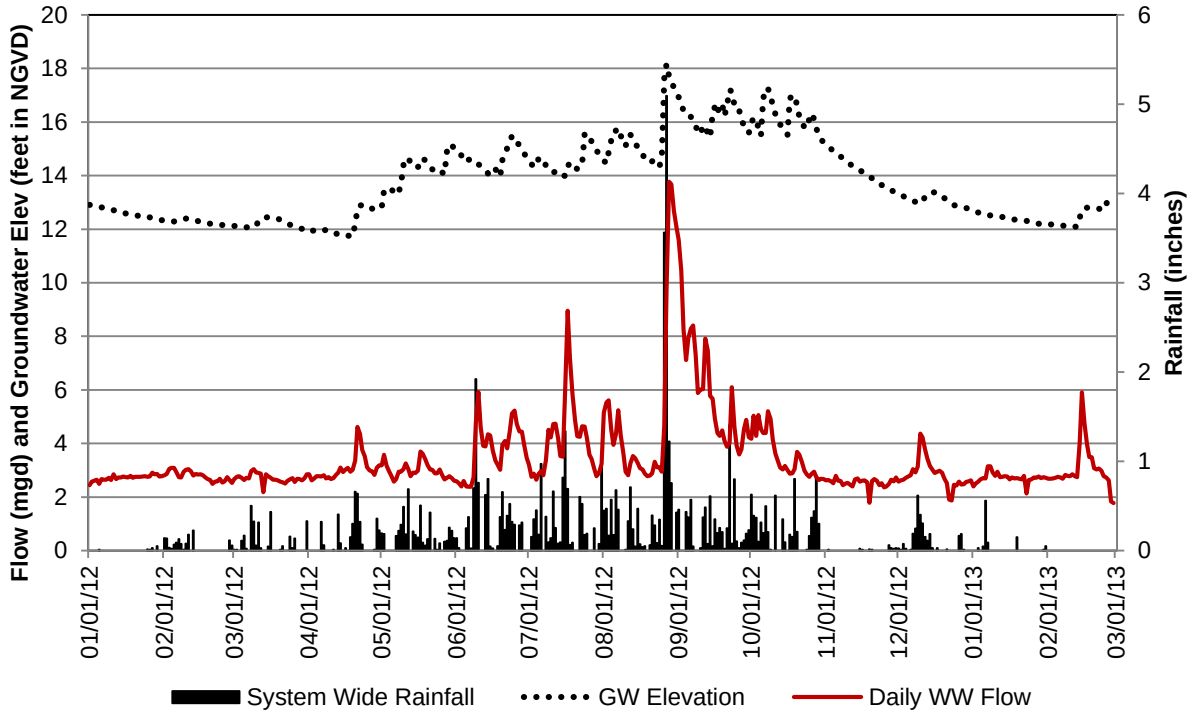


Figure 8-4
Groundwater Elevation, Rainfall, and Wastewater Flow - Belle Glade
(January 2012 – February 2013)

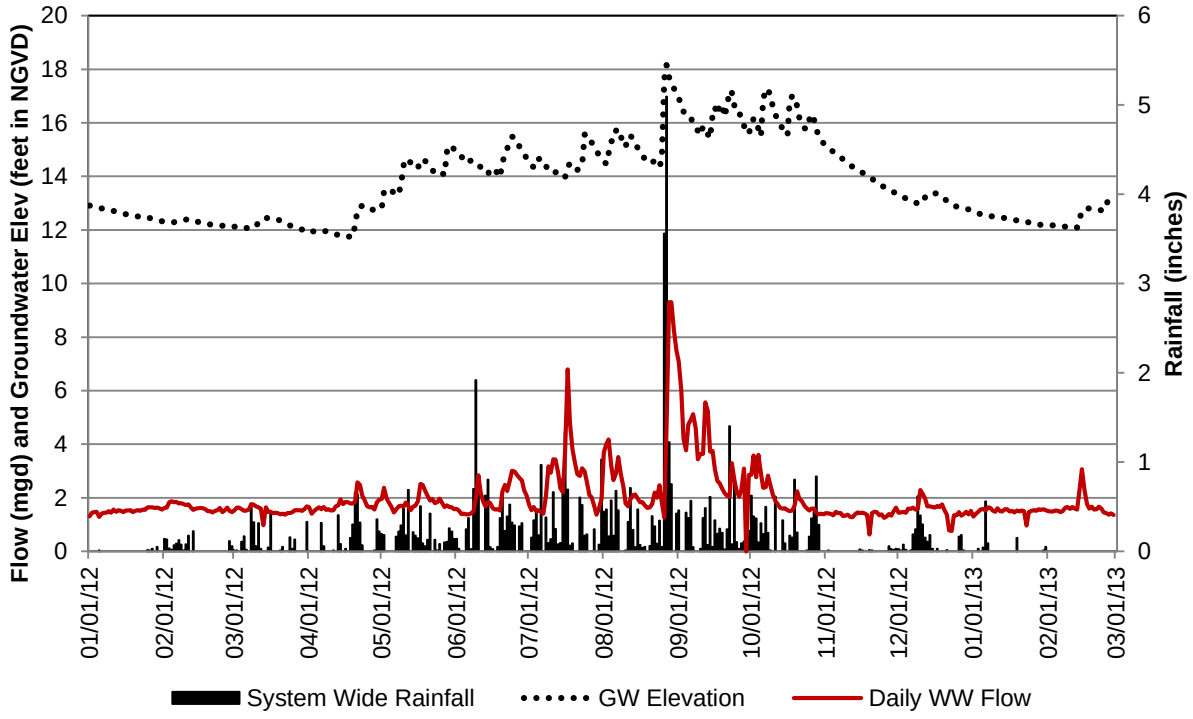


Figure 8-5
Groundwater Elevation, Rainfall, and Wastewater Flow – South Bay
(January 2012 – February 2013)

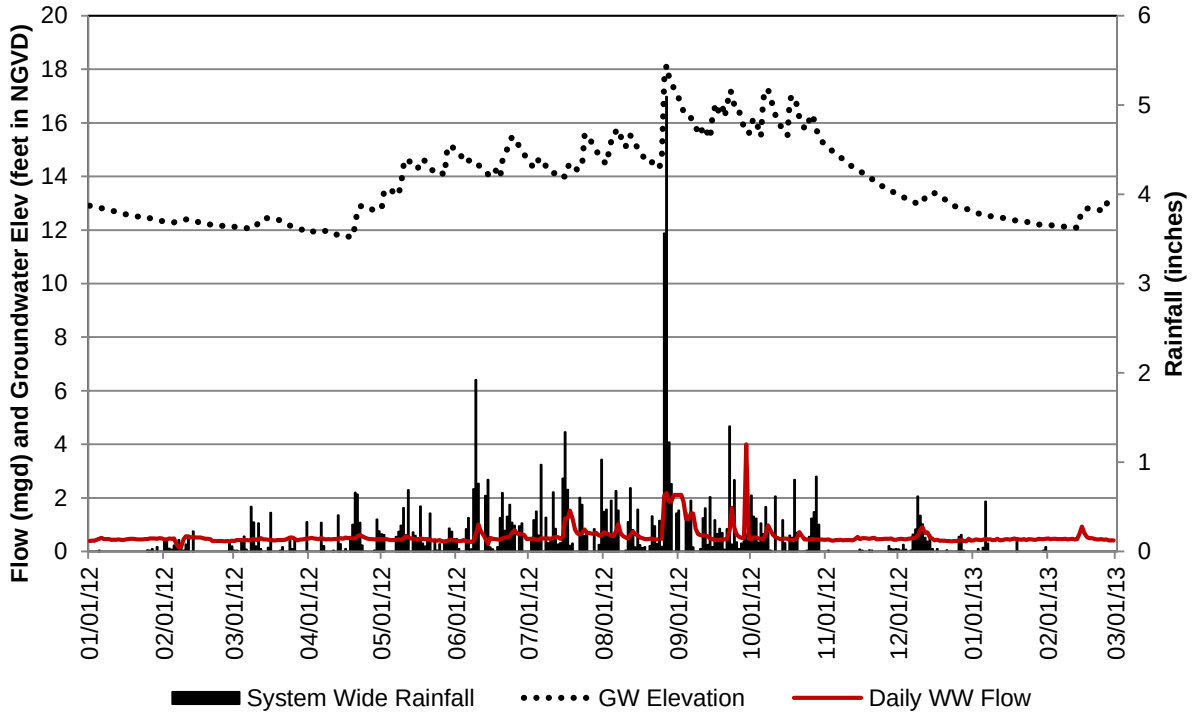


Figure 8-6
Groundwater Elevation, Rainfall, and Wastewater Flow - Pahokee
(January 2012 – February 2013)

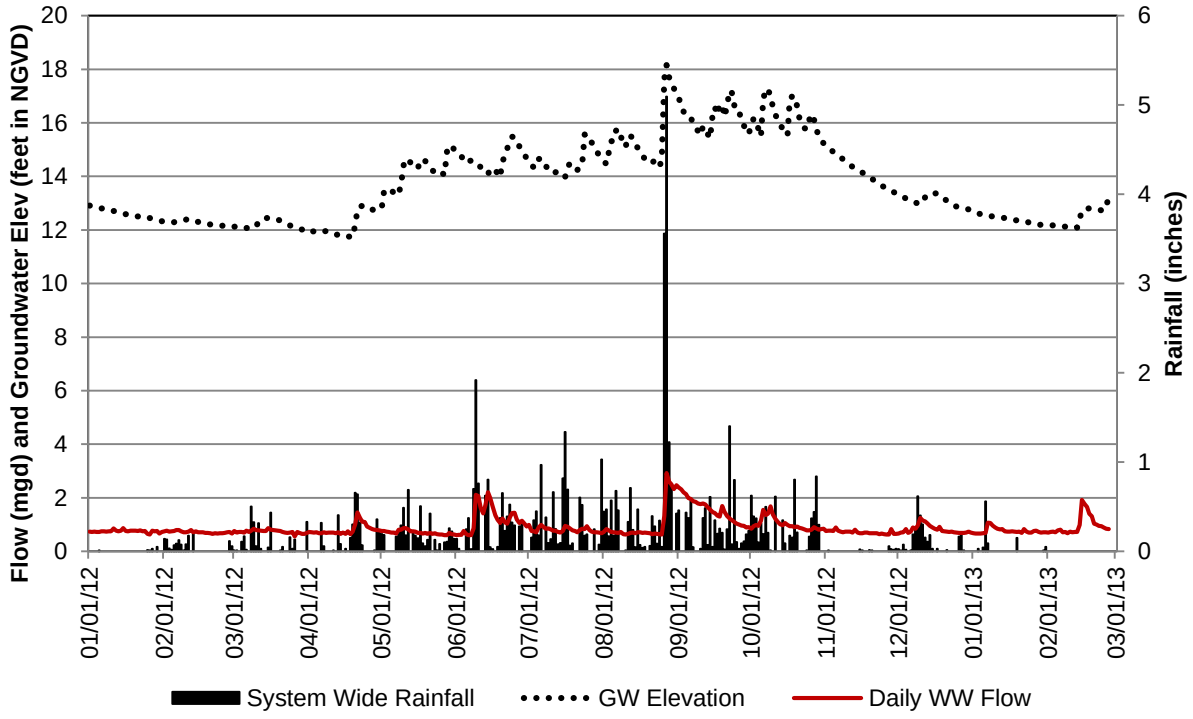


Figure 8-7
Estimated Infiltration and Inflow (January 2012 – February 2013)

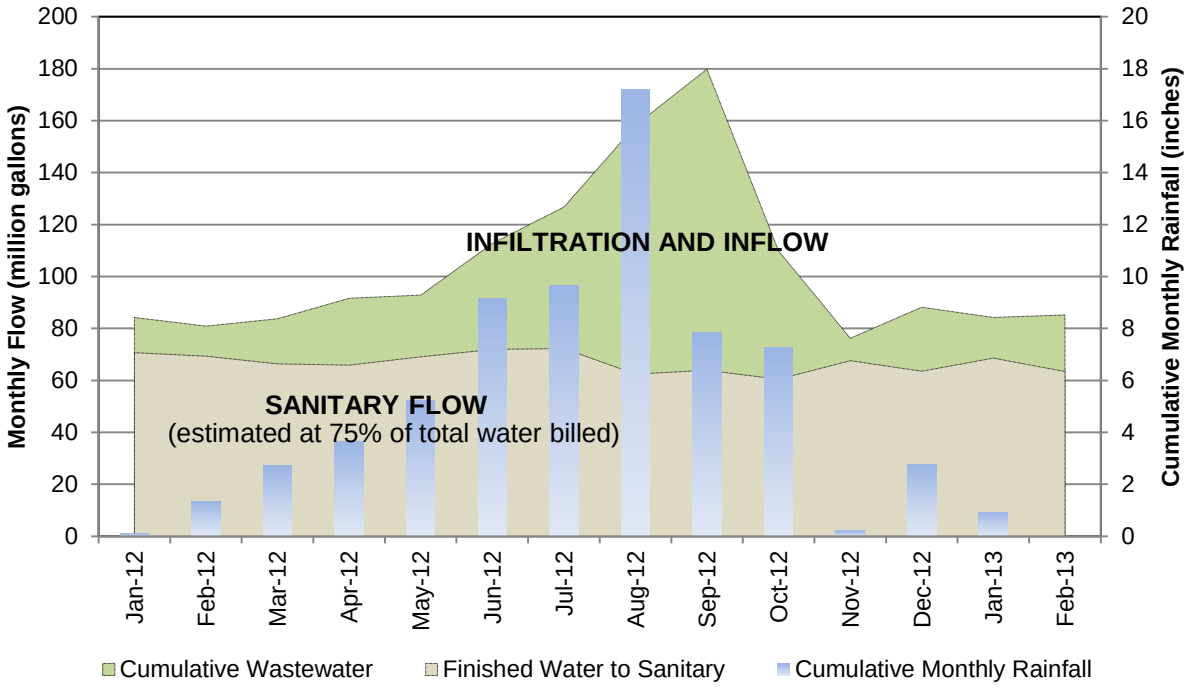


Figure 8-8
Estimated Infiltration and Inflow - Belle Glade (January 2012 – February 2013)

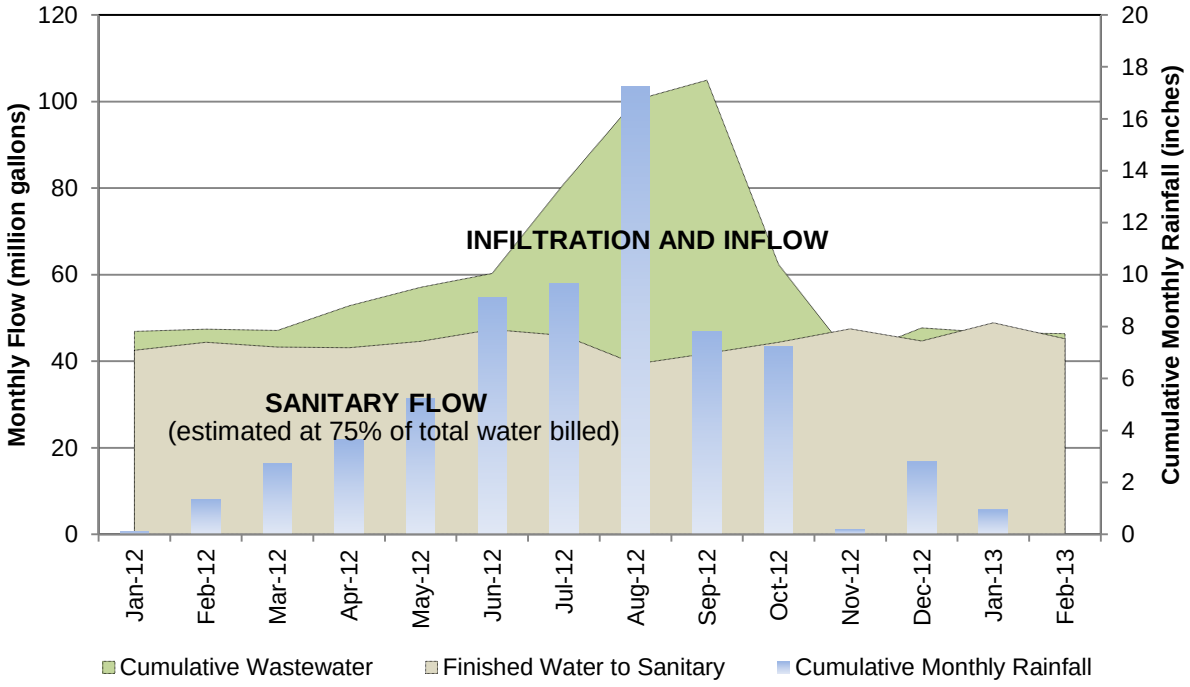


Figure 8-9
Estimated Infiltration and Inflow – South Bay (January 2012 – February 2013)

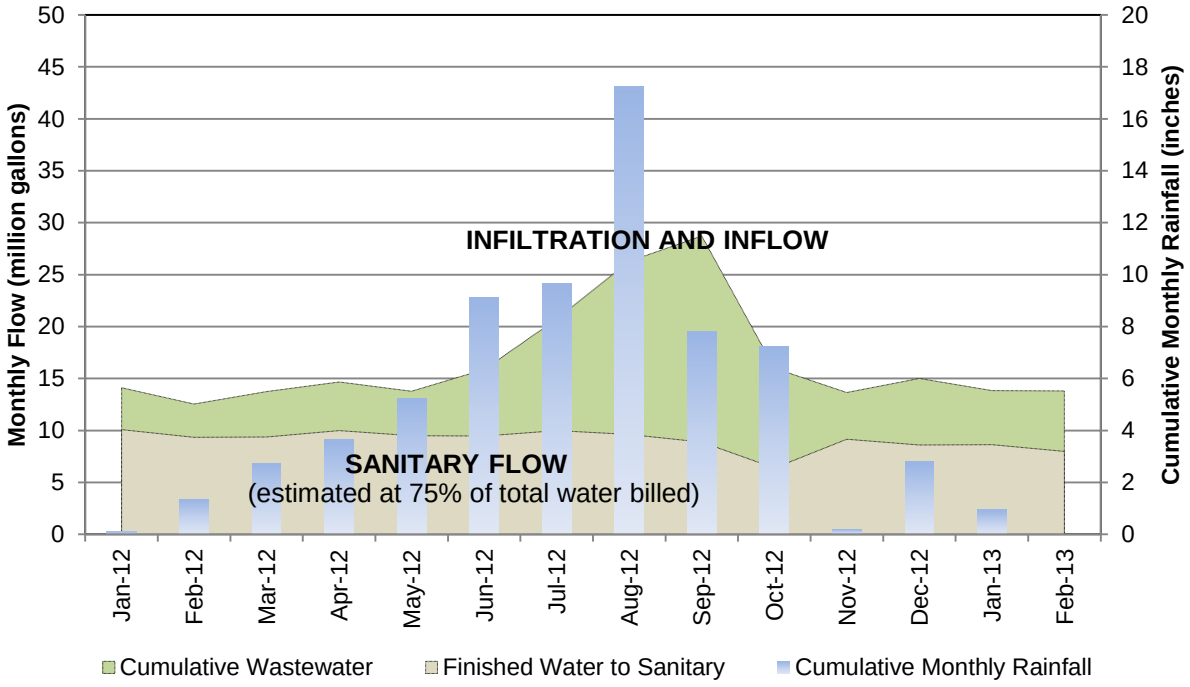
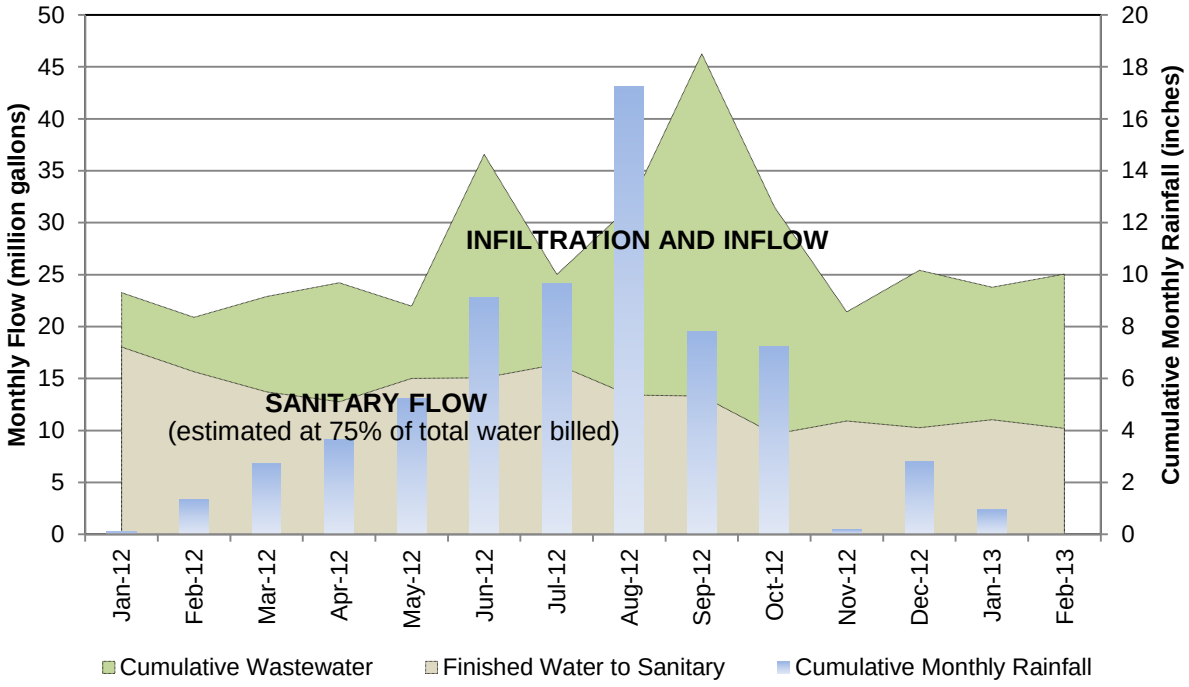


Figure 8-10
Estimated Infiltration and Inflow – Pahokee (January 2012 – February 2013)



the dry season (November through April) to approximately 49 percent of total flows in the wet season (May through October), with an annual average of approximately 37 percent.

Table 8.2 shows these estimated percentages for the three systems combined along with estimated percentages for each of Belle Glade, South Bay, and Pahokee individually. It is interesting to note that the above-referenced study by AECOM, which included night flow isolation measurements for 14 of the 23 Utility-owned basins in Pahokee, concluded that approximately half a million gallons per day of infiltration existed in the selected basins at that time (June 2009). While the system-level analysis presented herein focused on WWTP flows during a different time period and employed a different methodology to estimate I-I, both estimates are of a similar order of magnitude.

While as previously noted the amount of I-I estimated herein is highly dependent on the percent of potable water assumed to enter the sewer, and could in fact be somewhat more or less than shown, the data clearly indicate that I-I are a significant issue in the subject collection systems. Conditions are particularly acute during the wet season when direct inflow and RDI result in peak flows to the WWTPs that are multiples of average dry weather flows. The system-level evaluation, therefore, supports the conclusion that a comprehensive I-I reduction program is warranted for the Belle Glade, South Bay, and Pahokee wastewater collection systems.

Table 8.3 identifies the sources of data used in the foregoing system-level analysis and in the basin-level analysis that follows.

Figure 8-11 is a map of the service area showing the locations of rain and groundwater gauges.

BASIN-LEVEL EVALUATION

The basin-level evaluation involved selection of 30 pump station collection areas to represent “study areas” for more detailed analysis. Basins were selected through consultation with Utility O&M personnel following characterization based on the following criteria:

A. Does the basin have relatively low I-I levels as a result of being newer, smaller, and/or in better condition?

B. Is the gravity system privately owned?

C. Is the basin subject to flooding and/or heavy I-I?

D. Is I-I reduction work currently scheduled under other contracts?

Basins for which the answer to questions A, B, or D was “yes” were not selected. The answer to question C did not control selection either way and was simply for informational purposes.

Table 8.2 – Estimated Infiltration and Inflow Percentages

System	2012 Wet Season (May - October)			2012 Full Year (January - December)			2012 Dry Season (November - April)		
	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)	Total Wastewater Treated (mgd)	Estimated Infiltration and Inflow (mgd)	Estimated Infiltration and Inflow (%)
Belle Glade	2.55	1.11	43%	2.05	0.60	29%	1.55	0.10	6%
Pahokee	1.06	0.60	57%	0.91	0.46	50%	0.76	0.31	41%
South Bay	0.67	0.37	56%	0.56	0.26	46%	0.46	0.15	32%
Total	**4.27**	**2.08**	**49%**	**3.52**	**1.32**	**37%**	**2.77**	**0.56**	**20%**

Table 8.3 – Data Types and Sources

Type	Smallest Available Interval			Source
	Hourly or Sub-hourly	Daily	Monthly	
Potable water - system level			X	PBCWUD Historical Flows Records, MS Excel spreadsheet, 1987 - 2011
Potable water - volume customers		X		PBCWUD Bulk User Records, MS Excel spreadsheet, 2008 - 2011
Wastewater - system level	X			PBCWUD Bulk User Records, MS Excel spreadsheet, 1987 - 2011
Wastewater - volume customers		X		PBCWUD Bulk User Records, MS Excel spreadsheet, 2008 - 2011
Wastewater - basin level		X		PBCWUD Wastewater SCADA System, January 1, 2011 - December 31, 2011
				USGS Groundwater Monitoring Wells (G-1226,G-2035,F-291), January 2008 - March 2011 http://groundwaterwatch.usgs.gov/countymaps/FL_011.html
				South Florida Water Management District Rain Gages (FHCHSX, G300_R, G56_R, LWD.E1.3_R, LWD.E2.2_R, LWD.GA_R, LWD.HQ_R), January 2008 - December 2011 http://www.sfwmd.gov/dbhydroplsql

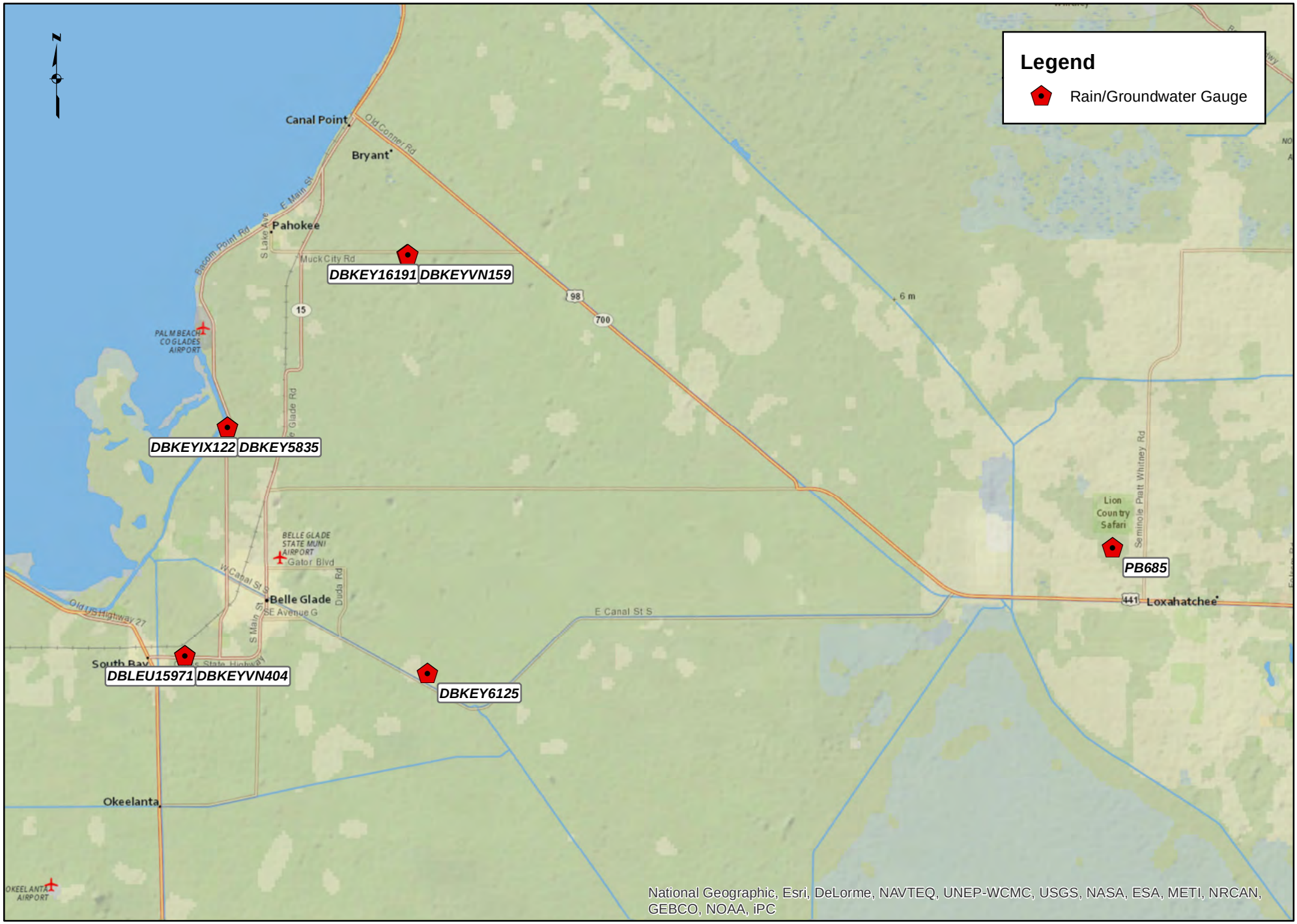


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Figure 8-11 - Rain and Groundwater Gauge Locations

The schematic shown in **Appendix A** provides a characterization of each basin with respect to the above criteria. Basins selected for flow monitoring are as listed in **Table 8.4**, along with the total linear footage of pipe of each diameter.

Flow Monitoring Methodology

Basin-level flow monitoring was conducted using the HOBO Motor On/Off Data Logger (Model UX90-004), which records motor on/off conditions by detecting the AC magnetic fields given off by a rotating motor and stores the dates and times of pump starts and stops. To implement this method of data collection, the following tasks were performed for the selected basins:

1. Measure cross-sectional area of wet well
2. Measure vertical distance between pump start float and pump stop float
3. Multiply cross sectional area from Task 1 by vertical distance from Task 2 to obtain wet well fill volume
4. Calculate time between pump stop and pump start using times recorded by the data logger to obtain wet well fill time
5. Divide wet well fill volume from Task 3 by wet well fill time from Task 4 to obtain flow rate

To initiate this work, Utility operations staff completed Tasks 1 and 2 for each pump station, and verified that the pump start elevation was at or below the invert of the incoming pipe to avoid any surcharging into the collection piping that would invalidate the volume calculation. H&S staff then completed the remaining steps and initiated a detailed analysis of data for each pump station as described below.

Appendix B contains a summary of wet well dimensions and control elevations.

Gravity System Gallon per Day-Inch-Mile Calculation

The basin diameter and footage inventory in **Table 8.4** allows the development of a useful metric for assessing the relative severity of infiltration among basins of different sizes. This metric, gallons per day-inch-mile (GPDIM), is arrived at as follows:

1. Measure basin-level wastewater flow during the so-called “night flow” time period between 1:00 AM and 5:00 AM, when flow derived from potable water usage is minimal and the majority of flow is infiltration. Convert this flow into units of gallons per day.

Table 8.4 - Wastewater Collection System Inventory for Selected Basins and Basins Upstream

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
BG	8101		92	**573**	16,618	2,486		2,735	1,501	**23,340**	**164,019**	**4.42**	**50.85**	**269**
		8119	18		4,690					**4,690**		**0.89**	**7.11**	
		8123	16		3,815					**3,815**		**0.72**	**5.78**	
		8106	33		7,134	240	1,745			**9,119**		**1.73**	**15.23**	
		8105	28		6,921	652				**7,573**		**1.43**	**11.72**	
		8114	73		14,291	331	718			**15,340**		**2.91**	**23.91**	
		8147 [b]	--		9,677					**9,677**		**1.83**	**14.66**	
		8113	67		14,458	778	880			**16,116**		**3.05**	**25.38**	
		8121	6		1,718					**1,718**		**0.33**	**2.60**	
		8116	14		1,870					**1,870**		**0.35**	**2.83**	
		8132	11		3,192					**3,192**		**0.60**	**4.84**	
		8128 [b]	--		1,866					**1,866**		**0.35**	**2.83**	
		8133 [b]	--		0					**0**		**0.00**	**0.00**	
		8138 [b]	--		0					**0**		**0.00**	**0.00**	
		8140 [b]	--		0					**0**		**0.00**	**0.00**	
		8111	37		8,406	903				**9,309**		**1.76**	**14.45**	
		8149	8		2,451					**2,451**		**0.46**	**3.71**	
		8112	60		13,136	951				**14,087**		**2.67**	**21.70**	
		8109	18		4,741					**4,741**		**0.90**	**7.18**	
		8110	36		8,329	1,110	980			**10,419**		**1.97**	**16.95**	
		8117	24		6,337					**6,337**		**1.20**	**9.60**	
		8115	27		7,910	330				**8,240**		**1.56**	**12.61**	
		8122 [b]	--		8,749					**8,749**		**1.66**	**13.26**	
		Private [c]	--							**0**		**0.00**	**0.00**	

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		Private [c]	--							0		0.00	0.00	
		Private [c]	--							0		0.00	0.00	
		8120 [b]	--		0					0		0.00	0.00	
		8127	5		1,370					1,370		0.26	2.08	
BG	8102		5		651					651		0.12	0.99	
BG	8107		24	114	4,349	2,180				6,529	30,347	1.24	10.72	11
		8108	27		7,681					7,681				
		8118	25		6,653					6,653				
		8126	38		9,484					9,484				
		8136 [b]	--		0					0				
BG	8108		27		7,681					7,681		1.45	11.64	
BG	8110		36		8,329	1,110	980			10,419		1.97	16.95	
BG	8111		37	45	8,406	903				9,309	11,760	1.76	14.45	14
		8149	8		2,451					2,451				
BG	8112		60	78	13,136	951				14,087	18,828	2.67	21.70	22
		8109	18		4,741					4,741				
BG	8114		73	73	14,291	331	718			15,340	25,017	2.91	23.91	24
		8147 [b]	--		9,677					9,677				
BG	8126		38		9,484					9,484		1.80	14.37	
BG	8128 [b]		--	0	1,866					1,866	1,866	0.35	2.83	3
		8133 [b]	--		0					0				
		8138 [b]	--		0					0				
BG	8132		11		3,192					3,192		0.60	4.84	
BG	8148		15		3,640					3,640		0.69	5.52	
BG	8149		8		2,451					2,451		0.46	3.71	
P	8201		168	225	39,055					39,055	51,735	7.40	59.17	78

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		8210	12		3,216					3,216		0.61	4.87	
		8212	5		1,944					1,944		0.37	2.95	
		8207	15		2,334					2,334		0.44	3.54	
		Private [c]	--							0		0.00	0.00	
		8213	13		3,056					3,056		0.58	4.63	
		8216	12		2,130					2,130		0.40	3.23	
P	8202		38	68	11,375					11,375	21,479	2.15	17.23	33
		8203	17		5,126					5,126		0.97	7.77	
		8208	4		2,334					2,334		0.44	3.54	
		8211	4		700					700		0.13	1.06	
		8212	5		1,944					1,944		0.37	2.95	
P	8203		17		5,126					5,126		0.97	7.77	
P	8204		12	22	3,872					3,872	6,237	0.73	5.87	9
		8209	7		1,755					1,755		0.33	2.66	
		8206	3		610					610		0.12	0.92	
P	8205		42	64	12,320					12,320	18,557	2.33	18.67	28
		8204	12		3,872					3,872		0.73	5.87	
		8209	7		1,755					1,755		0.33	2.66	
		8206	3		610					610		0.12	0.92	
P	8210		12		3,216					3,216		0.61	4.87	
P	8214		23		5,841					5,841		1.11	8.85	
P	8216		12		2,130					2,130		0.40	3.23	
P	8218		23		5,348					5,348		1.01	8.10	
P	8220		8		2,343					2,343		0.44	3.55	
SB	8301		30	85	3,900		1,389			5,289	19,853	1.00	9.07	31
		8303	35		9,272					9,272		1.76	14.05	

Table 8.4 (Cont.d)

System[a]	Basin No.	Upstream Basin No.	No. Manholes in Basin	No. Manholes in Basin Group	Pipe Length (feet) of Each Diameter (inches)					Length Mains in Basin (linear feet)	Length Mains in Basin Group (linear feet)	Length Mains in Basin (miles)	Inch-Mile (Direct)	Inch-Mile (Total)
					8	10	12	24	30					
		8306	3		1,076					**1,076**		**0.20**	**1.63**	
		8307	17		4,216					**4,216**		**0.80**	**6.39**	
SB	8302		65	**65**	17,025	2,254	205			**19,484**	**19,484**	**3.69**	**30.53**	**31**
		Private [c]	--							**0**		**0.00**	**0.00**	
SB	8303		35		9,272					**9,272**		**1.76**	**14.05**	
SB	8304		12	**12**	3,200					**3,200**	**3,200**	**0.61**	**4.85**	**5**
		8305 [b]	--		0					**0**		**0.00**	**0.00**	
SB	8305 [b]		--		0					**0**		**0.00**	**0.00**	
SB	8307		17		4,216					**4,216**		**0.80**	**6.39**	
SB	8308		23		4,821					**4,821**		**0.91**	**7.30**	

Notes:

(a) BG - Belle Glade, P - Pahokee and SB - South Bay

2. For each different gravity pipe diameter, multiply the diameter in inches by the total length of pipe in miles. Add the results for each different pipe diameter to obtain an overall value for the basin in units of inch-mile.

3. Divide gallons per day from Step 1 by inch-mile from Step 2 to obtain GPDIM.

The usefulness of this metric can be illustrated with the following example:

> Basins A and B both have night flow infiltration rates of 100 gallons per minute (144,000 gallons per day), but Basin A consists of one mile of 8-inch pipe and Basin B consists of 10 miles of 8-inch pipe, resulting in GPDIM values of 18,000 and 1,800 for Basins A and B respectively. This means that while both basins contribute an identical amount of infiltration to the overall system, Basin A on a relative basis has a much more severe infiltration problem that will likely be easier to locate and repair. It is therefore more cost-effective and efficient for the system's owner to focus inspection and rehabilitation efforts on Basin A.

Data Analysis

Analysis of basin level data was conducted for each pump station using the following procedure:

1. Develop formulas and commands within electronic data files to calculate wet well fill times throughout the monitoring period using the data logger pump start and stop times.

2. Identify data gaps along with any apparent erroneous or unreliable data.

3. Graph monitoring period with wastewater flow and concurrent rainfall. Identify specific periods of dry and wet weather for more detailed analysis of I-I.

4. Conduct inflow analysis using a selected wet weather event to assess the effect on wastewater flow. Ideally, a significant rain event is preceded and followed by a period of dry weather to more clearly illustrate the effects of the rainfall.

5. Conduct infiltration analysis using dry weather data under high and low groundwater conditions. Reference **Figure 8-12** for an example taken from Basin 8107 in Belle Glade during dry weather from November 1 through November 7, 2012. Note that the lowest portion of this regular, dry weather diurnal pattern corresponds to the so-called "night flow" period between 1:00 AM and 5:00 AM when water use is minimal and the majority of flow is infiltration.

6. Produce graphs illustrating daily rainfall, daily average flow, and hourly average flow throughout the monitoring period. Reference **Figure 8-13** for an example taken from Basin 8107 in Belle Glade.

Figure 8-12
Sample Dry Weather Diurnal Pattern – LS 8107 (November 1 – 7, 2012)

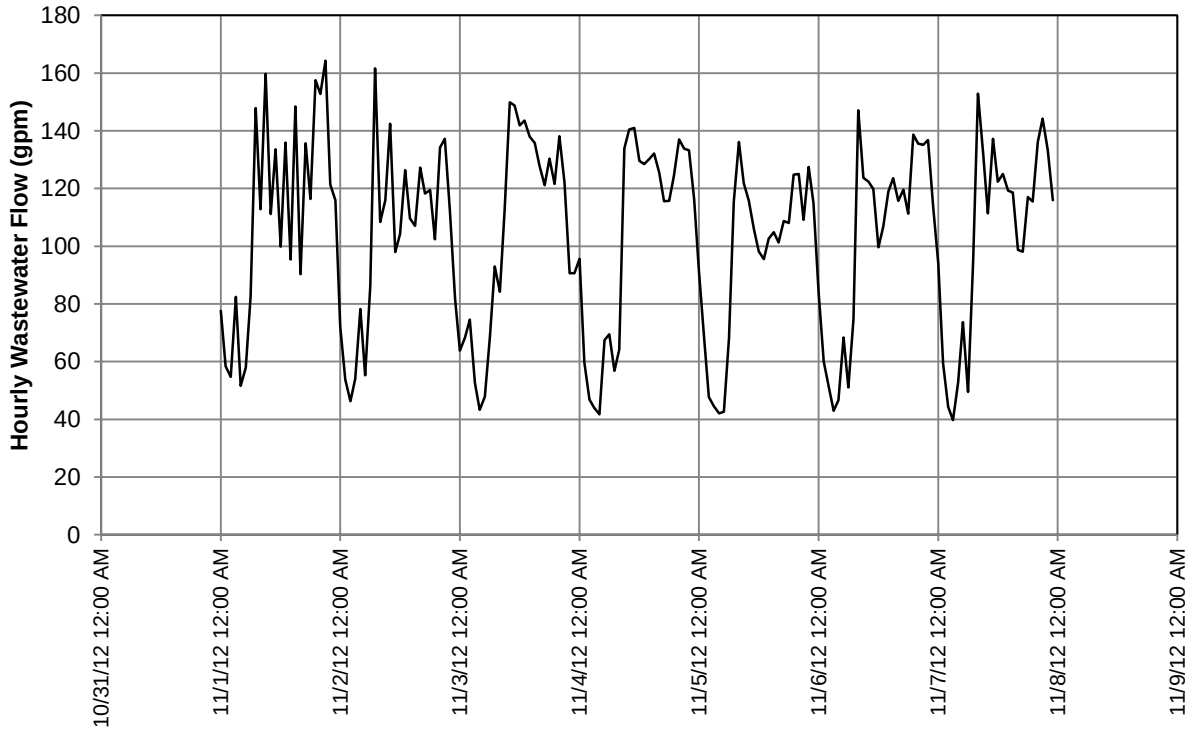
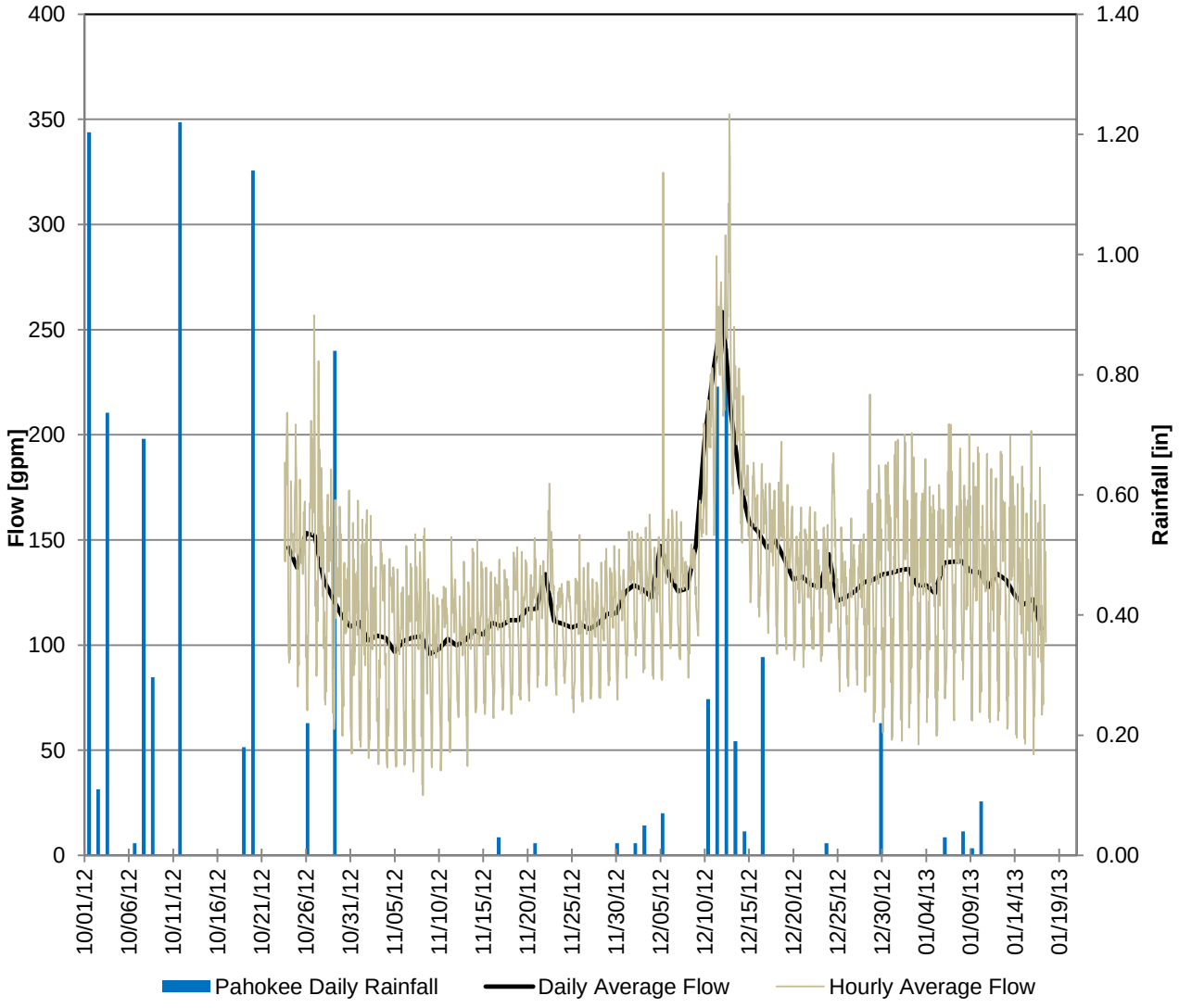


Figure 8-12
Sample Illustration of Daily Rainfall and Wastewater Flow – LS 8107
(October - December 2012)



Appendix C contains graphs showing daily rainfall, daily average flow, and hourly average flow for each pump station. The Appendix C graphs and associated data provide a basis for the I-I prioritization described in the following paragraphs. **Appendix D** summarizes the data monitoring period for each basin and identifies reasons for data gaps or observed discrepancies in the data.

It should be noted that many of the stations re-pump wastewater from tributary basins. Appendix A identifies these stations and the associated upstream basins. Since the subtraction of upstream flows would require a considerably more complex data collection and analysis process that is beyond the scope of this task, this type of measurement and adjustment was not attempted. The results, therefore, represent not only flows originating in gravity collection piping directly associated with the selected basins, but also flow originating in gravity collection piping belonging to any upstream basins. This means that the analysis for these "Basin Groups", while still useful as a screening tool to identify areas of the system where excessive I-I may exist, is less specific in that the relative I-I contributions of basins within a group cannot be observed, and more elevated I-I within one basin may be obscured by low I-I within other basins belonging to that group.

Table 8.5 summarizes the results of the flow monitoring analysis in order of Basin Number. Table 8.5 is constructed based on analysis of the data presented Appendix C, and summarizes average flows, peak hourly flows, and night flows for dry weather and wet weather periods throughout the data collection period from October of 2012 into January of 2013.

Table 8.6 shows basin priority using the **Table 8.5** data and multiple criteria as follow:

- By "**Dry Weather Period 1 Infiltration**" (GPDIM) in descending order. In this case, infiltration is measured as "night flow" – flow measured between 1:00 AM and 5:00 AM when most residents are asleep and water usage is at a minimum. As previously described, the GPDIM unit allows basins of different sizes to be compared with respect to the relative severity, not magnitude, of infiltration. This analysis focused on an extended period of dry weather (November 1 through 30, 2012) to exclude temporarily high groundwater elevations associated with specific rain events, thereby isolating baseline infiltration from rainfall-dependent infiltration. This could be considered to represent dry weather, dry season infiltration.

- By **"Dry Weather Period 2 Infiltration**" (GPDIM) in descending order. This analysis also used dry weather night flow data, but from December 15 through 21, 2012. This period followed a substantial period of wet weather ("Wet Weather Period") that occurred the previous week, when between December 8 and 14 the communities of Belle Glade, Pahokee, and South Bay received 2.44, 1.62, and 1.54 inches of rainfall, respectively. Dry Weather Period 2, therefore, provides an indication as to the baseline level of infiltration that occurs when the groundwater table approaches higher levels due to

Table 8.5 - Results of Flow Data Analysis Sorted by Basin Number

System	Pump Station	Linear Feet of All Gravity Mains Upstream of Pump Station	Inch-Mile for All Gravity Mains Upstream of Pump Station	Upstream Pump Station(s)	Monitoring Period		Dry Weather Period 1 (November 1-30, 2012)				Wet Weather Period (December 8-14, 2012)				Dry Weather Period 2 (December 15-21, 2012)				Night Flow (DW1) ÷ Average (DW1)	Night Flow (DW2) ÷ Night Flow (DW1)	Peak Hourly (WW) ÷ Average (DW1)	Average (WW) ÷ Average (DW1)	Average (DW2) ÷ Average (DW1)	Notes
					Date Start	Date Stop	Average (gpm)	Peak Hourly (gpm)	Night Flow (gpm)	Night Flow (gpdim)	Average (gpm)	Peak Hourly (gpm)	Night Flow (gpm)	Night Flow (gpdim)	Average (gpm)	Peak Hourly (gpm)	Night Flow (gpm)	Night Flow (gpdim)						
Belle Glade	8101	164,019	269	Numerous - see schematic	10/23/12	01/17/13	864	2340	678	3,628	1225	3795	1044	5,584	1186	2674	898	4,803	0.79	1.32	4.39	1.42	1.37	3
Belle Glade	8102	651	0.99	---	10/23/12	01/17/13	4	8	3	4,425	4	7	3	4,823	4	6	3	5,077	0.86	1.15	1.97	1.03	1.09	
Belle Glade	8107	30,347	11	8108, 8118, 8126, 8136	10/23/12	01/17/13	94	154	64	8,650	167	307	138	18,479	126	171	100	13,385	0.69	1.55	3.27	1.78	1.34	
Belle Glade	8108	7,681	11.64	---	10/23/12	01/17/13	32	54	23	2,894	49	70	41	5,048	43	83	35	4,361	0.74	1.51	2.21	1.57	1.37	3
Belle Glade	8110	10,419	16.95	---	10/23/12	01/17/13	40	108	32	2,716	85	140	75	6,360	72	126	61	5,169	0.80	1.90	3.51	2.13	1.82	
Belle Glade	8112	18,828	22	8109	10/23/12	12/23/12	115	244	97	6,437	129	202	108	7,193	476	813	381	25,267	0.84	3.93	1.75	1.12	4.13	
Belle Glade	8126	9,484	14.37	---	10/23/12	01/17/13	19	6	6	593				0				0	0.32	0.00	0.00	0.00	0.00	4
Belle Glade	8128	1,866	3	8133, 8138	10/23/12	01/17/13	37	154	21	10,447	66	161	60	30,766	32	78	18	9,336	0.56	0.89	4.39	1.80	0.88	
Belle Glade	8132	3,192	4.84	---	10/23/12	01/17/13	9	30	6	1,845	9	81	11	3,333	8	20	6	1,687	0.68	0.91	8.82	0.94	0.85	
Belle Glade	8148	3,640	5.52	---	10/23/12	01/17/13	11	22	7	1,869	13	23	10	2,498	12	21	9	2,275	0.66	1.22	2.10	1.21	1.08	
Belle Glade	8149	2,451	3.71	---	10/23/12	01/17/13	19	41	12	4,565	73	133	55	21,297	41	104	26	9,947	0.62	2.18	7.01	3.88	2.15	
Pahokee	8201	51,735	78	8207, 8210, 8212, 8213, 8216, Private	10/24/12	01/17/13	301	499	251	4,602	707	1,361	582	10,696	476	796	402	7,383	0.83	1.60	4.53	2.35	1.58	
Pahokee	8202	21,479	33	8203, 8208, 8211, 8212	10/24/12	01/17/13	166	249	131	5,811	232	332	209	9,231	149	232	130	5,742	0.79	0.99	2.00	1.40	0.89	
Pahokee	8203	5,126	7.77	---	10/24/12	01/17/13	21	83	14	2,556	17	31	14	2,583	18	42	13	2,403	0.65	0.94	1.45	0.79	0.86	
Pahokee	8204	6,237	9	8206, 8209	10/24/12	01/17/13	7	34	5	691	8	21	6	930	6	14	3	486	0.61	0.70	2.85	1.11	0.80	
Pahokee	8205	18,557	28	8204, 8206, 8209	10/24/12	01/17/13	30	49	24	1,239	32	58	27	1,360	32	64	25	1,274	0.82	1.03	1.96	1.07	1.07	
Pahokee	8210	3,216	4.87	---	10/24/12	01/17/13	15	112	13	3,817	27	41	26	7,740	14	21	14	4,143	0.86	1.09	2.75	1.79	0.92	
Pahokee	8214	5,841	8.85	---	10/24/12	01/17/13	166	249	131	21,370	232	332	209	33,944	149	232	130	21,116	0.79	0.99	2.00	1.40	0.89	
Pahokee	8216	2,130	3.23	---	10/24/12	01/17/13	5	32	3	1,345	6	16	3	1,531	6	13	4	1,708	0.59	1.27	3.06	1.21	1.16	
Pahokee	8218	5,348	8.10	---	10/24/12	01/17/13	19	40	11	2,040	34	78	31	5,422	18	35	11	1,933	0.59	0.95	3.99	1.76	0.92	
Pahokee	8220	2,343	3.55	---	10/24/12	01/17/13	36	69	24	9,633	37	80	24	9,819	37	68	23	9,443	0.66	0.98	2.22	1.04	1.02	
South Bay	8301	19,853	31	8303, 8306, 8307	10/24/12	01/17/13	45	192	29	1,361	89	177	74	3,433		109		0	0.66	0.00	3.97	1.99	0.00	5
South Bay	8302	19,484	31	Private (Jail)	10/24/12	01/17/13	70	215	55	2,607	88	195	58	2,721	67	220	53	2,482	0.79	0.95	2.81	1.27	0.96	
South Bay	8304	3,200	5	8305	10/24/12	01/17/13	7	21	3	1,031	10	19	6	1,792	8	17	4	1,086	0.48	1.05	2.62	1.42	1.07	
South Bay	8305	0	0.00	---	10/24/12	01/17/13	5	17	2	#DIV/0!	5	9	2	#DIV/0!	5	10	2	#DIV/0!	0.36	1.17	1.90	0.99	0.98	
South Bay	8307	4,216	6.39	---	10/24/12	01/17/13	6	23	3	638	8	26	5	1,133	7		3	650	0.45	1.02	4.12	1.31	1.15	6
South Bay	8308	4,821	7.30	---	10/24/12	01/17/13	5	11	4	814	6	20	5	957	4	10	3	613	0.77	0.75	3.65	1.19	0.82	

Notes:

1 Night Flow is 1:00 AM to 5:00 AM.
2 "gpdim" is gallons per day divided by length of pipe in miles x diameter of pipe in inches.
3 Staff indicate station is subject to heavy I-I / flooding.
4 8126 data missing from 11/28 to 12/24.
5 8301 data missing from 12/12 to 12/29.
6 8307 data missing from 12/18 to 01/11.
7 Reference Appendix E for explanations of data gaps and stations with no usable data (8111, 8114, 8303).
8 DW1 = Dry Weather Period 1; WW = Wet Weather Period; DW2 = Dry Weather Period 2.

Table 8.6 - Basin Prioritization Analyses

System	Pump Station	Linear Feet of All Gravity Mains Upstream of Pump Station	Infiltration Prioritization								Inflow Prioritization					
			Dry Weather Period 1 Infiltration			Dry Weather Period 2 Infiltration			Night Flow (DW2) ÷ Night Flow (DW1)		Average (WW) ÷ Average (DW1)			Peak Hourly (WW) ÷ Average (DW1)		
			Basin	GPM	GPDIM	Basin	GPM	GPDIM	Basin	Ratio	Basin	ADF WW1 (GPM)	Ratio	Basin	PHF (GPM)	Ratio
Belle Glade	8101	164,019	8214	131	21,370	8112	381	25,267	8112	3.93	8149	73	3.88	8132	81	8.82
Belle Glade	8102	651	8128	21	10,447	8214	130	21,116	8149	2.18	8201	707	2.35	8149	133	7.01
Belle Glade	8107	30,347	8220	24	9,633	8107	100	13,385	8110	1.90	8110	85	2.13	8201	1,361	4.53
Belle Glade	8108	7,681	8107	64	8,650	8149	26	9,947	8201	1.60	8301	89	1.99	8101	3,795	4.39
Belle Glade	8110	10,419	8112	97	6,437	8220	23	9,443	8107	1.55	8128	66	1.80	8128	161	4.39
Belle Glade	8112	18,828	8202	131	5,811	8128	18	9,336	8108	1.51	8210	27	1.79	8307	26	4.12
Belle Glade	8126	9,484	8201	251	4,602	8201	402	7,383	8101	1.32	8107	167	1.78	8218	78	3.99
Belle Glade	8128	1,866	8149	12	4,565	8202	130	5,742	8216	1.27	8218	34	1.76	8301	177	3.97
Belle Glade	8132	3,192	8102	3	4,425	8110	61	5,169	8148	1.22	8108	49	1.57	8308	20	3.65
Belle Glade	8148	3,640	8210	13	3,817	8102	3	5,077	8305	1.17	8304	10	1.42	8110	140	3.51
Belle Glade	8149	2,451	8101	678	3,628	8101	898	4,803	8102	1.15	8101	1225	1.42	8107	307	3.27
Pahokee	8201	51,735	8108	23	2,894	8108	35	4,361	8210	1.09	8214	232	1.40	8216	16	3.06
Pahokee	8202	21,479	8110	32	2,716	8210	14	4,143	8304	1.05	8202	232	1.40	8204	21	2.85
Pahokee	8203	5,126	8302	55	2,607	8302	53	2,482	8205	1.03	8307	8	1.31	8302	195	2.81
Pahokee	8204	6,237	8203	14	2,556	8203	13	2,403	8307	1.02	8302	88	1.27	8210	41	2.75
Pahokee	8205	18,557	8218	11	2,040	8148	9	2,275	8214	0.99	8148	13	1.21	8304	19	2.62
Pahokee	8210	3,216	8148	7	1,869	8218	11	1,933	8202	0.99	8216	6	1.21	8220	80	2.22
Pahokee	8214	5,841	8132	6	1,845	8216	4	1,708	8220	0.98	8308	6	1.19	8108	70	2.21
Pahokee	8216	2,130	8301	29	1,361	8132	6	1,687	8302	0.95	8112	129	1.12	8148	23	2.10
Pahokee	8218	5,348	8216	3	1,345	8205	25	1,274	8218	0.95	8204	8	1.11	8214	332	2.00
Pahokee	8220	2,343	8205	24	1,239	8304	4	1,086	8203	0.94	8205	32	1.07	8202	332	2.00
South Bay	8301	19,853	8304	3	1,031	8307	3	650	8132	0.91	8220	37	1.04	8102	7	1.97
South Bay	8302	19,484	8308	4	814	8308	3	613	8128	0.89	8102	4	1.03	8205	58	1.96
South Bay	8304	3,200	8204	5	691	8204	3	486	8308	0.75	8305	5	0.99	8305	9	1.90
South Bay	8305	0	8307	3	638	8301	---	0	8204	0.70	8132	9	0.94	8112	202	1.75
South Bay	8307	4,216	8126	6	593	8126	---	0	8301	0.00	8203	17	0.79	8203	31	1.45
South Bay	8308	4,821	8305	2		8305	2		8126	0.00	8126	---	0.00	8126	---	0.00

Notes:

1 DW1 = Dry Weather Period 1; WW = Wet Weather Period; DW2 = Dry Weather Period 2

2 Colors designate how top basins from the first infiltration prioritization rank in the 2 subsequent infiltration prioritizatons, then separately how top basins from the first inflow prioritzation rank in the second inflow prioritization.

seasonal rainfall. This could be considered to approximate dry weather, wet season infiltration. For most of the basins, this "wet season" infiltration is higher than dry season infiltration, suggesting that with higher groundwater elevations more pipeline defects become submerged in groundwater and/or a higher hydraulic gradient acts on submerged defects to drive a higher rate on infiltration. It is interesting to observe that both the infiltration prioritizations – Dry Weather Period 1 and Dry Weather Period 2 – result in a very similar prioritization, with the top 8 basins being the same in both cases. It should be noted that in addition to the relative severity of infiltration (GPDIM), the absolute level of infiltration is shown in units of gallons per minute (GPM). This provides indication as to the approximate volume of flow that could be removed from the system through rehabilitation of the associated basins. As an example, Basin 8112 appears to exhibit the most severe infiltration problem on a relative basis with a "wet season" rate of 25,267 GPDIM. On an absolute basis Basin 8112 also appears to be a high contributor of infiltration to the system, having an absolute rate of approximately 381 GPM under higher groundwater table conditions. Basin 8149, in contrast, ranks as No. 4 on the "wet season" GPDIM list but only by virtue of its small size (2,451 LF), since the absolute contribution is only approximately 26 GPM.

- By **Wet Weather Period Average Flow versus Dry Weather Period 1 Average Flow** (ratio) in descending order. This comparison provides an indication as to the sensitivity of each basin to direct inflow, but would also include RDI. In the top basin, 8149, average wet weather flows were nearly four times greater than average dry weather flows.

- By **Wet Weather Period Peak Hourly Flow versus Dry Weather Period 1 Average Flow** (ratio) in descending order. This quantity may be useful for consideration of pump station transmission capacity and the likelihood of having overflows in severe wet weather events. For this quantity Basin 8101 exhibited the largest peak hourly flow at 3,795 GPM, whereas Basin 8132 showed the largest peak to average flow ratio at 8.82. It should be noted that Basin 8101 (including upstream basins) is much larger than Basin 8132 in terms of the gravity collection mains the measured flows represent, with 164,019 linear feet versus 3,192 linear feet respectively, and it is not unusual to see higher peak to average ratios in smaller basins. Elevated wet weather flows are an indication of direct surface runoff entering the sewer through defects in laterals, mains, and manholes as well as possibly storm sewer cross connections, and basins of this type would be good candidates for a smoke testing program.

Infiltration Prioritization

A number of the basins studied exhibit elevated infiltration levels, as illustrated by the following summary of the ten highest GPDIM values measured (shown in **Table 8.7**). While Miami-Dade County currently enforces a standard of 5,000 GPDIM as previously noted, this value is provided as an example and is not necessarily applicable to the Glades Utility service area. The United States Environmental Protection Agency (USEPA) has used other metrics for infiltration. For example, infiltration was previously characterized as non-excessive provided that per capita dry weather values for wastewater did not exceed the national average, although the USEPA accepted higher values where removal could be shown not be cost effective. At this time, it seems most appropriate for PBCWUD to focus investigation and rehabilitation activities on basins having the highest GPDIM values, where such work is likely to provide the greatest benefit at the lowest cost.

Table 8.7 – Infiltration Prioritization

Priority	Basin	Night Flow (GPDIM)
1	8112	25,267
2	8214	21,116
3	8107	13,385
4	8149	9,947
5	8220	9,443
6	8128	9,336
7	8201	7,383
8	8202	5,742
9	8110	5,169
10	8102	5,077
Data from December 15-21, 2012		

Inflow Prioritization

In addition to infiltration under dry weather conditions, a number of the basins studied exhibit elevated wet weather flows. This can be illustrated by **Table 8.8**, which prioritizes the study basins using the ratio of *Wet Weather Period Average Flow to Dry Weather Period 1 Average*

Flow. It is interesting to note that six of these ten basins are also on the list of the ten highest *Wet Weather Period Peak Hourly Flow to Dry Weather Period 1 Average Flow* ratios (reference Table 8.6), which provides a somewhat closer indication of direct inflow as opposed to direct inflow combined with rainfall dependent infiltration. Whereas smoke testing may be effective for detecting some sources of rainfall-dependent infiltration, it is more likely to be effective as a tool for detecting direct inflow, and therefore these basins would appear to be among the best candidates for a smoke testing program.

Table 8.8 – Wet Weather Prioritization

Priority	Basin	Average (Wet Weather Period) ÷ Average (Dry Weather Period 1)
1	8149 *	3.88
2	8201 *	2.35
3	8110 *	2.13
4	8301 *	1.99
5	8128 *	1.80
6	8210	1.79
7	8107	1.78
8	8218 *	1.76
9	8108	1.57
10	8304	1.42

Wet Weather Period data from December 8-14, 2012

Dry Weather Period 1 data from November 1-30, 2012

* Designates basin also on list of ten highest *Wet Weather Period Peak Hourly Flow to Dry Weather Period 1 Average Flow* ratios

Cost Effectiveness

Rehabilitation of a collection system main line, manhole or service line is typically termed "cost-effective" when the cost of rehabilitation to remove a given amount of extraneous flow is less than the cost of continuing to transport, treat, and dispose of that same amount of extraneous

flow over some specified number of years. To assist in the evaluation of this metric, the PBCWUD provided guidance (see **Table 8.9**) concerning the costs of collection, transmission, treatment, and disposal in 2012.

Table 8.9 – Estimated Costs of Collection, Transmission, Treatment, and Disposal (2012)

Item	Unit	Quantity
WWTP Cost		
Belle Glade	$	1,738,342
Pahokee	$	539,316
Total	$	**2,277,658**
WWTP Total Flow		
Belle Glade	MG	961.04
Pahokee	MG	332.20
Total	MG	**1,293.24**
Lines and Lift Stations Cost		
Belle Glade and South Bay	$	1,417,549
Pahokee	$	489,996
Total	$	**1,907,545**
WWTP plus Lines and Lift Stations		
Belle Glade and South Bay	$ / 1,000 gallons	$3.28
Pahokee	$ / 1,000 gallons	$3.10
Total	$ / 1,000 gallons	**$3.24**

To provide a simple theoretical example of how this might be used, a 1 GPM leak coming from a broken pipe in Belle Glade would amount to 525,600 gallons per year, and at a rate of $3.28 per 1,000 gallons would result in an annual collection, pumping, treatment, and disposal cost of $1,724. Assuming this defect could be repaired via an excavated point repair costing approximately $7,000, the “payback period” would be about 4 years; that is, the cost of the repair would be recouped over a four-year period through reduced costs in collection, pumping, treatment, and disposal, after which a net cost savings would begin to accrue. Under such an analysis, those repairs having the shortest payback periods (quickest return on investment) would be considered most cost effective and would be given the highest priority in the expenditure of limited repair budgets.

It should be noted that in addition to cost-effectiveness, factors such as structural condition, public nuisance, health hazards, system hydraulics, and operation and maintenance demand may become the determining factor as to whether a given repair is assigned a higher priority for rehabilitation, should one or more such considerations constitute a sufficient basis for action.

Estimated Rehabilitation Costs

A review of existing inspection documentation was performed to assist in the development of cost estimates for investigation and rehabilitation of the Belle Glade, Pahokee, and South Bay systems. The inspection documentation, produced by others, included manhole inspection reports, sewer mainline video, and smoke testing reports.

Appendix E contains a summary of the specific documentation reviewed, as well as the number of occurrences of defects that appear to warrant some type of near-term intervention. Appendix E also contains system-specific cost estimates that incorporate the defect occurrence rates into assumptions concerning the condition of the remainder of the Belle Glade, Pahokee, and South Bay systems, respectively, and the corresponding level of inspection and repair that would be recommended or required. Where available documentation did not permit a defect occurrence rate to be developed for a particular collection system or type of repair (for example, no inspection documentation of any kind was available for South Bay, and no lateral video was available for any of the three collection systems), assumptions were made based on experience in similar systems. Such assumptions are noted for each of the estimates along with any other applicable assumptions concerning defect occurrence rates. This review, it should be noted, focused on structural defects and other defects affecting I-I. Maintenance-type issues such as grease and solids deposition were not included. Estimated repair costs from Appendix E are summarized below.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are made based on the system-level and basin-level evaluations presented herein:

- For the period studied, January of 2012 through February of 2013, the data indicate that I-I for the Belle Glade, Pahokee, and South Bay systems combined ranges from approximately 20 percent of total flows in the dry season (November through April) to approximately 49 percent of total flows in the wet season (May through October), with an annual average of approximately 37 percent.

- Baseline, dry weather infiltration on an average daily basis is estimated to be approximately 0.56 MGD for the period studied. The remaining fraction of extraneous flow is comprised of direct inflow and rainfall-dependent infiltration that results from a temporarily higher groundwater table caused by rainfall percolating through pervious surfaces. Peak monthly inflow (and rainfall-dependent infiltration) during the period studied was approximately 100 MG.

- I-I are a significant issue in the subject collection systems. Conditions are particularly acute during the wet season when direct inflow and rainfall-dependent infiltration result

in peak flows to the WWTPs that can be multiples of average dry weather flows.

- The basin-level flow data permit the individual basins to be characterized and prioritized with respect to inflow and infiltration. When SCADA data are unavailable, data loggers can provide a reliable, low-cost method of measuring flow to prioritize I-I reduction as well as to document flow reductions following rehabilitation.

- While direct inflow is observable in multiple basins following rain events, a significant percentage of rain-related flow increases appears to be rainfall-dependent infiltration resulting from a temporarily higher groundwater table. For many basins this effect continues for multiple days following rainfall events. This suggests that laterals may be a significant source of infiltration.

A comprehensive program of assessment and repair is recommended for the Belle Glade, South Bay, and Pahokee wastewater collection systems to limit I-I and help maintain a reliable and structurally sound system. The following actions are recommended in support of those goals:

- Conduct detailed field investigations in the identified priority basins (reference Tables 8.7 and 8.8) to identify the specific defects in mains, manholes, and laterals that contribute to the elevated rates of I-I observed. Investigations should include manhole inspection, smoke testing, and video inspection of sewer mains. Television inspection of suspect laterals should be performed as warranted following inspection of mains. Flow data analysis and night flow isolation can be used to focus and limit the scope of such investigations. Infiltration investigation activities should ideally coincide with periods of high groundwater to approximate worst-case conditions. Inflow investigation activities should ideally coincide with periods of dry weather and low groundwater, and should include manhole inspection and smoke testing. During the investigation activities, inflow dishes should be installed in manholes and missing or damaged cleanout caps should be replaced.

- Process, evaluate, and electronically store the results of inspection activities. Estimate flow rates associated with I-I sources and develop repair recommendations with cost estimates and payback period analysis. Prioritize the recommended rehabilitation work based on cost-effectiveness as well as other factors such as structural condition and maintenance demand.

- Policies may need to be developed concerning appropriate methods for addressing defects on the privately owned portion of the lateral. Based on the age and general condition of the collection systems studied herein, it is likely that laterals are a significant source of I-I to the system.

- The 2009 study in Pahokee by AECOM concluded that high levels of infiltration appeared to originate in privately owned gravity systems that rely on the Utility for

subsequent conveyance, treatment, and disposal of flows. Unfortunately, it is not uncommon for maintenance budgets and practices in such systems to be severely deficient. The County should consider contacting the owners of these private systems and initiating a program to assure that reasonable standards of maintenance and repair are upheld.

- As a general practice, the County should continue to monitor pump run times throughout the system to detect changes over time, and where inflow or infiltration is suspected the actual measurement of flows can be conducted using the data logger method implemented for this study. Since aging and deterioration of gravity collection systems is an ongoing process, the overall system should be evaluated periodically and priority basins should be identified for detailed investigation and rehabilitation as warranted.

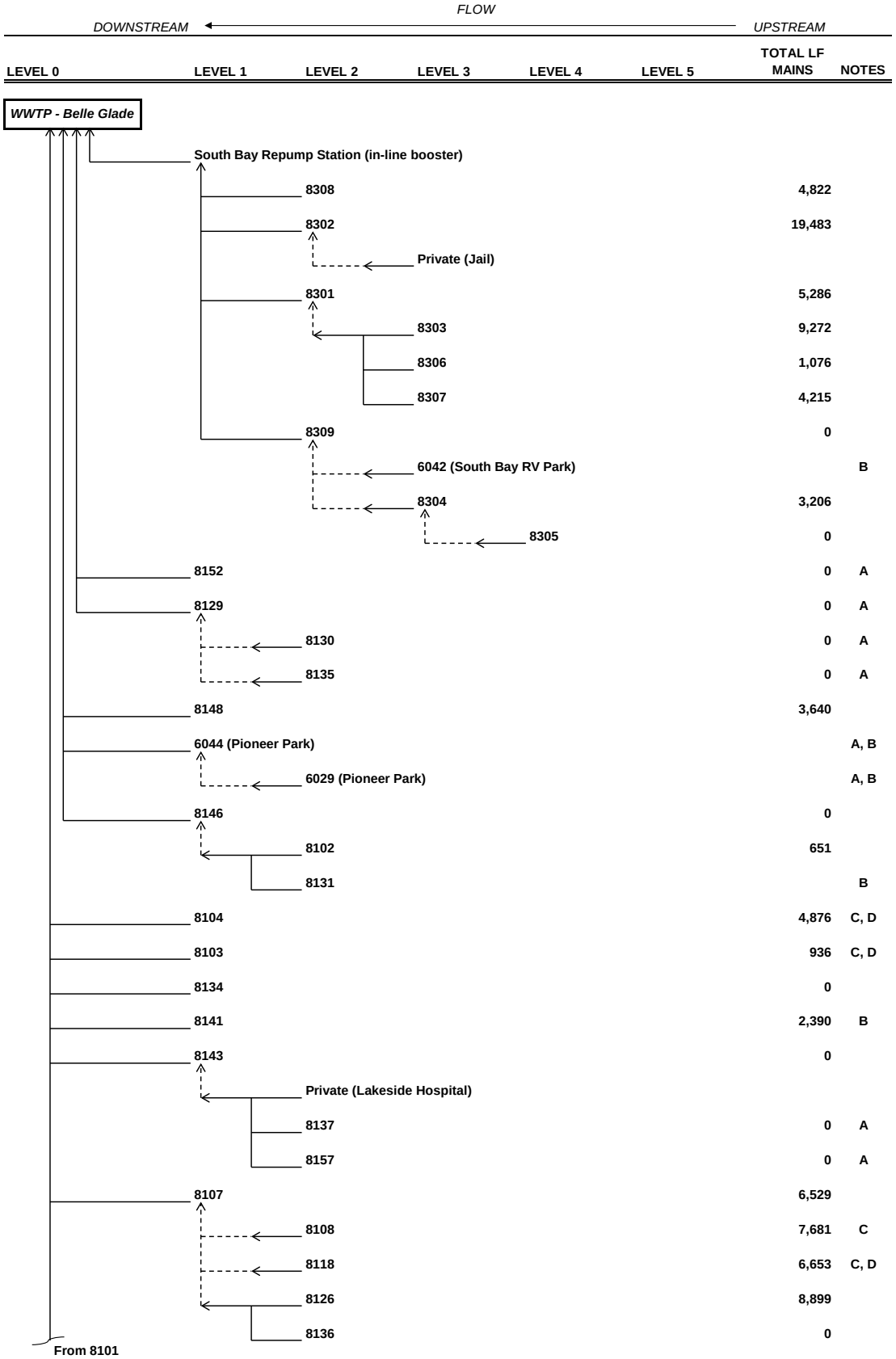
Table 8.10 summarizes the content of Appendix E concerning inspection and rehabilitation requirements along with estimated costs for each of Belle Glade, Pahokee, and South Bay. A three- to five-year program duration is recommended so that the financial costs, as well as the demands on Utility personnel, can be held to a manageable level.

Table 8.10 – Anticipated Tasks and Costs

Task	Estimated Cost		
	Belle Glade	**Pahokee**	**South Bay**
Inspection			
Preliminary evaluation and prioritization	$29,120	$13,440	$7,840
Smoke testing	$48,915	$25,521	$13,261
Manhole inspection	$49,984	$26,560	$12,032
Cleaning and video inspection of mains	$83,855	$21,875	$11,366
Cleaning and video inspection of laterals	$139,758	$36,458	$18,944
Program management and reporting	$70,326	$24,771	$12,689
Subtotal	**$421,958**	**$148,624**	**$76,132**
Rehabilitation			
Lining - manhole to manhole	$1,995,739	$260,310	$135,260
Lining - sectional	$83,855	$10,937	$5,683
Lining - lateral	$1,677,091	$437,496	$227,328
Excavated point repairs	$805,004	$104,999	$54,559
Excavated line replacement	$41,927	$5,469	$2,842
Manhole liners - cementitious	$569,818	$151,392	$68,582
Manhole liners - cementitious/epoxy or polyethylene	$112,464	$29,880	$13,536
Manhole repairs - miscellaneous	$281,160	$74,700	$33,840
Engineering and construction management	$1,113,411	$215,037	$108,326
Subtotal	**$6,680,468**	**$1,290,220**	**$649,956**
ESTIMATED PROGRAM TOTAL	**$7,102,426**	**$1,438,844**	**$726,088**

APPENDIX A
Lift Station Schematic

Appendix A-1
Belle Glade Wastewater Collection and Pumping Schematic



Notes and Legend:

_____ = force main

- - - - - - = gravity main

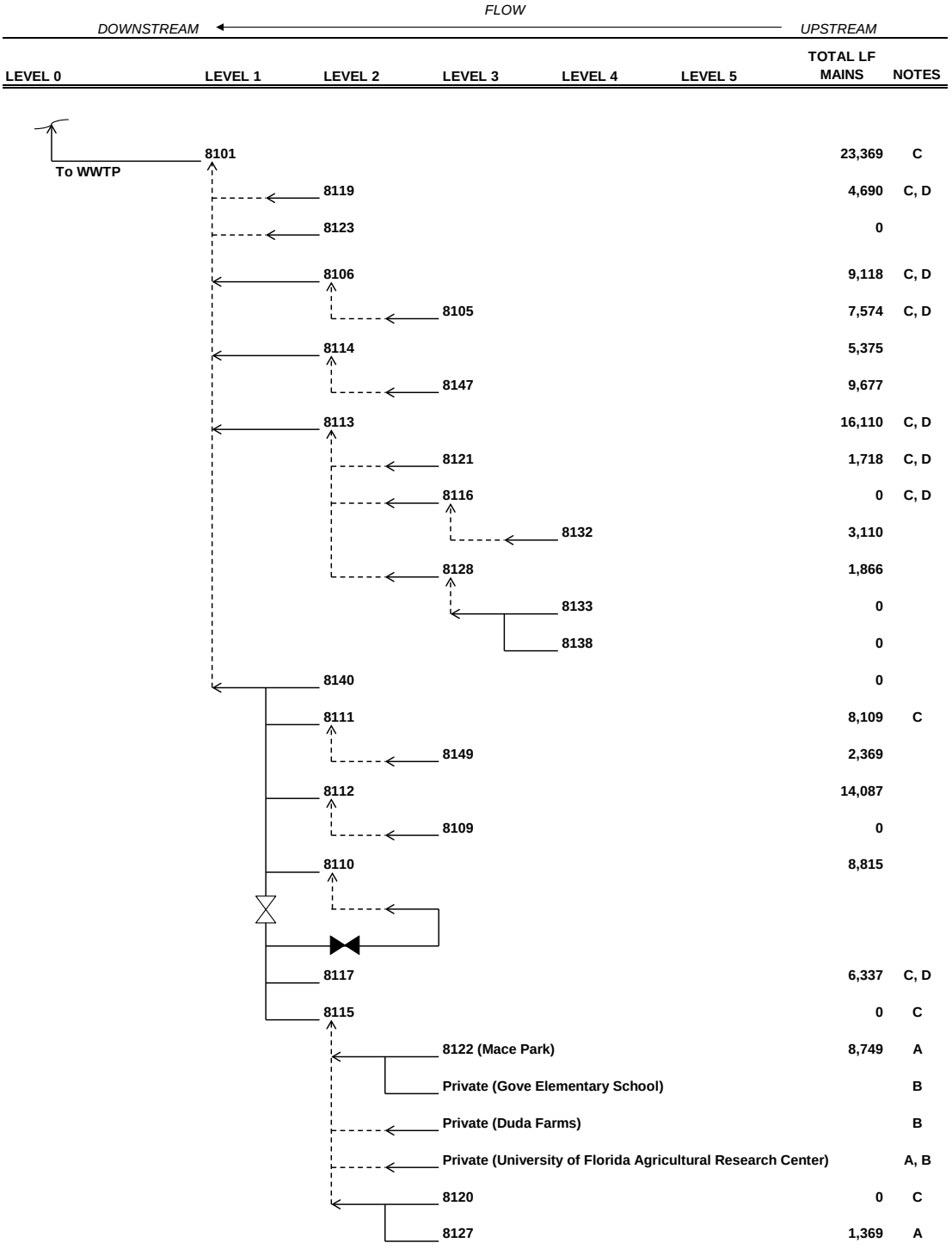
A = relatively lower I-I levels (newer, smaller, better condition)

B = gravity system is privately owned

C = Station is subject to flooding / heavy I-I

D = I-I reduction work is scheduled under other contracts

Appendix A-1
Belle Glade Wastewater Collection and Pumping Schematic



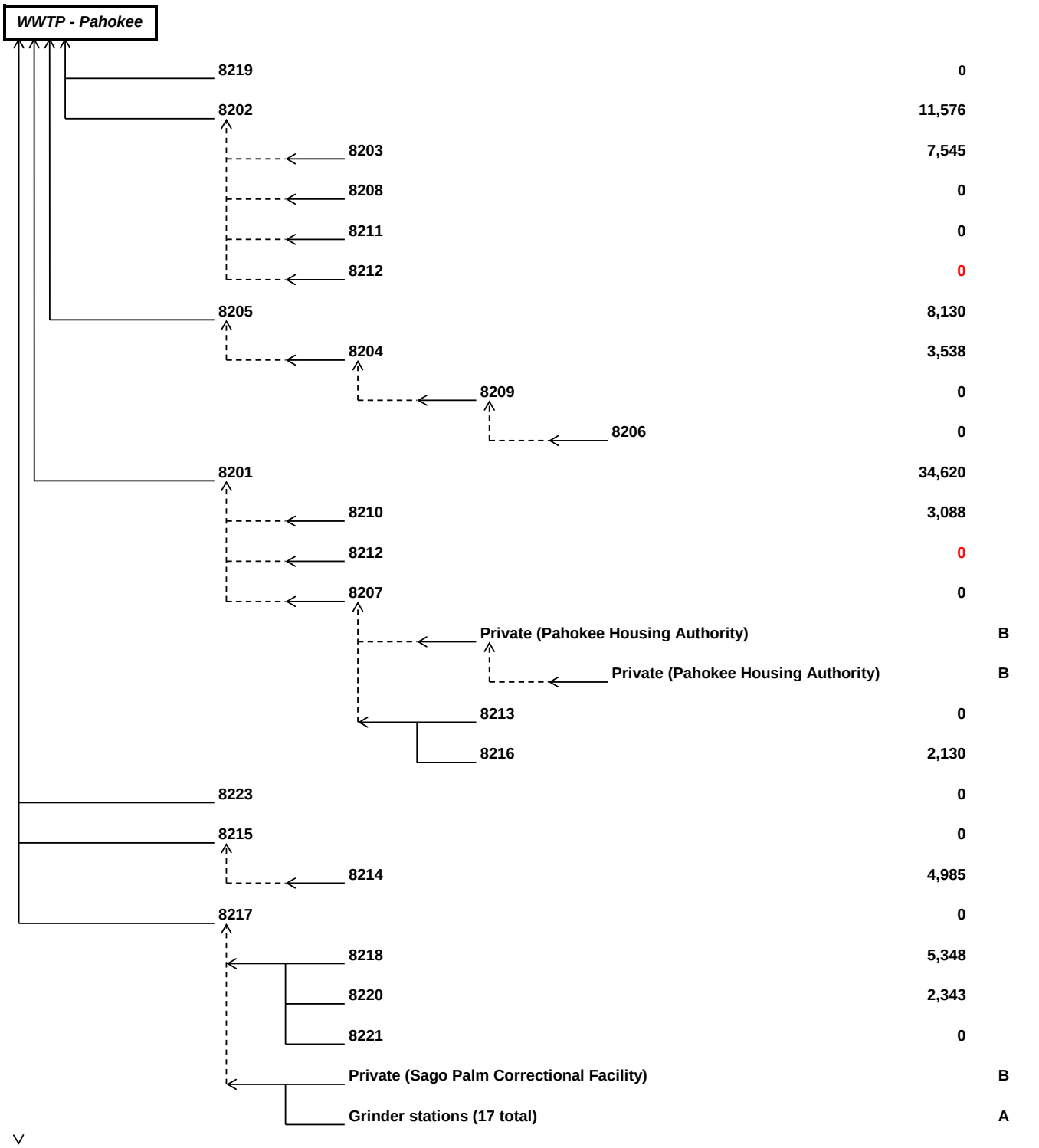
Notes and Legend:

- = force main
- = gravity main
- A = relatively lower I-I levels (newer, smaller, better condition)
- B = gravity system is privately owned
- C = Station is subject to flooding / heavy I-I
- D = I-I reduction work is scheduled under other contracts
- = normally open
- = normally closed

Appendix A-2
Pahokee Wastewater Collection and Pumping Schematic

FLOW

DOWNSTREAM ← *UPSTREAM*



LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	TOTAL LF MAINS	NOTES
WWTP - Pahokee	8219					0	
	8202					11,576	
		8203				7,545	
		8208				0	
		8211				0	
		8212				0	
	8205					8,130	
		8204				3,538	
			8209			0	
				8206		0	
	8201					34,620	
		8210				3,088	
		8212				0	
		8207				0	
			Private (Pahokee Housing Authority)				B
				Private (Pahokee Housing Authority)			B
			8213			0	
			8216			2,130	
	8223					0	
	8215					0	
		8214				4,985	
	8217					0	
		8218				5,348	
		8220				2,343	
		8221				0	
		Private (Sago Palm Correctional Facility)					B
		Grinder stations (17 total)					A

Notes and Legend:

- ———— = force main
- - - - - = gravity main
- **A** = relatively lower I-I levels (newer, smaller, better condition)
- **B** = gravity system is privately owned
- **C** = Station is subject to flooding / heavy I-I
- **D** = I-I reduction work is scheduled under other contracts

APPENDIX B

Wet Well Dimensions

Appendix B

Lift Station No.	Location	Wet Well Dimensions (ft)					Level Control Type	Pump Control Depths (ft)				Wet Well Volume (gals)
		L	W	Depth	Diam	Area (ft2)		All Pumps Off	Lead Pump On	Lag Pump On	High Level Alarm	
LS8101	1401 NW Ave D / NW 14th St	12	12	20		144	Probe	17.0	13.8	13.2	10.167	3,411
LS8102	Raiderville			12	6	28	Float	14.0	13.0	10.5	9	211
LS8107	NE Ave B / NE 2nd			16	8	50	Transducer	13.8	10.8	9.8	8.5	1128
LS8108	NE 1st / NE Ave I			14.5	6	28	Float	12.5	10.5	9.5	6	423
LS8110	SE Ave F / SE 2nd St			12	8	50	Probe	13.3	11.7	10.7	9.3	627
LS8111	SW Ave F / SW 3rd St			12	8	50	Probe	10.7	7.2	6.5	4.5	1,316
LS8112	SW 2nd St / SW Ave B			14.5	6	28	Floats	12.3	10.3	9.0	7	423
LS8113	SW Ave F / SW 10th St			20	8	50	Float	16.0	12.0	11.0	8	1,504
LS8114	SW Ave C / SW 8th St			20	6	28	Float	11.5	9.5	8.0	7	423
LS8115	SE Ave G / SE 4th St			12	8	50	Float	11.0	9.5	8.5	7.5	564
LS8126	NE Ave I / NE 28th St			12	6	28	Probe	11.0	8.2	7.5	5.3	599
LS8128	P.B. State College @ SR 715			18.5	10	79	Float	16.0	13.5	11.0	7	1,469
LS8129	B.G. Marina - Master			12	12	113	Float	11.5	9.5	7.5	6.5	1,692
LS8130	B.G. Marina - Fish Camp			14	6	28	Probe	12.2	9.5	8.8	6.2	564
LS8131	Trailer Park @ SR 715 next to Pimecy Park			12	6	28	Float	13.0	11.5	9.5	6	317
LS8132	SW Ave I / SW 10th St			12	6	28	Float	10.0	8.0	7.5	6	423
LS8143	NW Ave L & B.G. Elementary			12	8	50	Float	11.5	9.5	8.5	6.5	752
LS8146	2601 South Main St			20	12	113	Probe	16.0	15.3	13.3	10.6	564
LS8148	Behind Texaco Plaza - SW corner Main St			30	10	79	Float	18.3	16.3	13.3	12	1,175
LS8149	Winn Dixie Plaza			12	8	50	Float	11.0	9.4	8.0	6	595
LS8152	Drawbridge Café - B.G. Marina			7	4	13	Float	6.5	6.0	5.3	5.2	47
LS8155	B.G. WWTP			8	6	28	Float	6.5	5.5	4.5	3	211
LS8157	Industrial Park SR 15			21	8	50	Float	19.0	17.3	16.7	10	627
LS8201	E 7th St / Mc Claire Rd			20	10	79	Float	16.0	14.4	13.0	10	930
LS8202	E 1st St / Barfield Highway			18	8	50	Float	14.4	13.0	10.5	7.5	533
LS8203	1381 E Main St			20	10	79	Float	18.0	15.0	13.0	11	1,762
LS8204	Bacon Paint Rd / Good Shepherd			17	6	28	Float	14.5	13.5	9.5	7.5	211
LS8205	Bacon Paint / Hairplace			12	8	50	Float	16.0	14.5	12.5	9.5	564
LS8210	Mc Claire / S Coconut Rd			12	4	13	Float	10.5	9.3	8.3	5.5	110
LS8214	Muck City Rd / Service			20	6	28	Float	13.5	12.0	9.4	6.0	317
LS8215	St. Market Rd by water tower			18	12	113	Float	15.4	14.4	13.4	11.4	846
LS8216	86th St N & Glades Dr PBC			14	6	28	Float	11.0	9.8	8.7	7.7	247
LS8217	640 S Market Rd / Fleet			18	12	113	Float	14.5	13.5	13.0	8.5	846

Appendix B

Lift Station No.	Location	Wet Well Dimensions (ft)					Level Control Type	Pump Control Depths (ft)				Wet Well Volume (gals)
		L	W	Depth	Diam	Area (ft2)		All Pumps Off	Lead Pump On	Lag Pump On	High Level Alarm	
LS8218	Boone Ave			12	4	13	Float	9.4	7.8	6.8	5.3	149
LS8219	260 Barfield Highway (Nursing Home)			16	6	28	Float	13.7	12.0	10.3	9.0	352
LS8220	2500 E Main St by water area			16	8	50	Float	13.5	12.5	9.5	8.5	376
LS8223	7450 US 441 (New Hope Charity)			12	6	28	Float	8.5	7.4	6.7	5.0	229
LS8301	NW 1st Ave			22	8	50	Transducer	21.0	18.5	18.0	15.7	940
LS8302	SW 7th Ave			16	10	79	Transducer	12.8	11.0	10.5	9.0	1,028
LS8303	SE 2nd Ave			18	6	28	Float	16.0	14.5	13.5	7.5	317
LS8304	Jimmie Lou Ct			15	6	28	Float	13.0	12.0	10.0	8.0	211
LS8305	Henderson MHP			15	6	28	Float	10.0	8.5	7.5	6.5	317
LS8307	City Hall			15	6	28	Float	12.0	10.0	10.0	7.5	423
LS8308	Villa Logo			16	6	28	Float	13.5	13.0	10.5	6.5	106
LS8309	Gas Station across the Plant			20	12	113	Float	16.5	13.5	11.5	9.5	2,538

Notes:

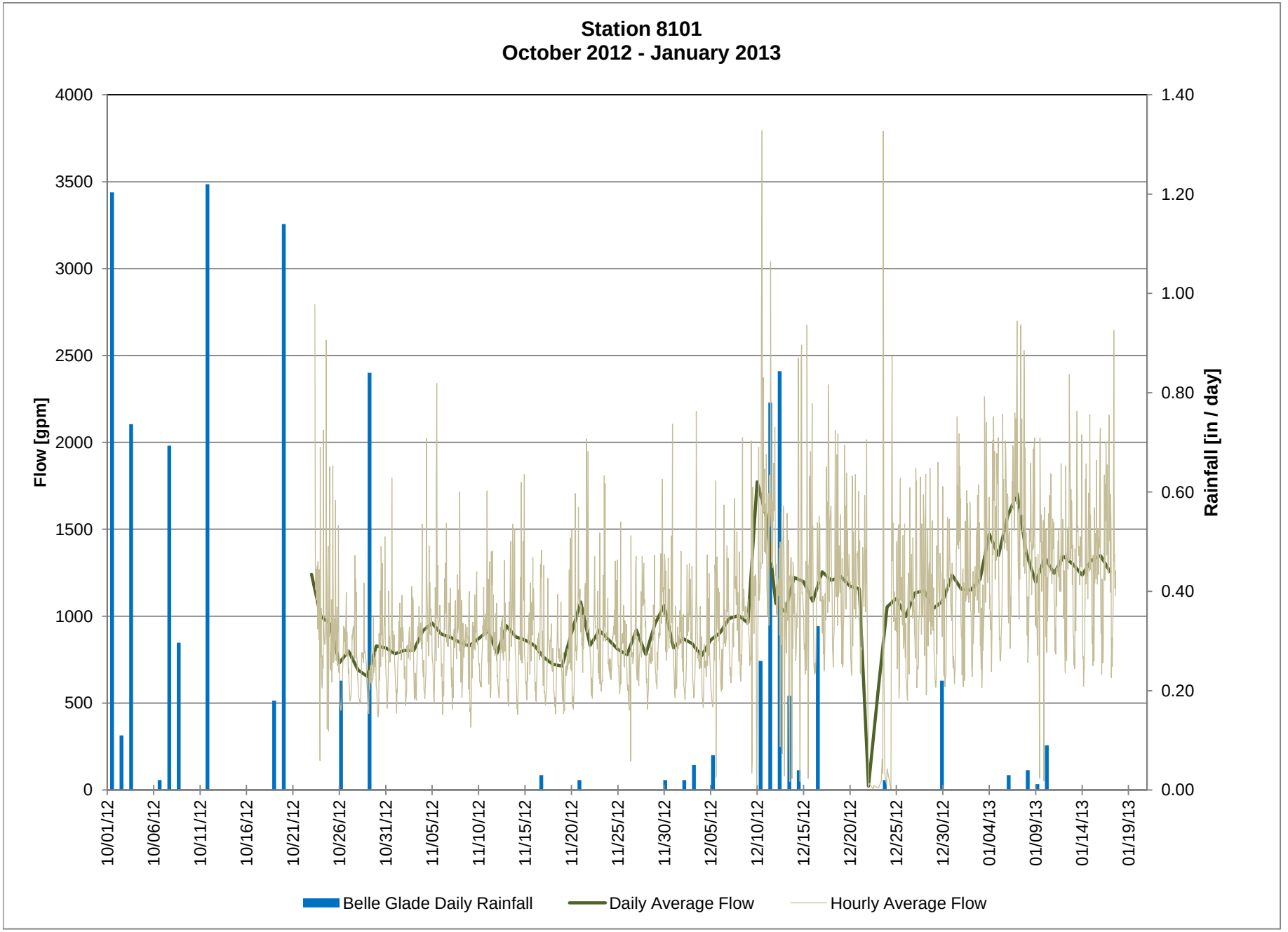
1. *Circular Wet Well Area = 3.14 x D x D/4*
2. *Wet Well Volume = Area x (Lead Pump On-All Pumps Off)*
3. *All wet well levels in feet of water*
4. *Station Type = Submersible or Can*

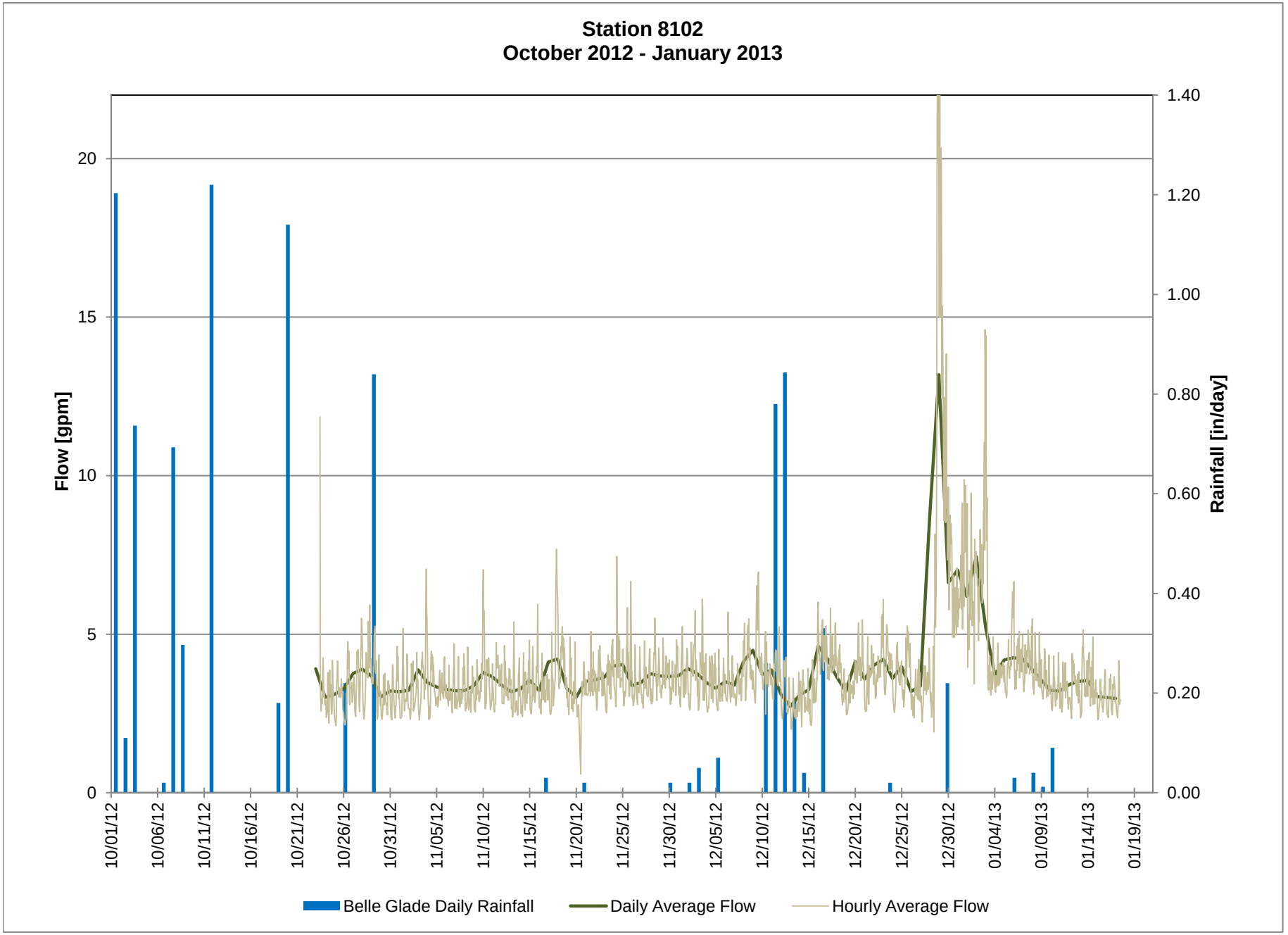
APPENDIX C
Lift Station Graphs

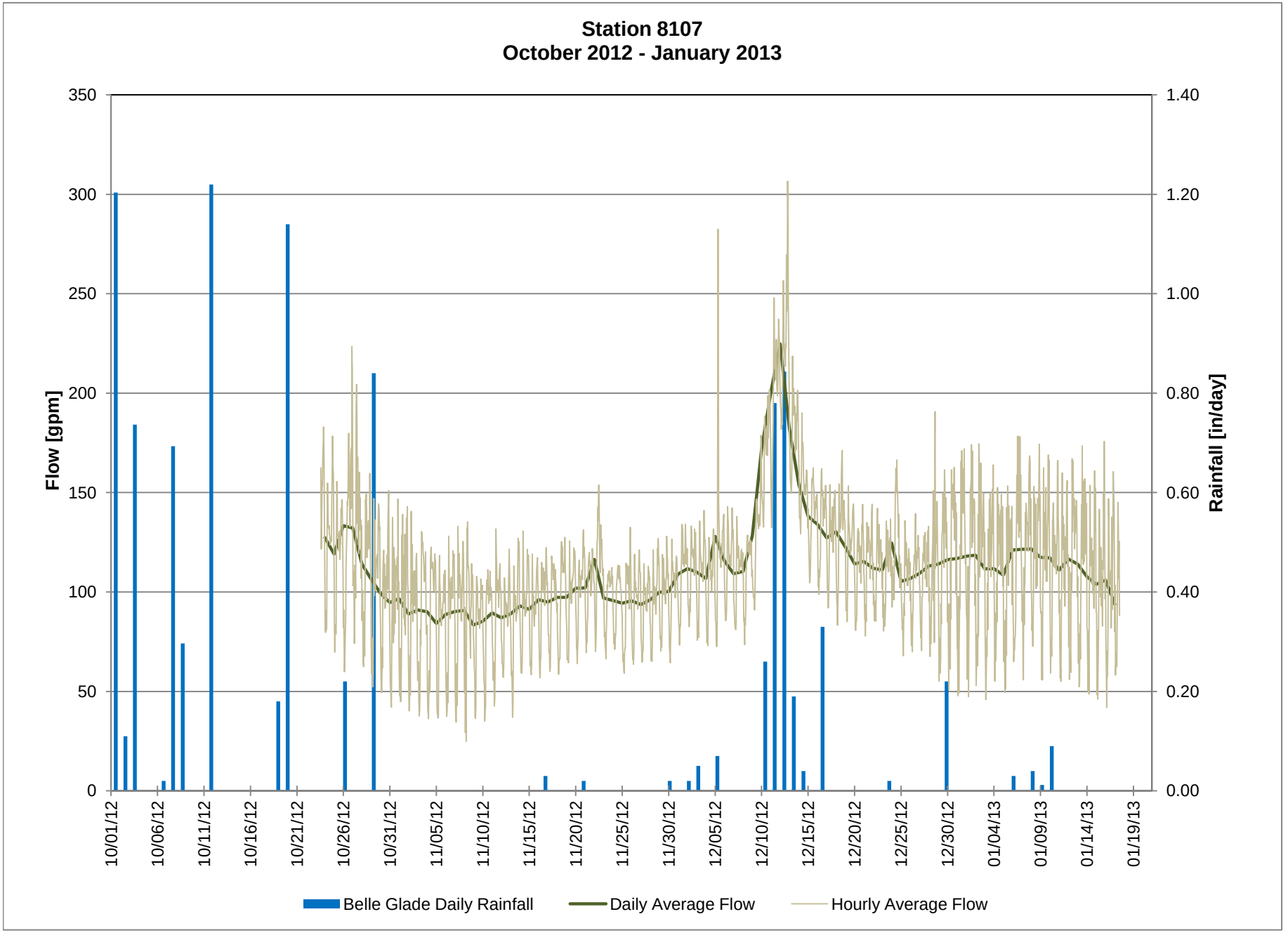
Belle Glade Collection System

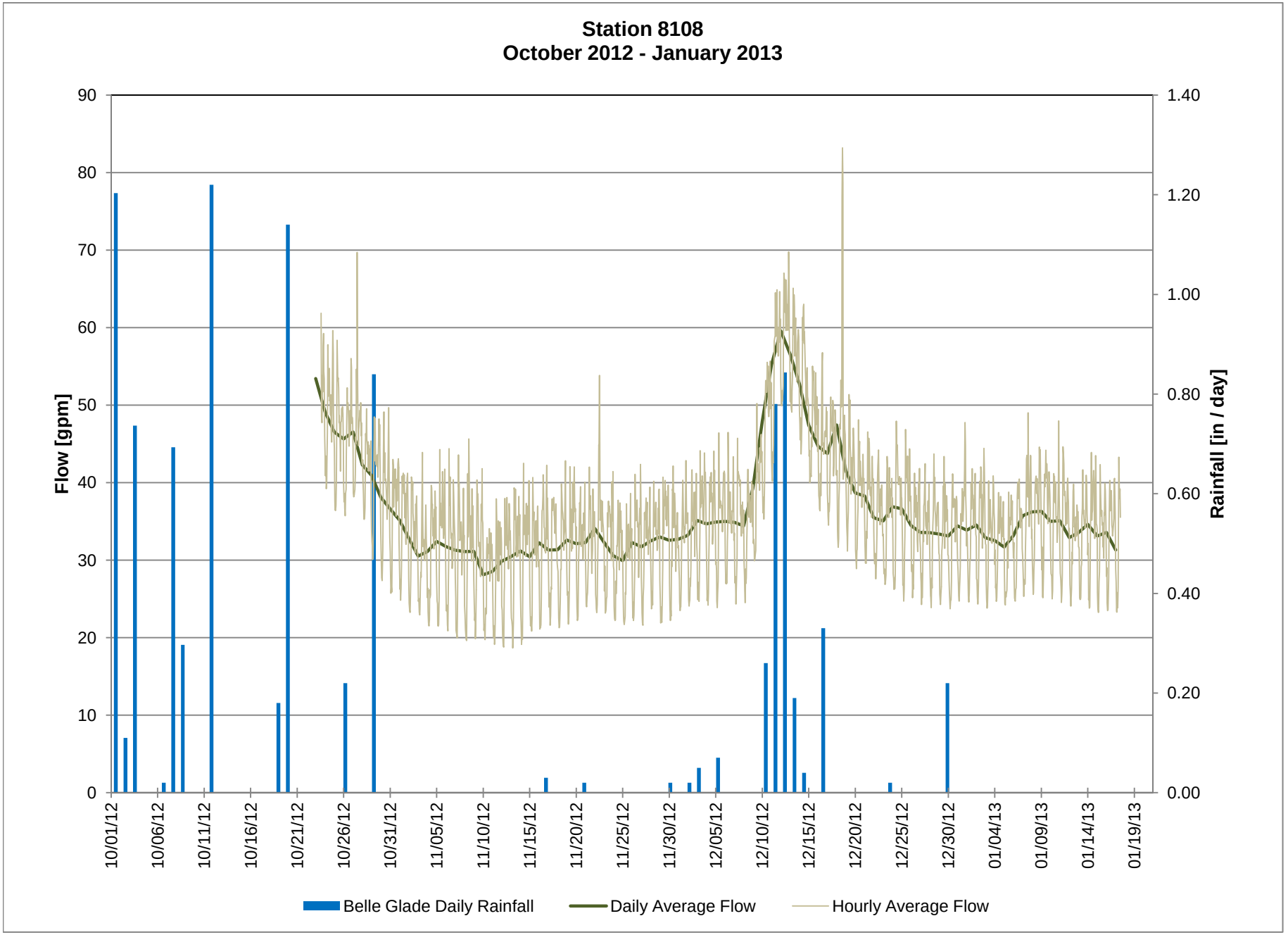
Glades WW Master Plan

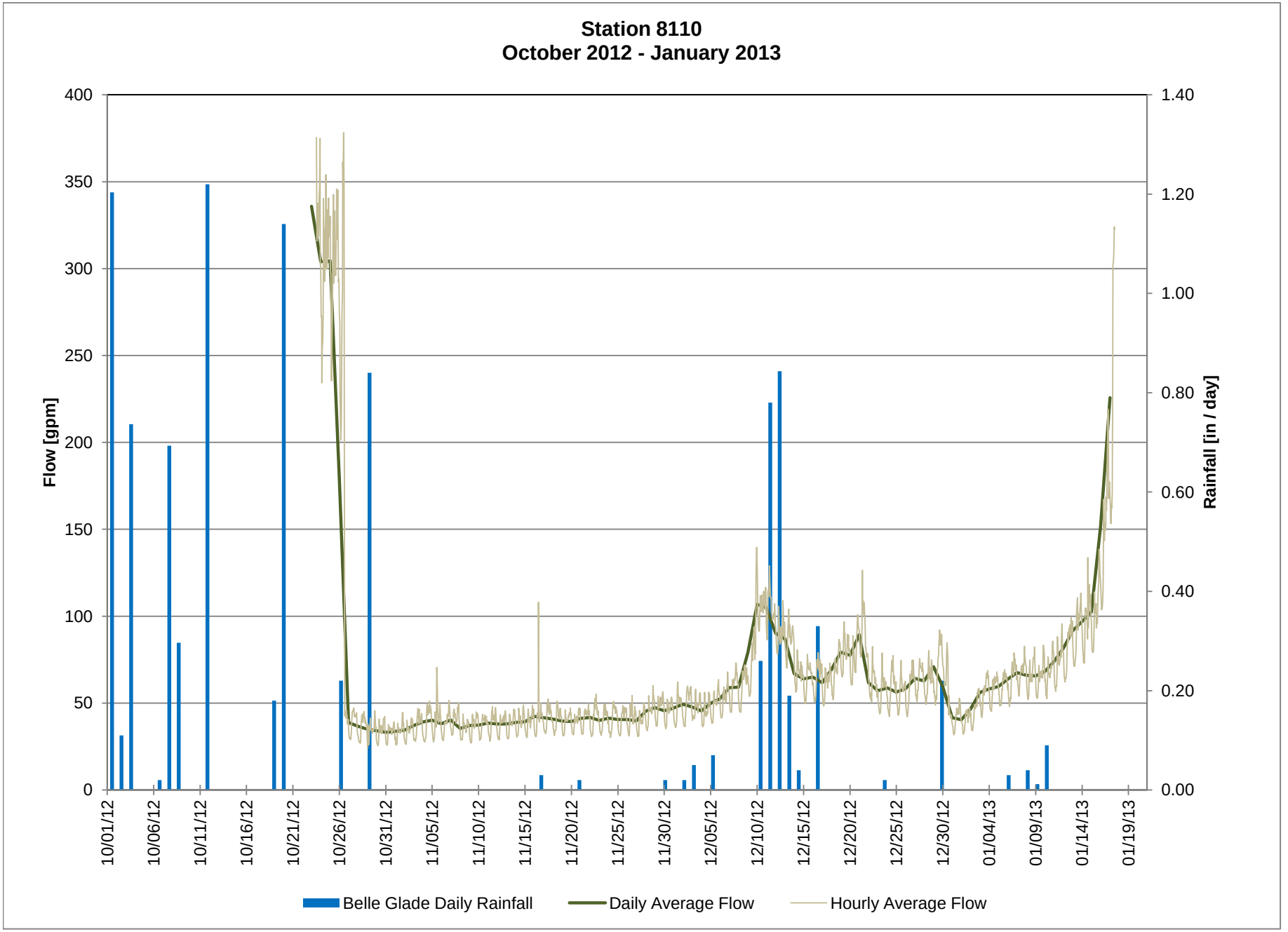
Palm Beach County Water Utilities Department

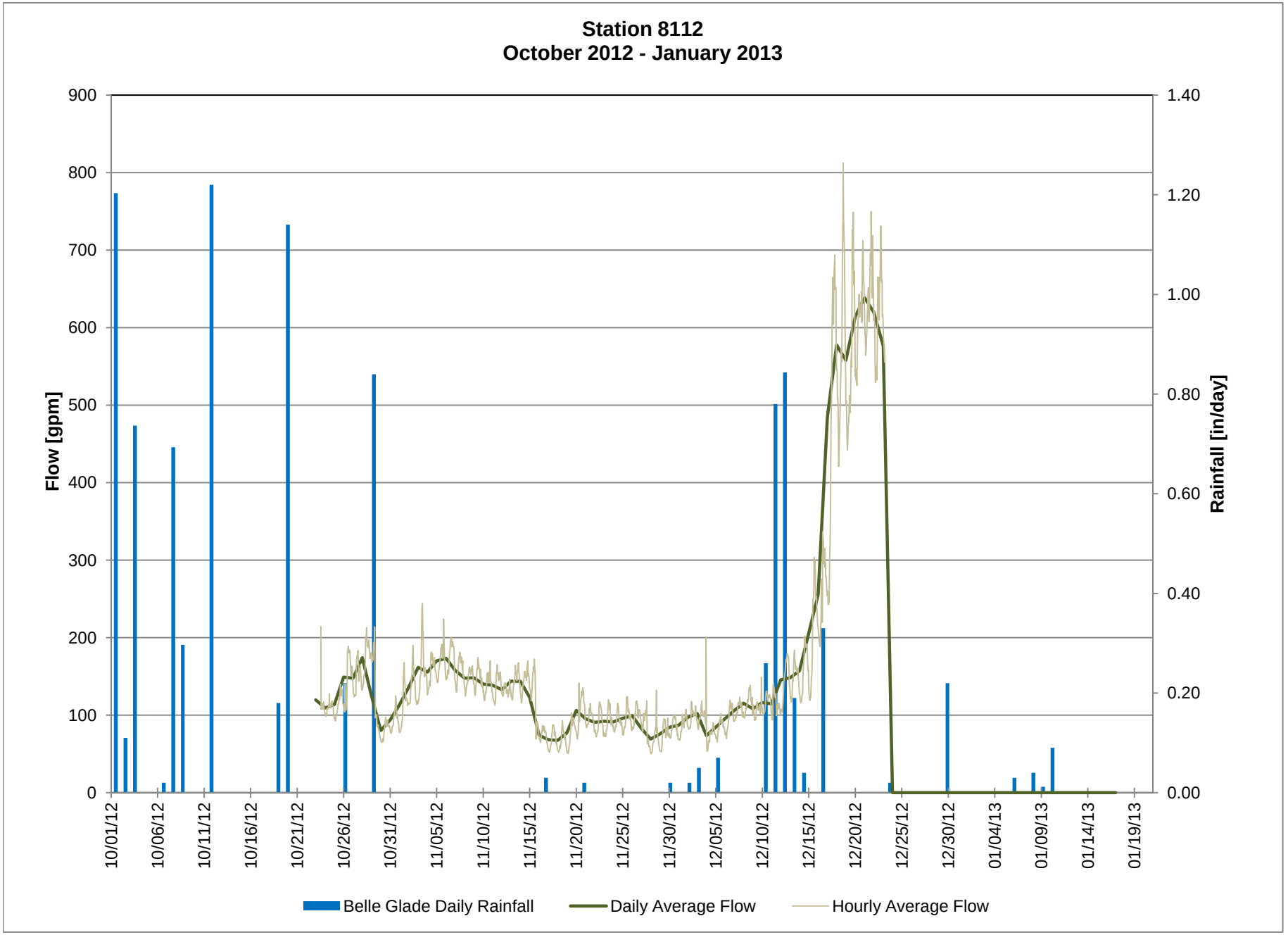

Station 8101
October 2012 - January 2013
Flow [gpm]
Rainfall [in / day]
4000
3500
3000
2500
2000
1500
1000
500
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

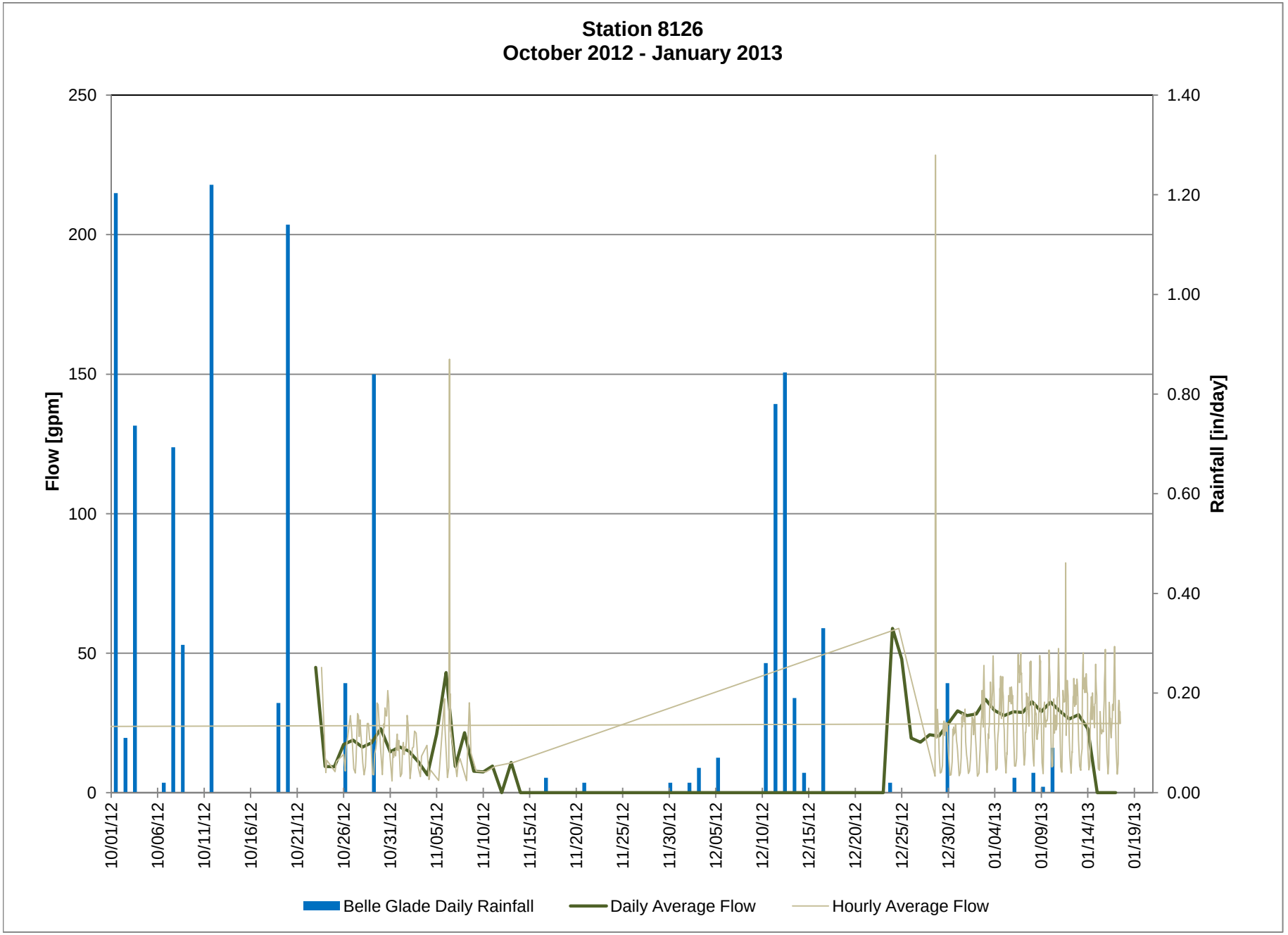

Station 8102
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
0
5
10
15
20
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

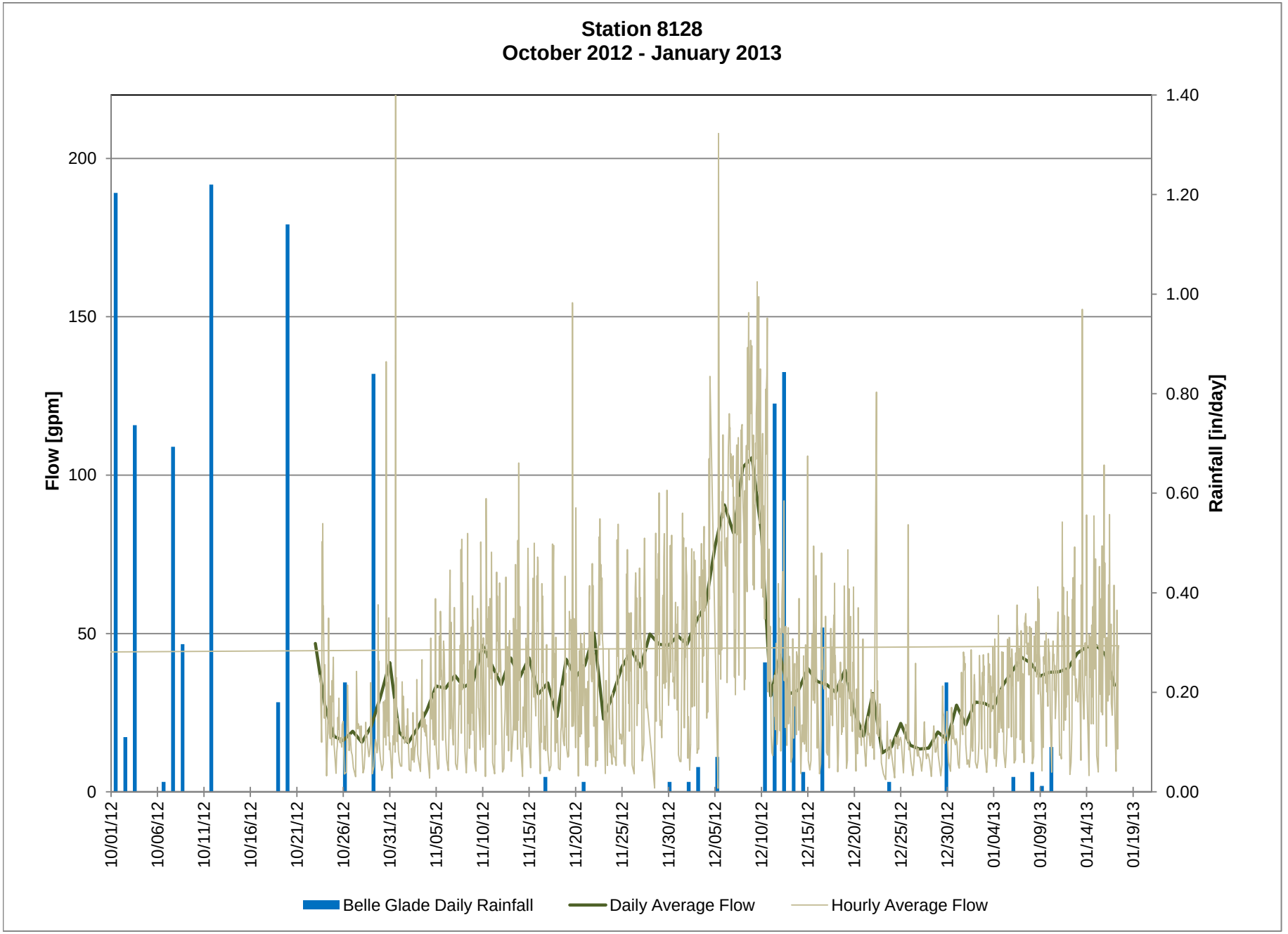

Station 8107
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
350
300
250
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

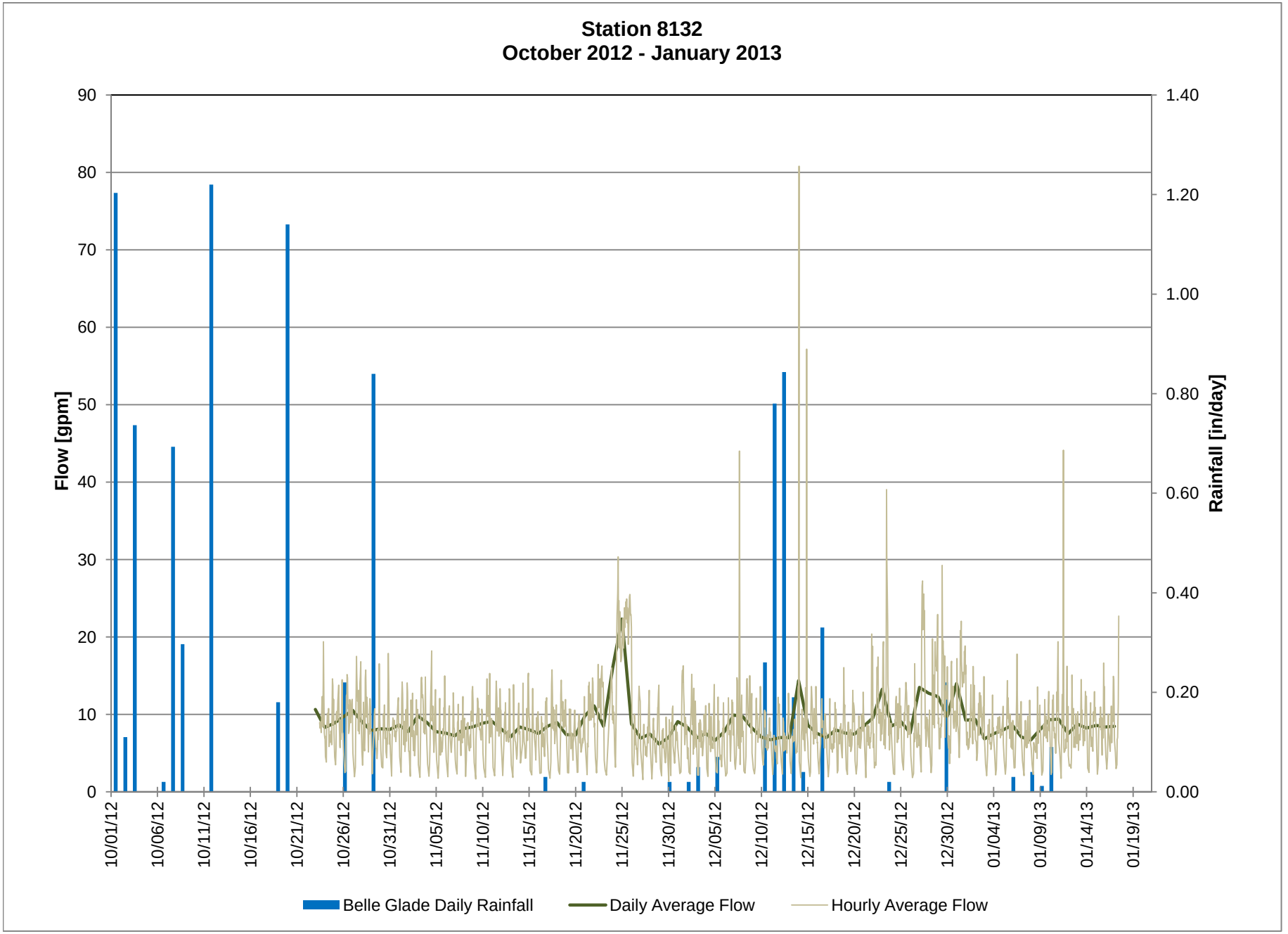

Station 8108
October 2012 - January 2013
Flow [gpm]
Rainfall [in / day]
90
80
70
60
50
40
30
20
10
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

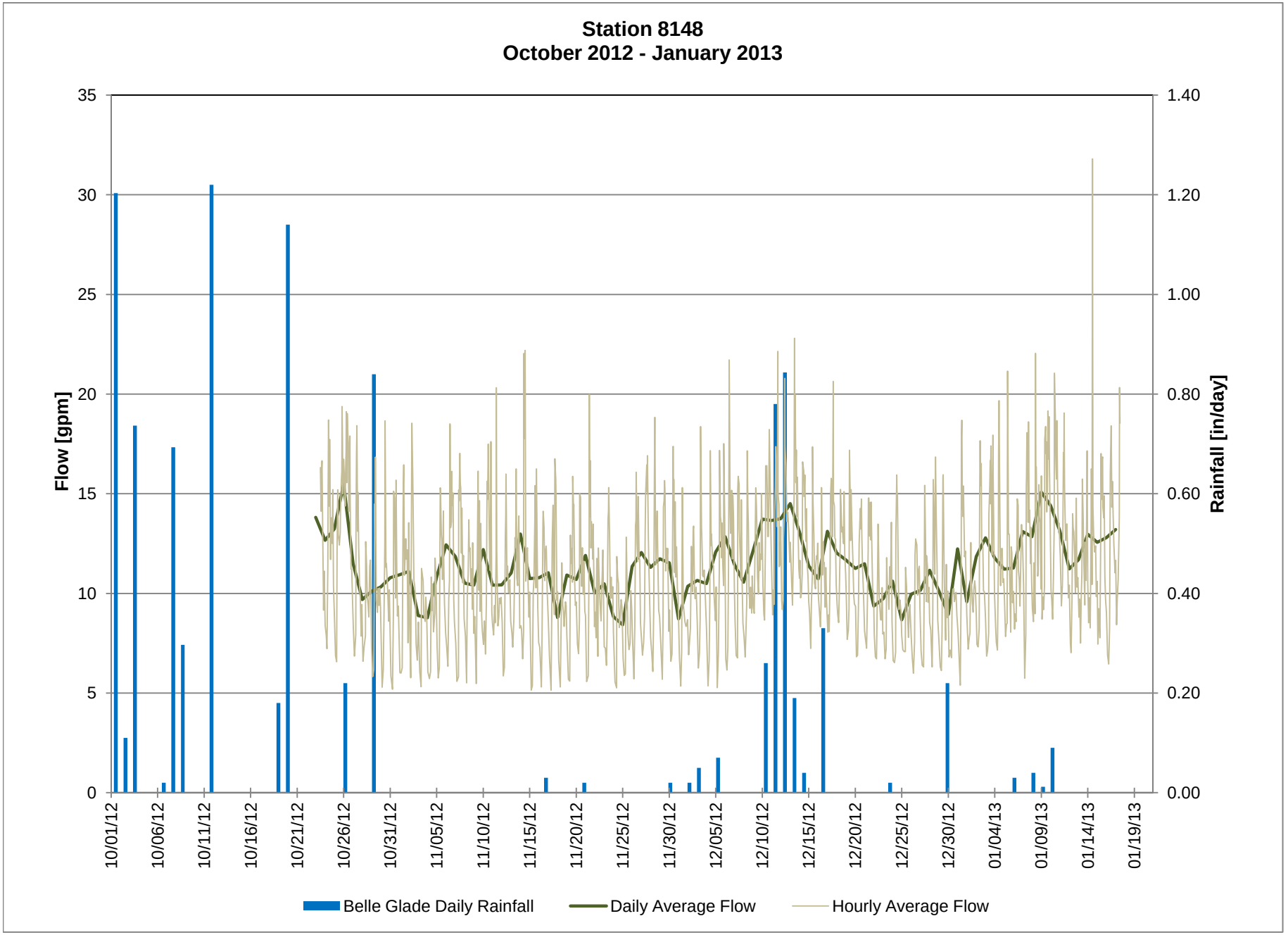

Station 8110
October 2012 - January 2013
Flow [gpm]
Rainfall [in / day]
400
350
300
250
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

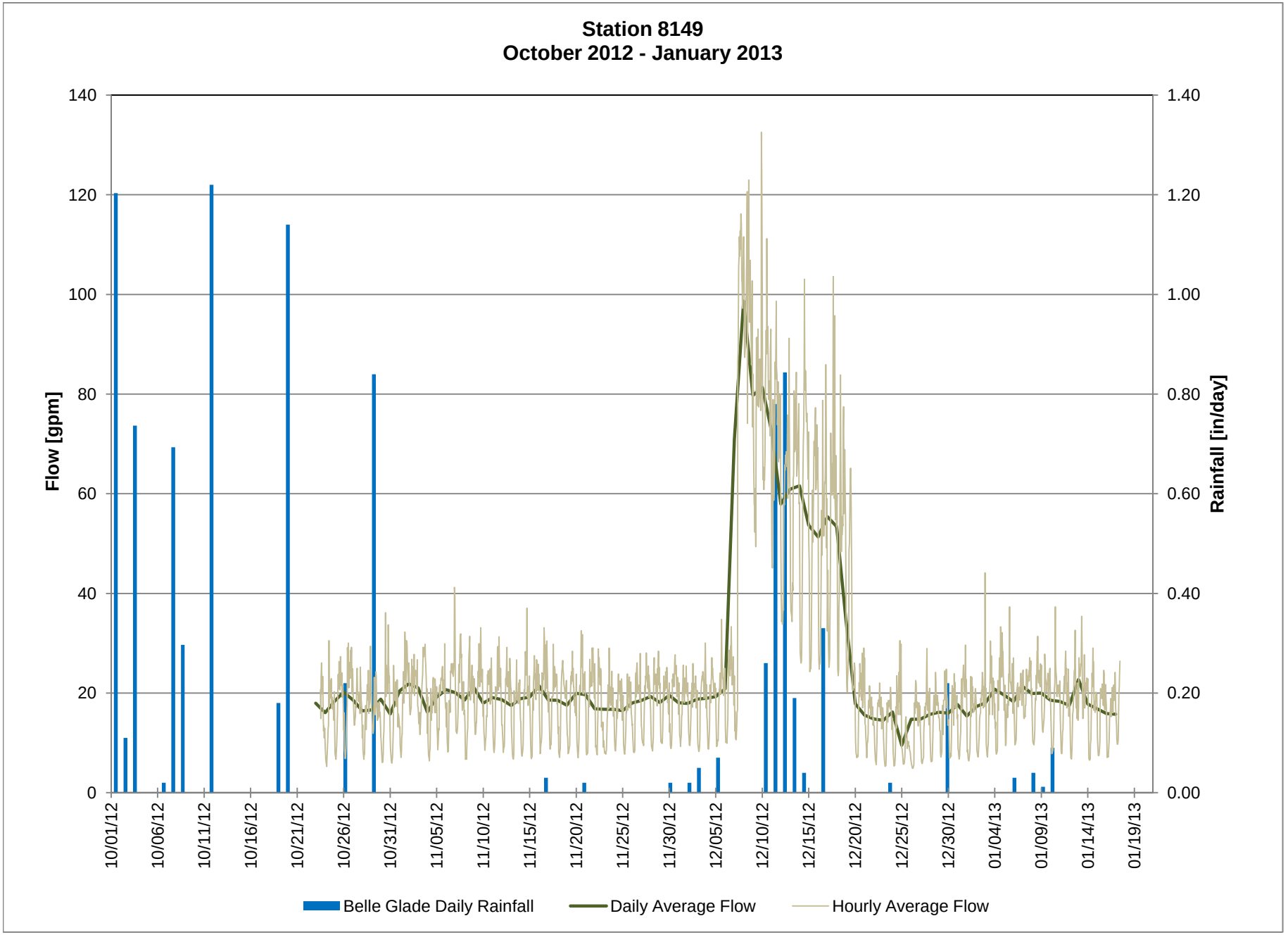

Station 8112
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
900
800
700
600
500
400
300
200
100
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8126
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
250
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8128
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8132
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
90
80
70
60
50
40
30
20
10
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

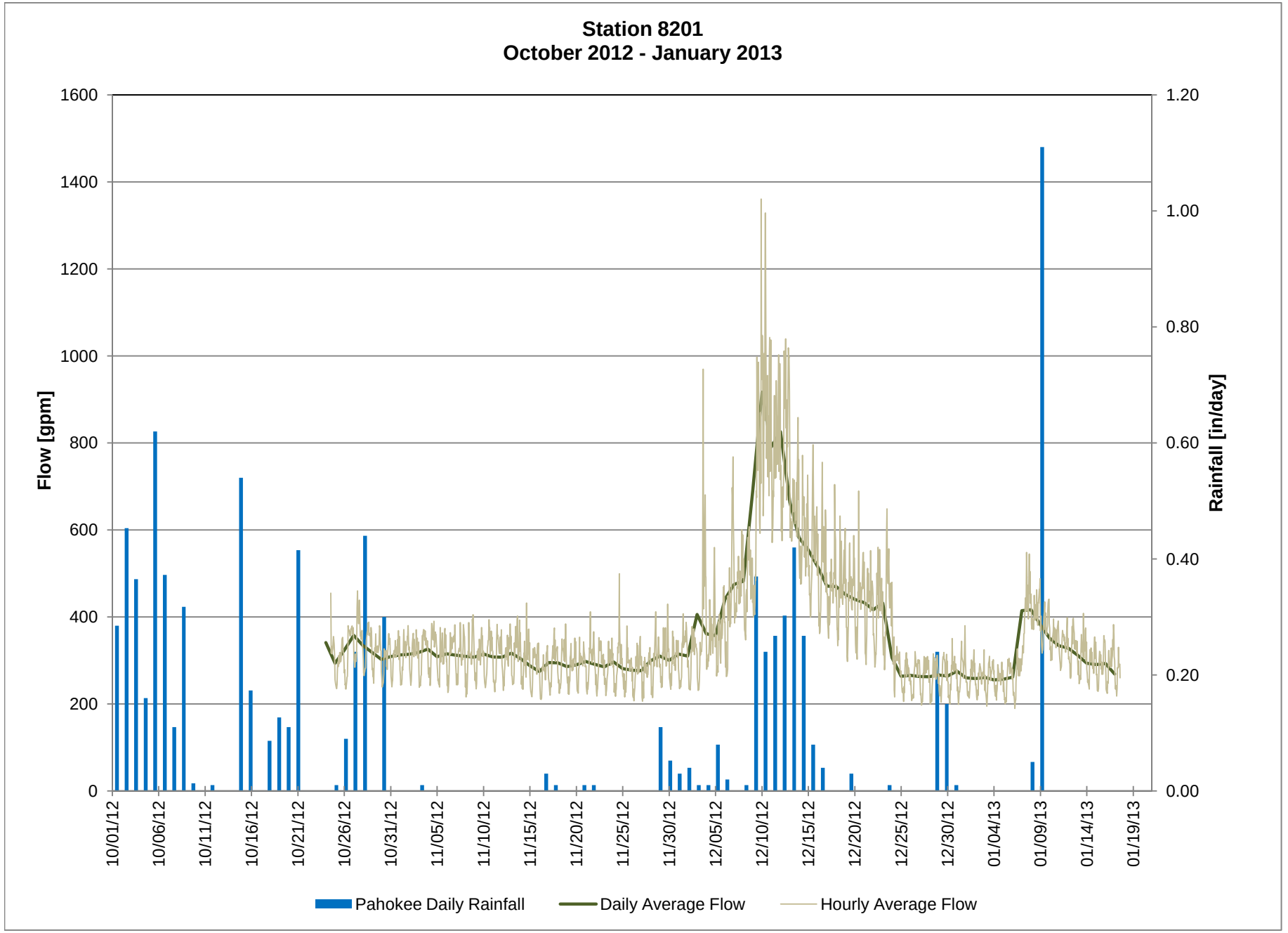

Station 8148
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
35
30
25
20
15
10
5
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

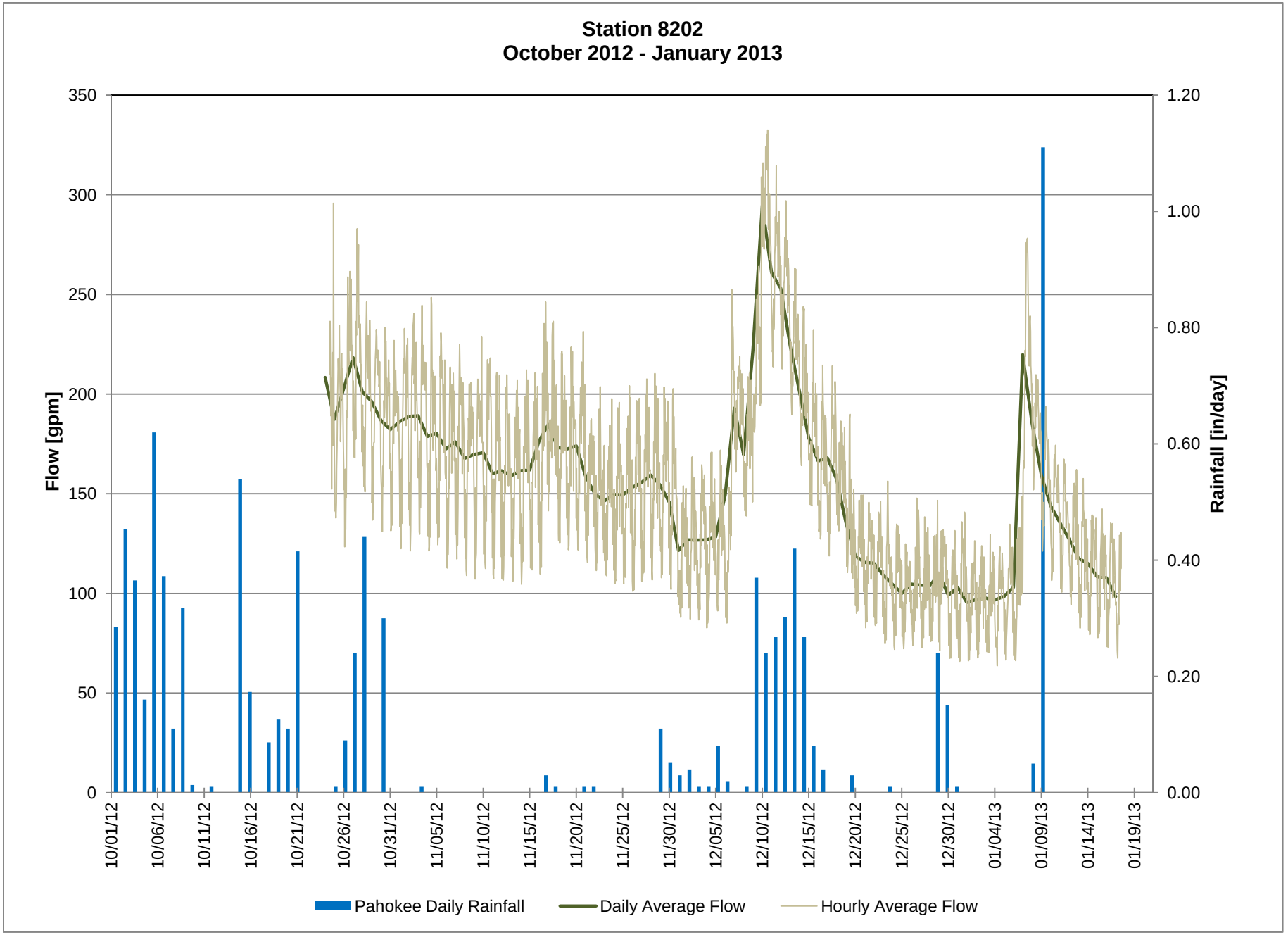

Station 8149
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
140
120
100
80
60
40
20
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Belle Glade Daily Rainfall
Daily Average Flow
Hourly Average Flow

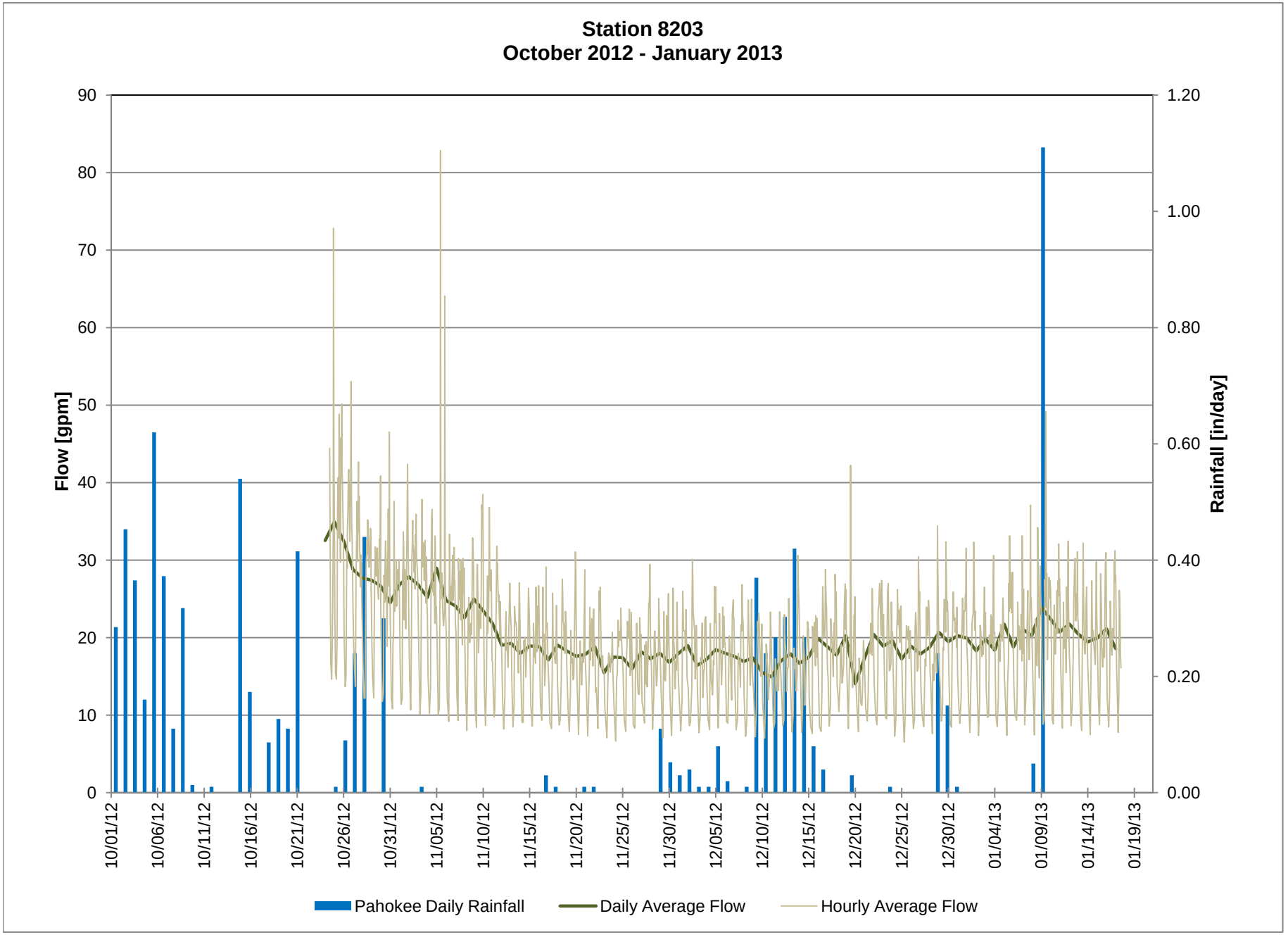
Pahokee Collection System

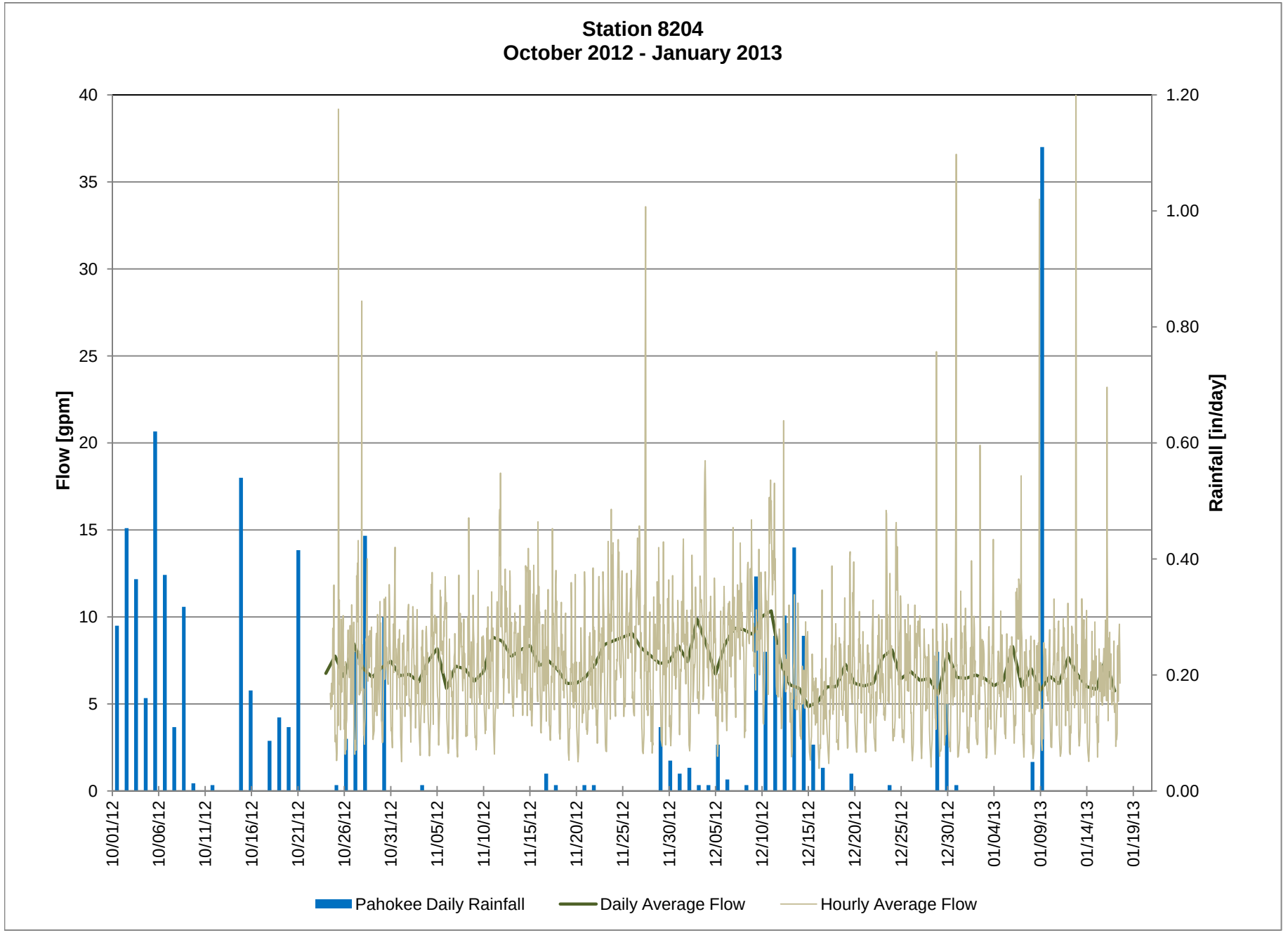
Glades WW Master Plan

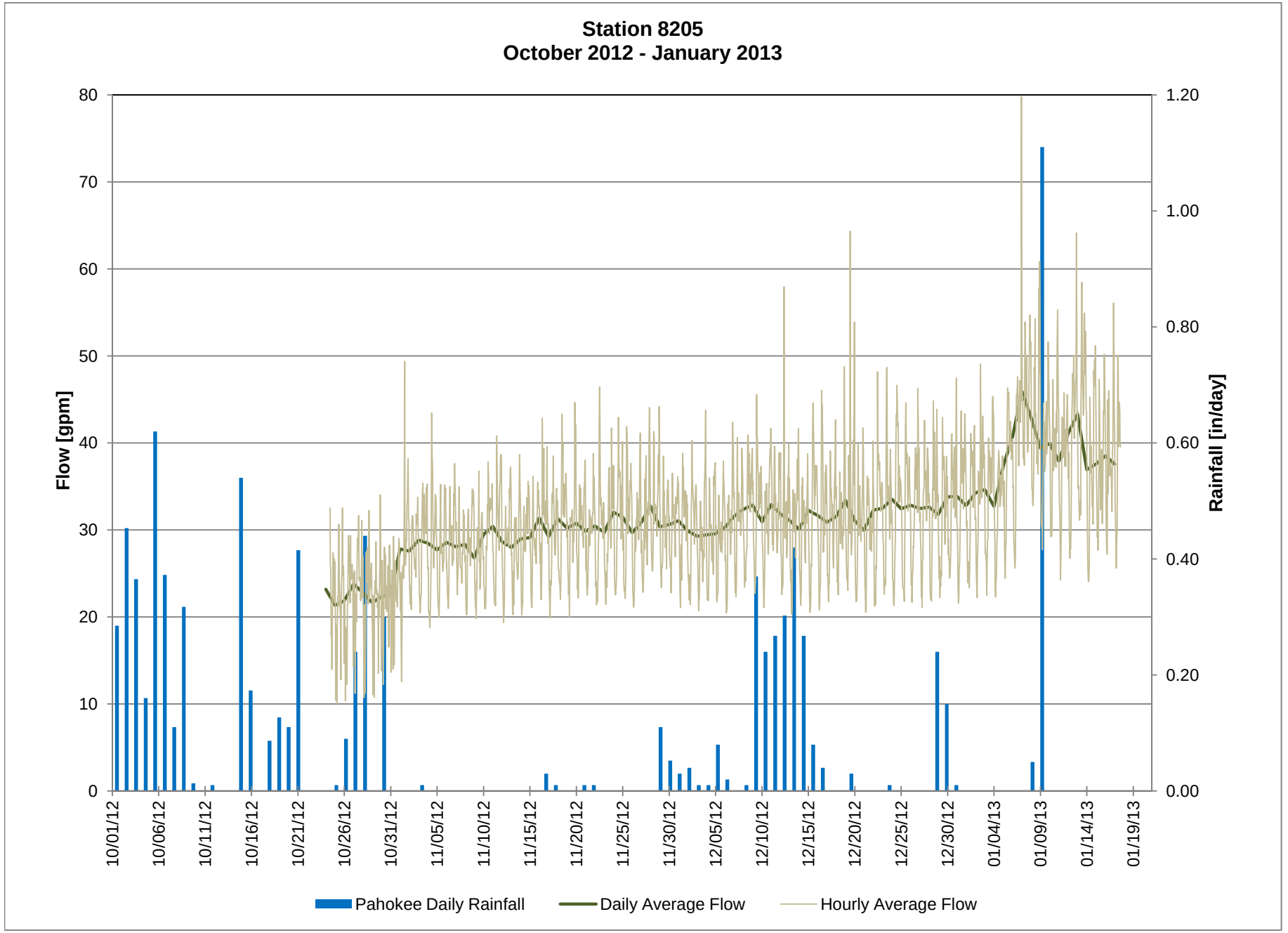
Palm Beach County Water Utilities Department

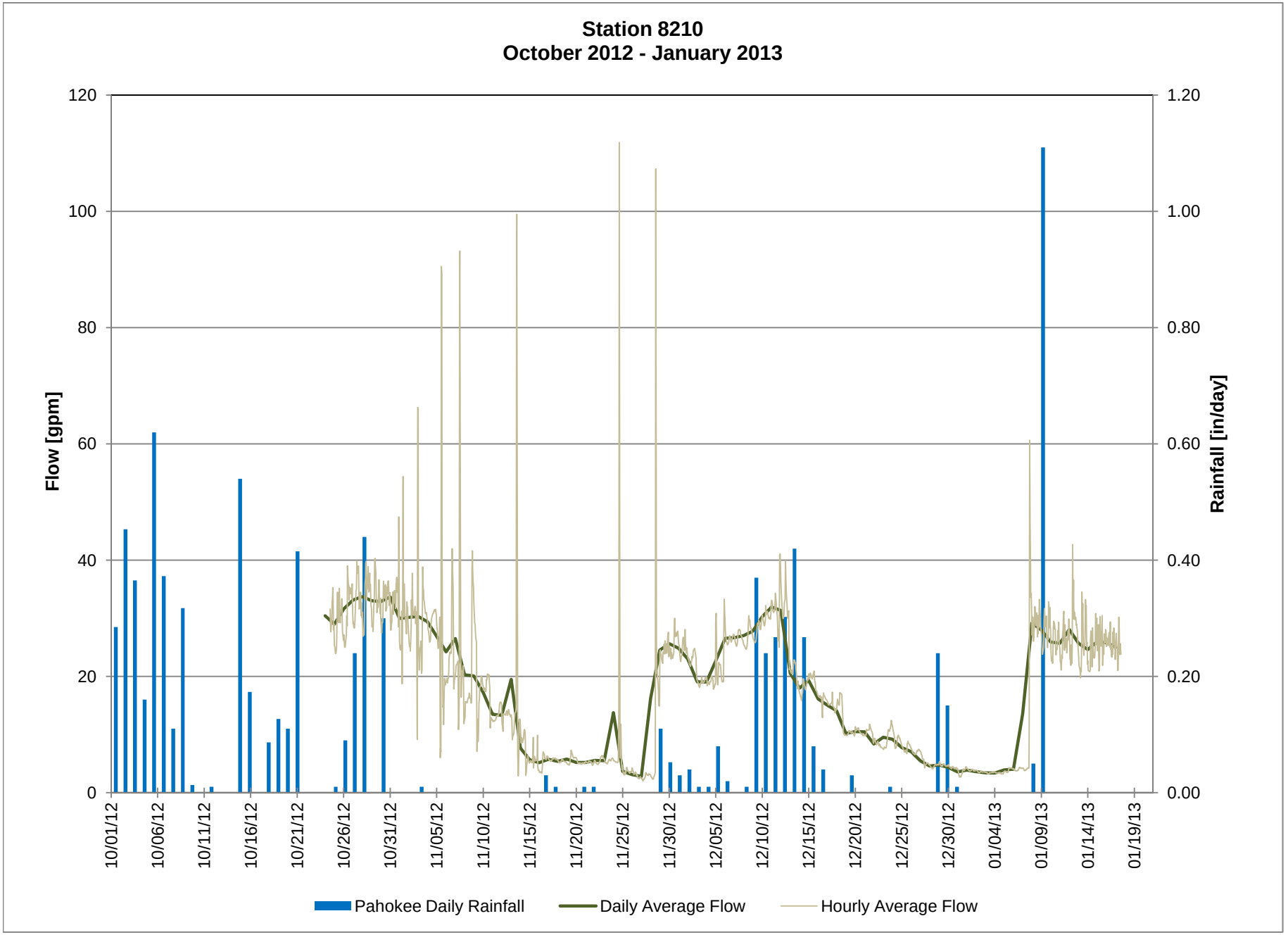

Station 8201
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
1600
1400
1200
1000
800
600
400
200
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

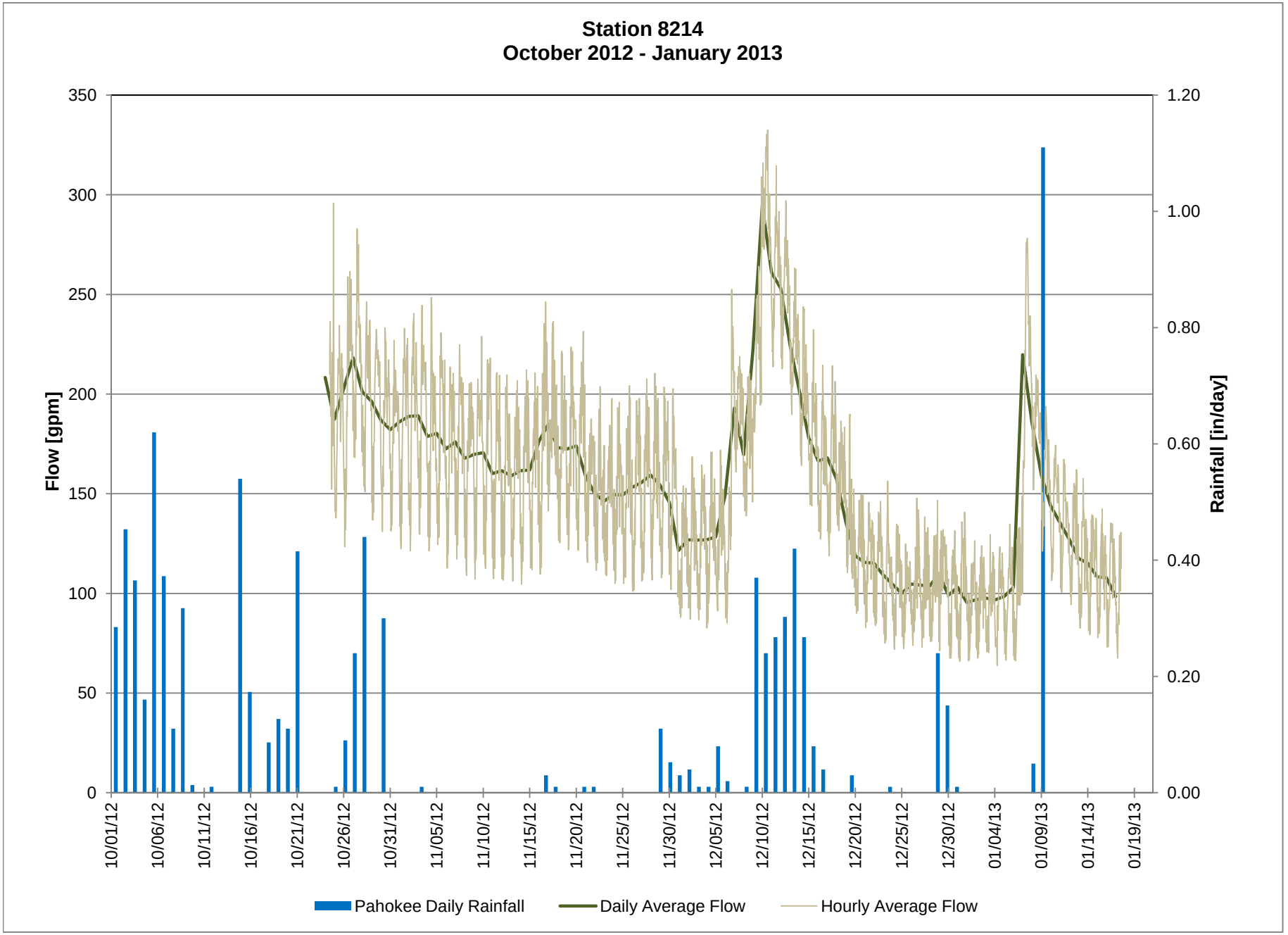

Station 8202
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
350
300
250
200
150
100
50
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

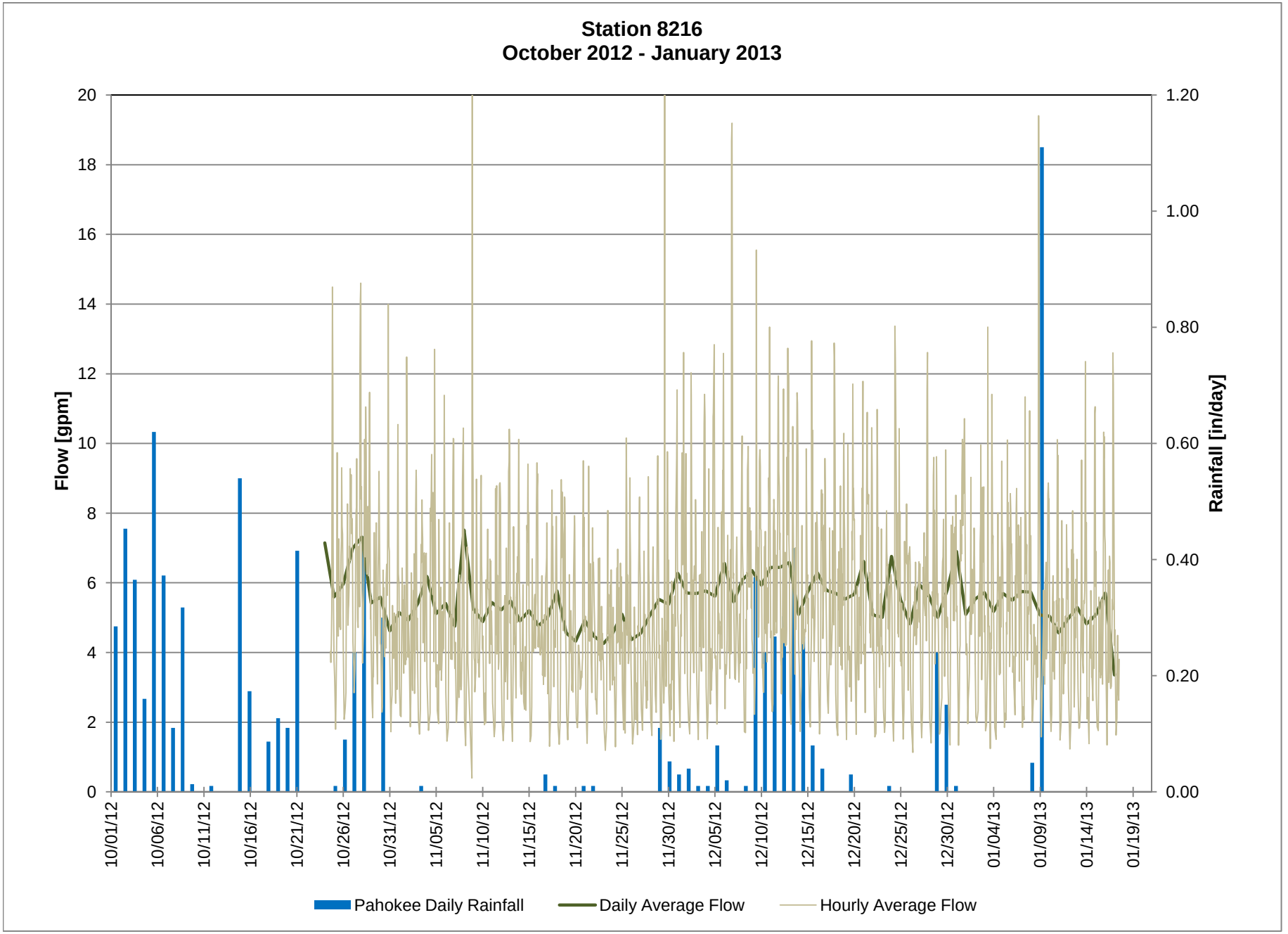

Station 8203
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
90
80
70
60
50
40
30
20
10
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

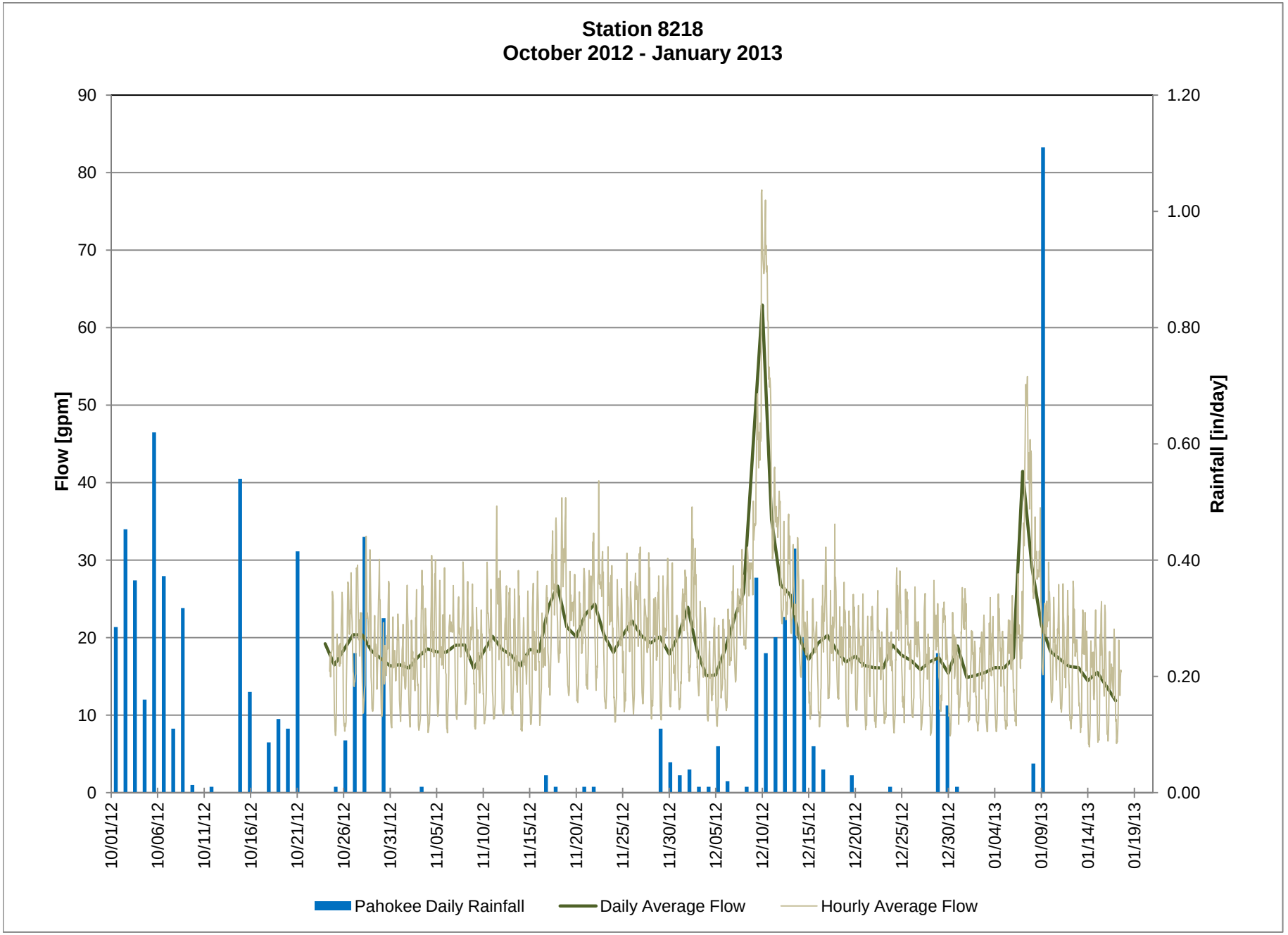

Station 8204
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
40
35
30
25
20
15
10
5
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

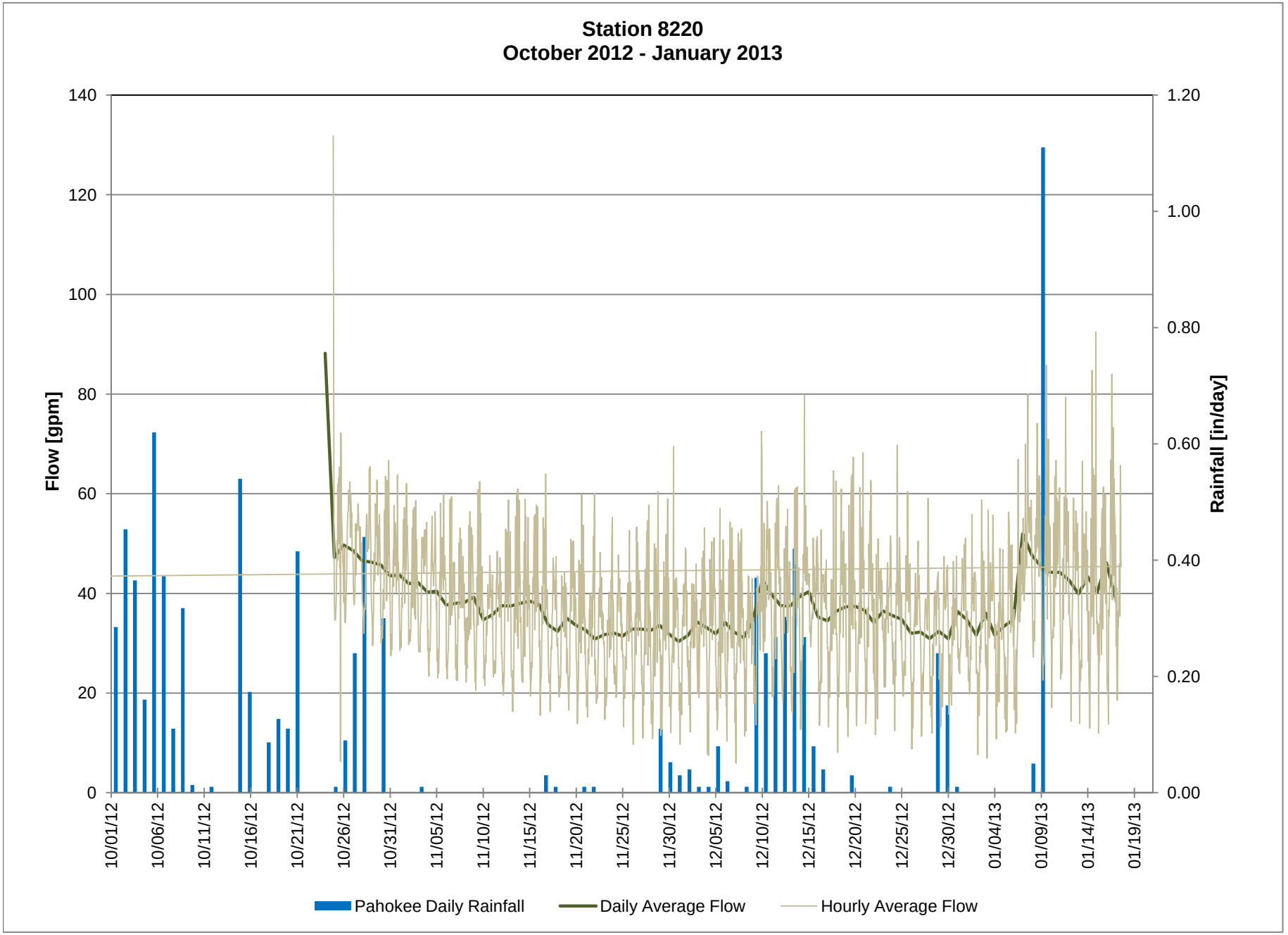

Station 8205
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
80
70
60
50
40
30
20
10
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8210
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
120
100
80
60
40
20
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8214
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
350
300
250
200
150
100
50
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8216
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
20
18
16
14
12
10
8
6
4
2
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

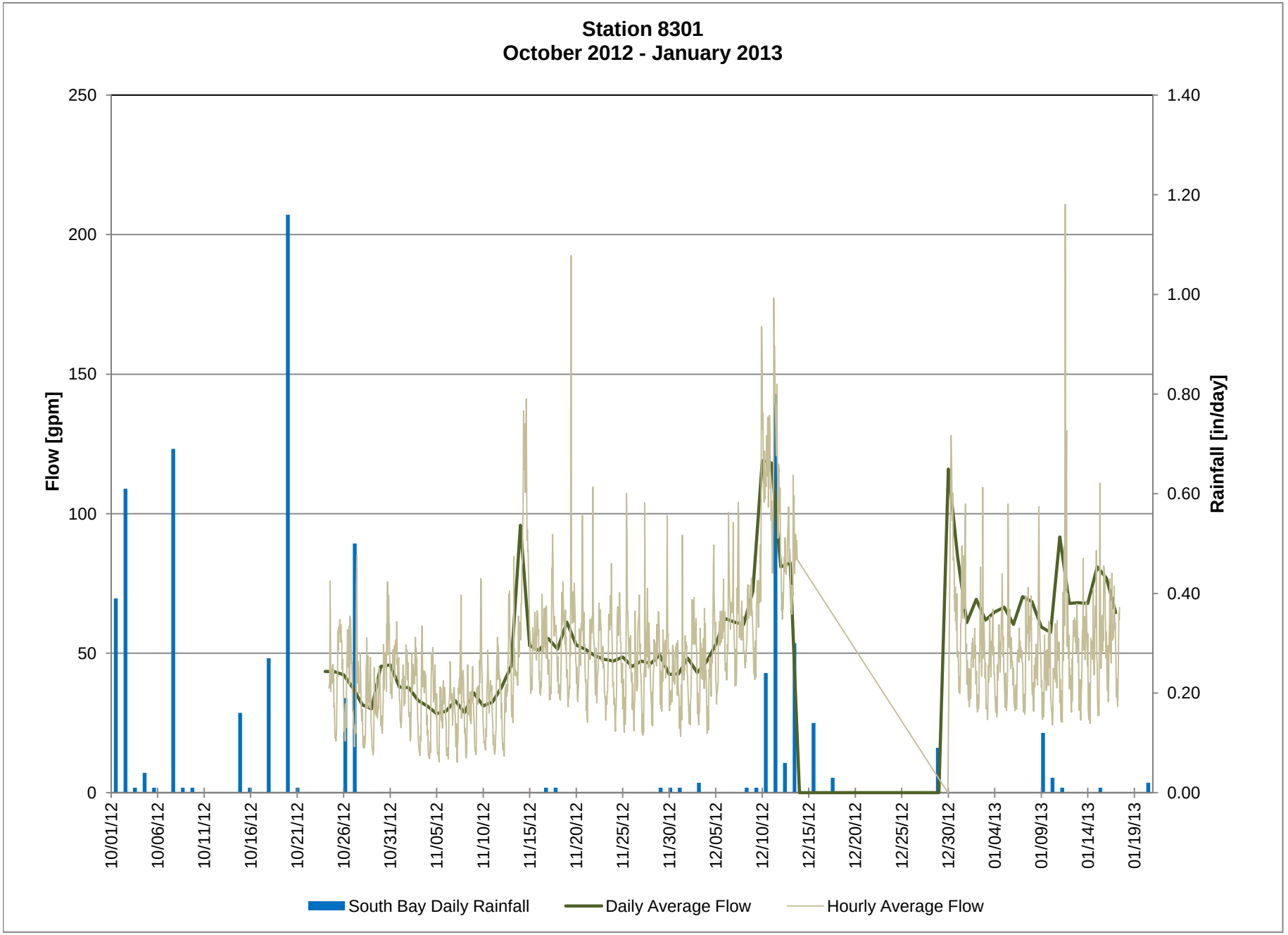

Station 8218
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
90
80
70
60
50
40
30
20
10
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

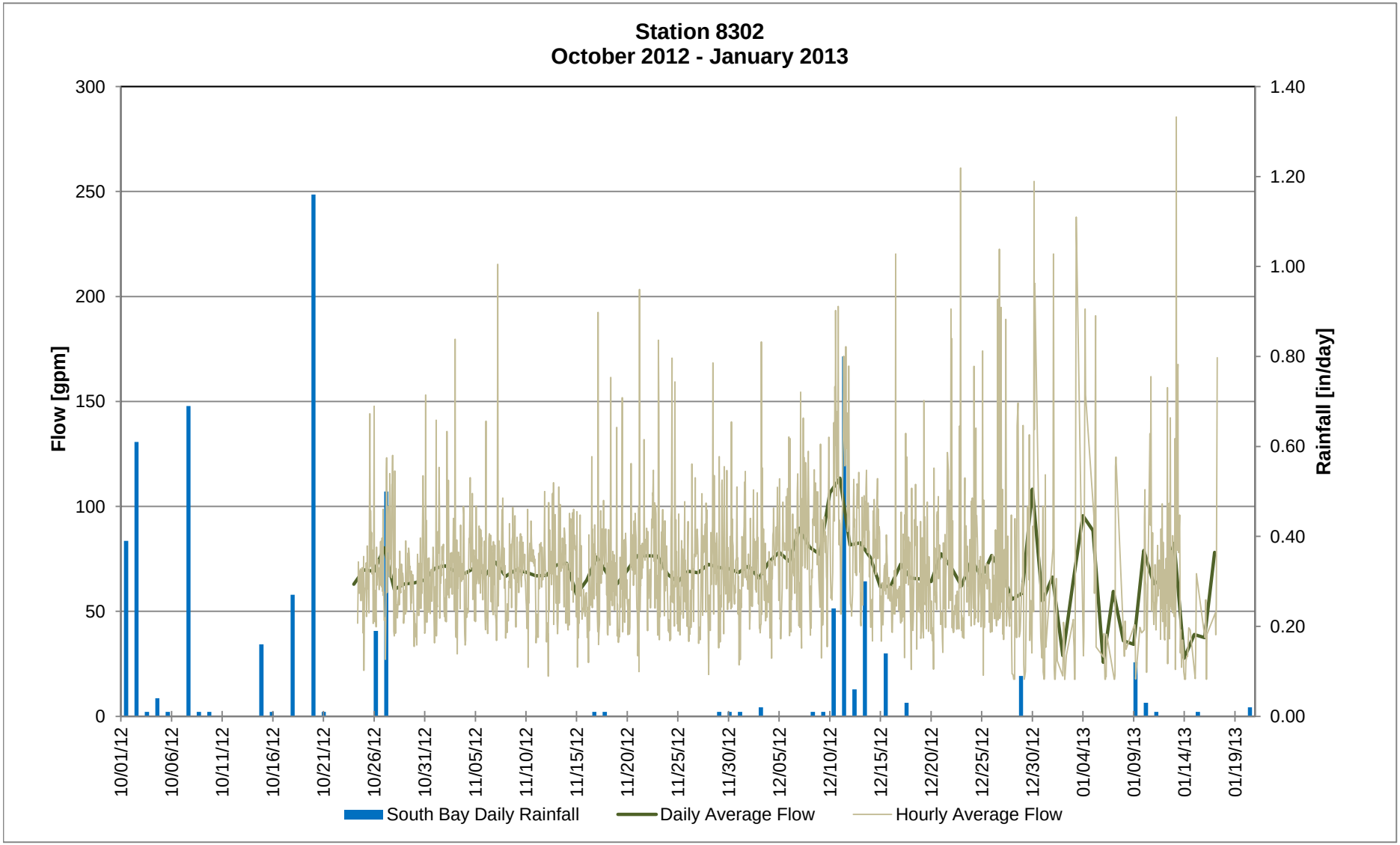

Station 8220
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
140
120
100
80
60
40
20
0
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
Pahokee Daily Rainfall
Daily Average Flow
Hourly Average Flow

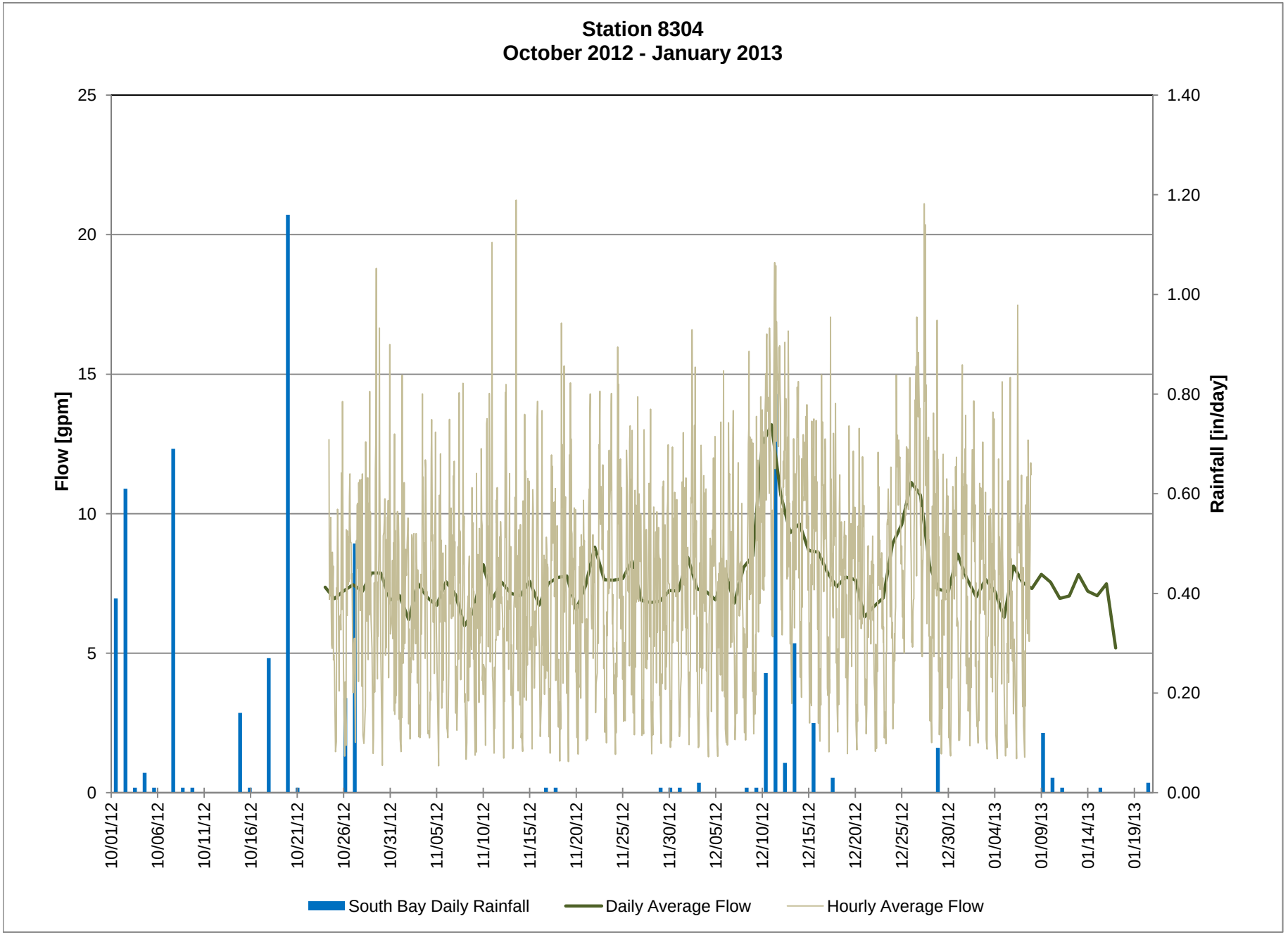
South Bay Collection System

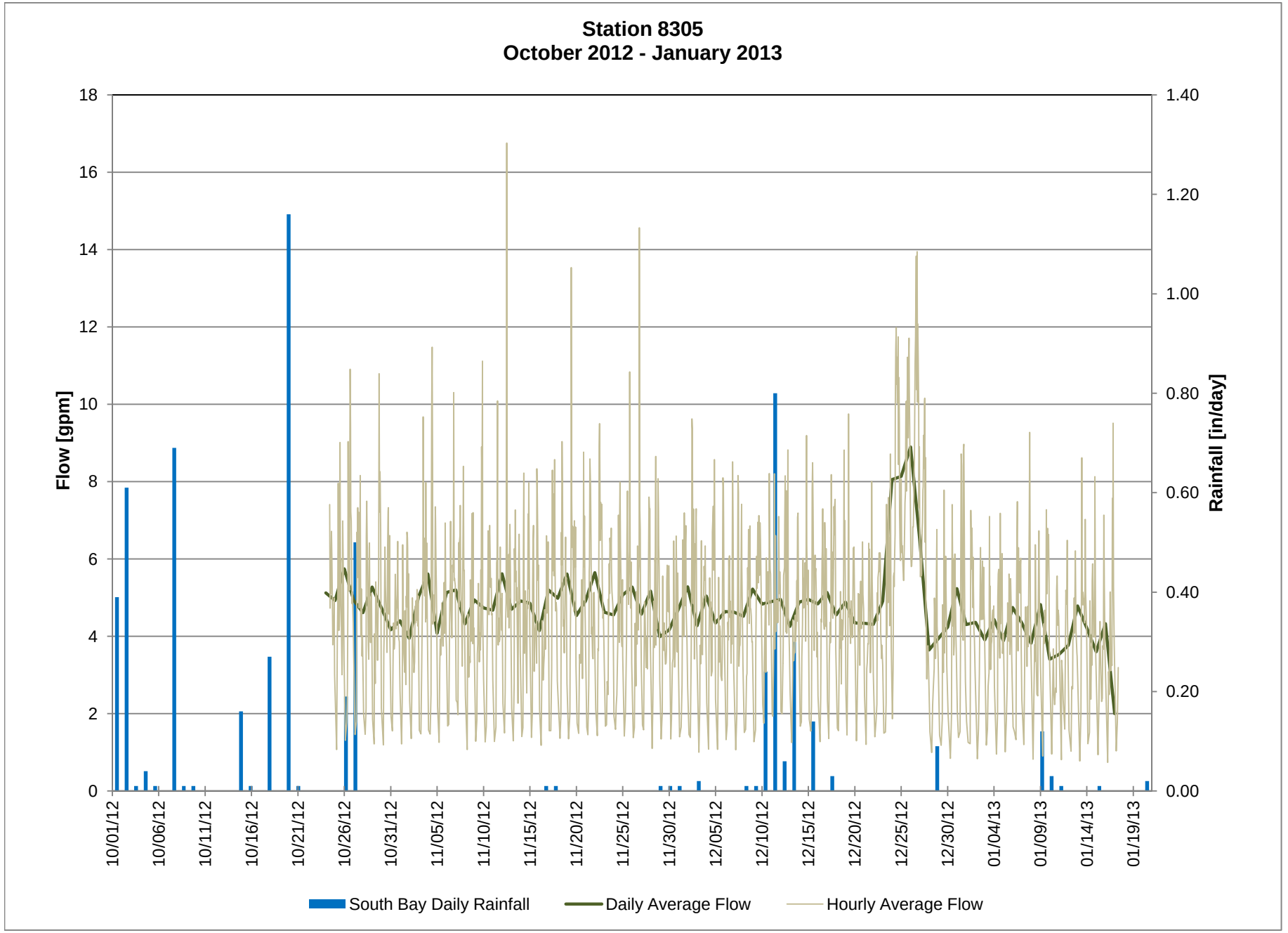
Glades WW Master Plan

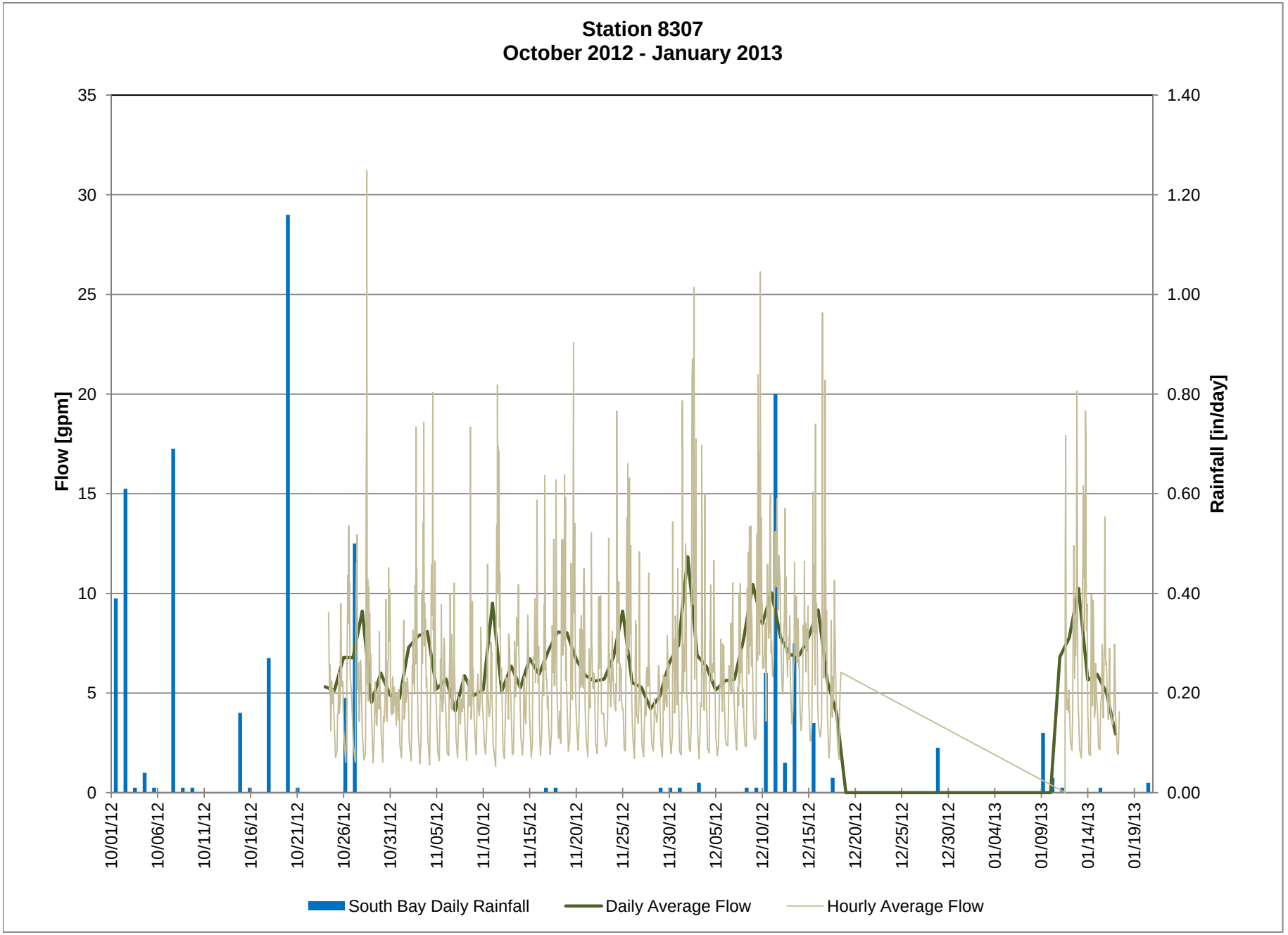
Palm Beach County Water Utilities Department

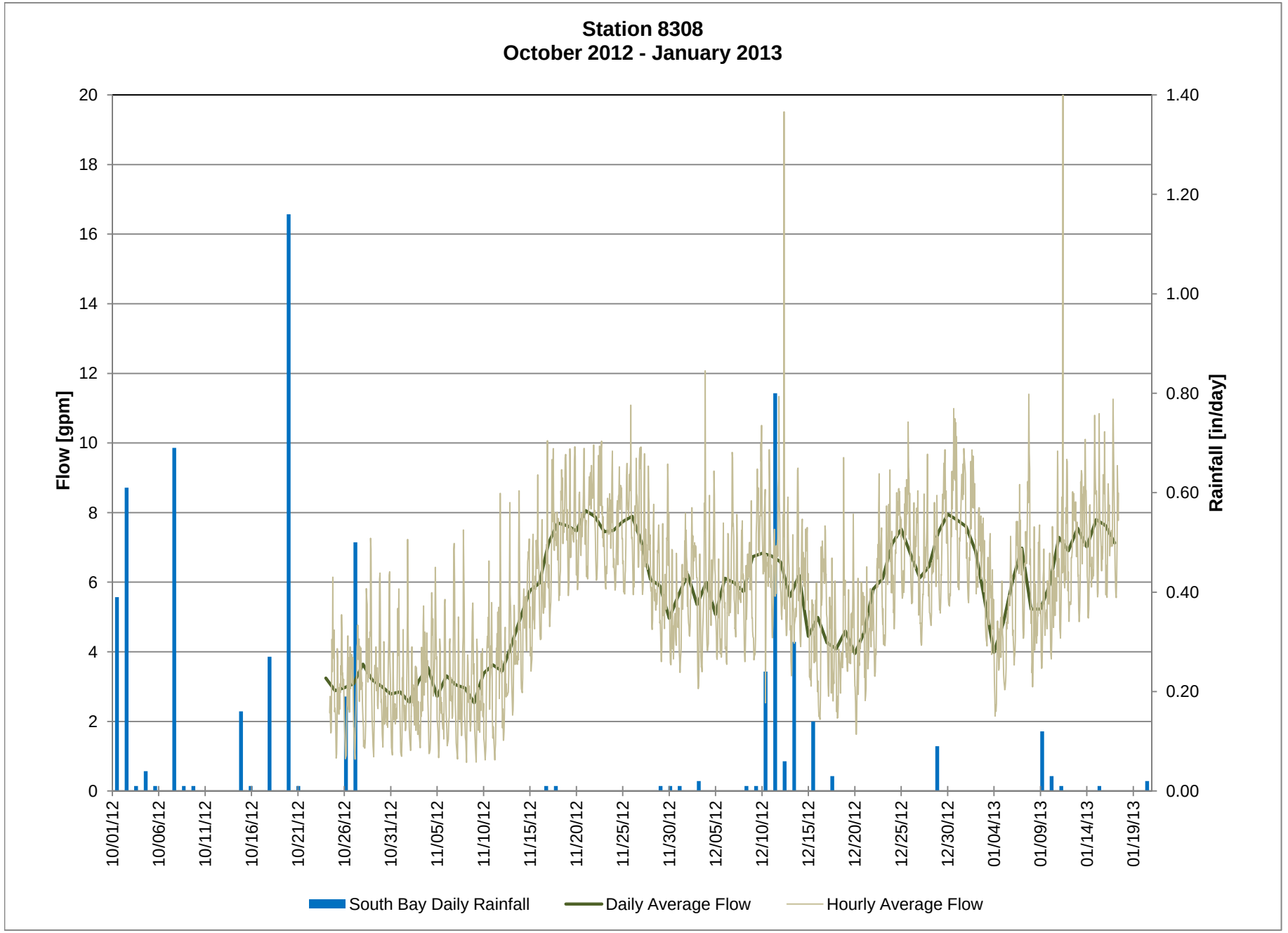

Station 8301
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
250
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8302
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
300
250
200
150
100
50
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8304
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
25
20
15
10
5
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8305
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
0
2
4
6
8
10
12
14
16
18
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8307
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
35
30
25
20
15
10
5
0
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow


Station 8308
October 2012 - January 2013
Flow [gpm]
Rainfall [in/day]
0
2
4
6
8
10
12
14
16
18
20
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
10/01/12
10/06/12
10/11/12
10/16/12
10/21/12
10/26/12
10/31/12
11/05/12
11/10/12
11/15/12
11/20/12
11/25/12
11/30/12
12/05/12
12/10/12
12/15/12
12/20/12
12/25/12
12/30/12
01/04/13
01/09/13
01/14/13
01/19/13
South Bay Daily Rainfall
Daily Average Flow
Hourly Average Flow

APPENDIX D
Data Monitoring Summary

APPENDIX D

Belle Glade - Data Monitoring Summary

LS No.	City	Date Range Start	Date Range Finish	Complete (Y or	Reason
8101	Belle Glade	10/23/2012	1/17/2013	Y	
8102	Belle Glade	10/23/2012	1/17/2013	Y	
8107	Belle Glade	10/23/2012	1/17/2013	Y	
8108	Belle Glade	10/23/2012	1/17/2013	Y	
8110	Belle Glade	10/23/2012	1/17/2013	Y	
8111	Belle Glade	10/23/2012	11/23/2012	N	Pump 1 Stopped on 12/2 in Hobo file and 11/23 in Datafile. Pump 2 on 11/13 in both Hobo File and Datafile. When returned for download on 11/17 - Pump 1 Memory was full and Pump 2 Battery was dislodged.
8112	Belle Glade	10/23/2012	12/23/2012	N	Pump 1 Hobo File Stopped on 12/26 (10:58) and Pump 2 on 12/26 (11:00). (65,782 samples - Motor 15% on, 85% off). When returned for download on 11/17 - Memory was full for both Pump 1 and 2. Datafile only recorded to 12/23.
8113	Belle Glade	12/13/2012	1/3/2013	N	All data present for the dates range deployed, Hobo File Stopped on 1/17/13. Not sure why 1/3/13. This was deployed on 12/13; therefore no issue but maybe with Datafile
8114	Belle Glade	10/23/2012	11/8/2012	N	Hobo File shows recordings from 10/23 to 1/17 without problems for Pump 1. Maybe issue in excel datafile processing. When returned for download on 11/17 - Pump 2 recorder had a bad battery and recorder was removed from service (10:45am).
8115	Belle Glade	12/13/2012	1/17/2013	N	All data present for the dates range deployed. Deployed 12/13 and recorded till 1/17
8126	Belle Glade	10/23/2012	1/17/2013	N	Hobo File statistics show all is ok. Maybe Staff pulled pumps for the period between 11/16 to 12/24 - also curious no on/off from 12/25-12/27 (next record at 12/28 10:52). This station frequently shows no activity for entire day. Note only one pump installed at station.
8128	Belle Glade	10/23/2012	1/17/2013	Y	
8129	Belle Glade	11/28/2012	1/17/2013	N	All data present for the dates range deployed. Deployed 11/28 and shows good data logging all way through 1/17
8132	Belle Glade	10/23/2012	1/17/2013	Y	
8143	Belle Glade	12/13/2012	1/17/2013	N	All data present for the dates range deployed. Deployed 12/13 and shows good data logging all way through 1/17.
8146	Belle Glade	12/13/2012	1/17/2013	N	Pump 1 - Bad Battery (logged 12/30/12 03:49) Safe shutdown on 1/3/13 10:56. Pump 2 first sample 12/13 and lasat sample 1/17 in Hobo file. Pump 2 was miss labeled as 8146-03. When returned for download on 11/17 - Pump 1 had bad battery and was removed from service. Recorder on Pump 2 was functional and was moved to Pump 1 for better chance of picking up both pumps running.
8148	Belle Glade	10/23/2012	1/17/2013	Y	When returned for download on 11/17 - Pump 2 had a bad battery and was removed from service 11/17 (11:23am).
8149	Belle Glade	10/23/2012	1/17/2013	Y	

APPENDIX D

Pahokee - Data Monitoring Summary

LS No.	City	Date Range Start	Date Range Finish	Complete (Y or	Reason
8201	Pahokee	10/24/2012	1/17/2013	Y	
8202	Pahokee	10/24/2012	1/17/2013	Y	
8203	Pahokee	10/24/2012	1/17/2013	Y	
8204	Pahokee	10/24/2012	1/17/2013	Y	
8205	Pahokee	10/24/2012	1/17/2013	Y	
8210	Pahokee	10/24/2012	1/17/2013	Y	
8214	Pahokee	10/24/2012	1/17/2013	Y	
8215	Pahokee	1/4/2013	1/17/2013	N	All data present for the dates range deployed.
8216	Pahokee	10/24/2012	1/17/2013	Y	
8217	Pahokee	1/4/2013	1/17/2013	N	All data present for the dates range deployed.
8218	Pahokee	10/24/2012	1/17/2013	Y	
8219	Pahokee	1/4/2013	1/17/2013	N	All data present for the dates range deployed.
8220	Pahokee	10/24/2012	1/17/2013	Y	
8223	Pahokee	1/4/2013	1/17/2013	N	All data present for the dates range deployed.

APPENDIX D

South Bay - Data Monitoring Summary

LS No.	City	Date Range Start	Date Range Finish	Complete (Y or	Reason
8301	South Bay	10/24/2012	1/17/2013	N	No data recorded from 12/14 to 12/29. Staff doesn't report any issues with this station in that period. Last record 12/13 at 6:57pm next record is at 12/29 at 11:50pm. Data recorder had no reported issues.
8302	South Bay	10/24/2012	1/17/2013	Y	
8303	South Bay	10/24/2012	12/3/2012	N	Data preset in Hobo File for entire period. Data was also preset in delivered Data file (excel .csv file) for entire period. Error in data processing.
8304	South Bay	10/24/2012	1/17/2013	Y	
8305	South Bay	10/24/2012	1/17/2013	Y	
8307	South Bay	10/24/2012	1/17/2013	N	No data recorded from 12/19 to 1/10. Staff didn't have any reported issues. Last record 12/18 at 11:04am next record is at 1/11 at 1:25pm. Data recorder had no reported issues.
8308	South Bay	10/24/2012	1/17/2013	Y	
8309	South Bay	11/21/2012	1/17/2013	N	All data present for the dates range deployed. Issue is that on Hobo Data recorder and corresponding data file (.csv) shows a later deployment on 11/28/13 but data is preset in processed file from 11/21/13. Was incorrect data file used to create processed data? Data install log also shows deployment of recorder on 11/28/13. Incorrect data must have been used.

APPENDIX E

Defect Occurrence Rates and Cost Estimates

Summary of Inspection Observations

Inspection Documentation and Defect Occurences	Unit	Belle Glade	Pahokee	South Bay	Probable Repair Method	Notes
Documentation Type						
Manhole Inspection Reports	Manholes reviewed (EA)	101	40	0		1
Sewer Main Inspection Video and Logs	Mainlines reviewed (LF)	26,658	0	0		2
Smoke Test Reports	Mainlines reviewed (LF)	17,665	10,874	0		
Sewer Lateral Inspection Video and Logs	Laterals reviewed (EA)	0	0	0		3
Defect Occurences (Number)						
Manhole frame and cover - Cracks, breaks, corrosion, vertical and/or horizontal misalignment	Each manhole	50	25	---	Realign or replace manhole frame and cover	
Manhole chimney, cone, and wall - Cracks, breaks, missing mortar, corrosion	Each manhole	58	28	---	Seal infiltration and install cementitious or cementitious/epoxy lining	
Manhole bench and channel - Cracks, breaks, corrosion	Each manhole	25	4	---	Repair or replace bench and channel	
Manhole pipe connection - Voids	Each manhole	0	0	---	Seal manhole pipe connection	
Manhole other - Major structural defect or collapse	Each manhole	0	0	---	Replace manhole	
Mainline - Cracks, breaks, moderate joint separations/offsets, root intrusion	Linear feet mainline	18,177	---	---	Install manhole to manhole liner	
Mainline - Missing pipe, severe misalignments, collapsed pipe	Each occurrence	32	---	---	Perform excavated point repair	
Lateral - Cracks, breaks, moderate joint separations/offsets, root intrusion	Each occurrence	---	---	---	Install lateral liner	4
Lateral - Missing pipe, severe misalignments, collapsed pipe	Each occurrence	---	---	---	Perform excavated point repair	
Lateral (from smoke test, not defined) - Cracks, breaks, moderate joint separations/offsets, root intrusion	Each occurrence	9	3	---	Perform excavated point repair and/or install lateral liner	
Lateral (from smoke test) - Missing cleanout cap, broken riser	Each occurrence	36	5	---	Replace cap and/or riser	
Lateral (from smoke test) - Storm sewer cross connection	Each occurrence	4	0	---	Perform excavated point repair	
Defect Occurences (Rate)						
Manhole frame and cover - Cracks, breaks, corrosion, vertical and/or horizontal misalignment	Occurrences per number reviewed	0.4950	0.6250	---		
Manhole chimney, cone, and wall - Cracks, breaks, missing mortar, corrosion	Occurrences per number reviewed	0.5743	0.7000	---		
Manhole bench and channel - Cracks, breaks, corrosion	Occurrences per number reviewed	0.2475	0.1000	---		
Manhole pipe connection - Voids	Occurrences per number reviewed	0.0000	0.0000	---		
Manhole other - Major structural defect or collapse	Occurrences per number reviewed	0.0000	0.0000	---		
Mainline - Cracks, breaks, moderate joint separations/offsets, root intrusion	Occurrences per linear foot reviewed	0.6819	---	---		
Mainline - Missing pipe, severe misalignments, collapsed pipe	Occurrences per linear foot reviewed	0.0012	---	---		
Lateral - Cracks, breaks, moderate joint separations/offsets, root intrusion	Occurrences per number reviewed	---	---	---		
Lateral - Missing pipe, severe misalignments, collapsed pipe	Occurrences per number reviewed	---	---	---		
Lateral (from smoke test, not defined) - Cracks, breaks, moderate joint separations/offsets, root intrusion	Occurrences per linear foot reviewed	0.0005	0.0003	---		
Lateral (from smoke test) - Missing cleanout cap, broken riser	Occurrences per linear foot reviewed	0.0020	0.0005	---		
Lateral (from smoke test) - Storm sewer cross connection	Occurrences per linear foot reviewed	0.0002	0.0000	---		

Notes

1. Pahokee manhole inspection reports from June 2009 (AECOM). Belle Glade manhole inspection reports from November 2012.
2. Lanzo Lining Services, Inc. (January - March, 2013).
3. Not available to date for any system.
4. Including mainline/lateral connection.
5. Defects noted may or may not be leaking.
6. Minor smoke testing defects such as missing cleanout caps are not noted.
7. Manhole condition assessment based on inspection reports by others.
8. Video logs reviewed for 110 Belle Glade mains, of which 64 appeared to warrant mainline liners and 38 were noted as having moderate to heavy infiltration.

Order-of-Magnitude Cost Estimate for Sewer Assessment and Rehabilitation / I-I Reduction Program
Belle Glade

BASIC SYSTEM DESCRIPTION		Notes
26	Number of pump stations with gravity systems	
174,697	Number of linear feet gravity sewer	
781	Number of manholes	

BASIC ASSUMPTIONS		
Inspection		
80	Percent of system screened via flow monitoring and/or other method(s)	A
100	Percent of screened system receiving smoke testing inspection	
100	Percent of screened system manholes receiving inspection	
60	Percent of screened system mains receiving cleaning and video inspection	B
10	Number of laterals receiving cleaning and video inspection per 1,200 LF of inspected mains	C
20	Percent of inspection budget for program management and reporting	
Rehabilitation		
68	Percent of inspected mains requiring manhole to manhole lining	D
1	Number of sectional liners per 1,200 LF of inspected mains	
8	Number of lateral liners per 1,200 LF of inspected mains	C
1.4	Number of excavated point repairs per 1,200 LF of inspected mains	D
0.5	Percent of inspected mains requiring replacement	
57	Number of cementitious MH liners per 100 MHs inspected	D
6	Number of cementitious/epoxy or polyethylene MH liners per 100 MHs inspected	
75	Number of miscellaneous MH repairs per 100 MHs inspected	D
20	Percent of rehabilitation budget for engineering and construction management	

	Task	Quantity	Unit	Average Unit Cost	Estimated Cost
	Inspection				
1	Preliminary evaluation and prioritization	21	BASIN	$1,400.00	$29,120
2	Smoke testing	139,758	LF	$0.35	$48,915
3	Manhole inspection	625	EA	$80.00	$49,984
4	Cleaning and video inspection of mains	83,855	LF	$1.00	$83,855
5	Cleaning and video inspection of laterals	699	EA	$200.00	$139,758
6	Program management and reporting				$70,326
				Subtotal	**$421,958**
	Rehabilitation				
7	Lining - manhole to manhole	57,021	LF	$35.00	$1,995,739
8	Lining - sectional	70	EA	$1,200.00	$83,855
9	Lining - lateral	559	EA	$3,000.00	$1,677,091
10	Excavated point repairs	101	EA	$8,000.00	$805,004
11	Excavated line replacement	419	LF	$100.00	$41,927
12	Manhole liners - cementitious	356	EA	$1,600.00	$569,818
13	Manhole liners - cementitious/epoxy or polyethylene	37	EA	$3,000.00	$112,464
14	Manhole repairs - miscellaneous	469	EA	$600.00	$281,160
15	Engineering and construction management				$1,113,411
				Subtotal	**$6,680,468**
				ESTIMATED PROGRAM TOTAL	**$7,102,426**

Notes:

A Assumes approximately 20 percent of system previously completed. System screening by "other method(s)" includes flow data analysis, pump run hour analysis, and operations personnel knowledge concerning repair history and system performance.

B Assumes some mains are known or determined to be in good condition and are not televised.

C Inspection documentation was not available for laterals and laterals represent a significant area of uncertainty.

D Defect occurrence rates from Table 10. All others estimated based on experience in similar systems.

Order-of-Magnitude Cost Estimate for Sewer Assessment and Rehabilitation / I-I Reduction Program
Pahokee

BASIC SYSTEM DESCRIPTION		Notes
12	Number of pump stations with gravity systems	
91,145	Number of linear feet gravity sewer	
415	Number of manholes	

BASIC ASSUMPTIONS		
Inspection		
80	Percent of system screened via flow monitoring and/or other method(s)	A
100	Percent of screened system receiving smoke testing inspection	
100	Percent of screened system manholes receiving inspection	
30	Percent of screened system mains receiving cleaning and video inspection	B
10	Number of laterals receiving cleaning and video inspection per 1,200 LF of inspected mains	C
20	Percent of inspection budget for program management and reporting	
Rehabilitation		
34	Percent of inspected mains requiring manhole to manhole lining	D
0.5	Number of sectional liners per 1,200 LF of inspected mains	
8	Number of lateral liners per 1,200 LF of inspected mains	C
0.7	Number of excavated point repairs per 1,200 LF of inspected mains	D
0.3	Percent of inspected mains requiring replacement	
29	Number of cementitious MH liners per 100 MHs inspected	D
3	Number of cementitious/epoxy or polyethylene MH liners per 100 MHs inspected	
38	Number of miscellaneous MH repairs per 100 MHs inspected	D
20	Percent of rehabilitation budget for engineering and construction management	

	Task	Quantity	Unit	Average Unit Cost	Estimated Cost
	Inspection				
1	Preliminary evaluation and prioritization	10	BASIN	$1,400.00	$13,440
2	Smoke testing	72,916	LF	$0.35	$25,521
3	Manhole inspection	332	EA	$80.00	$26,560
4	Cleaning and video inspection of mains	21,875	LF	$1.00	$21,875
5	Cleaning and video inspection of laterals	182	EA	$200.00	$36,458
6	Program management and reporting				$24,771
				Subtotal	**$148,624**
	Rehabilitation				
7	Lining - manhole to manhole	7,437	LF	$35.00	$260,310
8	Lining - sectional	9	EA	$1,200.00	$10,937
9	Lining - lateral	146	EA	$3,000.00	$437,496
10	Excavated point repairs	13	EA	$8,000.00	$104,999
11	Excavated line replacement	55	LF	$100.00	$5,469
12	Manhole liners - cementitious	95	EA	$1,600.00	$151,392
13	Manhole liners - cementitious/epoxy or polyethylene	10	EA	$3,000.00	$29,880
14	Manhole repairs - miscellaneous	125	EA	$600.00	$74,700
15	Engineering and construction management				$215,037
				Subtotal	**$1,290,220**
				ESTIMATED PROGRAM TOTAL	**$1,438,844**

Notes:

A Assumes approximately 20 percent of system previously completed. System screening by "other method(s)" includes flow data analysis, pump run hour analysis, and operations personnel knowledge concerning repair history and system performance.

B Assumes some mains are known or determined to be in good condition and are not televised.

C Inspection documentation was not available for laterals and laterals represent a significant area of uncertainty.

D Defect occurrence rates from Table 10. All others estimated based on experience in similar systems.

E With the exception of laterals, Pahokee and South Bay video inspection requirements and defect occurrence rates are assumed to be one half of those in Belle Glade due to previously completed rehabilitation work.

Order-of-Magnitude Cost Estimate for Sewer Assessment and Rehabilitation / I-I Reduction Program
South Bay

BASIC SYSTEM DESCRIPTION		Notes
7	Number of pump stations with gravity systems	
47,360	Number of linear feet gravity sewer	
188	Number of manholes	

BASIC ASSUMPTIONS		
Inspection		
80	Percent of system screened via flow monitoring and/or other method(s)	A
100	Percent of screened system receiving smoke testing inspection	
100	Percent of screened system manholes receiving inspection	
30	Percent of screened system mains receiving cleaning and video inspection	B
10	Number of laterals receiving cleaning and video inspection per 1,200 LF of inspected mains	C
20	Percent of inspection budget for program management and reporting	
Rehabilitation		
34	Percent of inspected mains requiring manhole to manhole lining	D
0.5	Number of sectional liners per 1,200 LF of inspected mains	
8	Number of lateral liners per 1,200 LF of inspected mains	C
0.7	Number of excavated point repairs per 1,200 LF of inspected mains	D
0.3	Percent of inspected mains requiring replacement	
29	Number of cementitious MH liners per 100 MHs inspected	D
3	Number of cementitious/epoxy or polyethylene MH liners per 100 MHs inspected	
38	Number of miscellaneous MH repairs per 100 MHs inspected	D
20	Percent of rehabilitation budget for engineering and construction management	

	Task	Quantity	Unit	Average Unit Cost	Estimated Cost
	Inspection				
1	Preliminary evaluation and prioritization	6	BASIN	$1,400.00	$7,840
2	Smoke testing	37,888	LF	$0.35	$13,261
3	Manhole inspection	150	EA	$80.00	$12,032
4	Cleaning and video inspection of mains	11,366	LF	$1.00	$11,366
5	Cleaning and video inspection of laterals	95	EA	$200.00	$18,944
6	Program management and reporting				$12,689
				Subtotal	**$76,132**
	Rehabilitation				
7	Lining - manhole to manhole	3,865	LF	$35.00	$135,260
8	Lining - sectional	5	EA	$1,200.00	$5,683
9	Lining - lateral	76	EA	$3,000.00	$227,328
10	Excavated point repairs	7	EA	$8,000.00	$54,559
11	Excavated line replacement	28	LF	$100.00	$2,842
12	Manhole liners - cementitious	43	EA	$1,600.00	$68,582
13	Manhole liners - cementitious/epoxy or polyethylene	5	EA	$3,000.00	$13,536
14	Manhole repairs - miscellaneous	56	EA	$600.00	$33,840
15	Engineering and construction management				$108,326
				Subtotal	**$649,956**
				ESTIMATED PROGRAM TOTAL	**$726,088**

Notes:

A Assumes approximately 20 percent of system previously completed. System screening by "other method(s)" includes flow data analysis, pump run hour analysis, and operations personnel knowledge concerning repair history and system performance.

B Assumes some mains are known or determined to be in good condition and are not televised.

C Inspection documentation was not available for laterals and laterals represent a significant area of uncertainty.

D Defect occurrence rates from Table 10. All others estimated based on experience in similar systems.

E With the exception of laterals, Pahokee and South Bay video inspection requirements and defect occurrence rates are assumed to be one half of those in Belle Glade due to previously completed rehabilitation work.

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TECHNICAL MEMORANDUM No. 9 – Regulatory Overview

TO:	Maurice Tobon / Palm Beach County Water Utilities Department Jennifer Medina / Palm Beach County Water Utilities Department
COPY:	John Koroshec / Hazen and Sawyer Albert Muniz / Hazen and Sawyer Rob Taylor / Hazen and Sawyer
FROM:	Eric Stanley / Hazen and Sawyer
DATE:	September 19, 2013
FILE:	45103-004.3.0
SUBJECT:	Palm Beach County Water Utilities Department (PBCWUD) Glades Wastewater Master Plan Project Number: WUD 12-068

Technical Memorandum No. 9 (TM-9) provides a regulatory overview of existing and new wastewater treatment and disposal requirements for the two wastewater treatment facilities serving the Glades Region Urban Service Area. TM-9 also describes regulatory and permit issues affecting the Belle Glade and Pahokee Wastewater Treatment Facilities (WWTFs), as well as emerging trends in local, state and federal wastewater regulations. The scope of work in *Task 9 – Regulatory Overview* generally states the following:

- *Prepare a regulatory overview of existing and pending wastewater treatment and disposal requirements.*
- *Summarize the critical regulatory and permit issues affecting the treatment facilities; assess emerging trends in local, state and federal wastewater regulations; and investigate potential future compliance issues.*
- *Review existing wastewater effluent, injection wells, reuse, numeric nutrient criteria, and bio-solids with respect to applicable standards.*

INTRODUCTION

This task consists of a regulatory overview of the current and emerging wastewater treatment and disposal requirements that may affect the Belle Glade and Pahokee WWTFs. Emerging trends

in local, state and federal wastewater regulations as well as potential future compliance issues are described. Existing as well as new and emerging regulations are discussed with respect to the following areas;

- Wastewater effluent
- Injection wells
- Reclaimed water
- Biosolids
- Recent state legislation and rulemaking
- Other regulations

WASTEWATER EFFLUENT REGULATIONS

Current Effluent Disposal Practices

The Belle Glade WWTF uses both deep well injection and percolation ponds for effluent disposal. The Belle Glade WWTF is currently permitted to dispose of 10.2 mgd maximum daily flow (MDF) of secondary effluent via a Class I underground injection well. The Belle Glade WWTF is also permitted to dispose of an additional 0.069 mgd maximum monthly average daily flow (MMADF) of disinfected secondary effluent via a one million gallon percolation pond.

The Pahokee WWTF also uses deep well injection and percolation ponds for effluent disposal. The Pahokee WWTF is currently permitted to dispose of 4.0 mgd monthly average daily flow (MADF) of secondary effluent via a Class I underground injection well, and an additional 0.08 mgd annual average daily flow (AADF) of disinfected effluent via a rapid infiltration basin.

Wastewater Effluent – Current Regulations

State regulations governing the design and operation of the Belle Glade and Pahokee WWTFs include the following:

- Florida Administrative Code (FAC) 62-600 – Domestic Wastewater Facilities
- FAC 62-601 – Domestic Wastewater Treatment Plant Monitoring

Wastewater Effluent – Emerging or New Regulations

There are no emerging or new regulations for wastewater effluent that will affect the Belle Glade and Pahokee WWTFs from a wastewater effluent perspective. Numeric Nutrient Criteria has been a high profile issue that will place more stringent standards on entities affecting or discharging to classified surface water bodies. Since the Belle Glade and Pahokee WWTFs do not currently discharge to classified surface waterbodies, nor are planning to discharge to classified surface

waterbodies, it is not anticipated that Numeric Nutrient Criteria will affect the current or future operation of the facilities.

INJECTION WELL REGULATIONS

As previously stated, the primary means of disposal of secondary effluent at the Belle Glade and Pahokee WWTFs are via on-site Class I underground injection wells.

Injection Well – Current Regulations

State regulations governing the design and operation of the injection wells at the Belle Glade and Pahokee WWTFs include the following:

- FAC 62-520 – Ground Water Classes, Standards and Exemptions
- FAC 62-528 – Underground Injection Control

Discharges to Class I injection wells permitted for construction after December 2005 must comply with HLD standards prior to injection. As a minimum, new injection wells will be required to comply with the HLD standards codified in FAC 62-600.440(5). HLD regulations require additional total suspended solids (TSS) control beyond secondary treatment to 5.0 mg/L single sample to maximize disinfection effectiveness, and the rule also requires that HLD facilities be designed to result in an effluent in which fecal coliform values are below detectable limits.

If the Pahokee WWTF is taken out of service and flow is redirected to the Belle Glade WWTF, the effluent disposal capacity of the injection well must be considered. If an additional well is required to be constructed at the Belle Glade WWTF to increase treatment capacity, HLD treatment of the effluent may be required. The latest Compliance Evaluation Inspection on November 8, 2012 noted that the deep injection well was operating at it's 10.2 mgd MDF limit, and indicated that this was a "Minor Out Of Compliance" condition. Further analysis of effluent disposal logistics are discussed in TM-X - Capacity Analysis Report (CAR) for the Belle Glade WWTF.

Increased secondary effluent disposal capacity may be achieved at the Belle Glade and Pahokee WWTFs by rerating the deep injection wells. The current permitted capacity at each plant is based on a velocity of 8 feet per second (fps). The current regulations allow 10 fps (and 12 fps for emergency conditions), which would increase capacity per well from 10.18 mgd to 12.72 mgd at the Belle Glade WWTF, and from 4.00 to 4.87 mgd at the Pahokee WWTF. Existing injection well pumping stations may require upgrades to increase the pumping capacity to meet the rerated disposal capacities.

Injection Well – Emerging or New Regulations

There are no apparent emerging or new regulations related to underground injection. However, permitting activities for underground injection control have recently been shifted from the Florida

Department of Environmental Protection (FDEP) southeast district office to the main office in Tallahassee.

RECLAIMED WATER REGULATIONS

As previously stated, secondary means of effluent disposal at the Belle Glade and Pahokee WWTFs are via on-site percolation ponds.

Reclaimed Water – Current Regulations

State regulations governing the reclaimed water distribution and application at the Belle Glade and Pahokee WWTFs include the following:

- FAC 62-610 – Reuse of Reclaimed Water and Land Application

If the Pahokee WWTF is taken out of service and flow is redirected to the Belle Glade WWTF, the effluent disposal capacity of the injection well must be considered. The Belle Glade and Pahokee WWTFs are not currently planning to install a reuse system or expand their percolation ponds. However, per FAC 62-610.525 installation of new percolation ponds may require additional treatment of secondary effluent to HLD standards and additional removal of TN. The requirement for this additional treatment may depend upon the FDEPs interpretation of the criteria in FAC 62-610.525.

Reclaimed Water – Emerging or New Regulations

There are no emerging or new regulations for wastewater effluent that will affect the Belle Glade and Pahokee WWTFs from a reclaimed water perspective.

BIOSOLIDS REGULATIONS

The Belle Glade WWTF currently stabilizes waste activated sludge with one 465,000 gallon aerobic digester. The facility reportedly currently produces biosolids that are disposed of at the Okeechobee Landfill. The facility is also permitted to dispose of Class B biosolids through land application at the Corkscrew Ranch in Lee County, and has previously disposed of biosolids at other agricultural use sites. The facility is permitted to meet Class B pathogen reduction per the requirements of 40 CFR 503.32(b)(2) (Monitoring of Indicator Organisms), and to meet vector attraction reduction per the requirements of 40 CFR 503.33(b)(4) (Meet a specific oxygen uptake rate for aerobically treated biosolids).

The Pahokee WWTF currently stabilizes waste activated sludge with two 75,000 gallon aerobic digesters. The facility is permitted to produce Class A biosolids that are currently disposed of at the Okeechobee Landfill, and additionally a Bioset lime treatment process produces Class AA biosolids which are hauled to various locations in South Florida for agricultural use. The facility is

permitted to dispose of biosolids by marketing and distribution, use as a biofuel or for bioenergy and/or disposal in a Class I solid waste landfill. The facility is permitted to meet Class A pathogen reduction by meeting the pathogen reduction per the requirements of 40 CFR 503.32(a)(3) (Thermally Treated Biosolids)" (for Alternative 1), or by meeting the pathogen reduction requirements in 40 CFR 503.32(a)(8) (Use of equivalent Processes to Further Reduce Pathogens for Alternative 6). The facility is permitted to meet Class A vector attraction reduction per 40 CFR 503.33(b)(6) (Add alkaline materials to raise the pH under specified conditions).

Biosolids – Current Regulations

State regulations governing biosolids processing and disposal at the Belle Glade and Pahokee WWTFs include the following;

- FAC 62-640 – Domestic Wastewater Residuals.

Biosolids – Emerging or New Regulations

The latest rulemaking on revisions to Chapter 62-640, F.A.C became effective on August 29, 2010. The new rule includes the following general changes for wastewater treatment facilities producing biosolids;

- New permit application requirements
- New record keeping and reporting requirements
- New monitoring and notification requirements
- Other licensing, labeling, and notification requirements specific to facilities that are distributing and marketing Class AA biosolids as fertilizer

The new rule also requires all sites receiving biosolids to be permitted. The following general requirements for sites applying biosolids were enacted;

- Site permit application and nutrient management plan requirements
- Background metals sampling
- Phosphorus assessment
- Crop yield assessment
- Restrictions on storage time and areas
- Prohibitions for applying biosolids in the Wekiva Study area, and the Northern Everglades and Estuary Protection Program areas

Both the Belle Glade and Pahokee WWTFs have been re-permitted to the most recent regulations following the Chapter 62-640, F.A.C revisions that became effective in August 2010. Recent records show that the Corskscrew Ranch biosolids application site was in the process of applying for a permit in March 2013.

SUMMARY OF RECENT STATE LEGISLATION AND RULEMAKING

Recent state legislation and rulemaking was surveyed, and recent developments potentially affecting the Belle Glade or Pahokee WWTFs wastewater effluent, injection wells, reclaimed water, and biosolids were investigated. No recent rules have been enacted or are under discussion that would directly affect the operation of the facilities, from the following entities:

- State of Florida
- South Florida Water Management District (SFWMD)
- Environmental Protection Agency (EPA)
- FDEP

SUMMARY OF OTHER REGULATIONS

Greenhouse Gas Legislation

In May 2010, the EPA issued its final "tailoring" rule for greenhouse gas (GHG) emissions, which exempted small “polluters” from its Clean Air Act permitting requirement. Facilities applying for New Source Review permits for other pollutants will be required to include greenhouse gases in their permits if they increase their emissions of GHG by at least 50,000 tons of carbon dioxide equivalent per year. This rulemaking would not require permitting for sources that emit less than 50,000 tons of carbon dioxide equivalent per year.

On July 1, 2011, the EPA finalized a three-year deferral of GHG permitting for “biogenic carbon dioxide emissions from bioenergy and other biogenic stationary sources” (including wastewater treatment plants). At this time, the EPA determined it is not appropriate to apply New Source Review Prevention of Significant Deterioration and Title V permitting requirements to additional, smaller sources of GHG emissions. On June 29, 2012 the EPA issued a final rule that does not revise the GHG permitting thresholds that were established in the previous GHG Tailoring Rule that went into effect July 1, 2011.

Although a detailed analysis would need to be performed to more accurately estimate the GHG emissions for the Belle Glade and Pahokee WWTFs, a rough approximation can be made using values reported in literature. Currently there is a mandatory reporting rule for GHG emission sources which emit more than 25,000 tons of carbon dioxide equivalent per year. It is not

anticipated the Belle Glade or Pahokee WWTFs will be required to report for flows up to their rated capacity, and it is estimated that the GHG production of each plant is well below the current emissions permit limits and the proposed 50,000 tons of carbon dioxide equivalent per year permitting limit.

The Southeast Florida Regional Climate Action Plan

The Southeast Florida Regional Climate Action Plan issued in October 2012 was developed by the Southeast Florida Regional Climate Change Compact; a collaborative effort among Palm Beach, Broward, Miami-Dade, and Monroe Counties, as well as municipalities and other partners within the four counties. The group has worked to develop regionally-consistent methodologies for mapping sea-level rise impacts, assessing vulnerability, and understanding the sources of regional greenhouse gas emissions. The Regional Climate Action Plan calls for action and provides recommendations for reducing greenhouse gas emissions and adapting to regional and local impacts of climate change. While the report appears to be non-binding, it will purportedly be used to guide legislative activity and expenditures for the planning and management of the effects of climate change. Multiple recommendations are made relevant to water and wastewater utilities related to water supply, saltwater intrusion, reclaimed water, and energy efficiency that may guide future local and state legislation.

Micro-constituents

Micro-constituents include organic chemicals, such as pharmaceutically active substances, personal care products, endocrine disrupting compounds, and previously unregulated inorganic elements whose toxicity may be reassessed or newly evaluated. The impacts of the extremely low concentrations of these compounds found in wastewater effluent or reclaimed water are unknown. To date, there is no evidence that micro-constituents cause human health effects at environmentally relevant concentrations. Monitoring for specific micro-constituents may become a part of the standard testing protocol as the use of reclaimed water for indirect potable reclaimed water applications increases. Additionally, it is possible future regulations may require reduction of micro-constituents from wastewater.

CONCLUSIONS / RECOMMENDATIONS

As part of the Glades Wastewater Master Plan prepared by H&S, a regulatory overview of existing and new wastewater treatment and disposal requirements was presented. Although a detailed analysis of records and operations was not completed, it was found that the Belle Glade and Pahokee WWTFs generally comply with current regulatory standards for wastewater effluent, injection wells, reclaimed water, and biosolids.

The regulatory overview also includes information about emerging local, state, and federal regulations. The following categorizes the emerging rules as either short term (within the next five

years) or long term (beyond the next five years) and summarizes the effects of the emerging rule on the Belle Glade or Pahokee WWTFs with respect to potential future compliance issues.

Short Term

An emerging rule was considered short term if it had the potential to affect the plant within five years (present time to 2018). The following emergency regulations fall into this category:

Climate Change Legislation

It is advisable for the PBCWUD to monitor issues related to climate change, such as the recommendations by the Southeast Florida Regional Climate Action Plan issued in October 2012, to keep abreast of potential areas of concern regarding future developing climate change legislation. The PBCWUD should focus on the recommendations related to water supply, saltwater intrusion, reclaimed water, and energy efficiency.

Injection Wells

The current permitted deep injection well disposal capacity at each plant is based on a velocity of 8 feet per second (fps), whereas the current regulations allow 10 fps. This could potentially increase the capacity per well from 10.18 mgd to 12.72 mgd at the Belle Glade WWTF, and from 4.00 to 4.87 mgd at the Pahokee WWTF. Existing injection well pumping stations may require upgrades to increase the pumping capacity to meet the rerated disposal capacities.

If the PBCWUD considers installing new injection wells, each new injection well will be required to comply with the HLD standards codified in FAC 62-600.440(5).

Reclaimed Water

If the PBCWUD considers expanding the percolation ponds, effluent being discharged to the basin may require additional treatment to HLD standards and additional removal of TN per FAC 62-610.525. The requirement for this additional treatment may depend upon the FDEPs interpretation of the criteria in FAC 62-610.525.

Long Term

Emerging regulations were considered long term if more than five years (beyond 2018) were assumed to pass before the PBCWUD would need to take action or if there is uncertainty regarding the sustainability of a proposed rule. Only one emerging rule met this criterion.

Micro-constituents

Although currently no legislation exists or is forthcoming regarding micro-constituents in reclaimed water, future regulations may require monitoring or removal of micro-constituents. PBCWUD should remain apprised of local, state, and federal legislation and participate in any workshops, conferences, or other efforts related to micro-constituents.

Palm Beach County Water Utilities Department (PBCWUD)

Belle Glade Wastewater Treatment Facility

Palm Beach County, Florida

Operation and Maintenance Performance Report

August 2014

FDEP Permit: *FLA027740-008DW1P*
Permit Expiration Date: *May 22, 2016*

CERTIFICATION BY THE PERMITTEE

I, Maurice Tobon, as the duly authorized representative of the Palm Beach County Water Utilities Department, hereby certify that I have reviewed the Operation and Maintenance Performance Report for the Belle Glade Wastewater Treatment Facility, and that I am fully aware and intend to comply with the recommendations and schedules included in the report.

ADDRESS:
8100 Forest Hill Boulevard
West Palm Beach, Florida 33413

Telephone:
(561) 747-5700

SIGNATURE:

Maurice Tobon, P.E.
Director of Engineering
PBCWUD

Date: _____, 2014

CERTIFICATION BY THE OPERATOR

I, Jose L. Pozo, Chief Operator for the Belle Glade Wastewater Treatment Facility, hereby certify that I have reviewed the Operation and Maintenance Performance Report for the Wastewater Treatment Facility and I am fully aware of the recommendations and schedules included in the report.

ADDRESS:
2055 West Canal Street
South Belle Glade, Florida 33430

Telephone:
(561) 493-6287

SIGNATURE:

Jose L. Pozo
Chief Operator
Operator Certification No.: XXXX

Date: _____, 2014

CERTIFICATION BY THE PROFESSIONAL ENGINEER

I, Joseph J. Franko, hereby certify that the information contained in the Operation and Maintenance Performance Report for the Belle Glade Wastewater Treatment Facility is true and correct to the best of my knowledge. The report was prepared in accordance with sound engineering principles and I have discussed the contents of this report with the operator; and, the aforementioned person agree that when properly operated and maintained, the facility will discharge an effluent that complies with the limitations specified in the permit application.

ADDRESS:

2101 NW Corporate Boulevard, Suite 301
Boca Raton, Florida 33431

Telephone:
(561) 997-8070

SIGNATURE:

For Hazen and Sawyer, P.C.

Joseph J. Franko, P.E.
Florida P.E. No. 48077

(Seal)

Date: _____, 2014

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Chapter 1 – Introduction

1.1 Background

This report is intended to meet the requirements of Florida Administrative Code (FAC) Chapter 17-600.735, by providing reasonable assurance that the facility will meet or exceed the effluent limit requirements during the period for which the facility is permitted. This report evaluates the capability of treatment facilities to function as intended including a detailed assessment of the physical condition of treatment process equipment, overall treatment efficiency of the plant, performance trends and the Operations and Maintenance program.

This report also identifies the deficiencies, if any, with the physical capacity and performance conditions of the plant including problems with the present Operations and Maintenance program. Finally, the report provides recommendations and schedules, if needed, for corrective actions leading to improved operations.

The Belle Glade Wastewater Treatment Facility (WWTF) is located on West Canal Street South in Belle Glade, Florida, just east of US-27 and south of State Road 80. The service area for this treatment plant facility is approximately 27 square miles (17,313 acres), extends from slightly north of Paul Rardin Park south to the G2 Canal. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Belle Glade WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Belle Glade). The treatment plant is permitted to operate with a capacity of 6.5 million gallon per day (MGD) Maximum Monthly Average Daily Flow (MMADF), 9.8 MGD Peak Hour Flow (PHF) under Florida Department of Environmental Protection (FDEP) Permit No. FLA027740-008-DW1P that was issued on May 23, 2011 and expires May 22, 2016 (see **Appendix A**). The facility is also permitted to discharge up to 0.069 MGD MMADF capacity via on-site land application in a 7.4 acre percolation pond. The facility also has an existing Underground Injection permit (0048217-008-UO) with a MDF permitted capacity of 10.2 MGD. Primary effluent disposal is deep well injection.

1.2 Treatment

The existing wastewater treatment plant was constructed in two phases: The original phase rated at 3.0 MGD went into operation in 1984 and the second 3.5 MGD phase was completed in April 2000. In April 2007, the City of South Bay began transmitting untreated wastewater via force main to the Belle Glade WWTP. In August, 2010 an In-line booster pump station as placed into service and all wastewater within the South Bay Service Area is pumped directly to the Belle Glade WWTF. Since the commissioning of the South Bay in-line booster pump station, raw wastewater flows from South Bay service area have ranged from 0.038 MGD to 3.99 MGD with an average flow of 0.565 MGD.

The Belle Glade WWTF is a complete mix oxidation ditch aeration type activated sludge

wastewater treatment plant. Wastewater enters the plant at the headworks facility and passes through two mechanical bar screens and two grit separators/classifiers. From the headworks, raw wastewater enters a flow splitter box and is distributed to the two oxidation ditches. Flow then passes through a second influent splitter box where it is split between the four clarifiers.

Secondary effluent from the clarifiers is sent through four roto screens before it is pumped down the injection well via the injection well pump station. A portion (0.069 MGD) of secondary effluent can be chlorinated and disposed of in the on-site percolation pond during injection well Mechanical Integrity Testing (MIT) or if there is an issue with the injection well pumping station.

Return activated sludge from the secondary clarifiers enters the return activated sludge/waste activated sludge (RAS/WAS) wet well where RAS is returned to the influent splitter box upstream of the oxidation ditches and WAS is sent to the sludge thickeners.

Waste sludge is thickened by two rotary drum thickeners, prior to aerobic digestion and ultimately disposed of in liquid form by land spreading at designated and separately permitted and privately operated agricultural use sites. The sludge treatment system can process in excess of 12,000 lbs. per day with one thickener in operation.

Below is a summary of the facilities at the Belle Glade WWTF:

- Two mechanical cleaned bar screens;
- Two 2,538 gallon grit forced vortex chambers with two cyclone/inclined screw classifier grit dewatering units;
- Two 1.9 million gallon Carousel oxidation ditch basins with a downstream flow splitter;
- Two rectangular secondary clarifiers with a volume of approximately 373,000 gallon each and two circular secondary clarifiers with a volume of 822,469 gallon each;
- Four 0.1-inch opening roto-screens rated at 2,650 gallons per minute each;
- One injection well pump station with a pumping capacity of 12.0 MGD when three pumps are online and one as a backup;
- One 20-inch, 10.2-MGD maximum daily flow Class I injection well;
- One 465,300 gallon aerobic digester;
- Two 320 gallon per minute rotary drum thickeners with a polymer blend system;
- Two 500 pound per day flow paced chlorinators and one 1,000 pound per day manual chlorinator;
- One 310 kilowatt (kW) and one 800 kW diesel engine auxiliary power generators; and
- One 0.069-MGD maximum monthly average daily flow percolation pond.

The current permit limits for effluent Carbonaceous 5-day Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS) are as follows:

Parameter	Limit
Flow	6.5 mgd (MMADF)
$CBOD_5$	20 mg/L, annual average
	30 mg/L, monthly average
	45 mg/L, weekly average
	60 mg/L, single sample
TSS	20 mg/L, annual average
	30 mg/L, monthly average
	45 mg/L, weekly average
	60 mg/L, single sample

MMADF = maximum month average daily flow

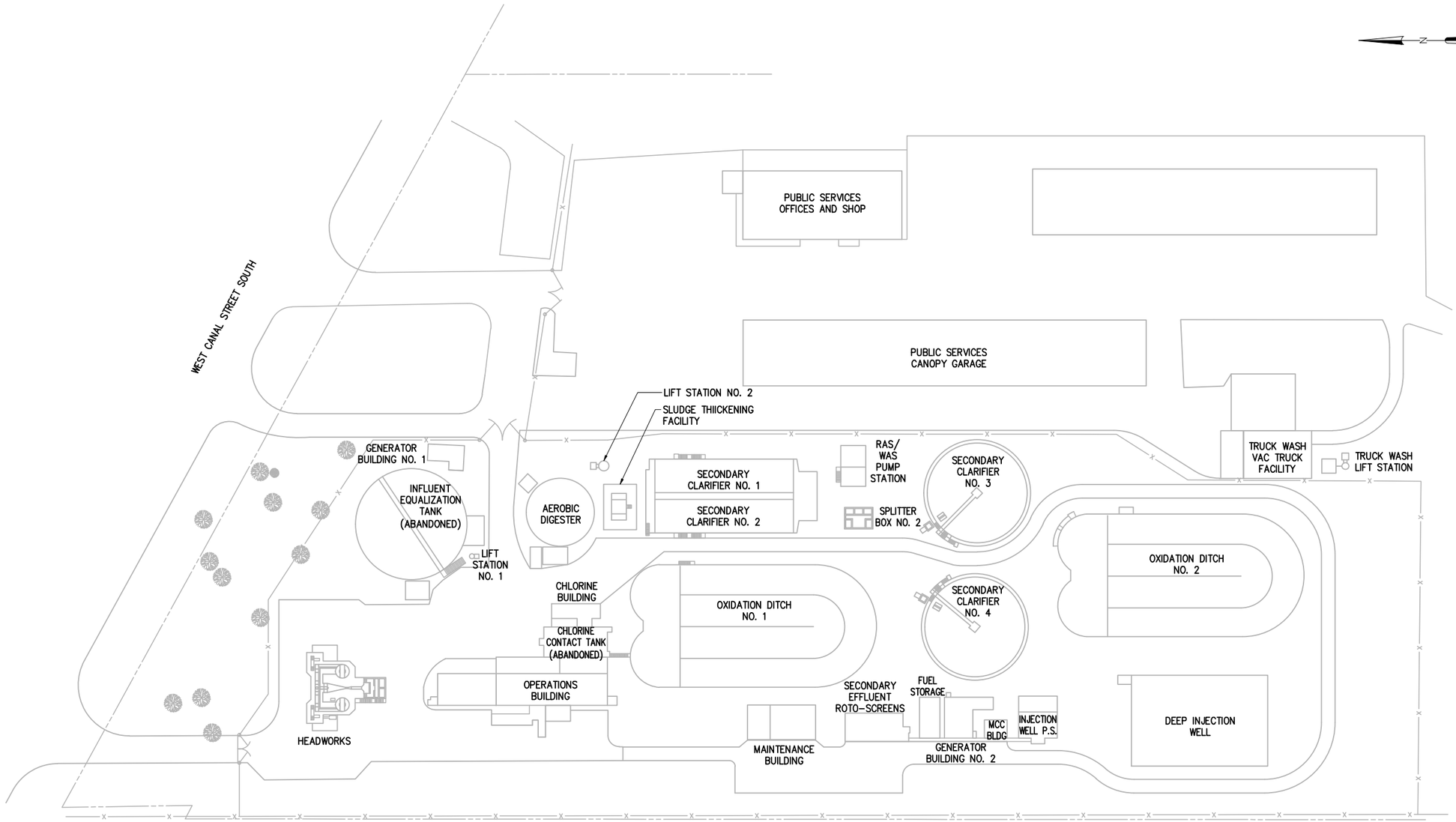

FIGURE 1-1
BELLE GLADE WWTF
SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

HAZEN AND SAWYER
Environmental Engineers & Scientists

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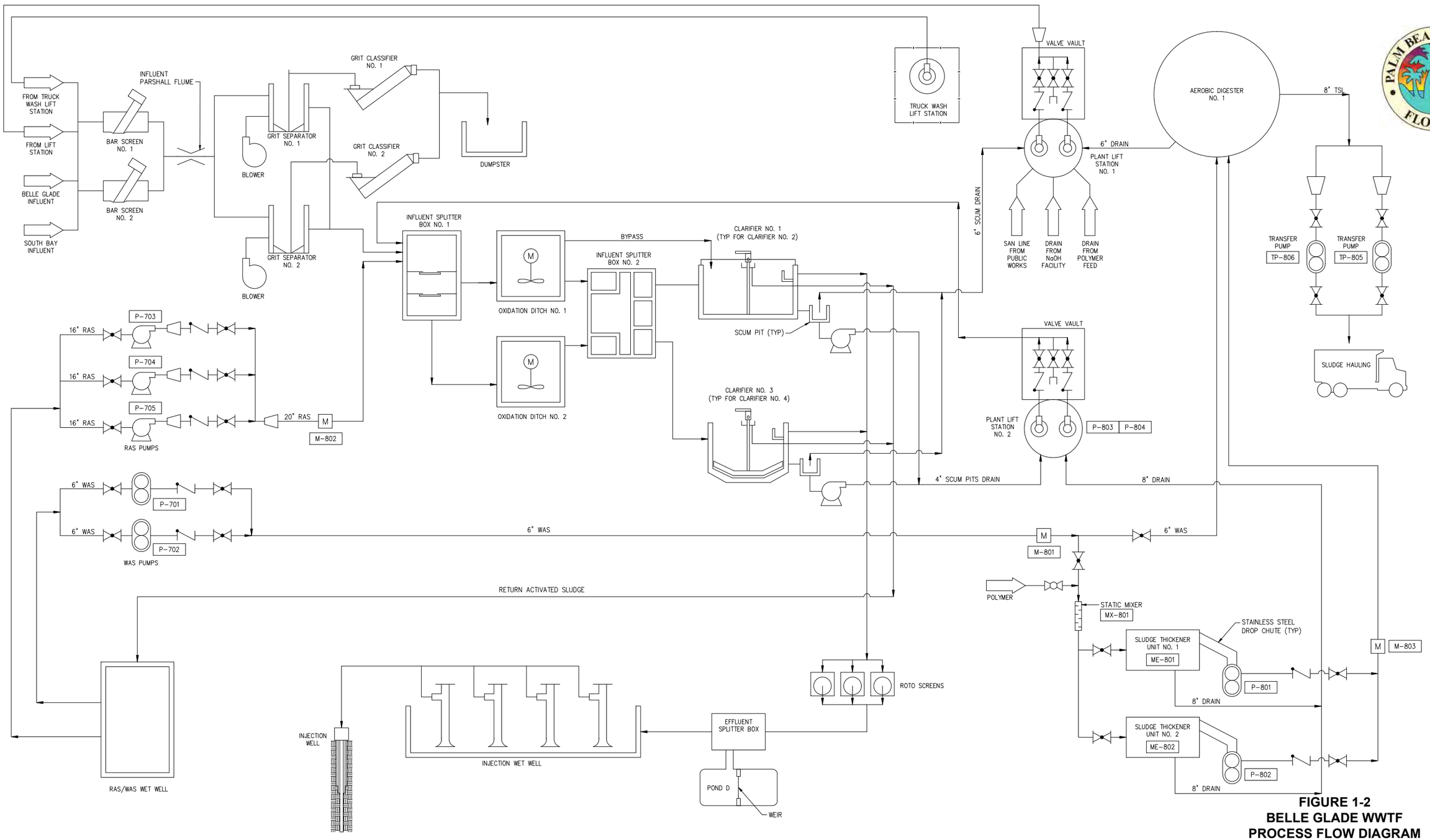

FIGURE 1-2
BELLE GLADE WWTF
PROCESS FLOW DIAGRAM

Palm Beach County
Water Utilities Department
Glades Utility Authority

HAZEN AND SAWYER
Environmental Engineers & Scientists

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Chapter 2 – Physical Condition

2.1 Introduction

This chapter presents details of process operations and descriptions of unit processes. In addition, the physical condition of process equipment and components are stated, based on the field evaluations conducted on December 4, 2012, April 29, 2013 and May 15, 2013.

The Belle Glade WWTF unit processes that were evaluated and are discussed herein are: Headworks, Secondary Treatment Process which includes; Oxidation Ditches, Rectangular Clarifiers, Circular Clarifiers (Walker Unit), Sludge Handling, Splitter Boxes, Disposal Systems, Chlorine Facilities and other miscellaneous buildings and equipment around the sites. The following sections provide a brief description of each building / treatment unit followed by its condition.

- **Headworks:** The facility consists of a two level reinforced concrete structure above grade. Level one is on grade, open (no walls), and serves to house two grit classifiers. The second level consists of multiple channels supported on columns and covered with aluminum grating. Access to the top level is via reinforced concrete stairs. The effluent box (Splitter Box No. 1) is located at the south side of the structure and is the full height of the structure. The top level also contains the following unit processes: two mechanical self-cleaning fine bar screens, two vortex grit tanks, two grit pumps, two air compressors (for the vortex grit removal system) and four slide gates. The first level contains two grit classifiers which receive grit from the grit pumps.

  The underside of upper level channels appear in good condition except for a leak under the influent parshall flume and several cracks at the cantilevered concrete walkway which appear to have been caused by shrinkage cracks. The access stair to the upper level has cracked at the intermediate landing apparently due to settlement of the bottom landing. Several cracks with evidence of leakage or past repairs are visible on the outside of the effluent box. Cracks are also visible on the bottom floor slab around columns. Exterior coating has deteriorated in some locations, particularly at the columns.

  The top level of the structure has suffered deterioration with some areas showing concrete aggregate due to erosion and corrosion near the splash zone of the effluent box, and map cracking near the parshall flume. Interior wall surfaces appear to be in good conditions, however the coating has failed in some areas, including at the joint with the partial flume. Several aluminum grating sections are loose. Concrete surfaces below the water line were not observed as the facility was in normal operation.

  The mechanical bar screens were rebuilt within the last three years and therefore are in good condition. However, wastewater treatment plant staff have expressed their concerns associated with the amount of captured screening material that is carried over the mechanical

bar screen to the downstream side of the screenings channel due to the inefficient cleaning mechanism.

The bar screen channels can be isolated by four slide gates which are in fair condition, except for the metal frames. The existing grit system is functional and in good condition.

There is some minor vibrations in the gear boxes of Pista Grit No. 1 and Pista Grit No. 2. There was high compressor vane passing frequencies present on Pista Grit No. 1 Air Compressor which could lead to vibration and bearing failure.

The electrical feed for the headworks is from MCC1 and is in good condition. The only issues reported is a possible bad fuse feeding Grit Classifier No. 1.

- **Oxidation Ditch No. 1:** Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Total tank area is approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the east and north. The structure was built in 1985 and modified in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

  Multiple cracks are present around the exterior of the structure. Cracks on the straight walls are vertical and are approximately evenly spaced. This type of cracking is typical of shrinkage cracking and, although unsightly, do not typically indicate an inherent structural integrity problem. Some vertical cracks have evidence of leakage.

  Diagonal cracks were observed towards the north end of the structure, with some evidence of leakage. Diagonal cracks are typically indicative of an underlying structural condition which most likely is differential settlement or differential deflection between structural members.

  Interior surfaces of the walls were not inspected as the tank was in normal operation. The water level in the tank was observed to be very close to the top of the wall. Plant staff indicated that there is a risk of water from inside the tank spilling and splashing on windy days. Circular walls on the north end were raised during the plant expansion of 2000 and a top slab was added which also increased the wall loading.

  The aerators were found to be in good condition. However, the flow split between Oxidation Ditch No. 1 and Oxidation Ditch No. 2 is unknown because here is no existing flow measurement between the ditches. Antimony was found to be higher than usual level in Ditch No. 1, Aerator No. 2 Gearbox which could result from Babbitt bearings. This could lead to a gear box failure.

  Electrically, the equipment is feed from MCC3 and it appears to be in good condition.

- **Oxidation Ditch No. 2:** Structure consists of a reinforced concrete tank with semi-circular walls on the north and south, and straight walls on the east, west, and center. Total tank area is approximately 217 feet long x 108 feet wide. The north end of the Oxidation Ditch is covered with a reinforced concrete slab which is accessible from grade via concrete stairs on the north-east. Oxidation Ditch No. 2 is newer than Oxidation Ditch No. 1, and is approximately 18 inches higher than Oxidation Ditch No. 1. The structure was built in 2000. Two vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

  There are multiple vertical cracks present all around the exterior of the structure on both the straight walls and the circular walls. Some cracks have evidence of leakage. This type of cracking is typical of shrinkage cracking and do not typically indicate an inherent structural integrity problem. Several concrete spalls were observed on the east wall towards the north end. The top slab over the north end of the tank appears to be separating from the exterior walls. Interior surfaces of the walls were not observed as the tank was in normal operation.

  The aerators were found to be in good condition. However, antimony, titanium and other metals were identified at higher than usual levels in the gearbox of aerator No. 1 and low levels of nickel were found in the gearbox of aerator No. 2.

- **Splitter Box No. 2:** Structure consists of a rectangular reinforced concrete tank covered with aluminum grating accessible via reinforced concrete stairs and serves to split flow to the secondary clarifiers. Flow to each of the four clarifiers is controlled by three slide gates installed in the Splitter Box No. 2 structure.

  Splitter Box No. 2 is in overall good condition and the slide gates are in good condition. However, the top surface does not have a kick plate around the perimeter along the guardrails.

- **Secondary Clarifier Nos. 1 and 2:** This structure consists of a rectangular reinforced concrete tank partially below grade. A center wall separates Clarifier No. 1 from Clarifier No. 2. One steel trussed walkway spans the structure in the short direction and is accessible from grade via aluminum stairs. The south end of the structure contains the pipe gallery which is below grade and covered with a reinforced concrete slab. The pipe gallery is accessible by a hatch on the top concrete slab and reinforced concrete stairs. Two rectangular reinforced concrete scum boxes (one for each clarifier) are located at the south end and connected to the main structure with a short section of ductile iron pipe. The 373,000-gallon (each) rectangular secondary clarifiers include overflow weirs, scum skimming, removal troughs and two scum pumps. The two drive mechanisms are supported on the respective exterior and center walls.

  Clarifier Nos. 1 and 2 are currently not in service but provide extra capacity to the plant during peak flow conditions. Several cracks with leakage evidence are visible on the east wall. Cracks are also visible on the cantilevered channel at the north end of the structure. The connection between the main basins and the scum boxes shows evidence of leakage even

though prior repairs are evident. The steel trussed structure for the walkway bridge has minimal signs of corrosion and the coating has failed. Plant staff has indicated that the structure and mechanisms are difficult to clean due to the lack of drains and sumps. The pipe gallery at the south end is in overall good condition; however there is evidence of flooding.

The mechanical equipment is in adequate condition for the extent that these clarifiers are utilized (i.e., backup during wet weather flow). However, it was reported that these clarifiers are difficult to maintain, operate and clean.

- **Secondary Clarifier No. 3:** This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  Overall condition of the clarifier is good. There is minor evidence of concrete spalls at the perimeter walkway where guardrail posts are embedded in the concrete walkway. The steel bridge appears to be in good condition but the protective coating is deteriorating.

  The secondary clarifier visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. The clarifier was in service so an inspection of the mechanism, arms and feedwells was not performed at this time to determine their condition. The Lower gearbox was observed to have a moderate level of gear and/or bearing metal in the oil and water is at a severe level in the upper gearbox, bushing/thrust metal is at a moderate level and gear and/or bearing metal is at a minor level.

- **Secondary Clarifier No. 4:** This structure consists of a circular reinforced concrete tank with a reinforced concrete walkway around the entire perimeter. A steel bridge for access to the clarifier mechanism motor is accessed through aluminum stairs. The 822,000-gallon center feed secondary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one scum pump. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly.

  The overall condition of the clarifier is good. The steel bridge appears to be in good condition but the protective coating is deteriorating.

  The visible mechanical equipment was found to be in relatively good condition, with no signs of an immediate need for repair. An inspection of the mechanism, arms and feedwells was not performed because the clarifier was in service during our inspection. The upper gearbox is leaking and needs repair.

- **Secondary Effluent Roto-Screens:** This structure consists of a pre-engineered steel open style building with metal roof panels on steel purlins. Foundation for the steel structure is a reinforced concrete slab on grade. Screen equipment is placed on reinforced concrete channels on grade. The four self-cleaning 0.1-inch Roto-Screens remove any remaining solids from the wastewater before it is pumped down the deep injection well.

  The concrete structure of the Roto Screens Facility is in overall good condition and does not require structural repairs. The metal framed structure covering the screens shows evidence of corrosion at the bases of columns and some of the roof members such as the purlins, metal roofing panels and cross-bracing rods.

  The Roto-Screens appear to be in good condition. However, during periods of high flow (i.e., rainfall events) and/or if maintenance is required on one of the units, a hydraulic constraint occurs as there currently is no bypass. The metal frames on the Roto-Screen effluent wet well slide gate and isolation gate appear to be in poor condition. The gearbox lubricant viscosity in the four Roto-Screens was reported by Florida Bearings to be at a severely low level, and water is entering the Roto-Screen No. 4 Gearbox.

- **Injection Well Pump Station:** The structure for the injection well pump station consists of a reinforced concrete wet well below grade with a concrete cover, and an adjacent reinforced concrete slab on grade. The four Injection well pumps are placed over the wet well on the concrete cover, and the slab on grade supports piping and valves.

  The overall condition of the visible areas of the structure appears to be good. The interior condition of the wet well was not accessible and was not observed.

  The pumps have been recently replaced/repaired and are in good condition. There was minor levels of copper found in the lubricating oil of pump No.1 and it has a slight vibration. Minor debris (particles) were found in the lubricating oil of pump Nos. 2 and 4. The electrical connection to the breaker for injection well pump No. 2 had a 32 degree temperature difference between the legs.

- **Deep Injection Well:** The injection well system consists of one deep injection well and an associated monitor well.

  Concrete slab on grade at the deep injection well is in overall good condition. Overall the injection well piping is in poor condition. It was reported that replacement parts for the existing deep injection well PLC system are unavailable.

- **RAS / WAS Pump Station:** This structure consists of a rectangular reinforced concrete wet well covered with a reinforced concrete slab accessible via reinforced concrete stairs. The outdoor pipe gallery is supported on a reinforced concrete slab covered with an open steel framed structure. There are three RAS pumps and two WAS pumps. Settled sludge from the

secondary clarifiers is returned to the oxidation ditches or wasted to the Sludge Thickening Facility.

The RAS / WAS Pump Station concrete structure is in overall good condition. No cracks or leaks were observed. The metal framed structure at the west housing the pumps has deteriorated paint and minor corrosion. Asbestos was found on some of the roof elements.

The pumps are in good condition. However, the RAS flow meter is not operating properly and therefore cannot provide accurate flow date. RAS pump Nos. 1 and 3, (MCC1) and (MCC2) have temperature differences between fuses which could be a loose breaker connection. WAS pump Nos. 1 and 2, (MCC1) and (MCC2) high temperature differences between the connections to the load reactor and the fuses with a 144 degree difference observed at the fuses for WAS pump No. 2.

- **Chlorine Building:** Facility consists of a one-level steel framed structure supported on a reinforced concrete slab on grade. FRP wall and roof panels partially cover the storage tanks. The chlorine equipment consists of two covered crosslink polyethylene chemical storage tanks storing 12 percent sodium hypochlorite solution, three diaphragm metering pumps and one sodium hypochlorite batching pump. Chlorine is diluted to 9 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the deep injection well is out of service, or the plant experiences a peak flow condition that exceeds the deep injection well capacity, sodium hypochlorite is injected into Clarifier No. 3 so that the secondary effluent can be discharged to the percolation ponds.

  Overall the chlorine facility is in good condition with minimal paint deterioration and FRP panel deterioration. The mechanical equipment appears to be in good condition.

- **Sludge Thickening Facility:** The facility consists of an open steel frame with metal roof panels supported on a reinforced concrete slab on grade. Thickening is employed to reduce the sludge volume prior to the aerobic digestion process. Two rotary drum thickeners located at the Sludge Thickening Facility thicken the WAS prior to digestion. The Sludge Thickening Facility also contains two thickened sludge pumps.

  The metal framed structure covering the thickening equipment has corrosion with widespread coating failure.

  The rotary drum thickeners were repaired recently and are in fair condition. The thickened sludge transfer pumps are in fair condition. The rotary drum thickeners have been repaired several times and are approaching the end of their useful life.

- **Aerobic Digester:** Consists of a circular reinforced concrete tank with several steel walkways on the top accessible via one aluminum stair structure. Adjacent to the tank is an open steel framed structure housing two blowers. This facility utilizes aerobic digestion for sludge

stabilization. The major components of the digester system are the 465,000-gallon circular concrete tank, two blowers and one truck loading pump.

Several cracks with evidence of leaks can be observed. One horizontal crack at approximately one-third of the wall height extends all around the perimeter of the tank. Several other smaller cracks can be seen around pipe penetrations. The walkway bridges and access stairs are in good condition.

The mechanical equipment associated with the digester is in good condition. However, the tank is not equipped with an overflow in order to ensure the Aerobic Digester does not exceed a maximum level. Blower No. 2, was observed to have high vibration amplitude and/or noise.

- **Influent Equalization (EQ) Tank:** Structure consists of a circular reinforced concrete tank. A steel bridge spans the tank completely and is accessible from grade via steel stairs. This structure has been abandoned and is no longer in use.

  Several cracks were observed on the exterior wall surface, with one horizontal crack of particular significance at the top of the wall towards the south. This crack is long and there is evidence of corrosion of reinforcing steel within the wall. The exterior surface of the concrete walls appears to be in good condition; however the protective coating has failed.

  The interior steel bridge and access stair appear to be in good condition but their protective coating has failed. The FRP grating at the bridge is deteriorated. Parts of the guardrail are damaged. The bridge walkway lacks OSHA required toe plates. The Influent Equalization Tank does not have any associated mechanical equipment.

- **MCC Building:** Facility consists of a one story reinforced concrete and masonry building with a flat roof supporting AC equipment.

  The MCC Building is in overall good condition. However, the two air handlers for the HVAC system are in poor condition.

- **Operations Building:** This structure consists of a two story reinforced concrete and masonry building with a tiled hip roof. Access to the building is via a concrete ramp and concrete stairs on the west side. The adjacent old Influent Structure to the north and old Chlorine Contact Tanks to the east have been abandoned, filled with sand and covered with a thin concrete slab to serve as a deck. The abandoned Influent Structure at the north end of the Operations Building has a basement level which has been cleared of all equipment.

  The new operations building is in overall good condition, however, plant staff report some roof leaks. The access ramp at the west side has cracked at the location of a support post for the walkway roof.

Concrete decks over the abandoned influent structure and chlorine contact basin have cracked on the top surface and at the interface with the old structure. Several cracks and spalls are visible on the walls of the abandoned structures with evidence of moisture seepage. An effluent box of the old chlorine contact basin is used as a planting area for a tree but roots of the tree have cracked the concrete. Exterior paint of the old structures has failed. The basement level of the old influent structure has been stripped of all equipment but is very humid, possibly due to groundwater intrusion. The building is equipped with five air conditioning units which are in poor working order

- **Maintenance Building:** Facility consists of a one story reinforced concrete and masonry building with a tiled hip roof.

  The maintenance building is in overall good condition, however plant staff report that they have some roof leaks. The Maintenance Building does not have any functional mechanical equipment.

- **On–site Lift Station No. 1:** Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two 5-Hp submersible pumps.

  The wet well is in poor condition. The 6-foot diameter wet well liner is failing. It has delaminated from the concrete walls in several places and has exposed the concrete. Most of the delaminating occurs around the pipe penetration into the wet well. There were no signs of soft concrete or exposed steel inside the wet well. The lifting eyes in the top slab are exposed and are rusted. The valve vault is concrete and does not have any coating and is in fair condition.

  The pumps appear to be in fair condition. The lift station has eight separate influent lines ranging in size from 2-inches up to 8-inches and their inverts range from 4 to 6 feet below grade. The discharge piping and valves are 6-inches in diameter and are significantly corroded. There is little to no protective coating or paint on the piping and valves. The isolation valves are plug valves and the check valves are spring cushioned swing checks. The spring systems are rusted or missing and not working on both check valves. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault does not drain into the wet well or is not equipped with a drain as it holds water.

- **On–site Lift Station No. 2:** Structure consists of a precast concrete circular wet well below grade. The lift station is a duplex station with two Flygt submersible pumps.

  The wet well is in fair condition. The 6-foot diameter wet well liner/coating is failing. There is exposed concrete in several places. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition, there are a few cracks in the top slab and evidence of differential settlement between the wet well top slab and the surrounding slab on grade. The valve vault has a coating and is in good condition.

The pumps were not visible so the condition could not be determined. The lift station has several separate influent lines ranging in size from 2 inches up to 6 inches. The discharge piping and valves are 4 inches in diameter and have some rust inside the wet well. There is a protective coating or paint on the piping and valves in the valve box and they appear to be in good condition with very little rust, mainly around the pump out connection. The isolation valves are plug valves and the check valves are leaver and weight swing checks. There was no evidence of surcharging or grease accumulation in the wet well. The valve vault is equipped with a drain to the wet well.

- **Generator Building No. 1:** Building consists of a one story reinforced concrete and masonry building with a flat roof over half of the building fully enclosing the generator. Approximately half of the building is open on the top at the location of the fuel tank. The b Building is in overall good condition, however plant staff report roof leaks. This building does not have any mechanical equipment.

- **Generator Building No. 2:** Structure consists of a one-story reinforced concrete and masonry building with a tiled hip roof. The building is in overall good condition, however plant staff report roof leaks. This building does not have any mechanical equipment. A slight temperature difference for the 300-kW generator (MCC3) was observed between the legs in the breaker.

- **Polymer Storage Building:** Structure consists of a one-story reinforced concrete and masonry building with a flat roof. Adjacent to the building is an uncovered concrete pad for temporary storage of polymer totes. The Polymer Storage Building also contains a polymer system with two polymer totes, one feeder system.

  The building is in overall good condition. The polymer system is inefficient and many components do not function. Polymer storage totes are stored outside on a slab and are not protected from exposure to the sun.

- **Electrical System:** The electrical distribution system at the Belle Glade WWTF consists of two utility FPL services. **Utility Service No. 1** is located in the north-east corner of the plant and is connected to a 750kVA FPL transformer. The 750kVA FPL transformer is located in the existing FPL vault. The step-down transformer is connected to the main switchboard (MSB-1) located in Generator Building No. 1. MSB-1 consists of one 800A rated main breaker, one 600A rated generator breaker, one 800A rated automatic transfer switch (ATS), and other feeder breakers. The main breaker and emergency breakers are electrically interlocked through an ATS control scheme to prevent from closing both breakers at the same time. MSB-1 provides power to Digester Blower No.1, Digester Blower No. 2, Oxidation Ditch No. 1 Aerator No. 1, Oxidation Ditch No. 1 Aerator No. 2, Chlorine Building and the Polymer Building. MSB-1 and the starters for the aerators were installed in 1982. This equipment is past its reliable life span (-11 to -6 years) and is in poor condition and also in a non-air-

conditioned space. The digester blower starters were installed in 1996; these starters are near the end of their expected life span (3-8 years).

Back-up power for MSB-1 is provided by a 300-kW (375kVA) generator rated at 480V, 3-phase. The generator was installed in 1982. MSB-1 is well past the reliable life span for electrical equipment, typically 20-25 years.

- **Utility Service No. 2** is located in the west-center of the plant and consists of two feeders derived from the same FPL distribution point. Each feeder is connected to an individual 1000-kVA outdoor pad mounted FPL transformer. The step-down transformers feed main switchboard No. 2 (MSB-2) located at Generator Building No.2. MSB-2 consists of two main breakers and two emergency breakers, rated 1600A. One main breaker and emergency breaker pair is connected to one bus and the other remaining pair is connected to another bus. Each set of main and generator breakers are electrically interlocked through an ATS control scheme such that both breakers cannot be closed at the same time. The two 1600A rated buses in the MSB-2 are connected to a Main-Tie-Main (MTM) switchboard. The MTM, installed in 2012, is a 1600A switchboard with two 1600A main breakers and a 1600A tie breaker used to provide the flexibility of connecting the power from either side of MSB-2 in the event of equipment failure at either bus of the MSB-2. From the MTM, power is distributed to switchboard IWA (SWBD-IWA) and switchboard IWB (SWBD-IWB). SWBD-IWA and SWBD-IWB are located in the MCC Building. SWBD-IWA provides power to Injection Well Pump No. 1 Variable Frequency Drives (VFD), Injection Well Pump No. 2, Oxidation Ditch No.2 Aerator No. 1 starter, Panel IWHA (480V) and MCC-1. SWBD-IWB provides power to Injection Well Pump No. 3 VFD and Injection Well Pump No. 4 VFD, Oxidation Ditch No. 2 Aerator No. 2 starter, Panel IWHB (480V), and MCC-1. The VFDs for Injection Well Pump Nos. 3 and 4 were installed in 2012 and are in excellent condition. SWBD-IWA, SWBD-IWB and Injection Well Pump Nos. 1 and 2 VFDs were installed in 1994 and are near the end of their expected life span (1-6 years) but are in good condition. The starters for Oxidation Ditch No. 2 Aerators were installed in 1996 and are in good condition but near the end of expected life span (3-8 years). The 480V panels IWHA and IWHB and low voltage panels associated with each were also installed in 1996 and are in good condition. MCC-1 and MCC-2 located in the Operations Building electric room provide power to the plants' headworks, clarifiers, on-site lift stations, plant water booster pumps, and general power for the Operations and Maintenance Buildings. The MCCs were installed in 1996 and are in good condition.

  Back-up emergency power for MSB-2 is from Generator No. 2, a 1500-kW (1875kVA) generator rated at 480V / 3-phase, also located in Generator Building No. 2. The generator was installed in 1994 and is in very good condition due to excellent maintenance. MSB-2 was installed in 1994 and near the end of its expected life span (1-6 years). With the recent replacement of the main and generator breakers at MSB-2 in the past year the switchboard is in good condition.

- **Plant PLC's:** Plant operations are monitored and controlled by three PLCs. PLC-1, located in the Operations Building Electric Room, was installed in 1998 and is good condition. PLC-1, located in the MCC Building, was installed in 1996 and is good condition. PLC-3, located near the chlorine facilities, was installed in 2012 and is in excellent condition.

2.2 Operating Limits

Operating flow capacities based on the current operating permit for the Belle Glade WWTF are as follows:

Maximum Month Average Daily Flow (MMADF)	6.5 MGD
Peak Hourly Flow (PHF)	9.8 MGD

2.3 Summary of Design Details

The following is a tabulation of design information on various systems/components at the Belle Glade WWTF:

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Headworks	
Bar Screens	
Type	Mechanical Self-Cleaning
Number of Units	2
Screen Element Spacing	6 mm
Motor	
Number of Units	2
Hp	0.5
Manufacturer	Baldor
Manufacturer	Parkson Aqua Guard
Grit Removal	
Number of Units	2
Type	Induced Vortex
Pista Grit Seperator Gearhead	
Type	550 Jeta Grit Trap
Diameter (Trap Zone)	12 feet
Manufacturer	Jones and Attwood
Motor	
Hp	1
Manufacturer	Baldor
Reducer	

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Type	Helical Gear
Manufacturer	Nord Gear Corp.
Pista Grit Air Compressor Motor	
Hp	5
Manufacturer	US Elec. Motors
Pista Grit Air Compressor	
Manufacturer	Tuthill Corp
Grit Classifier Motor	
Hp	0.5
Manufacturer	US Motor / Emerson
Grit Classifier Gear Reducer	
Type	Helical - Worm Gear
Manufacturer	SEW Eurodrive
Gritt Mitt Classifier	
Type	GF3
Manufacturer	Westech
Oxidation Ditch	
Number of Units	2
Area	217 ft. x 108 ft. (each)
Motor	
Number of Units per Oxidation Ditch	2
Hp	100 / 75
Manufacturer	Reliance Electric
Gear Reducer	
Number of Units per Oxidation Ditch	2
Manufacturer	Flender
Clarifiers	
Clarifiers No. 1 and No. 2	
Volume	373,000 gal. (each)
Motor	
Hp	0.33
Manufacturer	Leeson Elec. Corp.
Reducer	
Manufacturer	Browning
Scum Pump Motor	

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Type	TCE
Hp	3
Manufacturer	Haywood Gordon Limited
Clarifiers Nos. 3 and 4	
Volume	822,000 gal. (each)
Motor	
Manufacturer	Emerson Browning
Reducer	
Manufacturer	Browning
Scum Pump Motor	
Manufacturer	Emerson
Scum Pump	
Manufacturer	AMT
Secondary Effluent Roto-Screens	
Number of Units	4
Screen Element Spacing	0.1 in.
Motor	
Number of Units	4
Manufacturer	SEW Eurodrive
Gear Reducer	
Number of Units	4
Manufacturer	SEW Eurodrive
Injection Well Pump Station	
Motor	
Number of Units	4
Hp	300
Manufacturer	US Motors (3), Emerson (1)
Pump	
Number of Units	4
Capacity	3,450 GPM at 129 ft. TDH (each)
Manufacturer	Peerless Pump Co.
RAS / WAS Building	
RAS Motor	
Number of Units	3
Hp	25

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Manufacturer	Flygt
WAS Motor	
Number of Units	2
Manufacturer	US Elec. Motors
WAS Reducer	
Number of Units	2
Manufacturer	US Elec. Motors
WAS Pump	
Number of Units	2
Type	PL 400
Manufacturer	Borger
Disinfection Building	
Number of Units	2 Tanks
Chemical	12% Sodium Hypochlorite Solution
Bleach Pumps	
Number of Units	3
Manufacturer	Prominent Fluid Control
Motor	
Number of Units	3
Manufacturer	ATB
Sludge Handling Building	
Number of Units	2
Rotary Drum Thickener Motor	
Hp	2
Manufacturer	Reliance Electric (#1), Baldor (#2)
Rotary Drum Thickener Gear Reducer	
Manufacturer	Nord Gear Corp.
Thickened Sludge Pump Motor	
Type	TCIP
Hp	5
Manufacturer	US Elec. Motors
Thickened Sludge Pump Gear Reducer	
Manufacturer	Browning
Thickened Sludge Pump	
Type	P200

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Manufacturer	Borger
Digester Building	
Blower	
Number of Units	2
Manufacturer	Hoffman
Motor	
Type	11KK
Hp	125
Manufacturer	Toshiba
Truck Loading Pump	
Number of Units	1
Lift Station	
Lift Station No. 1	
Pump	
Number of Units	2
Hp	5
Wet Well Diameter	6 ft.
Lift Station No. 2	
Pump	
Number of Units	2
Manufacturer	Flygt
Wet Well Diameter	6 ft.

2.4 Conclusions

Based on the field evaluations conducted on December 4, 2012, April 29, 2013 and May 15, 2013 and review of the treatment plant records and monitoring reports, the following conclusions are reached:

- In general there is no evidence of hydraulic or organic overloading problems at the Belle Glade WWTF.
- The equipment is generally in fair condition and well maintained as detailed in the field evaluation report (Attachment 1).
- The facilities meet applicable requirements of:
    1. Reliability

2. Protection from adverse effects of odor, noise, aerosol drift and lighting.
3. Fencing (enclosure) to ward off animals and unauthorized persons.
4. Easy access points for influent and effluent sampling.
5. Provisions for flow measurements.

Thus, the facility complies with the requirements of F.A.C. 17-600.400(1)(b), (2)(a), (2)(b), (4)(a) and (4)(b).

- Physical signs indicate that the treatment units and associated equipment are operating properly and are expected to operate properly for the permit period.
- The equipment has the necessary safety features and is operated safely.

Chapter 3 – Treatment Efficiency

3.1 Introduction

Treatment efficiency of the major wastewater treatment units and overall treatment efficiency at the Belle Glade WWTF are presented below. The design and operating parameters used for the evaluation of treatment efficiency are those established in the treatment facility's capacity analysis report.

3.2 Factors Which Affect Plant Performance

Factors which affect plant performance and treatment efficiency include:

- Hydraulic and organic loadings
- Seasonal variation in flow
- Infiltration and inflow
- Contribution from industrial wastewater and septage
- Operations flexibility
- Accumulations of sand and grit
- Rag build-up
- Deterioration of baffles

3.3 Criteria for Evaluation

The complete mix activated sludge treatment process at the Belle Glade WWTF is designed to operate in the range of mixed liquor suspended solids (MLSS) concentration from 2,000 to 3,200 mg/L and a solids retention time (SRT) of 15 to 25 days. RAS flow range is from 67 to 128 percent of the plant influent and typically operated at 70 percent return.

3.4 Current Loadings

The average monthly operating conditions for the period extending from January 2002 through March 2013 are presented in the Table 3-1. Please note that data for carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) is only included from October 2009 through March 2013 and evaluated in this report due to inconsistencies in the data prior to October 2009. Figure 3-1 contains plots of average daily flows and a 3-month rolling average from January 2002 through March 2013. As shown in Table 3.1, the historical performance for this four year period has been excellent with $CBOD_5$ and TSS removal efficiencies of 98% and 97%, respectively. Historical flow data has been reviewed from January 2002 through March 2013. Flows during this 10 year period have averaged 2.79 mgd, which is well below the permitted MMADF of 6.5 mgd.

Table 3.1
Historical Flow and Treatment Data

YEAR	MONTH	FLOW		INFLUENT $CBOD_5$	EFFLUENT $CBOD_5$	REMOVAL	INFLUENT TSS	EFFLUENT TSS	REMOVAL
		monthly avg	3-mo avg	monthly avg	monthly avg	$CBOD_5$	monthly avg	monthly avg	TSS
		(mgd)	(mgd)	(mg/L)	(mg/L)	(%)	(mg/L)	(mg/L)	(%)
2002	Jan	1.81	1.81	-	-	-	-	-	-
	Feb	3.35	3.35	-	-	-	-	-	-
	Mar	1.62	2.26	-	-	-	-	-	-
	Apr	1.59	2.19	-	-	-	-	-	-
	May	2.19	1.80	-	-	-	-	-	-
	Jun	4.21	2.67	-	-	-	-	-	-
	Jul	3.25	3.22	-	-	-	-	-	-
	Aug	2.28	3.25	-	-	-	-	-	-
	Sep	2.68	2.74	-	-	-	-	-	-
	Oct	2.52	2.49	-	-	-	-	-	-
	Nov	2.43	2.54	-	-	-	-	-	-
	Dec	2.62	2.52	-	-	-	-	-	-
2003	Jan	0.00	1.68	-	-	-	-	-	-
	Feb	0.00	0.87	-	-	-	-	-	-
	Mar	3.03	1.01	-	-	-	-	-	-
	Apr	2.89	1.97	-	-	-	-	-	-
	May	0.00	1.97	-	-	-	-	-	-
	Jun	4.36	2.42	-	-	-	-	-	-
	Jul	3.57	2.64	-	-	-	-	-	-
	Aug	2.55	3.49	-	-	-	-	-	-
	Sep	2.69	2.94	-	-	-	-	-	-
	Oct	2.96	2.73	-	-	-	-	-	-
	Nov	2.80	2.82	-	-	-	-	-	-
	Dec	2.92	2.89	-	-	-	-	-	-

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW		INFLUENT $CBOD_5$	EFFLUENT $CBOD_5$	REMOVAL	INFLUENT TSS	EFFLUENT TSS	REMOVAL
		monthly avg	3-mo avg	monthly avg	monthly avg	$CBOD_5$	monthly avg	monthly avg	TSS
		(mgd)	(mgd)	(mg/L)	(mg/L)	(%)	(mg/L)	(mg/L)	(%)
2004	Jan	2.65	2.79	-	-	-	-	-	-
	Feb	2.92	2.83	-	-	-	-	-	-
	Mar	2.47	2.68	-	-	-	-	-	-
	Apr	2.18	2.52	-	-	-	-	-	-
	May	2.28	2.31	-	-	-	-	-	-
	Jun	2.62	2.36	-	-	-	-	-	-
	Jul	3.48	2.79	-	-	-	-	-	-
	Aug	4.87	3.66	-	-	-	-	-	-
	Sep	0.44	2.93	-	-	-	-	-	-
	Oct	1.39	2.24	-	-	-	-	-	-
	Nov	2.31	1.38	-	-	-	-	-	-
	Dec	3.49	2.39	-	-	-	-	-	-
2005	Jan	3.21	3.00	-	-	-	-	-	-
	Feb	3.25	3.32	-	-	-	-	-	-
	Mar	4.20	3.55	-	-	-	-	-	-
	Apr	3.48	3.64	-	-	-	-	-	-
	May	4.10	3.93	-	-	-	-	-	-
	Jun	4.20	3.93	-	-	-	-	-	-
	Jul	3.77	4.02	-	-	-	-	-	-
	Aug	3.45	3.81	-	-	-	-	-	-
	Sep	3.42	3.55	-	-	-	-	-	-
	Oct	4.13	3.67	-	-	-	-	-	-
	Nov	-	3.78	-	-	-	-	-	-
	Dec	-	4.13	-	-	-	-	-	-
2006	Jan	2.88	2.88	-	-	-	-	-	-
	Feb	3.34	3.11	-	-	-	-	-	-
	Mar	2.86	3.02	-	-	-	-	-	-
	Apr	2.88	3.02	-	-	-	-	-	-
	May	3.52	3.08	-	-	-	-	-	-
	Jun	2.89	3.10	-	-	-	-	-	-
	Jul	3.69	3.37	-	-	-	-	-	-
	Aug	3.43	3.34	-	-	-	-	-	-
	Sep	3.52	3.55	-	-	-	-	-	-
	Oct	2.51	3.15	-	-	-	-	-	-
	Nov	2.66	2.90	-	-	-	-	-	-
	Dec	2.81	2.66	-	-	-	-	-	-

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW		INFLUENT $CBOD_5$	EFFLUENT $CBOD_5$	REMOVAL	INFLUENT TSS	EFFLUENT TSS	REMOVAL
		monthly avg	3-mo avg	monthly avg	monthly avg	$CBOD_5$	monthly avg	monthly avg	TSS
		(mgd)	(mgd)	(mg/L)	(mg/L)	(%)	(mg/L)	(mg/L)	(%)
2007	Jan	2.71	2.73	-	-	-	-	-	-
	Feb	3.10	2.88	-	-	-	-	-	-
	Mar	3.14	2.99	-	-	-	-	-	-
	Apr	3.28	3.17	-	-	-	-	-	-
	May	3.58	3.33	-	-	-	-	-	-
	Jun	4.04	3.63	-	-	-	-	-	-
	Jul	3.72	3.78	-	-	-	-	-	-
	Aug	3.61	3.79	-	-	-	-	-	-
	Sep	3.77	3.70	-	-	-	-	-	-
	Oct	3.42	3.60	-	-	-	-	-	-
	Nov	2.87	3.35	-	-	-	-	-	-
	Dec	3.09	3.13	-	-	-	-	-	-
2008	Jan	3.41	3.12	-	-	-	-	-	-
	Feb	3.47	3.32	-	-	-	-	-	-
	Mar	3.25	3.37	-	-	-	-	-	-
	Apr	3.51	3.41	-	-	-	-	-	-
	May	2.25	3.00	-	-	-	-	-	-
	Jun	3.21	2.99	-	-	-	-	-	-
	Jul	3.19	2.88	-	-	-	-	-	-
	Aug	3.67	3.36	-	-	-	-	-	-
	Sep	3.24	3.37	-	-	-	-	-	-
	Oct	2.07	3.00	-	-	-	-	-	-
	Nov	2.00	2.44	-	-	-	-	-	-
	Dec	2.16	2.08	-	-	-	-	-	-
2009	Jan	2.22	2.13	-	-	-	-	-	-
	Feb	2.23	2.20	-	-	-	-	-	-
	Mar	2.20	2.22	-	-	-	-	-	-
	Apr	2.16	2.20	-	-	-	-	-	-
	May	3.39	2.58	-	-	-	-	-	-
	Jun	4.13	3.23	-	-	-	-	-	-
	Jul	3.06	3.53	-	-	-	-	-	-
	Aug	3.42	3.54	-	-	-	-	-	-
	Sep	3.58	3.36	-	-	-	-	-	-
	Oct	1.98	3.00	153	4.38	97.1%	168	11.02	93.4%
	Nov	2.16	2.57	155	2.13	98.6%	171	7.21	95.8%
	Dec	2.83	2.32	188	2.92	98.4%	200	5.64	97.2%

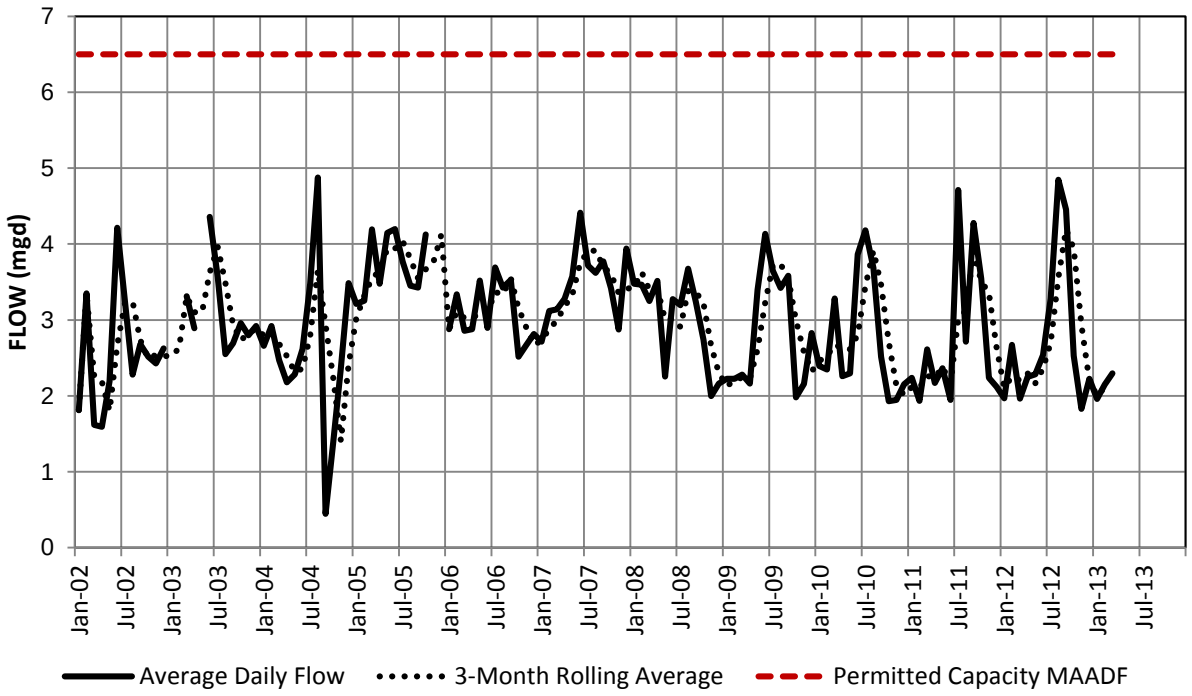
Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2010	Jan	2.31	2.43	181	2.40	98.7%	196	7.19	96.3%
	Feb	2.35	2.50	157	2.33	98.5%	163	5.22	96.8%
	Mar	3.28	2.65	159	2.32	98.5%	117	4.38	96.2%
	Apr	2.26	2.63	163	2.09	98.7%	131	3.55	97.3%
	May	2.02	2.52	186	2.14	98.9%	121	3.51	97.1%
	Jun	3.86	2.72	104	2.08	98.0%	73	6.36	91.3%
	Jul	4.18	3.36	115	2.05	98.2%	94	3.68	96.1%
	Aug	3.69	3.91	107	2.03	98.1%	64	3.53	94.5%
	Sep	2.52	3.46	109	2.01	98.2%	76	3.55	95.3%
	Oct	1.93	2.71	157	2.02	98.7%	112	3.57	96.8%
	Nov	1.95	2.13	170	2.01	98.8%	111	3.50	96.8%
	Dec	2.15	2.01	175	2.01	98.9%	192	4.21	97.8%
2011	Jan	2.24	2.11	167	2.07	98.8%	164	3.71	97.7%
	Feb	1.93	2.11	191	2.07	98.9%	198	3.85	98.1%
	Mar	2.61	2.26	136	2.07	98.5%	131	3.55	97.3%
	Apr	2.17	2.24	156	2.00	98.7%	152	3.68	97.6%
	May	2.37	2.38	125	2.01	98.4%	139	3.50	97.5%
	Jun	1.95	2.16	182	2.05	98.9%	148	3.95	97.3%
	Jul	4.71	3.01	67	2.05	96.9%	95	4.29	95.5%
	Aug	2.72	3.13	101	2.04	98.0%	132	3.61	97.3%
	Sep	4.28	3.90	68	2.05	97.0%	74	5.65	92.4%
	Oct	3.55	3.51	99	2.07	97.9%	170	3.76	97.8%
	Nov	2.24	3.35	167	2.14	98.7%	105	1.87	98.2%
	Dec	2.12	2.63	101	2.22	97.8%	112	2.39	97.9%
2012	Jan	1.97	2.11	118	2.19	98.1%	130	3.11	97.6%
	Feb	2.07	2.05	137	2.20	98.4%	113	2.48	97.8%
	Mar	1.96	2.00	138	2.34	98.3%	129	3.29	97.4%
	Apr	2.25	2.09	113	2.73	97.6%	113	3.42	97.0%
	May	2.29	2.17	132	3.71	97.2%	108	2.64	97.6%
	Jun	2.54	2.36	106	3.65	96.6%	88	2.05	97.7%
	Jul	3.28	2.70	91	4.45	95.1%	73	1.96	97.3%
	Aug	4.08	3.30	90	3.59	96.0%	77	4.07	94.7%
	Sep	4.45	3.94	58	3.48	94.0%	67	4.25	93.6%
	Oct	2.53	3.69	73	2.39	96.7%	99	1.56	98.4%
	Nov	1.83	2.94	115	2.30	98.0%	131	1.40	98.9%
	Dec	2.02	2.13	122	2.65	97.8%	121	1.77	98.5%

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2013	Jan	1.95	1.93	124	2.72	97.8%	115	1.79	98.4%
	Feb	2.15	2.04	128	3.17	97.5%	202	1.75	99.1%
	Mar	2.02	2.04	110	3.67	96.7%	133	1.78	98.7%

Figure 3-1 – Historical Flow Data (January 2002 through March 2013)



Figures 3-2 and 3-3 are plots of monthly average values for $CBOD_5$ loadings from October 2009 through March 2013. Figure 3-2 illustrates the historical performance for the period of record shown. An expanded scale version of the effluent data for $CBOD_5$ is presented in Figure 3-3. Figure 3-3 shows that the treatment process consistently produces an effluent with average $CBOD_5$ concentrations of approximately 2.70 mg/L.

The performance with respect to TSS removal is also excellent as shown in Figure 3-4. Figure 3-4 shows both influent and effluent data from October 2009 through March 2013. Percent removal of TSS has averaged approximately 97% for the period of record shown. Figure 3-5 presents the historical TSS effluent produced. Again, the removal efficiency is excellent achieving an average of 97% removal. The average effluent TSS values for the period of record shown is approximately 4.30 mg/L.

Figure 3-2 – Historical $CBOD_5$ Influent / Effluent Data (October 2009 through March 2013)

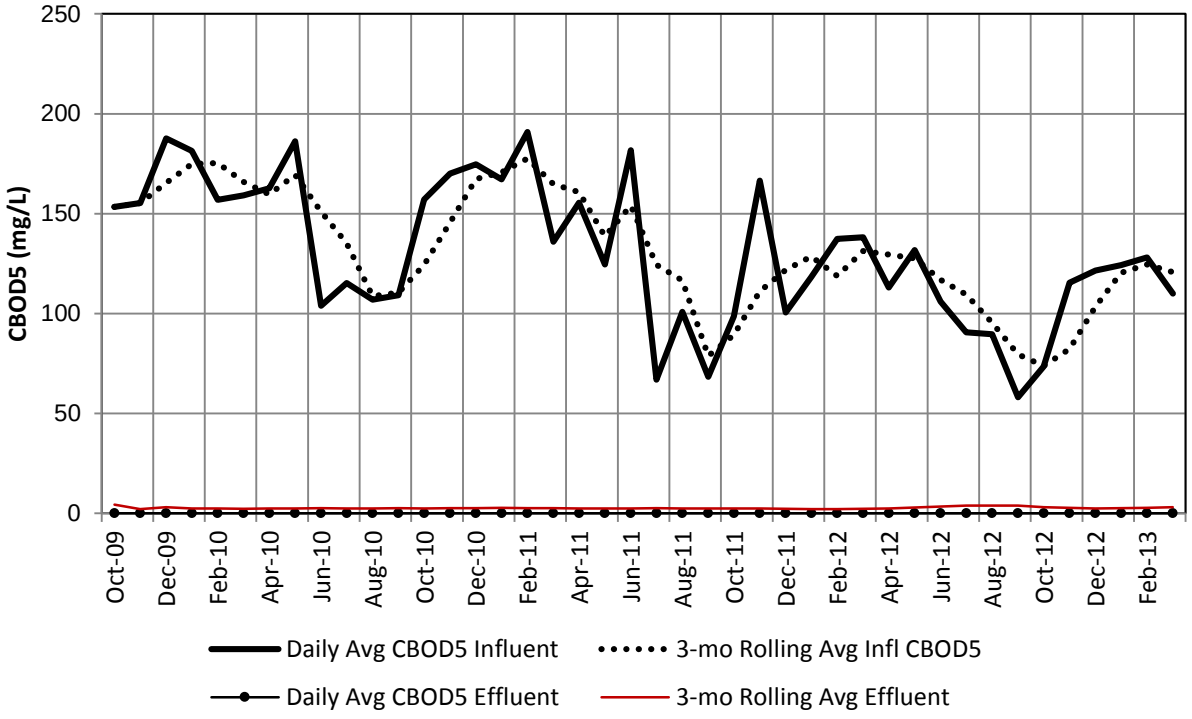


Figure 3-3 – Historical $CBOD_5$ Effluent Data (October 2009 through March 2013)

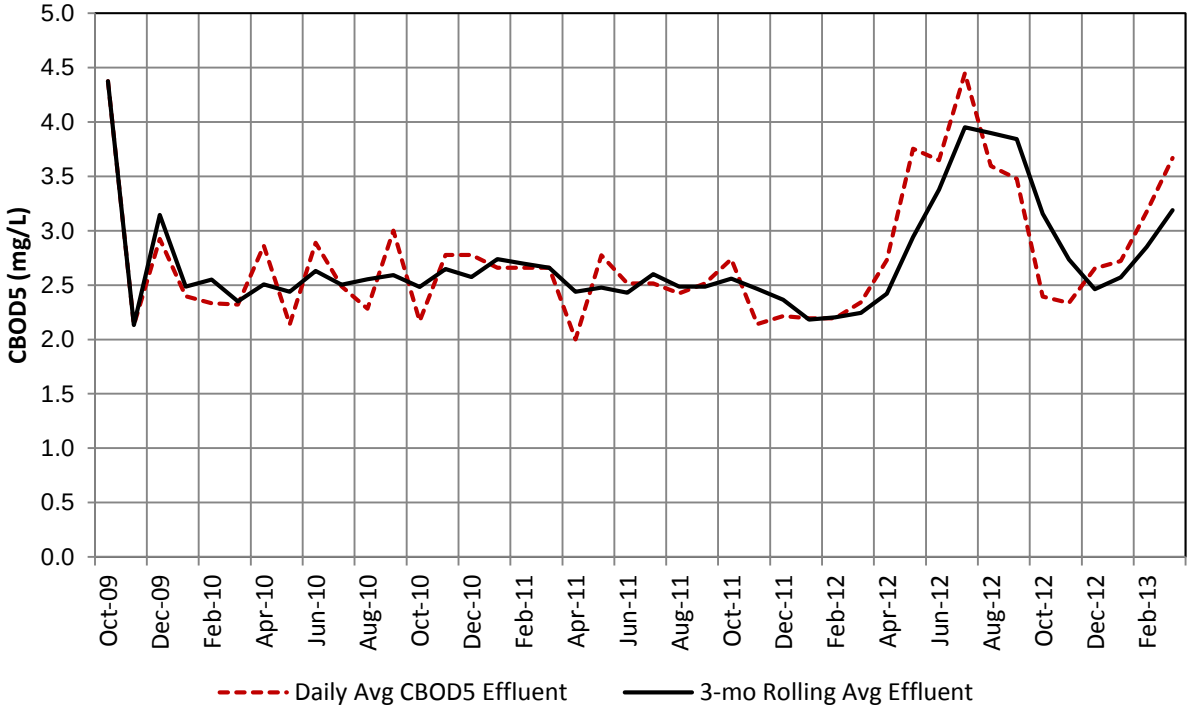


Figure 3-4 – Historical TSS Influent / Effluent Data (October 2009 through March 2013)

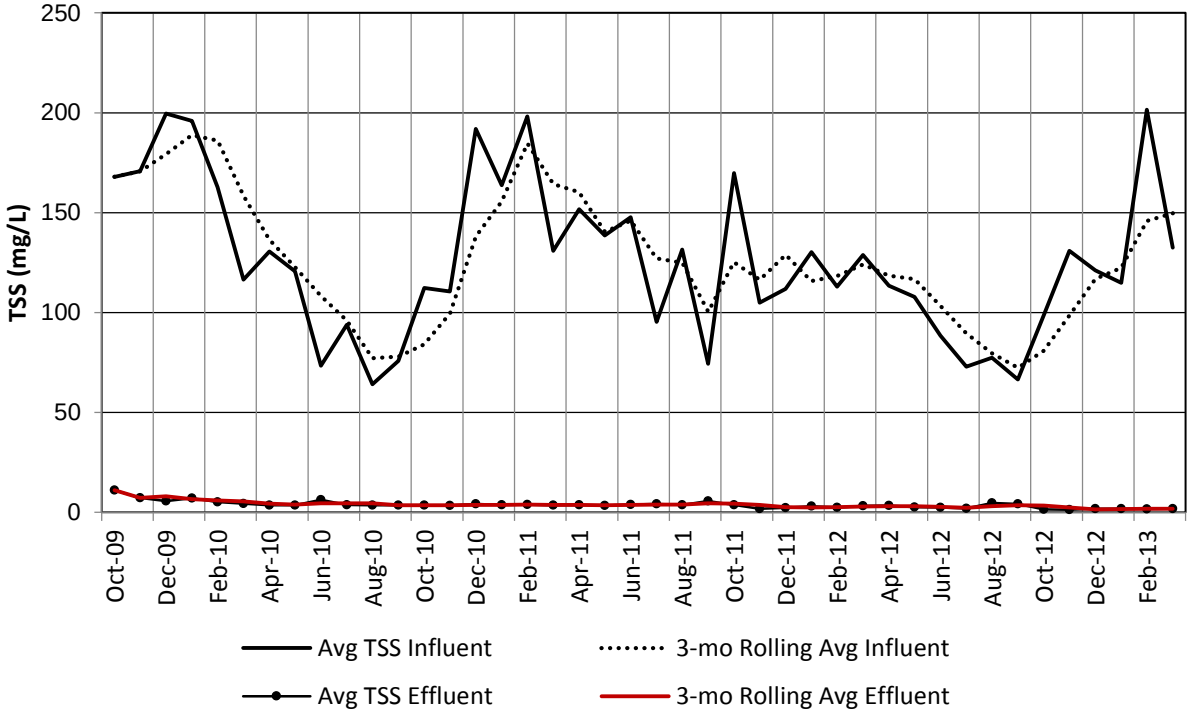
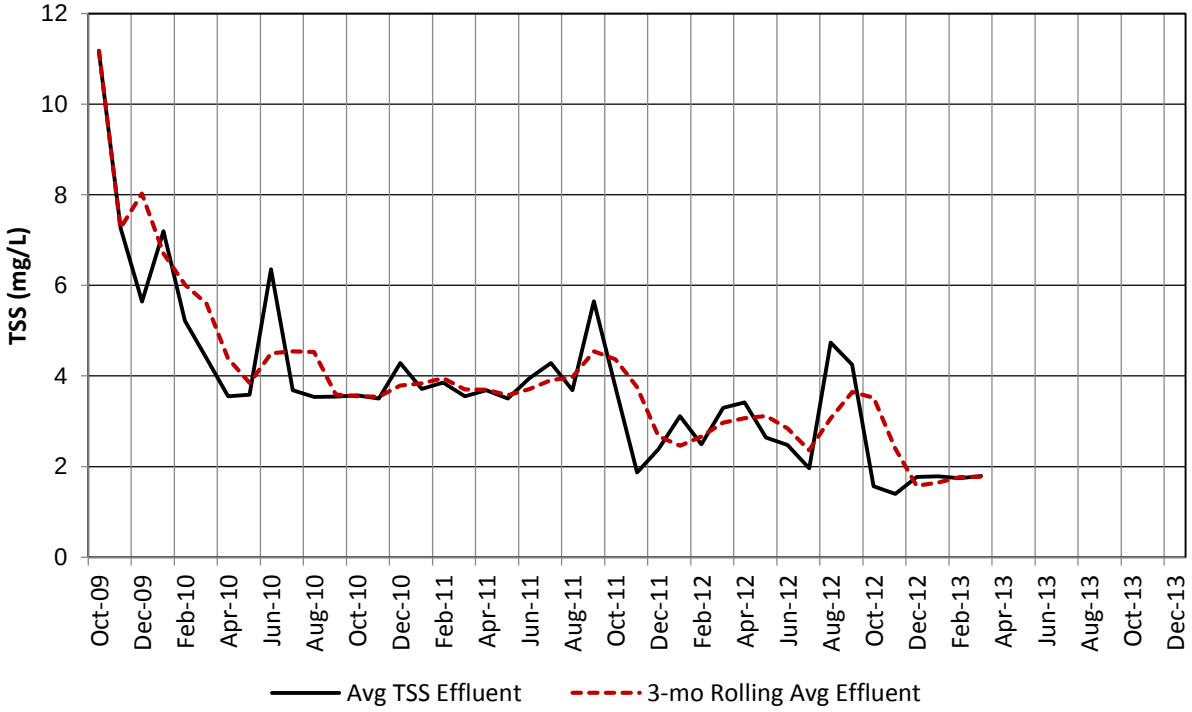


Figure 3-5 – Historical TSS Effluent Data (October 2009 through March 2013)



The annual average daily flow did not exceed the permitted flow of 6.5 mgd for the period of record extending from January 2002 through March 2013. There were no operational problems at the plant caused by hydraulic overloading of the treatment units. The three-month rolling average daily flow has been approximately 2.79 mgd, which is below the permitted annual average flow of 6.5 mgd. The corresponding influent values for $CBOD_5$ and TSS from October 2009 through March 2013 were 134 mg/L and 135 mg/L, respectively. These values correspond to 3,118 pounds per day of BOD_5, and 3,142 pounds per day of suspended solids loading, on an average at the plant. At the MMADF design capacity of 6.5 mgd, the plant is able to handle 10,840 pounds of $CBOD_5$ per day and 10,840 pounds per day of suspended solids on a maximum month concentration basis. The current loadings at the facility are based on data from March 2013 with an average flow that month of 2.02 mgd. The following is a tabulation of design and current operating values for $CBOD_5$ and TSS.

	Maximum Month Design Values		Current Loadings (March 2013)	
Parameter	Concentration (mg/L)	Quantity (lbs/day)	Concentration (mg/L)	Quantity (lbs/day)
$CBOD_5$	200	10,840	110	1,854
TSS	200	10,840	133	2,240

As shown in the above tabulation the current wastewater concentrations and loadings are well below the maximum design loadings of the Belle Glade WWTF.

3.5 Overall Treatment Efficiency

Based on the three month rolling average values for influent and effluent $CBOD_5$ and TSS, the average removal efficiencies for $CBOD_5$ and TSS are approximately 98 percent and 97 percent, respectively. These values indicate that the facility is capable of meeting the permit limitations required in the operating permit. Influent concentrations of $CBOD_5$ and TSS are slightly lower than similar size facilities. However, the ninety percent minimum removal is not difficult to maintain. At the current average daily flow, the plant is producing an effluent that consistently better than the required standards for $CBOD_5$ and TSS removal.

Effluent disposal down the deep injection well, permitted capacity of 10.2 mgd, has not exceeded the injection well capacity from January 2002 through March 2013. Flow to the existing on-site percolation pond, permitted capacity of 0.069 mgd, has not exceeded the permitted capacity over the same evaluation period.

Chapter 4 – Performance Trends

Performance trends in influent and effluent loadings for $CBOD_5$ and TSS are presented below.

4.1 Influent

For the four year period from January 2002 through March 2013, the monthly average influent $CBOD_5$ values ranged from 58 mg/L in September 2012 to 188 mg/L in December 2009, with an average of 134 mg/L (see Chapter 3 – Treatment Efficiency, Figure 3.2 and Table 3.1). During the same four year period, the TSS values ranged from 64 mg/L in August 2010 to a maximum of 202 mg/L in February 2013, with an average of 135 mg/L.

4.2 Effluent

The effluent values for $CBOD_5$ and TSS are presented in Table 3.1 for the period of October 2009 through March 2013. Figures 3.2 through 3.3 graphically illustrate the $CBOD_5$ and TSS data presented in Table 3.1. The monthly average effluent $CBOD_5$ values were within the range of 1.94 mg/L in February 2010 to 4.84 mg/L in March 2013. The monthly average effluent TSS values during the same period were within the range of 1.40 mg/L in November 2012 to 11.02 mg/L in October 2009. The $CBOD_5$ and TSS values for the WWTF effluent fall well below permit limits for the facility.

4.3 Three-Month Average Daily Flows

Figure 3.1 contains plots of monthly average daily flows and three-month average daily flows 10 year data period. The Belle Glade WWTF's three-month average flow has not exceeded the permitted 6.5 mgd annual average daily flow over that 10 year period from October 2002 through March 2013.

4.4 Groundwater Quality (Groundwater Monitoring Wells)

In accordance with the County's current operating permit for the Belle Glade WWTF, the County samples three (3) groundwater monitoring wells for groundwater quality. The three wells are sampled quarterly with groundwater monitoring reports completed in July, October, January and April. Table 4.1 shows the quarterly test results for April 2011 through April 2013 for each of the three wells. MWB-01 is a background well located at the adjacent public Works complex just west of 20th Street. MWC-02 is located northeast of the percolation pond. MWC-03 is located at the North Corner of the injection well pad.

Table 4.1
Belle Glade Water Quality Monitoring (April 2011 – April 2013)

Well ID	Well Type	Sp. Co. uS/cm	Water Level inch	NO2	TDS mg/l	TKN mg/l	P mg/l	As ug/l	Cl mg/l	Cd ug/l	Cr ug/l	Pb ug/l	Coli #/100ml	PH	SO4 mg/l
MWB-01	Background														
April, 2011		940		U	825	5.24	U	6.16	34.1	U	5.74	U	56	7.25	193
July, 2011		1140		0.375	788	8.29	0.068	9.4	28.4	U	7.88	U	58	7.21	169
October, 2011		1020		<0.12	918	4.50	<0.050	<5.0	31.6	<0.50	<2.5	<5.0	18	7.14	208
January, 2012		928		<0.050	902	4.70	0.050	<5.0	26.4	0.62	<2.5	<5.0	14	7.65	179
April, 2012		974	5.89	<0.050	762	9.90	0.970	<5.0	53.7	0.68	<2.5	<5.0	<10.0	7.46	86.8
August, 2012		1127		0.19	1090	4.20	<0.050	<5.0	29.4	<0.50	<2.5	<5.0	<1.0	7.04	140
November, 2012		1016		<0.050	848	4.70	<0.050	<5.0	38.3	1.40	<2.5	6.9	<1.0	7.00	187
January, 2013		1116		<0.050	870	5.20	<0.050	<5.0	34.7	<0.50	<2.5	<25.0	<2.0	7.07	167
April, 2013		897		<0.050	924	4.60	0.050	<5.0	39.8	<0.50	<2.5	<15.0	<1.0	7.45	147
Well ID	**Well Type**	**Sp. Co. uS/cm**	**Water Level inch**	**NO2**	**TDS mg/l**	**TKN mg/l**	**P mg/l**	**As ug/l**	**Cl mg/l**	**Cd ug/l**	**Cr ug/l**	**Pb ug/l**	**Coli #/100ml**	**PH**	**SO4 mg/l**
MWC-02	Compliance														
April, 2011		947		U	825	6.09	0.078	U	35.8	U	7.8	U	U	7.05	215
July, 2011		1160		U	758	6.95	U	U	41.2	U	7.79	U	18	7.35	217
October, 2011		1100		<0.12	936	4.70	0.069	<5.0	33.2	<0.50	<2.5	<5.0	10	7.01	221
January, 2012		912		<0.050	826	5.00	0.120	<5.0	39.7	<0.50	<2.5	<5.0	<2.0	7.47	199
April, 2012		795	11.26	<0.050	828	5.30	0.380	<5.0	43.4	<0.50	<2.5	<5.0	<10.0	7.25	197
August, 2012		1122		<0.050	810	5.00	0.095	<5.0	32.0	<0.50	<2.5	<5.0	5	7.18	195
November, 2012		1025		<0.050	816	5.40	0.150	<5.0	35.4	<0.50	<2.5	6.2	<1.0	7.19	186
January, 2013		1122		<0.050	834	4.90	0.100	<5.0	35.7	<0.50	<2.5	<25.0	<2.0	7.22	180
April, 2013		890		<0.050	864	4.30	0.110	<5.0	30.5	<0.50	<2.5	<5.0	<1.0	7.68	182

Table 4.1 (continued)
Belle Glade Water Quality Monitoring (April 2011 – April 2013)

Well ID	Well Type	Sp. Co.	Water Level		TDS	TKN	P	As	Cl	Cd	Cr	Pb	Coli		SO4
MWC-03	Compliance	uS/cm	inch	NO2	mg/l	mg/l	mg/l	ug/l	mg/l	ug/l	ug/l	ug/l	#/100ml	PH	mg/l
April, 2011		905		U	718	4.61	0.041	U	60.2	U	9.62	U	U	7.05	123
July, 2011		1160		U	763	5.50	0.075	U	78.3	U	8.64	U	3	7.34	140
October, 2011		1002		<0.12	908	5.00	0.096	<5.0	73.4	<.50	<2.5	<5.0	<2.0	7.63	144
January, 2012		939		<0.12	794	3.90	0.083	<5.0	62.4	<0.50	<2.5	<5.0	<2.0	8.20	134
April, 2012		778	8.12	<0.050	906	3.60	0.320	<5.0	33.2	1.50	<2.5	<5.0	<10.0	7.20	178
August, 2012		1188		<0.050	870	5.90	0.110	<5.0	74.3	<0.50	<2.5	<5.0	<1.0	7.11	116
November, 2012		1013		<0.050	840	4.90	0.100	<5.0	62.9	<0.50	<2.5	<5.0	<1.0	7.19	142
January, 2013		1078		<0.050	770	4.50	0.074	<5.0	55.7	<0.50	<2.5	<5.0	<2.0	7.72	138
April, 2013		836		<0.050	801	3.70	0.078	<5.0	42.4	<0.50	<2.5	<5.0	<1.0	7.39	121

Monitoring Well B-01 (background, up-gradient)

There have been some slight fluctuations in the monitoring parameters over the reporting period. However, these slight variations do not indicate a trend of increasing or decreasing.

Monitoring Well C-02 (compliance)

There have been some slight fluctuations in the monitoring parameters over the reporting period. However, these slight variations do not indicate a trend of increasing or decreasing.

Monitoring Well C-03 (compliance)

There have been some slight fluctuations in the monitoring parameters over the reporting period. However, these slight variations do not indicate a trend of increasing or decreasing.

4.4 Bypasses and Overflows

There have been no incidents of wastewater spills or incidents of non-compliance at the WWTF throughout the current permit cycle through March 2013.

Chapter 5 – Operation and Maintenance Program

5.1 Rule Requirements

Rules 17-600.717 and 17-600.730(4)(b), F.A.C. require that each domestic wastewater treatment facility must maintain up-to-date record drawings (plans and specifications) which identify modifications that have occurred since the original construction permit was issued.

Rules 17-600.720 and 17-600.730(4)(c), F.A.C., require that each wastewater treatment and effluent disposal or reuse facility must maintain up-to-date operation and maintenance manual(s).

5.2 Availability of Record Drawings

Up-to-date record drawings are available for the 1998-2001 construction program are available to the operators in the operations center of the Belle Glade WWTF located at 2205 W. Canal Street, South Belle Glade, Florida 33430.

5.3 Availability of Operation and Maintenance Manual

Copies of the Operation and Maintenance Manuals for the treatment, effluent disposal and sludge disposal systems are available to the operators in the operations center of the Belle Glade WWTF located at 2205 W. Canal Street, South Belle Glade, Florida 33430.

5.4 Contents of the Operation and Maintenance Manual

There are three separate O&M manuals for the Belle Glade WWTF. The three O&M Manuals include; the liquid process stream, the sludge process and the injection well system. Those manuals are maintained by the operating staff and the Utilities Superintendent. These manuals include general information of the design of each component, interconnecting piping, valves and other physical aspects pursuant to Rule 62-700.720 (1) (b), 62-610.330 (2), 62-604.600 (2) (f) and 62-28.230 (3), F.A.C. Copies of the manuals are maintained at the WWTF site.

5.5 Operation and Maintenance Log

The County's WWTF operating staff maintains a series of logs on day to day activities at the facility. These logs include process disruptions such as mechanical or electrical failures, preventative maintenance work performed, corrective maintenance work performed, laboratory sampling and testing data as required throughout treatment process, work by outside contractors, residuals hauled off site for disposal, weather incidences and other such data in accordance with the requirements of 62602.360 (1) (e), F.A.C.

The plant is typically manned with four to five staff, including the lab technician during the day shift and one person on the night shift. The plant is unmanned from midnight to 7:00 AM. Staffing for this facility is adequate for proper operations. Alarm conditions are monitored with an "on call" dialing system during the unmanned shift cycle.

In general the WWTF's maintenance and recordkeeping is adequate. Logs are very well maintained. Sampling programs are maintained in accordance with the requirements of the facility's FDEP permit. Laboratory procedures and tests are performed pursuant to the County's permit requirement. Sampling and testing is performed by a certified operator and under direction of a certified operator. The laboratory is certified by the FDEP, Number E56034.

The County is not required to have an industrial pretreatment program in-place for the Belle Glade WWTF. However, the County does have an ongoing cross connection control and inspection program.

5.6 Preventive Maintenance Program

A wastewater treatment plant cannot achieve maximum treatment efficiency without the proper operation and maintenance of equipment and facilities. Operation of the wastewater treatment plant must include flexibility to meet changing flow and load conditions while resulting in the production of a high quality plant effluent. County Staff have implemented several preventive maintenance programs to assist staff in performing the necessary duties to maintain the facilities.

The County has developed specific routine duties for each operator at the facility. Each Operator maintains a specific area(s) within the WWTF and these duties are typically carried out on a daily basis. The County has also implemented a valve exercising program where each valve or gate with the facility is identified as to location, unit process, criticality to the facility and frequency that the valve / gate is exercised. Routine maintenance is necessary to prevent equipment breakdown or malfunction which could lead to emergencies and / or unscheduled plant shutdowns. Table 5-1 presents the preventive maintenance schedule for the Belle Glade WWTF.

Table 5.1
Preventative Maintenance Schedule

Process	Frequency
Headworks Maintenance Schedule	
Bar Screen No. 1 - Inspect unit, grease all bearings, adjust chain as needed to remove excessive grease	Monthly
Bar Screen No. 2 - Inspect unit, grease all bearings, adjust chain as needed to remove excessive grease	Monthly
Bar Screen No. 1 and No. 2 - Inspect unit's brushes (upper)	Annually
Valves - Grease and inspect for rust, operate valves partially to insure operation	Semi-Annually
Sumitomo Reducer - Change oil	Every other year
Torque Bolts - Torque drive bushing to 70 lbs	Monthly
Driven Side Chain - Inspect chain for proper tension, inspect wear plate	Semi-Annually
Grit Classifiers No. 1 and No. 2	
Reducer - Check oil level	Semi-Annually
Reducer - Change oil 220 Mineral Oil	Annually
Wear Bar - Drain units and inspect wear bars	Annually

Table 5.1 (continued)
Preventative Maintenance Schedule

Process	Frequency
Grit Separator No. 1 and No. 2	
Gear Box - Change oil	Annually
Drain separator and inspect all equipment	Annually
Grit Blower - Grease drive side	Quarterly
Grit Blower - Change oil	Annually
Blower Belt - Check belt tension	Semi-Annually
Samplers	
Effluent - Change out hose, inspect and clean	Monthly
Raw - Change out hose, inspect and clean	Monthly
Aeration Basin No. 1 and No. 2	
Aeration Motors No. 1 and No. 2 - Remove drain plug, apply 6-8 pumps, let run for two hours, replace plug	Semi-Annually
Aeration Drives No. 1 and No. 2 - Check oil drive, add as needed	Monthly, Change Out Annually
Amp Reading - Performa amp test	Annually
Vibration and Oil Analysis - Perform test	Annually
Shut Down / Torque Bolts - Check for proper operation of oil shut off switch, torque all bolts	Semi-Annually
Clarifiers No. 3 and No. 4	
Motor - Grease motor, remove drain while pumping in lube (grease)	Semi-Annually
Motor Reducer - Check vent for operation	Monthly
Motor Reducer - Change oil in gear reducer	Annually
Upper Drive - Drain water, add oil if needed	Monthly, Change Oil Annually
Lower Drive - Drain water, add oil if needed	Monthly, Change Oil Annually
Drive Chain - Grease drive chain and check for proper tension	Monthly
Torque - Check setting for proper operation	Annually
Scum Pumps - Run pump for 5 minutes, prime if possible	Monthly
Clarifiers No. 1 and No. 2	
Place Units in Service - Place both units in service, perform all required maintenance	Annually
Cable - Check cable tension	Annually
Scum Pumps - Run pump for 5 minutes, prime if possible	Monthly
Pump out if needed	Monthly

Table 5.1 (continued)
Preventative Maintenance Schedule

Process	Frequency
Deep Well Pump 1-4	
Check mechanical seal for leaks, run each pump and record flow rate	Monthly
Vibration and Oil Analysis - Perform test	Annually
Motors No. 1 and No. 2 - Check oil appearance for any signs of deterioration	Monthly, Change Oil Annually
Motor No. 3 - Remove drain clear hole and apply one once, run for 15 minutes and replace plug	Semi-Annually
Motor No. 4 - Check oil appearance for any signs of deterioration	Monthly, Change Oil Annually
Compressors	
Drain water, cycle blow off and note pressure at fill completion	Monthly
Hydro Tank	
High Level Check - Clean sight glass	Monthly
Low Level Check - Clean sight glass	Monthly
Surge Tank - Inspect sight tubes and clean if necessary	Monthly
Effluent Drum Screen	
Drum No. 1, No. 2, No. 3, No. 4 - Grease pillow blocks, wipe off excess, check unit oil level	Monthly, Change Oil Annually
Float Operation - Manually trigger floats, check run time to insure sufficient to clean solids from screen	Monthly
Doctor Blades - Inspect to insure that one and a half inches are showing, check tensioners & springs	Monthly
Spray Nozzles - Check all nozzles and clean filter	Monthly
RAS/WAS	
RAS Pump No. 1, No. 2, No. 3 - Check oil for water	Semi-Annually
WAS Pump No. 1, No. 2 - Change oil	Annually
WAS Motor No. 1, No. 2 - Grease motor	Annually
Inspect belts for cracks, check oil for water	Monthly
Blowers	
Hoffman Motor No. 1 and No. 2 - Grease as per O&M page 8	Quarterly
Hoffman Blower No. 1 and No. 2 - Grease drive side	Semi-Annually
Hoffman Blower No. 1 and No. 2 - Grease driven side	3 Times per Year
Filter Change Out - Change filters as needed, inspect, clean	Monthly
Truck Loading Pump	
Pump Motor - Grease	Annually
Pump - Change oil, drain cambers, fill plugs	Annually
Pump - Inspect belts for cracks, clean air breather	Monthly

Table 5.1 (continued)
Preventative Maintenance Schedule

Process	Frequency
Generator (1500 Kw and 300 Kw)	
Check log, insure four hours of run time	Monthly
Check oil level, coolant level, inspect day tank, insure that heaters are functioning, check and record fuel level	Monthly
Set up filter change out and oil change	Annually
Plant Wash Water	
Pump No. 1 and No. 2 - Inspect for leaks	Monthly
Pump No. 1 and No. 2 - Grease Motors	Semi-Annually
Thickeners	
Drive Motor Unit 1 and Unit 2 - Grease motor	Semi-Annually
Gear Reducer Unit 1 and Unit 2 - Change oil	Every Other Year
V and Flat Drive Wheels - Grease pumps, inspect wheels for proper operation	Monthly
Drums - Inspect for cracks	Annually
Clean Y Strainers	Annually
Pump PL200 No. 1 and No. 2 - Change oil, drain cambers, fill plugs	Annually
Pump Motor No. 1 and No. 2 - Grease motor	Semi-Annually
Plant Lift Station	
Roto Station - Check floats for operation, run pumps in hand, check for operation	Monthly
Truck Wash - Check floats for operation, run pumps in hand, check for operation	Monthly
Thickener Station - Check floats for operation, run pumps in hand, check for operation	Monthly
Slide Gates	
Headworks - Grease and inspect for rust, operate valve partially to insure operation	Semi-Annually
RAS - Grease and inspect for rust, operate valve partially to insure operation	Semi-Annually
Clarifiers - Grease and inspect for rust, operate valve partially to insure operation	Semi-Annually
Effluent Wet Well - Grease and inspect for rust, operate valve partially to insure operation	Semi-Annually
Pond - Grease and inspect for rust, operate valve partially to insure operation	Semi-Annually

Chapter 6 - Collection System Evaluation

6.1 General

The Belle Glade WWTF serves the City of Belle Glade and the South Bay area. There are 46 lift stations in the Belle Glade service area and nine lift stations in the South Bay service area and an in-line booster pump station. The nine lift stations in the South Bay service area pump to the in-line booster pump station which repumps directly to the Belle Glade WWTF. The Belle Glade collection system consists of approximately 781 manholes and approximately 174,697 lineal feet of gravity mains. The South Bay collection system consists of approximately 188 manholes and approximately 47,360 lineal feet of gravity mains.

The guidelines for the preparation of Operation and Maintenance Performance Reports state, "The collection system shall be evaluated if treatment plant problems, untreated bypasses for discharges, or overflows results from the operation of the collection and transmission facilities." At the Belle Glade WWTF, no problems have occurred resulting from the operation of collection and transmission systems since the previous permit application. The plant does experience inflow and infiltration (I&I) and the County continues to work to minimize these contributions. The WWTF currently can operate within the permit requirements with the additional flows that it receives from I&I.

6.2 Septic Wastewater

No treatment problem caused by the treatment of septic wastewater has occurred at the Belle Glade WWTF.

6.3 Industrial Contributions

No major treatment problems have occurred at the Belle Glade WWTF, caused by industrial waste contribution.

Chapter 7 – Problems, Deficiencies and Corrective Actions

7.0 General

Based on the field observations and results of the investigation and testing, the main problems associated with the Belle Glade WWTF have to do with the age of the facility and some of the equipment. Below is presents the recommended repairs/modifications for the Belle Glade WWTF.

Belle Glade WWTF

Based on the evaluation, the Belle Glade WWTF receives routine maintenance and corrective action. The overall structural condition of the entire facility is good and the plant is in operating within the requirements of the operating permit. Deficiencies were observed (as documented in the previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 63 year old facility. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also separated into two categories: critical for continued use and non-critical that needs to be addressed before it becomes a critical item.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD fiscal year budget constraints. However, non-critical repairs may become critical if not implemented within a prudent time period.

Critical Repairs

1. Oxidation Ditch No. 1 Structural Rehabilitation
2. Oxidation Ditch No. 2 Structural Rehabilitation
3. Improvements to the Deep Injection Well
4. Installation of a Roto-Screen Bypass line
5. Repair cracks and leaks in Aerobic Digester
6. Replacement of Main Switchboard No. 1 (Generator Building No. 1)
7. Replacement of 300 kW generator (Generator Building No. 1)
8. Injection Well PLC replace (Parts are unavailable)
9. Replacement of electrical equipment in the MCC Building (Digester Blower Nos. 1 and 2 starters, Distribution Switchboard, Injection Well Pump No. 1 VFD, Aerator No. 1 Soft Start, Panel IWHA 480V, Transformer for Panel IWLA 25KVA 480-120/240V 1PH, Panel IWLA 120/240, Distribution Switchboard, Injection Well Pump No. 2 VFD, Aerator No. 2 Soft Start, PLC-2)

Non-Critical Repairs

1. Replace Parshall flume (in the Headworks)
2. Installation of a Headworks Bypass
3. Additional circular clarifier (to replace Clarifier Nos. 1 and 2)
4. Construct chlorine contact chamber
5. Prevent water intrusion to Operations Building by sealing the top surfaces of the Operations Building concrete decks (over abandoned structures)
6. Optimize Bar screens to achieve higher capture rate
7. Add toe board to Splitter Box No. 2 hand rail
8. Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum
9. Replacement of several air handlers and compressors
10. Replace Roto-Screen roof purlins and roof panels that have deteriorated
11. Replacement of the main PLC and PLC software
12. Lift station Nos. 1 and 2 rehabilitation
13. Replace Headworks access stair with an aluminum stair
14. Generator Building No. 2 electrical equipment replacement (Main Switchboard No. 2, 1500kW Generator, Panel IWHB 480V, Transformer for Panel IWLB 15KVA 480-120/208 3PH, Panel IWLB 120/208V)
15. Rehabilitation of the RAS / WAS structure
16. Installation of two polymer feeders
17. Repair leaks at the effluent box of the headworks
18. Replace Roto-Screen effluent wet well slide gate and isolation gate
19. Replace pond bypass gate
20. Paint steel roof over the Aerobic Digester blowers
21. Rehabilitate the Roto-Screen metal structure
22. Rehabilitate the Sludge Thickening Facility metal structure
23. Upgrading control room
24. Paint steel walkway bridge and structure on Clarifier 3 and 4
25. Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2
26. Paint steel bridge, stairs and EQ tank
27. New roofs on the Operation, Maintenance and both Generator buildings
28. Replace doors in MCC Building
29. Repair cracking at Headworks upper level slab

30. Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure
31. Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2
32. Replace Thickeners
33. Remove, replace and rewire Headwork's control panel
34. Relocate trees and plants placed inside abandoned structures
35. Construct overflow in Aerobic Digester
36. Repair crack at the Operations Building access ramp
37. Re-paint the entire exterior of the Headworks
38. Support of the Operations Building roof post should be replaced with a different type to avoid further cracking
39. Install flow meters on Oxidation Ditch Nos. 1 and 2
40. Install flow meters on Clarifier Nos. 3 and 4
41. Polymer containment and enclosure
42. Construction of a Switchgear Building with space for future equipment
43. Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight
44. Replace manual valves with electronic controlled valves
45. Repair the concrete spalls at guardrail posts at Clarifier No. 3
46. Replacing ceiling tiles in the Operations Building break room
47. Replace plant lighting with higher illumination LED lights
48. Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway
49. Chlorine Building electrical equipment replacement (Panel C 480V, Transformer for Panel D 25KVA 120/208V 1PH, Panel D 120/240V)
50. Replacement of four slide gates in Headworks
51. Replace RAS and Deep Injection Well flow meters with new magnetic meters
52. Replacement of MCC-3 (in the Operations Building Electric Room)
53. Polymer electrical equipment replacement (Transformer for Panel E 15KVA 120/240V 1PH, Panel E 120/240V)
54. Electrical equipment replacement in the Operations Building Electrical Room (Panel LP 120/208, Transformer for Panel LP-1 15KVA 480-120/208 3PH, Transformer for Panel PP-1 225KVA 480-120/240V 3PH, Motor Control Center MCC-1, Panel PP-1 480V, Motor Control Center MCC-2, PLC-1 (Main Control Panel))
55. Install automatic control gates for Oxidation Ditch No. 1 and 2

56. Flow meter for Clarifier Nos. 1 and 2
57. Crack repair on the exterior wall surfaces of EQ tank
58. Repair guardrails on EQ tank
59. Install fencing to enclose Truck Wash Lift Station
60. Install an odor control system at the Headworks
61. Install an onsite plant service water system including reuse system
62. Add sumps at one end of the Clarifier Nos. 1 and 2 structure
63. Painting of the facility
64. Upgrading cabinets in the Operations Building break room
65. Asphalt overlay and addition of parking spaces
66. Epoxy coat floors
67. Convert EQ tank to additional Clarifier or Aerobic Digester
68. Install drain on Oxidation Ditch No. 1

ATTACHMENT 1

FIELD EVALUATION FORM
FOR THE
OPERATION AND MAINTENANCE PERFORMANCE REPORT

BELLE GLADE
WASTEWATER TREATMENT FACILITY

October 2013

FIELD EVALUATION FORM FOR
OPERATION AND MAINTENANCE PERFORMANCE REPORTS FOR
DOMESTIC WASTEWATER FACILITIES

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PHYSICAL CONDITION

Hydraulic and Organic Overloading

1. Is there evidence of past spills at the plant or through nearby (upstream) manholes? (Discoloration of the ground or a strong smell may indicate past spills at the plant)
   ( ) yes (**X**) no

2. Are raw sewage pumping stations, influent lines, overflow weirs, or other structure surcharged? ( ) yes (**X**) no

3. Is there flow through bypass channels? ( ) yes (**X**) no

4. Are there old high water lines or are the weirs on the clarifier flooded? ( ) yes (**X**) no

5. Are there overflows at alternative discharge points, channels, or other areas? ( ) yes (**X**) no

6. Are there any open-ended pipes that appear to originate in a process or storage area and periodically contain flows to the ground or to surface water? (Although these pipes have been disconnected from a closed system or otherwise removed from service, they can still be connected to a discharge source.)
   ( ) yes (**X**) no

7. Is the facility receiving excessive septage dumping from septic tanks? ( ) yes (**X**) no

8. Are checks for overflows performed routinely? (**X**) yes ( ) no

General Condition

1. Is there evidence of corrosion problems at the treatment plant and in the collection system? (**X**) yes ( ) no

2. Do any of the units or associated equipment show signs of excessive wear? (**X**) yes ( ) no

Rule Requirements

1. Does each component, system, or process meet the applicable reliability standards required by Rule 62-600.400(1)(b), F.A.C.? (**X**) yes ( ) no

2. Does the facility have adequate alarm systems for power or equipment failures as recommended by standard design references? (**X**) yes ( ) no

   Are they working properly? (**X**) yes ( ) no

3. Is standby power or other equivalent provisions provided for all components, systems, and processes as **recommended** by standard design references? (**X**) yes ( ) no

4. Are there adverse effects resulting from odors, noise, aerosol drift, and lighting at the facility? ( ) yes (**X**) no

5. Are there piles of collected screenings, slurries, residuals, or by-products of treatment? (Their disposal, including run-off of any water, must be such that none enters surface waters or their tributaries.) ( ) yes (**X**) no

Operating Problems

1. Are all components, systems, or processes (including associated equipment such as pumps, blowers, air compressors, oxygen systems, scum collection systems, residuals collection systems, diffusers, mechanical aerators, mechanical drives, mechanical mixers, motors, residuals heater, feed systems, backwash systems, control systems, flow measurement devices, automatic valves, ventilation fans, and other miscellaneous equipment) operating properly? (**X**) yes ( ) no

   If no, explain.

   _____
   _____
   _____
   _____
   _____

2. Are any components, systems, or processes out of service? (**X**) yes ( ) no

If yes, complete the following table for each component, system, or process that is not operating.

Name	Date Out of Service	Type of Failure	Expected Date to Return to Service
Surge Tank	2008	Line Removed	N/A

3. Are there excessive noises associated with any component, system, or process? ( ) yes (**X**) no

4. Is there any unusual equipment intended to correct operational problems (e.g. special pumps, floating aerators in diffused air systems, chemical feeder, temporary construction or structures, or any improvised systems)? ( ) yes (**X**) no

5. Are all components, systems, and processes expected to continue to operate properly for the permit period? (**X**) yes ( ) no

   If no, explain. _____
   _____
   _____
   _____

Safety Features

1. Are proper safety precautions used for each component, system, and process? (**X**) yes ( ) no

   If no, explain. _____
   _____
   _____
   _____

2. Is a written set of safety rules available to all employees? (**X**) yes ( ) no

3. Is the plant generally clean and free from open trash areas? (**X**) yes ( ) no

4. Is the plant site enclosed with a fence or otherwise designed with appropriate features that discourage the entry of animals or unauthorized persons? (**X**) yes ( ) no

5. Are wastewater pipes clearly distinguished from product pipes? (**X**) yes ( ) no

6. Are there any cross connections between a potable water supply and non-potable source? ( ) yes (**X**) no

7. Does the plant have the following recommended safety equipment?

   a. Portable air blower (gas motor or electric motor operated) (**X**) yes ( ) no

   b. Electric explosion-proof lantern (**X**) yes ( ) no

   c. Safety harness (**X**) yes ( ) no

   d. Hose mask with hand blower and 50-foot hose ( ) yes (**X**) no

   e. Self contained breathing apparatus for plants using chlorine ( ) yes ( ) no (**X**) not applicable

   f. Explosion and oxygen meters (**X**) yes ( ) no

8. Is personal protective clothing provided (safety helmets, ear protectors, goggles, gloves, rubber boots with steel toes, etc)? (**X**) yes ( ) no

9. Are portable hoists available for equipment removal? (**X**) yes ( ) no

10. Are ladders provided to enter manholes of wetwells (fiberglass or wooden for electrical work)? (**X**) yes ( ) no

11. Are life preservers and throwlines provided adjacent to all basins, ponds, and lagoons? (**X**) yes ( ) no

12. Are handrails provided and in-place around all basins and openings? (**X**) yes ( ) no

13. Are all stairs, walkways, and platforms free of grease, oil, and debris and are nonskid surfaces used when needed? (**X**) yes ( ) no

14. Is adequate lighting provided? (**X**) yes ( ) no

15. Are all components, systems, and processes adequately ventilated? (**X**) yes ( ) no

16. Are protective guards provided and in-place on all rotating machinery? (**X**) yes ( ) no

17. Is all electrical circuitry enclosed and identified? (**X**) yes ( ) no

18. Are appropriate warning signs posted (no smoking, high voltage, non-potable water, chlorine hazard, toxic and flammable gases, etc)? (**X**) yes ( ) no

19. Are emergency shower and eye wash facilities provided where needed? (**X**) yes ( ) no

20. Are appropriate fire extinguishers provided where needed? (**X**) yes ( ) no

21. Is instrumentation provided and operational for the detection of toxic and flammable gases and low oxygen levels? ( ) yes ( ) no

22. Do pressure vessels operate within their design rating and have a functional pressure relief? (**X**) yes ( ) no ( ) not applicable

23. Are chemicals stored properly? (**X**) yes ( ) no

24. Are undiked oil/chemical storage tanks used at the facility? ( ) yes ( ) no (**X**) not applicable

25. Are chemical storage tanks designed to handle the particular chemical? (**X**) yes ( ) no ( ) not applicable

26. Are storage bins provided with dust collectors and vents? ( ) yes ( ) no (**X**) not applicable

27. Are storage bins large enough to avoid continuous filling which requires the presence of an operator all the time?
( ) yes ( ) no (**X**) not applicable

28. Are access points for sampling dry points which can be reached safely? (**X**) yes ( ) no

OPERATION AND MAINTENANCE PROGRAM

Staffing

1. Is the facility adequately staffed with certified operators in accordance with the requirements of Rule 17-602, F.A.C.? (**X**) yes ( ) no

Maintenance Management

1. Is there an identification system to locate and identify all items of equipment? (**X**) yes ( ) no

2. Does the facility maintain a records system which includes the following?

   a. Preventive and corrective maintenance work performed (**X**) yes ( ) no

   b. Maintenance man-hours (**X**) yes ( ) no

   c. Spare parts used in the repair (**X**) yes ( ) no

   d. Name of the person performing the work (**X**) yes ( ) no

   e. Maintenance related costs (**X**) yes ( ) no

3. Is routine and preventive maintenance scheduled and performed on time? (**X**) yes ( ) no

4. Are adequate spare parts and supply inventories maintained for each component, system, and process? (**X**) yes ( ) no

5. Is the maintenance program adequate? (**X**) yes ( ) no

   If no, explain. _____

   _____

Records Keeping

1. Are records required by the permit maintained for a period of five years? (**X**) yes ( ) no

2. Is the information required by the permit available, complete, and current? (**X**) yes ( ) no

3. Are analytical results consistent with the data reported in the following?

   a. Monthly operating report (**X**) yes ( ) no

   b. Limited wet weather discharge report (**X**) yes ( ) no

   c. Ground water monitoring report (**X**) yes ( ) no

   d. Reclaimed water or effluent analysis report
      (**X**) yes ( ) no

4. Do sampling and analyses data include the following?

   a. Dates, times, and location of the sampling
      (**X**) yes ( ) no

   b. The name of the individual performing the sampling
      (**X**) yes ( ) no

   c. The analytical methods and techniques used
      (**X**) yes ( ) no

   d. The results of the analyses and calibration
      (**X**) yes ( ) no

   e. The dates of the analyses (**X**) yes ( ) no

   f. The name of the person performing the analyses
      (**X**) yes ( ) no

   g. The instantaneous flow at the grab sample station
      ( ) yes (**X**) no

5. Do monitoring records include records for all parameters that must be monitored in accordance with the permit?
   (**X**) yes ( ) no

6. Are flow meter calibration records available?
   (**X**) yes ( ) no

7. Are laboratory equipment calibration and maintenance records adequate? (**X**) yes ( ) no

8. Are plant records adequate and do they include the following?

   a. A copy of the Department permit (**X**) yes ( ) no

   b. An up-to-date operation and maintenance manual (**X**) yes ( ) no

   c. Record drawings (**X**) yes ( ) no

   d. Schedules and dates of equipment maintenance repairs (**X**) yes ( ) no

   e. Equipment suppliers manual (**X**) yes ( ) no

   f. Equipment data cards or equal (**X**) yes ( ) no

9. Are operating records adequate? (**X**) yes ( ) no

10. Have all untreated bypasses and discharges or overflows been reported to the Department? (**X**) yes ( ) no

    If no, explain._____
    _____
    _____
    _____

Sampling

1. Are samples taken at the sites specified in the permit? (**X**) yes ( ) no

2. Is sampling and analysis completed for each parameter specified by the permit? (**X**) yes ( ) no

3. Is the frequency of sampling in accordance with the permit? (**X**) yes ( ) no

4. Is the method of sample collection (grab or composite) in accordance with the permit? (**X**) yes ( ) no

5. Are sample collection procedures in accordance with the approved test procedures referenced in Rule 62-601.400(1)(a), F.A.C.? (**X**) yes ( ) no

6. For flows of 100,000 gallons per day or greater, are recording flow meters and totalizers used? (**X**) yes ( ) no
( ) not applicable

7. Are flow recording devices calibrated at least annually? (**X**) yes ( ) no

Laboratory Analysis

1. Are all laboratory tests required by Department rules performed by a laboratory that has been certified by HRS, or, for on-site tests for dissolved oxygen, pH, and total chlorine residual, are all tests performed by a certified laboratory or under the direction of an operator certified in accordance with Chapter 61E12-41, F.A.C.? (**X**) yes ( ) no.

INDIVIDUAL COMPONENTS, SYSTEMS, AND PROCESSES

PUMPING

Raw Wastewater **(N/A, multiple lift stations feed the Facility)**

1. What is the location of the pump station? 1)
2. What is the design flows to the pump station?

Station	Average	Peak
1)	gpm	gpm
2)	gpm	gpm

3. What is the actual flows to the pump station?

Station	Average	Peak
1)	gpm	gpm
2)	gpm	gpm

4. What types of pump control system is used? ( ) variable speed ( ) constant speed

5. If the control system is variable speed, what type of controller is used? _____( ) not applicable

6. If multiple pumps are used, how is each unit operated? ( ) about 15-20% apart ( ) equally ( ) not alternated ( ) not applicable

   Is the system remotely monitored? ( ) yes ( ) no ( ) not applicable

7. Does the pump station have a bypass? ( ) yes ( ) no

   If yes, can the bypass flow be disinfected? ( ) yes ( ) no ( ) not applicable

8. Can the wet well be isolated into a minimum of two separate basins for maintenance? ( ) yes ( ) no

9. If one wet well basin is down for maintenance, how many pumps are operable? _____

10. Does the wet well design provide for equal division of flow to each of the pumps? ( ) yes ( ) no

11. What is the condition of the sump pump? ( ) good ( ) fair ( ) poor ( ) not applicable

12. What is the condition of the water seal systems? ( ) good ( ) fair ( ) poor ( ) not applicable

13. How often is the pump station checked? ( ) daily ( ) other

14. What is the downtime of the pumps? _____

15. What is the frequency of maintenance inspections by plant personnel? _____/year

16. If the pump station is constant speed, do sudden surges affect the operation of the treatment facility when each pump is activated? ( ) yes ( ) no ( ) not applicable

17. What is the general condition of the raw wastewater pump station? ( ) good ( ) fair ( ) poor

18. What are the most common problems that the operator has had with the pump station? If there are problems with the screens, use the section on screens.

_____

_____

PUMPING

Residuals

1. What is the design residuals pumping rate? 6,487,200 gallons/day RAS 100,000 gallons/day WAS

2. What is the actual residuals pumping rate? 3,000 gpm/4.32 mgd gallons/day RAS 288,000/200 gpm gallons/day WAS

3. What types of residuals are pumped? ( ) primary (X) return activated sludge (X) waste activated sludge ( ) Other

4. How are residuals pumped? ( ) manually (X) automatically

5. How often do the residuals pumps run? continuously

6. What is the frequency of maintenance inspections by plant personnel? 12 /Year

7. What is the general condition of the residuals pump station? (**X**) good ( ) fair ( ) poor

8. What are the most common problems that the operator has had with the pump station?
   Flow meter not operating properly (gets air bound)

FLOW MEASUREMENT

1. What type of flow meter is used? ( ) propeller meter
   ( ) magnetic meter ( ) venturi tube ( ) flow tube
   ( ) positive displacement ( ) diaphragm meter ( ) weir
   (X) Parshall flume ( ) rotameter ( ) other_____

2. What is the design capacity of the flow measurement device? 0-12 mgd

3. What is the present wastewater flow measured? 2.6 mgd

4. Where is the flow meter located? Headworks

5. Are the flow measurement device and associated instruments (totalizers, recorders, etc.) properly installed?
   (X) yes ( ) no

6. Is there adequate straight length of pipe or channel before and after the flowmeter? (X) yes ( ) no

7. Is the flow entering the flume reasonably well-distributed across the channel and free of turbulence, boils, or other disturbances? (X) yes ( ) no ( ) not applicable

8. Is the flow measurement system capable of measuring the entire range of wastewater flow? (X) yes ( ) no

9. Are flow measurements being properly made by plant personnel?
   (X) yes ( ) no

10. Are flow records properly kept? (X) yes ( ) no

11. Are sharp drops or increases in flow records accounted for?
    (X) yes ( ) no

12. Does the flow chart exhibit uniform flow? (X) yes ( ) no

13. Do any plant return flows discharge upstream from the meter?
    ( ) yes (X) no

14. Are float and bubble wells clean and free of grease and debris? ( ) yes ( ) no (x) not applicable

15. Are weirs free of debris? (X) yes ( ) no ( ) not applicable

16. Are weirs or flumes broken or cracked? ( ) yes (X) no ( ) not applicable

17. Are weir plates corroded or damaged, not sharp edged (# 1/8"), or not level? ( ) yes ( ) no (X) not applicable

18. Are stilling wells clogged or broken? ( ) yes ( ) no (X) not applicable

19. What is the frequency of calibration of the flow meter? 1/ year

20. What date was the flow meter last calibrated? 2/2013

21. Who performed the calibration? Quality Systems Lab

22. What is the frequency of routine inspections for proper operation? 2 times / day

23. What is the frequency of maintenance inspections by plant personnel? 2 times/year

24. What is the general condition of the flow measurement facilities? (X) good ( ) fair ( ) poor

25. What are the most common problems that the operator has had with the flow meter?
N/A

PRELIMINARY TREATMENT

Screens

1. What is the design flows of the screens? 6.5 mgd average 9.8 mgd peak

2. What is the actual plant flow? 2.61 mgd average 4.0 mgd peak

3. What type of screens are used? ( ) manual (X) mechanical

4. How many screens are there? 2

5. What is the capacity of each screen? 9.8 mgd average

6. How large are the screen openings? 6 mm

7. What are the dimensions of the channels? 35''x 48''depth

8. What is the total daily volume of screenings? 2 cubic ft

9. What is the unit volume of screenings? 1 cubic ft/million gallons

10. Is there excessive screen clogging or build-up of debris against the screens? ( ) yes (X) no

11. Is there a bypass channel? ( ) yes (X) no

    Does the bypass channel have a screen?
    ( ) yes ( ) no (X) not applicable

12. Does the influent channel design provide equal division of flow to each screen? (X) yes ( ) no.

13. How are screenings disposed? landfilled

14. What is the frequency of routine inspections for proper operation? 2 times/day

15. What is the frequency of maintenance inspections by plant personnel? 12 times/year

16. What is the downtime of the screens? 12 hours/year

17. What is the general condition of the screening facilities?
(X) good ( ) fair ( ) poor

18. What are the most common problems that the operator has had with the screening facilities? General housekeeping, capture rate

PRELIMINARY TREATMENT

Grit Removal

1. What is the design capacity of the grit removal system?
6.5 mgd average 9.8 mgd peak

2. What is the actual plant flow? 2.61 mgd average
4.0 mgd peak

3. What type of grit removal system is used? (X) velocity controlled ( ) aerated ( ) constant head ( ) other

4. How many grit removal units are there? 2

5. What is the capacity of each unit? 9.8 mgd peak

6. What are the dimensions of the units? 12 feet in diameter by 3 feet water depth

7. What is the daily volume of grit? 2 cubic feet

8. What is the unit volume of grit? 1 cubic ft/ million gallons

9. How is the grit collection equipment operated?
(X) manually ( ) time clock (X) continuous duty

10. Is the grit system clogged? ( ) yes (X) no

11. Is the grit system subject to odors? (X) yes ( ) no

12. Is the organic content of the grit excessive?( ) yes (X) no

13. Is there a bypass channel? ( ) yes (X) no

14. Does the influent channel design provide equal division of flows to each grit removal unit? (X) yes ( ) no ( ) not applicable

15. How is the grit disposed? Landfilled

16. What is the frequency of routine inspections for proper operation? 2 times / day

17. What is the frequency of maintenance inspections by plant personnel? 12 times / year

18. What are the most common problems that the operator has had with the grit removal facilities? General housekeeping, capture rate.

BIOLOGICAL TREATMENT

Activated Sludge

1. How many reactor basins are there? 2 Oxidation Ditches

2. What is the design capacity of each basin? 3.25 mgd

3. What is the actual flow to each basin? 1.3 mgd average 2.0 mgd peak

4. What is the flow regime? ( ) conventional ( ) step aeration (X) complete mix ( ) pure oxygen (PSA) ( ) other _____

5. What type of aeration equipment is used? ( ) diffused air (X) mechanical aerators ( ) other

6. What are the dimensions of each aeration basin? (26 FT width x 792 FT length x 13.5 FT depth

7. What is the color of the activated sludge? ( ) black ( ) dark brown (X) light brown ( ) other_____

8. What is the odor of the activated sludge? ( ) septic (X) earthy ( ) none ( ) other _____

9 What characteristics most accurately describe the foam?
( ) Light Crisp ( ) Thick Dark ( ) heavy, white (X) none

10. Are the tank contents mixed thoroughly? (X) yes ( ) no

11. Are there excessive air leaks in the compressed air piping?
( ) yes ( ) no (X) not applicable

12. Is the dissolved oxygen level in the reactor basin low
(# 1.0 mg/l)? ( ) yes (X) no

13. Does mixing appear excessive? ( ) yes (X) no

14. Does air rise in clumps? ( ) yes (X) no

15. Do there appear to be dead spots in the reactor basin? ( ) yes
(X) no

If yes, at what location? _____

16. What is the depth of the sand and grit layer? Aerition basin
1 - 0', Areation basin 2 - 1' to 2 feet.

17. What is the active capacity of the reactor basin?
254,011 cubic ft per reactor

18. Is the process operating in its design mode? (X) yes
( ) no If no explain. _____

19. Are the return activated sludge pumps operating? ( ) yes (
) no If no, what is the reason?_____

20. Are there flow measurement devices for the return activated
sludge and waste activated sludge systems? (X) yes ( ) no

21. Does the reactor basin have a foam control system?
( ) yes (X) no

22. If multiple basins are operating, is the flow distributed
equally? (X) yes ( ) no ( ) not applicable

How is it distributed? Horizontal weir at the influent splitter box.

23. Are the characteristics of the basin contents different in the various units? ( ) yes (X) no ( ) not applicable

24. How is the system operated? ( ) manually ( ) semi-automatically ( ) automatically (X) computer-controlled ( ) other _____

25. What is the frequency of routine inspections for proper operation? 2 times /day

26. What is the frequency of maintenance inspections by plant personnel? 12 times/year

27. What is the general condition of the activated sludge facilities? (X) good ( ) fair ( ) poor

28. What are the most common problems that the operator has had with the activated sludge system? Level control and flow control

SEDIMENTATION

Final

1. How many final sedimentation basins are there? 4

2. What is the design capacity of each basin? 2.006 mgd average 3.27 mgd peak

3. What is the actual flow to each basin? 1.3 mgd average 4.0 mgd peak

4. What are the dimensions of the basins?
   Nos. 1 & 2 - 28.5 FT X 125 FT X 14 ft depth
   Nos. 3 & 4 - 80 ft diameter x 12 ft depth

5. Is chemical addition used to improve settling? ( ) yes (X) no

   If yes, what chemical(s) are added? _____

6. Is there an excessive accumulation of scum, grease foam, or floating residuals in the clarifier? ( ) yes (X) no

7. Are there excessive gas bubbles on the surface of the clarifier? ( ) yes (X) no

8. Is there scum overflow, lack of adequate scum disposal, or is the scum pit full? ( ) yes (X) no

9. Does the tank surface indicate improper residuals withdrawal (i.e., excessive floating solids, gas, etc.) ( ) yes (X) no

10. What volume of residuals is pumped? _____ gpd total; 2,500,000 gpd RAS; 50,000 gpd WAS

11. What is the solids concentration of the residuals? 1% %

12. Are there settleable solids in the effluent? ( ) yes (X) no

13. How are residuals pumped? ( ) manually (X) automatically

14. How often do residuals pumps run? Continuously .

How long do residuals pumps run? Continuously

15. Does the residuals collection system show any signs of mechanical failure? ( ) yes (X) no

16. Are there excessive residuals on the bottom of the basin (i.e., inadequate residuals removal)? ( ) yes (X) no

17. Is there excessive solids build-up in the center well of the clarifier? ( ) yes (X) no

18. What is the depth of the sand and grit layer? UNKNOW feet

19. Are residuals withdrawal ports clogged? ( ) yes (X) no

20. Is the residuals blanket too high? ( ) yes (X) no

21. Is there deflocculation in the clarifier? ( ) yes (X) no

22. Is there pin floc in the overflow? ( ) yes (X) no

23. Is there billowing sludge in the clarifier? ( ) yes (X) no

24. Does the influent baffle system accomplish its purpose? (X) Yes ( ) no

25. Does the effluent baffle system accomplish its purpose? (X) Yes ( ) no

26. Does the unit show signs of short circuiting and/or overloads? ( ) yes (X) no

27. Are the effluent weirs level? (X) Yes ( ) no

28. Are the effluent weirs clean? (X) Yes ( ) no

29. If multiple units are used, is the flow distributed evenly? (X) Yes ( ) no ( ) not applicable

30. What is the frequency of routine inspections for proper operation? 4 Times/ day

31. What is the frequency of maintenance inspections by plant personnel? 12 Times /year

32. What is the general condition of the final sedimentation facilities? (X) Good ( ) fair ( ) poor

33. What are the most common problems that the operator has had with the final sedimentation facilities? Over loaded hydraulically.

FILTRATION (N/A)

1. How many filter units are there?

2. What is the design capacity of each unit? ___mgd average mgd peak

3. What is the actual flow to each unit? _____ mgd average mgd peak

4. What type of filters are used? ( ) gravity ( ) pressure

5. What type of filter media is used? ( ) sand ( ) dual media ( ) mixed media ( ) multi-media ( ) diatomaceous earth ( ) other

6. What is the surface loading rate? _____ gpm/ft^2

7. What is the backwash rate? _____ gpm/ft^2

8. What is the surface wash rate? __gpm/ft^2

   What is the pressure of the surface wash? _____ psi

9. What type of control system is used? ( ) constant flow ( ) headloss ( ) time ( ) turbidity of effluent ( ) total gallons filtered ( ) other

10. Are the valves sequencing (opening and closing in order) correctly? ( ) yes ( ) no ( ) not applicable

11. Is there a coagulant aid (filtration aid) system? ( ) yes ( ) no

    If yes, what type?

12. What are the dimensions of the filter?

13. How is the filter system operated? ( ) automatically ( ) manually ( ) semi-automatically ( ) other _____

14. Is the filter surface clogged? ( ) yes ( ) no

15. Is the filter run short? ( ) yes ( ) no

16. Is there gravel displacement of the filter media? ( ) yes ( ) no

17. Is there formation of mud balls in the filter media? ( ) yes ( ) no

18. Is there air binding of the filter media? ( ) yes ( ) no

19. Is there a loss of filter media during backwashing? ( ) yes ( ) no

20. Is there recycled filter backwash water in excess of five percent of the wastewater flow treated? ( ) yes ( ) no

21. What is the frequency of routine inspections for proper operation? _____ times/day

22. What is the frequency of maintenance inspections by plant personnel? _____ times /year

23. What is the general condition of the filtration facilities? ( ) good ( ) fair ( ) poor

24. What are the most common problems that the operator has had with the filtration facilities? _____

DISINFECTION (N/A)

Chlorination

1. How many chlorine contact basins are there?

2. What is the design capacity of each basin? ____ mgd average _____ mgd peak hourly flow

3. What is the actual flow to each basin? ____ mgd average mgd peak hourly flow

4. What are the dimensions of the basins?

5. What is the detention time of each contact basin at peak hourly flow? 20.1 minutes

6. What chlorine dosage is applied? _____ mg/l

7. What is the normal level of chlorine residual in the basin effluent? _____ mg/l

8. Are disinfection standards being met? ( ) yes ( ) no

9. What type of chlorination system is being used?
   ( ) chlorine cylinders ( ) on-site sodium hypochlorite generation ( ) sodium hypochlorite solution
   ( ) calcium hypochlorite solution

10. What is the design capacity of the chlorination system? _____lbs/day

    What is the maximum capacity of the chlorination system? _____ lbs/day

11. What is the configuration of the chlorine contact basin?
    ( ) round ( ) rectangular ( ) other

12. Is the contact basin adequately baffled to minimize short-circuiting? ( ) yes ( ) no

13. How is chlorine introduced into the wastewater entering the contact basin? ( ) perforated diffusers ( ) injector with single entry point ( ) other _____

14. Are mechanical mixing provisions incorporated in the chlorine contact basins design? ( ) yes ( ) no

15. Is there an adequate reserve supply of chlorine?
( ) yes ( ) no

How many days of supply is maintained? _____ days

16. Are there high temperatures in the chlorination rooms?
( ) yes ( ) no

17. Is there a build-up of residuals in the basin?
( ) yes ( ) no

18. Are there gas bubbles in the basin? ( ) yes ( ) no

19. Is there floating scum and/or solids in the basin?
( ) yes ( ) no

20. Is there excessive foaming downstream? ( ) yes ( ) no

21. Is there evidence of toxicity (dead fish, other dead organisms) downstream? ( ) yes ( ) no

22. What is the frequency of routine inspections for proper operation? _____ times/day

23. What is the frequency of maintenance inspections by plant personnel? _____ times /year

24. What is the general condition of the chlorination facilities?
( ) good ( ) fair ( ) poor

25. What are the most common problems that the operator has had with the chlorination process? _____

RESIDUALS TREATMENT

Chemical Conditioning

1. What is the actual volume of residuals conditioned? 50,000 gpd average

2. What is the design residuals volume? 100,000 gpd average

3. What type of residuals are conditioned? ( ) primary (X) waste activated ( ) other

4. What type of chemical is used for conditioning? ( ) lime ( ) ferric chloride (X) polymer ( ) other

5. What is the chemical dosage? 4-15 lbs polymer/ton dry solids average and N/A tons lime/day/100,000 gal

6. How are chemicals purchased? ( ) dry lime (X) liquid polymer

7. What chemical storage volume is provided? N/A days lime and 60 days polymer

8. How are chemicals fed? (X) automatically ( ) manually

9. If dry feeders are used, what type of feeder is used? ( ) volumetric ( ) gravimetric ( ) not applicable

10. Are chemical feeders automatically paced? (X) yes ( ) no

11. If lime is used, how is the lime purchased? ( ) bags ( ) bulk

12. If lime feeding is used, is a vapor and dust collection system installed? ( ) yes ( ) no (X) not applicable

13. Does the unit show signs of inadequate mixing? ( ) yes (X) no

14. What is the frequency of routine inspections for proper operation? 1 times /day

15. What is the frequency of maintenance inspections by plant personnel? 12 times /year

16. What is the general condition of the residuals chemical conditioning facilities? (X) good ( ) fair ( ) poor

17. What are the most common problems that the operator has had with the residuals chemical conditioning facilities? Inefficient

RESIDUALS TREATMENT (N/A)

Dewatering: Belt Filter Presses

1. How many belt filter presses are there?

2. What is the design influent flow to each belt filter press? _____ gallons / minute

3. What is the actual influent flow to each belt filter press? _____ gallons / minute

4. What is the percent solids of the influent residuals? ___%

5. What is the belt filter press volume? _____ cubic feet

6. What is the percent solids in the discharge cake? _____%

7. Are there settleable solids in the filtrate? ( ) yes ( ) no

   If yes, what is the solids concentration? _____ mg/1

8. How often does each belt filter press run? ____ hours per day
   How long does each filter operate each run __ minutes

9. If acid washing is provided, is a recirculating system included? ( ) yes ( ) no ( ) not applicable

10. What type of conditioning chemicals are used? ( ) lime ( ) alum ( ) ferric chloride ( ) other

11. What amount of conditioning chemicals are pumped? _____ lb/day

12. How are residuals pumped? ( ) manually ( ) automatically

13. How are chemicals fed? ( ) manually ( ) automatically

14. How often do residuals pumps run?

    How long do residuals pumps run each cycle?

15. How often does conditioning equipment run?
    How long does conditioning equipment run each cycle? _minutes

16. If multiple units are used, is the flow distributed evenly? ( ) yes ( ) no ( ) not applicable

17. Does the unit show signs of short circuiting and/or overloads? ( ) yes ( ) no

18. Is there a high level of solids in the filtrate? ( ) yes ( ) no

19. Is the filter cake thin? ( ) yes ( ) no

20. Is there a residuals build-up on the belts and/or rollers of the belt filter press? ( ) yes ( ) no

21. Is there excessive moisture in the belt filter press residuals cake? ( ) yes ( ) no

22. Is there difficult cake discharge from the belt filter presses? ( ) yes ( ) no

23. Does the filter cake stick to the solids-conveying equipment of the belt filter press? ( ) yes ( ) no

24. Is there frequent media binding of the belt filter press? ( ) yes ( ) no

25. What is the frequency of routine inspections for proper operation? ____ times ____ /day

26. What is the frequency of maintenance inspections by plant personnel? ____ times ____ /year

27. What is the general condition of the belt filter press facilities? ( ) good ( ) fair ( ) poor

28. What are the most common problems that the operator has had with the belt filter presses? _____

DISPOSAL SYSTEMS

Injection Well

1. What is the name and address of the facility where the injection wells(s) is located? Belle Glade WWTF, 2055 West Canal Street, South Belle Glade, Florida 33480.

2. Are additional facilities served by the injection well(s)? No

3. How many injection wells are there? 1

4. What is the maximum permitted flow to each injection well? 10.2 mgd peak hour flow

5. How many days during the last year has the actual maximum flow to the well exceeded the maximum permitted flow? None

6. What was the average daily flow to each well during the last year? 2.61 mgd

7. What is the inside diameter of each well? 18.812 inches

8. Is there a fluid-filled annulus? ( ) yes (X) no

9. What percentage of the total flow to the domestic wastewater treatment plant is from non-domestic sources? 0 %

10. Are there any wastestream sources that bypass the wastewater treatment plant and discharge directly to the wet well? ( ) yes (X) no

11. Does the fluid in the wet well appear to be free of solids/floatables? (X) yes ( ) no

12. What instrumentation is found at each well head?
(X) injection pressure (X) injection flow

13. What were the instrument readings during the inspection and the appropriate adjustment factors, if any?

    a. Injection pressure 40 psi
       Adjustment factor: _____

b. Injection flow 2.5 mgd
Adjustment factor: _____

c. Annulus pressure ___ psi
Adjustment factor:

d. other (specify) ____units
Adjustment factor: _____

14. What is the general condition of the well head instruments?
(X) good ( ) fair ( ) poor

15. How often are the instruments calibrated? _____ times/year

16. When were the instruments last calibrated?

a. Injection pressure 2/2012

b. Injection flow 2/2012

c. Annulus pressure N/A

d. Other (specify type) N/A Type:

17. Is there surge and water hammer control equipment present?
(X) yes ( ) no

If yes, what is the general condition of the surge and water hammer control equipment? (X) good ( ) fair ( ) poor

If poor, what is the problem?_____

18. Has mechanical integrity testing been conducted within the last five years? (X) yes ( ) no

If yes, complete the following:

a. Pressure test date: 5/2/2010
Test Pressure 200 psi
Pressure loss 2 psi
Test Duration 60 minutes

c. Temperature log date: 5/3/2010
Is there any anomalous temperature data?

( ) yes ( ) no
If yes, explain._____

d. Radioactive tracer survey date: _____
Was fluid movement indicated? ( ) yes ( ) no

19. What is the predetermined acceptable limits for annulus pressure? N/A

20. How many monitoring wells are there associated with the injection system? Three

21. Where are the monitoring wells located relative to the injection well(s) (distance/direction)? MWB-01 is approximately 75 feet southwest of the injection well, MWC-02 is approximately xx feet from the injection well and MWC-03 is at the xx injection well

22. Is each monitoring well functional? (X) yes ( ) no
If no, what is the problem?

23. Which zones are the monitoring wells designed to monitor?

Well Number	Monitoring Interval
MWB-01	Background
MWC-02	Lower (1,871 ft to 1,940 ft)
MWC-03	Upper (1,001 ft to 1,169 ft)

24. What volume of water is purged from each monitoring well prior to sampling? 3 well casings

25. How is the purge water disposed of?
(x) returned to wet well
( ) returned to head of treatment plant
( ) surface water discharge (may require separate permit)
( ) on well pad or ground (not acceptable)
( ) other (specify) _____

26. What chemical parameters are monitored and at what frequency are these parameters monitored?

Parameter Frequency

(See water quality monitoring data, the wells are sampled quarterly)

27. Have any water quality trends been observed in the monitoring data? (X) yes ( ) no

If yes, which parameters are affected and what trend has been observed (increase/decrease)?

Parameter Trend Observed

_____
_____
_____

28. What type of monitoring well instrumentation is present?
(x) pressure ( ) water level ( ) flow

29. When was the monitoring well instrumentation last calibrated?
2/2010

30. Does the water level/pressure data show a trend?
( ) yes (x) no

31. Are there any fluid leaks, or evidence of fluid leaks, at the injection or monitoring well heads? ( ) yes (X) no

32. Do the well heads, valves, and other surface appurtenances appear to be in good working order and well maintained?
(X) yes ( ) no

33. What is the general condition of the injection and monitoring well heads and other surface appurtenances?
(X) good ( ) fair ( ) poor

34. What is the emergency discharge method?
( ) other well(s) ( ) surface waters (X) percolation ponds
( ) other (specify)

35. Are facilities in place to use the specified emergency discharge method? (X) yes ( ) no

36. Are the injection and monitoring well heads fenced or otherwise protected from accidental damage by heavy equipment?
(X) yes ( ) no

37. Are plant operators familiar with procedures for emergency shut down of the injection system? (X) yes ( ) no

38. Is an emergency procedures manual located on-site?
(X) yes ( ) no

REUSE (N/A)

1. Is at least secondary filtration treatment provided? ( ) yes ( ) no

2. Is high level disinfection provided? ( ) yes ( ) no

3. Do the treatment facilities have permitted capacities in excess of the minimum system size requirements (0.1 mgd for public access systems, 0.5 mgd for residential irrigation, 0.5 mgd for edible crop irrigation)? ( ) yes ( ) no

4. Is there a DER-approved cross-connection control program covering the areas served by reclaimed water? ( ) yes ( ) no

5. Is there a uniform system for color coding and/or marking reclaimed water pipes? ( ) yes ( ) no

6. Does the utility inspect all new connections to the reclaimed water system? ( ) yes ( ) no

7. Does the utility provide routine inspections of existing connections to the reclaimed water system? ( ) yes ( ) no

8. Is an approved industrial pretreatment program enforced? ( ) yes ( ) no

9. Is the industrial pretreatment program enforced? ( ) yes ( ) no

10. Is there a DER-approved operating protocol on-site and available to the operators? ( ) yes ( ) no ( ) not needed

11. Has the operating protocol been updated and approved annually? ( ) yes ( ) no ( ) not applicable

12. What set points are contained in the operating protocol for the following items?

    Turbidity: _____ NTU
    Chlorine Residual: _____/mg/l
    Other Parameter (specify): Parameter:
    Limit:

13. Are the operators familiar with the operating protocol? ( ) yes ( ) no

14. Does the operator use the operating protocol to control the facility and to make judgements on the quality of the reclaimed water being produced? ( ) yes ( ) no

15. Is the 5.0 mg/l TSS limit met at all times for reclaimed water sent to the reuse system? ( ) yes ( ) no

16. Are the high-level disinfection criteria for fecal coliforms met at all times for reclaimed water sent to the reuse system? ( ) yes ( ) no

17. Have the operators simulate a case where turbidity or chlorine residuals violate the limits set in the operating protocol. Is the reclaimed water of "unacceptable quality" diverted to the reject storage system or permitted alternative discharge system? ( ) yes ( ) no

18. Are continuous monitoring devices provided for measuring turbidity (after filter/before chlorination) and chlorine residual (after contact chamber)? ( ) yes ( ) no

19. Are these instruments in good repair and used in the operation and control of the facilities? ( ) yes ( ) no

20. Are the filters in operation and in good repair? ( ) yes ( ) no

21. Are chemical feed facilities provided? ( ) yes ( ) no

22. What chemicals can be added?

23. Are the chemical feed facilities in operation and in good repair? ( ) yes ( ) no ( ) not applicable

24. Can the high-level disinfection criteria be met without chemical addition? ( ) yes ( ) no

25. Is the reclaimed water flowing out of the filters and chlorination system very clear? ( ) yes ( ) no

26. Is the turbidity measurement being reported consistent with the appearance of the reclaimed water? ( ) yes ( ) no

27. Are system storage facilities provided to store reclaimed water of acceptable quality? ( ) yes ( ) no

28. Are system storage facilities used? ( ) yes ( ) no

29. Are system storage facilities well maintained and fully operational? ( ) yes ( ) no

30. Are system storage facilities (including golf course lakes) used for temporary storage (as opposed to being used as "Percolation ponds" with no effort to pump out of them for irrigation purposes? ( ) yes ( ) no

31. Are lined reject storage facilities provided to store reclaimed water of unacceptable quality? ( ) yes ( ) no

32. Is there evidence that reject storage facilities are used? ( ) yes ( ) no ( ) not applicable

33. Is the reject storage system well maintained and fully operational? ( ) yes ( ) no ( ) not applicable

34. If automatic control and diversion are provided, are the systems operational, well maintained, and used? ( ) yes ( ) no ( ) not applicable

35. Is reclaimed water released to the system storage and reuse system only during periods when an operator is present? ( ) yes ( ) no ( ) not applicable (other reliability measures provided)

36. Is stored reject water returned to the treatment facilities for additional treatment and disinfection? ( ) yes ( ) no ( ) not applicable

37. Are the facilities for return of reject water to the treatment facilities well maintained, operational, and in use? ( ) yes ( ) no ( ) not applicable

38. Are reclaimed water pipes and appurtenances appropriately marked and color coded? ( ) yes ( ) no

39. Are advisory signs posted alerting the public that reclaimed water is being used? ( ) yes ( ) no

40. Are there illegal surface water discharge points? ( ) yes ( ) no

41. Is there evidence of abuse of the system, such as significant run-off off-site, or severe ponding? ( ) yes ( ) no

42. Are low trajectory nozzles used within 100 feet of outdoor public eating, drinking, or bathing facilities? ( ) yes ( ) no

43. Is reclaimed water applied within 75 feet of potable water supply wells? ( ) yes ( ) no

44. Are distribution systems and pumps operational and well maintained? ( ) yes ( ) no

45. Are ground water monitoring facilities provided and is monitoring regularly performed (normally quarterly)? ( ) yes ( ) no

46. Are background, intermediate, and compliance wells provided and monitored? ( ) yes ( ) no ( ) not applicable

47. Are monitoring wells well marked? ( ) yes ( ) no ( ) not applicable

48. Are monitoring wells operational and well maintained? ( ) yes ( ) no ( ) not applicable

49. Are there any violations of ground water standards at the compliance wells? ( ) yes ( ) no ( ) not applicable

50. Is there evidence of potential ground water quality problems at the intermediate wells? ( ) yes ( ) no ( ) not applicable

51. Are above ground hose bibbs present on reclaimed water lines? ( ) yes ( ) no ( ) not applicable

52. Is there evidence of or public complaints about aerosol drift, odors, or other nuisance conditions? ( ) yes ( ) no ( ) not applicable

This field evaluation of the Belle Glade Wastewater Treatment Plant was conducted by the following Owner and Hazen and Sawyer, P.C., staff:

Jose L. Pozo Chief Operator License No. xxxxx	Felipe Martinez P.E. Associate Florida Registration No. 62408 Hazen and Sawyer, P.C.

Palm Beach County Water Utilities Department (PBCWUD)

Pahokee Wastewater Treatment Facility

Palm Beach County, Florida

Operation and Maintenance Performance Report

August 2014

FDEP Permit: *FLA0136778-006-DN1P/NR*
Permit Expiration Date: *August 21, 2017*

CERTIFICATION BY THE PERMITTEE

I, Maurice Tobon, as the duly authorized representative of the Palm Beach County Water Utilities Department, hereby certify that I have reviewed the Operation and Maintenance Performance Report for the Belle Glade Wastewater Treatment Facility, and that I am fully aware and intend to comply with the recommendations and schedules included in the report.

ADDRESS:
8100 Forest Hill Boulevard
West Palm Beach, Florida 33413

Telephone:
(561) 747-5700

SIGNATURE:

Maurice Tobon, P.E.
Director of Engineering
PBCWUD

Date: _____, 2013

CERTIFICATION BY THE OPERATOR

I, Jose L. Pozo, Chief Operator for the Belle Glade Wastewater Treatment Facility, hereby certify that I have reviewed the Operation and Maintenance Performance Report for the Wastewater Treatment Facility and I am fully aware of the recommendations and schedules included in the report.

ADDRESS:
2055 West Canal Street
South Belle Glade, Florida 33430

Telephone:
(561) 493-6287

SIGNATURE:

Jose L. Pozo
Chief Operator
Operator Certification No.: XXXX

Date: _____, 2013

CERTIFICATION BY THE PROFESSIONAL ENGINEER

I, Joseph J. Franko, hereby certify that the information contained in the Operation and Maintenance Performance Report for the Belle Glade Wastewater Treatment Facility is true and correct to the best of my knowledge. The report was prepared in accordance with sound engineering principles and I have discussed the contents of this report with the operator; and, the aforementioned person agree that when properly operated and maintained, the facility will discharge an effluent that complies with the limitations specified in the permit application.

ADDRESS:

2101 NW Corporate Boulevard, Suite 301
Boca Raton, Florida 33431

Telephone:
(561) 997-8070

SIGNATURE:

For Hazen and Sawyer, P.C.

Joseph J. Franko, P.E.
Florida P.E. No. 48077

(Seal)

Date: _____, 2013

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Attachment 1 – Field Evaluation Form for the Operation and Maintenance Performance Report

Chapter 1 – Introduction

1.1 Background

This report is intended to meet the requirements of Florida Administrative Code (FAC) Chapter 17-600.735, by providing reasonable assurance that the facility will meet or exceed the effluent limit requirements during the period for which the facility is permitted. This report evaluates the capability of treatment facilities to function as intended including a detailed assessment of the physical condition of treatment process equipment, overall treatment efficiency of the plant, performance trends and the Operations and Maintenance program.

This report also identifies the deficiencies, if any, with the physical capacity and performance conditions of the plant including problems with the present Operations and Maintenance program. Finally, the report provides recommendations and schedules, if needed, for corrective actions leading to improved operations.

The Pahokee WWTF is located on Rim Canal Road in Pahokee, Florida, east of Lake Okeechobee and north of State Road 80. The service area for this treatment plant facility is approximately 16.5 square miles (10,569 acres), extends to the north of Paul Rardin Park up to Canal Point and is comprised of several collection basins. Wastewater generated in this service area is generally from residential with some commercial and non-categorical industrial contributors.

The Pahokee WWTF was acquired by the PBCWUD in May 2013 from Glades Utility Authority (previously the City of Pahokee). The treatment plant is permitted to operate with a capacity of 1.2 MGD three-month average daily flow (TMADF) under FDEP Permit No. FLA0136778-006-DW1P/NR that was issued on August 22, 2012 and expires August 21, 2017 (see **Attachment 1**). The Pahokee WWTF is an activated sludge wastewater treatment plant (WWTF) originally built in 1955 consisting of the following: a 0.50-MGD TMADF conventional activated sludge WWTF (Plant 1) and a 0.70-MGD TMADF complete mix Walker WWTF (Plant 2). The facility is also permitted to discharge up to 0.08 MGD AADF capacity via on-site rapid infiltration basin (RIB). The facility also has an existing Underground Injection permit (UO 50-194658) with a monthly average daily flow (MADF) permitted capacity of 4.0 MGD. Primary effluent disposal is deep well injection.

1.2 Treatment

A 1.2 MGD (three-month average daily flow) activated sludge wastewater treatment plant consisting of the following: a 0.50 MGD conventional complete mix WWTP and a 0.70 MGD complete mix Walker Modular Plant WWTP.

Major treatment plant components for the 0.50 MGD conventional complete mix plant are: one (1) 53,000 gallon primary clarifier with 707 sq. ft. of surface area; two (2) 75,000 gallon aeration basins; two (2) 80,000 gallon secondary clarifiers each with 1,062 sq. ft. of surface area; one (1)

258,000 gallon aerobic digester and air requirements provided by one (1) 15 hp mechanical aerator (for digester); and two (2) 750 cfm blowers for the aeration basins.

Major treatment components for the 0.70 MGD Walker complete mix plant consist of: aerated grit removal; one (1) 123,000 gallon aeration basin; one (1) 172,000 gallon clarifier with 1,590 sq. ft. of surface area; one (1) 172,000 gallon aerobic digester; and air requirements provided by two (2) 1,500 cfm blowers.

Common treatment plant components consist of an influent headwork's with Auger Monster mechanical bar screen rated at 3.0 MGD with a 3.5 MGD by-pass manually cleaned bar screen, an influent splitter box with mag meters to plant 1 and 2, two (2) emergency generators and the sludge handling facilities for residuals treatment.

Residuals treatment includes a BIOSET Class A stabilization unit capable of processing 675 pounds per hour of dry solids (cake sludge) and consists of an input hopper with primary motive mixer, lime storage silo with feed assembly, sulfamic acid hopper and feed assembly, solids/lime/acid reactor, all mounted on a covered concrete containment pad with floor drains for spill control, washdown, and further treatment as necessary. Supernate from the digesters will pass through the supernate disposal beds and will be collected at the bottom of the beds, which will be taken to the head of the plant for treatment.

Below is a summary of the facilities at the Pahokee WWTF:

Major treatment plant components for the Plant 1 include the following:

- One 53,000 gallon primary clarifier;
- Two 75,000 gallon aeration tanks with air requirements provided by two 750 cfm blowers;
- Two secondary clarifiers.

Major treatment components for the Plant 2 consist of the following:

- One aerated grit removal system;
- One 123,000 gallon aeration basin with air requirements provided by two 1,500 cfm blowers;
- One 172,000 gallon clarifier.

Common treatment plant components consist of the following:

- One influent mechanical bar screen with a manually cleaned by-pass bar screen;
- One influent splitter box;
- Two chlorine contact tanks;
- One effluent pump station;
- Two emergency generators;

- One 675 pounds per hour dry solids BIOSET Class A stabilization unit comprised of one input hopper with primary motive mixer, one lime storage silo with feed assembly, one sulfamic acid hopper and feed assembly and one solids/lime/acid reactor;
- One 172,000 gallon aerobic digester with air requirements provided by one mechanical aerator;
- One supernate disposal bed;
- One 12.75-inch, 4.0-MGD monthly average daily flow Class I injection well; and
- One 0.08-MGD annual average daily flow rapid infiltration basin.

The current permit limits for effluent carbonaceous 5-day Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS) are as follows:

Parameter	**Limit**
Flow	1.2 mgd (TMADF)
$CBOD_5$	20 mg/L, annual average
	30 mg/L, monthly average
	45 mg/L, weekly average
	60 mg/L, single sample
TSS	20 mg/L, annual average
	30 mg/L, monthly average
	45 mg/L, weekly average
	60 mg/L, single sample

MMADF = three-month average daily flow

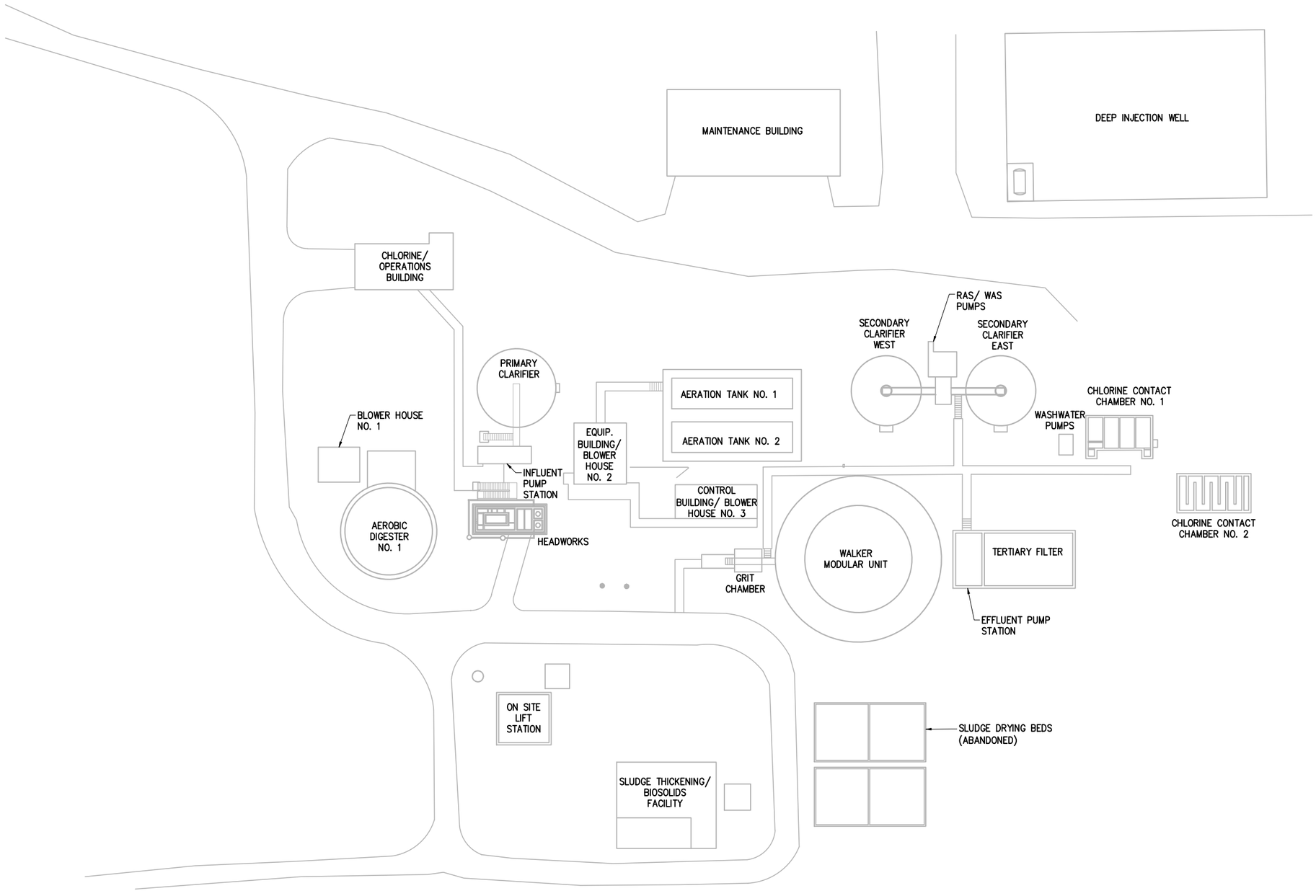

FIGURE 1-1
PAHOKEE WWTF
SITE PLAN

Palm Beach County
Water Utilities Department
Glades Utility Authority

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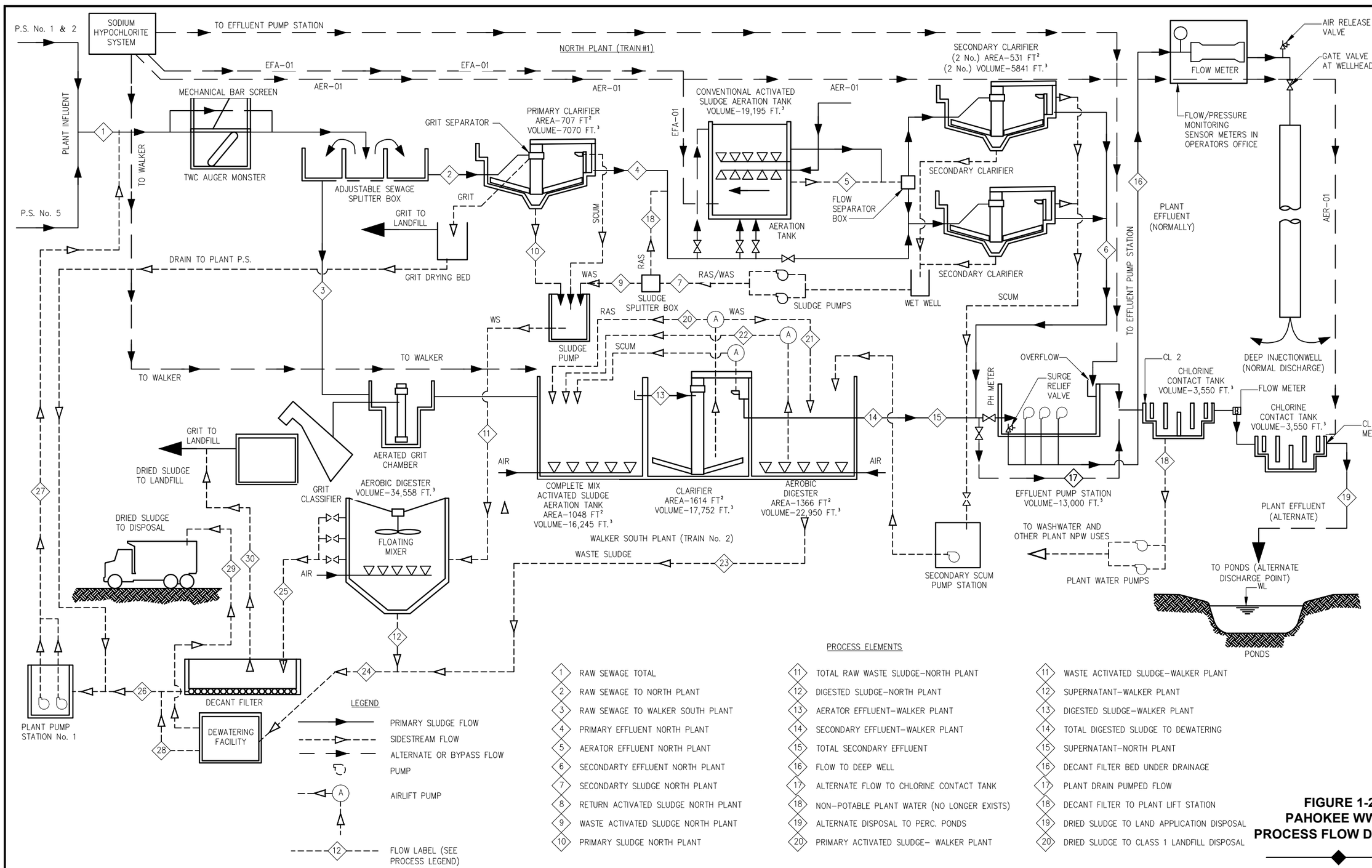

PROCESS ELEMENTS

1. RAW SEWAGE TOTAL
2. RAW SEWAGE TO NORTH PLANT
3. RAW SEWAGE TO WALKER SOUTH PLANT
4. PRIMARY EFFLUENT NORTH PLANT
5. AERATOR EFFLUENT NORTH PLANT
6. SECONDARTY EFFLUENT NORTH PLANT
7. SECONDARTY SLUDGE NORTH PLANT
8. RETURN ACTIVATED SLUDGE NORTH PLANT
9. WASTE ACTIVATED SLUDGE NORTH PLANT
10. PRIMARY SLUDGE NORTH PLANT
11. TOTAL RAW WASTE SLUDGE–NORTH PLANT
12. DIGESTED SLUDGE–NORTH PLANT
13. AERATOR EFFLUENT–WALKER PLANT
14. SECONDARY EFFLUENT–WALKER PLANT
15. TOTAL SECONDARY EFFLUENT
16. FLOW TO DEEP WELL
17. ALTERNATE FLOW TO CHLORINE CONTACT TANK
18. NON–POTABLE PLANT WATER (NO LONGER EXISTS)
19. ALTERNATE DISPOSAL TO PERC. PONDS
20. PRIMARY ACTIVATED SLUDGE– WALKER PLANT
11. WASTE ACTIVATED SLUDGE–WALKER PLANT
12. SUPERNATANT–WALKER PLANT
13. DIGESTED SLUDGE–WALKER PLANT
14. TOTAL DIGESTED SLUDGE TO DEWATERING
15. SUPERNATANT–NORTH PLANT
16. DECANT FILTER BED UNDER DRAINAGE
17. PLANT DRAIN PUMPED FLOW
18. DECANT FILTER TO PLANT LIFT STATION
19. DRIED SLUDGE TO LAND APPLICATION DISPOSAL
20. DRIED SLUDGE TO CLASS 1 LANDFILL DISPOSAL

PAHOKEE WWTP PROCESS FLOW DIAGRAM

FIGURE 1-2
PAHOKEE WWTF
PROCESS FLOW DIAGRAM

Palm Beach County
Water Utilities Department
Glades Utility Authority

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Environmental Engineers & Scientists

Chapter 2 – Physical Condition

2.1 Introduction

This chapter presents details of process operations and descriptions of unit processes. In addition, the physical condition of process equipment and components are stated, based on the field evaluations conducted on December 4, 2012, April 29, 2013 and May 17, 2013.

Items evaluated and discussed in the report are: Headworks, Secondary Treatment (Oxidation Ditches, Clarifiers, Walker Unit), Sludge Handling, Splitter Boxes, Disposal Systems, Chlorine Facilities and other miscellaneous buildings and equipment around the sites. The following sections provide a brief description of each building / treatment unit followed by its condition:

- **Influent Pump Station (common):** This structure consists of a rectangular reinforced concrete tank with a concrete top slab cover. The top slab is accessible through an aluminum stair that also serves as access to the Primary Clarifier bridge. Raw wastewater enters the Influent Pump Station, which is comprised of two submersible pumps.

  The exterior concrete surfaces of the splitter box are in good condition. Interior surfaces above the water line shows signs of erosion. Structure was in operation so the interior condition below the water line was not visible.

  The condition of the influent pumps is unknown because this structure does not have a bypass.

- **Headworks (common):** The facility consists of a two level reinforced concrete structure above grade. The bottom level is open and the top level consists of multiple channels supported on columns. The top level walking surface consists of a perimeter concrete cantilevered slab and metal grating over the screening channels. An aluminum staircase serves as access to the top level. The top level also contains pretreatment equipment consisting of one mechanical self–cleaning bar screen, one bypass manually cleaned bar screen, flow control slide gates and one grinder which is piped downward to screenings trash cans placed on the ground level.

  The Headworks structure is in overall good condition. At the time of the visit, the facility was in normal operation and the interior surfaces of the upper level channels could not be inspected.

  The equipment in the Headworks structure is in fair condition. However, the placement of the grinder prior to the mechanical bar screen creates solids small enough to pass through the screen thus affecting downstream equipment.

The grounding wire around the headworks structure is oxidizing and resulting in the discoloration stains on the floor deck and streaking down the walls from the upper deck. It is recommended that this grounding wire be replaced.

- **Primary Clarifier (Plant 1):** This structure consists of a circular reinforced concrete tank on grade with a steel bridge for access to the clarifier mechanism motor. Access to the steel bridge is via an aluminum stair which also serves as access to the top level of the Influent Pump Station. The 53,000-gallon center feed primary clarifier includes overflow weirs, full radius scum skimming, removal troughs and one primary sludge pump that pumps directly to the aerobic digester. A drive mechanism, supported on a central access platform, turns the attached rake arm assembly. Flow to the clarifier is controlled by splitter box at the end of the Headworks. There is also a Primary Clarifier Grit Chamber Structure which consists of a reinforced concrete slab with shallow channels.

  Exterior of the concrete structure of the primary clarifier is in good condition. Steel support members of the steel bridge are corroded. Interior of the clarifier was not visible during this visit as it was in operation, but the top of the interior wall surface above the water line was visible and had some erosion. The Primary Clarifier Grit Chamber Structure has settled and is need of replacement.

  After over 20 years in service, the primary clarifier's visible mechanical equipment was found to be in poor condition with rusting of several components. Above-grade piping appeared in good condition.

- **Aeration Tank Nos. 1 and 2 (Plant 1):** Structure consists of a rectangular reinforced concrete multi-cell tank above grade. A center wall separates Aeration Tank No. 1 from Aeration Tank No. 2. A concrete walkway on the north wall extends the full length of Aeration Tank No. 1. Metal grating over channels on the center wall and the outer east, west, and south walls serve as additional walkways. An aluminum stair serves as access to the top level of the tanks. Secondary treatment on the conventional side of the Pahokee WWTF starts with two aeration tanks. Air is introduced near the tank bottom which causes the basin's contents to be mixed. Dissolved oxygen (DO) levels in the tanks are monitored and blower rates adjusted to maintain the desired DO levels. The Aeration Tanks are comprised of the following components: two single pass Aeration Tanks, air piping and air diffusers.

  The exterior of the tanks appears to be in good condition as there is no evidence of leakage. The top level walkway is cracked in several locations, and one corner at the east end is spalled. Cracks and spalls can also be seen along the interface between the embedded grating frames and the concrete. The top support of the aluminum stairs that serve as access to the top level of the tanks is anchored to cracked and spalled concrete. There is evidence that old guardrails have been removed and new ones installed as a replacement. The exterior coating is stained. At the time of the visit, the tanks were in service and the interior of the tanks could not be inspected.

The Aeration Tanks are critical to the operation of the Pahokee WWTF. It has been several years since the tanks have been inspected. Plant staff have also noted that diffuser clogging is an issue.

- **Equipment Building / Blower House No. 2 (Plant 1):** Structure consists of a one-story reinforced masonry building with precast double-tees forming a flat roof. Process air is delivered to the aeration tanks by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 2 also contains one generator.

  Overall, the structure for Blower House 2 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  The blowers in the Equipment Building / Blower House No. 2 are in fair condition. Both have been rebuilt on various occasions.

  Blower House No. 2 Blower 1: Bushing / thrust metal is at a severe level in the lubricant.

  Blower House No. 2 Blower 2: Lead is at a moderate level. Lead sources in the gear systems include bushing / thrust overlay, lead solder, coatings or contamination from grease.

  The generator in the Equipment Building / Blower House No. 2 is in poor condition despite several recent repairs. Additionally, the MCC located in the Equipment Building / Blower House No. 2 needs to be replaced and contained within a climate controlled room, isolated from the rest of the equipment. Lastly, there is a 14.9 degree temperature difference between legs in the breaker for Effluent Pump No. 3.

- **Secondary Clarifiers:** East and West (Plant 1): These structures consist of a circular reinforced concrete tanks on grade with a steel bridge for access to the clarifier mechanism motor of each clarifier. Access to the steel bridges is via a common aluminum stair. The center feed secondary clarifiers include overflow weirs, full radius scum skimming, removal troughs and two sludge pumps (see RAS / WAS pumps). A drive mechanism, supported on a central access platform, turns the attached rake arm assembly. protective

  The exterior of the concrete structures of the secondary clarifiers is in good condition. The steel bridge has some slight corrosion and its coating has failed. The supports for the steel bridge have corrosion and are anchored to deteriorated concrete. The interior of the clarifiers were not visible during this visit as they were in operation.

  The secondary clarifiers' visible mechanical equipment was found to be in poor condition. Above-grade piping appeared in good condition. However, in order to more fully inspect the clarifiers, it is recommended that the tanks be drained to allow for a thorough inspection of the

mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed.

- **Grit Chamber (Plant 2):** Structure consists of a rectangular reinforced concrete tank on grade. A top level steel walkway is accessible from grade through a steel stair that also serves as access to the adjacent Walker Unit. Before wastewater enters the Walker Unit, it goes through additional pretreatment. The additional pretreatment equipment consists of one degritter / classifier unit.

  At the time of the visit, the tank was in service and the interior could not be inspected. Exterior wall surfaces appear to be in good condition, however, the top surfaces of the walls are deteriorated showing exposed aggregate, and have a diagonal crack at every wall corner intersection. Diagonal cracks at wall corner intersections may indicate separation of the walls caused by overstressing of the reinforcement steel as a result of insufficient reinforcement or unforeseen additional loading. The top steel walkway is corroded.

  Several steel pipe supports for DIP from the headworks to the grit chamber consist of steel posts and steel saddles. Steel pipe supports for elevated DIP are corroded and require replacement.

  The existing grit system is not functional. It is recommended that a new grit removal system be installed for entire plant at the Headworks structure. In this location, the new grit removal system would benefit the entire plant and not just the complete mix portion of the plant.

- **Walker Modular Unit (Plant 2):** Structure consists of a circular reinforced concrete tank on grade with a rotating steel bridge to access the center mechanism. The bridge is accessible via an aluminum stair that also serves as access to the Grit Chamber. Similar to the conventional plant, the secondary treatment in the Pahokee WWTF complete mix plant consists of one aeration basin (1/2 of the outer circle), one clarifier (inner circle) and one aerobic digestion (1/2 of the outer circle). In the aeration basin, air is introduced near the tank bottom which causes the basin's contents to be mixed. DO levels in the tanks are monitored and blower rates adjusted to maintain the desired DO levels. The clarifier portion of the Walker Unit includes effluent weirs, “full radius” scum skimming and a scum box. The aerobic digester consists of air piping and coarse bubble membrane diffusers.

  The exterior of the concrete structure of the Walker Unit is in good condition. The steel bridge has some slight corrosion and its protective coating has failed. Interior of the unit was not visible during this visit as it was in operation.

  The Walker Unit mechanical equipment was found to be in fair condition with minor rusting of some components. Above-grade piping appeared in good condition. To more fully inspect the Walker Unit, it should be drained to allow for a thorough inspection of the diffusers, air

piping, clarifier mechanism, arms, and feedwells to further determine the extent of capital improvements that may possibly be needed.

- **Control Building / Blower House No. 3 (Plant 2):** The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to the Walker Unit by a blower system comprised of two blowers and air piping to the diffusers. Blower House No. 3 also contains one generator.

  Overall, the structure for Blower House 3 is in good condition. Some of the roof flashing is missing. Doors and louvers are not likely rated for wind storm events.

  The blowers in the Control Building / Blower House No. 3 are in fair condition. Both have been rebuilt on various occasions.

  The generator in the Control Building / Blower House No. 3 is in poor condition despite several recent repairs. Additionally, there is a 9.8 degree temperature difference between legs in the breaker for Blower No. 2.

  Without a full time operator, plant operation cannot be optimized during unstaffed periods. It is recommended that the PLC system be upgraded to allow staff at the Belle Glade WWTF (staffed 24 hours per day) to monitor the DO levels and the blowers be upgraded to allow flow pacing.

- **Effluent Pump Station (common):** Structure consists of a rectangular reinforced concrete tank on grade open at the top. The east end of the structure serves as the effluent pump station and is covered with metal plates serving as walkway for access to the pumps. The Effluent Pump Station at the Pahokee WWTF consists of a large wet well followed by three pumps in the effluent pump station. The wet well for the three effluent pumps can be bypassed by diverting flow to the two chlorine contact chambers during wet well maintenance.

  Concrete structure of the wet well is in good condition. The west end of the structure that serves as the effluent pump station showed signs of corrosion on the metal covers supporting the pumps. However, the County has repaired the corroded metal plates and members since this visit.

  Overall the tertiary filters / effluent pump station is in good condition. The addition of the covers over both the wet well and pump station was an effective solution to reduce algal growth.

  If the pump starters are replaced with VFDs, as mentioned above, it is recommended that the PLC be upgraded with several displays to allow remote operation and control.

- **Deep Injection Well (common):** The injection well system consists of one deep injection well and an associated monitor well.

  The concrete pad around the well is in good condition and does not require structural repairs.

- **Chlorine Contact Chamber Nos. 1 and 2 (common):** Structures consist of rectangular reinforced concrete tanks partially below grade with internal concrete baffle walls. Guardrails are placed on the perimeter of the tanks, however there are no walkways at the top level. Chlorine contact chambers are only used when the injection well is out of service, for maintenance reasons.

  The Chlorine Contact Chamber No. 1 structure is in good condition. Exterior painting is stained by rust from steel guardrails on the top of the walls. The steel guardrails do not seem to serve any purpose and some sections are missing.

  The Chlorine Contact Chamber No. 2 structure is also in good condition. The steel guardrails do not seem to serve any purpose and some sections are missing, but is in overall good condition.

  There is no mechanical equipment on or near Chlorine Contact Chamber Nos. 1 and 2.

- **Washwater Pumps (common):** Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Plant service water was previously pumped throughout the Pahokee WWTF by this facility's two pumps.

  Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed.

  The mechanical equipment is not currently functioning and has been abandoned.

- **RAS / WAS Pump Station (common):** Structure is a reinforced concrete slab on grade supported on piles and supporting several pumps. Two RAS / WAS pumps collect settled sludge in the secondary clarifiers for either returning to the Aeration Tanks / Walker Unit or wasting to the sludge treatment facilities.

  Concrete structure is in good condition. Grade around the slab has settled leaving the underside of the slab exposed.

  The RAS / WAS pumps were replaced within the last year and appear to be in very good condition.

- **Chlorine / Operations Building (common):** This structure consists of a one-story reinforced concrete and masonry building with precast double tees forming a flat roof. Part of the building

is open on the sides for chlorine storage. The chemical feed system consists of two covered crosslink polyethylene chemical storage tanks and three diaphragm metering pumps for the storage and distribution of 12 percent sodium hypochlorite. Chlorine is diluted to 6 percent and used intermittently for control of filamentous bacteria and disinfection of secondary effluent. Additionally, when the well is out of service or they have a peak flow conditions that exceeds the well capacity, sodium hypochlorite is injected into the chlorine contact chambers so that the secondary effluent can be discharged to the percolation ponds. The Operations Building contains the plant staff offices / lunch area (one room), the plant laboratory / PLC Controls (one room) and one bathroom.

The condition of the concrete and masonry is good. Some windows are broken, doors and hardware are slightly corroded, and all components are not likely wind rated.

The chlorine tanks and pumps were replaced within the last three years and appear to be in very good condition. Additionally, the roof covering improves the expected life.

- **Sludge Thickening / Biosolids Facility (common):** This structure consists of a one-story partially open pre-engineered metal building supported on a reinforced concrete slab on grade. A steel lime silo is adjacent to the metal building. The major components of the sludge thickening system are as follows: one grinder, one high service pump, one high service feed pump, one sludge feed pump, four augers, one biosolids pump, one belt press, one lime silo system and one polymer mix and feed system.

  The metal building of the sludge facility is in good condition. One support leg of the lime silo adjacent to the metal building is slightly damaged. The ladder serving as access to the top of the silo and the guardrail at the top are corroded and unsafe. Exterior coating of the silo is damaged.

  Overall the mechanical equipment at the Sludge Thickening / Biosolids Facility is in good condition. However, there are several pieces of equipment which have minor issues. Biosolid Gearbox: continue to observe the trend and monitor equipment and fluid conditions as gear and/or bearing metal is at a moderate level and abrasives are at a minor level.

  1. Lime Auger: Water is at a severe level in the gearbox. It is recommended that the gearbox seals, breathers and fill ports be checked for the source of the water contamination and that the lubricant be changed.

  There is a 48.6 degree temperature difference between legs in the starter for the Primary Sludge Pump.

- **Aerobic Digester No. 1 (common):** The structure consists of a circular reinforced concrete tank without cover. A metal stair structure serves as access to the top of the tank. The major components of digester are one digester transfer pump and the 172,000-gallon circular concrete tank.

Two horizontal cracks around the entire perimeter of the tank are visible. One crack is approximately at the mid-height of the tank wall, and the other is at approximately ¾ of the wall height. There have been attempts of repairing the cracks as evidenced by multiple circular along the cracks which is typical when cracks are injected with a chemical grout. No leakage is evident from the repaired cracks which may indicate that the cracks were caused by joints in the concrete construction and not by a structural deficiency. Stairs for access to the top of the structure are steep, similar to a ship's ladder.

At the time of the visit, the tank was in service and the interior could not be inspected.

It has been reported by Florida Bearings report, that the Digester Transfer Pump, water level is leaking into the gearbox and evidence of abrasives and gear and/or bearing metal is also present.

- **Blower House No. 1 (Plant 1):** The structure consists of a one-story reinforced masonry building with a concrete flat roof. Process air is delivered to Digester No. 1 by a blower system comprised of two blowers and air piping.

  Overall, the structure for Blower House 1 is in good condition. Roof flashing is bent and separating from the walls and the roll-up door is corroded. Doors and louvers are not likely to be rated for wind storm events.

  The blowers are in fair condition; however, both have been rebuilt on various occasions. It has been reported by Florida Bearings, Blower Motor No. 2 be closely monitored for any increase in vibration amplitude and/or noise.

  There is a 4.9 degree temperature difference between legs in the starter for Blower No. 1. It is recommended that the connections be inspected and amp readings be checked.

- **Maintenance Building (common):** The structure consists of a one-story pre-engineered metal building built in two phases. Phase one of the building is supported on reinforced concrete footings and does not have a concrete floor slab. Phase two of the building is supported on a concrete slab on grade.

  Extensive corrosion is evident around the entire steel building including on the exterior metal panels, roof purlins, wall girts, and main frames. Wall panels are damaged and bent. One half of the building does not have a floor slab. Complete demolition and replacement of this building is recommended.

- **On–site Lift Station (common):** The lift station is a duplex station with two 7.5-Hp submersible pumps.

The wet well is in good condition. The 8-foot diameter wet well liner/coating appears to be in good condition. There were no signs of soft concrete or exposed steel inside the wet well. The top slab is in fair condition and there is evidence of ground settlement around the top slab. There is no valve vault as the discharge piping is above ground.

The pumps appear to be in good condition. The lift station has one 8-inch influent line with an invert 7 feet from the top of slab. The 4-inch discharge piping inside the wet well has severe rust and corrosion on the piping and hardware. There is no protective coating or paint on the piping inside the wet well. The discharge piping and valves are above ground and they appear to be in fair condition. There is a coating on the piping and isolation valves (plug type) however there is no coating on the check valves (leaver and weight swing checks). There is rust mainly around the piping flange connections and there is some severe corrosion between one of the flange connections. There was no evidence of surcharging or grease accumulation in the wet well.

- **Electrical System (common):** The electrical distribution system at the Pahokee WWTF consists of two utility FPL services. Utility service No. 1 is located at Blower House No. 3 and is connected to three 100kVA pole mount FPL transformers. The FPL step-down transformers are connected to two service entrance rated main disconnects from the utility meter.

  The primary power distribution electrical equipment is housed within Blower House No. 3 and Blower House No. 2. Blower House No. 3 contains main disconnect 1 of 2 and main disconnect 2 of 2. Main disconnect 1 of 2 is a service entrance rated 600A, 480V, 3-phase enclosed circuit breaker connected to a 600A ATS. The ATS is connected to distribution panel DP-1. DP-1 is a 600A, 480V, 3-phase panel. DP-1 provides power to Walker Unit Blower No. 1 and Blower No. 2 starters (in the Control Building / Blower House No. 3), Grit Blower starter, Grit Auger starter, Grit Blower, Walker Plant Bridge Drive control panel and panel LP-1. This electrical equipment was replaced in 2009 and is in excellent condition. Back-up power for DP-1 is from a 200-kW (250kVA) generator. The generator was installed in 2005 and is in poor condition. It is recommended that this generator be replaced.

  Main disconnect 2 of 2 is a 400A fused disconnect. Main disconnect 2 of 2 is connected to Motor Control Center 3 (MCC-3) located in Blower House No. 2. MCC-3 is a 600A, 480V, 3-phase motor control center with a 400A ATS. MCC-3 contains feeder breakers and starters for the conventional plant's Blowers Nos. 1 and 2 (in the Equipment Building / Blower House No. 2), Effluent Pumps Nos. 1, 2, and 3, Floating Mixer disconnect, DP-2 and control power for the Effluent Pump Control Panel. Panel DP-2 also located in Blower House No. 2 is a 480V, 3-phase panel rated at 225A with feeder breakers for the Headworks control panel, on-site lift station, Blower control panel (Digester No. 1 blowers 1 and 2 in Blower House No. 1). Feeder breakers from DP-2 are also connected to starters for the primary sludge pumps, washwater pumps, RAS pumps, east and west secondary clarifiers and primary clarifier. The starters and DP-2 were installed in 2009 and are in excellent condition. General house power for Blower House No. 2 and the Chlorine / Operations Building are supplied thru a 50kVA,

480V/120/240V single phase step-down transformer feed from DP-2. This transformer was installed in 2005 and is in good condition. The main breakers for the Chlorine / Operations Building and Blower House No. 2 panelboards are located in Blower House No. 2, were installed in 2005 and are in poor condition. It is recommended that both enclosed breakers be replaced.

The current bus configuration of MCC-3 only allows back-up power for one blower and one effluent pump to operate during a power outage. MCC-3 was installed in 2005 in a non-air-conditioned environment and is in poor condition. It should be replaced with a new MCC with bus configuration that allows operators the option to run critical equipment during a normal power failure. It is also recommended to enclosure the electrical equipment area with walls and install HVAC environment. Back-up power for MCC-3 is from a 230-kW (288kVA) generator. This generator was installed in 2006 and is in poor condition. It is recommended that this generator be replaced with a generator sized to allow for more flexibility for plant operations.

Utility Service No. 2 is located at the Sludge Thickening / Biosolids Facility and is connected to three 50kVA FPL pole mount transformers. The FPL step-down transformers are connected to a service entrance rated 480V, 3-phase, 200A disconnect. The Main disconnect is connected to panelboard P1, a 480V, 3-phase, 225A rated distribution panel. P1 contains feeder breakers for the belt drive, conveyor, booster pump, etc. for the process of solids. A 30kVA, 480V/120/208V 3-phase step-down transformer is feed from P1. The transformer feeds panel LP-1. LP-1 is a 208/120V, 3-phase panelboard rated for 100A. This panel board provides power for controls, convenience receptacles, lighting etc. Overall the electrical equipment at the Sludge Thickening / Biosolids Facility are in good condition. There are no recommendations for renewal or replacement at this time.

Plant operations are monitored and controlled with a supervisory control and data acquisition (SCADA) system. PLC-1 consists of an Allen-Bradley CompactLogix controller with associated terminal strips, relays, surge protectors, breakers, UPS, etc. The associated PLC equipment is housed in a NEMA 3R stainless steel enclosure located in Blower House No.2. PLC-1 was installed in 2011 and is in excellent condition.

2.2 Operating Limits

Operating flow capacities based on the current operating permit for the Pahokee WWTF are as follows:

Three Month Average Daily Flow (TMADF)	1.2 MGD

2.3 Summary of Design Details

The following is a tabulation of design information on various systems/components at the Belle Glade WWTF:

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Headworks	
Muffin Auger Gearbox	
Manufacturer	Nord Gear
Grinder	
Electric Motor	
Hp	5
Manufacturer	Baldor / Reliance
Gearbox	
Primary Clarifier	
Motor	
Type	DFT7-104-KS
Hp	0.5
Manufacturer	SEW Eurodrive
Gearbox	
Type	R63R42DT71D4-KS
Manufacturer	SEW Eurodrive
Sludge Pump	
Size	4 in.
Hp	11.4
Manufacturer	Homa
Blower House 2	
Blower	
Number of Units	2
Manufacturer	Hoffman
Electric Motor	
Type	TTKK
Hp	30
Manufacturer	Toshiba / Houston
Generator	
Type	Cummins
Manufacturer	Kohler
Walker Plant	
Drive Motor	
Manufacturer	Boston Gear
Drive Gear Box	

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Manufacturer	O/S
Degritter Classifier	
Manufacturer	O/S
Blower House 3	
Blower	
Number of Units	2
Type	Hoffman
Electric Motor	
Number of Units	2
Type	K (2)
Hp	100
Manufacturer	Baldor (1), General Electric (2)
Generator	
Type	Detroit
Manufacturer	Kohler
Secondary Clarifier	
East Clarifier	
Motor	
Type	DFT71D4-KS
Hp	0.5
Manufacturer	SEW Eurodrive
Gearbox	
Type	R63R420T71D4-KS
Manufacturer	SEW Eurodrive
West Clarifier	
Motor	
Hp	5
Manufacturer	Siemens / Allis
Gearbox	
Type	R57R37DRS71S4DH
Manufacturer	SEW Eurodrive
Blower House 1	
Blower	
Number of Units	2
Manufacturer	Hoffman

Table 2.1
Summary of Existing Treatment Facilities

Treatment Facility or Equipment System	Value
Electric Motor	
Type	TTKK
Hp	30
Manufacturer	Toshiba / Houston
Generator	
Type	Cummins
Manufacturer	Kohler

2.4 Conclusions

Based on the field evaluations conducted on December 4, 2012, April 29, 2013 and May 15, 2013 and review of the treatment plant records and monitoring reports, the following conclusions are reached:

- In general there is no evidence of hydraulic or organic overloading problems at the Pahokee WWTF.
- The equipment is generally in fair condition and well maintained as detailed in the field evaluation report (Attachment 1).
- The facilities meet applicable requirements of:
    1. Reliability
    2. Protection from adverse effects of odor, noise, aerosol drift and lighting.
    3. Fencing (enclosure) to ward off animals and unauthorized persons.
    4. Easy access points for influent and effluent sampling.
    5. Provisions for flow measurements.

    Thus, the facility complies with the requirements of F.A.C. 17-600.400(1)(b), (2)(a), (2)(b), (4)(a) and (4)(b).
- Physical signs indicate that the treatment units and associated equipment are operating properly and are expected to operate properly for the permit period.
- The equipment has the necessary safety features and is operated safely.

Chapter 3 – Treatment Efficiency

3.1 Introduction

Treatment efficiency of the major wastewater treatment units and overall treatment efficiency at the Pahokee WWTF are presented below. The design and operating parameters used for the evaluation of treatment efficiency are those established in the treatment facility's capacity analysis report.

3.2 Factors Which Affect Plant Performance

Factors which affect plant performance and treatment efficiency include:

- Hydraulic and organic loadings
- Seasonal variation in flow
- Infiltration and inflow
- Contribution from industrial wastewater and septage
- Operations flexibility
- Accumulations of sand and grit
- Rag build-up
- Deterioration of baffles

3.3 Criteria for Evaluation

The complete mix activated sludge treatment process at the Belle Glade WWTF is designed to operate in the range of mixed liquor suspended solids (MLSS) concentration from 2,000 to 3,200 mg/L and a solids retention time (SRT) of 15 to 25 days. RAS flow range is from 60 to 100 percent of the plant influent and typically operated at 65 percent return.

3.4 Current Loadings

The average monthly operating conditions for the period extending from January 2002 through March 2013 are presented in the Table 3-1. Please note that data for carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) is only included from October 2009 through March 2013 and evaluated in this report due to inconsistencies in the data prior to October 2009. Figure 3-1 contains plots of average daily flows and a 3-month rolling average from January 2002 through March 2013. As shown in Table 3.1, the historical performance for this four year period has been excellent with $CBOD_5$ and TSS removal efficiencies of 96% and 93%, respectively. Historical flow data has been reviewed from January 2002 through March 2013. Flows during this 10 year period have averaged 0.81 mgd, which is below the permitted TMADF of 1.2 mgd.

Table 3.1
Historical Flow and Treatment Data

YEAR	MONTH	FLOW		INFLUENT $CBOD_5$	EFFLUENT $CBOD_5$	REMOVAL	INFLUENT TSS	EFFLUENT TSS	REMOVAL
		monthly avg	3-mo avg	monthly avg	monthly avg	$CBOD_5$	monthly avg	monthly avg	TSS
		(mgd)	(mgd)	(mg/L)	(mg/L)	(%)	(mg/L)	(mg/L)	(%)
2002	Jan	0.74	0.74	-	-	-	-	-	-
	Feb	0.68	0.68	-	-	-	-	-	-
	Mar	0.80	0.74	-	-	-	-	-	-
	Apr	0.70	0.73	-	-	-	-	-	-
	May	0.52	0.67	-	-	-	-	-	-
	Jun	0.99	0.74	-	-	-	-	-	-
	Jul	1.08	0.86	-	-	-	-	-	-
	Aug	1.38	1.15	-	-	-	-	-	-
	Sep	0.82	1.09	-	-	-	-	-	-
	Oct	0.71	0.97	-	-	-	-	-	-
	Nov	0.82	0.78	-	-	-	-	-	-
	Dec	0.89	0.81	-	-	-	-	-	-
2003	Jan	0.87	0.86	-	-	-	-	-	-
	Feb	0.92	0.89	-	-	-	-	-	-
	Mar	0.79	0.86	-	-	-	-	-	-
	Apr	0.73	0.81	-	-	-	-	-	-
	May	0.84	0.79	-	-	-	-	-	-
	Jun	1.04	0.87	-	-	-	-	-	-
	Jul	1.19	1.02	-	-	-	-	-	-
	Aug	1.66	1.30	-	-	-	-	-	-
	Sep	1.00	1.28	-	-	-	-	-	-
	Oct	0.99	1.22	-	-	-	-	-	-
	Nov	0.80	0.93	-	-	-	-	-	-
	Dec	0.82	0.87	-	-	-	-	-	-

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2004	Jan	0.81	0.81	-	-	-	-	-	-
	Feb	0.82	0.82	-	-	-	-	-	-
	Mar	0.68	0.77	-	-	-	-	-	-
	Apr	0.67	0.72	-	-	-	-	-	-
	May	0.66	0.67	-	-	-	-	-	-
	Jun	1.01	0.78	-	-	-	-	-	-
	Jul	0.78	0.82	-	-	-	-	-	-
	Aug	1.25	1.01	-	-	-	-	-	-
	Sep	1.31	1.11	-	-	-	-	-	-
	Oct	1.01	1.19	-	-	-	-	-	-
	Nov	0.72	1.01	-	-	-	-	-	-
	Dec	0.56	0.76	-	-	-	-	-	-
2005	Jan	0.58	0.62	-	-	-	-	-	-
	Feb	0.64	0.59	-	-	-	-	-	-
	Mar	0.85	0.69	-	-	-	-	-	-
	Apr	0.82	0.77	-	-	-	-	-	-
	May	0.76	0.81	-	-	-	-	-	-
	Jun	1.15	0.91	-	-	-	-	-	-
	Jul	0.93	0.95	-	-	-	-	-	-
	Aug	0.77	0.95	-	-	-	-	-	-
	Sep	0.72	0.81	-	-	-	-	-	-
	Oct	0.61	0.70	-	-	-	-	-	-
	Nov	0.95	0.76	-	-	-	-	-	-
	Dec	0.69	0.75	-	-	-	-	-	-
2006	Jan	0.71	0.78	-	-	-	-	-	-
	Feb	0.87	0.76	-	-	-	-	-	-
	Mar	0.63	0.74	-	-	-	-	-	-
	Apr	0.64	0.71	-	-	-	-	-	-
	May	0.61	0.63	-	-	-	-	-	-
	Jun	0.61	0.62	-	-	-	-	-	-
	Jul	0.98	0.73	-	-	-	-	-	-
	Aug	0.72	0.77	-	-	-	-	-	-
	Sep	1.32	1.01	-	-	-	-	-	-
	Oct	0.71	0.92	-	-	-	-	-	-
	Nov	0.63	0.89	-	-	-	-	-	-
	Dec	0.63	0.66	-	-	-	-	-	-

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2007	Jan	0.62	0.63	-	-	-	-	-	-
	Feb	0.58	0.61	-	-	-	-	-	-
	Mar	0.46	0.55	-	-	-	-	-	-
	Apr	0.45	0.50	-	-	-	-	-	-
	May	0.43	0.45	-	-	-	-	-	-
	Jun	0.59	0.49	-	-	-	-	-	-
	Jul	0.70	0.57	-	-	-	-	-	-
	Aug	0.48	0.59	-	-	-	-	-	-
	Sep	0.55	0.58	-	-	-	-	-	-
	Oct	0.70	0.58	-	-	-	-	-	-
	Nov	0.46	0.57	-	-	-	-	-	-
	Dec	0.61	0.59	-	-	-	-	-	-
2008	Jan	0.54	0.54	-	-	-	-	-	-
	Feb	0.57	0.57	-	-	-	-	-	-
	Mar	0.54	0.55	-	-	-	-	-	-
	Apr	0.67	0.59	-	-	-	-	-	-
	May	0.49	0.57	-	-	-	-	-	-
	Jun	0.56	0.57	-	-	-	-	-	-
	Jul	1.11	0.72	-	-	-	-	-	-
	Aug	1.59	1.09	-	-	-	-	-	-
	Sep	1.31	1.34	-	-	-	-	-	-
	Oct	0.83	1.24	-	-	-	-	-	-
	Nov	0.59	0.91	-	-	-	-	-	-
	Dec	0.55	0.66	-	-	-	-		-
2009	Jan	0.55	0.56	-	-	-	-	-	-
	Feb	0.59	0.56	-	-	-	-	-	-
	Mar	0.56	0.57	-	-	-	-	-	-
	Apr	0.53	0.56	-	-	-	-	-	-
	May	0.69	0.59	-	-	-	-	-	-
	Jun	1.03	0.75	-	-	-	-	-	-
	Jul	0.97	0.90	-	-	-	-	-	-
	Aug	0.89	0.96	-	-	-	-	-	-
	Sep	0.86	0.91	-	-	-	-	-	-
	Oct	0.62	0.79	74	1.88	97.5%	56	5.92	89.5%
	Nov	0.63	0.70	102	2.01	98.0%	326	5.75	98.2%
	Dec	0.66	0.64	86	1.92	97.8%	100	4.27	95.8%

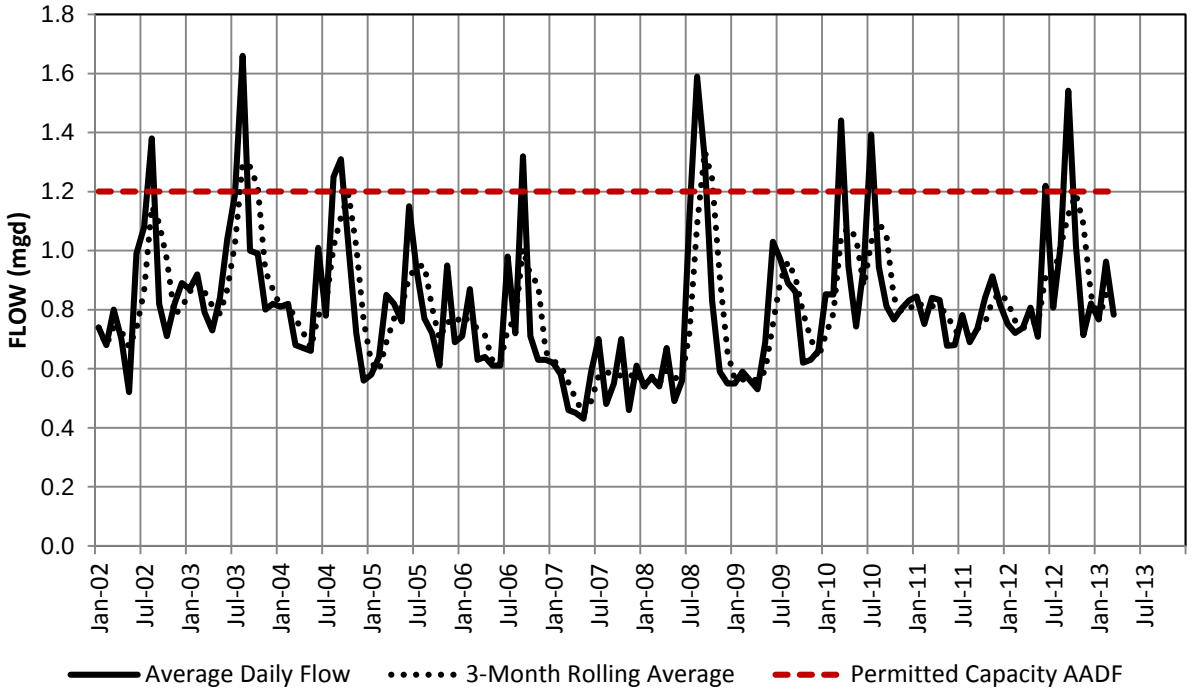
Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2010	Jan	0.85	0.71	184	3.53	98.1%	157	6.45	95.9%
	Feb	0.85	0.79	111	1.82	98.4%	106	4.50	95.8%
	Mar	1.44	1.05	64	2.70	95.8%	84	6.46	92.3%
	Apr	0.95	1.08	140	3.31	97.6%	143	5.13	96.4%
	May	0.74	1.04	90	2.40	97.3%	99	5.75	94.2%
	Jun	0.95	0.88	102	2.35	97.7%	78	5.95	92.4%
	Jul	1.39	1.03	57	2.28	96.0%	65	8.00	87.6%
	Aug	0.94	1.10	89	2.62	97.1%	125	7.08	94.3%
	Sep	0.81	1.05	126	2.90	97.7%	106	7.13	93.2%
	Oct	0.77	0.84	102	2.73	97.3%	90	6.58	92.7%
	Nov	0.80	0.79	137	3.46	97.5%	124	11.18	91.0%
	Dec	0.83	0.80	112	5.64	95.0%	120	20.55	82.8%
2011	Jan	0.85	0.83	105	2.68	97.5%	140	7.63	94.6%
	Feb	0.75	0.81	138	3.68	97.3%	211	7.28	96.5%
	Mar	0.84	0.81	122	4.16	96.6%	176	7.90	95.5%
	Apr	0.83	0.81	117	5.24	95.5%	109	11.16	89.8%
	May	0.68	0.78	99	5.78	94.1%	103	14.00	86.3%
	Jun	0.68	0.73	173	5.20	97.0%	232	13.68	94.1%
	Jul	0.78	0.71	88	6.93	92.2%	96	8.20	91.5%
	Aug	0.69	0.72	90	6.03	93.3%	90	15.13	83.2%
	Sep	0.74	0.74	106	5.18	95.1%	103	13.48	86.9%
	Oct	0.84	0.76	104	3.05	97.1%	124	9.30	92.5%
	Nov	0.91	0.83	93	2.26	97.6%	106	5.80	94.5%
	Dec	0.82	0.86	95	3.59	96.2%	112	9.32	91.6%
2012	Jan	0.75	0.83	100	5.13	94.8%	156	11.31	92.7%
	Feb	0.72	0.76	108	3.33	96.9%	155	7.37	95.3%
	Mar	0.74	0.74	118	2.26	98.1%	133	5.77	95.7%
	Apr	0.81	0.76	126	3.64	97.1%	115	12.65	89.0%
	May	0.71	0.75	117	5.41	95.4%	143	5.10	96.4%
	Jun	1.22	0.91	90	4.21	95.3%	115	7.69	93.3%
	Jul	0.81	0.91	114	3.92	96.6%	130	6.30	95.2%
	Aug	1.02	1.01	82	2.68	96.7%	85	15.70	81.6%
	Sep	1.54	1.12	40	3.95	90.1%	75	19.75	73.7%
	Oct	1.02	1.19	57	3.67	93.5%	76	7.82	89.7%
	Nov	0.71	1.09	93	2.84	96.9%	125	5.29	95.8%
	Dec	0.82	0.85	146	5.38	96.3%	184	9.00	95.1%

Table 3.1 (continued)
Historical Flow and Treatment Data

YEAR	MONTH	FLOW monthly avg (mgd)	FLOW 3-mo avg (mgd)	INFLUENT $CBOD_5$ monthly avg (mg/L)	EFFLUENT $CBOD_5$ monthly avg (mg/L)	REMOVAL $CBOD_5$ (%)	INFLUENT TSS monthly avg (mg/L)	EFFLUENT TSS monthly avg (mg/L)	REMOVAL TSS (%)
2013	Jan	0.77	0.77	119	4.30	96.4%	172	5.69	96.7%
	Feb	0.96	0.85	102	6.13	94.0%	129	7.17	94.5%
	Mar	0.78	0.84	105	6.12	94.2%	195	15.97	91.8%

Figure 3-1 – Historical Flow Data (January 2002 through March 2013)



Figures 3-2 and 3-3 are plots of monthly average values for $CBOD_5$ loadings from October 2009 through March 2013. Figure 3-2 illustrates the historical performance for the period of record shown. An expanded scale version of the effluent data for $CBOD_5$ is presented in Figure 3-3. Figure 3-3 shows that the treatment process consistently produces an effluent with average $CBOD_5$ concentrations of approximately 3.76 mg/L.

The performance with respect to TSS removal is also excellent as shown in Figure 3-4. Figure 3-4 shows both influent and effluent data from October 2009 through March 2013. Percent removal of TSS has averaged approximately 93% for the period of record shown. Figure 3-5 presents the historical TSS effluent produced. The average effluent TSS values for the period of record shown is approximately 8.51 mg/L.

Figure 3-2 – Historical $CBOD_5$ Influent / Effluent Data (October 2009 through March 2013)

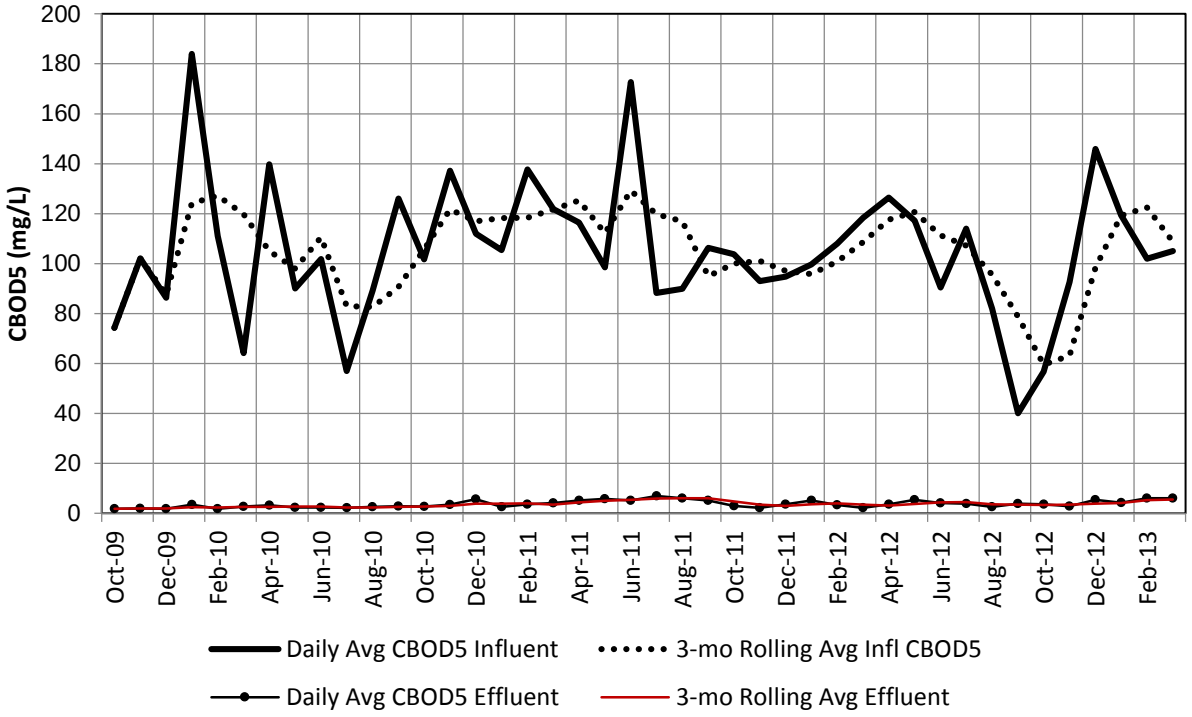


Figure 3-3 – Historical $CBOD_5$ Effluent Data (October 2009 through March 2013)

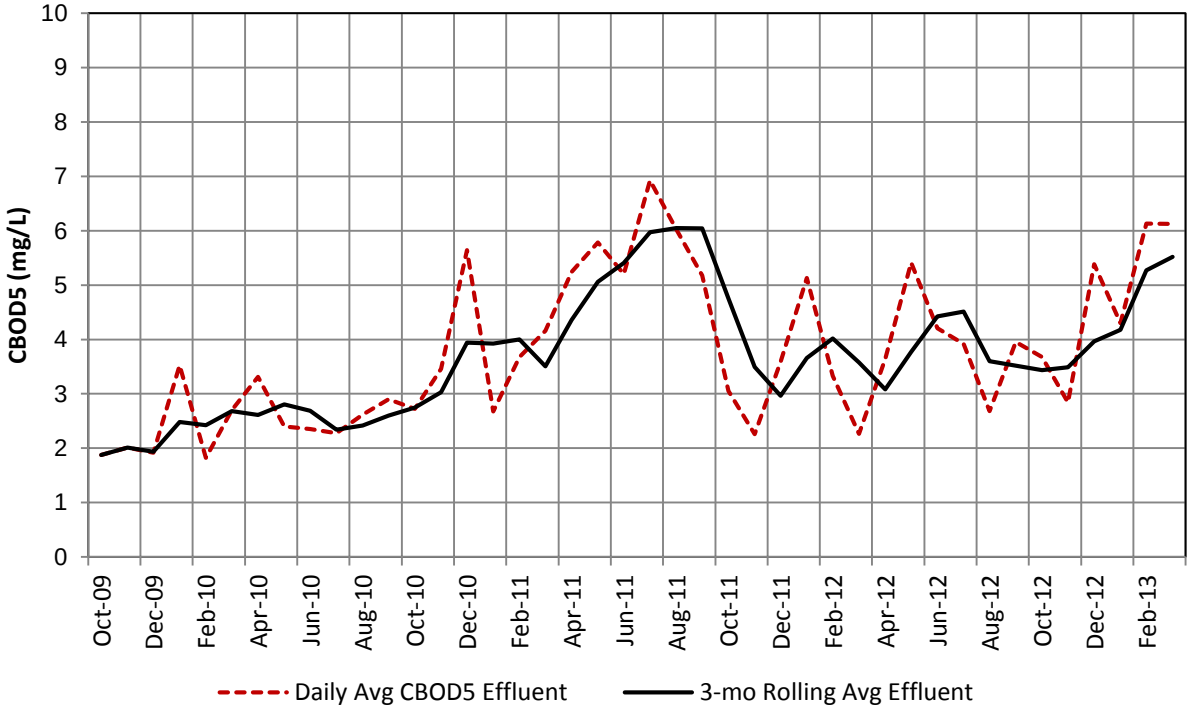


Figure 3-4 – Historical TSS Influent / Effluent Data (October 2009 through March 2013)

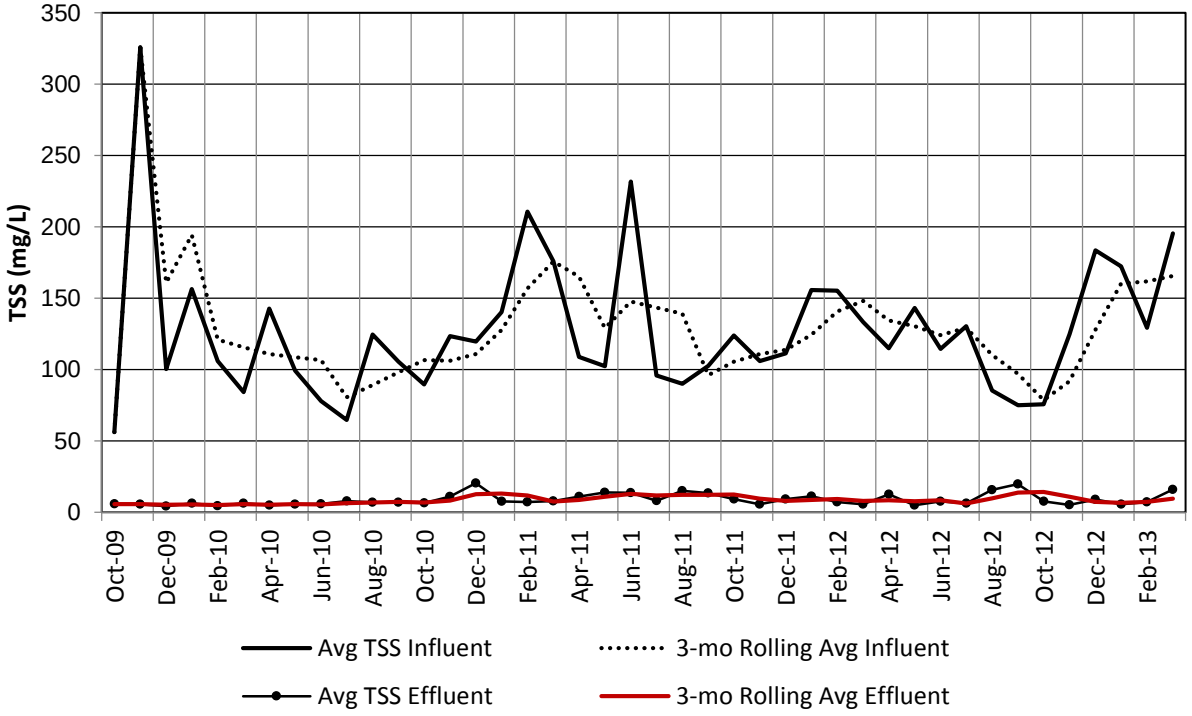
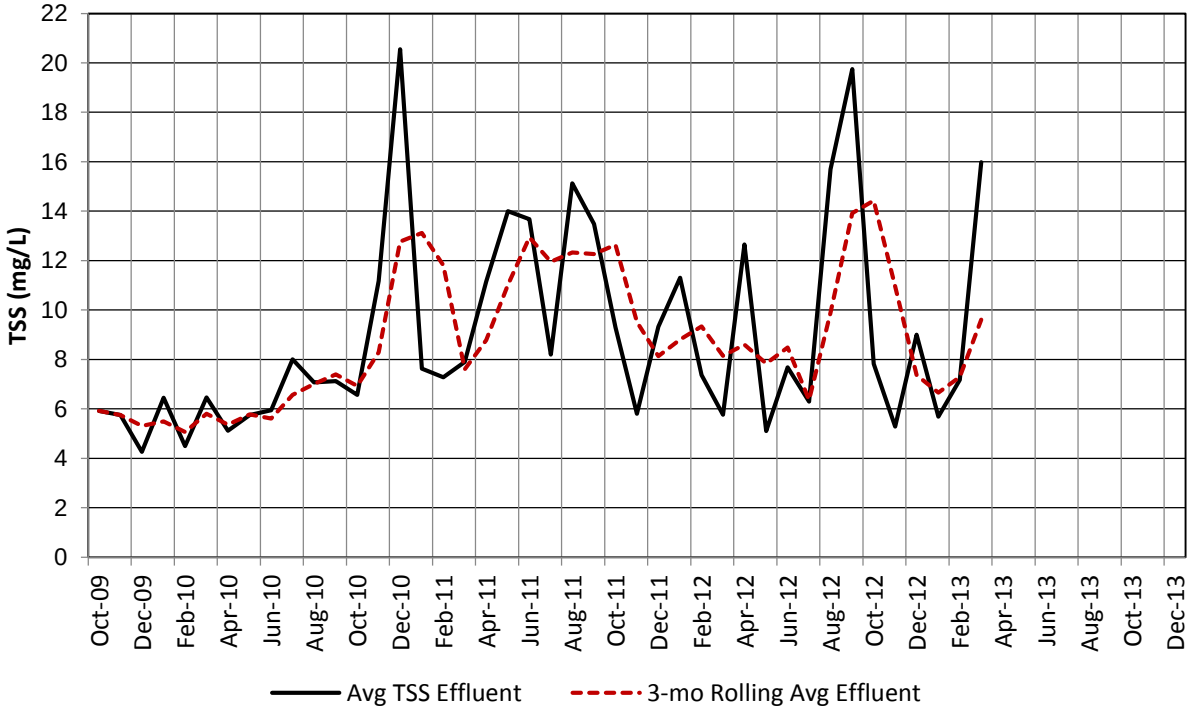


Figure 3-5 – Historical TSS Effluent Data (October 2009 through March 2013)



The annual average daily flow has exceeded the permitted flow of 1.2 mgd for the period of record extending from January 2002 through March 2013. There were no operational problems at the plant caused by hydraulic overloading of the treatment units. The three-month rolling average daily flow has been approximately 0.81 mgd, which is below the permitted annual average flow of 1.2 mgd. The corresponding influent values for $CBOD_5$ and TSS from October 2009 through March 2013 were 103 mg/L and 138 mg/L, respectively. These values correspond to 696 pounds per day of BOD_5, and 933 pounds per day of suspended solids loading, on an average at the plant. At the TMADF design capacity of 1.2 mgd, the plant is able to handle 2,000 pounds of $CBOD_5$ per day and 2,000 pounds per day of suspended solids on a maximum month concentration basis. The current loadings at the facility are based on data from March 2013 with an average flow that month of 0.78 mgd. The following is a tabulation of design and current operating values for $CBOD_5$ and TSS.

	Maximum Month Design Values		Current Loadings (March 2013)	
Parameter	Concentration (mg/L)	Quantity (lbs/day)	Concentration (mg/L)	Quantity (lbs/day)
$CBOD_5$	200	2,000	105	683
TSS	200	2,000	195	1,269

As shown in the above tabulation the current wastewater concentrations and loadings are well below the maximum design loadings of the Belle Glade WWTF.

3.5 Overall Treatment Efficiency

Based on the three month rolling average values for influent and effluent $CBOD_5$ and TSS, the average removal efficiencies for $CBOD_5$ and TSS are approximately 96 percent and 93 percent, respectively. These values indicate that the facility is capable of meeting the permit limitations required in the operating permit. Influent concentrations of $CBOD_5$ and TSS are slightly lower than similar size facilities. However, the ninety percent minimum removal is not difficult to maintain. At the current average daily flow, the plant is producing an effluent that consistently better than the required standards for $CBOD_5$ and TSS removal.

Effluent disposal down the deep injection well, permitted capacity of 4.0 mgd, has not exceeded the injection well capacity from January 2002 through March 2013. Flow to the existing on-site percolation pond, permitted capacity of 0.08 mgd, has not exceeded the permitted capacity over the same evaluation period.

Chapter 4 – Performance Trends

Performance trends in influent and effluent loadings for $CBOD_5$ and TSS are presented below.

4.1 Influent

For the four year period from January 2002 through March 2013, the monthly average influent $CBOD_5$ values ranged from 57 mg/L in July 2010 to 184 mg/L in January 2010, with an average of 103 mg/L (see Chapter 3 – Treatment Efficiency, Figure 3.2 and Table 3.1). During the same four year period, the TSS values ranged from 56 mg/L in October 2009 to a maximum of 326 mg/L in November 2009, with an average of 138 mg/L.

4.2 Effluent

The effluent values for $CBOD_5$ and TSS are presented in Table 3.1 for the period of October 2009 through March 2013. Figures 3.2 through 3.3 graphically illustrate the $CBOD_5$ and TSS data presented in Table 3.1. The monthly average effluent $CBOD_5$ values were within the range of 1.82 mg/L in February 2010 to 6.12 mg/L in March 2013. The monthly average effluent TSS values during the same period were within the range of 4.5 mg/L in February 2010 to 20.6 mg/L in December 2010. The $CBOD_5$ and TSS values for the WWTF effluent fall below permit limits for the facility.

4.3 Three-Month Average Daily Flows

Figure 3.1 contains plots of monthly average daily flows and three-month average daily flows 10 year data period. The Pahokee WWTF's three-month average flow has exceeded the permitted 1.2 mgd annual average daily flow capacity on several occasions over that 10 year period from October 2002 through March 2013.

4.4 Groundwater Quality (Groundwater Monitoring Wells)

In accordance with the County's current operating permit for the Pahokee WWTF, groundwater monitoring is not required.

4.5 Bypasses and Overflows

There have been no incidents of wastewater spills or incidents of non-compliance at the WWTF throughout the current permit cycle through March 2013. The plant capacity of 1.2 mgd has been exceeded throughout the review period.

Chapter 5 – Operation and Maintenance Program

5.1 Rule Requirements

Rules 17-600.717 and 17-600.730(4)(b), F.A.C. require that each domestic wastewater treatment facility must maintain up-to-date record drawings (plans and specifications) which identify modifications that have occurred since the original construction permit was issued.

Rules 17-600.720 and 17-600.730(4) (c), F.A.C., require that each wastewater treatment and effluent disposal or reuse facility must maintain up-to-date operation and maintenance manual(s).

5.2 Availability of Record Drawings

Up-to-date record drawings are available for the 1998-2001 construction program are available to the operators in the operations center of the Belle Glade WWTF located at 2205 W. Canal Street, South Belle Glade, Florida 33430.

5.3 Availability of Operation and Maintenance Manual

Copies of the Operation and Maintenance Manuals for the treatment, effluent disposal and sludge disposal systems are available to the operators at the Pahokee WWTF.

5.4 Contents of the Operation and Maintenance Manual

There is an Operation and Maintenance Manual (O&M Manual) for the Pahokee WWTF which is kept at the facility. The O&M Manual includes information on the liquid process stream, the sludge process and the injection well system. Those manuals are maintained by the operating staff and the Utilities Superintendent. These manuals include general information of the design of each component, interconnecting piping, valves and other physical aspects pursuant to Rule 62-700.720 (1) (b), 62-610.330 (2), 62-604.600 (2) (f) and 62-28.230 (3), F.A.C. Copies of the manuals are maintained at the WWTF site.

5.5 Operation and Maintenance Log

The County's WWTF operating staff maintains a series of logs on day to day activities at the facility. These logs include process disruptions such as mechanical or electrical failures, preventative maintenance work performed, corrective maintenance work performed, laboratory sampling and testing data as required throughout treatment process, work by outside contractors, residuals hauled off site for disposal, weather incidences and other such data in accordance with the requirements of 62-602.360 (1) (e), F.A.C.

The plant is typically manned with one person during the day shift and one person on the night shift. The plant is unmanned from midnight to 7:00 AM. Staffing for this facility is adequate for proper operations. Alarm conditions are monitored with an "on call" dialing system during the unmanned shift cycle.

In general the WWTF's maintenance and recordkeeping is adequate. Logs are very well maintained. Sampling programs are maintained in accordance with the requirements of the facility's FDEP permit. Laboratory procedures and tests are performed pursuant to the County's permit requirement. Sampling and testing is performed by a certified operator and under direction of a certified operator.

The County is not required to have an industrial pretreatment program in-place for the Pahokee WWTF. However, the County does have an ongoing cross connection control and inspection program.

5.6 Preventive Maintenance Program

A wastewater treatment plant cannot achieve maximum treatment efficiency without the proper operation and maintenance of equipment and facilities. Operation of the wastewater treatment plant must include flexibility to meet changing flow and load conditions while resulting in the production of a high quality plant effluent. County Staff have implemented several preventive maintenance programs to assist staff in performing the necessary duties to maintain the facilities.

The County has developed specific routine duties for each operator at the facility. Each Operator maintains a specific area(s) within the WWTF and these duties are typically carried out on a daily basis. The County has also implemented a valve exercising program where each valve or gate with the facility is identified as to location, unit process, criticality to the facility and frequency that the valve / gate is exercised. Routine maintenance is necessary to prevent equipment breakdown or malfunction which could lead to emergencies and / or unscheduled plant shutdowns. Table 5-1 presents the preventive maintenance schedule for the Belle Glade WWTF.

Table 5.1
Preventative Maintenance Schedule

Process	Frequency
Headworks	
Grinder - Inspect unit, grease all bearings, adjust chain, remove excessive grease	Monthly
Grinder - Grease bottom and top of the unit	Bi-Weekly
Auger - Inspect unit, grease all bearings, adjust chain, remove excessive grease	Monthly
Valves - Grease and inspect for rust	Monthly
Valves - Operate valve partially to insure operation	Semi-Annually
Blower House No. 1	
No. 1: 40 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly
No. 2: 40 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly

Table 5.1 (continued)
Preventative Maintenance Schedule

Process	Frequency
Blower House No. 2	
No. 1: 30 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly
No. 2: 30 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly
Blower House No. 3	
No. 1: 100 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly
No. 2: 100 Hp. Blower - Inspect unit and change air filter / check coupling and note excessive vibrations	Monthly
Samplers	
Effluent - Change out hose, inspect and clean unit, clean area	Monthly
Influent - Change out hose, inspect and clean unit, clean area	Monthly
Deep Well Pumps	
Effluent Pumps Nos. 1, 2, and 3 - Observe packing glands while running, adjust if packing is leaking, do work order if it needs to be repacked	Monthly
RAS/WAS	
RAS Pumps - 2 shots of grease in each of the two grease fittings on each pump	Bi-Weekly
Walker Plant	
Walker Drive - 10 shots of grease in each pillar bearing on each axle	Bi-Weekly
Walker Main Bearing - 10 shots of grease in each of the four grease fittings	Bi-Weekly

Chapter 6 - Collection System Evaluation

6.1 General

The Pahokee WWTF serves the City of Pahokee and the Canal Point area. There are 23 lift stations in the Pahokee service area and 17 grinder stations in the Canal Point service area. The Pahokee / Canal Point collection system consists of approximately 415 manholes and approximately 91,145 lineal feet of gravity mains.

The guidelines for the preparation of Operation and Maintenance Performance Reports state, "The collection system shall be evaluated if treatment plant problems, untreated bypasses for discharges, or overflows results from the operation of the collection and transmission facilities." At the Pahokee WWTF, no problems have occurred resulting from the operation of collection and transmission systems since the previous permit application. The plant does experience inflow and infiltration (I&I) and the County continues to work to minimize these contributions. The WWTF currently can operate within the permit requirements except on capacity with the additional flows that it receives from I&I.

6.2 Septic Wastewater

No treatment problem caused by the treatment of septic wastewater has occurred at the Pahokee WWTF.

6.3 Industrial Contributions

No major treatment problems have occurred at the Pahokee WWTF, caused by industrial waste contribution.

Chapter 7 – Problems, Deficiencies and Corrective Actions

7.0 General

Based on the field observations and results of the investigation and testing, the main problems associated with the Pahokee WWTF have to do with the age of the facility and some of the equipment. Below is presents the recommended repairs/modifications for the Pahokee WWTF.

Pahokee WWTF

Based on the evaluation, the Pahokee WWTF has been noted to require routine maintenance and corrective action. The overall structural condition of the entire facility is good and the plant is in operable condition. Deficiencies were observed (as documented in previous sections), such as cracks, leaks, corrosion in metals, coating failures, and damage to building components; but they are considered typical and expected in a 58 year old facility. However, it is noted that overall, the Pahokee WWTF operates adequately. The recommended repairs / modifications listed in order of priority are presented below. The recommended repairs are also separated into two categories: critical for continued use and non-critical / facility enhancement.

Critical repairs are those that are required to restore structural, mechanical or electrical integrity to the facility and prevent rapid deterioration of the structure, equipment and/or operation of the plant. Non-critical repairs will improve the performance of the facility by providing additional protection but their implementation may be delayed to meet the PBCWUD fiscal year budget. However, non-critical repairs may become critical if not implemented within a prudent time period. Non-critical repairs also include modifications that may be identified by PBCWUD as desired but their implementation is not required as part of the rehabilitation and will not impair the use of the facility.

Critical Repairs

1. Replacement of generators
2. New grit removal system at Headworks
3. Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps
4. Replace steel bridge supports on Primary and Secondary Clarifiers
5. Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)
6. Replace Walker Unit elevated influent pipe supports
7. Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)
8. Replacement of 12” valve on the Deep Injection Well System
9. Rehabilitate all three Secondary Clarifiers

10. Modify stair top support on Aeration Tank Nos. 1 and 2
11. Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office

Non-Critical Repairs

1. Replacement of the mechanical bar screen
2. Replace Digester stairs
3. Replace all diffusers
4. Influent Pump Station rehabilitation
5. Reconfigure Chlorine / Operations Building and replace 4-inch sewer line
6. Remove and replace all sidewalks
7. Replace Wet well By-Pass valve
8. Rehabilitate Chlorine Contact Chamber Nos. 1 and 2
9. Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)
10. Replace all six blowers
11. Recoat two Secondary Clarifiers and repaint the steel bridges
12. Recoat Primary Clarifier and repaint the steel bridge
13. Recoat the Walker Unit and repaint the steel bridge
14. Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)
15. Blower House Nos.1, 2 and 3 roof, door and louver replacement
16. Replacement of electrical equipment in the Blower House No. 3 (Main 1 of 2 (600A) (480V), Emergency Generator NO. 1 (200KW), Transfer Switch, DP-1 480V 3PH Panelboard, Blower No.1 SSRVS, Blower No.2 SSRVS, 7.5kVA Transformer, Panel LP-1 240V 1PH, Main 2 of 2 (400A) (480V))
17. Replacement of electrical equipment in the Blower House No. 2 (Emergency Generator NO. 2 (230KW), MCC-3 with 400A ATS, DP-2, Transformer for Panels LP-2/LP-3 50KVA 480-120/240 1PH, Size 1 Combination Starter (RAS Pump West), Size 1 Combination Starter (RAS Pump East), Size 1 Combination Starter (Secondary Clarifier East), Size 1 Combination Starter (Secondary Clarifier West), Size 1 Combination Starter (Primary Clarifier), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 2),LP-2 Main Breaker (40A), LP-3 Main Breaker (125A), 60A NEMA 1 480V 3PH Safety Switch (Blower No. 1), LP-2 120/240V 1PH)
18. Replacement of electrical equipment in the Blower House No. 1 (Size 3 Starter (Blower No. 1), Size 3 Starter (Blower No. 2))
19. Replacement of electrical equipment in the Pump Pad (Size 1 Combination Starter (Primary Sludge Pump), Size 1 Combination Starter (Wash Water Pump North), Size 1 Combination Starter (Wash Water Pump South))

20. Replacement of electrical equipment in the Chlorine / Operations Building (LP-3 120/240V 1PH, PLC-1)
21. Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility (P1 480V Panelboard, Transformer for Panel LP-1 30KVA 480-120/208 3PH, Panel LP-1 120/208V 3PH)
22. Replacement of electrical equipment in the Effluent Pump Station (100A NEMA 4X S.S. Safety Switch (Effluent Pump Nos. 1, 2 and 3))
23. Flow pace blowers
24. Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2
25. Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures
26. Replace pump and auger in the Bioset system
27. Installation of a security fence
28. Replace Effluent Pump starters with VFDs
29. PLC system upgrade
30. Replace manual valves with electronic controlled valves
31. Replace grounding at the Headworks
32. Painting of the facility
33. Epoxy coat floors

ATTACHMENT 1

FIELD EVALUATION FORM
FOR THE
OPERATION AND MAINTENANCE PERFORMANCE REPORT

PAHOKEE
WASTEWATER TREATMENT FACILITY

October 2013

FIELD EVALUATION FORM FOR
OPERATION AND MAINTENANCE PERFORMANCE REPORTS FOR
DOMESTIC WASTEWATER FACILITIES

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PHYSICAL CONDITION

Hydraulic and Organic Overloading

1. Is there evidence of past spills at the plant or through nearby (upstream) manholes? (Discoloration of the ground or a strong smell may indicate past spills at the plant)
   ( ) yes (**X**) no

2. Are raw sewage pumping stations, influent lines, overflow weirs, or other structure surcharged? ( ) yes (**X**) no

3. Is there flow through bypass channels? ( ) yes (**X**) no

4. Are there old high water lines or are the weirs on the clarifier flooded? ( ) yes (**X**) no

5. Are there overflows at alternative discharge points, channels, or other areas? ( ) yes (**X**) no

6. Are there any open-ended pipes that appear to originate in a process or storage area and periodically contain flows to the ground or to surface water? (Although these pipes have been disconnected from a closed system or otherwise removed from service, they can still be connected to a discharge source.)
   ( ) yes (**X**) no

7. Is the facility receiving excessive septage dumping from septic tanks? ( ) yes (**X**) no

8. Are checks for overflows performed routinely? (**X**) yes ( ) no

General Condition

1. Is there evidence of corrosion problems at the treatment plant and in the collection system? (**X**) yes ( ) no

2. Do any of the units or associated equipment show signs of excessive wear? (**X**) yes ( ) no

Rule Requirements

1. Does each component, system, or process meet the applicable reliability standards required by Rule 62-600.400(1)(b), F.A.C.? (**X**) yes ( ) no

2. Does the facility have adequate alarm systems for power or equipment failures as recommended by standard design references? (**X**) yes ( ) no

   Are they working properly? (**X**) yes ( ) no

3. Is standby power or other equivalent provisions provided for all components, systems, and processes as **recommended** by standard design references? (**X**) yes ( ) no

4. Are there adverse effects resulting from odors, noise, aerosol drift, and lighting at the facility? ( ) yes (**X**) no

5. Are there piles of collected screenings, slurries, residuals, or by-products of treatment? (Their disposal, including run-off of any water, must be such that none enters surface waters or their tributaries.) ( ) yes (**X**) no

Operating Problems

1. Are all components, systems, or processes (including associated equipment such as pumps, blowers, air compressors, oxygen systems, scum collection systems, residuals collection systems, diffusers, mechanical aerators, mechanical drives, mechanical mixers, motors, residuals heater, feed systems, backwash systems, control systems, flow measurement devices, automatic valves, ventilation fans, and other miscellaneous equipment) operating properly? (**X**) yes ( ) no

   If no, explain.

   _____
   _____
   _____
   _____
   _____

2. Are any components, systems, or processes out of service? ( ) yes (**X**) no

   If yes, complete the following table for each component, system, or process that is not operating.

Name	Date Out of Service	Type of Failure	Expected Date to Return to

3. Are there excessive noises associated with any component, system, or process? ( ) yes (**X**) no

4. Is there any unusual equipment intended to correct operational problems (e.g. special pumps, floating aerators in diffused air systems, chemical feeder, temporary construction or structures, or any improvised systems)? ( ) yes (**X**) no

5. Are all components, systems, and processes expected to continue to operate properly for the permit period? (**X**) yes ( ) no

   If no, explain. _____
   _____
   _____
   _____

Safety Features

1. Are proper safety precautions used for each component, system, and process? (**X**) yes ( ) no

   If no, explain. _____
   _____
   _____
   _____

2. Is a written set of safety rules available to all employees? (**X**) yes ( ) no

3. Is the plant generally clean and free from open trash areas? (**X**) yes ( ) no

4. Is the plant site enclosed with a fence or otherwise designed with appropriate features that discourage the entry of animals or unauthorized persons? ( ) yes (**X**) no

5. Are wastewater pipes clearly distinguished from product pipes? (**X**) yes ( ) no

6. Are there any cross connections between a potable water supply and non-potable source? ( ) yes (**X**) no

7. Does the plant have the following recommended safety equipment?

   a. Portable air blower (gas motor or electric motor operated) (**X**) yes ( ) no

   b. Electric explosion-proof lantern (**X**) yes ( ) no

   c. Safety harness (**X**) yes ( ) no

   d. Hose mask with hand blower and 50-foot hose ( ) yes (**X**) no

   e. Self contained breathing apparatus for plants using chlorine ( ) yes ( ) no (**X**) not applicable

   f. Explosion and oxygen meters (**X**) yes ( ) no

8. Is personal protective clothing provided (safety helmets, ear protectors, goggles, gloves, rubber boots with steel toes, etc)? (**X**) yes ( ) no

9. Are portable hoists available for equipment removal? (**X**) yes ( ) no

10. Are ladders provided to enter manholes of wetwells (fiberglass or wooden for electrical work)? (**X**) yes ( ) no

11. Are life preservers and throwlines provided adjacent to all basins, ponds, and lagoons? ( ) yes (**X**) no

12. Are handrails provided and in-place around all basins and openings? (**X**) yes ( ) no

13. Are all stairs, walkways, and platforms free of grease, oil, and debris and are nonskid surfaces used when needed? (**X**) yes ( ) no

14. Is adequate lighting provided? (**X**) yes ( ) no

15. Are all components, systems, and processes adequately ventilated? (**X**) yes ( ) no

16. Are protective guards provided and in-place on all rotating machinery? (**X**) yes ( ) no

17. Is all electrical circuitry enclosed and identified? (**X**) yes ( ) no

18. Are appropriate warning signs posted (no smoking, high voltage, non-potable water, chlorine hazard, toxic and flammable gases, etc)? (**X**) yes ( ) no

19. Are emergency shower and eye wash facilities provided where needed? (**X**) yes ( ) no

20. Are appropriate fire extinguishers provided where needed? (**X**) yes ( ) no

21. Is instrumentation provided and operational for the detection of toxic and flammable gases and low oxygen levels? (**X**) yes ( ) no

22. Do pressure vessels operate within their design rating and have a functional pressure relief? (**X**) yes ( ) no ( ) not applicable

23. Are chemicals stored properly? (**X**) yes ( ) no

24. Are undiked oil/chemical storage tanks used at the facility? ( ) yes ( ) no (**X**) not applicable

25. Are chemical storage tanks designed to handle the particular chemical? (**X**) yes ( ) no ( ) not applicable

26. Are storage bins provided with dust collectors and vents? ( ) yes ( ) no (**X**) not applicable

27. Are storage bins large enough to avoid continuous filling which requires the presence of an operator all the time? ( ) yes ( ) no (**X**) not applicable

28. Are access points for sampling dry points which can be reached safely? (**X**) yes ( ) no

OPERATION AND MAINTENANCE PROGRAM

Staffing

1. Is the facility adequately staffed with certified operators in accordance with the requirements of Rule 17-602, F.A.C.? (**X**) yes ( ) no

Maintenance Management

1. Is there an identification system to locate and identify all items of equipment? (**X**) yes ( ) no

2. Does the facility maintain a records system which includes the following?

   a. Preventive and corrective maintenance work performed (**X**) yes ( ) no

   b. Maintenance man-hours (**X**) yes ( ) no

   c. Spare parts used in the repair (**X**) yes ( ) no

   d. Name of the person performing the work (**X**) yes ( ) no

   e. Maintenance related costs (**X**) yes ( ) no

3. Is routine and preventive maintenance scheduled and performed on time? (**X**) yes ( ) no

4. Are adequate spare parts and supply inventories maintained for each component, system, and process? (**X**) yes ( ) no

5. Is the maintenance program adequate? (**X**) yes ( ) no

   If no, explain. _____

   _____

Records Keeping

1. Are records required by the permit maintained for a period of five years? (**X**) yes ( ) no

2. Is the information required by the permit available, complete, and current? (**X**) yes ( ) no

3. Are analytical results consistent with the data reported in the following?

   a. Monthly operating report (**X**) yes ( ) no

   b. Limited wet weather discharge report (**X**) yes ( ) no

   c. Ground water monitoring report (**X**) yes ( ) no

   d. Reclaimed water or effluent analysis report
   (**X**) yes ( ) no

4. Do sampling and analyses data include the following?

   a. Dates, times, and location of the sampling
   (**X**) yes ( ) no

   b. The name of the individual performing the sampling
   (**X**) yes ( ) no

   c. The analytical methods and techniques used
   (**X**) yes ( ) no

   d. The results of the analyses and calibration
   (**X**) yes ( ) no

   e. The dates of the analyses (**X**) yes ( ) no

   f. The name of the person performing the analyses
   (**X**) yes ( ) no

   g. The instantaneous flow at the grab sample station
   ( ) yes (**X**) no

5. Do monitoring records include records for all parameters that must be monitored in accordance with the permit?
   (**X**) yes ( ) no

6. Are flow meter calibration records available?
   (**X**) yes ( ) no

7. Are laboratory equipment calibration and maintenance records adequate? (**X**) yes ( ) no

8. Are plant records adequate and do they include the following?

   a. A copy of the Department permit (**X**) yes ( ) no

   b. An up-to-date operation and maintenance manual (**X**) yes ( ) no

   c. Record drawings (**X**) yes ( ) no

   d. Schedules and dates of equipment maintenance repairs (**X**) yes ( ) no

   e. Equipment suppliers manual (**X**) yes ( ) no

   f. Equipment data cards or equal (**X**) yes ( ) no

9. Are operating records adequate? (**X**) yes ( ) no

10. Have all untreated bypasses and discharges or overflows been reported to the Department? (**X**) yes ( ) no

    If no, explain._____
    _____
    _____
    _____

Sampling

1. Are samples taken at the sites specified in the permit? (**X**) yes ( ) no

2. Is sampling and analysis completed for each parameter specified by the permit? (**X**) yes ( ) no

3. Is the frequency of sampling in accordance with the permit? (**X**) yes ( ) no

4. Is the method of sample collection (grab or composite) in accordance with the permit? (**X**) yes ( ) no

5. Are sample collection procedures in accordance with the approved test procedures referenced in Rule 62-601.400(1)(a), F.A.C.? (**X**) yes ( ) no

6. For flows of 100,000 gallons per day or greater, are recording flow meters and totalizers used? (**X**) yes ( ) no
( ) not applicable

7. Are flow recording devices calibrated at least annually? (**X**) yes ( ) no

Laboratory Analysis

1. Are all laboratory tests required by Department rules performed by a laboratory that has been certified by HRS, or, for on-site tests for dissolved oxygen, pH, and total chlorine residual, are all tests performed by a certified laboratory or under the direction of an operator certified in accordance with Chapter 61E12-41, F.A.C.? (**X**) yes ( ) no.

INDIVIDUAL COMPONENTS, SYSTEMS, AND PROCESSES

PUMPING

Raw Wastewater **(N/A, multiple lift stations feed the Facility)**

1. What is the location of the pump station? 1)
2. What is the design flows to the pump station?

Station	Average	Peak
1)	gpm	gpm
2)	gpm	gpm

3. What is the actual flows to the pump station?

Station	Average	Peak
1)	gpm	gpm
2)	gpm	gpm

4. What types of pump control system is used? ( ) variable speed ( ) constant speed

5. If the control system is variable speed, what type of controller is used? _____( ) not applicable

6. If multiple pumps are used, how is each unit operated? ( ) about 15-20% apart ( ) equally ( ) not alternated ( ) not applicable

   Is the system remotely monitored? ( ) yes ( ) no ( ) not applicable

7. Does the pump station have a bypass? ( ) yes ( ) no

   If yes, can the bypass flow be disinfected? ( ) yes ( ) no ( ) not applicable

8. Can the wet well be isolated into a minimum of two separate basins for maintenance? ( ) yes ( ) no

9. If one wet well basin is down for maintenance, how many pumps are operable? _____

10. Does the wet well design provide for equal division of flow to each of the pumps? ( ) yes ( ) no

11. What is the condition of the sump pump? ( ) good ( ) fair ( ) poor ( ) not applicable

12. What is the condition of the water seal systems? ( ) good ( ) fair ( ) poor ( ) not applicable

13. How often is the pump station checked? ( ) daily ( ) other

14. What is the downtime of the pumps? _____

15. What is the frequency of maintenance inspections by plant personnel? _____/year

16. If the pump station is constant speed, do sudden surges affect the operation of the treatment facility when each pump is activated? ( ) yes ( ) no ( ) not applicable

17. What is the general condition of the raw wastewater pump station? ( ) good ( ) fair ( ) poor

18. What are the most common problems that the operator has had with the pump station? If there are problems with the screens, use the section on screens.

_____

_____

PUMPING

Residuals

1. What is the design residuals pumping rate? 1,200,000 gallons/day RAS 20,0000 gallons/day WAS

2. What is the actual residuals pumping rate? _____ gallons/day RAS _____ gallons/day WAS

3. What types of residuals are pumped? ( ) primary (X) return activated sludge (X) waste activated sludge ( ) Other

4. How are residuals pumped? ( ) manually (X) automatically

5. How often do the residuals pumps run? continuously

6. What is the frequency of maintenance inspections by plant personnel? 12 /Year

7. What is the general condition of the residuals pump station? (X) good ( ) fair ( ) poor

8. What are the most common problems that the operator has had with the pump station?

_____

_____

FLOW MEASUREMENT

1. What type of flow meter is used? ( ) propeller meter
   ( ) magnetic meter ( ) venturi tube ( ) flow tube
   ( ) positive displacement ( ) diaphragm meter ( ) weir
   (x) Parshall flume ( ) rotameter ( ) other_____

2. What is the design capacity of the flow measurement device?
   4 mgd

3. What is the present wastewater flow measured? _____ mgd

4. Where is the flow meter located?

5. Are the flow measurement device and associated instruments (totalizers, recorders, etc.) properly installed?
   (X) yes ( ) no

6. Is there adequate straight length of pipe or channel before and after the flowmeter? (X) yes ( ) no

7. Is the flow entering the flume reasonably well-distributed across the channel and free of turbulence, boils, or other disturbances? (X) yes ( ) no ( ) not applicable

8. Is the flow measurement system capable of measuring the entire range of wastewater flow? (X) yes ( ) no

9. Are flow measurements being properly made by plant personnel?
   (X) yes ( ) no

10. Are flow records properly kept? (X) yes ( ) no

11. Are sharp drops or increases in flow records accounted for?
    (X) yes ( ) no

12. Does the flow chart exhibit uniform flow? (X) yes ( ) no

13. Do any plant return flows discharge upstream from the meter?
    ( ) yes (X) no

14. Are float and bubble wells clean and free of grease and debris? ( ) yes ( ) no (x) not applicable

15. Are weirs free of debris? (X) yes ( ) no ( ) not applicable

16. Are weirs or flumes broken or cracked? ( ) yes (X) no ( ) not applicable

17. Are weir plates corroded or damaged, not sharp edged (# 1/8"), or not level? ( ) yes ( ) no (X) not applicable

18. Are stilling wells clogged or broken? ( ) yes ( ) no (X) not applicable

19. What is the frequency of calibration of the flow meter? 1/ year

20. What date was the flow meter last calibrated? _____

21. Who performed the calibration? _____

22. What is the frequency of routine inspections for proper operation? 2 times / day

23. What is the frequency of maintenance inspections by plant personnel? 2 times/year

24. What is the general condition of the flow measurement facilities? (X) good ( ) fair ( ) poor

25. What are the most common problems that the operator has had with the flow meter?

_____

PRELIMINARY TREATMENT

Screens **(N/A the Plant has an Auger Monster at the Headworks)**

1. What is the design flows of the screens? ____mgd average ___mgd peak

2. What is the actual plant flow? _____mgd average _____mgd peak

3. What type of screens are used? ( ) manual ( ) mechanical

4. How many screens are there?

5. What is the capacity of each screen? ____mgd average

6. How large are the screen openings? ___mm

7. What are the dimensions of the channels? ___ depth

8. What is the total daily volume of screenings? _____ cubic ft

9. What is the unit volume of screenings? _____cubic ft/million gallons

10. Is there excessive screen clogging or build-up of debris against the screens? ( ) yes ( ) no

11. Is there a bypass channel? (x) yes ( ) no

    Does the bypass channel have a screen?
    (X) yes ( ) no ( ) not applicable

12. Does the influent channel design provide equal division of flow to each screen? ( ) yes ( ) no.

13. How are screenings disposed? _____ landfilled

14. What is the frequency of routine inspections for proper operation? __2__ times/day

15. What is the frequency of maintenance inspections by plant personnel? __12__ times/year

16. What is the downtime of the screens? _____

17. What is the general condition of the screening facilities?
( ) good ( ) fair ( ) poor

18. What are the most common problems that the operator has had with the screening facilities? _____

PRELIMINARY TREATMENT

Grit Removal

1. What is the design capacity of the grit removal system?
___ mgd average _ mgd peak

2. What is the actual plant flow? _____ mgd average
_____ mgd peak

3. What type of grit removal system is used? ( ) velocity controlled ( ) aerated ( ) constant head ( ) other

4. How many grit removal units are there?

5. What is the capacity of each unit? ___mgd peak

6. What are the dimensions of the units? __ feet in diameter by feet water depth

7. What is the daily volume of grit? _____ cubic feet

8. What is the unit volume of grit? _____ cubic ft/ million gallons

9. How is the grit collection equipment operated?
( ) manually ( ) time clock ( ) continuous duty

10. Is the grit system clogged? ( ) yes ( ) no

11. Is the grit system subject to odors? ( ) yes ( ) no

12. Is the organic content of the grit excessive?( ) yes (X) no

13. Is there a bypass channel? ( ) yes ( ) no

14. Does the influent channel design provide equal division of flows to each grit removal unit? ( ) yes ( ) no ( ) not applicable

15. How is the grit disposed? Landfilled

16. What is the frequency of routine inspections for proper operation? times / day

17. What is the frequency of maintenance inspections by plant personnel? times / year

18. What are the most common problems that the operator has had with the grit removal facilities? _____

BIOLOGICAL TREATMENT

Activated Sludge

1. How many reactor basins are there? 2

2. What is the design capacity of each basin? 0.70/0.50 mgd

3. What is the actual flow to each basin? ____ mgd average ___mgd peak

4. What is the flow regime? (X) conventional ( ) step aeration (X) complete mix ( ) pure oxygen (PSA) ( ) other _____

5. What type of aeration equipment is used? (X) diffused air ( ) mechanical aerators ( ) other

6. What are the dimensions of each aeration basin?

7. What is the color of the activated sludge? ( ) black ( ) dark brown (X) light brown ( ) other_____

8. What is the odor of the activated sludge? ( ) septic (X) earthy ( ) none ( ) other _____

9 What characteristics most accurately describe the foam? ( ) Light Crisp ( ) Thick Dark ( ) heavy, white (X) none

10. Are the tank contents mixed thoroughly? (X) yes ( ) no

11. Are there excessive air leaks in the compressed air piping? ( ) yes (X) no ( ) not applicable

12. Is the dissolved oxygen level in the reactor basin low (# 1.0 mg/l)? ( ) yes (X) no

13. Does mixing appear excessive? ( ) yes (X) no

14. Does air rise in clumps? ( ) yes (X) no

15. Do there appear to be dead spots in the reactor basin? ( ) yes (X) no

If yes, at what location? _____

16. What is the depth of the sand and grit layer? Unknown

17. What is the active capacity of the reactor basin?
__cubic ft per reactor

18. Is the process operating in its design mode? (X) yes
( ) no If no explain. _____

19. Are the return activated sludge pumps operating? (X) yes
( ) no If no, what is the reason?_____

20. Are there flow measurement devices for the return activated sludge and waste activated sludge systems? (X) yes ( ) no

21. Does the reactor basin have a foam control system?
( ) yes (X) no

22. If multiple basins are operating, is the flow distributed equally? (X) yes ( ) no ( ) not applicable

How is it distributed? Horizontal weir at the influent splitter box.

23. Are the characteristics of the basin contents different in the various units? ( ) yes (X) no ( ) not applicable

24. How is the system operated? ( ) manually ( ) semi-automatically ( ) automatically (X) computer-controlled ( ) other _____

25. What is the frequency of routine inspections for proper operation? 2 times /day

26. What is the frequency of maintenance inspections by plant personnel? 12 times/year

27. What is the general condition of the activated sludge facilities? ( ) good (X) fair ( ) poor

28. What are the most common problems that the operator has had with the activated sludge system? _____

SEDIMENTATION

Final

1. How many final sedimentation basins are there? 3

2. What is the design capacity of each basin? ____ mgd average
   mgd peak

3. What is the actual flow to each basin? ____ mgd average __ mgd peak

4. What are the dimensions of the basins?

5. Is chemical addition used to improve settling? ( ) yes (X) no

   If yes, what chemical(s) are added? _____

6. Is there an excessive accumulation of scum, grease foam, or floating residuals in the clarifier? ( ) yes (X) no

7. Are there excessive gas bubbles on the surface of the clarifier? ( ) yes (X) no

8. Is there scum overflow, lack of adequate scum disposal, or is the scum pit full? ( ) yes (X) no

9. Does the tank surface indicate improper residuals withdrawal (i.e., excessive floating solids, gas, etc.) ( ) yes (X) no

10. What volume of residuals is pumped? _____ gpd total; _____ gpd RAS; _____ gpd WAS

11. What is the solids concentration of the residuals? 1 %

12. Are there settleable solids in the effluent? ( ) yes (X) no

13. How are residuals pumped? ( ) manually (X) automatically

14. How often do residuals pumps run? Continuously .

    How long do residuals pumps run? Continuously

15. Does the residuals collection system show any signs of mechanical failure? ( ) yes (X) no

16. Are there excessive residuals on the bottom of the basin (i.e., inadequate residuals removal)? ( ) yes (X) no

17. Is there excessive solids build-up in the center well of the clarifier? ( ) yes (X) no

18. What is the depth of the sand and grit layer? UNKNOW feet

19. Are residuals withdrawal ports clogged? ( ) yes (X) no

20. Is the residuals blanket too high? ( ) yes (X) no

21. Is there deflocculation in the clarifier? ( ) yes (X) no

22. Is there pin floc in the overflow? ( ) yes (X) no

23. Is there billowing sludge in the clarifier? ( ) yes (X) no

24. Does the influent baffle system accomplish its purpose? (X) yes ( ) no

25. Does the effluent baffle system accomplish its purpose? (X) yes ( ) no

26. Does the unit show signs of short circuiting and/or overloads? ( ) yes (X) no

27. Are the effluent weirs level? (X) yes ( ) no

28. Are the effluent weirs clean? (X) yes ( ) no

29. If multiple units are used, is the flow distributed evenly? (X) yes ( ) no ( ) not applicable

30. What is the frequency of routine inspections for proper operation? 2 times/ day

31. What is the frequency of maintenance inspections by plant personnel? 12 times /year

32. What is the general condition of the final sedimentation facilities? (X) good ( ) fair ( ) poor

33. What are the most common problems that the operator has had with the final sedimentation facilities?

_____.

FILTRATION (N/A)

1. How many filter units are there?

2. What is the design capacity of each unit? ___mgd average mgd peak

3. What is the actual flow to each unit? _____ mgd average mgd peak

4. What type of filters are used? ( ) gravity ( ) pressure

5. What type of filter media is used? ( ) sand ( ) dual media ( ) mixed media ( ) multi-media ( ) diatomaceous earth ( ) other

6. What is the surface loading rate? _____ gpm/ft^2

7. What is the backwash rate? _____ gpm/ft^2

8. What is the surface wash rate? __gpm/ft^2

   What is the pressure of the surface wash? _____ psi

9. What type of control system is used? ( ) constant flow ( ) headloss ( ) time ( ) turbidity of effluent ( ) total gallons filtered ( ) other

10. Are the valves sequencing (opening and closing in order) correctly? ( ) yes ( ) no ( ) not applicable

11. Is there a coagulant aid (filtration aid) system? ( ) yes ( ) no

    If yes, what type?

12. What are the dimensions of the filter?

13. How is the filter system operated? ( ) automatically ( ) manually ( ) semi-automatically ( ) other _____

14. Is the filter surface clogged? ( ) yes ( ) no

15. Is the filter run short? ( ) yes ( ) no

16. Is there gravel displacement of the filter media? ( ) yes ( ) no

17. Is there formation of mud balls in the filter media? ( ) yes ( ) no

18. Is there air binding of the filter media? ( ) yes ( ) no

19. Is there a loss of filter media during backwashing? ( ) yes ( ) no

20. Is there recycled filter backwash water in excess of five percent of the wastewater flow treated? ( ) yes ( ) no

21. What is the frequency of routine inspections for proper operation? _____ times/day

22. What is the frequency of maintenance inspections by plant personnel? _____ times /year

23. What is the general condition of the filtration facilities? ( ) good ( ) fair ( ) poor

24. What are the most common problems that the operator has had with the filtration facilities? _____

DISINFECTION (N/A)

Chlorination

1. How many chlorine contact basins are there?

2. What is the design capacity of each basin? ____ mgd average _____ mgd peak hourly flow

3. What is the actual flow to each basin? _____ mgd average mgd peak hourly flow

4. What are the dimensions of the basins?

5. What is the detention time of each contact basin at peak hourly flow? __ minutes

6. What chlorine dosage is applied? _____ mg/l

7. What is the normal level of chlorine residual in the basin effluent? _____ mg/l

8. Are disinfection standards being met? ( ) yes ( ) no

9. What type of chlorination system is being used?
   ( ) chlorine cylinders ( ) on-site sodium hypochlorite generation ( ) sodium hypochlorite solution
   ( ) calcium hypochlorite solution

10. What is the design capacity of the chlorination system? _____lbs/day

    What is the maximum capacity of the chlorination system? _____ lbs/day

11. What is the configuration of the chlorine contact basin?
    ( ) round ( ) rectangular ( ) other

12. Is the contact basin adequately baffled to minimize short-circuiting? ( ) yes ( ) no

13. How is chlorine introduced into the wastewater entering the contact basin? ( ) perforated diffusers ( ) injector with single entry point ( ) other _____

14. Are mechanical mixing provisions incorporated in the chlorine contact basins design? ( ) yes ( ) no

15. Is there an adequate reserve supply of chlorine?
( ) yes ( ) no

How many days of supply is maintained? ____ days

16. Are there high temperatures in the chlorination rooms?
( ) yes ( ) no

17. Is there a build-up of residuals in the basin?
( ) yes ( ) no

18. Are there gas bubbles in the basin? ( ) yes ( ) no

19. Is there floating scum and/or solids in the basin?
( ) yes ( ) no

20. Is there excessive foaming downstream? ( ) yes ( ) no

21. Is there evidence of toxicity (dead fish, other dead organisms) downstream? ( ) yes ( ) no

22. What is the frequency of routine inspections for proper operation? _____ times/day

23. What is the frequency of maintenance inspections by plant personnel? _____ times /year

24. What is the general condition of the chlorination facilities?
( ) good ( ) fair ( ) poor

25. What are the most common problems that the operator has had with the chlorination process? _____

RESIDUALS TREATMENT

Chemical Conditioning

1. What is the actual volume of residuals conditioned? _____gpd average

2. What is the design residuals volume? _____gpd average

3. What type of residuals are conditioned? ( ) primary (X) waste activated ( ) other

4. What type of chemical is used for conditioning? (X) lime ( ) ferric chloride ( ) polymer (X) other

5. What is the chemical dosage? ____ lbs polymer/ton dry solids average and _____ tons lime/day/100,000 gal

6. How are chemicals purchased? (X) dry lime ( ) liquid polymer

7. What chemical storage volume is provided? ___ days lime and ____ days polymer

8. How are chemicals fed? (X) automatically ( ) manually

9. If dry feeders are used, what type of feeder is used? ( ) volumetric ( ) gravimetric ( ) not applicable

10. Are chemical feeders automatically paced? (X) yes ( ) no

11. If lime is used, how is the lime purchased? ( ) bags (X) bulk

12. If lime feeding is used, is a vapor and dust collection system installed? (X) yes ( ) no ( ) not applicable

13. Does the unit show signs of inadequate mixing? ( ) yes (X) no

14. What is the frequency of routine inspections for proper operation? 2 times /day

15. What is the frequency of maintenance inspections by plant personnel? 12 times /year

16. What is the general condition of the residuals chemical conditioning facilities? (X) good ( ) fair ( ) poor

17. What are the most common problems that the operator has had with the residuals chemical conditioning facilities? _____

RESIDUALS TREATMENT (N/A)

Dewatering: Belt Filter Presses

1. How many belt filter presses are there?

2. What is the design influent flow to each belt filter press? _____ gallons / minute

3. What is the actual influent flow to each belt filter press? _____ gallons / minute

4. What is the percent solids of the influent residuals? ___%

5. What is the belt filter press volume? _____ cubic feet

6. What is the percent solids in the discharge cake? _____%

7. Are there settleable solids in the filtrate? ( ) yes ( ) no

   If yes, what is the solids concentration? _____ mg/1

8. How often does each belt filter press run? ____ hours per day
   How long does each filter operate each run __ minutes

9. If acid washing is provided, is a recirculating system included? ( ) yes ( ) no ( ) not applicable

10. What type of conditioning chemicals are used? ( ) lime ( ) alum ( ) ferric chloride ( ) other

11. What amount of conditioning chemicals are pumped? _____ lb/day

12. How are residuals pumped? ( ) manually ( ) automatically

13. How are chemicals fed? ( ) manually ( ) automatically

14. How often do residuals pumps run?

    How long do residuals pumps run each cycle?

15. How often does conditioning equipment run?
    How long does conditioning equipment run each cycle? _minutes

16. If multiple units are used, is the flow distributed evenly? ( ) yes ( ) no ( ) not applicable

17. Does the unit show signs of short circuiting and/or overloads? ( ) yes ( ) no

18. Is there a high level of solids in the filtrate? ( ) yes ( ) no

19. Is the filter cake thin? ( ) yes ( ) no

20. Is there a residuals build-up on the belts and/or rollers of the belt filter press? ( ) yes ( ) no

21. Is there excessive moisture in the belt filter press residuals cake? ( ) yes ( ) no

22. Is there difficult cake discharge from the belt filter presses? ( ) yes ( ) no

23. Does the filter cake stick to the solids-conveying equipment of the belt filter press? ( ) yes ( ) no

24. Is there frequent media binding of the belt filter press? ( ) yes ( ) no

25. What is the frequency of routine inspections for proper operation? ____ times __ /day

26. What is the frequency of maintenance inspections by plant personnel? ____ times __ /year

27. What is the general condition of the belt filter press facilities? ( ) good ( ) fair ( ) poor

28. What are the most common problems that the operator has had with the belt filter presses? _____

DISPOSAL SYSTEMS

Injection Well

1. What is the name and address of the facility where the injection wells(s) is located? Pahokee WWTF, 1001 Rim Canal Road, Pahokee, Florida 33476.

2. Are additional facilities served by the injection well(s)? No

3. How many injection wells are there? 1

4. What is the maximum permitted flow to each injection well? 4.4 mgd peak hour flow

5. How many days during the last year has the actual maximum flow to the well exceeded the maximum permitted flow? None

6. What was the average daily flow to each well during the last year? 0.81 mgd

7. What is the inside diameter of each well? 12 inches

8. Is there a fluid-filled annulus? ( ) yes (X) no

9. What percentage of the total flow to the domestic wastewater treatment plant is from non-domestic sources? ____%

10. Are there any waste stream sources that bypass the wastewater treatment plant and discharge directly to the wet well? ( ) yes (X) no

11. Does the fluid in the wet well appear to be free of solids/floatables? (X) yes ( ) no

12. What instrumentation is found at each well head?
(X) injection pressure (X) injection flow

13. What were the instrument readings during the inspection and the appropriate adjustment factors, if any?

    a. Injection pressure _____ psi
       Adjustment factor: _____

    b. Injection flow _____ mgd

Adjustment factor: _____

c. Annulus pressure ___ psi
Adjustment factor:

d. other (specify) ____units
Adjustment factor: _____

14. What is the general condition of the well head instruments?
(X) good ( ) fair ( ) poor

15. How often are the instruments calibrated? ___1__ times/year

16. When were the instruments last calibrated?

a. Injection pressure _____

b. Injection flow _____

c. Annulus pressure N/A

d. Other (specify type) N/A Type:

17. Is there surge and water hammer control equipment present?
(X) yes ( ) no

If yes, what is the general condition of the surge and water hammer control equipment? (X) good ( ) fair ( ) poor

If poor, what is the problem?_____

18. Has mechanical integrity testing been conducted within the last five years? (X) yes ( ) no

If yes, complete the following:

a. Pressure test date: 9/11/09
Test Pressure 150.5 psi
Pressure loss 2 psi
Test Duration 60 minutes

c. Temperature log date: 9/23/09
Is there any anomalous temperature data?
( ) yes (X) no
If yes, explain._____

d. Radioactive tracer survey date: 9/23/09

Was fluid movement indicated? ( ) yes (X) no

19. What is the predetermined acceptable limits for annulus pressure? N/A

20. How many monitoring wells are there associated with the injection system? N/A

21. Where are the monitoring wells located relative to the injection well(s) (distance/direction)?

22. Is each monitoring well functional? ( ) yes ( ) no
If no, what is the problem?

23. Which zones are the monitoring wells designed to monitor?

Well Number Monitoring Interval

What volume of water is purged from each monitoring well prior to sampling?

25. How is the purge water disposed of?
( ) returned to wet well
( ) returned to head of treatment plant
( ) surface water discharge (may require separate permit)
( ) on well pad or ground (not acceptable)
( ) other (specify) _____

26. What chemical parameters are monitored and at what frequency are these parameters monitored?

Parameter Frequency

27. Have any water quality trends been observed in the monitoring data? ( ) yes ( ) no

If yes, which parameters are affected and what trend has been observed (increase/decrease)?

Parameter Trend Observed

_____
_____
_____

28. What type of monitoring well instrumentation is present?
( ) pressure ( ) water level ( ) flow

29. When was the monitoring well instrumentation last calibrated?
_____

30. Does the water level/pressure data show a trend?
( ) yes ( ) no

31. Are there any fluid leaks, or evidence of fluid leaks, at the injection or monitoring well heads? ( ) yes ( ) no

32. Do the well heads, valves, and other surface appurtenances appear to be in good working order and well maintained?
(X) yes ( ) no

33. What is the general condition of the injection and monitoring well heads and other surface appurtenances?
(X) good ( ) fair ( ) poor

34. What is the emergency discharge method?
( ) other well(s) ( ) surface waters (X) percolation ponds
( ) other (specify)

35. Are facilities in place to use the specified emergency discharge method? (X) yes ( ) no

36. Are the injection and monitoring well heads fenced or otherwise protected from accidental damage by heavy equipment?
( ) yes (X) no

37. Are plant operators familiar with procedures for emergency shut down of the injection system? (X) yes ( ) no

38. Is an emergency procedures manual located on-site?
(X) yes ( ) no

REUSE (N/A)

1. Is at least secondary filtration treatment provided? ( ) yes ( ) no

2. Is high level disinfection provided? ( ) yes ( ) no

3. Do the treatment facilities have permitted capacities in excess of the minimum system size requirements (0.1 mgd for public access systems, 0.5 mgd for residential irrigation, 0.5 mgd for edible crop irrigation)? ( ) yes ( ) no

4. Is there a DER-approved cross-connection control program covering the areas served by reclaimed water? ( ) yes ( ) no

5. Is there a uniform system for color coding and/or marking reclaimed water pipes? ( ) yes ( ) no

6. Does the utility inspect all new connections to the reclaimed water system? ( ) yes ( ) no

7. Does the utility provide routine inspections of existing connections to the reclaimed water system? ( ) yes ( ) no

8. Is an approved industrial pretreatment program enforced? ( ) yes ( ) no

9. Is the industrial pretreatment program enforced? ( ) yes ( ) no

10. Is there a DER-approved operating protocol on-site and available to the operators? ( ) yes ( ) no ( ) not needed

11. Has the operating protocol been updated and approved annually? ( ) yes ( ) no ( ) not applicable

12. What set points are contained in the operating protocol for the following items?

    Turbidity: _____ NTU
    Chlorine Residual: _____/mg/l
    Other Parameter (specify): Parameter:
    Limit:

13. Are the operators familiar with the operating protocol? ( ) yes ( ) no

14. Does the operator use the operating protocol to control the facility and to make judgements on the quality of the reclaimed water being produced? ( ) yes ( ) no

15. Is the 5.0 mg/l TSS limit met at all times for reclaimed water sent to the reuse system? ( ) yes ( ) no

16. Are the high-level disinfection criteria for fecal coliforms met at all times for reclaimed water sent to the reuse system? ( ) yes ( ) no

17. Have the operators simulate a case where turbidity or chlorine residuals violate the limits set in the operating protocol. Is the reclaimed water of "unacceptable quality" diverted to the reject storage system or permitted alternative discharge system? ( ) yes ( ) no

18. Are continuous monitoring devices provided for measuring turbidity (after filter/before chlorination) and chlorine residual (after contact chamber)? ( ) yes ( ) no

19. Are these instruments in good repair and used in the operation and control of the facilities? ( ) yes ( ) no

20. Are the filters in operation and in good repair? ( ) yes ( ) no

21. Are chemical feed facilities provided? ( ) yes ( ) no

22. What chemicals can be added? Chlorine gas

23. Are the chemical feed facilities in operation and in good repair? ( ) yes ( ) no ( ) not applicable

24. Can the high-level disinfection criteria be met without chemical addition? ( ) yes ( ) no

25. Is the reclaimed water flowing out of the filters and chlorination system very clear? ( ) yes ( ) no

26. Is the turbidity measurement being reported consistent with the appearance of the reclaimed water? ( ) yes ( ) no

27. Are system storage facilities provided to store reclaimed water of acceptable quality? ( ) yes ( ) no

28. Are system storage facilities used? ( ) yes ( ) no

29. Are system storage facilities well maintained and fully operational? ( ) yes ( ) no

30. Are system storage facilities (including golf course lakes) used for temporary storage (as opposed to being used as "Percolation ponds" with no effort to pump out of them for irrigation purposes? ( ) yes ( ) no

31. Are lined reject storage facilities provided to store reclaimed water of unacceptable quality? ( ) yes ( ) no

32. Is there evidence that reject storage facilities are used? ( ) yes ( ) no ( ) not applicable

33. Is the reject storage system well maintained and fully operational? ( ) yes ( ) no ( ) not applicable

34. If automatic control and diversion are provided, are the systems operational, well maintained, and used? ( ) yes ( ) no ( ) not applicable

35. Is reclaimed water released to the system storage and reuse system only during periods when an operator is present? ( ) yes ( ) no ( ) not applicable (other reliability measures provided)

36. Is stored reject water returned to the treatment facilities for additional treatment and disinfection? ( ) yes ( ) no ( ) not applicable

37. Are the facilities for return of reject water to the treatment facilities well maintained, operational, and in use? ( ) yes ( ) no ( ) not applicable

38. Are reclaimed water pipes and appurtenances appropriately marked and color coded? ( ) yes ( ) no

39. Are advisory signs posted alerting the public that reclaimed water is being used? ( ) yes ( ) no

40. Are there illegal surface water discharge points? ( ) yes ( ) no

41. Is there evidence of abuse of the system, such as significant run-off off-site, or severe ponding? ( ) yes ( ) no

42. Are low trajectory nozzles used within 100 feet of outdoor public eating, drinking, or bathing facilities? ( ) yes ( ) no

43. Is reclaimed water applied within 75 feet of potable water supply wells? ( ) yes ( ) no

44. Are distribution systems and pumps operational and well maintained? ( ) yes ( ) no

45. Are ground water monitoring facilities provided and is monitoring regularly performed (normally quarterly)? ( ) yes ( ) no

46. Are background, intermediate, and compliance wells provided and monitored? ( ) yes ( ) no ( ) not applicable

47. Are monitoring wells well marked? ( ) yes ( ) no ( ) not applicable

48. Are monitoring wells operational and well maintained? ( ) yes ( ) no ( ) not applicable

49. Are there any violations of ground water standards at the compliance wells? ( ) yes ( ) no ( ) not applicable

50. Is there evidence of potential ground water quality problems at the intermediate wells? ( ) yes ( ) no ( ) not applicable

51. Are above ground hose bibbs present on reclaimed water lines? ( ) yes ( ) no ( ) not applicable

52. Is there evidence of or public complaints about aerosol drift, odors, or other nuisance conditions? ( ) yes ( ) no ( ) not applicable

This field evaluation of the Belle Glade Wastewater Treatment Plant was conducted by the following Owner and Hazen and Sawyer, P.C., staff:

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TECHNICAL MEMORANDUM No. 11 – Capacity Analysis and Plant Optimization

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer
Mark Drummond / C Solutions

FROM: Kurt Pfeffer / Hazen and Sawyer

DATE: September 8, 2014

FILE: 45103-004.3.1

SUBJECT: Palm Beach County Water Utilities Department
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 11 (TM-11) addresses the Palm Beach County Water Utilities Department (PBCWUD) area known as the Glades Region Urban Service Area. For the purpose of this technical memorandum, the area will be referred to as the Glades Region Wastewater Service Area. The scope of work in *Task 11 – Capacity Analysis and Plant Optimization* is as follows:

> *CONSULTANT will prepare a Capacity Analysis Report for both WWTFs (i.e., Belle Glade and Pahokee) based on the requirements of Florida Administrative Code (FAC) Chapter 62-600.405. The report will summarize evaluation of the capacity of the plants and contain data showing the permitted capacity; monthly average flows, three-month average flows; and annual average daily flows for the past 10 years; seasonal variations in flow; flow projections based on local population growth and water usage rates over the next 10 years; and an estimate of time required for the three-month average daily flow to reach the permitted capacity. The report will include capital cost estimates of infrastructure improvements required to maintain permitted plant capacities.*
>
> *In addition to the capacity analysis, CONSULTANT will develop baseline energy efficiency models of both plants, using Hazen Energy Efficiency Tool (HEET). CONSULTANT will develop (jointly with COUNTY and GLADES WASTEWATER) and evaluate potential optimization improvements, including:*

Belle Glade WWTF:

- *Evaluation of influent flow equalization*
- *Improvements to flow distribution to Oxidation Ditches Nos. 1 and 2*
- *Improvements to secondary clarifier reliability improvements*
- *Consideration of permanent sludge dewatering facilities*
- *Feasibility of taking one oxidation ditch off-line to reduce energy consumption*
- *Rehabilitation of deep injection wells; re-development, acidification, re-rate from 8 feet per second to 10 feet per second*

Pahokee WWTF

- *Assess existing pumping and aeration efficiencies*
- *Evaluate the potential conversion of the Pahokee WWTF to a regional pump station that transfers wastewater flow to Belle Glade WWTF through a new force main for treatment and disposal. Elements to be included in the evaluation are as follows:*
  - *Demolition of Pahokee WWTF and conversion to pump station*
  - *New force main to Belle Glade WWTF*
  - *Relocation of belt press dewatering and stabilization process to Belle Glade WWTF*
  - *Improved treatment efficiency per million gallons at Belle Glade versus Pahokee*

CONSULTANT will use the HEET model to assess optimization scenarios identified above and define recommended improvements based on acceptable payback periods. CONSULTANT will prepare capital cost estimates of recommended optimization improvements.

1.0 CAPACITY ANALYSIS

1.1 FDEP Capacity Analysis Reports (10-Year Window)

Capacity analysis reports for the Belle Glade and Pahokee Wastewater Treatment Facilities (WWTFs) are included in **Appendices A and B** of this technical memorandum, respectively. The Belle Glade WWTF has adequate capacity to process projected flows and loadings over the next ten (10) years, provided that renewal and replacement projects listed in Technical Memorandum No. 2 are completed. Projected flows will exceed the Pahokee WWTF's permitted capacity in the Year 2018. Total influent loadings for biochemical oxygen demand (BOD) and total suspended solids (TSS) are projected to remain below the Pahokee WWTF's organic loading capacity for the

next ten (10) years. Therefore, improvements would be required at the Pahokee plant to increase treatment capacity for unit processes governed by hydraulic loading rates. Those improvements are identified in **Appendix B**.

1.2 Capacity Analysis for Master Planning (20-Year Window)

In addition to Capacity Analysis Reports, which are required to assess plant capacities over the next 10 years to satisfy FDEP regulatory requirements, flows and loadings were also projected for each facility over the next 20 years to identify any longer term capacity shortfalls during the master planning period (Years 2015 – 2035).

1.2.1 Belle Glade WWTF

The Belle Glade WWTF provides secondary treatment, on-site sludge thickening and digestion, and effluent disposal via deep well injection and land application. Digested sludge is dewatered and disposed offsite by a contract provider. The Belle Glade WWTF is currently permitted to treat 6.5 mgd maximum monthly average daily flow (MMADF) with permitted effluent discharge capacities of 10.2 mgd maximum daily flow (MDF) via a Class I underground injection well and an additional 0.069 mgd maximum monthly average daily flow (MMADF) via a percolation pond. **Figures 1 and 2** show the existing site plan and process flow diagram, respectively.

The Belle Glade WWTF is permitted based on the following design criteria.

Table 1
General Influent Design Criteria for Belle Glade WWTF

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	6.5
Influent $CBOD_5$ and TSS (mg/L)	220
Influent $CBOD_5$ and TSS (lbs/day)	12,000
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

Figures 3 and 4 present flow and loadings projections for the Belle Glade WWTF through the Year 2035.

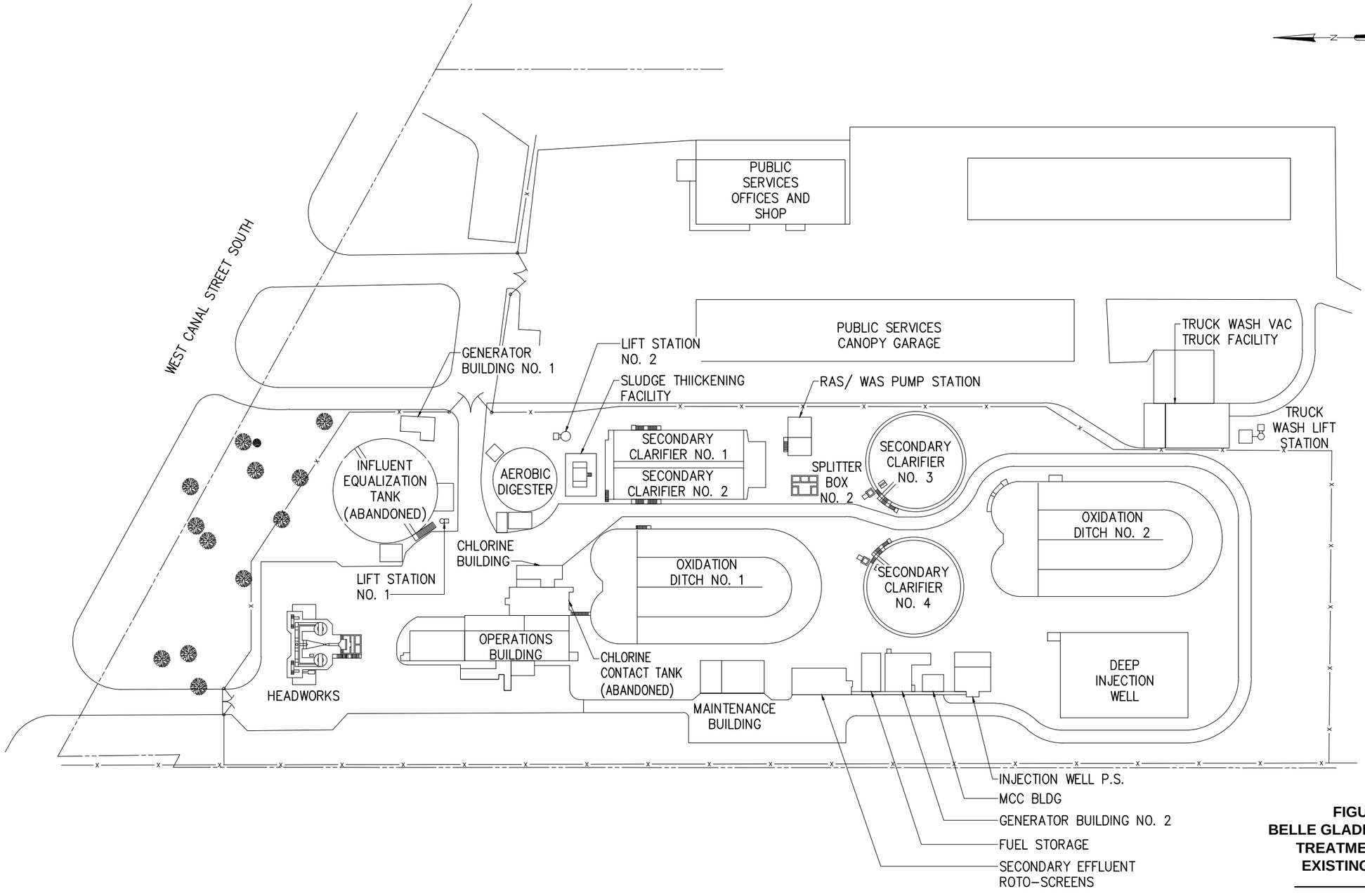

FIGURE 11-1
BELLE GLADE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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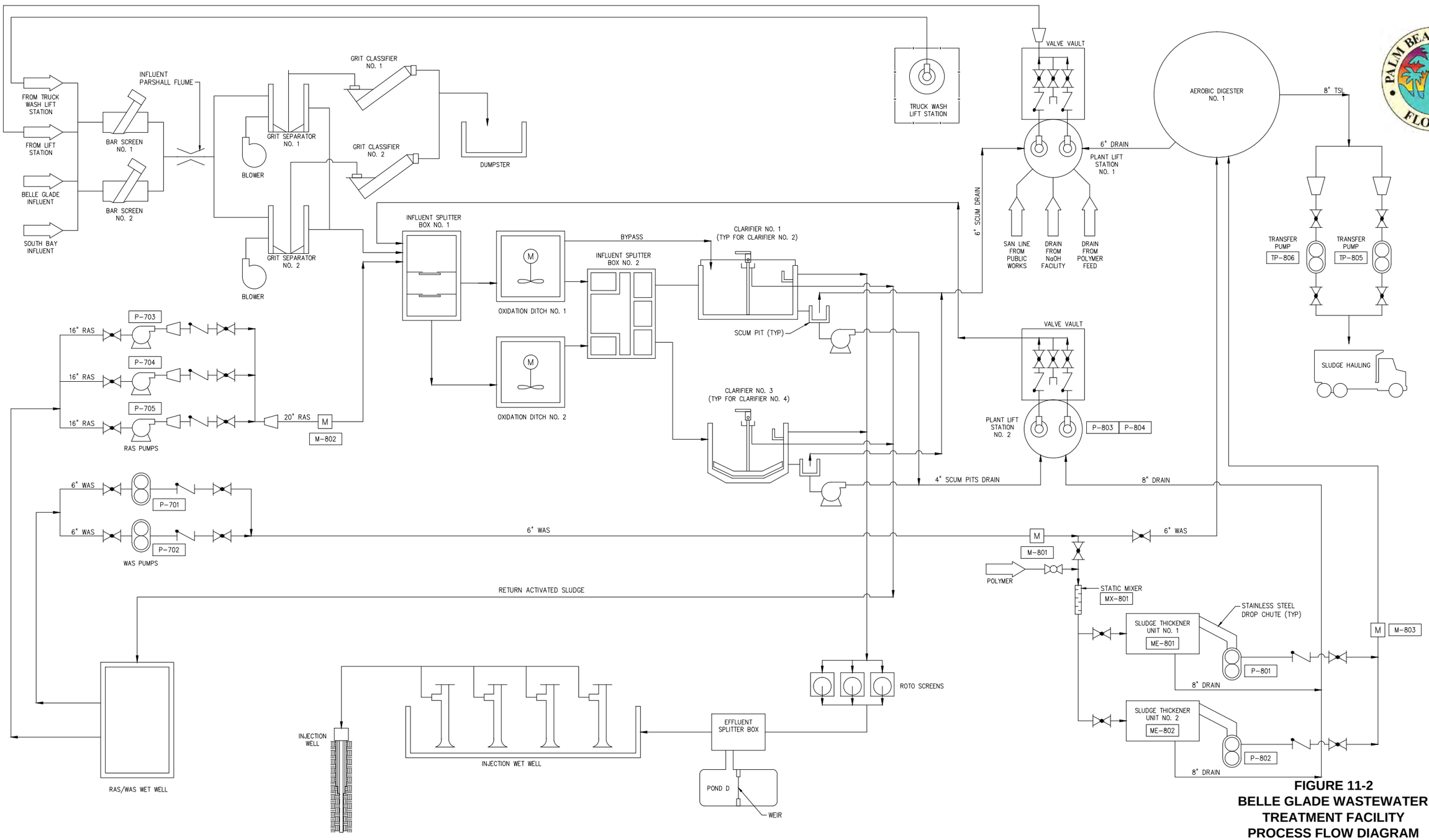

FIGURE 11-2
BELLE GLADE WASTEWATER TREATMENT FACILITY
PROCESS FLOW DIAGRAM

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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Figure 3
Belle Glade WWTF Projected Flows

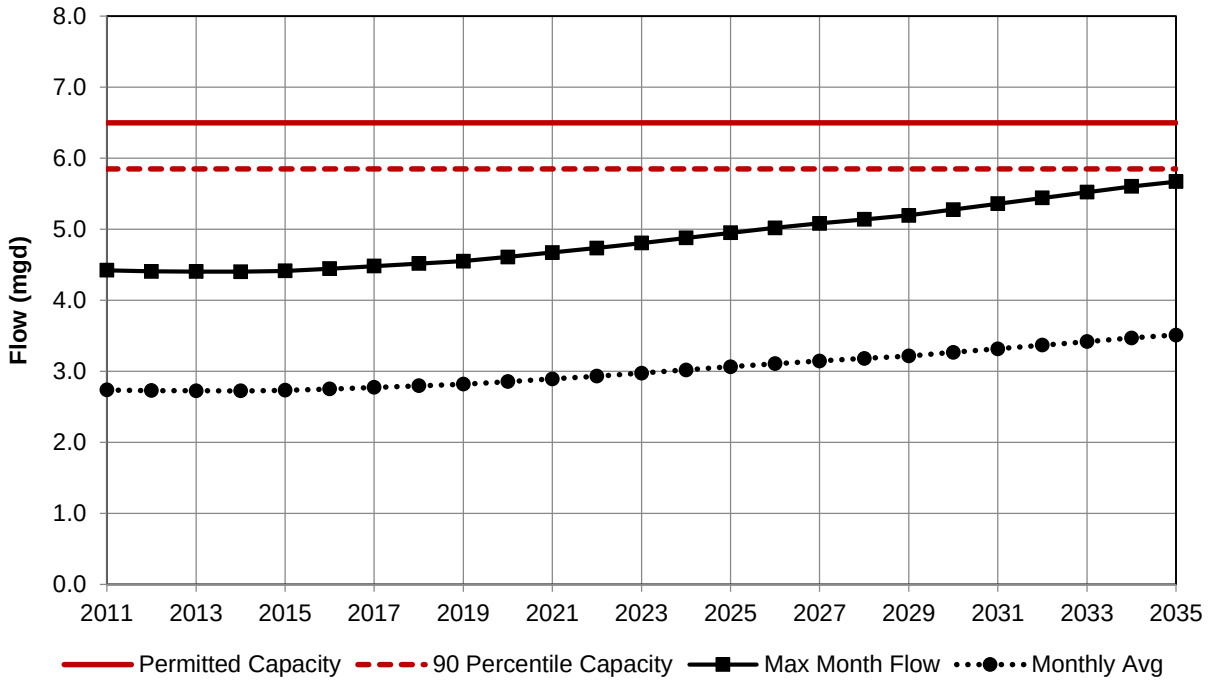
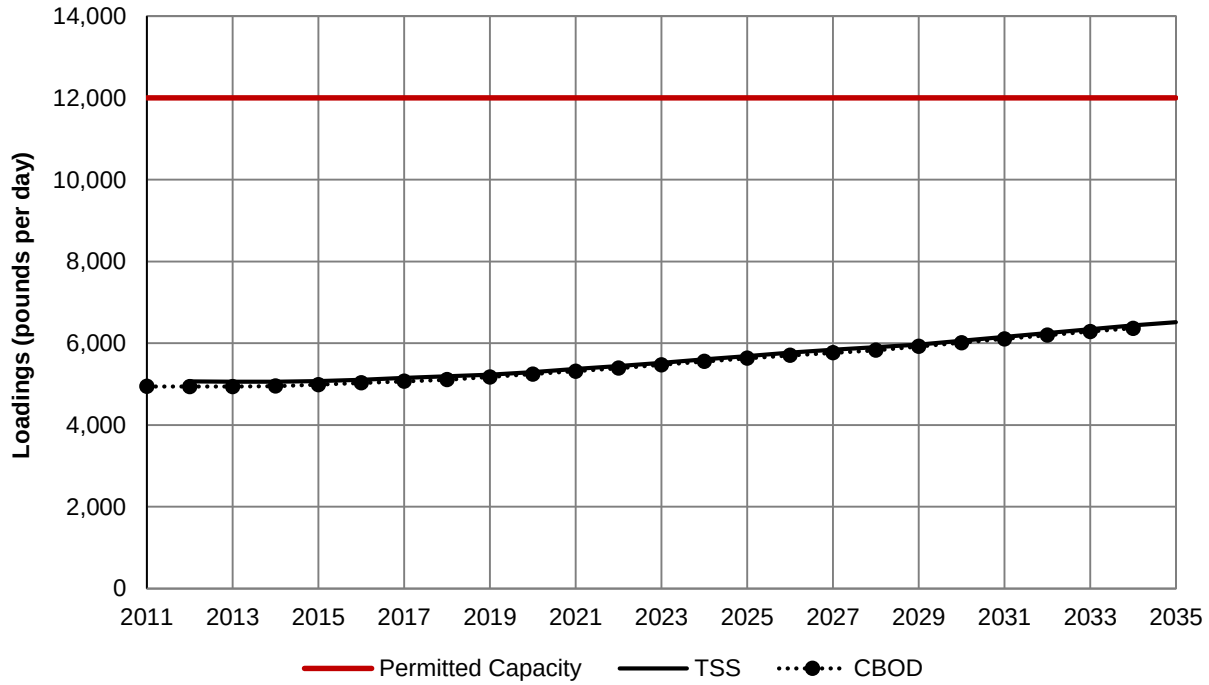


Figure 4
Belle Glade WWTF Projected Loadings



Future flows and loadings are both projected to remain below original design capacity criteria through the Year 2035. As such, there is no need to expand the Belle Glade WWTF to meet Belle Glade WWTF service area growth.

1.2.2 Pahokee WWTF

The Pahokee WWTF provides secondary treatment, on-site biosolids processing and stabilization, and effluent disposal primarily via deep well injection. The Pahokee WWTF is currently permitted to treat 1.2 mgd maximum three-month average daily flow (TMADF) with permitted effluent discharge capacities of 4.0 mgd maximum daily flow (MDF) via a Class I underground injection well and an additional 0.8 mgd maximum monthly average daily flow (MMADF) via a percolation pond.

The Pahokee WWTF is an activated sludge wastewater treatment plant consisting of a 0.50 mgd (TMADF) conventional wastewater treatment train and a 0.70 mgd (TMADF) complete-mix treatment train (Walker Modular Plant) to provide its total rated capacity of 1.20 mgd (TMADF). **Figures 5 and 6** show the existing site plan and process flow diagram, respectively.

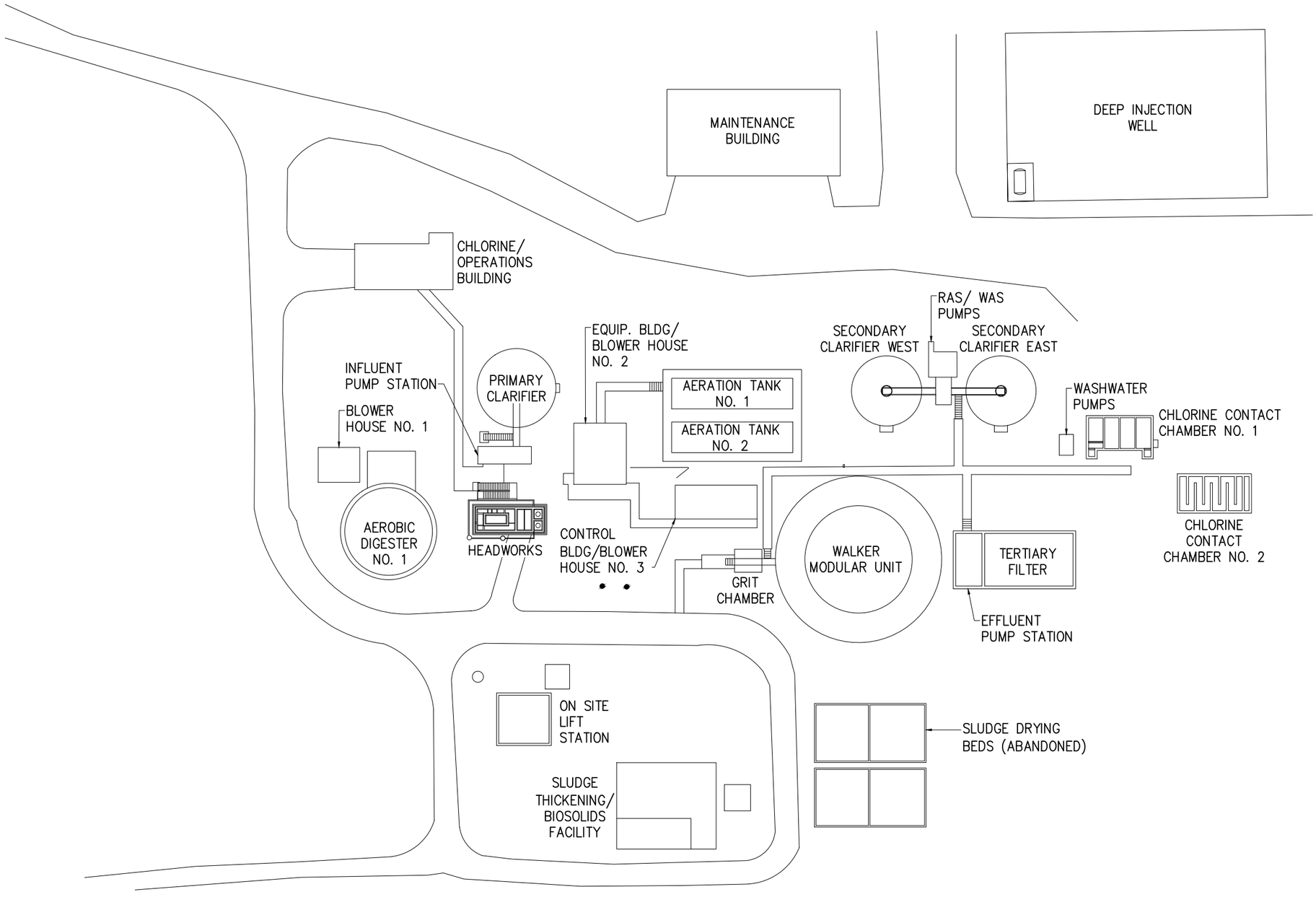


FIGURE 11-5
PAHOKEE WASTEWATER TREATMENT FACILITY
EXISTING SITE PLAN

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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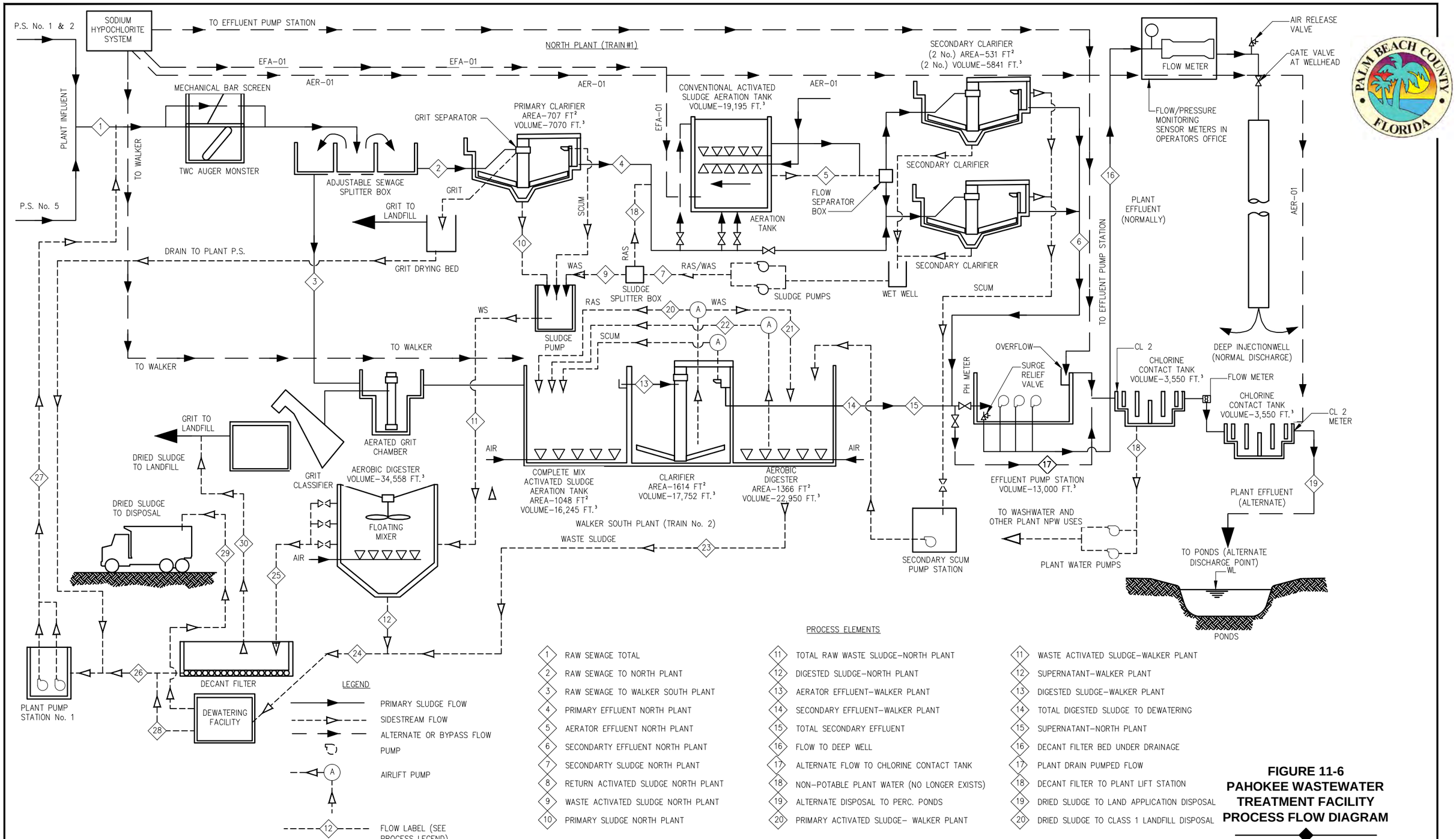


PROCESS ELEMENTS

1. RAW SEWAGE TOTAL
2. RAW SEWAGE TO NORTH PLANT
3. RAW SEWAGE TO WALKER SOUTH PLANT
4. PRIMARY EFFLUENT NORTH PLANT
5. AERATOR EFFLUENT NORTH PLANT
6. SECONDARTY EFFLUENT NORTH PLANT
7. SECONDARTY SLUDGE NORTH PLANT
8. RETURN ACTIVATED SLUDGE NORTH PLANT
9. WASTE ACTIVATED SLUDGE NORTH PLANT
10. PRIMARY SLUDGE NORTH PLANT
11. TOTAL RAW WASTE SLUDGE–NORTH PLANT
12. DIGESTED SLUDGE–NORTH PLANT
13. AERATOR EFFLUENT–WALKER PLANT
14. SECONDARY EFFLUENT–WALKER PLANT
15. TOTAL SECONDARY EFFLUENT
16. FLOW TO DEEP WELL
17. ALTERNATE FLOW TO CHLORINE CONTACT TANK
18. NON–POTABLE PLANT WATER (NO LONGER EXISTS)
19. ALTERNATE DISPOSAL TO PERC. PONDS
20. PRIMARY ACTIVATED SLUDGE– WALKER PLANT
11. WASTE ACTIVATED SLUDGE–WALKER PLANT
12. SUPERNATANT–WALKER PLANT
13. DIGESTED SLUDGE–WALKER PLANT
14. TOTAL DIGESTED SLUDGE TO DEWATERING
15. SUPERNATANT–NORTH PLANT
16. DECANT FILTER BED UNDER DRAINAGE
17. PLANT DRAIN PUMPED FLOW
18. DECANT FILTER TO PLANT LIFT STATION
19. DRIED SLUDGE TO LAND APPLICATION DISPOSAL
20. DRIED SLUDGE TO CLASS 1 LANDFILL DISPOSAL

PAHOKEE WWTP PROCESS FLOW DIAGRAM

FIGURE 11-6
PAHOKEE WASTEWATER TREATMENT FACILITY PROCESS FLOW DIAGRAM

Palm Beach County Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

The Pahokee WWTF is permitted based on the following design criteria:

Table 2
General Influent Design Criteria for Pahokee WWTF

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	1.2
Influent $CBOD_5$ and TSS (mg/L)	180
Influent $CBOD_5$ and TSS (lbs/day)	1,800
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

Figures 7 and 8 present flow and loadings projections for the Pahokee WWTF through the Year 2035.

Figure 7
Pahokee WWTF Projected Flows

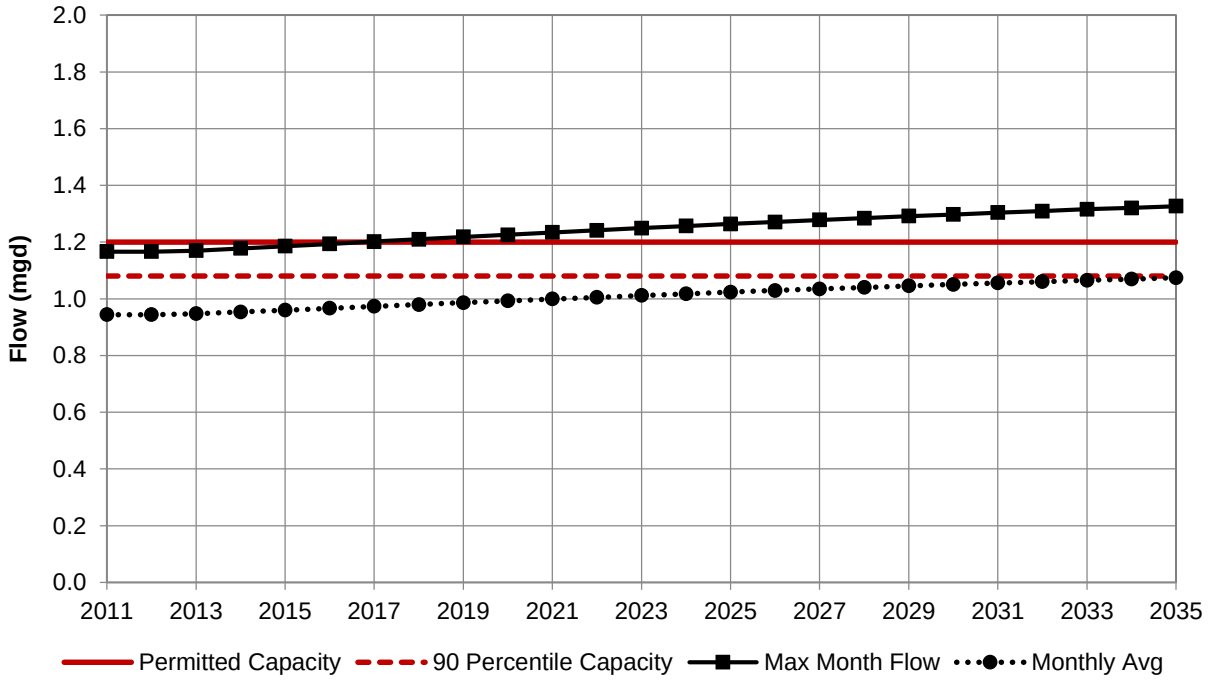
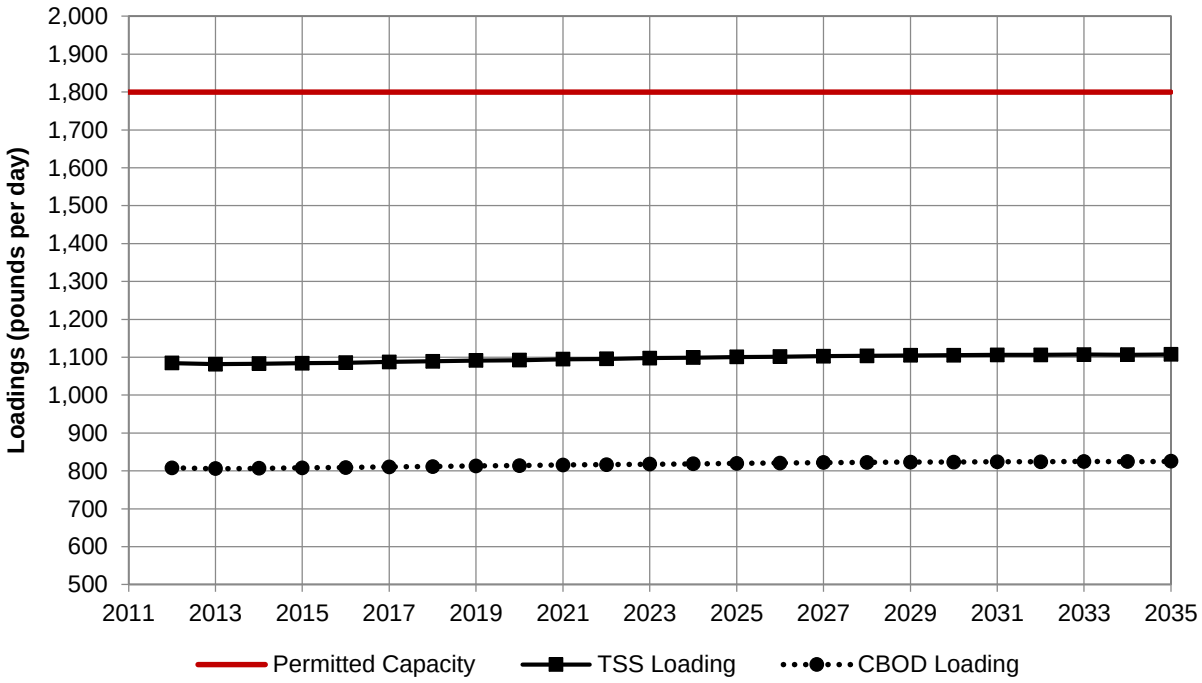


Figure 8
Pahokee WWTF Projected Loadings



Future flows are projected to exceed the Pahokee WWTF's rated capacity by the Year 2018. However, due to the fact that influent BOD and TSS concentrations (103 mg/L) are significantly lower than the original design criteria (180 mg/L), future loadings (pounds per day) are projected to remain below original design capacity criteria through the Year 2035. Therefore, a review of individual unit process capacities through the Year 2035 was conducted and indicates the following:

- The headworks screen is hydraulically overloaded, even at current peak hourly flows (note that the screen is already scheduled for replacement under renewal and replacement projects identified in Technical Memorandum No. 2).
- Primary clarifier capacity in the conventional train is adequate through 2035.
- Conventional train aeration basins have adequate volume to meet future BOD loading rates through 2035, with or without primary treatment.
- Conventional train secondary clarifiers are hydraulically overloaded with one clarifier out of service, even at current flows. A new secondary clarifier would be recommended to provide adequate firm capacity. Recommended clarifier upgrades also include a new mixed liquor splitter box to connect existing and new clarifiers; additional return activated sludge (RAS) / waste activated sludge (WAS) pumps/piping for the new clarifier; and

replacement of the two existing clarifier mechanisms. Note that replacement of mechanisms is already planned as a renewal and replacement project identified in Technical Memorandum No. 2.

- The Walker train's aeration basin would experience higher than recommended BOD loading rates within the 20-year planning period.
- Since solids loading rates will remain under original design loading rates through the Year 2035, aerobic digester capacity should also be adequate through the Year 2035.
- The injection well pump station and deep injection well are adequate through the Year 2035.

In addition to the hydraulic capacity concerns, Technical Memorandum No. 2 (Renewal and Replacement Improvements) concluded that the following major components of the Pahokee plant were in poor condition and in need of complete replacement or major repairs:

- Headworks mechanical screen (replacement)
- Conventional plant
  - Primary clarifier equipment (replacement)
  - Aeration basin walkways and air diffusers (replacement)
  - Aeration blowers (replacement)
  - Instrumentation and controls (upgrades)
  - Secondary clarifier mechanism (replacement)
- Walker Plant
  - Grit removal system (replacement)
  - Concrete tank and mechanical equipment (inspection and rehabilitation)
  - Aeration blowers (replacement)
  - Secondary clarifier mechanism (replacement)
  - Instrumentation and controls (upgrades)
- Effluent Pump Station and Deep Injection Well
  - Replace effluent pump starters with VFDs
  - Repair monitoring well

- Aerobic Digester
  - Potential tank crack repairs
  - Blowers (replacement)
- Electrical
  - Common standby generator (replacement)
  - Main breakers (replacement)
  - MCC-3 (replacement, new bus configuration)

Since current TMADF flows have virtually reached the Pahokee WWTF's permitted capacity, there is not adequate firm capacity to remove any major process unit from service for inspection, replacement or upgrades. Therefore, one new aeration basin and the additional secondary clarifier must be constructed and placed into service before one of the existing aeration basins or clarifiers can be removed from service for structural rehabilitation and/or equipment replacement (e.g. blowers, diffusers).

The following general approach is recommended to rehabilitate and provide reliable capacity to the Pahokee WWTF:

1. Construct and commission the following new facilities:
   a. 0.7 MGD aeration basin and new blower building
   b. Two secondary clarifiers (equal in capacity to the existing clarifiers); and related RAS/WAS pumping and piping
   c. Clarifier influent splitter box to distribute a common mixed liquor stream from the existing and new aeration basins to the existing and new secondary clarifiers
2. Once new facilities are operating, maintain the Walker train in service, and upgrade and "re-rate" the existing 0.5 MGD conventional train to 0.7 MGD capacity, as follows:
   a. All renewal and replacement work listed in Technical Memorandum No. 2
   b. Hydraulic improvements as required
3. Once the upgraded 0.7 MGD conventional train is back in service, abandon the Walker train or maintain it for emergency service.

2.0 BASELINE ENERGY EFFICIENCY MODELS

Energy consumption was modeled at each plant using the Hazen Energy Efficiency Tool (HEET), an integrated process and energy model. The main inputs to the HEET model are basic wastewater quality information at various locations throughout the treatment process and operational information related to the various motors and electric loads at the treatment plants. Based on plant records and information obtained during site visits, HEET models were populated and the overall electrical consumption at each facility was computed.

Preliminary energy evaluations of the Belle Glade and Pahokee WWTFs establish a baseline for potential plant optimization projects. The baseline energy efficient models are used to identify, within a strategic framework, optimization opportunities that have the potential to result in reduced energy and operational costs. The focus of the work is to identify major opportunities available with the understanding that some minor items such as lighting, building fixtures, smaller HP equipment, etc. are not included.

Energy models are also used to project O&M costs at each plant over the 20-year planning period; those O&M costs will factor into a subsequent life-cycle cost analysis of two major facilities options (see Section 3.4):

- Option 1 – Upgrade and operate Belle Glade and Pahokee WWTFs separately
- Option 2 – Upgrade Belle Glade WWTF only; convert the Pahokee WWTF to a regional pump station and treat Pahokee service area flows at the upgraded Belle Glade WWTF

2.1 Belle Glade WWTF

2.1.1 Summary of Existing Major Equipment

Existing major equipment items are summarized below in **Table 3** to determine the instantaneous power demands.

Table 3
Existing Major Equipment Items at Belle Glade WWTF

Item	Horsepower	Operational Frequency	Comment
Bar Screen Motor	2 @ 5 HP	2 Bar Screens, 24/7	--
Grit Separator, Compressor, and Classifier	2 @ 6.5 HP	2 Systems, 24/7	Combined HP of grit system listed
Oxidation Ditch Motor	4 @ 100 HP	4 Motors, 24/7	Motors running at 60% in model
Clarifier Motor	4 @ 0.33 HP	2 Clarifiers, 24/7	--
Clarifier Scum Pump	4 @ 3 HP	2 Scum Pumps, 24/7	--
RAS Pump	3 @ 25 HP	1 RAS pump, 24/7	Pumps running at 60% Influent flow in model
WAS Pump	2 (HP not available)	1 WAS pump, 12/7	No HP listed, assumed one (1) 10 pump HP running
Injection Well Pump	4 @ 300 HP	1 Pump, 8/7	Assumed 1 pump running at 150' Head. (+20' head for high discharge pressure)
Rotary Drum Thickener	2 @ 2 HP	2 RDT, 1 day/week	--
Thickened Sludge Pump	2 @ 5 HP	2 TS pump, 1 day/week	--
Truck Loading Pump	1 (HP not available)	1 Running, 1 day/week	No HP listed, assumed one(1) 5 HP pump
Chlorination Pump	3 (HP not available)	Chlorine Pump, 24/7	--

2.1.2 Overall Electrical Consumption at Belle Glade WWTF

The results of the Belle Glade HEET model are summarized by process in **Table 4**.

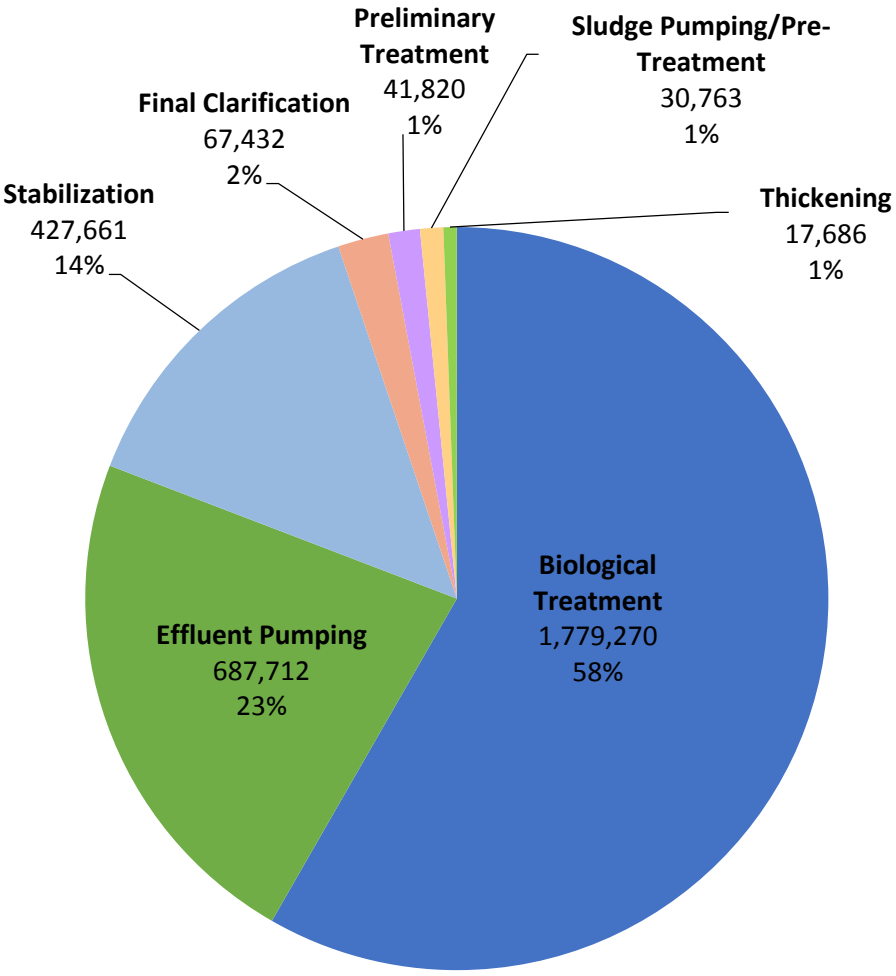
Table 4
HEET Model Electrical Consumption Summary for Belle Glade WWTF

Process	Annual Energy Consumption (kWh/year)
Biological Treatment	1,779,270
Effluent Pumping	687,712
Stabilization	427,661
Final Clarification	67,432
Preliminary Treatment	41,820
Sludge Pumping	30,763
Thickening	17,686
Disinfection	11
TOTAL	**3,052,355**

Total electrical use modeled is slightly less than the total electrical consumption billed for the plant between October 2012 and July 2013. August and September 2013 billed electrical use was estimated based on the average of October 2012, June 2013 and July 2013 data to produce a complete year of electrical data. The billed electrical consumption was converted to energy use using a unit cost of $0.08/kWh, leading to a modeled energy use of 3,209,525 kWh over that period. The total consumption estimated by the HEET model is 5% less than the billed data, or 3,052,355 kWh. This 5% variance is expected due to the exclusion of building, lighting, HVAC and other non-process related consumption in the HEET model. Based on this minor variance, the HEET model appears to provide a reasonable estimate of the process-related electrical consumption at the Belle Glade WWTF. Results are summarized graphically by major process in **Figure 9**.

The Belle Glade WWTF baseline energy model provides a basis for evaluating the cost-effectiveness of proposed optimization strategies evaluated in Section 4 of this technical memorandum. For example, if one oxidation ditch were adequate for treatment of projected flows through the Year 2023, aerators for second oxidation ditch would be turned off in the HEET model to compute the reduction in energy consumption over that period of time.

Figure 9
HEET Model Electrical Consumption for Belle Glade WWTF



2.2 Pahokee WWTF

Existing major equipment items are summarized below in **Table 5** to determine the instantaneous power demands.

Table 5
Existing Major Equipment Items at Pahokee WWTF

Item	Horsepower	Operational Frequency	Comment
Auger Monster	1 @ 5 HP	1 Unit, 24/7	--
Primary Clarifier	1 @ 1.5 HP	1 Motor, 24/7	Includes collector & Scum Pump
Blowers (North)	2 @ 750 SCFM	1 Blower, 24/7	Model scales energy based on air needed for nitrification
Blowers (Walker)	2 @ 1,500 SCFM	1 Blower, 24/7	Model scales energy based on air needed for nitrification
Secondary Clarifiers	2 @ 3 HP	1 clarifier, 24/7	Includes collector & scum pump
RAS Pumps	1 (HP not available)	1 pump, 24/7	Pumps running at 50% Influent flow in model
WAS Pumps	1 (HP not available)	1 pump, 12/7	No HP listed, assumed 5 HP
Aerobic Digester Mixer (North)	1 @ 15 HP	1 mixer, 24/7 @ 50%	Estimated Based on 37% VSR
Aerobic Digester Blower (South)	2 @ 1,500 SCFM	1 Blower, 24/7	Air requirement shared with aeration basin. 37% VSR
Primary Sludge Pump	1 @ 11.4HP	1 Pump 12/7	--
Belt Filter Press Feed Pump	1 @ 7.5HP	1 BFP, 1 day per week	Only run when BFP is running
Belt Filter Press	1 @ 4.5HP	1 BFP, 1 day per week	Includes Belt Drive & polymer system
Biosolids Pump	1 @ 20 HP	1 Pump, 1 day per week	Only run when BFP is running
Effluent Pump Station	3 @ 60 HP	1 Pump 24/7	--
Chlorination		1 Chlorine Pump, 24/7	Assume 5 mg/L dose

2.2.1 Overall Electrical Consumption at Pahokee WWTF

The results of the Pahokee HEET model are summarized by process in **Table 6**.

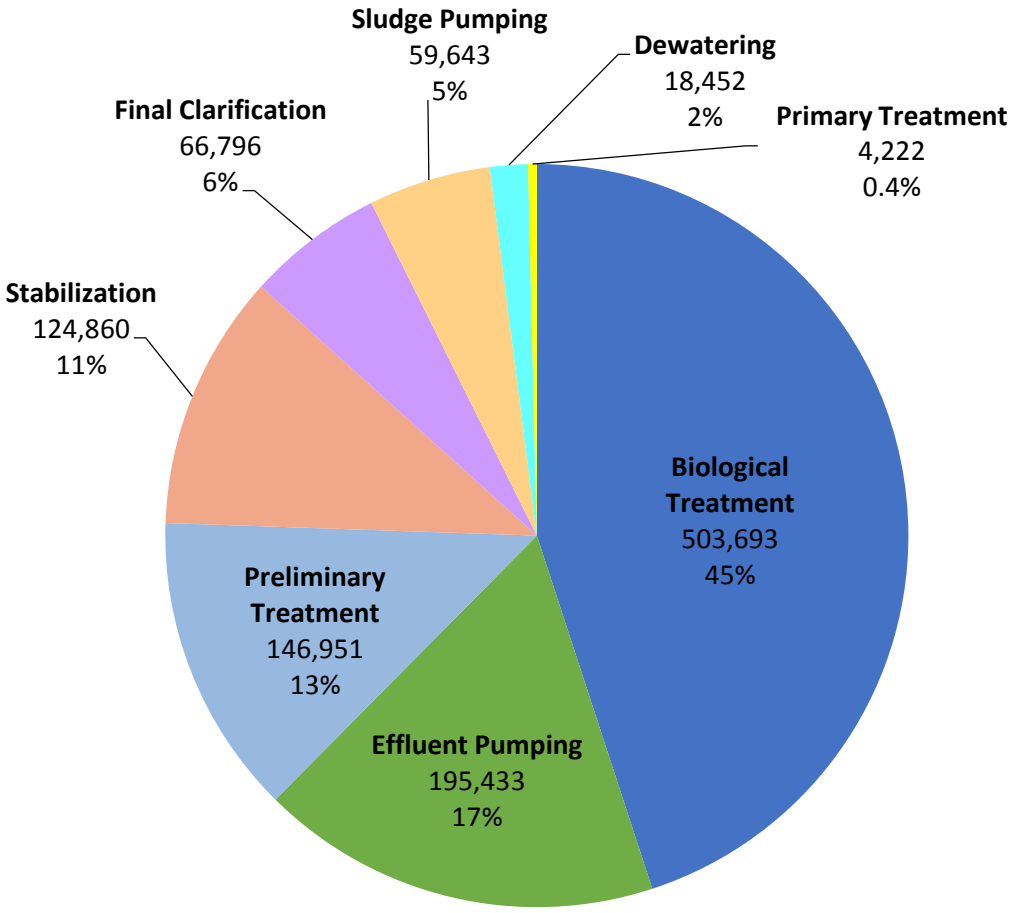
Table 6
HEET Model Electrical Consumption Summary for Pahokee WWTF

Process	Annual Energy Consumption (kWh/year)
Biological Treatment	503,693
Effluent Pumping	195,433
Preliminary Treatment	146,951
Stabilization	124,860
Final Clarification	66,796
Sludge Pumping	59,643
Dewatering	18,452
Primary Treatment	4,222
Disinfection	5
TOTAL	**1,120,051**

This total electrical use is slightly less than the total electrical consumption billed for the plant between October 2012 and July 2013. August and September 2013 billed electrical use was estimated based on the average of October 2012, and June and July 2013 data to have a complete year of electrical data. The billed electrical consumption was converted to energy use using $0.08/kWh, leading to an energy use of 1,168,978 kWh over that period. The total consumption estimated by the HEET model is 4% less than the billed data. This 4% variance can be explained through the exclusion of building, lighting, HVAC and other non-process related consumption in the HEET model. Based on this relative difference, the HEET model appears to provide a reasonable estimate of the process-related electrical consumption at the Pahokee WWTF. Graphically, the results are summarized in **Figure 10**.

The Pahokee WWTF baseline energy model provides a basis for evaluating the cost-effectiveness of proposed optimization strategies evaluated in Section 4 of this technical memorandum. For example, if aeration basin coarse bubble diffusers were replaced (per the renewal and replacement projects listed in Technical Memorandum No. 2) with fine-bubble diffusers, the improved oxygen transfer efficiency would be updated in the model to compute the reduction in energy consumption over the next 20 years.

Figure 10
HEET Model Electrical Consumption for Pahokee WWTF



3.0 CONVERSION OF PAHOKEE WWTF TO REGIONAL PUMP STATION

This section evaluates the potential conversion of the Pahokee WWTF to a wastewater pump station that would transfer all Pahokee service area flows to the Belle Glade WWTF. Key factors to be considered in this evaluation include:

- Capacity of the Belle Glade WWTF to process additional flow from the Pahokee WWTF
- Improved energy efficiency from treating all flow through the Belle Glade WWTF
- Capital savings by eliminating renewal and replacement projects at the Pahokee WWTF
- Added capital costs for Pahokee pump station and force main to Belle Glade WWTF
- Added energy costs for pumping Pahokee flows to Belle Glade WWTF

3.1 Capacity Analysis of Belle Glade WWTF to Treat Pahokee Service Area

Figures 11 and 12 present combined flows and loadings projections from the Belle Glade and Pahokee service areas through the Year 2035. Note that, unlike the Capacity Analysis Reports, these projections include a 1 percent per year reduction in inflow and infiltration based on projected improvements discussed in Technical Memorandum No. 8.

Figure 11
Combined Flows Projected from Belle Glades and Pahokee Service Area

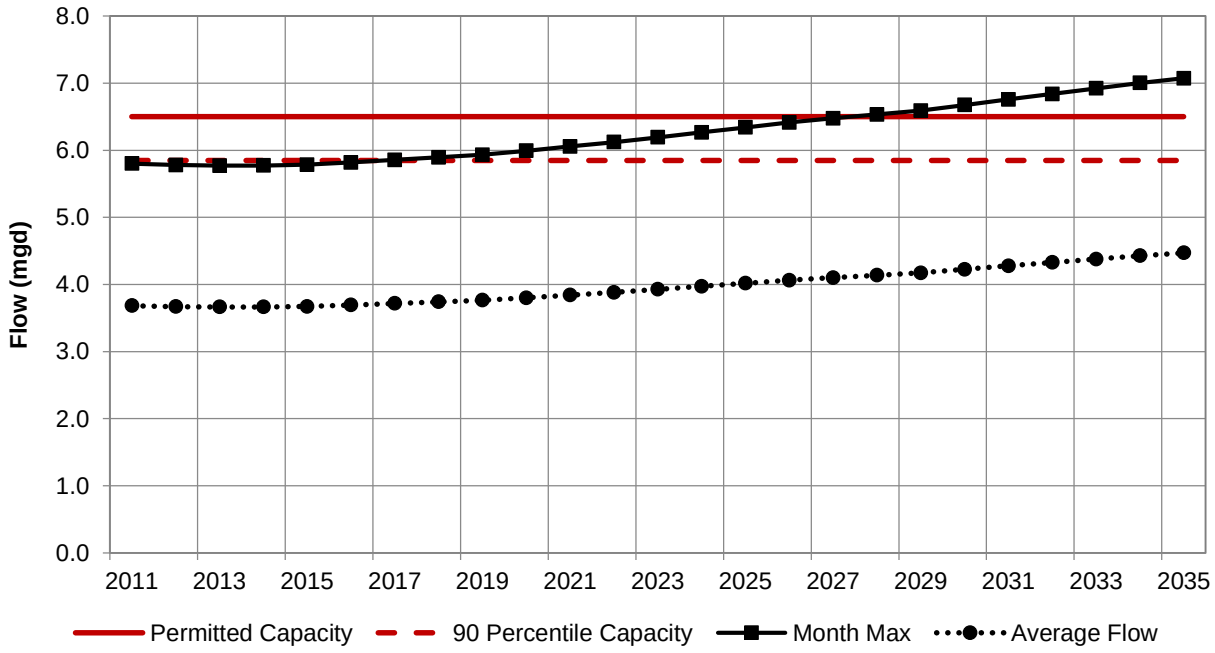


Figure 12
Projected Combined Loadings from Belle Glade and Pahokee Service Areas

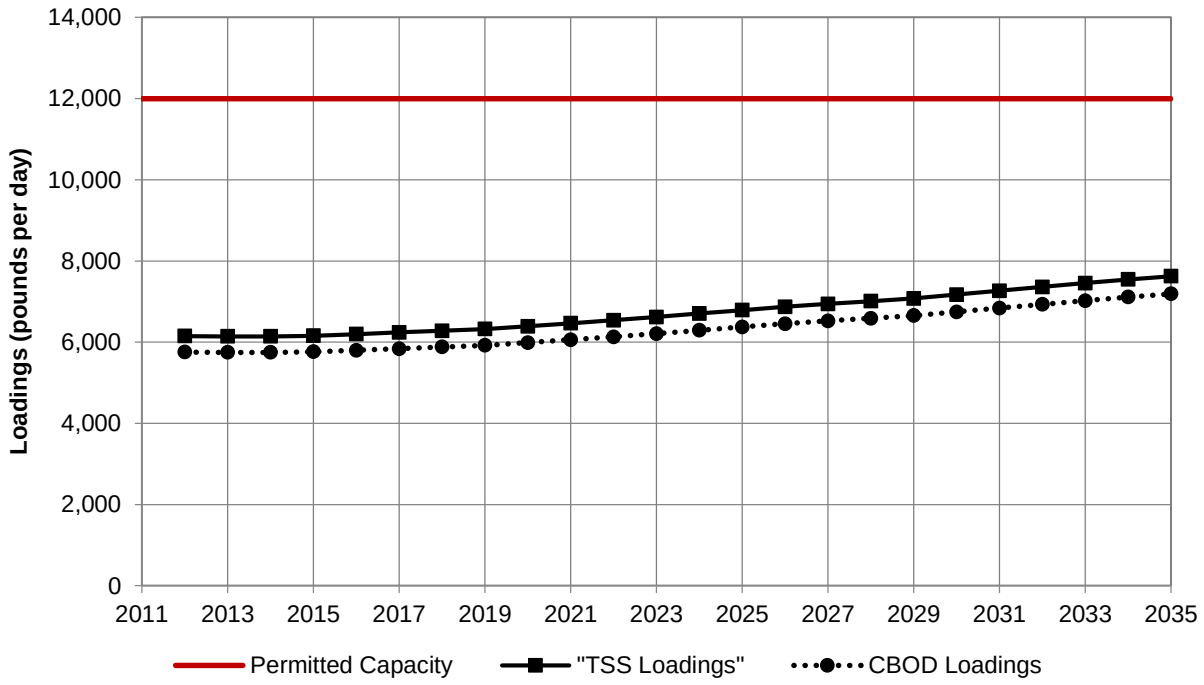


Figure 11 indicates that future combined flows from Belle Glade and Pahokee service areas are projected to exceed the Belle Glade WWTF's rated capacity by the Year 2027. However, due to the fact that influent BOD and TSS concentrations (130 mg/L, approximate weighted average of the two plants) are significantly lower than the original design criteria (220 mg/L), future loadings (pounds per day) are projected to remain below original design capacity criteria through the Year 2035. Therefore, a review of individual unit process capacities through the Year 2035 was conducted and is summarized below.

3.1.1 Mechanical Screens

Technical Memorandum No. 2 (Renewal and Replacement Improvements) recommends replacing the 6mm screens with 3mm screens for better solids debris capture. New screens could be sized to accommodate projected combined peak flows from both service areas.

3.1.2 Grit Chambers

Technical Memorandum No. 2 states that the two Pista Grit Chambers are in good condition. Projected combined flows will exceed Belle Glade WWTF design flows by less than 10 percent by the Year 2035. The added flows from Pahokee may slightly reduce grit removal efficiency by the Year 2035, but expansion of the grit removal facilities would not be warranted at this time.

3.1.3 Oxidation Ditches

Since BOD loadings are projected to remain below original Belle Glade WWTF design loadings through the Year 2035, it would be reasonable to conclude that Oxidation Ditches 1 and 2 are adequate to treat combined flows from both service areas through the Year 2035. BioWin model runs of the Belle Glade WWTF with combined flows and loadings confirm that the oxidation ditches, in fact, have adequate volume and adequate oxygen transfer capacities to treat combined service area flows through the Year 2035.

3.1.4 Secondary Clarifiers

The Belle Glade WWTF contains four secondary clarifiers, as described below:

- Secondary Clarifiers 1 and 2 are abandoned rectangular basins with flight and chain sludge collectors. As discussed in Technical Memorandum No. 2, there are several cracks and evidence of leakage in exterior tank walls and the divider wall between Clarifiers 1 and 2. Plant staff indicates that the structure and collector mechanisms are difficult to clean due to the lack of drains and sumps. Crack injection and retrofit of drainage sumps would be required if these clarifiers were to be placed back unto service.

- Secondary Clarifiers 3 and 4 are 85' diameter circular tanks, consisting of center feed wells, full-radius scum troughs and perimeter effluent weirs. Technical Memorandum No. 2 indicates that the tanks and mechanisms are in good condition. Plant staff has indicated that they are easier to operate and maintain than the abandoned rectangular clarifiers.

Table 7 summarizes design criteria for the four secondary clarifiers, total and firm secondary clarifier capacity with the abandoned rectangular units out of service, and total and firm secondary clarifier capacity with additional circular secondary clarifiers.

Table 7
Belle Glade WWTF – Secondary Clarifier Capacity Analysis

Description	Current		Year 2023		Year 2035	
	All in Service	One Off-Line	All in Service	One Off-Line	All in Service	One Off-Line
Number of Clarifiers	2	1	3	2	4	3
Diameter, feet	85		85		85	
Maximum Month						
Plant Flow, mgd	3.9		4.4		7.1	
Surface Overflow Rate						
Projected, gpd/ft2	346	692	258	388	309	412
Max. Recommended, gpd/ft2	550 - 600					
Peak Hour						
Plant Flow, mgd	10.3		11.6		18.5	
Surface Overflow Rate						
Projected, gpd/ft2	910	**1,820**	681	1,022	813	1,084
Max. Recommended, gpd/ft2	**1,000 - 1,200**					
Adequate Capacity?	Yes	**No**	Yes	Yes	Yes	Yes

Table 7 indicates that Secondary Clarifiers 3 and 4 do not have adequate capacity to treat current or projected flows with one clarifier out of service; that one additional circular clarifier should be constructed to provide adequate firm capacity for Year 2023 flows; and that a fourth circular clarifier should be constructed around the Year 2023 to provide adequate firm capacity for Year 2035 conditions with one clarifier out of service. **Figure 13** shows the locations of existing, abandoned and proposed secondary Clarifiers as recommended above. Note that Technical Memorandum No. 2 already recommends a renewal and replacement capital project to construct two additional secondary clarifiers to replace the abandoned and difficult to maintain rectangular clarifiers. Therefore, costs for the additional clarifiers are not included in this life-cycle cost analysis for the consolidated WWTF option.

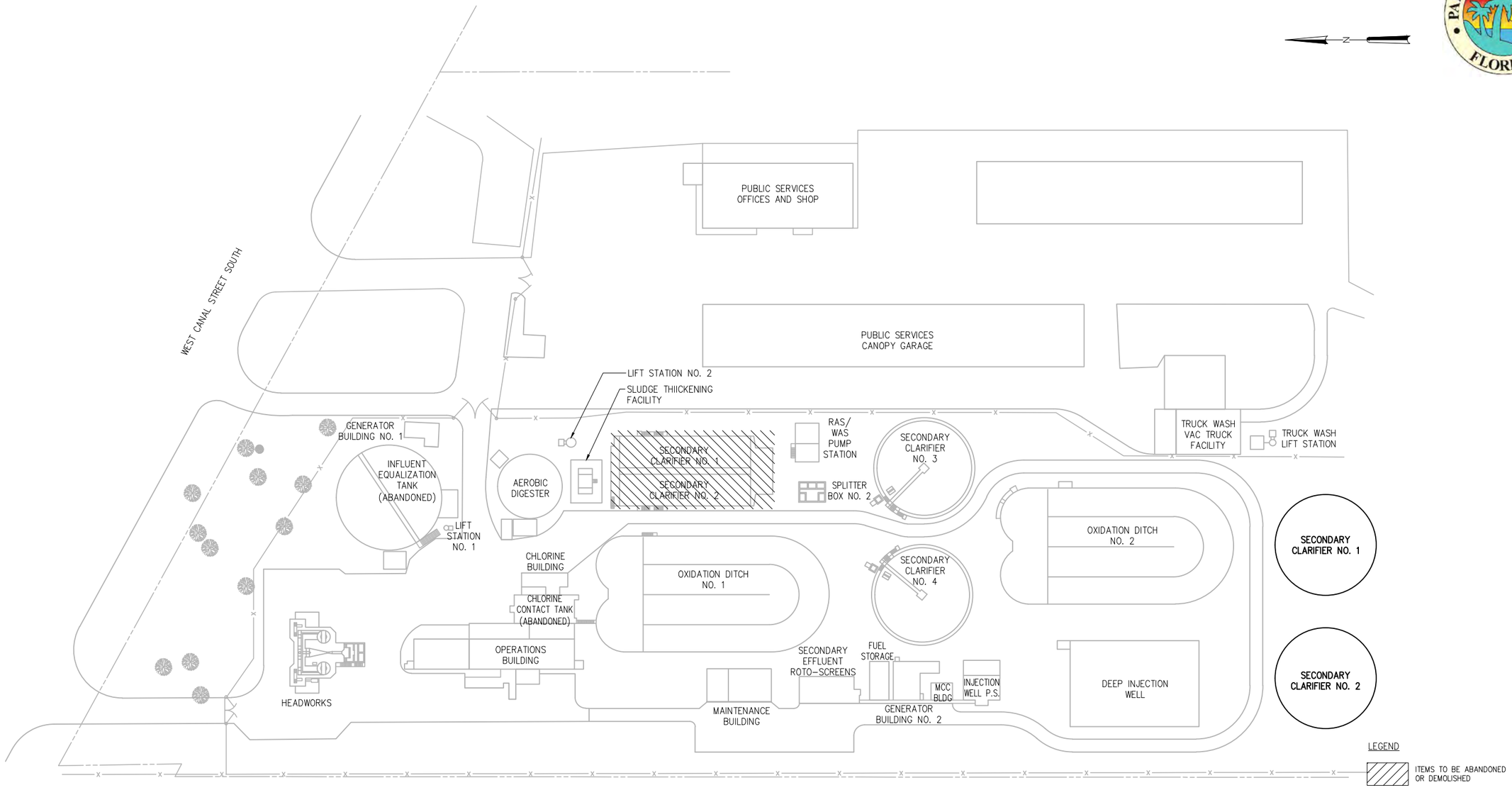


FIGURE 11-13
BELLE GLADE WASTEWATER TREATMENT FACILITY
PROPOSED SECONDARY CLARIFIERS

Palm Beach County
Water Utilities Department

HAZEN AND SAWYER
Environmental Engineers & Scientists

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3.1.5 Hydraulic Capacity between Oxidation Ditches and Clarifiers

Mixed liquor from Oxidation Ditches 1 and 2 combine in Splitter Box 2, which was designed to distribute mixed liquor to Secondary Clarifiers 1, 2, 3 and 4. Flow to (rectangular) Secondary Clarifiers 1 and 2 (when in service) discharged over a single 5' weir into a common clarifier influent pipe header. Flow to Secondary Clarifiers 3 and 4 discharge over separate 5' weirs and clarifier influent pipes.

Recent hydraulic profile evaluations conducted by another consultant (*Belle Glade Wastewater Treatment Plant Hydraulic Profile Technical Memorandum, AECOM, December 2010*) indicate that Splitter Box 2 weirs become submerged at current maximum month flows; and oxidation ditch weirs also become submerged at the plant's permitted capacity of 6.5 mgd. The hydraulic profile evaluations recommended that the submerged weirs be addressed by making improvements to Splitter Box 2 and clarifier influent piping.

As just stated in Section 3.1.4, two (2) new secondary clarifiers are recommended to provide adequate process capacity to treat design flows. The design of new clarifiers can incorporate the following improvements to alleviate submerged weirs at the oxidation ditches and Splitter Box 2:

- Hydraulic profile analysis to determine the required weir lengths and clarifier influent pipe diameters to eliminate weir submergence at Splitter Box 2 and upstream in Oxidation Ditches 1 and 2.
- Expansion or replacement of Splitter Box 2 to provide a fourth distribution weir and fourth clarifier influent pipe (i.e. dedicated weirs and influent pipes to each of the four clarifiers)

Costs for these improvements are also already included in the renewal and replacement project list in Technical Memorandum No. 2.

3.1.6 Injection Wells

3.1.6.1 Original Design Criteria and Current Performance

The primary means of effluent disposal at the Belle Glade and Pahokee WWTFs are injection wells. Injection well design criteria is summarized in **Table 9**.

Table 9
Design Criteria for Injection Wells

	Belle Glade WWTF	Pahokee WWTF
FDEP Permit Number	0048217-008-UO	0138286-017-UO
Outside Diameter Final Casing,	20.00 inches	12.75 inches
Inside Diameter Final Casing	19.00 inches	11.75 inches
Velocity (fps)	8	8
Permitted Capacity (based on a velocity of 8 fps)	10.18	4.00

Injection wells are typically designed to accept a designated flow at a reasonable injection pressure. Effluent being injected underground is thought to have had clarification, filtration and disinfection prior to injection. Hence, no floating matter or debris should be injected into the well as this may cause formation plugging. Formation plugging is a concern because it adversely affects the injection pressure. Partially clogged injection horizons require a larger amount of pressure (i.e., energy) for disposal of an equivalent flow. This leads to inefficient operation and may also impact the design operating pressures of the pumping system. The Belle Glade deep injection well is fouled due to debris from injection of unscreened raw wastewater. Staff has recovered a portion of the original flow capacity through surfactant cleaning, but the well is still fouled and pumping pressures are significantly higher than original design, resulting in higher energy consumption. Redevelopment with aggressive surging and acidization can recover significant specific capacity and reduce pumping pressures for long-term energy savings.

Appendix G of the Belle Glade WWTF Deep Injection Well – IW-1 Mechanical Integrity Test Report (July 2010) indicates that the injectivity index (injection flow rate divided by injection pressure) has decreased from approximately 80-100 gpm/psi in Year 2003 to approximately 30-35 gpm/psi in Year 2010. If the injection well were redeveloped, the injectivity index could be restored to a value of approximately 80 gpm/psi, resulting in injection flows and pressures for future conditions as shown in **Table 10.**

Table 10
Future Flow/Pressure Conditions for Redeveloped Belle Glade WWTF Injection Well

Belle Glade Flows Only	Injection Flow (mgd)	Injection Pressure (psi)	Velocity (fps)
Year 2023 AADF	3.08	27	2.4
Year 2023 MMADF	4.96	43	3.9
Year 2023 MDF	9.36	81	7.4
Year 2023 PHF	12.94	112	10.2
Year 2035 AADF	3.71	32	2.9
Year 2035 MMADF	5.97	52	4.7
Year 2035 MDF	11.28	98	8.9
Year 2035 PHF	15.58	135	12.2
Belle Glade and Pahokee Flows			
Year 2023 AADF	3.93	34	3.1
Year 2023 MMADF	6.17	54	4.8
Year 2023 MDF	11.79	102	9.3
Year 2023 PHF	16.23	141	12.8
Year 2035 AADF	4.47	39	3.5
Year 2035 MMADF	7.02	61	5.5
Year 2035 MDF	13.41	116	10.5
Year 2035 PHF	18.46	160	14.5

3.1.6.2 Re-Rating Injection Wells

Belle Glade and Pahokee injection wells are rated at a velocity of 8 feet per second (fps); FDEP now allows re-rating of wells by minor permit revision to a design velocity of 10 fps and an emergency discharge velocity of 12 fps. Re-rating injection wells at both plants is desirable to meet future flow conditions listed in **Table 10**.

Under the option of consolidating treatment at the Belle Glade WWTF, a fully redeveloped, re-rated injection well at Belle Glade WWTF would provide adequate disposal capacity to meet Year 2035 maximum day flow conditions, but not peak hour flow conditions. Maximum day flows are associated with extreme wet-weather events; under these conditions, the emergency discharge velocity of 12 fps would apply. There appears to be adequate land available to construct a lined pond to store the difference between peak hour flows and maximum day flows. That stored volume could then be pumped back through the plant (with rented portable pumps) for deep well injection once the wet-weather flow conditions subside.

If redevelopment of the Belle Glade WWTF injection well did not recover sufficient specific capacity to take advantage of full re-rating, an effluent pipeline from the Belle Glade WWTF back to the Pahokee injection well would be recommended and could be installed in a common trench with the Pahokee Wastewater Pump Station force mains.

3.1.7 Effluent Pump Station

The Belle Glade WWTF Effluent Pump Station includes four 300 horsepower vertical turbine pumps, each with a rated capacity of 3,450 gpm at 245 feet of total dynamic head (TDH) or 2,950 gpm at 300 feet TDH. Based on the vendor O&M manual pump/system curves for the effluent pumps, the pump station has a firm capacity (3 of 4 pumps running) of 8,900 gpm (12.7 mgd) at 300 feet (130 psi) total dynamic head. Under this consolidated plant scenario, the Belle Glade WWTF Effluent Pump Station must have adequate capacity to pump combined Year 2035 maximum day flows from both service areas of 13.41 mgd at 268 feet TDH (116 psi) (per **Table 10**).

The existing pumps have adequate capacity to pump combined plant flows to a redeveloped, re-rated injection wells for at least the next 10 years. It appears that pumps could be upgraded by changing bowls and impellers to meet Year 2035 maximum day flows.

3.2 Demolition of Pahokee WWTF and Conversion to Pump Station

This analysis assumes that the Pahokee WWTF would be completely demolished so that the land could be restored for another use. For the life-cycle cost analysis, it was assumed that a demolition crew would consist of a foreman, 6 laborers, 3 equipment operators, 2 truck drivers and 2 dump trucks. It was assumed that the combined crew and equipment cost would total $9,000 per day; that debris would be disposed at a landfill for $50 per cubic yard; and that the crew would complete the demolition, disposal and restoration in two months. The total cost for demolition, disposal and restoration was projected at $640,000.

This analysis assumes that the new Pahokee Pump Station would be constructed as a skid-mounted, inline wastewater pump station similar to the South Bay Pump Station (placed into service in 2010). The proposed station would consist of three pumps (two duty plus one standby) designed to pump a peak flow of 4.2 mgd. Pumps would be powered by variable speed drives to modulate input based on a range of minimum to peak flow rates; and the skid-mounted station would include a master control panel to automatically control pumping rates. The total estimated construction cost for the proposed pump station is projected at $1,200,000.

3.3 New Force Main to Belle Glade WWTF

Multiple alignments are available to route force mains from the Pahokee. For the three most likely alignments considered, the total length is approximately eight (8) miles. Minimum, average and peak flows from the Pahokee pump station would be 0.5 mgd, 1.0 mgd and 4.2 mgd, respectively. The force main diameter must be sized to maintain minimum velocity of 2 feet per second at average flows to prevent solids settling; while limiting maximum velocities and total head loss at

peak flow conditions. Due to the wide range in flows and the length of the force main, two parallel 12-inch force mains are assumed to satisfy minimum and maximum flow conditions. The total cost for installation of dual force mains was projected at $8,100,000.

3.4 Life-Cycle Cost Analysis of Separate WTFs vs. Conversion of Pahokee WWTF to Regional Pump Station with Combined Treatment at Belle Glade WWTF

Life cycle cost analyses were performed for the following options:

- Upgrade the Belle Glade and Pahokee WWTFs separately as required for each WWTF to treat projected Year 2035 flows and loadings
- Convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF

Life cycle cost analyses were based on the following common economic assumptions:

- Duration: 20 years
- Annual interest rate: 3.8% (Bond-Buyer 20-year GO Index, 12-month average)
- Annual Inflation: 2.3% (20-year average Consumer Price Index)

Life cycle costs included the following components:

- Capital costs for Belle Glade and Pahokee renewal and replacement projects identified in Technical Memorandum No. 2
- Annual labor costs for operations and maintenance staff at each plant
- Annual treatment costs (energy, chemicals) at each plant
- Annual miscellaneous fixed O&M costs at each plant
- Capital costs for demolition of the Pahokee WWTF, construction of the Pahokee Pump Station and force mains to the Belle Glade WWTF
- Annual O&M costs for the Pahokee Pump Station and force mains

Summaries of life-cycle and total net present worth costs for upgrades and continued operation of separate Belle Glade and Pahokee WWTFs are presented in **Tables 11 and 12**, respectively. The cost for improvements to the Pahokee WWF monitoring well is pending and should be added to the Pahokee WWTF renewal and replacement costs once determined.

A summary of life-cycle and total net present worth costs for the option to convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF, including Belle Glade upgrades, is presented in **Table 13**.

Table 11
Life Cycle Cost Analysis Summary for Upgrades to and Separate Operation of Belle Glade WWTF

Assumptions:	**Value**	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	R&R Capital Improvements	Labor	Treatment	Miscellaneous	O&M Cost per Year	Operation Cost Per 1,000 Gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	2.74	$1,360,000	$846,084	$540,750	$814,918	$2,201,752	$2.20	$2,201,752	$1,360,000	$3,561,752
2015	2.77	$1,580,000	$846,084	$545,618	$814,918	$2,206,620	$2.18	$2,174,010	$1,580,000	$3,754,010
2016	2.81	$840,000	$846,084	$554,035	$814,918	$2,215,037	$2.16	$2,150,052	$840,000	$2,990,052
2017	2.86	$0	$846,084	$563,195	$814,918	$2,224,197	$2.13	$2,127,038	$0	$2,127,038
2018	2.90	$0	$846,084	$572,420	$814,918	$2,233,422	$2.11	$2,104,296	$0	$2,104,296
2019	2.95	$2,560,000	$846,084	$581,387	$814,918	$2,242,389	$2.08	$2,081,521	$2,560,000	$4,641,521
2020	3.02	$1,330,000	$846,084	$594,617	$814,918	$2,255,619	$2.05	$2,062,859	$1,330,000	$3,392,859
2021	3.09	$270,000	$846,084	$608,721	$814,918	$2,269,723	$2.01	$2,045,081	$270,000	$2,315,081
2022	3.16	$520,000	$846,084	$622,675	$814,918	$2,283,677	$1.98	$2,027,246	$520,000	$2,547,246
2023	3.24	$1,260,000	$846,084	$637,876	$814,918	$2,298,878	$1.95	$2,010,581	$1,260,000	$3,270,581
2024	3.31	$250,000	$846,084	$653,575	$814,918	$2,314,577	$1.91	$1,994,396	$250,000	$2,244,396
2025	3.39	$380,000	$846,084	$669,210	$814,918	$2,330,212	$1.88	$1,978,195	$380,000	$2,358,195
2026	3.47	$400,000	$846,084	$684,685	$814,918	$2,345,687	$1.85	$1,961,904	$400,000	$2,361,904
2027	3.54	$70,000	$846,084	$698,325	$814,918	$2,359,327	$1.82	$1,944,149	$70,000	$2,014,149
2028	3.61	$140,000	$846,084	$711,044	$814,918	$2,372,046	$1.80	$1,925,744	$140,000	$2,065,744
2029	3.67	$180,000	$846,084	$723,688	$814,918	$2,384,690	$1.78	$1,907,398	$180,000	$2,087,398
2030	3.76	$410,000	$846,084	$741,132	$814,918	$2,402,134	$1.75	$1,892,957	$410,000	$2,302,957
2031	3.85	$180,000	$846,084	$758,574	$814,918	$2,419,576	$1.72	$1,878,524	$180,000	$2,058,524
2032	3.94	$3,860,000	$846,084	$775,849	$814,918	$2,436,851	$1.70	$1,863,976	$3,860,000	$5,723,976
2033	4.02	$2,220,000	$846,084	$792,996	$814,918	$2,453,998	$1.67	$1,849,352	$2,220,000	$4,069,352
2034	4.11	$210,000	$846,084	$810,074	$814,918	$2,471,076	$1.65	$1,834,701	$210,000	$2,044,701
Notes:							***Total***	***$42,015,800***	***$18,020,000***	***$60,035,800***

1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD

2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow

3. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.

Table 12
Life Cycle Cost Analysis Summary for Upgrades to and Separate Operation of Pahokee WWTF

Assumptions:	**Value**	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	R&R Capital Improvements	Labor	Treatment	Miscellaneous	O&M Cost per Year	Operation Cost Per 1,000 gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	0.96	$1,300,000	$205,011	$163,550	$355,242	$723,803	$2.06	$723,803	$1,300,000	$2,023,803
2015	0.98	$240,000	$205,011	$166,066	$355,242	$726,319	$2.04	$715,586	$240,000	$955,586
2016	0.99	$110,000	$205,011	$168,583	$355,242	$728,836	$2.01	$707,454	$110,000	$817,454
2017	1.01	$220,000	$205,011	$144,877	$355,242	$705,130	$1.92	$674,329	$220,000	$894,329
2018	1.02	$770,000	$205,011	$146,939	$355,242	$707,192	$1.90	$666,305	$770,000	$1,436,305
2019	1.04	$590,000	$205,011	$149,283	$355,242	$709,536	$1.87	$658,635	$590,000	$1,248,635
2020	1.05	$160,000	$205,011	$151,229	$355,242	$711,482	$1.85	$650,681	$160,000	$810,681
2021	1.07	$110,000	$205,011	$153,488	$355,242	$713,741	$1.83	$643,101	$110,000	$753,101
2022	1.08	$960,000	$205,011	$155,461	$355,242	$715,714	$1.81	$635,348	$960,000	$1,595,348
2023	1.10	$5,830,000	$205,011	$157,626	$355,242	$717,879	$1.79	$627,852	$5,830,000	$6,457,852
2024	1.11	$350,000	$205,011	$159,542	$355,242	$719,795	$1.78	$620,224	$350,000	$970,224
2025	1.12	$20,000	$205,011	$161,607	$355,242	$721,860	$1.76	$612,811	$20,000	$632,811
2026	1.14	$100,000	$205,011	$163,420	$355,242	$723,673	$1.74	$605,272	$100,000	$705,272
2027	1.15	$50,000	$205,011	$165,381	$355,242	$725,634	$1.73	$597,943	$50,000	$647,943
2028	1.16	$80,000	$205,011	$167,090	$355,242	$727,343	$1.71	$590,494	$80,000	$670,494
2029	1.18	$630,000	$205,011	$168,947	$355,242	$729,200	$1.70	$583,252	$630,000	$1,213,252
2030	1.19	$100,000	$205,011	$170,552	$355,242	$730,805	$1.69	$575,897	$100,000	$675,897
2031	1.20	$150,000	$205,011	$172,304	$355,242	$732,557	$1.67	$568,747	$150,000	$718,747
2032	1.21	$170,000	$205,011	$173,770	$355,242	$734,023	$1.66	$561,464	$170,000	$731,464
2033	1.22	$30,000	$205,011	$175,493	$355,242	$735,746	$1.65	$554,465	$30,000	$584,465
2034	1.23	$40,000	$205,011	$176,824	$355,242	$737,077	$1.64	$547,258	$40,000	$587,258
Notes:							***Total***	***$13,121,000***	***$12,010,000***	***$25,131,000***

1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD

2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow

3. Reduction in Pahokee treatment cost starting in Year 2017 based on upgrades to high-efficiency blowers and fine bubble diffusers under R&R projects already accounted for in TM-2

4. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.

Table 13
Life Cycle Cost Analysis Summary for Consolidation of Pahokee Treatment to Belle Glade WWTF

Assumptions:	**Value**	
Life Cycle Analysis Duration (years):	20	
Annual Interest Rate (%):	3.8%	Based on Bond Buyer 20-year Bond GO Index, 12 month average
Annual Inflation (%):	2.3%	Based on 20-year average Consumer Price Index

Year	Flow	Pahokee Decommission, PS and FM	Belle Glade Capital Improvements to Treat Pahokee	Belle Glade R&R Capital Improvements	BG (with Pahokee Flows) Labor	BG (with Pahokee Flows) Treatment	BG (with Pahokee Flows) Miscellaneous	Pahokee PS and FM O&M (Energy, Maint.)	O&M Cost per Year	Operation Cost Per 1,000 Gallons	Present Worth ($) Operation	Present Worth ($) Capital Improvements	Present Worth ($) Total
2014	3.70	$0	$0	$1,360,000	$1,051,095	$730,428	$814,918	$0	$2,596,441	$1.92	$2,596,442	$1,360,000	$3,956,442
2015	3.74	$0	$0	$1,580,000	$1,051,095	$738,214	$814,918	$0	$2,604,227	$1.91	$2,565,741	$1,580,000	$4,145,741
2016	3.80	$10,470,000	$0	$840,000	$1,051,095	$749,550	$814,918	$96,000	$2,703,463	$1.95	$2,624,149	$11,310,000	$13,934,149
2017	3.86	$0	$0	$0	$1,051,095	$761,897	$814,918	$97,564	$2,717,242	$1.93	$2,598,545	$0	$2,598,545
2018	3.93	$0	$0	$0	$1,051,095	$773,949	$814,918	$98,953	$2,730,566	$1.91	$2,572,696	$0	$2,572,696
2019	3.99	$0	$0	$2,560,000	$1,051,095	$786,131	$814,918	$100,531	$2,744,193	$1.89	$2,547,326	$2,560,000	$5,107,326
2020	4.07	$0	$0	$1,330,000	$1,051,095	$802,030	$814,918	$101,842	$2,761,292	$1.86	$2,525,319	$1,330,000	$3,855,319
2021	4.16	$0	$0	$270,000	$1,051,095	$819,232	$814,918	$103,363	$2,779,887	$1.83	$2,504,753	$270,000	$2,774,753
2022	4.24	$0	$0	$520,000	$1,051,095	$835,893	$814,918	$104,692	$2,797,764	$1.81	$2,483,607	$520,000	$3,003,607
2023	4.33	$0	$0	$1,260,000	$1,051,095	$854,063	$814,918	$106,150	$2,817,269	$1.78	$2,463,962	$1,260,000	$3,723,962
2024	4.42	$0	$0	$250,000	$1,051,095	$872,390	$814,918	$107,440	$2,836,777	$1.76	$2,444,359	$250,000	$2,694,359
2025	4.52	$0	$0	$380,000	$1,051,095	$890,856	$814,918	$108,831	$2,856,597	$1.73	$2,424,993	$380,000	$2,804,993
2026	4.61	$0	$0	$400,000	$1,051,095	$908,818	$814,918	$110,052	$2,875,597	$1.71	$2,405,114	$400,000	$2,805,114
2027	4.69	$0	$0	$70,000	$1,051,095	$925,148	$814,918	$111,372	$2,893,136	$1.69	$2,384,023	$70,000	$2,454,023
2028	4.77	$0	$0	$140,000	$1,051,095	$940,211	$814,918	$112,523	$2,909,253	$1.67	$2,361,875	$140,000	$2,501,875
2029	4.85	$0	$0	$180,000	$1,051,095	$955,401	$814,918	$113,774	$2,925,588	$1.65	$2,340,037	$180,000	$2,520,037
2030	4.95	$0	$0	$410,000	$1,051,095	$975,047	$814,918	$114,854	$2,946,223	$1.63	$2,321,716	$410,000	$2,731,716
2031	5.05	$0	$0	$180,000	$1,051,095	$994,893	$814,918	$116,035	$2,967,150	$1.61	$2,303,652	$180,000	$2,483,652
2032	5.14	$0	$0	$3,860,000	$1,051,095	$1,014,178	$814,918	$117,022	$2,987,339	$1.59	$2,285,051	$3,860,000	$6,145,051
2033	5.24	$0	$0	$2,220,000	$1,051,095	$1,033,689	$814,918	$118,182	$3,007,912	$1.57	$2,266,786	$2,220,000	$4,486,786
2034	5.34	$0	$0	$210,000	$1,051,095	$1,052,590	$814,918	$119,078	$3,027,634	$1.55	$2,247,929	$210,000	$2,457,929
Notes:										***Total***	***$51,268,100***	***$28,4900,000***	***$79,758,100***

1. Year 2014 labor, treatment, miscellaneous costs based on Year 2013 budgets from PBCWUD

2. Future year labor, treatment, miscellaneous costs based on Year 2014 costs and ratio of future year flow to Year 2014 flow

3. Annual costs for Labor, Treatment, Miscellaneous and O&M Cost per Year columns are presented in 2014 dollars. All annual cost columns are summed and adjusted to net present worth values in the Present Worth Operation column.

A summary of new present worth costs for the two options is presented in **Table 14**.

Table 14
Net Present Worth Cost Comparison of Separate and Consolidated WWTF Options

	O&M Costs	Capital Improvements	Total
Belle Glade WWTF	*$42,015,800*	*$18,020,000*	*$60,035,800*
Pahokee WWTF	*$13,121,000*	*$12,010,000*	*$25,131,000*
Total Belle Glade and Pahokee WWTFs (separate treatment plants)	$55,136,800	$30,030,000	$85,166,800
Convert Pahokee WWTF to Pump Station, treat all flows at Belle Glade WWTF	$51,628,100	$28,490,000	$79,758,100

The total net present worth of the option to convert the Pahokee WWTF to a Pahokee Pump Station and treat combined flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF results in approximately $5 million in net present worth savings (including approximately $1.5 million of capital cost savings) over the option to upgrade and continue operation of both plants. The cost to demolish the Pahokee WWTF and construct a Pahokee Pump Station and force mains is more than offset by the savings in eliminating renewal and replacement costs required for long-term operation of the Pahokee WWTF. Annual O&M costs associated with the Pahokee Pump Station are also more than offset by the savings in consolidating treatment costs to the Belle Glade WWTF.

3.5 Recommendation

Based on these preliminary life-cycle cost analyses, it is recommended that the County convert the Pahokee WWTF to a Pahokee Wastewater Pump Station and treat flows from the Belle Glade and Pahokee service areas at the upgraded Belle Glade WWTF. A Business Case Evaluation should be performed to justify this project.

4.0 POTENTIAL OPTIMIZATION IMPROVEMENTS AT BELLE GLADE WWTF

Since the life-cycle cost analysis shows that treatment of flows from the Belle Glade and Pahokee service areas at the Belle Glade WWTF is more cost effective than upgrading and maintaining the Pahokee WWTF in service, this section evaluates options for optimizing the Belle Glade WWTF under the combined flow scenario. Based on process, hydraulic and operational evaluations of the existing Belle Glade WTF, the following potential optimization improvements were identified in the scope of work:

4.1 Influent Flow Equalization

Influent flow equalization is typically used to attenuate dry-weather diurnal peaks. Peak flow

attenuation provides more constant, steady-state loading of the activated sludge process, which generally results in better process control, reduced aeration energy demand and improved secondary effluent quality.

Influent flow equalization is generally not practical for attenuating wet-weather peak flows. Operating data and discussions with plant staff indicate that inflow and infiltration in the Belle Glade and Pahokee service areas results in wet weather peak flows that remain elevated for several days. A sustained wet-weather flow of 12 mgd lasting two days (consistent with reports from plant staff) would require an equalization volume of several million gallons. The abandoned equalization tank volume is only 830,000 gallons.

Influent flow equalization can also improve a plant's hydraulic profile by eliminating submerged weirs at peak flow conditions. According to the Belle Glade Wastewater Treatment Plant Hydraulic Profile Technical Memorandum (AECOM, December 2010), clarifier influent splitter box weirs become submerged at current maximum month flows; and oxidation ditch weirs also become submerged at the plant's permitted capacity of 6.5 mgd. This previous hydraulic study recommended that weir submergence be addressed by reducing the head loss through the clarifier influent splitter box and clarifier influent piping. Technical Memorandum No. 2 and Section 3.1.3 above recommends the construction of two additional circular clarifiers to restore process capacity related to the abandoned rectangular clarifiers. The clarifier influent splitter box would be modified to incorporate the new circular clarifiers. These improvements will address hydraulic profile issues without the need for influent flow equalization.

Therefore, the benefits of influent flow equalization are limited to reduced aeration energy demand. Aeration energy savings are far less than the capital and O&M costs to construct and operate an influent flow equalization system. Therefore, this optimization is not recommended.

4.2 Evaluation of Permanent Sludge Dewatering Facilities

Digested sludge from the Belle Glade WWTF is currently dewatered and hauled off site once per month by a contract provider using portable centrifuge dewatering equipment. The scope includes an evaluation of whether relocation of the dewatering and Bioset stabilization systems from the Pahokee WWTF for implementation of permanent dewatering at the Belle Glade WWTF would be more cost effective than continued contract dewatering.

Before conducting a payback analysis, confirmation that the belt filter press and Bioset systems can process Year 2035 sludge production rates is required. Projected annual sludge production rates from the Belle Glade WWTF (based on consolidated treatment of both service areas at the Belle Glade WWTF), capacities of the existing belt press and Bioset systems and required run times are listed in **Table 15.**

Table 15
Belt Filter Press Capacity Analysis for Consolidated WWTF Option

Year	Digested Sludge (lbs per day)	Belt Press / Bioset Capacity (lbs/hour)	Belt Press / Bioset Run Time (hours/day)
2023 Average Annual	2,731	675	4.0
2023 Maximum Month	3,928	675	5.8
2035 Average Annual	3,167	675	4.7
2035 Maximum Month	4,644	675	6.9

Therefore, the belt filter press and Bioset systems have adequate capacity to process combined plant sludge production rates.

The estimated capital cost to relocate the belt filter press and Bioset systems from the Pahokee WWTF to the Belle Glade WWTF, including new concrete structures, piping, electrical and SCADA connections, is approximately $900,000. A summary of the comparative net present worth analysis for permanent dewatering facilities and continued contract dewatering and disposal is presented in **Table 16**.

Table 16
Permanent Dewatering and Bioset Stabilization Net Present Worth Analysis

Contract Dewatering and Disposal	
Net Present Worth of Annual Costs	$3,930,000
Permanent Dewatering	
Capital Costs	$900,000
Net Present Worth of Annual Costs	$2,990,000
Total Net Present Worth	$3,890,000
Cost/Savings from Permanent Dewatering	40,000

The total net present worth costs of the two options are virtually equal. Therefore, relocation of Pahokee dewatering and Bioset systems to the Belle Glade WTP for permanent dewatering is not recommended at this time. Should contract disposal costs increase significantly due to a potential reduction in available Class B disposal sites, permanent dewatering and stabilization at the Belle Glade WWTF should be reconsidered.

4.3 Feasibility of One Oxidation Ditch Offline (Energy Savings)

The Belle Glade WWTF operates both Oxidation Ditches 1 and 2 at current MMADF flows of 2.8 mgd, or less than half of the plant's rated MMADF capacity of 6.5 mgd. BioWin modeling was conducted to evaluate whether the plant could take one oxidation ditch off line; and if so for how many years. Modeling results presented below in **Table 17** indicate that one oxidation ditch has adequate volume and oxygen transfer capacity to process MMADF flows from both the Belle Glade and Pahokee service areas through the Year 2023.

Table 17
Modeling Results for Operating One of Two Belle Glade WWTF Oxidation Ditches

	Annual Average	Maximum Month	Maximum Day
BOD, pounds/day	2,814	3,972	5,130
Dissolved Oxygen, mg/L	2.0	1.5	1.0
Aerator Horsepower Required	135	163	176
Aerator Horsepower Available	200	200	200

HEET modeling indicates that energy savings from taking one oxidation ditch out of service through the Year 2023 would result in an annual savings of approximately $30,000 per year. Over ten years (Years 2013 to 2023), energy savings would total approximately $300,000.

5.0 SUMMARY AND CONCLUSIONS

Based on the evaluations and analyses presented above, a summary of conclusions and recommendations is presented below:

- The Belle Glade WWTF has adequate capacity to treat projected Belle Glade service area flows through the Year 2035
- The Pahokee WWTF's hydraulic treatment capacity will be exceeded by the Year 2018.
- The Belle Glade WWTF has adequate capacity to treat projected flows from the Belle Glade and Pahokee service areas through the Year 2035, provided that Belle Glade WWTF renewal and replacement projects (Technical Memorandum No. 2) are completed.
- The option to demolish the Pahokee WWTF, convert the Pahokee WWTF to a regional wastewater pump station, install force mains to convey Pahokee service area flows to the Belle Glade WWTF, and consolidate treatment to the Belle Glade WWTF is more cost-effective than upgrading both plants, expanding the Pahokee WWTF and operating / maintaining two separate treatment plants. A Business Case Evaluation should be performed to justify this project.

- Influent flow equalization at the Belle Glade WWTF is not cost-effective and is not recommended.

- Under the consolidated treatment option, the Belle Glade WWTF can treat flows with one oxidation ditch and take the second oxidation ditch offline until the Year 2023, resulting in a total energy savings of approximately $300,000.

- Hydraulic constraints (submerged weirs and limited freeboard) at the Belle Glade WWTF oxidation ditches and clarifier influent splitter box can be alleviated when new circular clarifiers are added to replace the two abandoned rectangular clarifiers.

- The Belle Glade deep injection well should be redeveloped and acidized to recover specific capacity; and re-rated to 10 feet per second. If redeveloped and re-rated, the Belle Glade injection well will have adequate capacity to serve the consolidated treatment plant option through Year 2035 maximum day flows. A lined effluent storage pond may become necessary after Year 2023 to store the difference between maximum day and peak hour flows until those stored flows can be pumped back to the treatment process.

- The Pahokee WWTF dewatering belt press and Bioset stabilization systems have adequate capacity to process projected sludge production from the Belle Glade WWTF under the consolidated treatment option. Net present worth costs of the two options are virtually equal. Continued contract dewatering and hauling at the Belle Glade WWTF is recommended unless contract costs increase due to the potential reduction in Class B disposal sites.

APPENDIX A

Belle Glade WWTF Capacity Analysis Report

Palm Beach County Water Utilities Department

CAPACITY ANALYSIS REPORT

Belle Glade Wastewater Treatment Facility

Palm Beach County, FL

Permit No.: FLA027740-008

Report Date: October 2013

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Chapter 1 – Introduction

The Capacity Analysis Report (CAR) is required to fulfill the requirements of Chapter 62-600.405 of the Florida Administrative Code (FAC) and provide an assurance to the Florida Department of Environmental Protection (FDEP) that the wastewater treatment facility does not exceed its permitted capacity. Currently the Belle Glade Wastewater Treatment Facility (Belle Glade WWTF) operates under two operating permits: WWTF Operating Permit (Permit No. FLA027740-005) and the Injection Well Operating Permit (Permit No. 482171W-1). The last capacity analysis report was submitted for the Belle Glade WWTF to the Florida Department of Environmental Protection (FDEP) in July 2008 and anticipated that the Belle Glade WWTF would not exceed its treatment capacity of 6.5 million gallons per day (mgd) maximum monthly average daily flow (MMADF) within the next ten years.

This report provides an overview of the existing and future conditions of the Belle Glade WWTF as related to the WWTF's permitted capacity and summarizes the WWTF's ability to provide treatment in compliance with its permitted capacity.

An inter-local agreement between the Cities of Belle Glade, Belle Glade and South Bay for the established of the Glades Utility Authority (GUA) was executed on June 6, 2009 under Resolution R-2009-1034. The ownership of the Belle Glade WWTF was transferred from the City of Belle Glade to the GUA on October 1, 2009. The GUA and its operational control was subsequently transferred to Palm Beach County Utilities.

Collection System Description

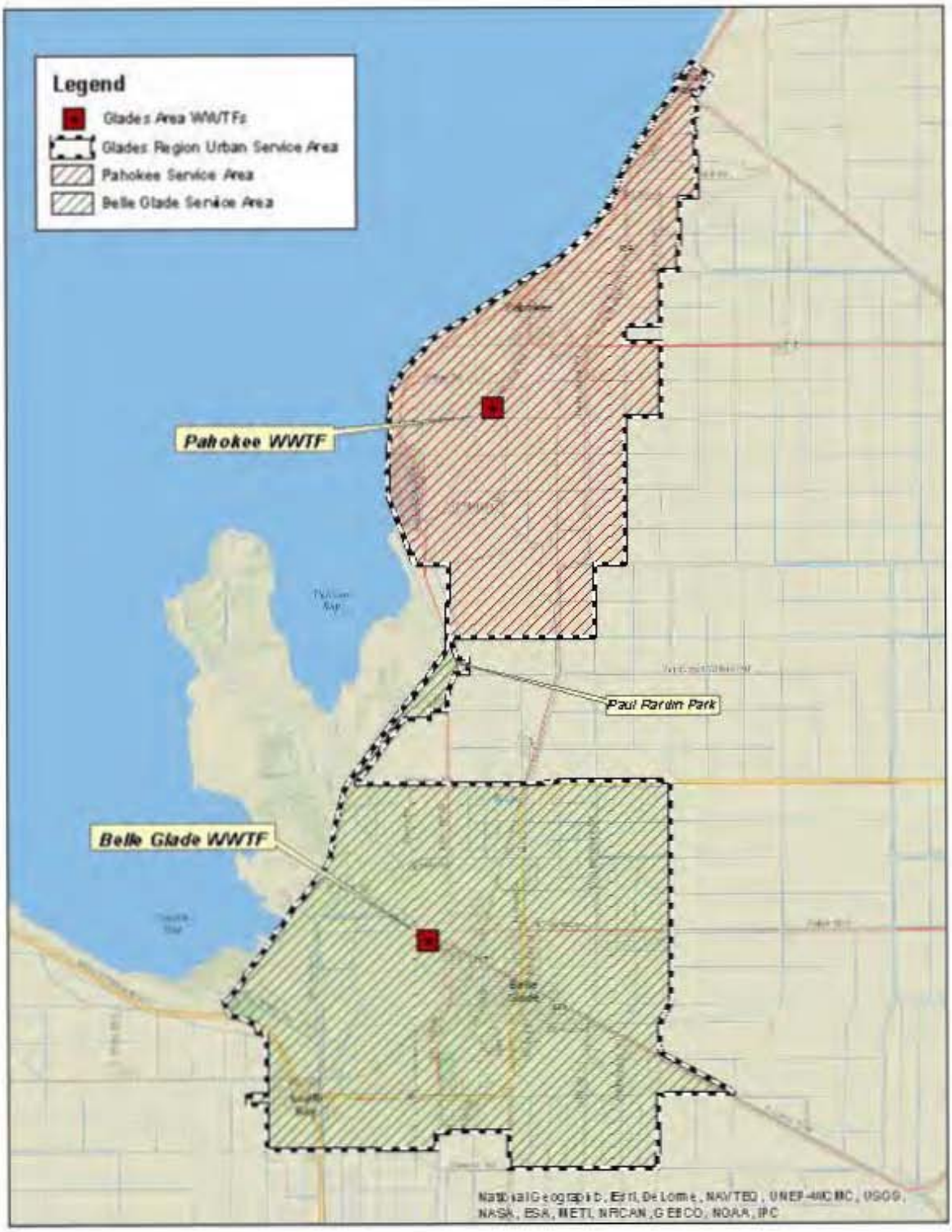
The Belle Glade WWTF serves the City of Belle Glade and the City of South Bay within the Belle Glade WWTF service area as shown on **Figure 1**. The collection system consists of 95 lift stations. Wastewater is transferred to the WWTF via four force mains that manifold to enter a flow splitter box located directly upstream of the headworks.

Collection system improvements to reduce Infiltration and Inflow (I&I) were completed in May 2011, in response to a study performed by AECOM in 2009 to identify sources of I&I within the collection system. As a result of the study, 23 lift stations were repaired, 33,900 linear feet of new pipe installed, and existing pipes and manholes were cleaned and/or repaired.

Treatment System Description

The Belle Glade WWTF is located at 2055 West Canal Street in Belle Glade, Florida. The Belle Glade WWTF provides secondary treatment, on-site biosolids processing and stabilization, and effluent disposal via land application and deep well injection. The Belle Glade WWTF is currently permitted to treat 6.5 mgd maximum monthly average daily flow (MMADF) with permitted effluent discharge capacities of 10.2 mgd maximum daily flow (MDF) via a Class I underground injection well and an additional 0.069 mgd maximum monthly average daily flow (MMADF) via percolation pond. Emergency disposal is by gravity flow of high-level disinfected effluent to the polishing ponds with a capacity of one million gallons.

Figure 1 – Glades Region Wastewater Service Sub-areas



Permit Summary

Effluent discharge permit limitations for five-day carbonaceous biochemical oxygen demand (CBOD5), total suspended solids (TSS) and pH are specified in **Table 1** (Underground Injection Well) and **Table 2** (Percolation Pond).

Table 1 - Effluent Discharge Permit Requirements - Underground Injection Well

Effluent Parameter	Effluent Permit Limitation
Monthly Day Flow (mgd)	10.2
Annual Average $CBOD_5$ and TSS (mg/L)	20
Monthly Average $CBOD_5$ and TSS (mg/L)	30
Weekly Average $CBOD_5$ and TSS (mg/L)	45
Single Sample $CBOD_5$ and TSS (mg/L)	60
pH (minimum and maximum)	6.0 to 8.5

Table 2 - Effluent Discharge Permit Requirements - Percolation Pond

Effluent Parameter	Effluent Permit Limitation
Monthly Average Daily Flow (mgd)	0.069
Annual Average $CBOD_5$ and TSS (mg/L)	20
Monthly Average $CBOD_5$ and TSS (mg/L)	30
Weekly Average $CBOD_5$ and TSS (mg/L)	45
Single Sample $CBOD_5$ and TSS (mg/L)	60
Total Residual Chlorine (mg/L)	0.5 (minimum)
Total Nitrogen (as N) (mg/L)	12.0
Annual Average Total Fecal Coliform (#/100mL)	200
Monthly Geometric Mean Total Fecal Coliform (#/100mL)	200
Single Sample Total Fecal Coliform (#/100mL)	800
pH (minimum and maximum)	6.0 to 8.5

Chapter 2 – Existing Conditions

Facility Design Criteria

The Belle Glade WWTF is oxidation ditch aeration type activated sludge wastewater treatment plant. General influent design criteria are specified in **Table 3**.

Table 3 - General Influent Design Criteria

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	6.5
Influent CBOD5 and TSS (mg/L)	220
Influent CBOD5 and TSS (lbs/day)	12,000
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

The Belle Glade WWTF consists of preliminary treatment with mechanical bar screens and grit removal chambers. Liquid process treatment includes oxidation ditches, clarifiers and rotating drum screens. Residuals treatment includes an aerobic digester, sludge thickeners and a polymer feed system. Digested sludge is dewatered and hauled offsite by a contract service provider. Liquid effluent is disposed onsite through either a deep injection well or rapid infiltration basin. Backup power is provided by one (1) 310 kilowatt (kW) and one (1) 800 kW diesel engine generator. The major treatment plant components and the rated design capacities are listed in **Table 4**.

Table 4 - Major Treatment Components

Component (Quantity)	Capacity / Parameter
Mechanical Bar Screens (2)	9.80 mgd (each) (PHF)
Grit forced vortex chambers (2)	9.80 mgd (each) (PHF)
Oxidation ditches (2)	3.25 mgd (each) (MMADF)
Rectangular secondary clarifiers (2)	2.05 mgd each (MMADF)
Circular secondary clarifiers (2)	3.25 mgd each (MMADF)
Secondary effluent screens (4)	4.00 mgd each (PHF)
Aerobic Digester (1)	Hydraulic retention time of 53 days (MMADF)
Rotary drum sludge thickeners (2)	320 gpm each at 0.6% solids
Deep Well Injection Pumps (4)	12.06 mgd (PHF)
Deep Injection Well (1)	10.2 mgd (MDF)
Rapid Infiltration Basin (1))	0.069 mgd (MADF)

Historical Population

Table 5 shows the combined historical population for the Cities of Belle Glade and South Bay (US Census) and the Belle Glade WWTF service area (Palm Beach County TAZ population estimates). The population for the service area is significantly higher than the census data because the Belle Glade WWTF service area encompasses a larger geographic area than the City limits of Belle Glade and South Bay.

Table 5 - Historical Population

Year	City of Belle Glade and South Bay Census	Belle Glade WWTF Service Area
2010	22,343	25,095
2012	22,741	25,104

Source: Palm Beach County Planning Division Population Allocation Model (via PBCWUD)

Monthly and Annual Average Flows and Loadings

This Capacity Analysis Report update provides a summary of operational data for a 10-year period of record that extends from January 2003 through December 2012. **Table 6** summarizes flows on a monthly and annual basis. **Figures 2 and 3** present annual average and maximum month flows from 2003 through 2012, respectively. Seasonal flow variation does not appear to be population related since the Belle Glade WWTF service area does not have significant seasonal variations in population. Data would suggest that the seasonal flow variations are more likely related to rainfall and related Infiltration and Inflow (I&I) contributions to the collection system. As shown in **Table 6**, maximum monthly average daily flows (MMADFs) tend to occur in the months between June and September where historical rainfall has been the highest. At this time, no impacts are anticipated which would trigger the need for a plant expansion during the

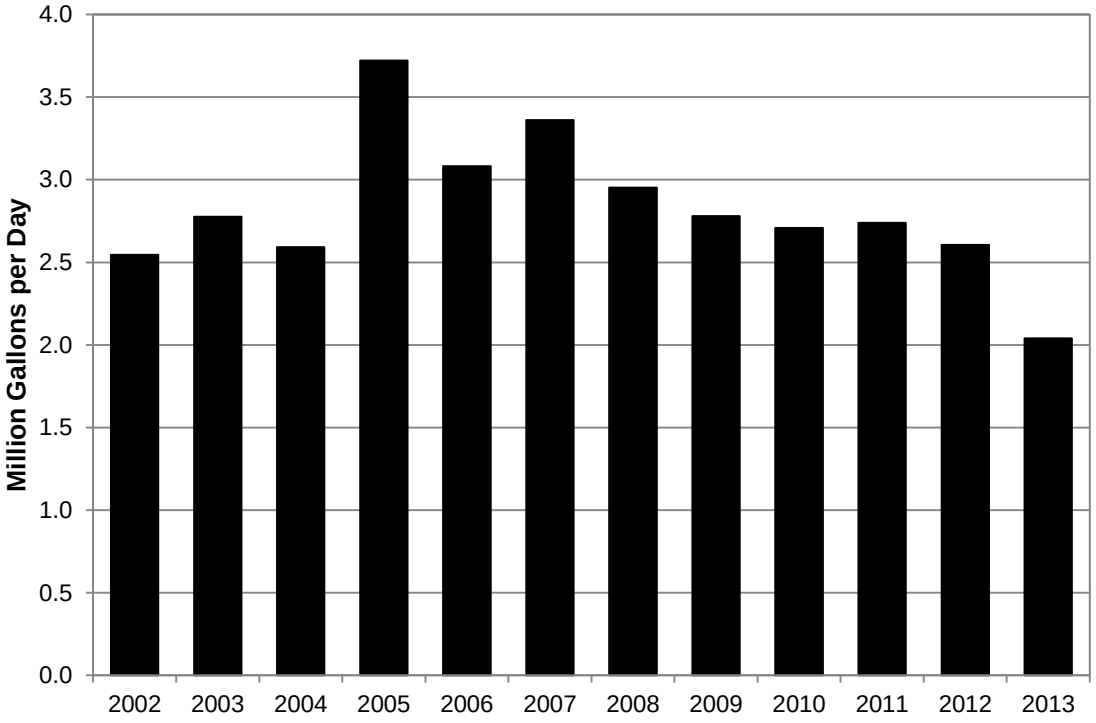
next ten years. Maximum month flows over the previous ten years have been approximately 65% of the existing permitted treatment capacity of 6.5 mgd. Maximum month flow for 2012 was 68% of the current permitted treatment capacity.

Table 6 – Monthly Average Daily Flows (mgd)

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Jan	1.81	--	2.65	3.21	2.88	2.71	3.41	2.22	2.31	2.24	1.97	1.95	**2.49**
Feb	3.35	--	2.92	3.25	3.34	3.10	3.47	2.23	2.35	1.93	2.07	2.15	**2.74**
Mar	1.62	3.03	2.47	4.20	2.86	3.14	3.25	2.20	3.28	2.61	1.96	2.02	**2.72**
Apr	1.59	2.89	2.18	3.48	2.88	3.28	3.51	2.16	2.26	2.17	2.25	--	**2.60**
May	2.19	0.00	2.28	4.10	3.52	3.58	2.25	3.39	2.02	2.37	2.29	--	**2.54**
Jun	4.21	4.36	2.62	4.20	2.89	4.04	3.21	4.13	3.86	1.95	2.54	--	**3.46**
Jul	3.25	3.57	3.48	3.77	3.69	3.72	3.19	3.06	4.18	4.71	3.28	--	**3.63**
Aug	2.28	2.55	4.87	3.45	3.43	3.61	3.67	3.42	3.69	2.72	4.08	--	**3.43**
Sep	2.68	2.69	0.44	3.42	3.52	3.77	3.24	3.58	2.52	4.28	4.45	--	**3.15**
Oct	2.52	2.96	1.39	4.13	2.51	3.42	2.07	1.98	1.93	3.55	2.53	--	**2.63**
Nov	2.43	2.80	2.31	--	2.66	2.87	2.00	2.16	1.95	2.24	1.83	--	**2.32**
Dec	2.62	2.92	3.49	--	2.81	3.09	2.16	2.83	2.15	2.12	2.02	--	**2.62**
Average	**2.55**	**2.78**	**2.59**	**3.72**	**3.08**	**3.36**	**2.95**	**2.78**	**2.71**	**2.74**	**2.61**	**2.04**	**2.83**
Maximum	**4.21**	**4.36**	**4.87**	**4.20**	**3.69**	**4.04**	**3.67**	**4.13**	**4.18**	**4.71**	**4.45**		

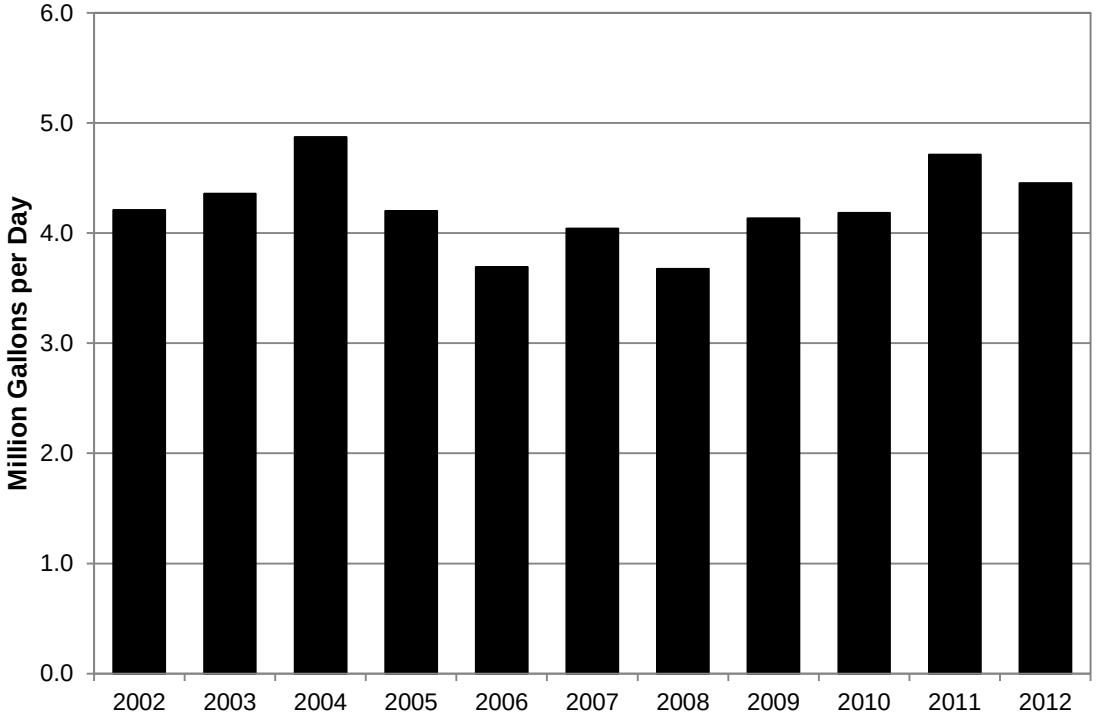
Note: Maximum month capacity is 6.5 mgd

Figure 2 – Annual Average Flows (2002-2013)



To account for unseasonal peaks in flow, the FDEP requires a review of historical flows using a 3-month rolling average. Since the Belle Glade WWTF is permitted on a maximum month basis, this report reviews historical flows at the more stringent maximum month basis. This information is presented in **Figure 3** for historical data from January 2003 through December 2012. This data also indicates that the Belle Glade WWTF is operating well within its permitted capacity.

Figure 3 – Maximum Month Average Daily Flows (2003-2012)



Review of historical data indicates that the permitted capacity of the Belle Glade WWTF is operating well within its 6.5 mgd permitted capacity and is not in need of expansion.

Plant Performance

Historical loads from 2009 – 2012, in terms of Carbonaceous 5-day Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS), are presented in **Tables 8 and 9,** respectively. As shown, the influent loadings over the past four years are well within the WWTF's general rated capacity of 12,000 lbs/day.

Figure 4 shows the removal percentage for both $CBOD_5$ and TSS, respectively. As shown in these figures, the level of treatment achieved for $CBOD_5$ removal is typically above 95%. Removal efficiency for TSS is nearly 92% for the period of record observed. The performance measurements confirm that the Belle Glade WWTF has and continues to operate satisfactorily.

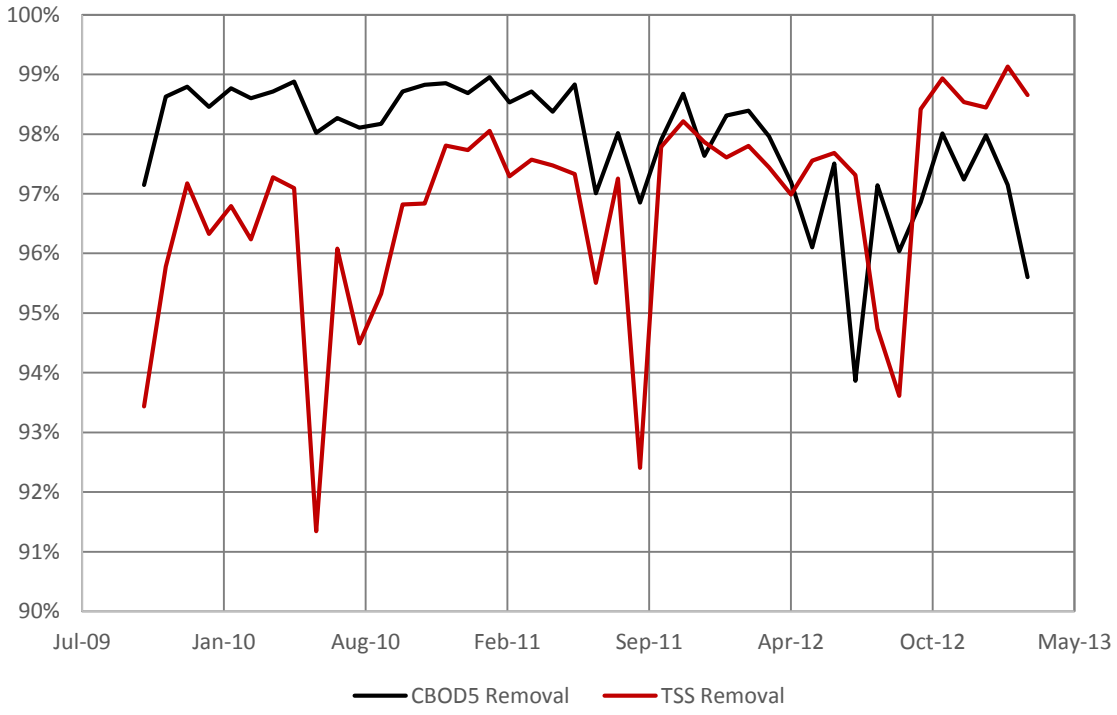
Table 8 – Monthly Average $CBOD_5$ Loading (pounds per day)

Month	2009	2010	2011	2012	2013	Average
Jan	--	3,495	3,121	1,944	2,021	**2,645**
Feb	--	3,074	3,081	2,369	2,296	**2,705**
Mar	--	4,360	2,963	2,263	1,854	**2,860**
Apr	--	3,066	2,813	2,120	--	**2,666**
May	--	3,140	2,459	2,512	--	**2,704**
Jun	--	3,350	2,952	2,244	--	**2,849**
Jul	--	4,023	2,628	2,482	--	**3,045**
Aug	--	3,293	2,286	3,056	--	**2,878**
Sep	--	2,294	2,440	2,162	--	**2,299**
Oct	2,532	2,527	2,917	1,548	--	**2,381**
Nov	2,796	2,762	3,109	1,760	--	**2,607**
Dec	4,428	3,138	1,777	2,051	--	**2,848**
Average	**3,252**	**3,210**	**2,712**	**2,209**	**2,057**	**2,688**

Table 9 – Monthly Average TSS Loading (pounds per day)

Month	2009	2010	2011	2012	2013	Average
Jan	--	3,772	3,057	2,140	1,869	**2,709**
Feb	--	3,186	3,197	1,949	3,613	**2,986**
Mar	--	3,192	2,853	2,110	2,235	**2,597**
Apr	--	2,461	2,743	2,129	--	**2,444**
May	--	2,034	2,735	2,056	--	**2,275**
Jun	--	2,368	2,398	1,872	--	**2,212**
Jul	--	3,277	3,748	1,996	--	**3,007**
Aug	--	1,972	2,978	2,637	--	**2,529**
Sep	--	1,591	2,653	2,472	--	**2,239**
Oct	2,772	1,805	5,024	2,081	--	**2,921**
Nov	3,072	1,796	1,959	1,994	--	**2,205**
Dec	4,710	3,448	1,976	2,043	--	**3,044**
Average	**3,518**	**2,575**	**2,943**	**2,123**	**2,572**	**2,746**

Figure 4 – Percent $CBOD_5$ and TSS Removal (2009-2013)



The Belle Glade WWTF disposes of effluent through a deep injection well. As with the treatment system, the permitted capacity for injection is within the operational requirements needed to safely operate the wastewater treatment facility.

Chapter 3 – Future Conditions

Population Projections

Population projections are based on the derived population projection per traffic analysis zone performed by Palm Beach County. These numbers are currently being used in the water and wastewater master plans currently being generated for the Glades region and will be the base for any water or wastewater planning activities for within the Belle Glade WWTF service area. **Table 10** provides the anticipated population growth for the Belle Glade WWTF service area for the next 10 years.

Table 10 - Population Projections

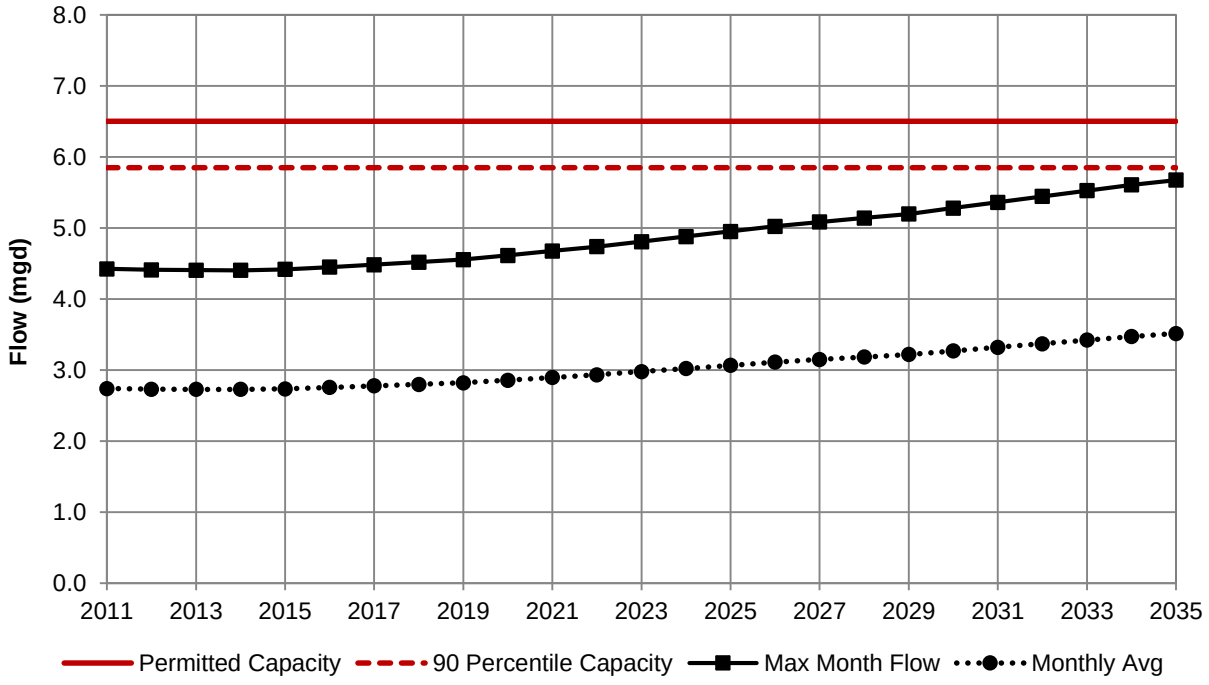
Year	Belle Glade WWTF Service Area	Yearly % Population Growth
2012	25,904	--
2013	26,001	0.37%
2014	26,121	0.46%
2015	26,356	0.90%
2016	26,763	1.54%
2017	27,205	1.65%
2018	27,651	1.64%
2019	28,084	1.57%
2020	28,723	2.28%
2021	29,404	2.37%
2022	30,078	2.29%
2023	30,813	2.44%

Source: Palm Beach County Planning Division Population Allocation Model (via PBCWUD)

Flow Projections

The Belle Glade WWTF service area population **(Table 10)** and average annual average daily (AADF) historical inflow for 2012 was used to derive the estimated wastewater generated per capita. 2012 data was utilized since it encompassed the most recent full calendar year of data collection and included an extreme rainfall event. Based on the population and flow data for 2012, a per capita wastewater generation rate of 70 gpd per capita was derived. Population projections, per capita flow rate and infiltration and inflow data were used to estimate future influent flows to the Belle Glade WWTF, as shown in **Figure 6.** In 2023, the anticipated Annual Average Daily Flow (AADF) inflow to the Belle Glade WWTF will be 3.08 mgd which correlates to a future MMADF of 4.98 mgd, utilizing a peaking factor of 1.61. As shown in **Figure 5**, the existing permitted capacity (6.5 mgd MMADF) will be adequate for the next 10 years.

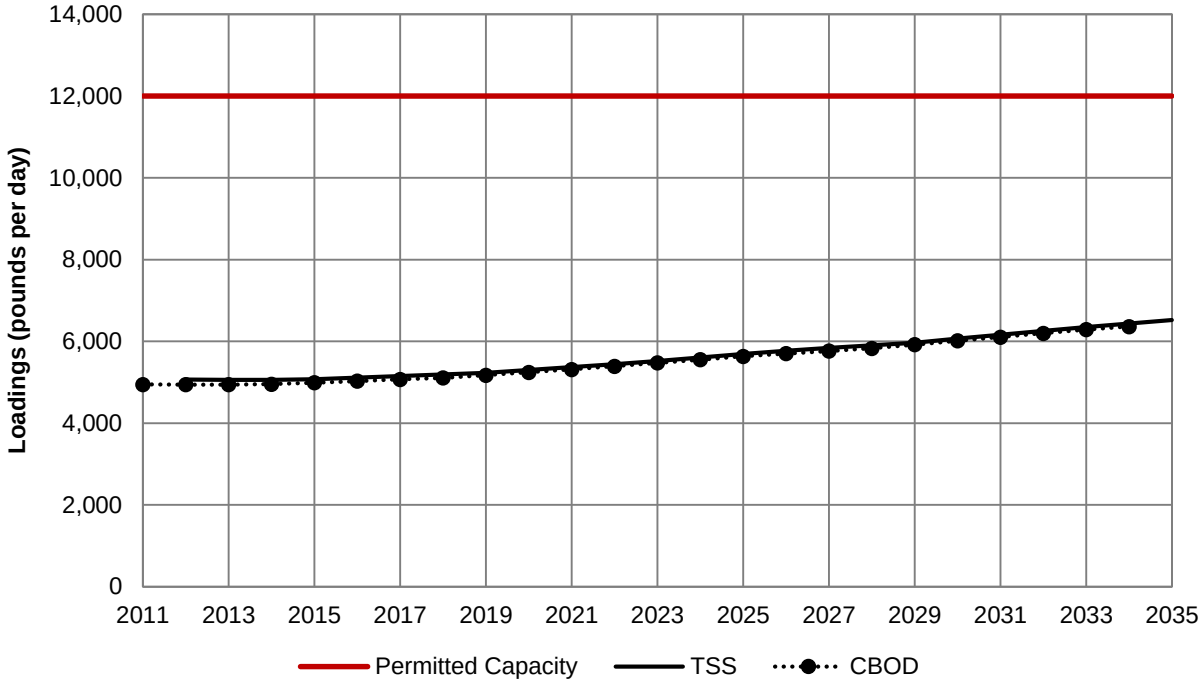
Figure 5 – Projected Estimates of Wastewater Flows



Loading Projections

The Belle Glade WWTF was originally designed based on BOD and TSS loading concentrations of 220 mg/L. Actual BOD and TSS concentrations from Year 2009 through 2012 are significantly less than the original design criteria, as summarized in **Tables 8 and 9**. Average concentrations from Years 2009 through 2012 and flow projections were used to calculate projected BOD and TSS loading in pounds per day. As illustrated in **Figure 6** below, BOD and TSS loadings are projected to remain well under the original design criteria of 12,000 pounds per day through the 10-year planning period.

Figure 6 – Projected Estimates of Wastewater Loadings



Chapter 4 – Summary

Summary

An updated Capacity Analysis Report has been prepared for the Belle Glade WWTF. This report is intended to provide documentation on the present status and future plans of the wastewater treatment facilities. Findings of this report are presented below:

- The service area boundaries have been established and there are no current plans to expand the territorial service area.
- The Belle Glade WWTF has a current permitted capacity of 6.5 mgd (based on maximum month average daily flow).
- The Belle Glade WWTF deep injection well has a permitted capacity of 10.3 mgd
- Maximum month average daily flows have averaged 4.23 mgd during the past ten years (i.e., 2003 through 2012), which is approximately 65% of the existing permitted capacity.
- Maximum month average daily flows during the past 12 months have averaged around 4.45 mgd, which is 68% of the permitted capacity.
- The wastewater treatment facility operates satisfactorily as indicated by the historical treatment levels achieved in terms of percent $CBOD_5$ and TSS removed. The amount $CBOD_5$ removed is typically over 95% while the TSS removal efficiency is around 92%.
- While flow projections are anticipated to increase over the next ten (10) years, total maximum month average daily flows are estimated to be 4.98 mgd which is below the permitted capacity of 6.5 mgd and the 90th percentile capacity of 5.85 mgd. In addition, the maximum three-month rolling average daily flow does not equal or exceed the permitted capacity. Based on the above, an increase to the treatment capacity is not deemed necessary during the next ten (10) years.

The 2013 Capacity Analysis Report for the Belle Glade Wastewater Treatment Facility has been prepared by:

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APPENDIX B

Pahokee WWTF Capacity Analysis Report

Palm Beach County Water Utilities Department

CAPACITY ANALYSIS REPORT

Pahokee Wastewater Treatment Facility

Palm Beach County, FL

Permit No.: FLA0136778-008

Report Date: October 2013

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Chapter 1 – Introduction

The Capacity Analysis Report (CAR) is required to fulfill the requirements of Chapter 62-600.405 of the Florida Administrative Code (FAC) and provide an assurance to the Florida Department of Environmental Protection (FDEP) that the wastewater treatment facility does not exceed its permitted capacity. Currently the Pahokee Wastewater Treatment Facility (WWTF) operates under two operating permits: WWTF Operating Permit (Permit No. FLA0136778) and the Injection Well Operating Permit (Permit No. 0138286-017-UO). The last capacity analysis report was submitted for the Pahokee WWTF to the Florida Department of Environmental Protection (FDEP) in December 2011 and anticipated that the Pahokee WWTF would not exceed its treatment capacity of 1.2 million gallons per day (mgd) three-month average daily flow (TMADF) within the next five years.

This report provides an overview of the existing and future conditions of the Pahokee WWTF as related to the WWTF's permitted capacity and summarizes the WWTF's ability to provide treatment in compliance with its permitted capacity.

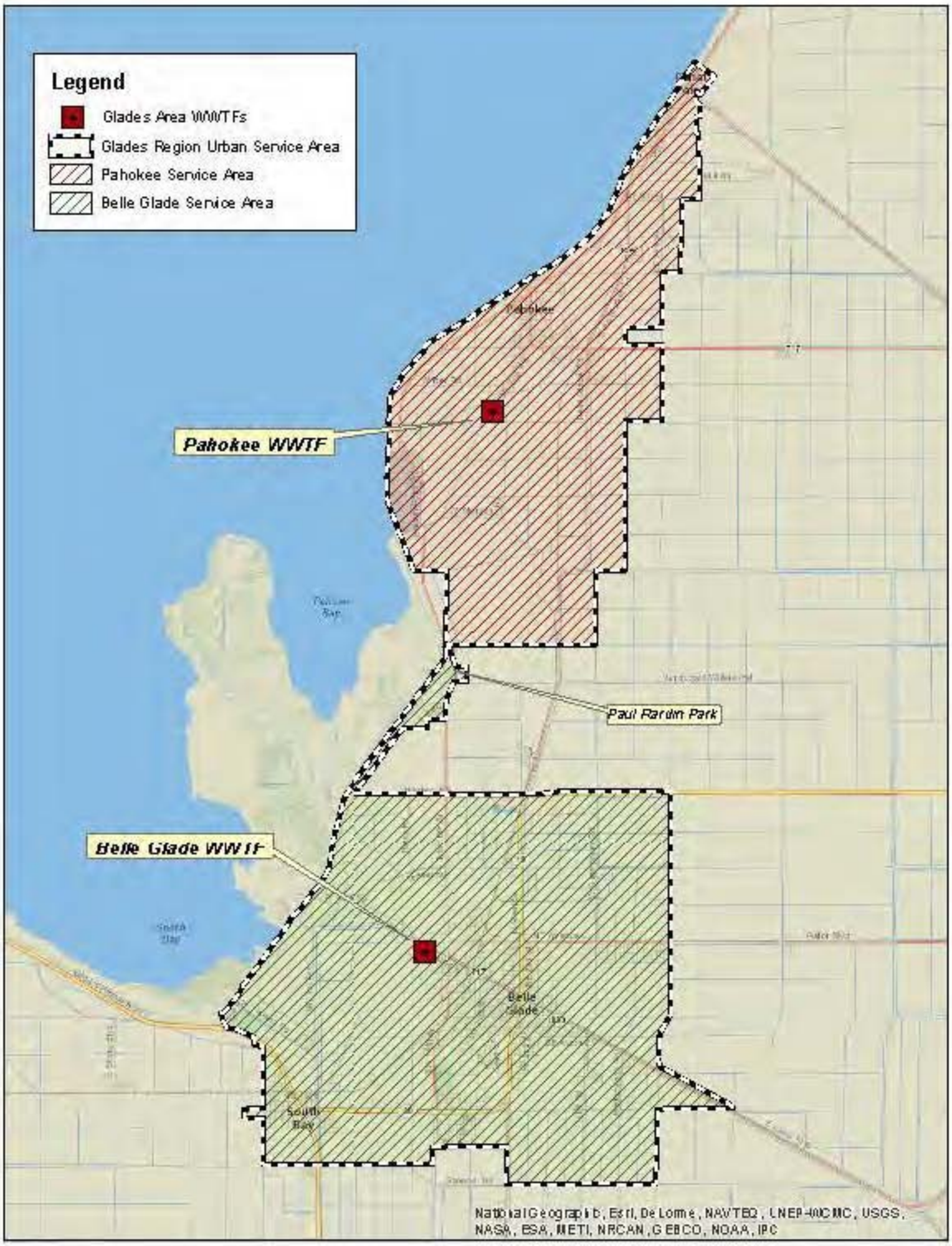
An inter-local agreement between the Cities of Pahokee, Belle Glade and South Bay for the established of the Glades Utility Authority (GUA) was executed on June 6, 2009 under Resolution R-2009-1034. The ownership and operational control of the Pahokee WWTF was transferred from the City of Pahokee to the GUA on October 1, 2009. The GUA and operational control were subsequently transferred to Palm Beach County Utilities.

Collection System Description

The Pahokee WWTF serves the City of Pahokee and Canal Point within the Pahokee WWTF service area as shown in **Figure 1**. The collection system consists of 40 lift stations. Wastewater is transferred to the WWTF via three force mains that manifold to enter a flow splitter box located ahead of the headworks.

Collection system improvements to reduce Infiltration and Inflow (I&I) were completed in May 2011, in response to a study performed by AECOM in 2009 to identify sources of I&I within the collection system. As a result of the study 23 lift stations were repaired, 33,900 linear feet of new pipe installed, and existing pipes and manholes cleaned and/or repaired.

Figure 1 – Glades Region Wastewater Service Sub-areas



Treatment System Description

The Pahokee WWTF is located on approximately 31 acres at 1001 Rim Canal Road in Pahokee, Florida. The Pahokee WWTF provides secondary treatment, on-site biosolids processing and stabilization, and effluent disposal primarily via deep well injection. The Pahokee WWTF is currently permitted to treat 1.2 mgd TMADF with permitted effluent discharge capacities of 4.0 mgd monthly average daily flow (MADF) via a Class I underground injection well and an additional 0.08 mgd annual average daily flow (AADF) via a rapid infiltration basin. Emergency disposal is by gravity flow of high-level disinfected effluent to the polishing ponds with a capacity of one million gallons.

Permit Summary

Effluent discharge permit limitations for five-day carbonaceous biochemical oxygen demand (CBOD5), total suspended solids (TSS) and pH are specified in **Table 1** (Underground Injection Well) and **Table 2** (Rapid Infiltration Basin).

Table 1 - Effluent Discharge Permit Requirements - Underground Injection Well

Effluent Parameter	Effluent Permit Limitation
Peak Hourly Flow (mgd)	4.0
Annual Average CBOD5 and TSS (mg/L)	20
Monthly Average CBOD5 and TSS (mg/L)	30
Weekly Average CBOD5 and TSS (mg/L)	45
Single Sample CBOD5 and TSS (mg/L)	60
pH (minimum and maximum)	6.5 to 8.5

Table 2 - Effluent Discharge Permit Requirements - Rapid Infiltration Basin

Effluent Parameter	Effluent Permit Limitation
Monthly Average Daily Flow (mgd)	4.0
Annual Average $CBOD_5$ and TSS (mg/L)	20
Monthly Average $CBOD_5$ and TSS (mg/L)	30
Weekly Average $CBOD_5$ and TSS (mg/L)	45
Single Sample $CBOD_5$ and TSS (mg/L)	60
Total Residual Chlorine (mg/L)	0.5 (minimum)
Total Nitrogen (as N) (mg/L)	12.0
Annual Average Total Fecal Coliform (#/100mL)	200
Monthly Geometric Mean Total Fecal Coliform (#/100mL)	200
Single Sample Total Fecal Coliform (#/100mL)	800
pH (minimum and maximum)	6.5 to 8.5

Chapter 2 – Existing Conditions

Facility Design Criteria

The Pahokee WWTF is activated sludge wastewater treatment plant consisting of a 0.50 mgd TMADF conventional wastewater treatment plant (WWTP) and a 0.70mgd TMADF complete mix WWTP (Walker Modular Plant) to provide its rated capacity of 1.2 mgd TMADF. General influent design criteria are specified in **Table 3**.

Table 3 - General Influent Design Criteria

Influent Design Criteria	Parameter
Rated Design Flow (mgd)	1.2
Influent CBOD5 and TSS (mg/L)	180
Influent CBOD5 and TSS (lbs/day)	1800
Total Nitrogen (mg/L)	40
Ammonia Nitrogen (mg/L)	25
Total Phosphorous (mg/L)	10
pH (minimum and maximum)	6.5 to 8.5

Influent flow enters the WWTF at the influent flow splitter box where flow is divided, and individually measured by two magnetic flow meters, to either mechanical bar screens (JWC Auger Monsters) or manually cleaned bar screens (by-pass) located at the headworks. Flow is then distributed to the 0.50 mgd conventional plant and 0.70 mgd Walker modular plant. Residuals treatment includes aerobic digestion, dewatering by a belt filter press and a Class A stabilization unit (BIOSET) capable of processing 675 pounds per hour of dry solids. The BIOSET unit consists of an input hopper with primary motive mixer, lime storage silo with feed assembly, sulfuric acid hopper and feed assembly, solids/lime/acid reactor, all mounted on a covered concrete containment pad with floor drains for spill control, washdown, and further treatment as necessary. Supernatant from the digesters is collected and returned to the headworks for treatment. Liquid effluent is disposed onsite through either a deep injection well or rapid infiltration basin. The major treatment plant components common to both the 0.50 and 0.70 mgd WWTPs, and the rated design capacities are listed in **Table 4**. The major treatment plant components for the 0.50 mgd conventional WWTP and the rated design capacities are listed in **Table 5**. The major treatment plant components for the 0.70 mgd complete mix Walker Modular WWTP and the rated design capacities are listed in **Table 6**.

Table 4 - Common Major Treatment Components

	Quantity	Parameter
JWC Auger Monster Screens (Headworks)	1	3.0 mgd (PHF)
Manually Cleaned Screens (Headworks)	1	3.5 mgd (PHF)
BIOSET Class A Stabilization Unit	1	675 lbs/day
Deep Injection Well	1	3.89 mgd
Rapid Infiltration Basin (Land Application)	1	0.08 mgd

Table 5 - Major Treatment Components - 0.50 mgd WWTP

	Quantity	Parameter
Primary Clarifier	1	53,000 gallons
Aeration Basins	2	75,000 gallons each
Secondary Clarifiers	2	80,000 gallons each
Aerobic Digester	1	258,000 gallons

Table 6 - Major Treatment Components - 0.70 mgd WWTP

	Quantity	Parameter
Aerated Grit Removal Basin	1	---
Aeration Basins	1	123,000 gallons
Clarifier	1	172,000 gallons
Aerobic Digester	1	172,000 gallons

Historical Population

Table 7 shows the historical population for the City of Pahokee (US Census) and the Pahokee WWTF service area (Palm Beach County TAZ population estimates). The population for the service area is significantly higher than the census data because the Pahokee WWTF service area encompasses a larger geographic area than the Pahokee City limits.

Table 7 - Historical Population

Year	City of Pahokee Census	Pahokee WWTF Service Area
2010	5,649	7,834
2012	N/A	7,838

Source: Palm Beach County Planning Division Population Allocation Model (via PBCWUD)

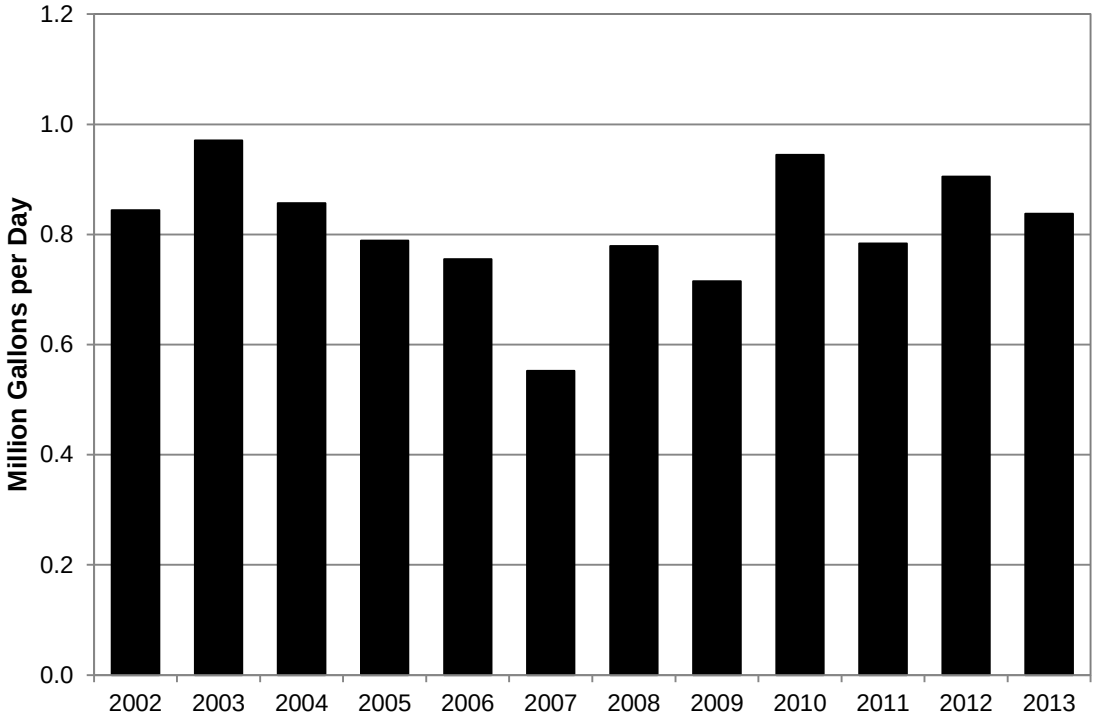
Monthly and Annual Average Flows and Loadings

This Capacity Analysis Report update provides a summary of operational data for a 10-year period of record that extends from January 2003 through December 2012. **Table 8** summarizes flows on a monthly and annual basis. **Figure 2** presents annual average flows from 2003 through 2012. For the current period of record (2003-2012), flows averaged 0.81 mgd. Seasonal flow variation does not appear to be population related since the Pahokee WWTF service area does not have significant seasonal variations in population. Data would suggest that the seasonal flow variations are more likely related to rainfall and related Infiltration and Inflow (I&I) contributions to the collection system. As shown in **Table 8**, maximum month average daily flows tend to occur in the months between July and October where historical rainfall has been the highest. Maximum three-month average daily flows over the previous ten years have been approximately 88% of the existing permitted treatment capacity of 1.2 mgd. The maximum three-month average flow for 2012 was 99% of the current permitted treatment capacity.

Table 8 – Monthly Average Daily Flows (mgd)

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Jan	0.74	0.87	0.81	0.58	0.71	0.62	0.54	0.55	0.85	0.85	0.75	0.77	**0.72**
Feb	0.68	0.92	0.82	0.64	0.87	0.58	0.57	0.59	0.85	0.75	0.72	0.96	**0.75**
Mar	0.80	0.79	0.68	0.85	0.63	0.46	0.54	0.56	1.44	0.84	0.74	0.78	**0.76**
Apr	0.70	0.73	0.67	0.82	0.64	0.45	0.67	0.53	0.95	0.83	0.81	--	**0.71**
May	0.52	0.84	0.66	0.76	0.61	0.43	0.49	0.69	0.74	0.68	0.71	--	**0.65**
Jun	0.99	1.04	1.01	1.15	0.61	0.59	0.56	1.03	0.95	0.68	1.22	--	**0.89**
Jul	1.08	1.19	0.78	0.93	0.98	0.70	1.11	0.97	1.39	0.78	0.81	--	**0.97**
Aug	1.38	1.66	1.25	0.77	0.72	0.48	1.59	0.89	0.94	0.69	1.02	--	**1.04**
Sep	0.82	1.00	1.31	0.72	1.32	0.55	1.31	0.86	0.81	0.74	1.54	--	**1.00**
Oct	0.71	0.99	1.01	0.61	0.71	0.70	0.83	0.62	0.77	0.84	1.02	--	**0.80**
Nov	0.82	0.80	0.72	0.95	0.63	0.46	0.59	0.63	0.80	0.91	0.71	--	**0.73**
Dec	0.89	0.82	0.56	0.69	0.63	0.61	0.55	0.66	0.83	0.82	0.82	--	**0.72**
Average	**0.84**	**0.97**	**0.86**	**0.79**	**0.76**	**0.55**	**0.78**	**0.72**	**0.94**	**0.78**	**0.91**	**0.84**	**0.81**

Figure 2 – Annual Average Flows (2002-2013)

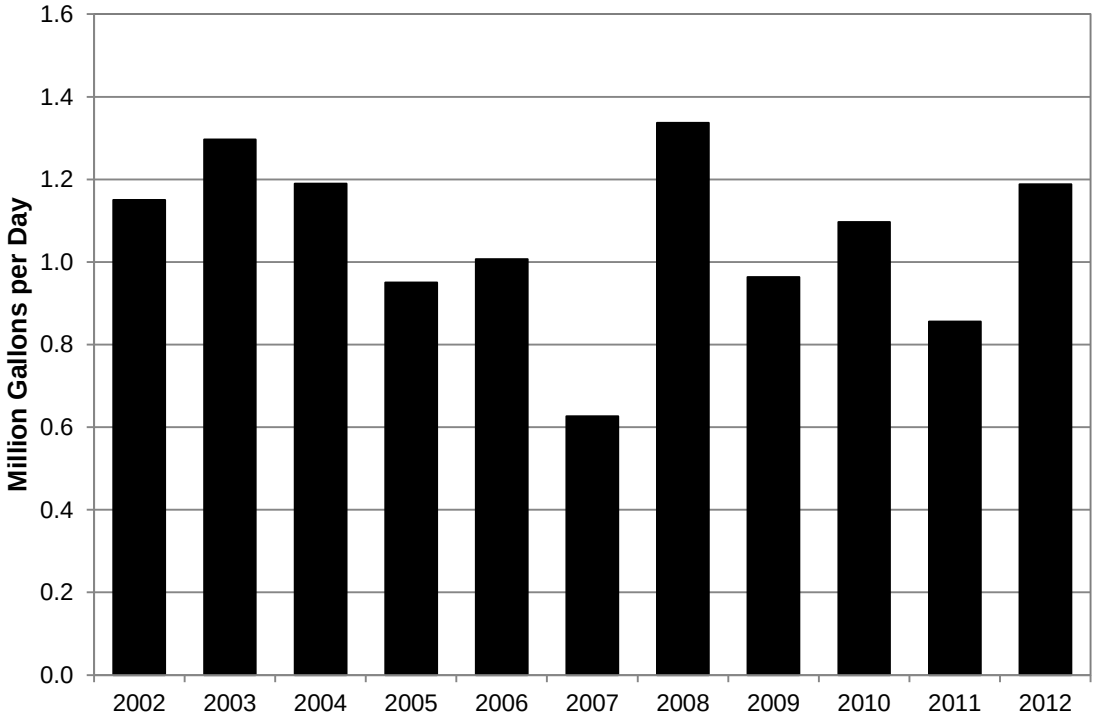


To account for unseasonal peaks in flow, the FDEP requires a review of historical flows using a 3-month rolling average. This information is presented in **Table 9** and **Figure 3** for historical data from January 2003 through December 2012. This data also indicates that the Pahokee WWTF is operating within its permitted capacity.

Table 9 – Three Month Rolling Average Daily Flows (mgd)

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Jan	0.69	0.86	0.81	0.62	0.78	0.63	0.54	0.56	0.71	0.83	0.83	0.77	**0.72**
Feb	0.68	0.89	0.82	0.59	0.76	0.61	0.57	0.56	0.79	0.81	0.76	0.84	**0.72**
Mar	0.74	0.86	0.77	0.69	0.74	0.55	0.55	0.57	1.05	0.81	0.74	0.83	**0.74**
Apr	0.73	0.81	0.72	0.77	0.71	0.50	0.59	0.56	1.10	0.81	0.76	--	**0.73**
May	0.67	0.79	0.67	0.81	0.63	0.45	0.57	0.59	1.05	0.78	0.75	--	**0.71**
Jun	0.74	0.87	0.78	0.91	0.62	0.49	0.57	0.75	0.87	0.73	0.91	--	**0.75**
Jul	0.86	1.02	0.82	0.95	0.73	0.57	0.72	0.90	1.03	0.71	0.91	--	**0.84**
Aug	1.15	1.30	1.01	0.95	0.77	0.59	1.09	0.96	1.10	0.72	1.01	--	**0.97**
Sep	1.09	1.28	1.11	0.81	1.01	0.58	1.34	0.91	1.05	0.74	1.12	--	**1.00**
Oct	0.97	1.22	1.19	0.70	0.92	0.58	1.24	0.79	0.84	0.76	1.19	--	**0.94**
Nov	0.78	0.93	1.01	0.76	0.89	0.57	0.91	0.70	0.79	0.83	1.09	--	**0.84**
Dec	0.81	0.87	0.76	0.75	0.66	0.59	0.66	0.64	0.80	0.86	0.85	--	**0.75**
Average	**0.83**	**0.98**	**0.87**	**0.78**	**0.77**	**0.56**	**0.78**	**0.71**	**0.93**	**0.78**	**0.91**	**0.81**	**0.81**
Max.	**1.15**	**1.30**	**1.19**	**0.95**	**1.01**	**0.63**	**1.34**	**0.96**	**1.10**	**0.86**	**1.19**	**0.81**	**1.06**

Figure 3 – Maximum Three-Month Average Daily Flows (2002-2012)



Review of historical data from Years 2009 to 2012 indicates that the influent flows to the Pahokee WWTF are approaching the 1.2 mgd permitted capacity.

Plant Performance

Historical loads from 2009 – 2012, in terms of Carbonaceous 5-day Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS), are presented in **Tables 10 and11,** respectively. As shown, the influent loadings over the past four years are well within the WWTF's general rated capacity of 1,800 lbs/day.

Figure 4 shows the removal percentage for both $CBOD_5$ and TSS, respectively. As shown in these figures, the level of treatment achieved for $CBOD_5$ removal is typically above 92%. Removal efficiency for TSS is nearly 85% for the period of record observed. The performance measurements confirm that the Pahokee WWTF has and continues to operate satisfactorily.

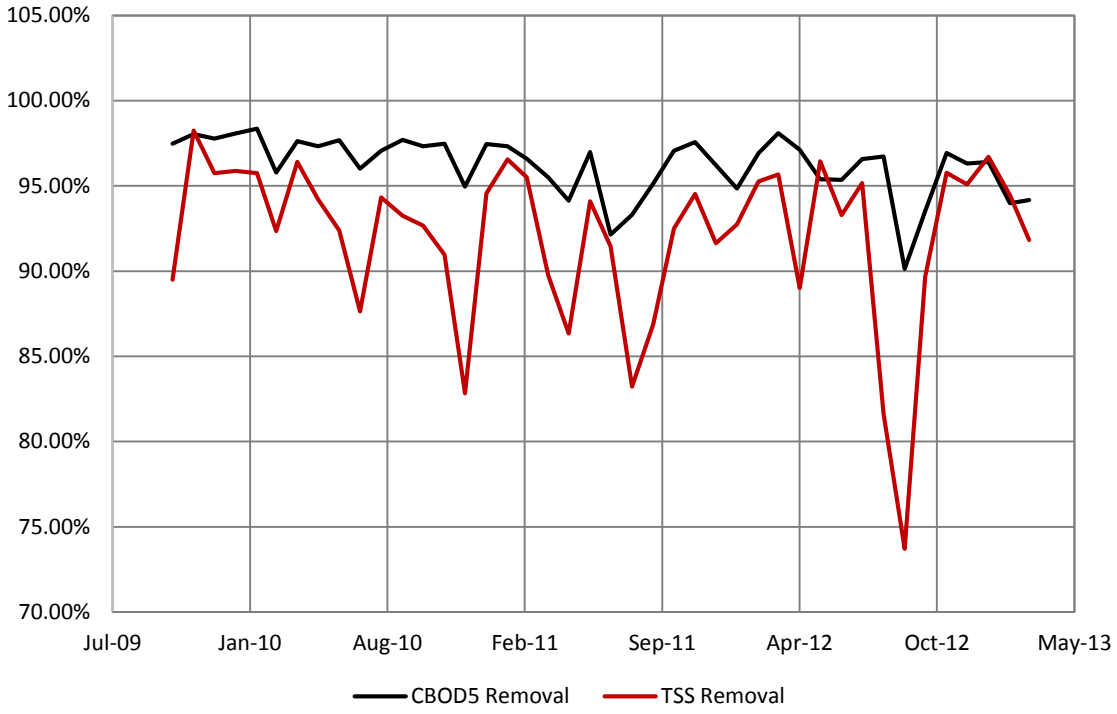
Table 10 – Monthly Average $CBOD_5$ Loading (pounds per day)

Month	2009	2010	2011	2012	2013	Average
Jan	--	1,308	743	623	764	**859**
Feb	--	788	864	649	819	**780**
Mar	--	771	854	729	686	**760**
Apr	--	1,103	809	851	--	**921**
May	--	558	557	693	--	**603**
Jun	--	806	979	920	--	**901**
Jul	--	662	575	768	--	**668**
Aug	--	702	518	695	--	**638**
Sep	--	852	653	515	--	**674**
Oct	384	651	727	481	--	**561**
Nov	536	919	708	551	--	**679**
Dec	476	777	645	998	--	**724**
Average	**465**	**825**	**719**	**706**	**756**	**694**

Table 11 – Monthly Average TSS Loading (pounds per day)

Month	2009	2010	2011	2012	2013	Average
Jan	--	1,112	988	975	1,103	**1,045**
Feb	--	752	1,321	934	1,040	**1,012**
Mar	--	1,014	1,234	821	1,277	**1,086**
Apr	--	1,126	757	774	--	**886**
May	--	615	580	847	--	**680**
Jun	--	618	1,313	1,165	--	**1,032**
Jul	--	752	626	878	--	**752**
Aug	--	982	519	724	--	**742**
Sep	--	714	630	966	--	**770**
Oct	292	574	869	643	--	**594**
Nov	1,713	828	807	743	--	**1,023**
Dec	553	831	759	1,256	-	**850**
Average	**852**	**826**	**867**	**894**	**1,140**	**916**

Figure 4 – Percent $CBOD_5$ and TSS Removal (2009-2013)



The Pahokee WWTF disposes of effluent through a deep injection well. As with the treatment system, the permitted capacity for injection is within the operational requirements needed to safely operate the wastewater treatment facility.

Chapter 3 – Future Conditions

Population Projections

Population projections are based on the derived population projection per traffic analysis zone performed by Palm Beach County. These numbers are currently being used in the water and wastewater master plans currently being generated for the Glades region and will be the base for any water or wastewater planning activities for within the Pahokee WWTF service area. **Table 12** provides the anticipated population growth for the Pahokee WWTF service area for the next 10 years.

Table 12 - Population Projections

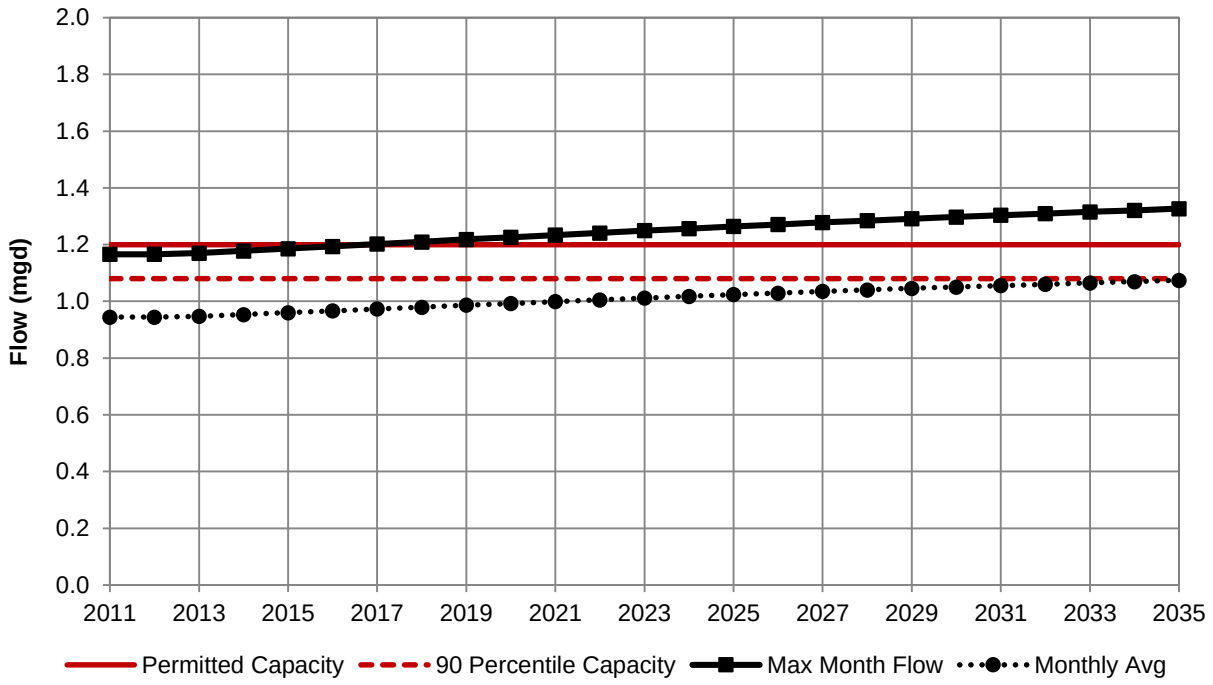
Year	Pahokee WWTF Service Area	Yearly % Population Growth
2012	7,838	--
2013	7,895	0.72%
2014	8,017	1.55%
2015	8,140	1.54%
2016	8,264	1.52%
2017	8,398	1.63%
2018	8,518	1.42%
2019	8,654	1.60%
2020	8,767	1.30%
2021	8,898	1.49%
2022	9,012	1.29%
2023	9,138	1.39%

Flow Projections

As shown in Table 7, the Pahokee WWTF has exceeded its permitted three-month average daily flow (TMADF) capacity of 1.2 mgd twice in the past ten (10) years; however, since the transfer of the GUA to Palm Beach County Utilities the Pahokee WWTF has not exceeded its permitted capacity. In October 2012 the Pahokee WWTF approached its permitted capacity with a TMADF of 1.19 mgd, corresponding to 99% of the permitted capacity of the WWTF. This was the result of an extreme rainfall period occurring between August 27, 2012 and September 13, 2012 where large parts of the service area were flooded. Low corresponding daily influent loadings ranging from 15 mg/L $CBOD_5$ to 42 mg/L $CBOD_5$ and 25 to 41 mg/L TSS during this period indicate a large contribution to the collection system from rainfall. It is likely that the inflow and infiltration rehabilitation project completed in May 2011, prevented the Pahokee WWTF from exceeding its permitted capacity during this extreme rain event. Since May 2011, the Pahokee WWTF has typically operated at or below 75% of its permitted capacity, with TMADFs only exceeding 0.9 mgd as a result of the extreme rain event experienced in 2012.

The Pahokee WWTF service area population **(Table 12)** and average annual average daily (AADF) historical inflow for 2012 was used to derive the estimated wastewater generated per capita. 2012 data was utilized since it encompassed the most recent full calendar year of data collection and included an extreme rainfall event. Based on the population, flow data for 2012, and inflow and infiltration data, a per capita wastewater generation rate of 51 gpd per capita was derived. Population projections, per capita flow projections and inflow and infiltration data, were used to estimate future inflows to the Pahokee WWTF, as shown in **Table 12 and Figure 5**. As shown in **Figure 5**, future flows are projected to exceed the existing permitted capacity (1.2 mgd TMADF) in the Year 2018.

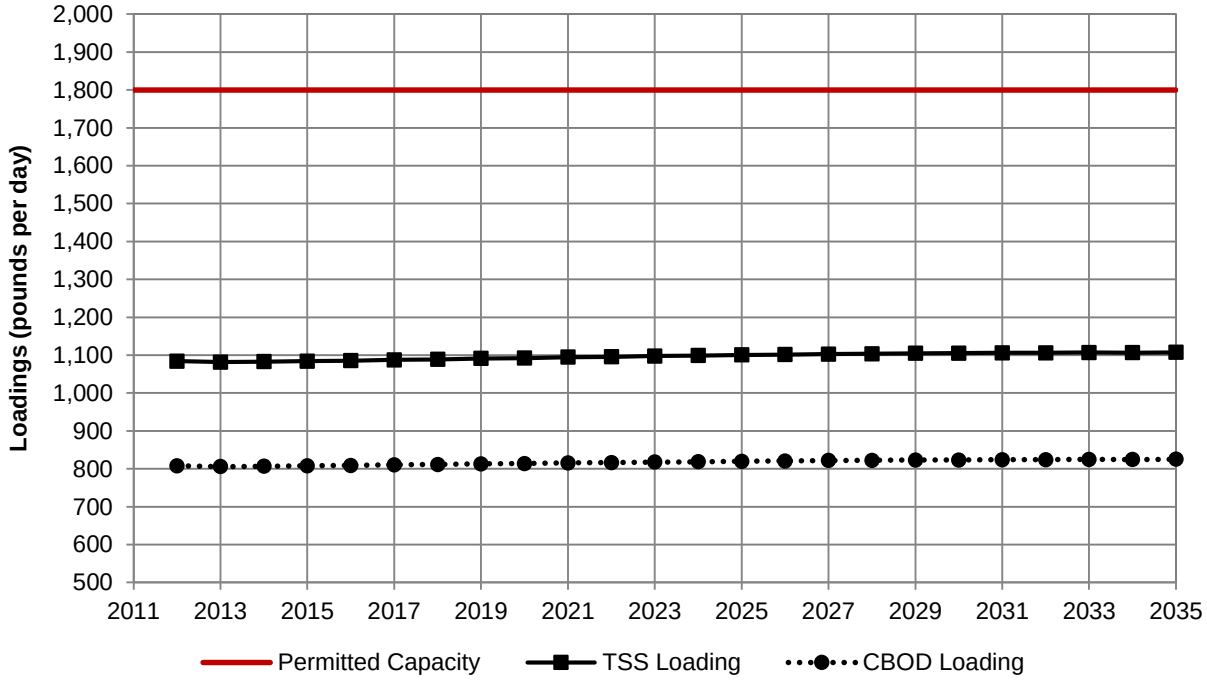
Figure 5 – Projected Estimates of Wastewater Flows



Loading Projections

The Pahokee WWTF was originally designed based on BOD and TSS loading concentrations of 180 mg/L. Actual BOD and TSS concentrations from Year 2009 through 2012 are significantly less than the original design criteria, as summarized in **Tables 8 and 9**. Average concentrations from Years 2009 through 2012 and flow projections were used to calculate projected BOD and TSS loading in pounds per day. As illustrated in **Figure 6** below, BOD and TSS loadings are projected to remain well under the original design criteria of 1,800 pounds per day through the 10-year planning period.

Figure 6 – Projected Estimates of Wastewater Loadings



Chapter 4 – Summary

Summary

An updated Capacity Analysis Report has been prepared for the Pahokee WWTF. This report is intended to provide documentation on the present status and future plans of the wastewater treatment facilities. Findings of this report are presented below:

- The service area boundaries have been established and there are no current plans to expand the territorial service area.
- The Pahokee WWTF has a current permitted capacity of 1.2 mgd (based on maximum three-month average daily flow).
- The injection well has a permitted capacity of 3.89 mgd
- Maximum three month average daily flows have averaged 1.06 mgd during the past ten years (i.e., 2003 through 2012), which is approximately 88% of the existing permitted capacity.
- Maximum three month average daily flows during the past 12 months were 1.19 mgd, which is 99% of the permitted capacity.
- The wastewater treatment facility operates satisfactorily as indicated by the historical treatment levels achieved in terms of percent $CBOD_5$ and TSS removed. The amount $CBOD_5$ removed is typically 92% while the TSS removal efficiency is 85%.
- The maximum projected three month average daily flow is projected to exceed the plant's capacity by the Year 2018.
- FDEP 62-600.405 (8a) states that "…*if the initial capacity analysis report or an update of the capacity analysis report documents that the permitted capacity will be equaled or exceeded within the next 5 years, the report shall include a statement, signed and sealed by a professional engineer registered in Florida, that planning and preliminary design of the necessary expansion have been initiated.*"
- Palm Beach County Water Utilities Department has initiated planning as part of the Glades Wastewater Master Plan, which includes conceptual planning of an expansion to the Pahokee WWTF; and conceptual planning of an alternate approach to convert the Pahokee WWTF to a regional pump station and treat Pahokee service area flows at the Belle Glade WWTF.

The 2013 Capacity Analysis Report for the Pahokee Wastewater Treatment Facility has been prepared by:

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TECHNICAL MEMORANDUM No. 12 – Implementation Plan

TO: Maurice Tobon / Palm Beach County Water Utilities Department
Jennifer Medina / Palm Beach County Water Utilities Department

COPY: Albert Muniz / Hazen and Sawyer
Rob Taylor / Hazen and Sawyer

FROM: Kurt Pfeffer / Hazen and Sawyer

DATE: September 8, 2014

FILE: 45103-004.3.1

SUBJECT: Palm Beach County Water Utilities Department
Glades Wastewater Master Plan
Project Number: WUD 12-068

Technical Memorandum No. 12 (TM-12) addresses an implementation plan for projects identified during development of the Glades Wastewater Master Plan. Estimated costs for projects identified have been prepared and assigned to fiscal years based on criticality of renewal and replacement improvements and priorities established with the Palm Beach County Water Utilities Department (PBCWUD) staff. For the purpose of this plan, the planning horizon extends through Fiscal Year 2035. Fiscal years commence on October 1st. Therefore, Fiscal Year 2015 is represented as FY15; meaning the period from October 1, 2014 through September 30, 2015.

INTRODUCTION

The wastewater master planning effort for the Glades Region Urban Service area includes an evaluation of its wastewater system, consisting of collection (i.e., lift stations), transmission (force mains), treatment and disposal.

IMPLEMENTATION PLAN

Projects have been grouped based on the following categories:

- Collection System (Lift Stations)
- Transmission System (Force Mains)
- Infiltration and Inflow
- Wastewater Treatment

Wastewater treatment and disposal projects have been further subdivided into the following sub-categories:

- Belle Glade WWTF Renewal and Replacement
- Pahokee WWTF Renewal and Replacement
- Pahokee Conversion to Regional Pump Station (for treatment at Belle Glade WWTF)

As discussed in Chapter 11, the wastewater master plan presents two possible scenarios for treatment of wastewater flows from the Pahokee service area. The first option assumes continued treatment at a rehabilitated Pahokee WWTF. The second option assumes demolition of the Pahokee WWTF, construction of a regional Pahokee Regional Wastewater Pump Station and force main, and treatment of Pahokee service area wastewater flows at the Belle Glade WWTF. Each scenario is presented separately below. PBCWUD is in the process of conducting a Business Case Evaluation of the two scenarios, and this implementation plan should be updated once the County selects between the two scenarios.

In addition to the categories listed above, tables presented below include descriptive columns to further define the projects. For example, each project has been assigned a: 1) project number, 2) project name, 3) improvement type, and 4) cost. The project number is an identification code to facilitate project tracking, and the project name is a short descriptive title related to the project scope. Brief descriptions of the project scopes are also included herein where applicable. The detailed descriptions of the project scopes are presented in prior sections of this report.

The improvement type column, if applicable, provides an indication of what drives the need for the project. In some instances, as discussed below, the criteria is either not applicable or is being addressed separately by the PBCWUD engineering staff. Descriptions of criteria are presented below:

1. Regulatory: Regulatory driven projects are improvements that are considered necessary for compliance with current regulations and/or possible future regulations.

2. Capacity: Capacity driven projects are improvements that increase the capacity of the wastewater collection, wastewater pumping, transmission and treatment/ disposal systems to meet the needs of current customers as well as meeting the needs for forecasted population growth.

3. Renewal and Replacement: Renewal and Replacement (R&R) projects are those needed to address aging infrastructure to maintain a reliable and sustainable utility.

4. Facility Improvement: Facility improvement projects are those recommended to enhance operational effectiveness, reliability, and / or efficiency.

OPINIONS OF PROBABLE CONSTRUCTION COST

The opinions of probable cost presented herein have been prepared based upon master plan level information. Because of the level of scope development at this stage the opinion is an "Order Of Magnitude" estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected range of accuracy for this type of opinion is +50 percent to -30 percent. These opinions of probable cost have been prepared for guidance in project evaluation and implementation from the information available at this stage of the estimate. The final costs of the projects will depend on actual labor and material cost, competitive market conditions, final project scope, implementation schedule, and other variable conditions. As a result, the final project costs will vary from the opinions presented herein.

The cost opinions are "project costs" and are inclusive of: construction costs; contractor overhead and profit; estimated allowance for permit application fees; 20 percent estimated allowance for engineering services during the design, permitting, construction and startup of the project; along with a 30 percent contingency. The costs are based upon year 2013 dollars and do not include escalation for inflation.

Collection System (Lift Station) Projects

The opinions of probable cost for collection system projects are presented in **Table 12.1**.

Table 12.1
Opinions of Probable Project Cost
Collection System (Lift Station) Projects

Project No.	Project Name	Improvement Type	Project Cost
LS001	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	R&R	$4,111,250
LS002	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	R&R	$5,692,500
LS003	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	R&R	$2,530,000
LS004	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	R&R	$2,530,000
LS005	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	R&R	$2,530,000
LS006	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	R&R	$4,743,750
LS007	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	R&R	$4,117,000
Total – Collection System (Lift Station) Projects			***$26,254,500***

See TM-7 for further details regarding the scope of rehabilitation of the various lift stations.

Transmission System (Force Main) Projects

The opinions of probable cost for transmission system projects are presented in **Table 12.2**.

Table 12.2
Opinions of Probable Project Cost
Transmission System (Force Main) Projects

Project No.	Project Name	Improvement Type	Project Cost
FM001	Belle Glade – North Canal Street Force Main Upgrade	Capacity	$220,000
FM002	Belle Glade - South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade	Capacity	$2,550,000
Total – Transmission System (Force Main) Projects			***$2,770,000***

Project No. FM001

Remove approximately 1,600 feet of existing 6-inch diameter wastewater force main along North Canal Street in Belle Glade between LS 8103 and LS 8104, and replace with an equivalent length of 10-inch diameter HDPE force main. By reducing head-loss in this portion of the force main, LS 8103 pump run-time is reduced below the performance criteria threshold and surcharging is eliminated. It is recommended that this improvement be implemented within the current 5 year planning horizon.

Project No. FM002

Replace the existing 10-inch diameter force main from the South Bay Booster Pump Station to the Belle Glade WWTF and with approximately 12,000 feet of 12-inch diameter force main following the existing pipe route or an alternative route based on a routing study. A 12-inch diameter force main is adequate to alleviate pump run-time and wet well surcharging at LS 8201, LS 8302, LS 8306 and LS 8308 by reducing high head-loss in the upgraded force main which supports a reduction of the South Bay Booster Pump Station suction control pressure from 38 psi to 10 psi. This in turn supports increased flow from upstream lift stations LS 8301, LS 8302, LS 8306 and LS 8308, thereby eliminating surcharging and reducing run-time below performance criteria thresholds. Average day flow velocity in the proposed 12-inch diameter force main is 3.5 feet/second, which is well above the 2 feet/second minimum velocity requirement. Because this improvement successfully address several deficiencies at upstream lift stations, including overflows at LS 8306 and LS 8308, it is recommended that this proposed improvement be implemented as soon as is practical within the current 5-year planning horizon.

Infiltration and Inflow Projects

The opinions of probable cost for infiltration and inflow related projects are presented in **Table 12.3**.

Table 12.3
Opinions of Probable Project Cost
Infiltration and Inflow Projects

Project No.	Project Name	Improvement Type	Project Cost
I&I001	Inspection – Belle Glade service area	R&R	$420,000
I&I002	Inspection – Pahokee service area	R&R	$150,000
I&I003	Inspection – South Bay service area	R&R	$80,000
I&I004	Rehabilitation – Belle Glade service area	R&R	$6,680,000
I&I005	Rehabilitation – Pahokee service area	R&R	$1,290,000
I&I006	Rehabilitation – South Bay service area	R&R	$650,000
Total – Infiltration and Inflow (I&I) Projects			***$9,270,000***

Project Nos. I&I 001, 002 and 003

Inspection projects for the Belle Glade, Pahokee and South Bay collection systems will consist of field investigations in the identified priority basins (referenced in Chapter 8) to identify the specific defects in mains, manholes, and laterals that contribute to the elevated rates of I/I observed. Investigations should include manhole inspection, smoke testing, and video inspection of sewer mains. Television inspection of suspect laterals should be performed as warranted following inspection of mains. Flow data analysis and night flow isolation can be used to focus and limit the scope of such investigations. During the investigation activities, inflow dishes should be installed in manholes and missing or damaged cleanout caps should be replaced. Process, evaluate, and electronically store the results of inspection activities. Estimate flow rates associated with I/I sources and develop repair recommendations with cost estimates and payback period analysis. Prioritize the recommended rehabilitation work based on cost-effectiveness as well as other factors such as structural condition and maintenance demand.

Project Nos. I&I 004, 005 and 006

Based on inspection results, rehabilitation projects in the priority basins of the Belle Glade, Pahokee and South Bay collection systems will generally consist of lining (manholes, manhole to manhole, sectional and lateral), excavated point repairs, excavated line replacements and manhole repairs. More specific scopes for rehabilitation projects will be identified based on the recommendations developed in Projects I&I 001, 002 and 003.

Wastewater Treatment and Disposal

Opinions of probable construction cost for wastewater treatment and disposal projects are presented in the following subsections.

Belle Glade WWTF

The opinions of probable cost for wastewater treatment and disposal projects at the Belle Glade WWTF are presented in **Table 12.4**. All projects address renewal and replacement recommendations developed in Chapter 2 are are subdivided into critical and non-critical categories. There are no capacity-driven projects, since the capacity analysis provided in Chapter 11 concludes that the Belle Glade WWTF has adequate treatment capacity through the Year 2035. Critical items are highlighted in blue.

Table 12.4
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG001	Oxidation Ditch No. 1 Structural Rehabilitation	R&R, Critical	$770,000
WWBG002	Oxidation Ditch No. 2 Structural Rehabilitation	R&R, Critical	$280,000
WWBG003	Improvements to the Deep Injection Well	R&R, Critical	$980,000
WWBG004	Installation of Roto-Screen Bypass Line	R&R, Critical	$280,000
WWBG005	Repair cracks and leaks in Aerobic Digestor	R&R, Critical	$140,000
WWBG006	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	R&R, Critical	$100,000
WWBG007	Replacement of 300 kW generator (Generator Building No. 1)	R&R, Critical	$560,000
WWBG008	Injection Well PLC replace. Parts are unavailable	R&R, Critical	$120,000
WWBG009	Replacement of electrical equipment in the MCC Building	R&R, Critical	$700,000
WWBG010	Replace parshall flume (in the Headworks)	R&R, Non-Critical	$70,000
WWBG011	Installation of a Headworks Bypass	R&R, Non-Critical	$280,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG012	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	R&R, Non-Critical	$700,000
WWBG013	Construct chlorine contact chamber	R&R, Non-Critical	$980,000
WWBG014	Prevent water intrusion to Operations Building	R&R, Non-Critical	$0
WWBG015	Optimize Bar screens to achieve higher capture rate	R&R, Non-Critical	$490,000
WWBG016	Add toe board to Splitter Box No. 2 hand rail	R&R, Non-Critical	$10,000
WWBG017	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	R&R, Non-Critical	$30,000
WWBG018	Replacement of several air handlers and compressors	R&R, Non-Critical	$100,000
WWBG019	Replace Roto-Screen roof purlins and roof panels that have deteriorated	R&R, Non-Critical	$50,000
WWBG020	Replacement of the main PLC and PLC software	R&R, Non-Critical	$280,000
WWBG021	Lift station No. 1 and No. 2 rehabilitation	R&R, Non-Critical	$50,000
WWBG022	Replace Headworks access stair with an aluminum stair	R&R, Non-Critical	$30,000
WWBG023	Generator Building No. 2 electrical equipment replacement	R&R, Non-Critical	$790,000
WWBG024	Rehabilitation of the RAS / WAS structure	R&R, Non-Critical	$30,000
WWBG025	Installation of two polymer feeders	R&R, Non-Critical	$30,000
WWBG026	Repair leaks at the effluent box of the headworks	R&R, Non-Critical	$20,000
WWBG027	Replace Roto-Screen effluent wet well slide gate and isolation gate	R&R, Non-Critical	$50,000
WWBG028	Replace pond bypass gate	R&R, Non-Critical	$30,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG029	Paint steel roof over the Aerobic Digester blowers	R&R, Non-Critical	$30,000
WWBG030	Rehabilitate the Roto-Screen metal structure	R&R, Non-Critical	$20,000
WWBG031	Rehabilitate the Sludge Thickening Facility metal structure	R&R, Non-Critical	$90,000
WWBG032	Upgrading control room	R&R, Non-Critical	$60,000
WWBG033	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	R&R, Non-Critical	$200,000
WWBG034	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	R&R, Non-Critical	$50,000
WWBG035	Paint steel bridge, stairs and EQ tank	R&R, Non-Critical	$110,000
WWBG036	New roofs on the Operation, Maintenance and both Generator buildings	R&R, Non-Critical	$60,000
WWBG037	Replace doors in MCC Building	R&R, Non-Critical	$20,000
WWBG038	Repair cracking at Headworks upper level slab	R&R, Non-Critical	$20,000
WWBG039	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	R&R, Non-Critical	$210,000
WWBG040	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	R&R, Non-Critical	$30,000
WWBG041	Replace Thickeners	R&R, Non-Critical	$840,000
WWBG042	Remove, replace and rewire Headwork's control panel	R&R, Non-Critical	$70,000
WWBG043	Relocate trees and plants placed inside abandoned structures	R&R, Non-Critical	$30,000
WWBG044	Construct overflow in Aerobic Digester	R&R, Non-Critical	$60,000
WWBG045	Repair crack at the Operations Building access ramp	R&R, Non-Critical	$20,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG046	Re-paint the entire exterior of the Headworks	R&R, Non-Critical	$70,000
WWBG047	Support of the Operations Building roof post should be replaced with a different type to avoid further cracking	R&R, Non-Critical	$10,000
WWBG048	Install flow meters on Oxidation Ditch Nos. 1 and 2	R&R, Non-Critical	$180,000
WWBG049	Install flow meters on Clarifier Nos. 3 and 4 b	R&R, Non-Critical	$140,000
WWBG050	Polymer containment and enclosure	R&R, Non-Critical	$60,000
WWBG051	Construction of a Switchgear Building with space for future equipment	R&R, Non-Critical	$280,000
WWBG052	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	R&R, Non-Critical	$20,000
WWBG053	Replace manual valves with electronic controlled valves	R&R, Non-Critical	$100,000
WWBG054	Repair the concrete spalls at guardrail posts at Clarifier No. 3	R&R, Non-Critical	$30,000
WWBG055	Replacing ceiling tiles in the Operations Building break room	R&R, Non-Critical	$20,000
WWBG056	Replace plant lighting with higher illumination LED lights	R&R, Non-Critical	$20,000
WWBG057	Add toe boards to all horizontal walking surfaces of the EQ tank bride, replace fiberglass walkway grating	R&R, Non-Critical	$40,000
WWBG058	Chlorine Building electrical equipment replacement	R&R, Non-Critical	$70,000
WWBG059	Replacement of four slide gates in Headworks	R&R, Non-Critical	$50,000
WWBG060	Replace RAS and Deep Injection Well flow meters with new magnetic meters	R&R, Non-Critical	$50,000
WWBG061	Replacement of MCC-3 (in the Operations Building Electric Room)	R&R, Non-Critical	$120,000

Table 12.4 (continued)
Opinions of Probable Project Cost
Wastewater Treatment Projects at Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWBG062	Polymer electrical equipment replacement	R&R, Non-Critical	$10,000
WWBG063	Electrical equipment replacement in the Operations Building Electrical Room	R&R, Non-Critical	$340,000
WWBG064	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	R&R, Non-Critical	$70,000
WWBG065	Flow meter for Clarifier Nos. 1 and 2 b	R&R, Non-Critical	$110,000
WWBG066	Crack repair on the exterior wall surfaces of EQ tank	R&R, Non-Critical	$30,000
WWBG067	Repair guardrails on EQ tank	R&R, Non-Critical	$40,000
WWBG068	Install fencing to enclose Truck Wash Lift Station	R&R, Non-Critical	$280,000
WWBG069	Install an odor control system at the Headworks	R&R, Non-Critical	$980,000
WWBG070	Install an onsite plant service water system including reuse system	R&R, Non-Critical	$1,960,000
WWBG071	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	R&R, Non-Critical	$50,000
WWBG072	Painting of the facility	R&R, Non-Critical	$210,000
WWBG073	Upgrading cabinets in the Operations Building break room	R&R, Non-Critical	$20,000
WWBG074	Asphalt overlay and addition of parking spaces	R&R, Non-Critical	$50,000
WWBG075	Epoxy coat floors	R&R, Non-Critical	$70,000
WWBG076	Convert EQ tank to additional Clarifier or Aerobic Digester	R&R, Non-Critical	$0
WWBG077	Install drain on Oxidation Ditch No. 1	R&R, Non-Critical	$70,000
Total – Wastewater Treatment and Disposal Projects at Belle Glade WWTF			***$15,420,000***

Pahokee WWTF

The opinions of probable cost for wastewater treatment projects at the Pahokee WWTF are presented in **Table 12.5**. The majority of these projects address renewal and replacement recommendations developed in Chapter 2 and are subdivided into critical and non-critical projects.

In addition, the capacity analysis provided in Chapter 11 determined that the following capacity-related projects are required:

1. A new mechanical screen to replace the existing screen that is hydraulically overloaded under current peak flow conditions.

2. Two new secondary clarifiers to supplement existing secondary clarifiers that are currently hydraulically overloaded when one unit out of service.

3. A new conventional aeration basin to provide adequate reliable treatment capacity while the existing conventional aeration basin and Walker process unit are each removed from service for required renewal and replacement.

4. Secondary clarifier influent splitter box to distribute a common mixed liquor stream from the existing and proposed aeration basins to the existing and proposed secondary clarifiers.

If the County elects to convert the Pahokee WWTF into a regional pump station, some or all of the critical renewal and replacement projects should still be implemented to maintain reliable treatment until Pahokee flows can be routed to the Belle Glade WWTF and the Pahokee WWTF can be decommissioned. Under this scenario, non-critical R&R projects and capacity-related projects for the Pahokee WWTF would not be implemented. Critical items are highlighted in blue.

Table 12.5
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP001	Replacement of generators	R&R, Critical	$700,000
WWP002	New grit removal system at Headworks	R&R, Critical	$600,000
WWP003	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	R&R, Critical	$70,000
WWP004	Replace steel bridge supports on Primary and Secondary Clarifiers	R&R, Critical	$60,000
WWP005	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	R&R, Critical	$110,000
WWP006	Replace Walker Unit elevated influent pipe supports	R&R, Critical	$70,000
WWP007	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	R&R, Critical	$40,000
WWP008	Replacement of 12-inch valve on the Deep Injection Well System	R&R, Critical	$20,000
WWP009	New conventional aeration basis, two new secondary clarifiers, and secondary clarifier influent splitter box (required for firm capacity prior to aeration and secondary clarifier R&R projects)	Capacity	$5,000,000
WWP010	Rehabilitate all three Secondary Clarifiers	R&R, Critical	$200,000
WWP011	Modify stair top support on Aeration Tank Nos. 1 and 2	R&R, Critical	$20,000
WWP012	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	R&R, Critical	$750,000
WWP013	Replacement of the mechanical bar screen	Capacity	$490,000
WWP014	Replace Digester stairs	R&R, Non-Critical	$60,000

Table 12.5 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP015	Replace all diffusers	R&R, Non-Critical	$40,000
WWP016	Influent Pump Station rehabilitation	R&R, Non-Critical	$30,000
WWP017	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	R&R, Non-Critical	$110,000
WWP018	Remove and replace all sidewalks	R&R, Non-Critical	$20,000
WWP019	Replace Wet well By-Pass valve	R&R, Non-Critical	$20,000
WWP020	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	R&R, Non-Critical	$70,000
WWP021	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)	R&R, Non-Critical	$0
WWP022	Replace all six blowers	R&R, Non-Critical	$840,000
WWP023	Recoat two Secondary Clarifiers and repaint the steel bridges	R&R, Non-Critical	$70,000
WWP024	Recoat Primary Clarifier and repaint the steel bridge	R&R, Non-Critical	$50,000
WWP025	Recoat the Walker Unit and repaint the steel bridge	R&R, Non-Critical	$130,000
WWP026	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	R&R, Non-Critical	$600,000
WWP027	Blower House Nos.1, 2 and 3 roof, door and louver replacement	R&R, Non-Critical	$70,000
WWP028	Replacement of electrical equipment in the Blower House No. 3	R&R, Non-Critical	$170,000
WWP029	Replacement of electrical equipment in the Blower House No. 2	R&R, Non-Critical	$180,000
WWP030	Replacement of electrical equipment in the Blower House No. 1	R&R, Non-Critical	$10,000

Table 12.5 (continued)
Opinions of Probable Project Cost
Wastewater Treatment and Disposal Projects at Pahokee WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWP031	Replacement of electrical equipment in the Pump Pad	R&R, Non-Critical	$10,000
WWP032	Replacement of electrical equipment in the Chlorine / Operations Building	R&R, Non-Critical	$100,000
WWP033	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility	R&R, Non-Critical	$30,000
WWP034	Replacement of electrical equipment in the Effluent Pump Station	R&R, Non-Critical	$30,000
WWP035	Flow pace blowers	R&R, Non-Critical	$30,000
WWP036	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	R&R, Non-Critical	$20,000
WWP037	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	R&R, Non-Critical	$50,000
WWP038	Replace pump and auger in the Bioset system	R&R, Non-Critical	$30,000
WWP039	Installation of a security fence	R&R, Non-Critical	$630,000
WWP040	Replace Effluent Pump starters with VFDs	R&R, Non-Critical	$170,000
WWP041	PLC system upgrade	R&R, Non-Critical	$70,000
WWP042	Replace manual valves with electronic controlled valves	R&R, Non-Critical	$30,000
WWP043	Replace grounding at the Headworks	R&R, Non-Critical	$10,000
WWP044	Painting of the facility	R&R, Non-Critical	$140,000
WWP045	Epoxy coat floors	R&R, Non-Critical	$40,000
Total – Wastewater Treatment and Disposal Projects at Pahokee WWTF			***$11,990,000***

Pahokee Regional Pump Station and Force Main

The opinions of probable cost for the conversion of the Pahokee WWTF to a regional pump station and force main to direct Pahokee wastewater flows to the Belle Glade WWTF for treatment are presented in **Table 12.6**.

Table 12.6
Opinions of Probable Project Cost
Wastewater Treatment Projects for Conversion of Pahokee WWTF to Regional Pump Station and Force Main to Belle Glade WWTF

Project No.	Project Name	Improvement Type	Project Cost
WWRPS001	Pahokee Regional Pump Station	R&R, Facility Improvements	$1,200,000
WWRPS002	Force Main from Pahokee Regional Pump Station to Belle Glade WWTF	R&R, Facility Improvements	$8,100,000
WWRPS003	Demolition of Pahokee WWTF	R&R, Facility Improvements	$640,000
Total – Wastewater Treatment Projects for Conversion of Pahokee WWTF to Regional Pump Station			***$9,940,000***

SUMMARY

Pending the decision regarding whether to rehabilitate the Pahokee WWTF or pump Pahokee service area flows to the Belle Glade WWTF for treatment, summary tables of total capital costs for each scenario are presented in **Tables 12.7** and **12.8**. Based on priorities and discussions with PBCWUD, a schedule for implementation was prepared and is shown in **Table 12.9**. The implementation schedule also includes wastewater treatment and disposal projects for each of the two Pahokee wastewater treatment scenarios.

Table 12.7
Opinions of Probable Project Cost
Summary of Capital Projects
Scenario of Long-Term Wastewater Treatment at Pahokee WWTF

Project Category	Project Cost
Collection System (Lift Stations)	$26,254,500
Transmission System (Force Mains)	$2,770,000
Infiltration and Inflow	$9,270,000
Wastewater Treatment	$27,410,000
Total – Capital Projects	***$65,704,500***

Table 12.8
Opinions of Probable Project Cost
Summary of Capital Projects
Scenario of Converting Pahokee WWTF to Regional Pump Station

Project Category	Project Cost
Collection System (Lift Stations)	$26,254,500
Transmission System (Force Mains)	$2,770,000
Infiltration and Inflow	$9,270,000
Wastewater Treatment (and conversion of Pahokee WWTF to Regional Pump Station)	$25,360,000
Total – Capital Projects	***$63,654,500***

(Continued on Next Page)

Table 12.9
Capital Improvement Schedule Through 2035

PROJECT DESCRIPTION		IMPLEMENTATION SCHEDULE							
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
1.0 – Collection System (Lift Stations)									
LS001	Rehabilitation of Submersible Lift Station Nos. 8104, 8113, 8115, 8116, 8120, 8128, 8129, 8133, 8149, 8302, 8303, 8304, & 8307	**$4,111,250**	$4,111,250	$0	$0	$0	$0	$0	$0
LS002	Rehabilitation of Submersible Lift Station Nos. 8101, 8143, 8305, 8106, 8136, 8309, 8146, 8135, 8134, 8208, 8306, 8130, 8105, 8103, 8301, 8223, 8141, & 8118	**$5,692,500**	$0	$5,692,500	$0	$0	$0	$0	$0
LS003	Rehabilitation of Submersible Lift Station Nos. 8140, 8201, 8114, 8109, 8206, 8117, 8122, & 8148	**$2,530,000**	$0	$0	$2,530,000	$0	$0	$0	$0
LS004	Rehabilitation of Submersible Lift Station Nos. 8102, 8138, 8123, 8108, 8207, 8132, 8147, & 8131	**$2,530,000**	$0	$0	$0	$2,530,000	$0	$0	$0
LS005	Rehabilitation of Submersible Lift Station Nos. 8110, 8209, 8121, 8119, 8155, 8212, 8217, & 8204	**$2,530,000**	$0	$0	$0	$0	$2,530,000	$0	$0
LS006	Rehabilitation of Submersible Lift Station Nos. 8308, 8111, 8202, 8219, 8205, 8137, 8213, 8127, 8126, 8112, 8222, 8310, 8211, 8210, & 8216	**$4,743,750**	$0	$0	$0	$0	$0	$4,743,750	$0
LS007	Rehabilitation of Submersible Lift Station Nos. 8218, 8232, 8107, 8215, 8235, 8234, 8227, 8225, 8152, 8157, 8240, 8239, 8238, 8237, 8236, 8233, 8231, 8230, 8229, 8228, 8226, 8224, 8221, 8150, 8220, 8214, & 8203	**$4,117,000**	$0	$0	$0	$0	$0	$0	$4,117,000
1.0 - Total Estimated Annual Capital Costs, Collection System (Lift Stations)		***$26,254,500***	***$4,111,250***	***$5,692,500***	***$2,530,000***	***$2,530,000***	***$2,530,000***	***$4,743,750***	***$4,117,000***

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

2.0 – Transmission System (Force Mains)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
FM001	Belle Glade – North Canal Street Force Main Upgrade	**$220,000**	$0	$0	$220,000	$0	$0	$0	$0
FM002	Belle Glade - South Bay Booster Pump Station to Belle Glade WWTF Force Main Upgrade	**$2,550,000**	$0	$2,550,000	$0	$0	$0	$0	$0
2.0 - Total Estimated Annual Capital Costs, Transmission System (Force Mains)		***$2,770,000***	***$0***	***$2,550,000***	***$220,000***	***$0***	***$0***	***$0***	***$0***
3.0 - Infiltration and Inflow									
I&I001	Inspection – Belle Glade service area	**$420,000**	$0	$420,000	$0	$0	$0	$0	$0
I&I002	Inspection – Pahokee service area	**$150,000**	$0	$150,000	$0	$0	$0	$0	$0
I&I003	Inspection – South Bay service area	**$80,000**	$0	$80,000	$0	$0	$0	$0	$0
I&I004	Rehabilitation – Belle Glade service area	**$6,680,000**	$0	$0	$3,340,000	$3,340,000	$0	$0	$0
I&I005	Rehabilitation – Pahokee service area	**$1,290,000**	$0	$0	$0	$0	$1,290,000	$0	$0
I&I006	Rehabilitation – South Bay service area	**$650,000**	$0	$0	$0	$0	$650,000	$0	$0
3.0 - Total Estimated Annual Capital Costs, Infiltration and Inflow		***$9,270,000***	***$0***	***$650,000***	***$3,340,000***	***$3,340,000***	***$1,940,000***	***$0***	***$0***

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG001	Oxidation Ditch No. 1 Structural Rehabilitation	**$770,000**	$0	$770,000	$0	$0	$0	$0	$0
WWBG002	Oxidation Ditch No. 2 Structural Rehabilitation	**$280,000**	$0	$0	$0	$280,000	$0	$0	$0
WWBG003	Improvements to the Deep Injection Well	**$980,000**	$980,000	$0	$0	$0	$0	$0	$0
WWBG004	Installation of Roto-Screen Bypass Line	**$280,000**	$280,000	$0	$0	$0	$0	$0	$0
WWBG005	Repair cracks and leaks in Aerobic Digester	**$140,000**	$0	$0	$140,000	$0	$0	$0	$0
WWBG006	Replacement of Main Switchboard No. 1 (Generator Building No. 1)	**$100,000**	$0	$0	$100,000	$0	$0	$0	$0
WWBG007	Replacement of 300 kW generator (Generator Building No. 1)	**$560,000**	$0	$0	$560,000	$0	$0	$0	$0
WWBG008	Injection Well PLC replace. Parts are unavailable	**$120,000**	$0	$120,000	$0	$0	$0	$0	$0
WWBG009	Replacement of electrical equipment in the MCC Building	**$700,000**	$0	$550,000	$0	$0	$0	$0	$150,000
WWBG010	Replace parshall flume (in the Headworks)	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWBG011	Installation of a Headworks Bypass	**$280,000**	$0	$0	$0	$0	$0	$280,000	$0
WWBG012	Additional circular clarifier (to replace Clarifier Nos. 1 and 2)	**$700,000**	$0	$0	$700,000	$0	$0	$0	$0
WWBG013	Construct chlorine contact chamber	**$980,000**	$0	$0	$0	$0	$0	$980,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG014	Prevent water intrusion to Operations Building	**$0**	$0	$0	$0	$0	$0	$0	$0
WWBG015	Optimize Bar screens to achieve higher capture rate	**$490,000**	$0	$0	$0	$0	$0	$490,000	$0
WWBG016	Add toe board to Splitter Box No. 2 hand rail	**$10,000**	$0	$0	$0	$0	$0	$10,000	$0
WWBG017	Replace fiberglass walkways on Clarifier Nos. 1 and 2 with aluminum	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG018	Replacement of several air handlers and compressors	**$100,000**	$0	$0	$0	$0	$0	$100,000	$0
WWBG019	Replace Roto-Screen roof purlins and roof panels that have deteriorated	**$50,000**	$0	$0	$50,000	$0	$0	$0	$0
WWBG020	Replacement of the main PLC and PLC software	**$280,000**	$0	$0	$280,000	$0	$0	$0	$0
WWBG021	Lift station No. 1 and No. 2 rehabilitation	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG022	Replace Headworks access stair with an aluminum stair	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG023	Generator Building No. 2 electrical equipment replacement	**$790,000**	$0	$0	$0	$0	$0	$790,000	$0
WWBG024	Rehabilitation of the RAS / WAS structure	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWBG025	Installation of two polymer feeders	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG026	Repair leaks at the effluent box of the headworks	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG027	Replace Roto-Screen effluent wet well slide gate and isolation gate	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG028	Replace pond bypass gate	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG029	Paint steel roof over the Aerobic Digester blowers	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG030	Rehabilitate the Roto-Screen metal structure	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG031	Rehabilitate the Sludge Thickening Facility metal structure	**$90,000**	$0	$0	$0	$90,000	$0	$0	$0
WWBG032	Upgrading control room	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG033	Paint steel walkway bridge and structure on Clarifier Nos. 3 and 4	**$200,000**	$0	$0	$200,000	$0	$0	$0	$0
WWBG034	Paint the steel trussed walkway bridge on Clarifier Nos. 1 and 2	**$50,000**	$0	$0	$0	$0	$0	$50,000	$0
WWBG035	Paint steel bridge, stairs and EQ tank	**$110,000**	$0	$0	$0	$0	$0	$110,000	$0
WWBG036	New roofs on the Operation, Maintenance and both Generator buildings	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG037	Replace doors in MCC Building	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWBG038	Repair cracking at Headworks upper level slab	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG039	Repair all wall cracks and spalls at the abandoned structures on the Operations Building and re-paint the entire structure	**$210,000**	$0	$0	$0	$0	$0	$210,000	$0
WWBG040	Crack repair on the exterior wall surfaces of Clarifier Nos. 1 and 2	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG041	Replace Thickeners	**$840,000**	$0	$0	$0	$840,000	$0	$0	$0
WWBG042	Remove, replace and rewire Headwork's control panel	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWBG043	Relocate trees and plants placed inside abandoned structures	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWBG044	Construct overflow in Aerobic Digester	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWBG045	Repair crack at the Operations Building access ramp	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG046	Re-paint the entire exterior of the Headworks	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG047	Replace support of the Operations Building roof post	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWBG048	Install flow meters on Oxidation Ditch Nos. 1 and 2	**$180,000**	$0	$0	$0	$0	$0	$0	$180,000
WWBG049	Install flow meters on Clarifier Nos. 3 and 4 b	**$140,000**	$0	$0	$0	$0	$0	$0	$140,000
WWBG050	Polymer containment and enclosure	**$60,000**	$0	$0	$0	$0	$0	$0	$60,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG051	Construction of a Switchgear Building with space for future equipment	**$280,000**	$0	$0	$0	$0	$0	$0	$280,000
WWBG052	Make connection between the Clarifier Nos. 1 and 2 and the adjacent scum boxes more watertight	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG053	Replace manual valves with electronic controlled valves	**$100,000**	$0	$0	$0	$0	$0	$0	$100,000
WWBG054	Repair the concrete spalls at guardrail posts at Clarifier No. 3	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWBG055	Replacing ceiling tiles in the Operations Building break room	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG056	Replace plant lighting with higher illumination LED lights	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG057	Add toe boards to all horizontal walking surfaces of the EQ tank bridge, replace fiberglass walkway grating	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWBG058	Chlorine Building electrical equipment replacement	**$70,000**	$0	$0	$0	$0	$0	$20,000	$50,000
WWBG059	Replacement of four slide gates in Headworks	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG060	Replace RAS and Deep Injection Well flow meters with new magnetic meters	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG061	Replacement of MCC-3 (in the Operations Building Electric Room)	**$120,000**	$0	$0	$0	$0	$0	$0	$120,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG062	Polymer electrical equipment replacement	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWBG063	Electrical equipment replacement in the Operations Building Electrical Room	**$340,000**	$0	$0	$0	$0	$0	$0	$340,000
WWBG064	Install automatic control gates for Oxidation Ditch Nos. 1 and 2	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG065	Flow meter for Clarifier Nos. 1 and 2 b	**$110,000**	$0	$0	$0	$0	$0	$0	$110,000
WWBG066	Crack repair on the exterior wall surfaces of EQ tank	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWBG067	Repair guardrails on EQ tank	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWBG068	Install fencing to enclose Truck Wash Lift Station	**$280,000**	$0	$0	$0	$0	$0	$0	$280,000
WWBG069	Install an odor control system at the Headworks	**$980,000**	$0	$0	$0	$0	$0	$0	$980,000
WWBG070	Install an onsite plant service water system including reuse system	**$1,960,000**	$0	$0	$0	$0	$0	$0	$1,960,000
WWBG071	Add sumps at one end of the Clarifier Nos. 1 and 2 structure	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWBG072	Painting of the facility	**$210,000**	$0	$0	$0	$0	$0	$0	$210,000
WWBG073	Upgrading cabinets in the Operations Building break room	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWBG074	Asphalt overlay and addition of parking spaces	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWBG075	Epoxy coat floors	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWBG076	Convert EQ tank to additional Clarifier or Aerobic Digester	**$0**	$0	$0	$0	$0	$0	$0	$0
WWBG077	Install drain on Oxidation Ditch No. 1	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWP001	Replacement of generators	**$700,000**	$0	$700,000	$0	$0	$0	$0	$0
WWP002	New grit removal system at Headworks	**$600,000**	$0	$0	$0	$0	$600,000	$0	$0
WWP003	Isolate and replace Blower House No. 2 MCC and modify to incorporate all three effluent pumps	**$70,000**	$0	$0	$70,000	$0	$0	$0	$0
WWP004	Replace steel bridge supports on Primary and Secondary Clarifiers	**$60,000**	$0	$0	$60,000	$0	$0	$0	$0
WWP005	Fuel tank replacement (three at 500 gallons with one at 2,000 gallons)	**$110,000**	$0	$110,000	$0	$0	$0	$0	$0
WWP006	Replace Walker Unit elevated influent pipe supports	**$70,000**	$0	$70,000	$0	$0	$0	$0	$0
WWP007	Replace damaged support leg, access ladder and guardrails of the lime silo and repaint (Sludge Thickening / Biosolids Facility)	**$40,000**	$0	$0	$0	$40,000	$0	$0	$0
WWP008	Replacement of 12-inch valve on the Deep Injection Well System	**$20,000**	$0	$20,000	$0	$0	$0	$0	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP009	Rehabilitate all three Secondary Clarifiers	**$200,000**	$0	$0	$200,000	$0	$0	$0	$0
WWP010	Modify stair top support on Aeration Tank Nos. 1 and 2	**$20,000**	$0	$0	$0	$20,000	$0	$0	$0
WWP011	Replace the Maintenance Building and move the Control / Operations Building to a new warehouse / office	**$750,000**	$0	$0	$0	$0	$750,000	$0	$0
WWP012	Replacement of the mechanical bar screen	**$490,000**	$0	$0	$0	$0	$0	$490,000	$0
WWP013	Replace Digester stairs	**$60,000**	$0	$0	$0	$0	$0	$60,000	$0
WWP014	Replace all diffusers	**$40,000**	$0	$0	$40,000	$0	$0	$40,000	$0
WWP015	Influent Pump Station rehabilitation	**$30,000**	$0	$0	$0	$0	$0	$30,000	$0
WWP016	Reconfigure Chlorine / Operations Building and replace 4-inch sewer line	**$110,000**	$0	$0	$0	$0	$0	$110,000	$0
WWP017	Remove and replace all sidewalks	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWP018	Replace Wet well By-Pass valve	**$20,000**	$0	$0	$0	$0	$0	$20,000	$0
WWP019	Rehabilitate Chlorine Contact Chamber Nos. 1 and 2	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP020	Chlorine / Operation Building rehabilitation (replace all doors / windows and repaint)	**$0**	$0	$0	$0	$0	$0	$0	$0
WWP021	Replace all six blowers	**$840,000**	$0	$0	$0	$0	$0	$840,000	$0
WWP022	Recoat two Secondary Clarifiers and repaint the steel bridges	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWP024	Recoat the Walker Unit and repaint the steel bridge	**$130,000**	$0	$0	$0	$0	$0	$130,000	$0
WWP025	Walker Unit Modification to Secondary Clarifier (parallel with East and West Secondary Clarifiers)	**$5,600,000**	$0	$0	$0	$0	$0	$5,600,000	$0
WWP026	Blower House Nos.1, 2 and 3 roof, door and louver replacement	**$70,000**	$0	$0	$0	$0	$0	$70,000	$0
WWP027	Replacement of electrical equipment in the Blower House No. 3	**$170,000**	$0	$0	$0	$0	$0	$170,000$0	$0
WWP028	Replacement of electrical equipment in the Blower House No. 2	**$180,000**	$0	$0	$0	$0	$0	$0	$180,000
WWP029	Replacement of electrical equipment in the Blower House No. 1	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000
WWP030	Replacement of electrical equipment in the Pump Pad	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP031	Replacement of electrical equipment in the Chlorine / Operations Building	**$100,000**	$0	$0	$0	$0	$0	$0	$100,000
WWP032	Replacement of electrical equipment in the Sludge Thickening / Biosolids Facility	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP033	Replacement of electrical equipment in the Effluent Pump Station	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP034	Flow pace blowers	**$30,000**	$0	$0	$0	$0	$30,000	$0	$0
WWP035	Repair top level cracks / spalls in the Aeration Tank Nos. 1 and 2	**$20,000**	$0	$0	$0	$0	$0	$0	$20,000
WWP036	Remove / repair guardrails on the Chlorine Contact Chambers and coat entire structures	**$50,000**	$0	$0	$0	$0	$0	$0	$50,000
WWP037	Replace pump and auger in the Bioset system	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWP038	Installation of a security fence	**$630,000**	$0	$0	$0	$0	$0	$0	$630,000
WWP039	Replace Effluent Pump starters with VFDs	**$170,000**	$0	$0	$0	$0	$0	$0	$170,000
WWP040	PLC system upgrade	**$70,000**	$0	$0	$0	$0	$0	$0	$70,000
WWP041	Replace manual valves with electronic controlled valves	**$30,000**	$0	$0	$0	$0	$0	$0	$30,000
WWP042	Replace grounding at the Headworks	**$10,000**	$0	$0	$0	$0	$0	$0	$10,000

Table 12.9 (Continued)
Capital Improvement Schedule Through 2035

4.0 – Wastewater Treatment and Disposal (continued)									
No.	Description	**TOTALS**	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019 thru FY2023	FY2024 thru FY2035
WWP043	Painting of the facility	**$140,000**	$0	$0	$0	$0	$0	$0	$140,000
WWP044	Epoxy coat floors	**$40,000**	$0	$0	$0	$0	$0	$0	$40,000
WWRPS001	Pahokee Regional Pump Station	**$1,200,000**	$0	$0	$0	$0	$0	$0	$1,200,000
WWRPS002	Force Main from Pahokee Regional Pump Station to Belle Glade WWTF	**$8,100,000**	$0	$0	$0	$0	$0	$0	$8,100,000
WWRPS003	Demolition of Pahokee WWTF	**$640,000**	$0	$0	$0	$0	$0	$0	$640,000
4.0 - Total Estimated Annual Costs, Wastewater Treatment									
Long-Term Use of Pahokee WWTF		***$27,410,000***	*$1,260,000*	*$2,340,000*	*$2,160,000*	*$1,250,000*	*$1,600,000*	*$11,380,000*	*$7,420,000*
Pahokee Regional Pump Station, All Treatment at Belle Glade WWTF		***$25,360,000***	*$1,260,000*	*$1,440,000*	*$7,000,000*	*$6,180,000*	*$30,000*	*$3,750,000*	*$5,700,000*
TOTAL ESTIMATED ANNUAL CAPITAL COSTS (Sections 1.0 through 4.0)									
LONG-TERM USE OF PAHOKEE WWTF		***$65,704,500***	***$5,371,250***	***$11,232,500***	***$8,250,000***	***$7,120,000***	***$6,070,000***	***$16,123,750***	***$11,537,000***
PAHOKEE REGIONAL PUMP STATION, ALL TREATMENT AT BELLE GLADE WWTF		***$63,654,500***	***$5,371,250***	***$10,332,500***	***$13,090,000***	***$12,380,000***	***$4,500,000***	***$8,493,750***	***$9,817,000***

Climate Resilience

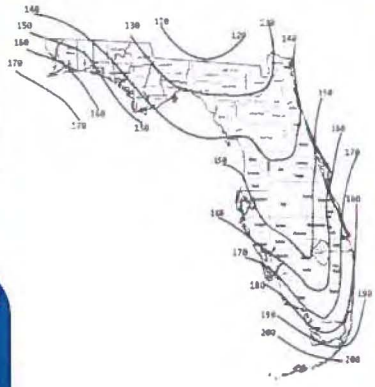
For Various Palm Beach County

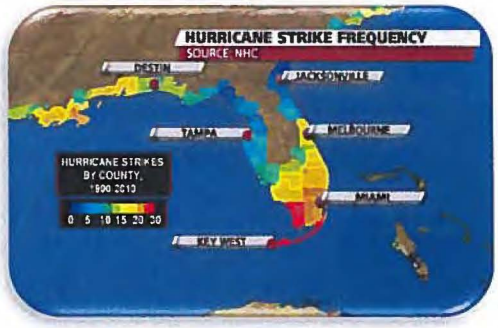
Water Utility Department Facilities

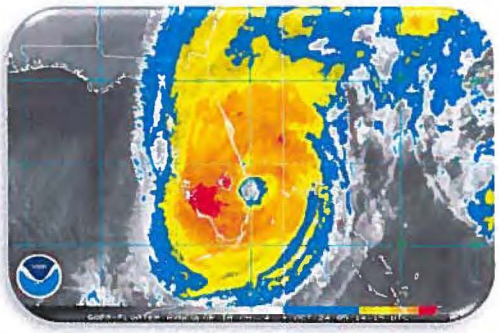
Belle Glade Waste Water Treatment Facility

Belle Glade, Florida

April 3, 2014







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Belle Glade Waste Water Treatment Facility

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Palm Beach County
Belle Glade Waste Water Treatment Facility
2055 W. Canal Street
Belle Glade, Florida

GENERAL

A site visit to the facility was made on March 6th, 2014. Each building, tank and storage facility was evaluated for hurricane vulnerability, and further reviewed for general compliance with the 2010 Florida Building Code.

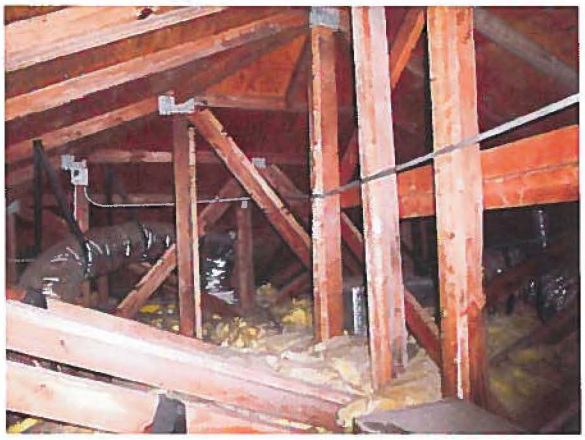
Operations Building:

The Operations Building was constructed in two phases. The original construction consisted of two independent reinforced concrete masonry unit (CMU) structures constructed in 1983. These structures were combined during construction in 1996 to consist of a single reinforced CMU structure. The building is mostly covered with a hipped wood truss roof. One of the original structures has a hollow-core concrete roof beneath the hipped wood trusses.

West side of the building

Southeast end of the building

The building's plans call out for the roof trusses to be tied down with Simpson Heta16 brackets. These brackets are designed to resist wind uplift forces. We were unable to visually verify the presence of the brackets during our inspection though construction photos show evidence that they are in place.



Wood roof trusses

Wood roof trusses

The roof top equipment consists of four roof fans. It is our experience that these units are not adequately designed to resist current design wind loads and can become wind-borne debris during hurricane events. It is our recommendation that stainless steel straps be installed over the fans.

Unsecured roof top equipment

Unsecured roof top equipment

The north side of building has four wall openings. The first floor has one non-hurricane rated exterior swinging door and two non-hurricane rated windows. A non-hurricane rated window is also located on the second floor. It is our recommendation that the exterior swinging door and three unprotected windows be replaced with hurricane rated protection. In addition to the wall openings there are also four inadequately secured air-conditioning units. These units are attached to the roof of a concrete tank using thin metal brackets that were observed to be rusted. We have found that these types of brackets do not provide adequate strength to resist hurricane force winds. It is our recommendation that steel straps be installed over the top of these air-conditioning units.

Air Conditioning Units

Inadequate restraint on air conditioning unit

The south side of building has five wall openings. The first floor has one non-hurricane rated exterior swinging door and one non-hurricane rated window. Three additional non-hurricane rated windows are located on the second floor. It is our recommendation that the exterior swinging door and unprotected windows be replaced with hurricane rated protection. In addition to the wall openings there is also an unsecured air-conditioning unit located to the south of the building. This unit is attached to a thin concrete slab that has been partially undermined. We recommend that a new foundation slab for this unit be constructed and that steel straps be installed over the unit to prevent it from becoming wind borne debris during a high wind event.

Air conditioning unit to the south of the building

The east side of the building has eleven wall openings. The first and second floors have a total of eight non-hurricane rated windows. The first floor has one non-hurricane rated exterior swinging louvered door and one non-hurricane rated exterior swinging door. A wall vent is located behind the ramp on the east side of the building. This opening is protected from wind-borne debris by the building's ADA access ramp. It is our recommendation that the exterior swinging door and unprotected windows be replaced with hurricane rated protection.

The west side of the building has fifteen wall openings. The first and second floors have a total of ten non-hurricane rated windows. There three non-hurricane rated exterior swinging doors on the first floor and one non-hurricane rated exterior swinging door located on the second floor. A non-hurricane rated operable louver is located west side of the building. This louver and the wall vent present on the east side of the building provide air-flow through the submerged concrete tanks that the building was built above. It is our recommendation that the exterior swinging doors, unprotected windows, and unprotected louver be replaced with hurricane rated protection.

An existing concrete tank located on the southeast corner of the Operation building was capped with a concrete slab during the building's construction. The concrete slab shows signs of failure and should be removed and replaced.

Top slab of an existing concrete tank

2" of observed settlement in the top of the tank

Chlorine Building:

The Chlorine Building is constructed of a steel framed structure covered with steel sheeting. The building is anchored to the ground with two anchor bolts per steel column. The building's exterior has nine openings. These openings consist of two overhead doors, one exterior swinging door, three non-hurricane rated louvers and three wall mounted fans. The overhead doors are rated for wind pressures of +24.4psf and -27.0psf but do not provide impact protection.

Chlorine Building

Roll down door on the Chlorine Building

Two large chlorine tanks are located inside the building. Each tank is strapped down with steel cables which are attached to brackets anchored on a concrete equipment pad.

Tie down cables on chlorine tank

Interior framing of the Chlorine Building

Headworks:

The Headworks structured is constructed as a reinforced concrete structure. The top of the Headworks is covered with either grating or steel plates.

Headworks Structure

Headworks Structure

There is evidence of concrete cracking in the bottom of the headworks and on the intermediate landing of the stairway. Concrete cracking was also observed along the edges of the metal grating on the roof of the structure. We recommend that these deteriorated areas be repaired.

Concrete cracking beneath the structure

Cracking in the concrete stairway

The Headworks has several pieces of equipment which could become wind-borne debris during hurricane events. On the roof of the structure a plastic white box was observed with six screws attached along the base of box. From our experience this type of anchorage is not sufficient to prevent damage during hurricane events. It is our recommendation that steel cables be installed over the box before a hurricane event. Beneath the structure a wheeled metal dumpster bin was observed. Two steel chains were observed to hold the dumpster in place, but the configuration of the chains will not adequately restrain the dumpster during hurricane force winds. It is our recommendation that this

dumpster either be removed and properly stored during hurricane events or be installed with steel cables to temporarily anchor the dumpster.

Inadequately secured equipment on the structure

Loose dumpster at the Headworks

A plastic control box was observed beneath the Headworks and was observed to have a steel cable tying the box to a concrete slab. This anchorage appears to be adequate to resist hurricane force winds.

Secured control box

Generator Building No. 1:

The Generator Building is constructed of a reinforced concrete masonry unit (CMU) structure with a flat roof. Access to this structure was limited as the building was being painted during our inspection. The building has non-hurricane rated louvers on three sides of the building. In addition to the louvers there are two exterior swinging doors on the building. The exterior doors consist of single louvered door and a double door. We recommend that walls be constructed in front of the louvers to provide impact protection. We also recommend that the doors be removed and replaced with hurricane rated doorways.

Generator Building No. 1

Generator Building No. 1

A fuel tank is located on the outside of the building. This tank was observed to not be adequately tied down. We recommend that this tank be filled prior to a hurricane event and that steel straps be installed in order to tie down the tank.

Unsecured fuel tank

The building was observed to have undergone some settlement. Stepped cracks were observed on two sides of the building. We recommend that these cracks be regularly monitored. If the cracks continue to grow then the county will need to look at providing repairs to the building's foundation.

Settlement cracks in the building

Settlement cracks in the building

Aerobic Digester:

The aerobic digester is a reinforced concrete tank with an adjacent reinforced concrete masonry unit (CMU) building topped with a prestressed concrete double-tee roof. The reinforced concrete tank has numerous vertical and horizontal cracks. A steel stairway and ladder are attached to the side of the tanks and lead up to steel catwalks that cross over the top of the aerobic digester.

Aerobic Digester

Catwalk above the Aerobic Digester

The CMU building's exterior has eight openings. These openings include one exterior swing door, one overhead door, two louvers and four windows. The exterior swing door has an impact rating of 350 ft-lbs with a design wind pressure of +/- 65 psf. The overhead door is hurricane rated in the State of Florida for High Velocity Hurricane Zones (FL8344-R2). It is noted that this door had wind locks installed on every other slat. We recommend that wind locks be installed on every slat. The double-tee roof members were observed to not have positive anchorage to the building. We recommend that brackets be installed in order to provide positive connection and to resist hurricane wind uplift forces. The bearing point of one of the double-tee roof beams was observed to be cracked. A steel canopy is attached to the side of the building. Underneath this canopy some temporary storage tanks were observed. These tanks can become wind borne debris during hurricane events. We recommend that these tanks be relocated prior to high wind events.

Building adjacent to digester

Building adjacent to digester

A steel framed structure is attached to side of the aerobic digester tank. The frame's columns have positive connection to resist uplift wind forces. The paint on the steel frame was observed to have deteriorated. We recommend that the frame be mechanically cleaned and recoated with paint to provide protection against corrosion.

Sludge Thickening Facility:

The Sludge Thickening Facility is covered with a steel framed canopy. The frame was observed to have positive anchorage to the concrete slab beneath the sludge thickening facility. The paint on the steel frame was observed to have deteriorated. We recommend that the frame be mechanically cleaned and recoated with paint to provide protection against corrosion.

Sludge Thickening Facility

Metal framing of the Sludge Thickening Facility

Secondary Clarifier No. 1 and No. 2:

The Secondary Clarifier Numbers 1 and 2 was empty at the time of the inspection. The clarifier is constructed with reinforced concrete walls with a steel truss supported catwalk over the clarifier. The catwalk and its supports have a positive anchorage to the concrete clarifier and do not show signs of deterioration. Numerous cracks were observed in the concrete portions of the clarifier. These cracks were present in the vertical walls and in the horizontal slabs along the bottom of the clarifier.

Secondary Clarifier No. 1 and No. 2

Cracking in the base of the clarifier

To the south of the tank two items were noted that will require attention. A reinforced concrete tank with a concrete cover is located north of the clarifier. A fan located on the roof of this tank should be strapped down with steel cables to prevent the fan from becoming wind-borne debris. In this same area a cellar door constructed out of diamond plating was observed.

Roof top fan and cellar door

Oxidation Ditch No. 1 and No. 2:

Oxidation Ditch Numbers 1 and 2 are constructed of reinforced concrete walls with a concrete platform over one end of the structure. Some cracking was observed along the edge of the concrete platform. This cracking should be monitored.

Oxidation Ditch No. 1

Oxidation Ditch No. 1

RAS/WAS Pump Station:

The RAS/WAS Pump Station is a reinforced concrete structure with a steel framed canopy located to its east. The paint on the steel frame was observed to have deteriorated. We recommend that the frame be mechanically cleaned and recoated with paint to provide protection against corrosion.

Steel frame adjacent to pump station

RAS/WAS Pump Station

The light pole attached to concrete roof of the pump station was observed to be missing a nut. This light pole was very loose and is likely to fail during a high wind event.

Very loose light pole base

Splitter Box No. 2:

The Splitter Box No. 2 is a reinforced concrete structure with an open top covered with grating and metal plates. No issues were noted.

Splitter Box No. 2

Splitter Box No. 2

Maintenance Building:

The maintenance building is a reinforced concrete masonry unit (CMU) structure with a wood truss roof. During our site visit we were unable to verify if positive roof anchorages were present to resist hurricane uplifting wind forces. The building's roof extends beyond the north side of the building supported by concrete beams and columns. Several pieces of mechanical equipment and an ice chest were observed under the canopy. These items are not restrained against hurricane forces and are likely to become wind borne debris during hurricane events.

Maintenance Building

Maintenance Building

The building's exterior has seven openings. These openings consist of three 4'x4' tempered glass windows, two overhead roll-down doors, and two exterior swing doors. The windows were constructed of tempered glass but did not display any information relating to an impact rating. Neither the overhead roll-down doors nor the exterior swing doors were posted with NOA or hurricane ratings. The roll-down doors were observed to have wind locks installed on every other slat. We have observed doors with wind locks on every other slat to be susceptible to wind-borne debris. We recommend that the windows be provided with impact resistant hurricane rated shutters. We also recommend that the doorways be removed and replaced with impact resistant hurricane rated doorways.

A small storage shed is located adjacent to the maintenance building. The shed is constructed with timber framing covered with corrugated metal roof and composite siding. The building has three non-hurricane rated windows and a single non-hurricane rated overhead roll down door. The building's base was observed to be tied to hurricane tie-down anchors, though their depth was not verified. The storage shed's survivability in a major hurricane is questionable. Replacement of the shed with a permanent structure should be considered.

Storage shed near Maintenance Building

Interior framing of the storage shed

The west side of the maintenance building has racks attached to the walls for pipe storage. These pipes can become wind borne debris during hurricane events. It is recommended that these pipes be secured with cable straps prior to a hurricane event.

Pipe storage behind the Maintenance Building

Secondary Effluent/Roto Screenings:

The Secondary Effluent and Roto-Screening Facility is covered with a steel framed canopy. The frame was observed to have positive anchorage to the concrete slab beneath the facility. The paint on the steel frame was observed to have deteriorated in some areas with rust on the base of the steel frame's support columns. We recommend that the steel frame and anchorage connections be mechanically cleaned and recoated with paint to provide protection against further corrosion. Several loose metal dumpsters with no positive anchorage were observed at the base of the structure. We recommend that the dumpsters be provided with either tie-down straps or be removed prior to a hurricane event.

Loose dumpsters at the Secondary Effluent Roto-Screens

Rusted steel frame member

Fuel Storage:

The fuel storage tank for the Generator is a welded steel tank with integral supports. It is adequately anchored to its concrete foundation. We recommend that the fuel storage tank be filled prior to a hurricane event from an operational standpoint.

Fuel Tank

Generator Building No. 2:

Generator Building Number 2 is a reinforced concrete masonry unit (CMU) structure with a wood truss roof. During our site visit we were unable to verify if positive roof anchorages were present to resist hurricane uplifting wind forces between the walls and the trusses. The building's exterior has nine openings. These openings consist of two single exterior swing doors, one double exterior swing door, and six louvers. The exterior swing doors are posted as being impact rated for 350 ft*lbs with a design wind pressure of +/- 65psf. The louvers were observed to not be hurricane rated. We would recommend that CMU walls be constructed in front of the louvers in order to provide impact protection for the louvers. Note that with the estimate 5'-8' of muck on the site that any new wall will require anchorage tied below this weak soil layer. The generator's muffler is attached to the roof of the building. The muffler was observed to be strapped down to angled braces.

Generator Building No. 2

Generator Building No. 2

MCC Building:

The MCC Building is a reinforced concrete masonry unit (CMU) structure with a concrete roof. The building's exterior has two openings. The openings consist of two single exterior swing doors that are posted as being impact rated for 350 ft*lbs with a design wind pressure of +/- 65psf. Two air handling units are located on the roof the building. We recommend that stainless steel straps be installed over these units.

MCC Building

MCC Building

Injection Well Pump Station:

The Injection Well Pump Station is covered with a reinforced concrete slab and metal grating. The pump equipment and steel framing members were observed to be bolted to the concrete slab. No issues were noted.

Injection Well Pump Station

Climate Resilience

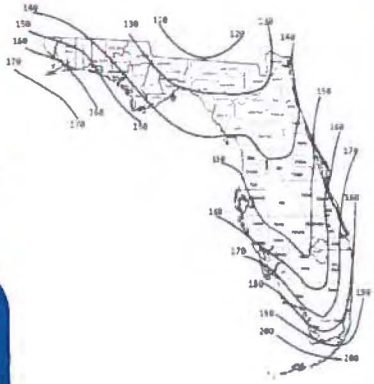
For Various Palm Beach County

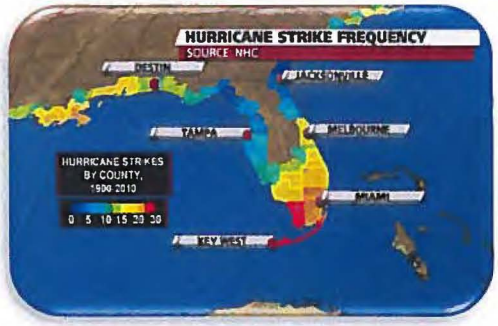
Water Utility Department Facilities

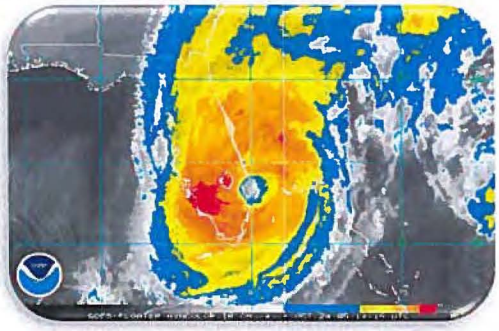
Western Region Waste Water Treatment Facility-North

Pahokee, Florida

April 3, 2014







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Western Region Waste Water Treatment Facility

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Palm Beach County
West Region Waste Water Treatment Facility-North
1001 Rim Canal Road
Pahokee, Florida

GENERAL

A site visit to the facility was made on March 10th, 2014. Each building, tank and storage facility was evaluated for hurricane vulnerability, and further reviewed for general compliance with the 2010 Florida Building Code.

Chlorine and Operations Building:

The Ozone and Control Building is constructed as a reinforced concrete masonry units (CMU) structure with prestressed concrete double tee roof beams and interior concrete floor slabs. No positive anchorage was observed between the building's frame and the double tee roof beams. We recommend that brackets be installed to provide positive anchorages between the roof beams and wall. The northern portion of the roof extends over a chemical containment area. This portion of the roof is supported with concrete beams and columns.

Chlorine and Operations Building

Chlorine and Operations Building

The building's exterior has ten openings. These openings include three exterior swinging doors, five windows, one louver, and one glass doorway that is covered with accordion shutters. Accordion shutters are installed on all of the windows. The louver is not hurricane rated and should be replaced with a hurricane rated louver. The doors were not posted as being hurricane or impact rated and should be replaced with hurricane rated doors.

An air conditioning unit was observed on the east side of the building. This unit was observed to have only four screws installed through its base to provide resistance for hurricane wind forces. It is our experience that this type of connection is insufficient to resist hurricane forces. We recommend that steel cables be installed over the air conditioning unit. Two chemical storage tanks were observed under the roof canopy on the north side of the building. These tanks were observed to be tied down with steel cables.

Blower Building No. 1:

The Blower Building is constructed as a reinforced concrete masonry units (CMU) structure with concrete hollow core roof slabs and interior concrete floor slabs. No positive anchorage was observed between the building's frame and the hollow core slabs. We recommend that brackets be installed to provide positive anchorages between the roof members and wall.

Blower Building No. 1

Blower Building No. 1

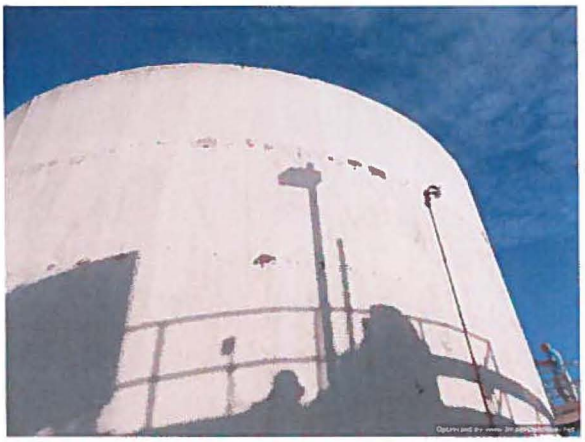
The building's exterior has four openings and one wall mounted fan. The openings include two exterior swinging doors, one louver, and one overhead roll-down door that were all not hurricane rated. The exterior swinging doors were noted to have rusted hinges. The overhead door was observed to have wind-locks installed at every other slat. We recommend that the doors and louvers be removed and replaced with hurricane rated openings. Hurricane rated straps should be installed over the wall mounted fan in order to prevent the fan from becoming wind-born debris during hurricane events.

The roof trim was observed to be loose, which can result in the members of the roof becoming wind-borne debris during hurricane event. We recommend that any loose trim be reattached to the roof structure.

Aerobic Digester:

The aerobic digester is a reinforced concrete tank. A steel stairway and ladder are attached to the side of the tanks. Numerous horizontal cracks were observed along the side of the tank. The concrete tank was also observed to have areas of scaling.

Aerobic Digester



Aerobic Digester

The concrete slab that supports the steel stairway and ladder was observed to have up to 4" of settlement beneath the slab. This settlement puts additional forces on the slab that the slab was not originally designed to resist. We recommend that the tank and slab be regularly monitored to determine if this settlement is causing damage to the concrete structures.

Settlement beneath the Aerobic Digester

Headworks:

The Headworks structure is constructed as a reinforced concrete structure. The top of the Headworks is covered with either grating of steel plates.

Roof top of the Headworks

Headworks Structure

Concrete cracks were observed on the tank located on the eastern end of the headworks structure. It is our recommendation that these concrete members be repaired to help mitigate further deterioration of the structure. One pipe support member was observed to not be properly bolted to the concrete slab. We would recommend that this bracket be removed and replaced with a bracket that is capable of resisting hurricane force wind pressures on the pipe.

Concrete cracking in the Headworks

Inadequate pipe support bracket

Influent Pump Station:

The influent pump station is a reinforced concrete structure. The structure has two openings into a storage room. The openings are covered with a chain link door and a louver. Neither the chain link door nor the louver is hurricane rated. The roof is constructed of both an open concrete tank and a concrete platform.

The concrete roof and other exposed areas of concrete on the roof shows significant damage. The concrete roof members had numerous cracks with rust stains. Areas of the concrete tank have undergone an acid attack that has resulted in concrete scaling, exposed aggregate and section loss of the concrete. We recommend that this concrete be mechanically cleaned back to sound material, rebuilt, and coated with a new liner that is impervious to the acid attack. The remaining areas of deteriorated concrete should be repaired to mitigate further damage from occurring.

Roof top of the Influent Pump Station

Deteriorated concrete on the Influent Pump Station

Primary Clarifier:

The primary clarifier is constructed with reinforced concrete walls with a steel catwalk over the clarifier. The catwalk and its supports have a positive anchorage to the concrete clarifier and do not show signs of deterioration, regardless we recommend that steel cables be installed to the catwalk to help restrain the catwalk during hurricane events. . A minor concrete spall was observed on the corner of the tank which should be repaired.

Primary Clarifier

Catwalk above the Primary Clarifier

Equipment Building and Blower House No. 2:

The Equipment Building and Blower house is constructed as a reinforced concrete masonry units (CMU) structure with concrete double tee roof beams and interior concrete floor slabs. No positive anchorage was observed between the building's frame and the double tee roof beams. We recommend that brackets be installed to provide positive anchorages between the roof members and wall.

Equipment Building and Blower House No. 2

Equipment Building and Blower House No. 2

The building's exterior has nine openings and one wall mounted generator muffler. These openings include three exterior swinging doors, five louvers, one wall vent and one wall vent that has been sealed with a metal plate. The exterior swinging doors were manufactured by SteelCraft but are not noted as being designed to handle hurricane force winds. None of the louvers were observed to be hurricane rated. We recommend that the doors and louvers be removed and replaced with hurricane rated openings. Hurricane rated straps should be installed over the wall mounted muffler in order to prevent the muffler from becoming wind-born debris during hurricane events.

Wall mounted muffler

Interior view of the louvers

The openings located on the east side of the building have been modified since the original building's construction. This face originally had two openings sized 3'4" x 4'8" have since been infilled with CMU blocks and either a 2'0"x2'0" vent or a 2'0"x2'0" steel plate. Two layers of block infill were also observed over the doorway. The blocks located over the door were not grouted in place. This ungrouted infill does not meet current building code requirements and will not provide adequate strength to resist hurricane force wind pressures. We recommend that these blocks be strengthened by doweling steel reinforcement through these blocks and grouting the blocks solid.

CMU Infill on the east face of the building

CMU Infill over the door

The building's interior shows signs of damage from settlement. Stepped cracks were noted in a number of locations in the CMU walls. These cracks should be regularly monitored to insure that the settlement of the building does not jeopardize the building's stability.

Stepped cracks in the CMU

Stepped cracks in the CMU

A fuel tank was observed outside of this building with fuel hoses attached through the building's walls. No anchorage or tie downs were observed for this tank. This tank was also observed to not be located within a fuel containment area as specified by the Florida Building Code. We recommend that an adequate containment area be constructed beneath the tank and that steel cables be installed over the tank. From an operational point of view we would also recommend that the tank be filled prior to a hurricane event.

Fuel tank without an adequate containment area

Control Building and Blower House No. 3:

The Control Building and Blower House No. 3 is constructed as a reinforced concrete masonry units (CMU) structure with concrete hollow core roof slabs and interior concrete floor slabs. No positive anchorage was observed between the building's frame and the hollow core roof slabs. We recommend that brackets be installed to provide positive anchorages between the roof members and walls. The building is constructed with two enclosed rooms separated with a covered bay housing two pumps.

Control House and Blower House No. 3

Control House and Blower House No. 3

The building's exterior has seven openings. These openings consists of two wall mounted fans, two wall openings covered with expanded metal grating, one exterior swinging door with a louver, one exterior swinging door without a louver, and one generator exhaust pipe. The metal grating located over the two wall openings does not provide adequate hurricane protection. Both of these openings should be enclosed with a hurricane rated louver. The wall mounted fans should be tied down to the wall with steel cables. The exterior swinging doors are not hurricane rated. We recommend that these doors be removed and replaced with hurricane rated doors.

Steel grating installed over openings

Steel grating installed over openings

A fuel tank was observed outside of this building with no observed anchorage or tie downs. We recommend that steel cables be installed over the tank. From an operational point of view we would also recommend that the tank be filled prior to a hurricane event.

Fuel tank

Pipe attachments to the building's exterior

There are several pipe attachments to the side of the building that appear in good condition.

There is evidence of significant settlement adjacent to the building, six to eight inches of settlement was observed. The building and adjacent structures should be regularly monitored to insure that damage to the structures does not occur.

Settlement around the building

Settlement around the building

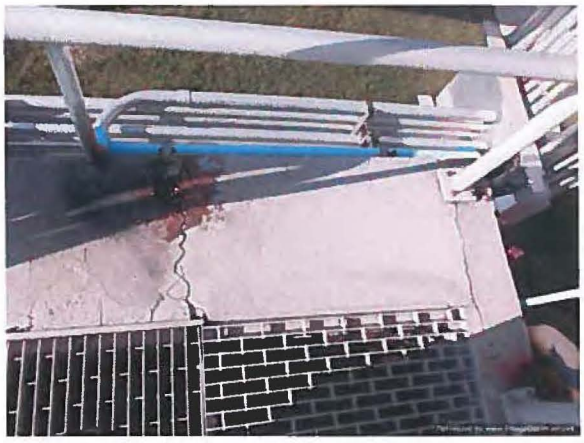
Aeration Tank No. 1 and No. 2:

Aeration Tank Number 1 and 2 are constructed as an open top tank with reinforced concrete walls. The open tanks are surrounded by a combination of concrete and metal grating. The concrete walls and walkways showed signs of deterioration. The original railing posts have been removed and replaced with new railing. The existing post anchorages that remain are heavily corroded and have caused cracking in the concrete. The concrete deterioration that was observed will weaken the structure can could result in possible failure if the tank is not repaired. Numerous pipes are attached to pipe brackets along the side of the tank. Some of these brackets are being used as storage locations for ladders and spare piping. These items should be removed and properly stored prior to a hurricane event in order to eliminate them from becoming wind-borne debris.

Pipe brackets installed on side of tank

Side of the Aeration Tank

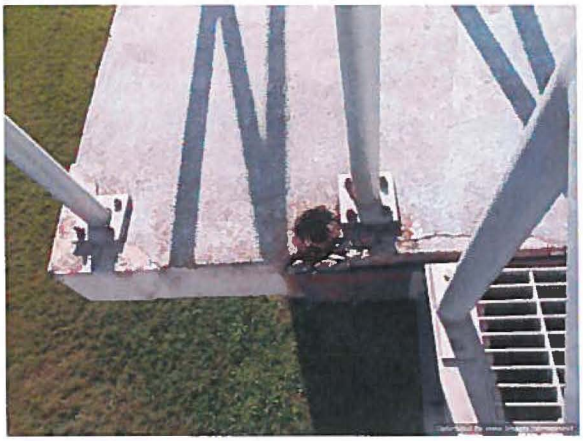
Concrete deterioration along the top of the tank



Concrete deterioration along the top of the tank

The stairway access located on the northeast corn of the tank has been altered from its original configuration. Concrete spalls and cracking were observed behind the current stairway connection plate.

Attachment of the stairway



Cracking along the attachment of the stairway

Grit Chamber:

The Grit Chamber is constructed as a reinforced concrete structure. The top of the Grit Chamber consists of either a reinforced concrete tank cover in one section or has a open roof with a steel grating catwalk over the tank. Concrete cracks were observed on the structure. The exposed top of the Grit Chambers shows signs of beginning to experience an acid attack of the concrete. The concrete is scaling with exposed aggregate and a partial loss of section. We recommend that this concrete be mechanically cleaned back to sound material and coated with a new liner that is impervious to the concrete acid attack.

Grit Chamber

Concrete deterioration in the top of the Grit Chamber

The base plate for a pipe support column was observed to be corroded. We recommend that this plate be mechanically cleaned and powder coated. After mechanically cleaning the plate, the condition of the

anchor bolts should be investigated to determine if the bolt's capacity has been degraded from corrosion.

Base of the stairway and pipe support column

Base of the stairway and pipe support column

The base of the stairway was observed to be unconnected at the concrete slab. We recommend that anchors be provided at the base of the stairs.

Walker Modular Unit:

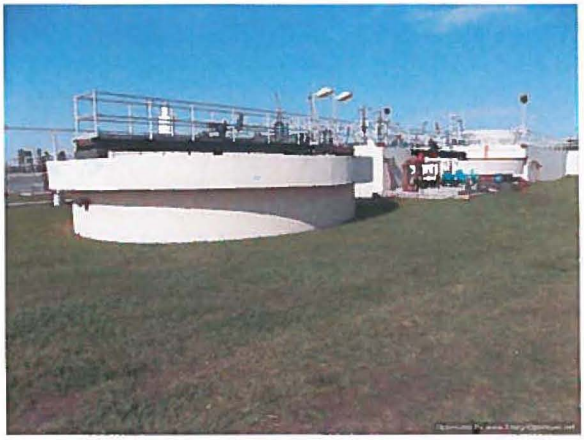
The Walker Modular Unit is a reinforced concrete tank with an open top. A moveable steel catwalk is located above the tank and rotates about the tank's center pivot. Cracking and scaling of the concrete tank was observed. With the moveable nature of the steel catwalk, the catwalk is prone to be damaged during hurricane event. We recommend that steel cables be installed prior to hurricane events in order to restrain the walkway from hurricane force winds. Concrete cracks and scaling should be repaired in order to prevent further deterioration from jeopardizing the structure.

Walker Modular Unit

Catwalk above the Walker Modular Unit

Secondary Clarifier West and East:

The secondary clarifiers are constructed with reinforced concrete walls with an open top. A steel catwalk extends over the two clarifiers and the RAS and WAS Pumps located between the tanks.



Secondary Clarifier

Secondary Clarifier

The catwalk and its supports have a positive anchorage to the concrete clarifier and show signs of deterioration including rusting of the supports anchor plates and bolts. These rusted members should be mechanically cleaned and repainted to prevent further deterioration. We recommend that steel cables be installed to the catwalk to help restrain the catwalk during hurricane events.

Catwalk above the Tank

Concrete deterioration and rusting of the catwalk

Cracks and scaling was observed on the concrete tanks.

Effluent Pump Station and Tertiary Filter:

The Effluent Pump Station and Tertiary Filter are constructed of reinforced concrete tanks either covered with a reinforced concrete slab or covered with filter fabric. The concrete walls and roof show signs of deterioration with areas that are cracked and spalled. Note that the filter cloth located over the tertiary filter is prone to being damaged during a hurricane event. We recommend that steps be taken to protect this cloth prior to hurricane events.

Effluent Pump Station and Tertiary Filter

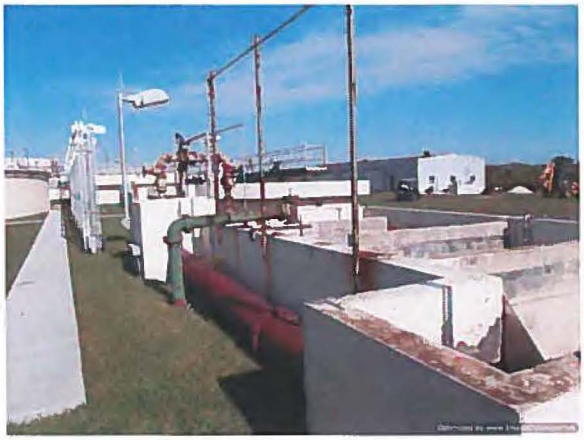
Effluent Pump Station and Tertiary Filter

A plastic control box is attached to the side of the Effluent Pump Station using uni-struts with the box sitting on unsecured concrete blocks. The attachment of the box is not adequate to resist hurricane force winds. We anticipate that this box and the loose concrete masonry units will become wind borne debris during hurricane events. We recommend that the existing uni-struts be removed and an adequate housekeeping slab and hurricane ties be installed for the control box.

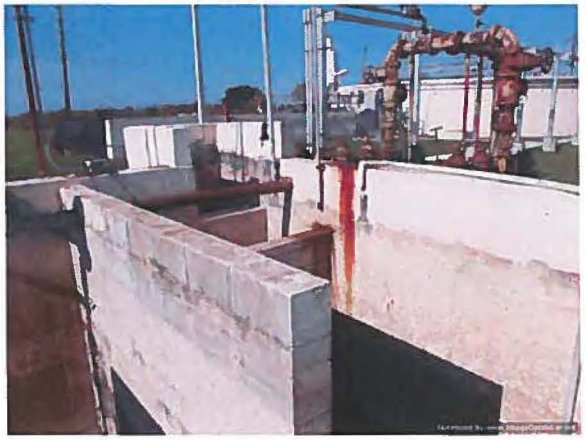
Control box attachment to the pump station

Chlorine Contact Chamber No. 1:

The Chlorine Contact Chamber No.1 is a reinforced concrete tank with an open top. Interior walls of the tank are constructed with reinforced concrete masonry units. Portions of the concrete tanks are cracked with rust stains. These areas of cracking and rust stains are primarily located adjacent to steel anchorages to the tank. Pipe fittings adjacent the tank are rusting. We recommend that the steel anchorages and pipes be mechanically cleaned and coated to prevent further deterioration.



Chlorine Contact Chamber



Chlorine Contact Chamber

Maintenance Building:

The maintenance building is steel framed building with metal sheet panel roof panels and siding. The building's exterior has fourteen openings. These openings include six windows, three overhead roll down doors, two wall mounted fans, two openings along the ridge of the roof, and one exterior swing door. The six windows are single pane sliding windows. These windows are not hurricane rated. The overhead roll-down doors are also not hurricane rated. These doors were noted to have wind-locks installed at every other slat which we have found to not be adequate to resist forces from hurricane winds. Numerous gaps were observed around the edge of the doors. The roll-down doors have areas of rust and a few locations where impact damage is present. The exterior swing door is also not hurricane rated and was observed to be missing a screw in its hinge.

Maintenance Building

Maintenance Building

The two wall mounted fans are attached to ductwork on the interior of the building and the building's wall panels. No connection to the building's frame was observed.

Exterior view of the wall mounted fan

Interior view of the wall mounting

Numerous openings in the building's exterior sheet paneling were observed. These openings consist of areas were sheet panels had become corroded. Openings were also observed impact to the panels had resulted in the loss of the panel's original shape. These openings in the building's exterior expose the building to more severe wind pressures than a fully enclosed building. In addition to damage that was observed in the building's exterior cladding some wall girts were found to be severely corroded and no longer properly attached to the remaining building frame.

Damage to the building's envelope

Openings through the building's envelope

Numerous objects are stored along the exterior of the building. Three metal storage containers are located on the north side of the building. These trailers were not anchored to the ground in any way. We recommend that hurricane tie-down anchors be provide to the storage containers prior to a hurricane event. Several plastic containment containers and metal piping are stored on the east side of the building. These objects can become wind-borne debris during hurricane events. We recommend that these items be removed or properly stored prior to hurricane events.

Potential wind-borne debris located around building

Potential wind-borne debris located around building

Considering the condition of the building and the exterior unsecured storage, we would recommend the complete replacement of the Maintenance Building. A new building should be programmed with enough square footage to accommodate the material stored on the exterior of the building.

Sludge Thickening and Biosolids Facility:

The Sludge Thickening and Biosolids Facility is constructed as a reinforced concrete masonry units (CMU) structure with hollow core concrete roof beams and interior concrete floor slabs. The building is open to the elements on two sides. No positive anchorage was observed between the building's frame and the double tee roof beams. We recommend that brackets be installed to provide positive anchorages between the roof members and wall.

Sludge Thickening and Biosolids Facility

Sludge Thickening and Biosolids Facility

The CMU walls were observed to be constructed in a stack bond configuration. This configuration of masonry units indicates that the building's strength is provided by the concrete columns and tie-beams of the structure. The stack bond masonry units act as infill between the concrete framing of the building.

Stack bond wall CMU

Cracked CMU in stack bond wall

The steel silo adjacent to the Sludge Thickening and Biosolids Facility was observed to have numerous areas were rust was observed. Notably several layers of rust were observed along the edge of the silos roof, and numerous rust spots we observed on the connections of the ladder's safety cage. These protective rails should be mechanically cleaned, repaired, and coated or be replaced.

Steel Silo

Rusted members of the silo railing and ladder

Climate Resilience

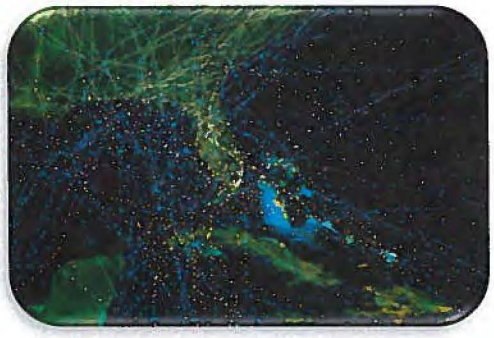
For Various Palm Beach County

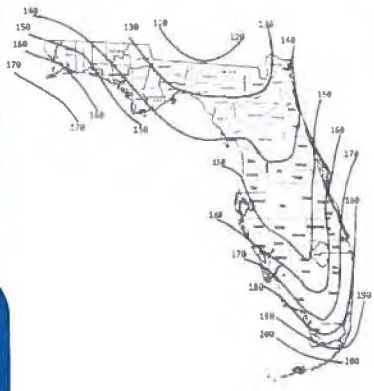
Water Utility Department Facilities

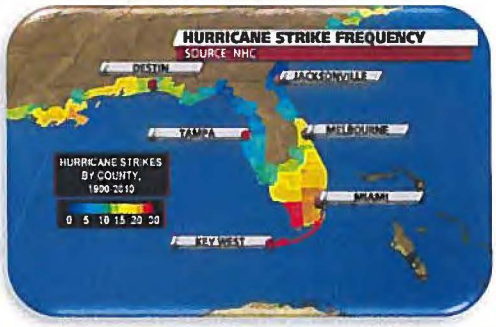
Water Treatment Plant 11

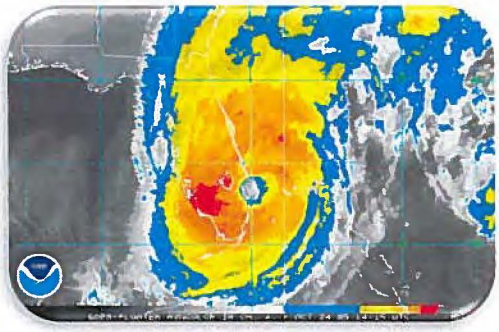
Belle Glade, Florida

April 28, 2014









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Water Treatment Plant -11 Belle Glade

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Palm Beach County
Water Treatment Plant No. 11
39700 Hooker Highway
Belle Glade, Florida

GENERAL

A site visit to the facility was made on April 16th, 2013. Each building, tank and storage facility was evaluated for hurricane vulnerability, and further reviewed for general compliance with the 2010 Florida Building Code.

Building 1 - Membrane Building and Reverse Osmosis Facility:

The Membrane Building and Reverse Osmosis Facility is constructed as a reinforced concrete column and beam structure infilled with reinforced concrete masonry units (CMUs). There is an upper and lower roof with the upper roof constructed of prestressed concrete double tee roof beams with the lower roof constructed of 8" hollow core units. The double tee roof beams have embedded plates connecting the roof beams to the building's frame. These plates provide positive anchorage to resist wind uplift forces. The lower roof does not have positive anchorage to the building's frame. We recommend that steel brackets be installed to tie the hollow core slabs to the building.

The upper roof is comprised of built up asphalt composition tiles and is drained by five roof drains and five overflow drains. A 16" tall parapet surrounds the upper roof. The lower roof is drained with three drains and three overflow drains.

Upper roof

Lower roof

The roof top equipment on the upper roof consists of seven roof fans, four equipment hatches, and a roof access hatch. The fans have been tied down to the roof with ¼" diameter stainless steel cables. No markings were observed on the roof hatches to confirm if they were hurricane rated. If shop drawings cannot be located confirming the hatches are hurricane rated, we recommend that these hatches be removed and replaced with hurricane rated hatches. Walkway tiles on the roof have become damaged by their exposure to the elements and have begun to curl along their edges. In addition to becoming a tripping hazard, the loose edges are likely to break off in a hurricane event and become wind borne debris. We recommend that these damaged tiles be removed.

Roof top equipment with hurricane straps

Skylight on the lower level

A skylight is located on the lower roof over the entrance to the building. The skylight is constructed of translucent exterior panels attached on an aluminum frame. From discussions with the onsite personnel the skylight was not installed as originally detailed in the plans. The light from skylight is currently provided by an electrical light located above interior ceiling tiles. The design plans called out for the skylight to be open up to the exterior translucent panels. There was no visible marking on the translucent panels to indicate if they were hurricane rated. Regardless, the panels deflected a great deal when touched suggesting that these are not hurricane rated. We recommend replacement of the panels with a hurricane rated system.

The north side of building has eleven wall openings that consist of three exterior swinging hurricane and impact rated doors (FL Product Approval No. 9925), four glass windows, one exterior swinging double glass doorway with a glass transom, and four translucent exterior panels. The glass windows and doorway are Miami Dade County Approved hurricane rated glass. There was no visible marking on the translucent panels to indicate if they were hurricane rated. The building's design plans called out for the manufacturer to provide verification that the panels had undergone state and local product approval reviews and had been tested for impact resistance.

Entrance to the building - north side of building

East side of the building

The east side of the building has six wall openings. These openings include two louvers, one exterior out swinging door, one double out swinging door, one overhead roll down door, and one translucent exterior panel. The louvers were marked as having a Miami Dade Product Approval. Both of the swinging doors are marked as having a Florida Product Approval Number (FL 9925). The overhead roll down door is not marked as having either Miami Dade or Florida Product Approval though the design plans called out for the door to be a Cookson door with a Florida Product Approval Number (FL2211). . There was no visible marking on the translucent panels to indicate if they were hurricane rated. If shop drawings cannot be located confirming the Panels are hurricane rated, we recommend that these panels be removed and replaced with hurricane rated panels

West side of the building

South side of the building

The west side of the building has five wall openings. These openings include two louvers, one exterior out swinging door, one overhead roll down door, and one translucent exterior panel. The louvers were marked as having a Miami Dade Product Approval. The exterior out swinging door is marked as having a Florida Product Approval Number (FL 9925). The overhead roll down door is not marked as having either Miami Dade or Florida Product Approval though the design plans called out for the door to be a

Cookson door with a Florida Product Approval Number (FL2211). . There was no visible marking on the translucent panels to indicate if they were hurricane rated. If shop drawings cannot be located confirming the Panels are hurricane rated, we recommend that these panels be removed and replaced with hurricane rated panels

The south side of the building has eight wall openings. These openings include six louvers, and two exterior out swinging doors. The louvers and doors were marked as having Miami Dade Product Approval and Florida Product Approval respectively. The screen on one of the louvers was observed to be damaged.

The building's design plans called out for the manufacturer of the translucent panels to provide verification that the panels had gone through state and local product approval reviews and were impact resistant. From our inspection these panels do not appear to provide adequate hurricane protection as the panels flexed when minor lateral loads were applied. If shop drawings cannot be located confirming the panels are hurricane rated, we recommend that these panels be removed and replaced with hurricane rated panels

Building 2 - Bulk Chlorine:

The Bulk Chlorine facility consists of three large chemical tanks located within a reinforced concrete containment area. A metal Pump and Electrical containment box was located to the south of the Bulk Chlorine Area. The equipment box is sitting on a concrete slab on grade but not positive connection could be observed. We recommend that box be strapped or bolted down in placed. Pipes and equipment located within the containment area were adequately strapped in place to resist hurricane winds. From an operational standpoint we recommend that these tanks be filled prior to a hurricane event.

Bulk chlorine containment area

Unsecured equipment box

Building 3 - Emergency Generator:

The Emergency Generator is enclosed in a pre-engineered building. The building was observed to have an internal steel framing. The enclosed building's interior has seven openings. These openings consist of two exterior swinging doors, two small moveable louvers, and three air intake vents. The doors and louvers are not hurricane rated and may be damaged during a hurricane event. We recommend that they be removed and replaced with hurricane rated doors and louvers. The air intake vents are configured to prevent wind borne debris from entering the enclosure and damaging the generator. A generator exhaust muffler is located on the roof of the building and is supported by independent steel frames.

Emergency generator

Building 4 and 5 - Clearwell and Degasifier:

The clearwell is constructed as a reinforced concrete structure with the degasifiers installed above the clearwell. The degasifiers are constructed of steel tanks that are bolted to the roof of the clearwell. Two elevated platforms span between the degasifier towers and connected to the degasifiers. The platforms, piping attached to the degasifiers, and machinery on top of the clearwell are adequately braced to resist hurricane force winds. Some miscellaneous equipment was noted on top of the clearwell that should be properly stowed away before a hurricane event.

Clearwell and degasifier

Building 6 - Scrubber:

The scrubber consists of a steel tank that is located within a reinforced concrete containment area. The tank was observed to be adequately anchored to the concrete slab. Within the containment area a chemical storage container was observed to be unsecured. We recommend that stainless steel straps be installed over the container prior to a hurricane event.

Scrubber

Scrubber containment area with unsecured chemical storage

Building 7 - Transfer Pump Station:

The transfer pump station consists of three pumps which are exposed to the environment which are sitting on a reinforced concrete slab. No issues were noted.

Transfer pump station

Building 8 - Chemical Storage:

The chemical storage consists of several steel tanks located within a reinforced concrete containment area. The tanks were observed to be adequately anchored to the concrete slab. From an operational standpoint we would recommend that these tanks be filled prior to a hurricane event. Some rusting was observed along the bases of the sodium hydroxide containers. Some equipment within or near to the containment area were observed to be inadequately restrained against hurricane force winds. We recommend that any loose equipment be stowed away prior a hurricane event. Chemical storage containers should be tied down with stainless steel straps.

Building 9 - Ammonia Tank and Ammonia Feed Room:

The ammonia tank is a welded steel tank with integral supports which bears on a reinforced concrete slab on grade. Positive anchor was observed between the tank and concrete bearing slab. From an operational standpoint we would recommend that the tank be filled prior to a hurricane event.

Ammonia tank and feed room

Ammonia feed room

The ammonia feed room is a shed reinforced with uni-strut framing. The base of the shed is anchored to a reinforced concrete slab on grade. The shed contains one door and one louver which are not hurricane rated. This building is prone to being damaged during a hurricane event and should be replaced with a building designed to resist hurricane force winds.

Building 10 - Carbon Dioxide Tank:

The carbon dioxide storage tank is a welded steel tank with integral supports. It is adequately bolted to a concrete foundation. We recommend that tank be filled prior to a hurricane event from an operational standpoint.

Carbon dioxide tank

Building 11- Deep Injection Well:

The deep injection well consists of a reinforced concrete containment area with pipe work and a welded steel fuel tank with integral supports. The piping and tank have adequate positive anchorage to resist hurricane forces.

Deep injection well

Tank on the deep injection well

Adjacent to the deep injection well is another welded steel tank with integral supports and small free standing enclosure. The free standing enclosure is constructed of corrugated metal sheeting with no apparent internal frame. This enclosure houses an air compressor which was observed to be bolted to the concrete slab on grade and some miscellaneous hoses. This structure is not adequate to resist hurricane forces and is likely to become wind borne debris during hurricane events.

Surge Tank

Surge Tank air compressor enclosure

Building 12 - Duel Zone Monitoring Well:

The duel zone monitoring well is a reinforced concrete slab on grade. No hurricane vulnerabilities were noted.

Building 13 – High Service Pump Station:

The high service pump station consists of four pumps exposed to the environment and the High Service Pump Electrical Building. The building was constructed with precast reinforced concrete walls and roof members attached with welded angle brackets. The building has two doors and two wall mounted air conditioning units. The doors were not marked as being hurricane rated. We recommend that the doors be removed and replaced with hurricane rated doors. Steel straps should be installed over the air conditioning units to prevent them from becoming wind borne debris during hurricane events.

High Service Pump Station

Electrical Building with

The south side of the building was observed to have several large cracks near to where a previous wall mounted control panel had been located. Numerous items were located along the exterior of the building which could become wind borne debris during hurricane event. We recommend that these items either be removed or properly stowed during hurricane events or be adequately restrained to resist hurricane forces.

Cracking on the High Service Pump Electrical Building

Unsecured fuel storage tank container

Building 14 - Water Storage Tank:

The water storage tank is a Crom prestressed concrete tank. The roof the tank has an access hatch and vent that are not hurricane rated. The access hatch should be locked down prior to hurricane events and we recommend that stainless steel straps be installed over the vent. Some cracks were observed in the walls of the tank.

Water Storage Tank

Building 15 - Cal Flo:

The Cal Flow consists of a welded steel silo and attached steel building. The building is constructed of corrugated metal sheeting installed over a light gauge steel frame. The building has one exterior out swinging door that is posted as being hurricane and impact rated. The building also has two small (1'0" x 1'0") louvers which are not hurricane rated. Rust was noted along the bottom edges of the corrugated building walls. An access hatch is bolted on the top of the welded steel silo.

Cal Flo

Corrugated building attached to Cal Flo

General Site Considerations:

Between the membrane processing building and the chemical storage area there is a utility trench that is covered with unsecured concrete panels. If one of these panels were to be lifted up by winds during a hurricane it is likely that the majority of the panels would be jeopardized and could become wind borne debris. The lifting or moving of these loose tiles could also jeopardize the piping within the trench. We recommend that the county contact the trench manufacturer to determine a way to secure the tiles.

Unsecured concrete panels

The dumpster enclosure located near the transfer pump station and clearwell was observed to have a damaged door. We recommend that the fasteners for the dumpster gates be repaired.

Damaged dumpster enclosure

During our site visit we observed several items that are likely to become wind borne debris during hurricane events. These items include miscellaneous pipes and empty chemical containers, as well as a lot of loose items located on the adjacent property. We recommend that these items either be removed or properly secured during hurricanes.

Loose items which could become wind borne debris

Palm Beach County
Water Treatment Plant No. 11
39700 Hooker Highway
Belle Glade, Florida

Unsecured items on adjacent property

Climate Resilience

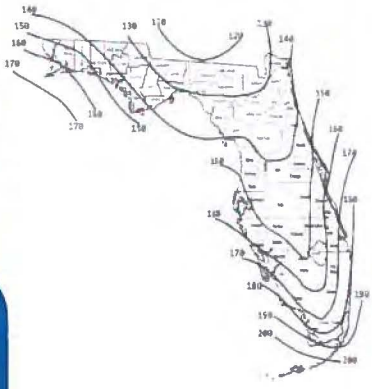
For Various Palm Beach County

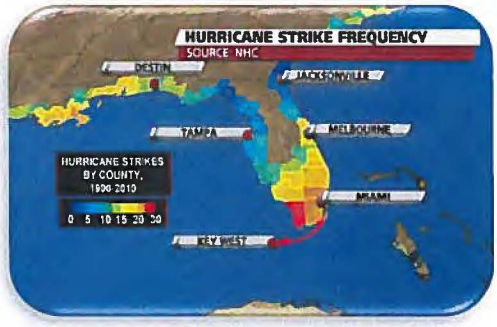
Water Utility Department Facilities

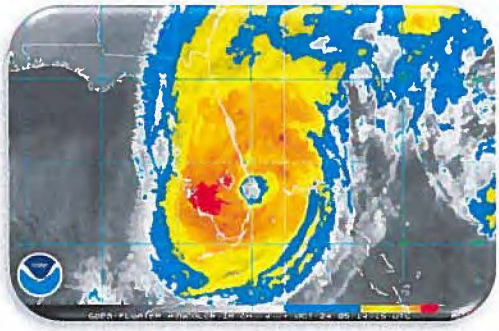
Belle Glade and South Bay Storage Tanks

Belle Glade, Florida

April 30, 2014







Prepared By: Jeffrey Bergmann, P.E. 50159

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Belle Glade and South Bay Storage Tanks

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GENERAL

Site visits to the facilities were made on April 23rd, 2014. Each building and tank were evaluated for hurricane vulnerability and further reviewed for general compliance with the 2010 Florida Building Code.

Belle Glade Re-Pump Station:

The Belle Glade Re-Pump Station is constructed as either a cast in place or reinforced concrete masonry unit (CMU) structure with internal concrete floors. The structures walls are stuccoed both exterior and interior making it difficult to confirm the wall construction. Regardless, the structure walls appeared in good condition with only minor hairline cracks noted at the corner of the louvers. The building is covered with a hipped wooden truss roof. During our site visit we were unable to obtain access into the roof in order to determine if adequate positive anchorage was provided at each end of the trusses. A review of photos during a recent ceiling repair also failed to confirm the presence of hurricane anchorage. We recommend that the presence of hurricane ties be confirmed or be installed to provide positive anchorage between the roof trusses and the building's frame.

East face of the building and Crom Tank

North face of the building

The north face of the building has two openings. These openings consist of an overhead roll-down door and a louver. The overhead door is not posted as being hurricane rated and was observed to only have wind-locks installed on every other slat. We recommend that this door be removed and replaced with a hurricane rated overhead door that has wind-locks installed on every slat. The louver was also observed to not be hurricane or impacted rated. This louver should either be replaced with a hurricane rated louver or protected with another form of hurricane protection. Additional hurricane protection can consist of either hurricane shutters or the construction of a screen wall which will protect the louver against impact loadings.

The east face of the building has three openings. These openings include an exterior swinging door, one louver, and one wall mounted fan. The exterior swinging door was observed to not be hurricane rated and should be removed and replaced with a hurricane rated door. No straps were observed over the wall mounted fan. From our experience these types of fans can become wind-borne debris during hurricane events. We recommend that steel straps be installed over the fan. The louver was observed to be not hurricane rated and should be replaced with a hurricane rated louver.

South face of the building

West face of the building

The south face of the building has seven openings. These openings consist of two exterior swinging doors, four louvers, and the generator's exhaust muffler. Both doors were observed to not be hurricane rated with one door noted as having a damaged locking mechanism which prevented the door from be secured. We recommend that both doors be removed and replaced with hurricane rated doors. The four louvers consist of one generator exhaust louver and three ventilation louvers. All four louvers were observed to not be hurricane rated and should be replaced with hurricane rated louvers or be provided with adequate hurricane protection. The generator's exhaust muffler was observed to be adequately braced against hurricane winds.

The west face of the building has three openings. These openings consisted of two large louvers and one small louver. All the louvers were observed to not be hurricane rated. We recommend that the louvers be replaced with hurricane rated louvers or be provided with adequate hurricane protection. Two wall mounted electrical control boxes were observed to be attached to this face of the wall.

Roof top equipment on the building

Two roof fans were observed to be mounted on the south side of the building. From our experience these types of fans are not designed to resist hurricane force winds and can become wind-borne debris during hurricane events. We recommend that the steel straps be installed over the roof mounted fans.

Transformer

Air conditioning unit

The west side of the building also had a free standing air conditioning unit and an electric transformer. Both the air conditioning unit and the transformer were standing on independent concrete slabs on grade. The air conditioning unit was observed to have no external hurricane anchorages. We recommend that steel cables be installed over the air conditioning unit. The concrete bearing slab beneath the transformer was observed to have undergone settlement. The transformer slab was visibly sloped with the bottom of the slab on grade footing exposed on one corner. We recommend that steps be taken to stabilize this support slab to prevent further settlement from jeopardizing the electrical box and its attachments. Helical anchors have been used to stabilize similar structures.

The east side of the building has a free standing concrete petroleum tank. This tank is bearing on a concrete slab on grade foundation. We recommend that steel cables be installed over the tank. From an operational point of view we would also recommend that the tank be filled prior to a hurricane event.

Petroleum fuel tank

Belle Glade Crom Storage Tank:

The Crom Storage Tank adjacent to the Belle Glade Re-Pump Station was observed to have numerous cracks in the tank walls and on the roof. We recommend that the County hire Crom Tank® to perform a full structural evaluation of the tank. From a hurricane hardening standpoint the following items were noted. The center tank roof vent was observed to be unsecured; we recommend that steel straps be installed over the vent in order to prevent the vent from becoming wind-borne debris during hurricane events. The roof access hatch was observed to have insufficient anchorage. The tank lid is only restrained from uplift by a padlock clipped through a bent metal bar. The current configuration will allow 3" to 4" of lift in the hatch before any restraint is provided. With this amount of uplift possible in the hatch we feel the hatch is likely to be damaged during hurricane events. We recommend that the hatch be removed and replaced with a properly designed hurricane hatch.

Center roof vent

Crom Tank roof access hatch

South Bay Re-Pump Station:

The South Bay Re-Pump Station is constructed as a reinforced concrete structures with a flat concrete hollow core roof. The building was built in 1980. No positive anchorage was observed between the roof slabs and the building. We recommend that anchorage brackets be installed between the roof slabs and the walls to prevent hurricane uplifting forces from damaging the structure.

Re-Pump Station south and east face of building visible

Roof and north face of the building

The flat roof is surrounded with a 1'0" tall parapet. Drainage is provided from four roof scuppers installed through the northern parapet. The roof has one roof mounted fan which was observed to be not adequately secured. We recommend that the steel straps be installed over the roof mounted fan.

The north face of the building has four openings. These openings consist of two windows, one exterior swinging door and one louver. The two windows are not hurricane rated but do have hurricane protection provided by accordion shutters. The accordion shutters were noted as being Miami Dade Approved for hurricane protection. The exterior swinging door was observed to not be hurricane rated and should be removed and replaced with a hurricane rated door. The louver on this side of the building is the generator's exhaust louver. We recommend that this louver either be replaced with a hurricane rated louver or be provided with adequate hurricane protection such as a hurricane screen wall or hurricane rated shutters.

The east face of the building has three openings. These openings include one double exterior swinging door, one louver, and the generator's exhaust muffler. The doors and louver were observed to not be hurricane rated and should be removed and replaced with hurricane rated openings. The generator's exhaust muffler was observed to be adequately anchored with angled metal brackets and tie down straps to the building's wall. Some conduits were observed to enter the building through a hole in the wall above the muffler. We recommend that this hole be sealed up to prevent water intrusion and wind damage to the interior of the building.

West face of the building

West and south face of the building

The south face of the building has five openings. These openings consist of two exterior swing doors, two windows, and one louver. The exterior swinging doors were observed to not be hurricane rated and should be removed and replaced with hurricane rated doors. The windows are not hurricane rated but do have hurricane protection provided by Miami Dade Approved accordion shutters. The louver is an air intake louver and was also observed to be a non-hurricane rated louver. We recommend that either this louver be replaced with a hurricane rated louver or that adequate hurricane protection be provided for the louver. A wall mounted air conditioning unit is attached on this face of the building. We recommend that the air conditioning unit be secured with either steel straps or angled brackets.

The west face of the building has one louver which was observed to not be hurricane rated. We recommend that the louver be replaced with a hurricane rated louver or be provided with hurricane protection.

On the west side of the building two welded steel tanks with internal bracing were observed. During our site visits we were informed that these tanks are no longer in use. The tanks were observed to be rusted. Concrete slabs on grade were observed beneath the tanks that are significantly undermined. The supports for the tanks were observed to extend through this undermined slab. We recommend that prior to using these tanks in the future that the tanks and foundations receive a structural evaluation to determine their capacity. The observed anchorage of the tank appears sufficient to resist overturning during hurricane events.

Abandoned steel storage tanks

Undermining beneath the tank

South Bay Crom Storage Tank:

The Crom Storage Tank adjacent to the South Bay Station was observed to have numerous cracks in the tank walls and on the roof. We recommend that the County hire Crom Tank® to perform a full structural evaluation of the tank. From a hurricane hardening standpoint the following items were noted. The center tank roof vent was observed to be unsecured; we recommend that steel straps be installed over the vent in order to prevent the vent from becoming wind-borne debris during hurricane events. The roof access hatch was observed to have insufficient anchorage. The tank lid is only restrained from uplift by a padlock clipped through a bent metal bar. The current configuration will allow 3" to 4" of lift in the hatch before being restrained. With this amount of uplift possible in the hatch we feel the hatch is likely to be damaged during hurricane events. We recommend the hatch be removed and replaced with a properly secured and designed hurricane hatch.

Roof access hatch

Center roof vent

APPENDIX E

Glades Region Master Plan –
Drainage Inventory and Evaluation (Task 5.4, 5.7 and 5.8 Deliverables), Last Devenport, Inc. / Mock Roos, January 2014

MOCK • ROOS
ENGINEERS • SURVEYORS • PLANNERS

January 16, 2014

Kristine Frazell-Smith
Palm Beach County Engineering and Public Works
2300 North Jog Road
West Palm Beach, FL 33411

Ref. No. B2014.00
Subject: **Glades Region Master Plan – Drainage System Inventory and Evaluation**
Palm Beach County Project No. 2012057
Existing Drainage System Evaluation Report (Task ENG 3, 5.4 Deliverable)

Dear Kristine:

This final letter report constitutes the first deliverable for the above-referenced County Project.

Background

The Palm Beach County Department of Economic Sustainability (PBCDES) has undertaken the task of developing a master plan for the Glades Region of Palm Beach County, with funding provided by a Community Challenge Planning Grant from the U.S. Department of Housing and Urban Development (HUD). DES designated a portion of the funding for the completion of a new Drainage System Inventory and Evaluation, to be overseen by the Palm Beach County Department of Engineering and Public Works (PBCENG).

PBCENG negotiated with Last Devenport, Inc., a general consultant with an existing PBCENG contract, for a scope of services to complete the services necessary to produce the Drainage System Inventory and Evaluation. This letter report is the first deliverable of that effort, documenting the first two tasks of the Scope of Services. The tasks include the data collection effort and the preliminary assessment and recommendations for further evaluation (task 5.3 and 5.4 in the Scope of Services).

Regional Drainage System Description

In general, the Glades Region consists of the Cities of Belle Glade, Pahokee, and South Bay, as well as a portion of the unincorporated Palm Beach County (PBC) area (see Exhibit 1). The area is in proximity of three major South Florida Water Management District (SFWMD) canals, the West Palm Beach Canal, the Hillsboro Canal, and the North New River Canal. These primary canals are depicted on Exhibit 2. The lands within the Study Area are also situated partially or fully within the service areas of a number of designated water control districts (WCDs). These are shown on Exhibit 3. The WCDs primarily function to drain and provide irrigation water to the agricultural lands they serve, but they also receive stormwater discharge from developed lands. The WCD systems consist of networks of main canals and lateral canals, along with control structures, pumps, and other appurtenances for moving water. Much

Mock, Roos & Associates, Inc.
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of the discharge from the municipal and County stormwater systems is received by the WCD canals and is, therefore, impacted by the operation of the WCD systems.

Data Collection

Coordination with stakeholders within the Study Area was carried out over the course of several weeks. Ultimately, information came from municipalities, the County, and a consultant for the WCDs.

Municipality Coordination

Extensive effort was made to engage representatives of each of the three municipalities within the study area. The primary intent was to gather information about existing stormwater systems and any noted drainage problem areas.

Belle Glade

A 2012 system schematic was provided showing stormwater piping, outfall locations, and drainage basins. The system component data (i.e., pipe size, pipe and structure type, invert elevations, length) was not provided.

A meeting was held in December 2012 with the Public Works Director to discuss drainage problems areas. The City indicated the six locations shown on Exhibit 4. The locations are numbered in order of priority as indicated by the City.

Pahokee

A 1998 system schematic was provided showing stormwater structures and piping. No other system component data was provided.

A meeting was held in March 2013 with the Public Services Director and administrative staff to discuss the drainage system and drainage problems areas. The City agreed to review their existing information and to identify problem areas. In September 2013 the City and representatives of Palm Beach County Department of Economic Sustainability and U. S. Department of Housing and Urban Development met and discussed several drainage problems areas. As a result of that meeting three problem areas within Pahokee were identified. These three locations are shown on Exhibit 4. A priority ranking for the locations was not provided.

South Bay

A 1990s system schematic was provided showing stormwater structures and type, piping, and outfalls. No other system component data was provided.

A meeting was held in March 2013 with the Public Works Director to discuss the drainage system and drainage problems areas. The City conducted a field investigation and verified the piping network shown in the 1990s schematic and provided drainage basins for their system. The City indicated the three problem areas shown on Exhibit 4. The City provided photographs

showing the extent of flooding in the areas from Tropical Storm Isaac (August 26-28, 2012). A priority ranking for the locations was not provided.

Palm Beach County Coordination

A meeting was held in February 2013 with Palm Beach County Engineering Department Road Section – District 5 to discuss drainage problems in the unincorporated PBC area that is within the Glades Study Area. The County indicated the two locations within the unincorporated area shown on Exhibit 4. A priority ranking for the locations was not provided.

The County held a public meeting for the Glades Study on March 1, 2013 to provide an overview of the project and invite public participation. Graphics to assist in the presentation were provided to the County. A stormwater/drainage survey (Attachment A) to gather information on additional problem areas was also prepared for distribution at the meeting. Copies of the survey were also provided to each municipality for distribution to stakeholders who did not attend the meeting. There has been no response to the survey to date.

Water Control District Coordination

There are six water control districts (WCDs) within the Glades Study Area: Pelican Lake WCD, East Beach WCD, Pahokee Drainage District, East Shore WCD, South Florida Conservancy District, and South Shore Drainage District. Five of these six WCDs serve the municipalities within the Glades Study Area. All the WCDs have the same Manager and the same District Engineer (AECOM). Water control plans and AutoCAD drawing files of each WCD's facilities were provided by the District Engineer and included the following:

a. An aerial map delineating the legal boundary of the WCDs and their respective sub-districts and/or units within that District
b. A narrative description of the stormwater management facilities (pump stations, control structures, operational criteria, and control elevations)
c. A map of the stormwater system (canals and laterals)
d. A table of the land uses within the District and percentage of urban and agricultural areas

System Summaries

Following are brief narrative summaries of each entity's existing stormwater system. These summaries are based on data provided in each municipality's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Permit.

Palm Beach County

The stormwater system owned and maintained by the County is limited to those inlets, pipes, and outfalls that serve County rights-of-way within the Study Area. The County is currently working on its system inventory throughout the County.

Belle Glade

The stormwater system within Belle Glade consists of approximately 2 miles of swales, 9 miles of stormwater piping, 200 structures, and 6 major outfalls. The system is within the South Florida Conservancy District's Units 1, 2 and 6 with an ultimate discharge to either SFWMD's North New River Canal or Hillsboro Canal. The WCD facilities within Belle Glade are shown on Exhibit 5. A majority of the municipal drainage system discharges by gravity into the WCD's canals and laterals. Some drainage areas within the municipality discharge directly into SFWMD canals.

Pahokee

The stormwater system within Pahokee consists of approximately 3.5 miles of swales, 3.5 miles of stormwater piping, 294 structures, and 3 major outfalls. The system is within East Beach and Pelican Lake WCDs with an ultimate discharge to SFWMD's West Palm Beach Canal. The WCD facilities within Pahokee are shown on Exhibit 6.

South Bay

The stormwater system within South Bay consists of approximately 0.5 miles of swales, 10 miles of stormwater piping, 167 structures, and 9 major outfalls. The system is within the South Shore Drainage District with an ultimate discharge to SFWMD's North New River Canal. The WCD facilities within South Bay are shown on Exhibit 7. A majority of the municipal drainage system discharges by gravity into the WCD's canals and laterals. Some drainage areas within the municipality discharge directly into SFWMD canals.

Water Control Districts

Each of the WCDs consists of canals, laterals, control structures, and pump stations with specifications for controlling the stormwater within their jurisdiction. These WCDs' facilities serving the municipal areas are shown in Exhibits 5 through 7.

An actual physical inventory of the existing systems described above was not provided by the municipalities. From information gathered from the various entities, the existing systems were mapped to the greatest extent possible. The system schematics provided by each entity were used as a base to develop the maps. Digital Elevation Model (DEM) data was obtained from SFWMD's GIS database to delineate drainage basins for Pahokee. This DEM was developed by SFWMD in 2007.

Site investigation and research of existing SFWMD permits within the noted problem areas supplemented the information provided by each municipality. Mapping of this partial information for each municipality's storm system is shown in Exhibits 8 through 10.

Identified Problems

The data collection process revealed three primary problems within the study area: incomplete system inventories, undocumented operations and insufficient maintenance, and inadequate system infrastructure.

System Inventories

The most glaring problem identified during the data collection task was the limited information of the physical inventories of the existing stormwater systems by the municipalities within the Study Area. The system schematics that were provided lacked detailed information about the system components. The WCDs have their facilities mapped and provided detailed information about their systems. Survey of the existing drainage collection systems was not included in this Scope of Services as it was anticipated that the municipalities would provide complete inventories of their facilities.

System Operation and Maintenance

A second key issue was identified during the data collection task. Municipal systems are heavily dependent on the operation and maintenance of the WCD systems, as well as the maintenance of their own systems. Increased requirements of the NPDES permit (held by all three of the municipalities in the Study Area) should assist in assuring that the municipal systems are inspected and maintained regularly and that deficiencies in the systems are identified more quickly. However, the WCDs are not party to this NPDES permit, and the requirements for regularly scheduled inspection and maintenance of their systems is unknown. The maintenance of the WCDs' systems is a crucial component for many areas within the municipalities. Stages within the WCDs' main and lateral canals affect the ability for discharge from the municipalities' storm systems. Therefore, communication between the municipalities and the WCDs is a critical component of a well-functioning regional drainage system.

System Infrastructure

The system infrastructure is vital for stormwater management. Systems that are damaged, undersized, or non-existent, lead to flooding. Areas experiencing flooding and areas at risk for potential flooding were identified as problem areas. Below is a list of the twelve areas shown on Exhibit 4:

Belle Glade

Area B1 – NW Avenue H
Severe flooding of the roadway and roadway deterioration

Area B2 – NE 2nd Street and NE 3rd Street
Damaged cross drains, improperly maintained swales, and ponding within the roadway.

Area B3 – SE Avenue K
Roadway deterioration along the street

Area B4 – SW 8th Street
A substandard stormwater conveyance system

Area B5 – SW 1st Street
Periodic flooding of lots during heavy rainfall has been observed

Area B6 – Linda Road and Sara Road
Minor flooding and roadway deterioration

Pahokee

Area P1 – Seville Street and El Dorado Street
Severe flooding (up to 12") during large storm events and road deterioration

Area P2 – Glades Citizens Villa

Periodic flooding of roadway

Area P3 – Amaryllis Gardens

Periodic flooding of roadway

South Bay

Area S1 – NW 9th Avenue
Severe roadway flooding during heavy rainfall events

Area S2 – SE 2nd Ave
Severe flooding of lots and roadway and roadway deterioration

Area S3 – Taner Park (SW 2nd Ave)
Flooding of Taner Park during heavy rainfall events

Unincorporated PBC

Area U1 – Padgett Island
Severe flooding (up to 12") during large storm events in this development

Area U2 – Sugar Cane Villas
Severe flooding (up to 12") during large storm events in this development

System Analysis

An overall regional drainage system evaluation was not completed; however, each reported problem area was preliminarily reviewed, inspected, and discussed with the system owner/operator. A review of available topographic information, aerial photography and relevant permit information was completed. The preliminary assessment of each problem is summarized below:

Area B1 – NW Avenue H
The stormwater system along NW Avenue H consists of inlets and piping with outfalls to the west and east. The western outfall is a 24-inch corrugated metal pipe (CMP) that discharges to a ditch on private property. The 24-inch outfall pipe is undersized for the contributing drainage area and there are larger pipes upstream of this outfall. The ditch requires maintenance. This ditch discharges to the South Florida Conservancy District's Lateral 1-1A. The normal control elevation of Lat1-1A is elevation 7.5 feet, NGVD and the pump on elevation is 8.0 feet, NGVD.

Based on the system schematic, there appears to be multiple interconnects and a 72-inch outfall to South Florida Conservancy District's Canal 4. There were no SFWMD permits in the area to provide additional information about the eastern system.

The existing lot elevations within this area are below inlet elevations allowing flooding of the lots.

Area B2 – NE 2nd Street and NE 3rd Street
The stormwater system along NE 2nd Street and NE 3rd Street consists of swales and CMP cross drains. The swales require grading and the cross drains need replacement and/or repair. This area is within a sub-basin that outfalls into the Hillsboro Canal.

Area B3 – SE Avenue K
The stormwater system along SE Avenue K consists of swales and cross drains that discharge to a ditch on private property. The swales require grading and the cross drains need replacement

and/or repair. The ditch is obstructed and requires maintenance. This ditch discharges to South Florida Conservancy District's Canal 2. The normal control elevation of Canal 2 is elevation 8.5 feet, NGVD and when the stages in the canal rise to elevation 9.0' NGVD the WCD pumps are activated.

Area B4 – SW 8th Street

The stormwater system along SW 8th Street consists of curb and gutter, inlets, piping and a concrete conduit that discharges to Canal 1 within the South Florida Conservancy District. The concrete conduit is an old concrete lined swale that was covered with a concrete slab to approximate a closed box system. The structure needs repair and/ or replacement. The normal control elevation of Canal 1 is elevation 8.5 feet, NGVD and the pump on elevation is 9.0 feet, NGVD.

Area B5 – SW 1st Street

There is no existing collection and conveyance system in this area. This area is within a sub-basin that outfalls into the South Florida Conservancy District's Canal 1. The normal control elevation of Canal 1 is elevation 8.5 feet, NGVD and the pump on elevation is 9.0 feet, NGVD.

Area B6 – Linda Road and Sara Road

There is no existing collection and conveyance system in this area. This area is not associated with a sub-basin defined by Belle Glade. No outfall was indicated for this area.

Area P1– Seville Street and El Dorado Street

The stormwater system along Seville and El Dorado Streets consists of swales, inlets and piping with outfall pipes to the east and west. Information about the eastern outfall pipe is inadequate to determine its discharge location. After construction of the eastern outfall, the western outfall was plugged and abandoned in place. Severe flooding of the development caused the County to reopen the western outfall which slightly improved flooding in the development. The western outfall pipe discharges into East Beach WCD's Canal C3. During heavy rainfall events it is reported that stages in the canal are too high to accept discharge from this outfall. The normal control elevation of Canal C3 is elevation 8.0 feet, NGVD and the pump on elevation is 8.5 feet, NGVD.

Area P2 – Glades Citizens Villa

The stormwater system within Glades Citizens Villas consist of swales, inlets, and piping that outfall to drainage ditches along the east and south perimeter of the development. These canals discharge to the East Beach WCD's Lateral 4-1 N. The normal control elevation of the Lateral 4-1N is elevation 6.0 feet, NGVD and the pump elevation is 6.5 feet, NGVD.

Area P3 – Amaryllis Gardens
The stormwater system within Amaryllis Gardens consist of swales, inlets, and piping that discharges to the Amaryllis Avenue Stormwater Collection System. This system is within the East Beach WCD, but no information was provided for its outfall location.

Area S1 – NW 9th Avenue
The stormwater system along NW 9th Avenue consists of curb and gutter, inlets and piping that outfall to South Shore WCD's Lateral 18. It was reported that the outfall may be damaged and possibly undersized for the contributing drainage area. This street floods because it is at the lowest elevation within the drainage area. The normal control elevation of Lateral 18 is elevation 8.0 feet, NGVD and the pump on elevation is 8.5 feet, NGVD.

Area S2 – SE 2nd Ave
There is no stormwater system in this area. Stormwater collects in lots with low elevations. When the stormwater levels become high enough, discharge occurs to South Florida Conservancy District's Lateral 2-1S. The normal control elevation of Lateral 2-1S is elevation 8.5 feet, NGVD and the pump on elevation is 9.0 feet, NGVD.

Area S3 – Taner Park (SW 2nd Ave)
There is no stormwater collection system in this area. Stormwater collects in a grassed low area in the park. No outfall was indicated for this area.

Area U1 – Padgett Island
The stormwater system within Padgett Island consists of valley gutter, inlets and piping that outfall to an unclaimed canal west of the development. The west side of the canal is being maintained by the adjacent agricultural land owner but the entire canal requires maintenance. This canal discharges into East Beach WCD's Lateral 3-1N. The normal control elevation of Lateral 3-1N is elevation 8.0 feet, NGVD and the pump on elevation is 8.5 feet, NGVD.

Area U2 – Sugar Cane Villas
The stormwater system within Sugar Cane Villas consists of inlets, piping, and a grassed detention area which outfalls to an unclaimed canal west of the development. The canal is in need of maintenance. This canal discharges to East Beach WCD's C-3 Canal. The normal control elevation of Canal C3 is elevation 8.0 feet, NGVD and the pump on elevation is 8.5 feet, NGVD.

Recommendations

The recommendations resulting from the completed research and assessment, follow the three identified issues: incomplete system inventories, undocumented operation and insufficient maintenance, and inadequate system infrastructure.

System Inventories

The first step in evaluating the stormwater system is identifying what facilities are within the system. A survey of the existing system is necessary to determine the details and conditions of the system components. Therefore, the primary recommendation is the completion of a field survey of the existing stormwater facilities within the Glades Study Area.

System Operation and Maintenance

Since the municipalities within the Study Area are very dependent upon the WCDs operation and maintenance protocols (i.e., canal stages), a formal agreement between each municipality and the WCDs within which they are located, should be developed. Components of the agreement may include, but should not be limited to, an identified schedule for regular maintenance of the WCD canals, 24-hour contact information for coordinating operations, a reporting procedure for non-emergency maintenance issues, and a yearly meeting to discuss policy and procedure changes or updates. In addition, municipalities and the County should review the written procedures prepared for MS4 NPDES permit compliance, to confirm that sufficient inspection and maintenance activities are scheduled for these problem areas.

System Infrastructure

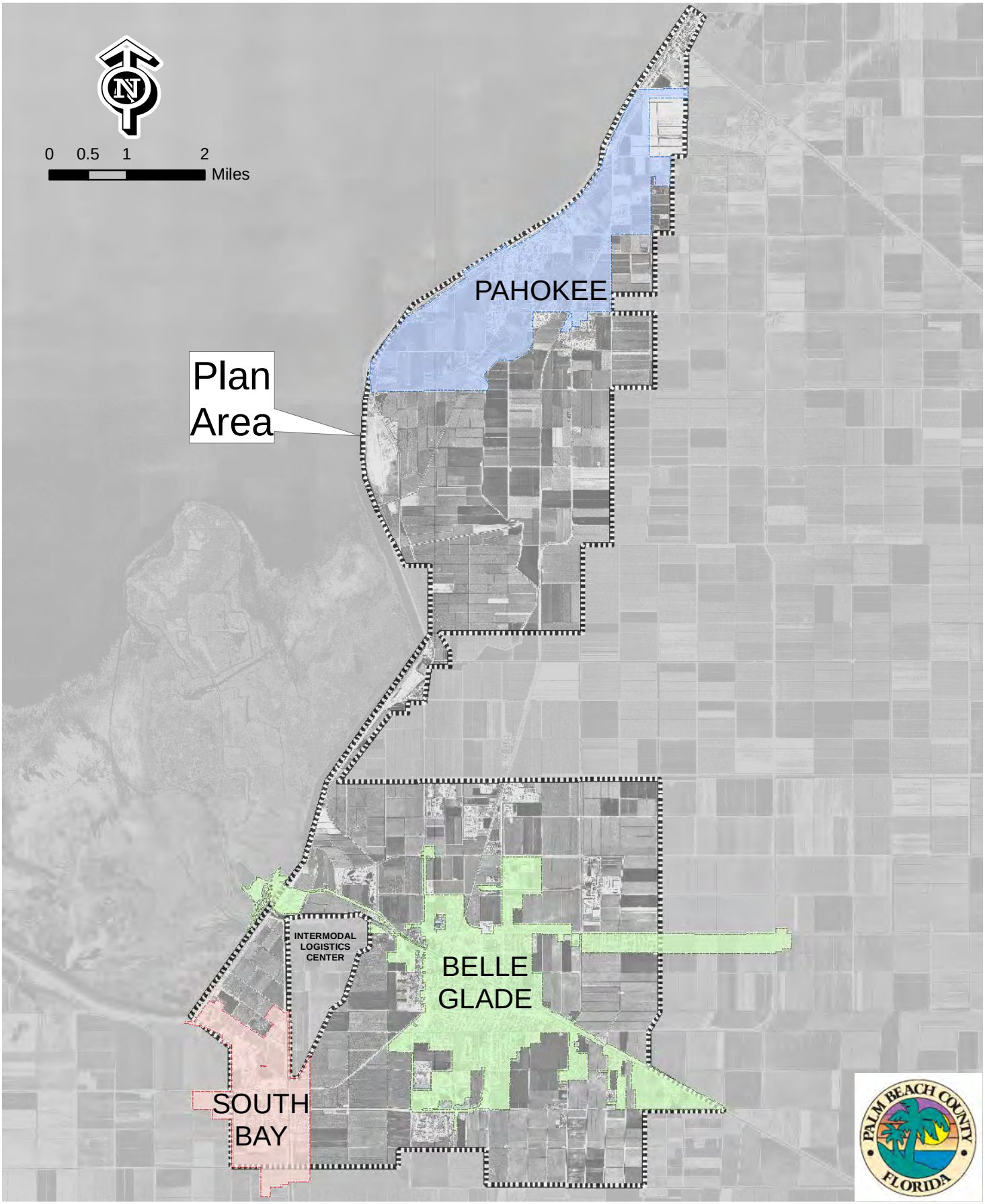
The entities identified twelve problem areas within the Study Area. Due to project funding, the County requested recommendations on up to five capital improvements projects. The initial assessment of the twelve problem areas was used to narrow down the list to five for further evaluation. The selection of the five projects was based on location and severity of the drainage problem. In order to represent each government entity within the Study Area, the most severe problem area within each municipality/County was chosen. The fifth area was deemed to be the most severe problem out of the remaining eight problem areas. The five problem areas chosen for capital improvements projects are: Areas B1, P1, S1, S2, U1 (See Exhibit 4). The DEM obtained from SFWMD was mapped for each of these problem areas (see Exhibits 11 to 15), and photographs of the five areas are provided in Attachment B. A detailed analysis of the five problem areas, along with recommended alternatives will be completed once the areas are approved for further analysis by the County.

Sincerely,

Ronald W. Last, P.E., LEED AP
President, Last Devenport, Inc.

Alan Wertepny, P.E.
Vice-President, Mock•Roos

Enclosures



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Prepared by:

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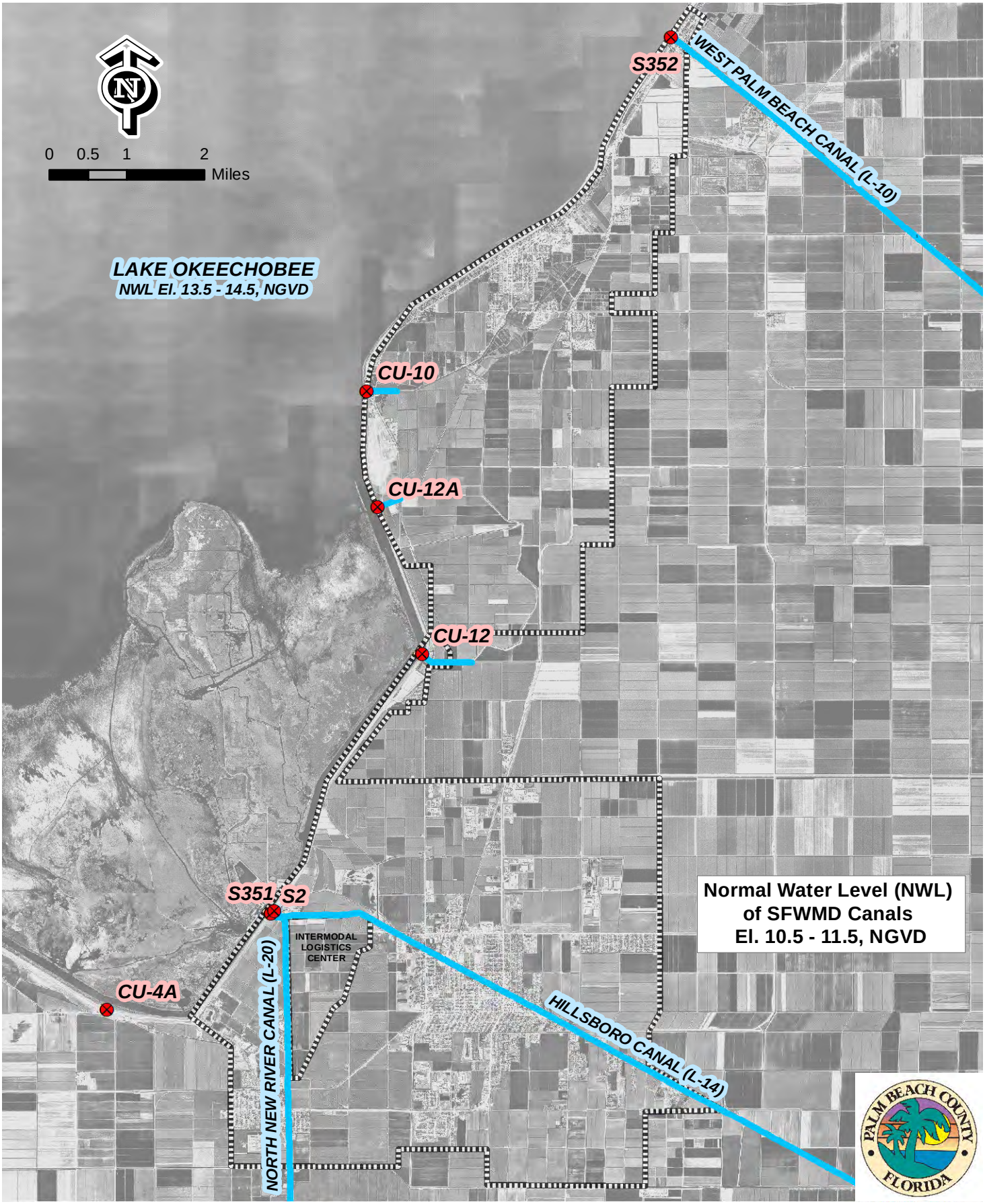
PLAN AREA



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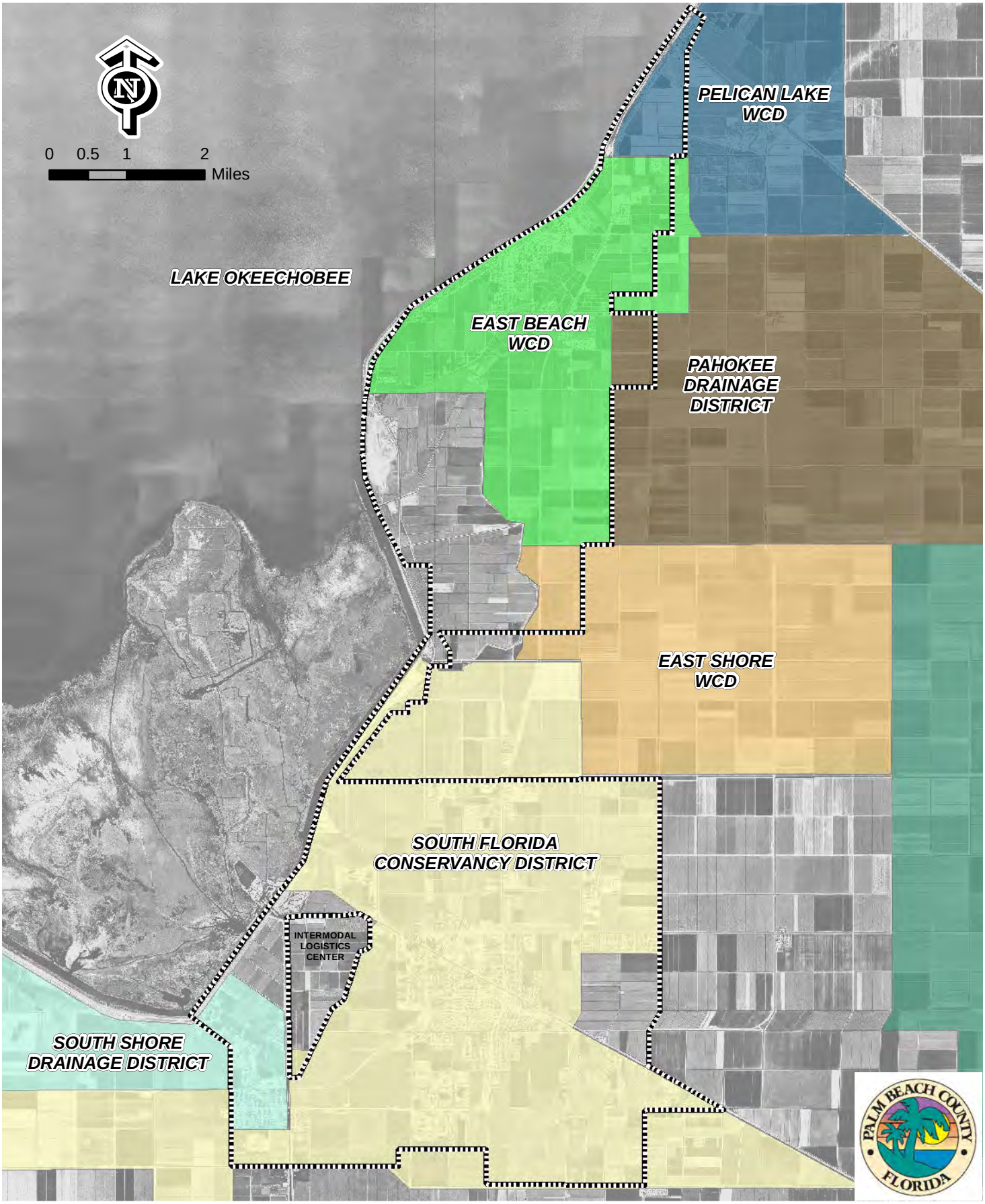
WESTERN COMMUNITIES SFWMD CANALS & STRUCTURES



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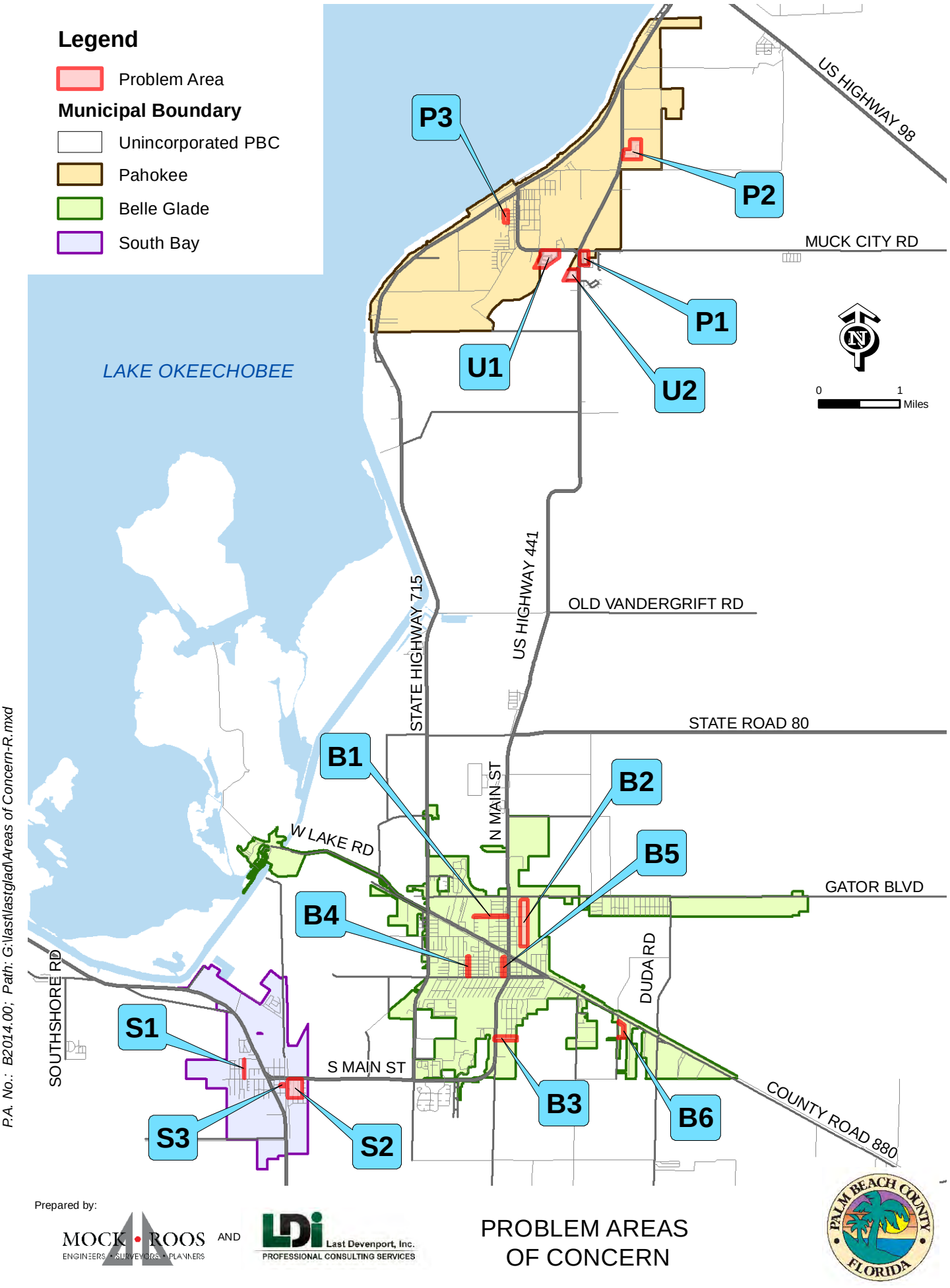
WESTERN COMMUNITIES WATER CONTROL DISTRICT BOUNDARIES



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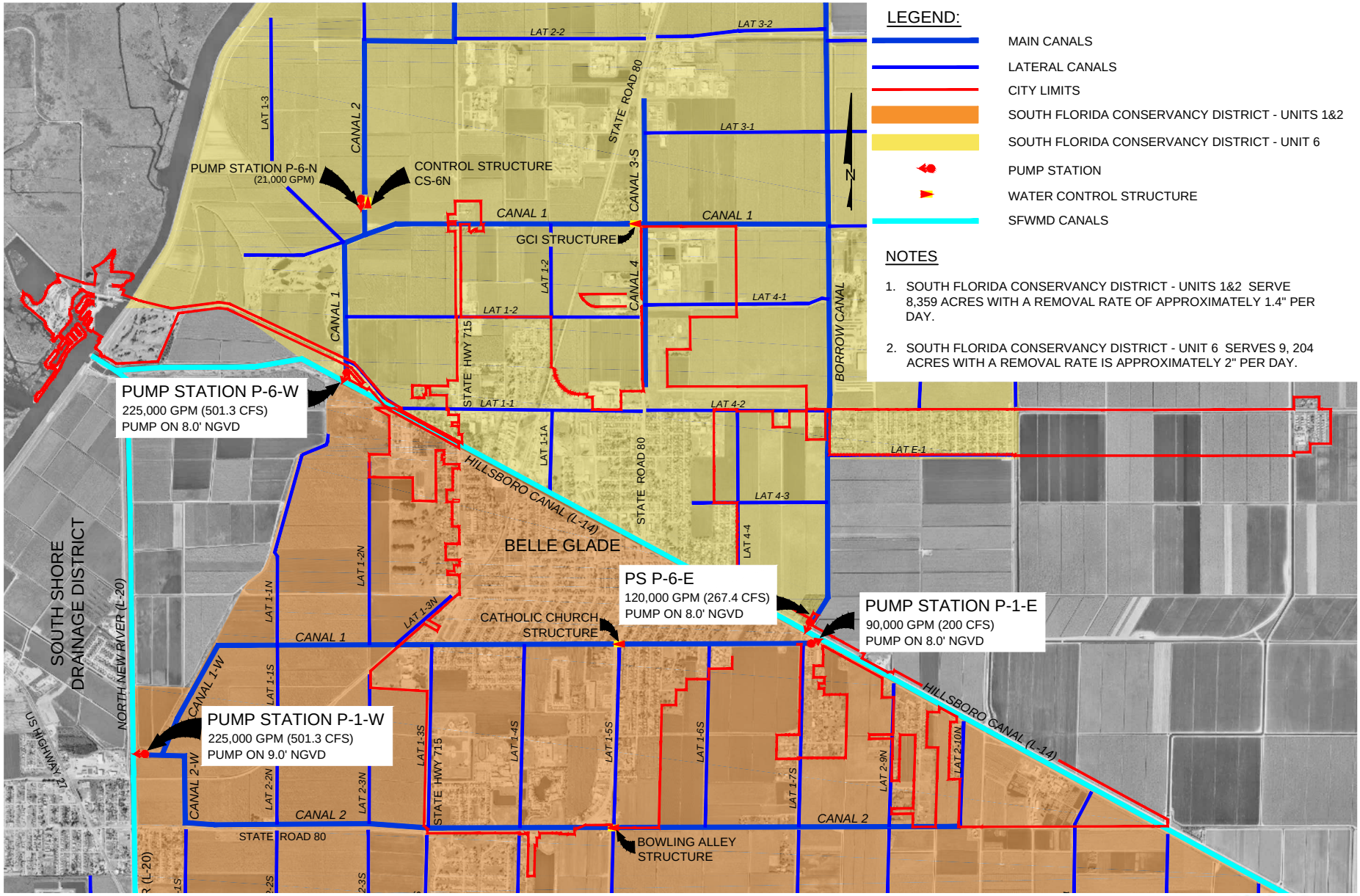
PROBLEM AREAS OF CONCERN

PALM BEACH COUNTY FLORIDA



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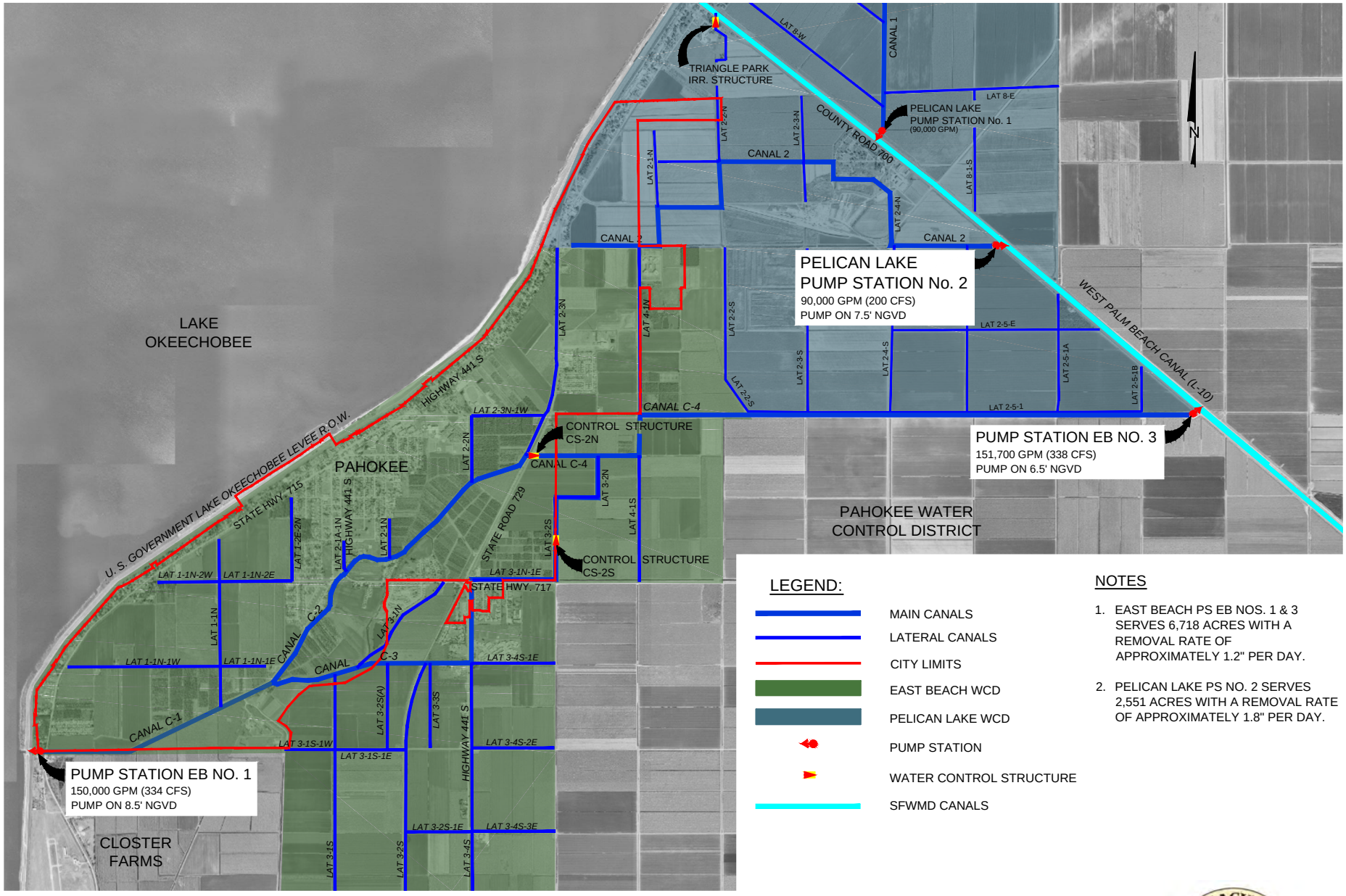
AND

LDi Last Devenport, Inc.
PROFESSIONAL CONSULTING SERVICES

WATER CONTROL DISTRICT FACILITIES IN BELLE GLADE

PALM BEACH COUNTY FLORIDA



LEGEND:

- MAIN CANALS
- LATERAL CANALS
- CITY LIMITS
- EAST BEACH WCD
- PELICAN LAKE WCD
- PUMP STATION
- WATER CONTROL STRUCTURE
- SFWMD CANALS

NOTES

1. EAST BEACH PS EB NOS. 1 & 3 SERVES 6,718 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 1.2" PER DAY.
2. PELICAN LAKE PS NO. 2 SERVES 2,551 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 1.8" PER DAY.

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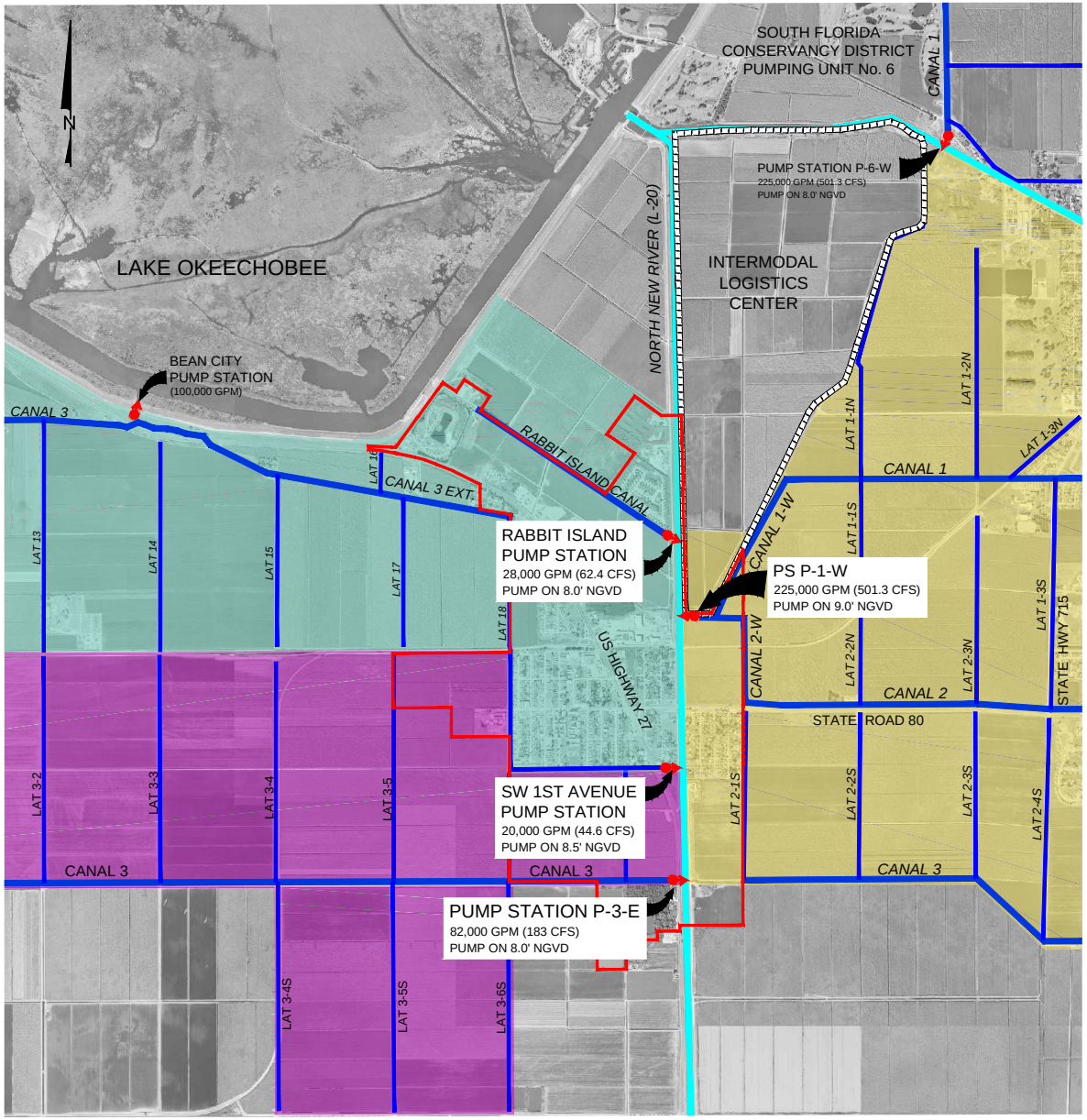
WATER CONTROL DISTRICT FACILITIES IN PAHOKEE

PALM BEACH COUNTY • FLORIDA



LEGEND:

- MAIN CANALS
- LATERAL CANALS
- CITY LIMITS
- SOUTH SHORE DRAINAGE DISTRICT
- SOUTH FLORIDA CONSERVANCY DISTRICT - UNITS 1&2
- SOUTH FLORIDA CONSERVANCY DISTRICT - UNIT 3
- PUMP STATION
- WATER CONTROL STRUCTURE
- SFWMD CANALS

NOTES

1. SOUTH FLORIDA CONSERVANCY DISTRICT - UNITS 1&2 SERVE 8,359 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 1.4" PER DAY.
2. SOUTH FLORIDA CONSERVANCY DISTRICT - UNIT 3 SERVES 2,413 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 1.8" PER DAY.
3. SOUTH SHORE SW 1ST AVENUE PUMP STATION SERVES 781 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 1.4" PER DAY.
4. SOUTH SHORE RABBIT ISLAND PUMP STATION AND SW 1ST AVENUE PUMP STATION SERVE 558 ACRES WITH A REMOVAL RATE OF APPROXIMATELY 2.6" PER DAY.

DATE: Aug 08, 2013 - 2:49pm K:\lost\lastglad\dwg\SOUTH BAY SPECIAL DISTRICTS EXH.dwg

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AND

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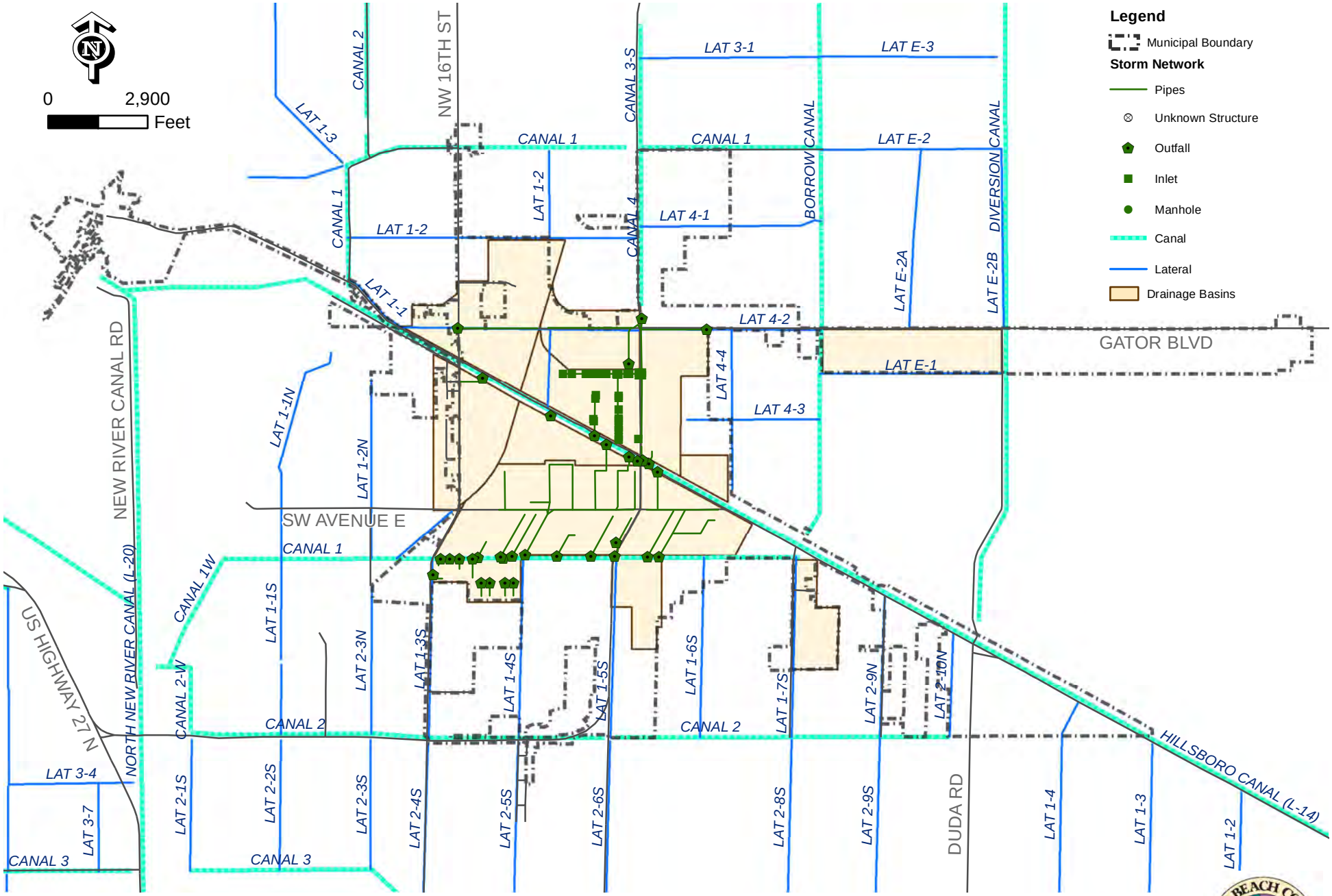
WATER CONTROL DISTRICT FACILITIES IN SOUTH BAY

PALM BEACH COUNTY FLORIDA



P.A. No.: B2014.00; g:Path: G:\last\lastglad\Belle Glade Storm System-R.mxd

Prepared by:

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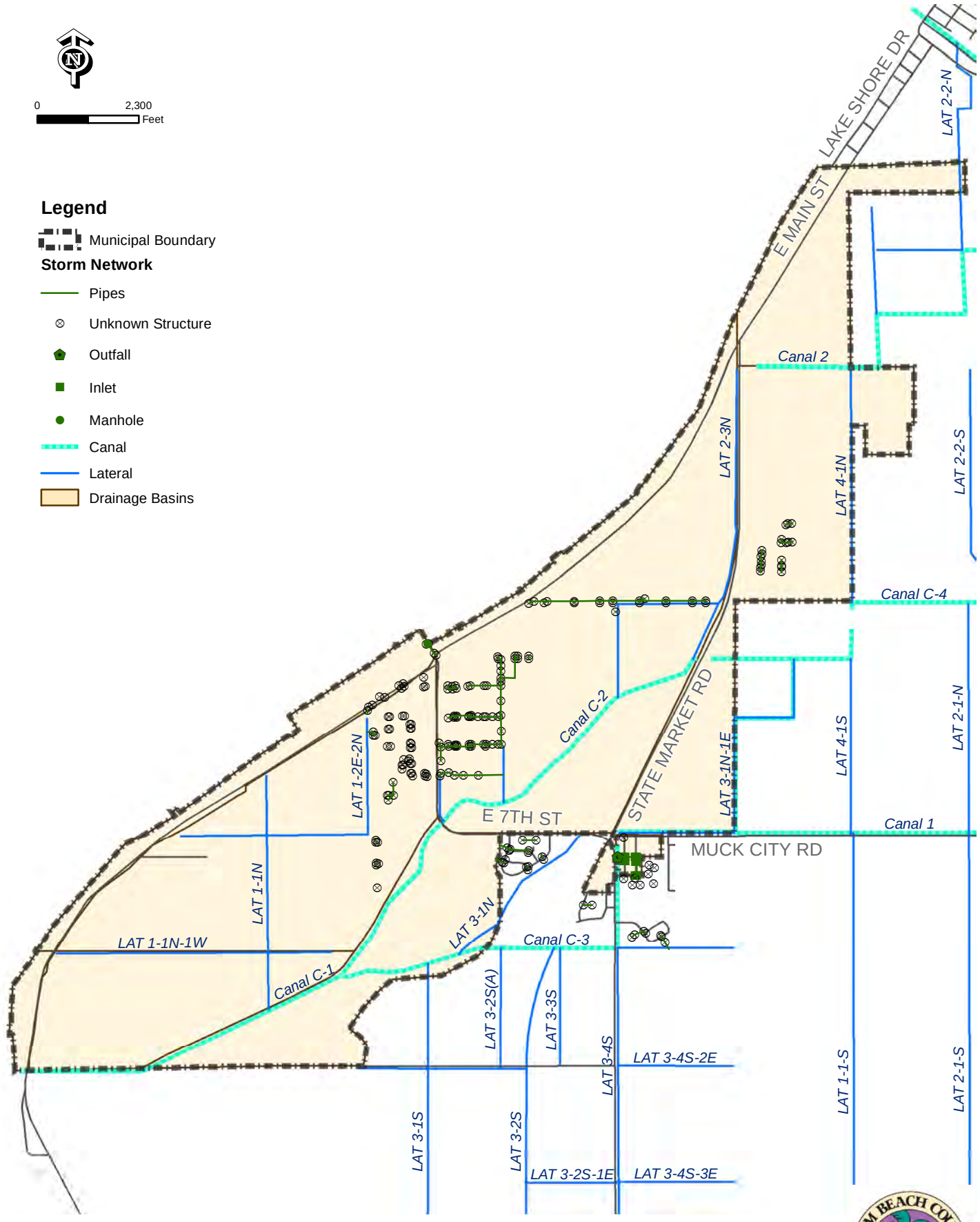
Belle Glade
Stormwater System Schematic

PALM BEACH COUNTY • FLORIDA



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Prepared by:

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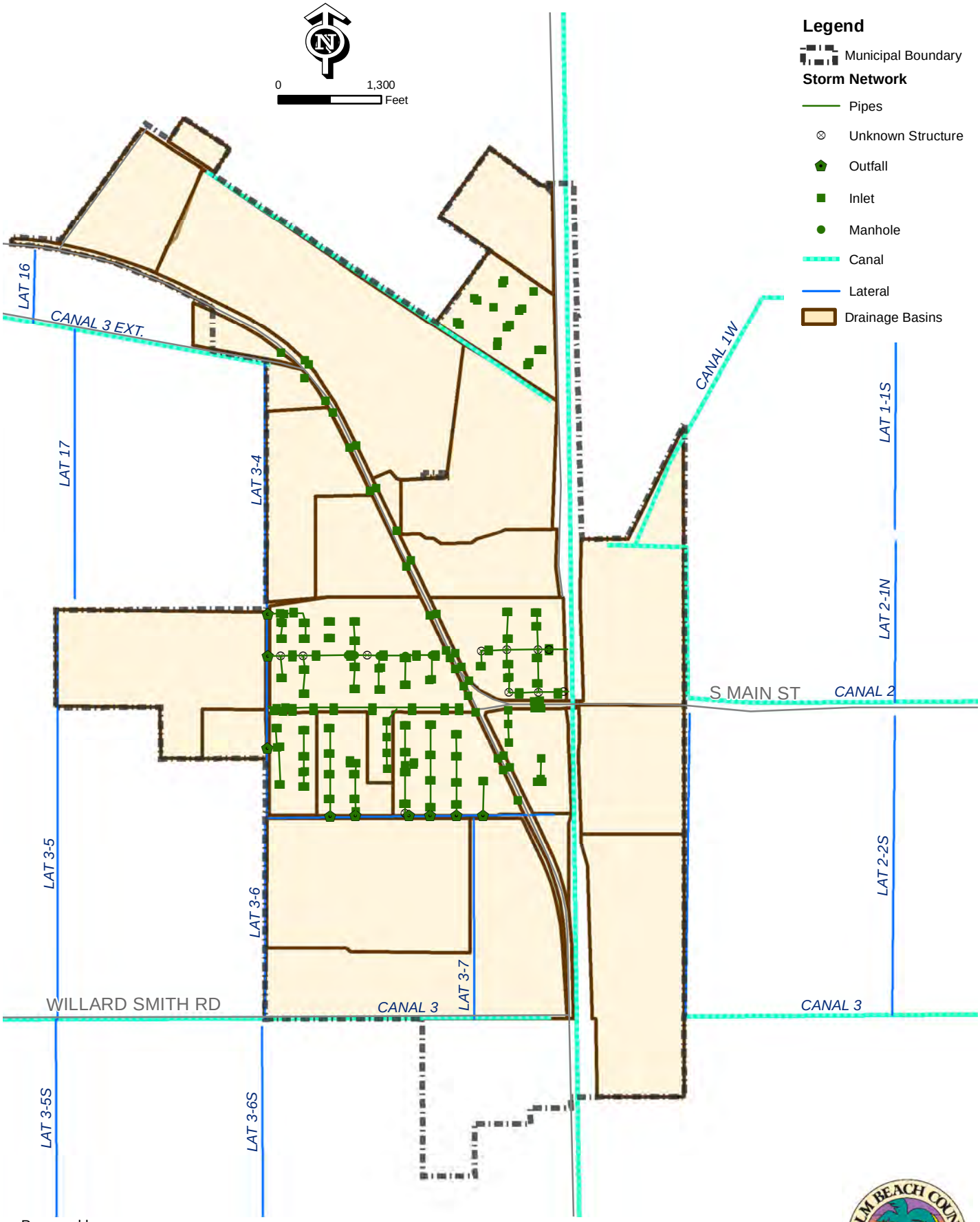
Pahokee
Stormwater System Schematic

PALM BEACH COUNTY FLORIDA



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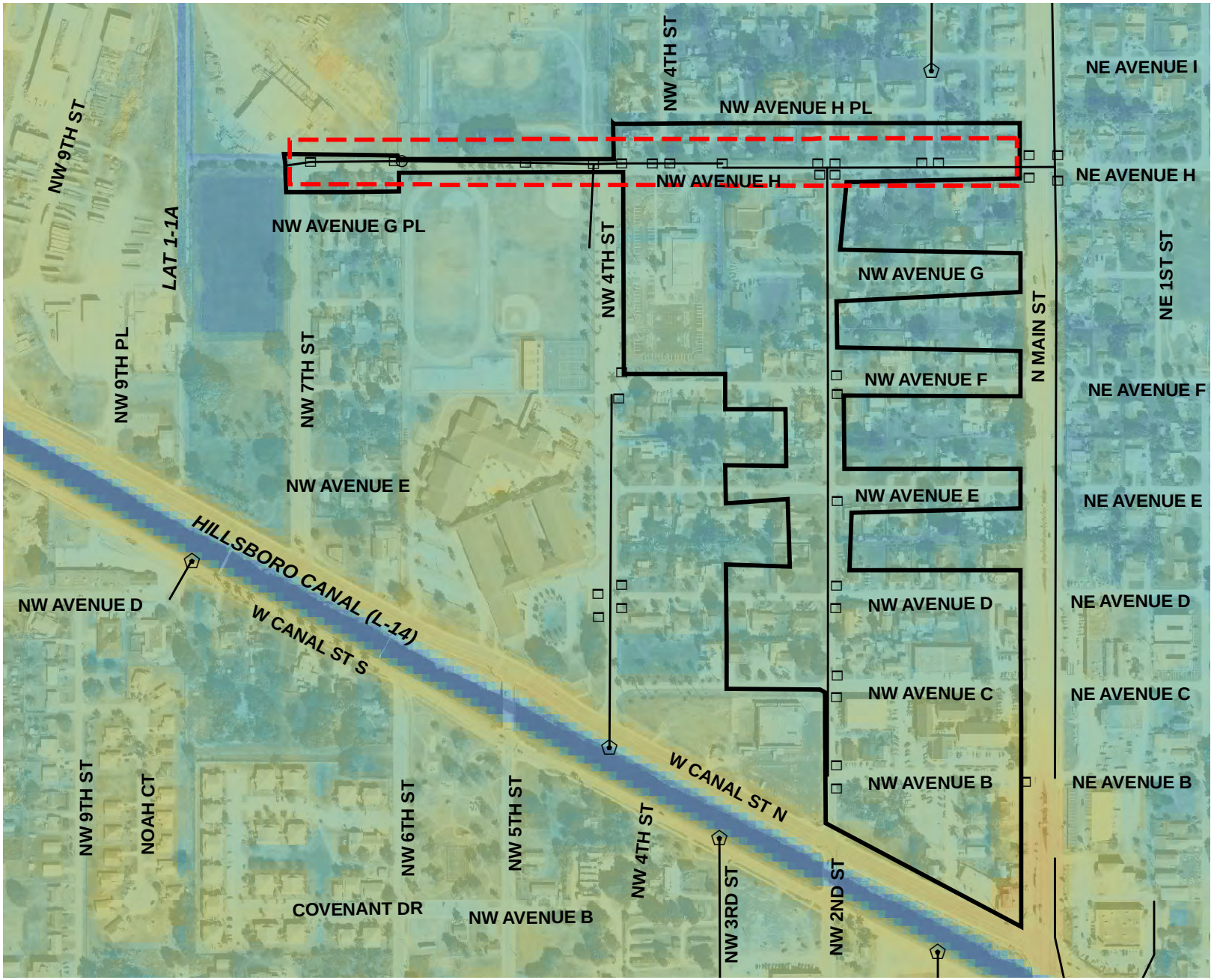
South Bay Stormwater System Schematic

PALM BEACH COUNTY FLORIDA



Legend

- Problem Area
- Drainage Area

Existing Storm Network

- Unknown Structure
- Inlet
- Manhole
- Outfall
- Pipes

LiDAR Data (NGVD)

26
23.5
21
18.5
16
13.5
11
8.5
6

P.A. No.: B2014.00; g:Path: G:\last\lastglad\Study Area Topo-R.mxd

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Problem Area B1
Digital Elevation Model Data

N

Legend

- Problem Area
- Drainage Area

Existing Storm Network

- Unknown Structure
- Inlet
- Manhole
- Outfall
- Pipes

LiDAR Data (NGVD)

26
23.5
21
18.5
16
13.5
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8.5
6

P.A. No.: B2014.00; g:Path: G:\last\lastglad\Study Area Topo-R.mxd

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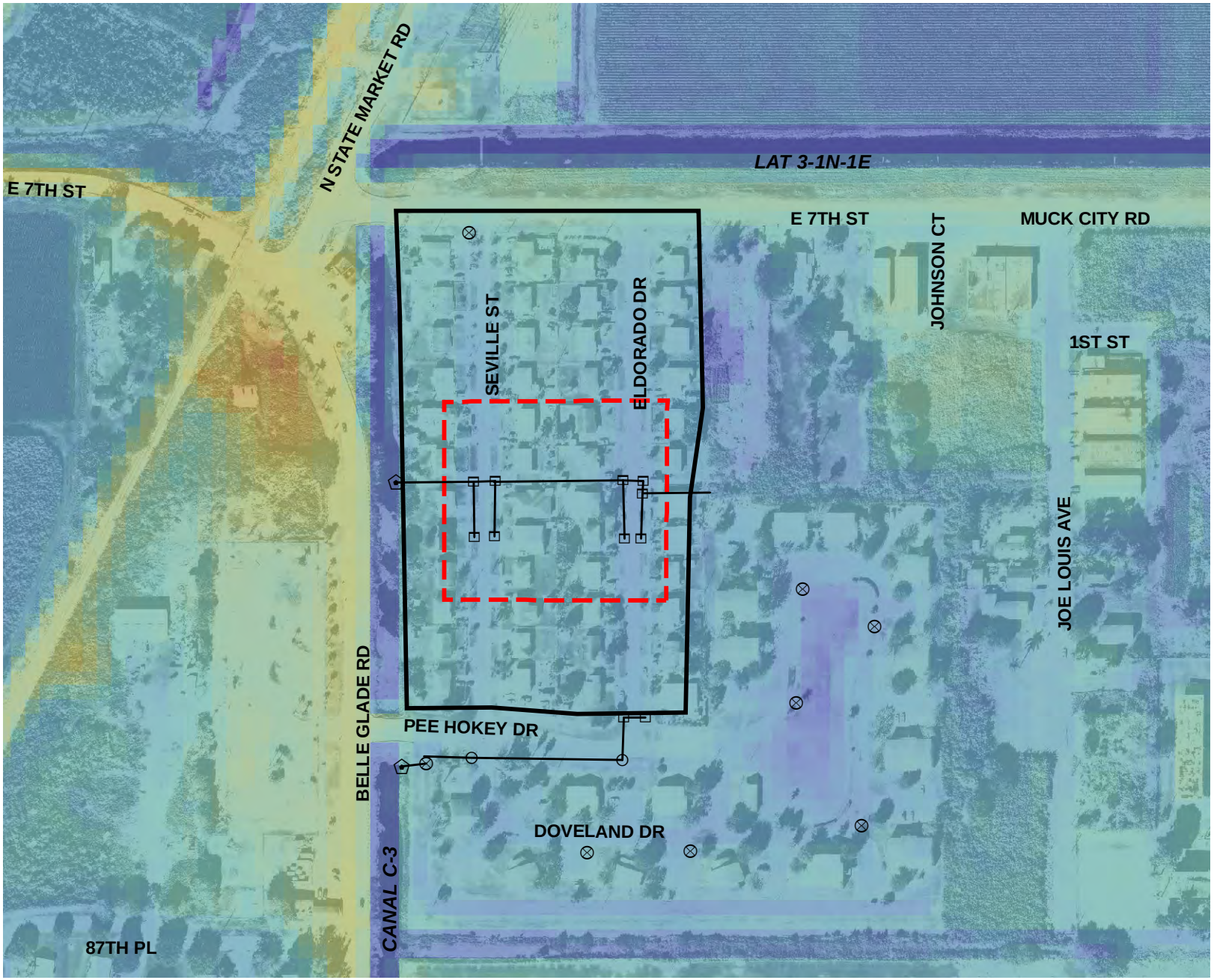
Problem Area U1
Digital Elevation Model Data

PALM BEACH COUNTY FLORIDA



N

Legend

- Problem Area
- Drainage Area

Existing Storm Network

- Unknown Structure
- Inlet
- Manhole
- Outfall
- Pipes

LiDAR Data (NGVD)

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P.A. No.: B2014.00; g:Path: G:\last\lastglad\Study Area Topo-R.mxd

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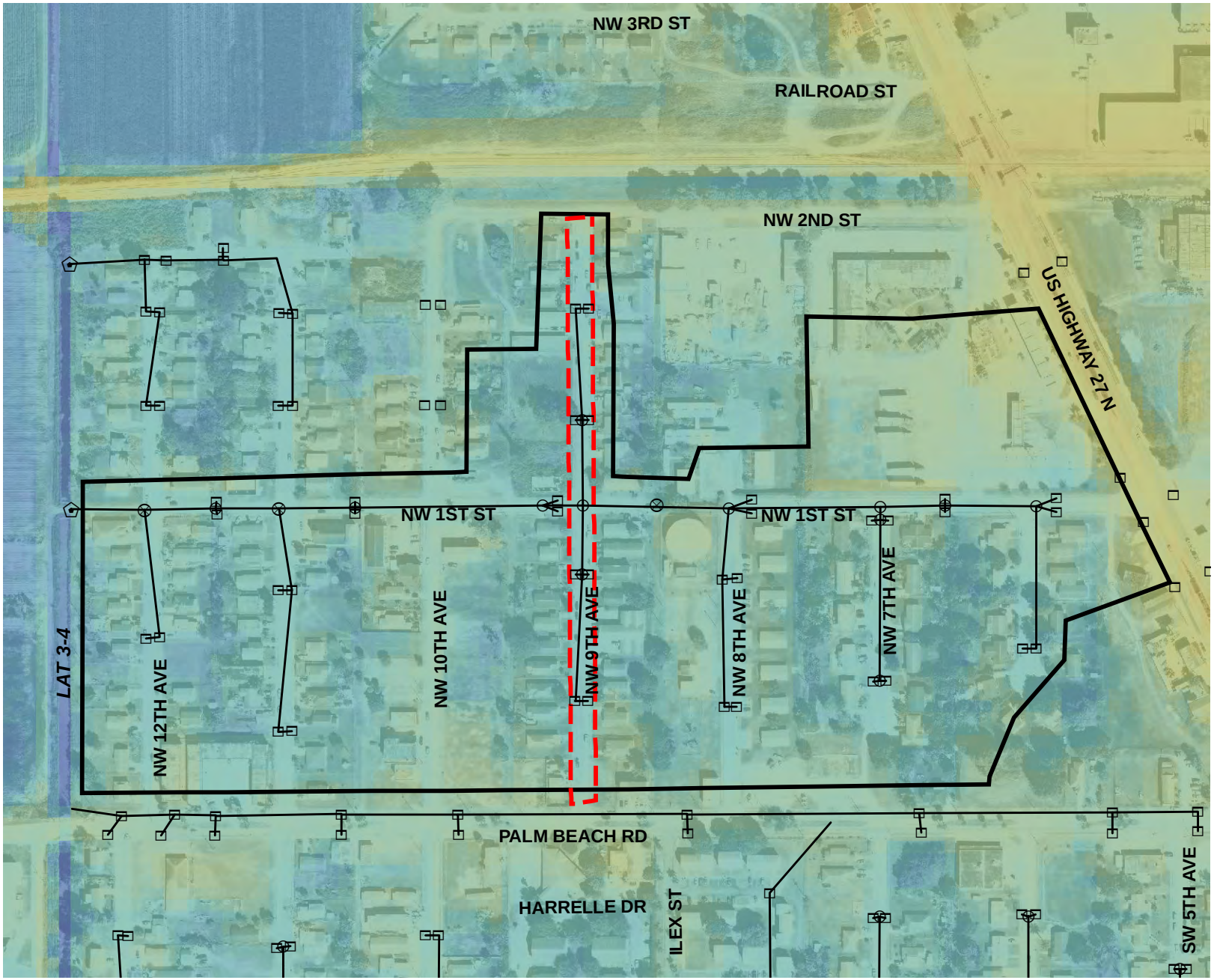
Problem Area P1
Digital Elevation Model Data

PALM BEACH COUNTY FLORIDA



Legend

- Problem Area
- Drainage Area

Existing Storm Network

- Unknown Structure
- Inlet
- Manhole
- Outfall
- Pipes

LiDAR Data (NGVD)

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P.A. No.: B2014.00; g:Path: G:\last\lastglad\Study Area Topo-R.mxd

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Problem Area S1
Digital Elevation Model Data

PALM BEACH COUNTY FLORIDA

Legend

- Problem Area
- Drainage Area

Existing Storm Network

- Unknown Structure
- Inlet
- Manhole
- Outfall
- Pipes

LiDAR Data (NGVD)

26
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P.A. No.: B2014.00; g:Path: G:\last\lastglad\Study Area Topo-R.mxd

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Problem Area S2
Digital Elevation Model Data

Attachment A

Public Stormwater/Drainage Survey

(Please complete a separate form for each problem area)

1. What type of drainage/stormwater problem have you observed? (check all that apply)

☐ flooding ☐ potholes ☐ damaged gutters/drains/manholes ☐ other _____

2. Where is the problem located? Please provide an address, a street and cross-street, or locate on a map:_____

_____

_____

3. Please answer to the best of your ability:

Does it take a large storm to flood the area? ☐ Yes ☐ No

On average, how often does the area flood? _____

On average, how deep is the flooding? _____

On average, how long does it take for the floodwaters to go away? _____

Approximately how long has the problem existed? _____

Has the problem gotten worse over time? ☐ Yes ☐ No

Is there trash left behind when the floodwaters are gone? ☐ Yes ☐ No

When did the worst flooding occur? _____

4. Do you have any idea what may be causing the problem? _____

_____

_____

5. Additional Comments: _____

_____

_____

6. May we contact you? ☐ Yes ☐ No If yes, please provide the following:

Name: _____

Address: _____ Phone (day) _____

_____ Phone (eve) _____

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Attachment B

Area B1 – Belle Glade: NW H Avenue

Outfall ditch at the west end of NW H Avenue within private property

Damaged 24” outfall pipe at the west end of NW H Avenue

Existing inlet within private property adjacent to NW H Avenue

Road deterioration on NW H Avenue

Area P1 – Pahokee: Seville Street and El Dorado Street

Road deterioration on Seville Street

El Dorado Street

Inlet upstream of outfall on Seville Street

Outfall pipe location, East Beach WCD's Canal C3

Area S1 – South Bay: NW 9th Avenue

Flooding on NW 9th Avenue after Tropical Storm Isaac

Area S2 – South Bay: SE 2nd Avenue

Flooding of lots adjacent to SE 2nd Avenue

Flooding of lots adjacent to SE 2nd Avenue

Severe road deterioration on SE 2nd Avenue

Area U1 – Unincorporated PBC: Padgett Island

Existing inlet, curb and gutter within Padgett Island

Small channel that collects runoff before outfalling to the unclaimed canal west of the property

Unclaimed outfall canal west of the development

Unclaimed outfall canal west of the development

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June 4, 2014

Ms. Kristine Frazell-Smith
Palm Beach County Engineering and Public Works
2300 North Jog Road
West Palm Beach, FL 33411

Ref. No. B2014.00
Subject: **Glades Region Master Plan**
Drainage System Inventory and Evaluation
Palm Beach County Project No. 2012057
Alternative Solutions Report (Task ENG 3, 5.7 Deliverable)

Dear Kristine:

This letter report constitutes the second deliverable for the above-referenced County Project.

Background
The Palm Beach County Department of Economic Sustainability (PBCDES) has undertaken the task of developing a master plan for the Glades Region of Palm Beach County, with funding provided by a Community Challenge Planning Grant from the U.S. Department of Housing and Urban Development (HUD). DES designated a portion of the funding for the completion of a new Drainage System Inventory and Evaluation, to be overseen by the Palm Beach County Department of Engineering and Public Works (PBCENG).

PBCENG negotiated with Last Devenport, Inc., a general consultant with an existing PBCENG contract, for a scope of services to complete the tasks necessary to produce the Drainage System Inventory and Evaluation. This report is the second deliverable of that effort, documenting the fourth task of the Scope of Services (Task 5.6). This task includes the development of two alternative solutions for the five prioritized problem areas identified under Task 5.4.

Alternative Solutions
Two conceptual design alternatives are proposed for each of the five prioritized problem areas. The storm systems in these areas are either inadequately sized to accommodate their contributing drainage areas, require maintenance and/or replacement, have restrictions impeding discharge from the areas, or are non-existent. Additionally, as development occurs in each of the areas the existing open areas providing storage are eliminated and runoff to the storm system increases. The ideal solution for this problem would be to provide a storage component within each of the areas. This is not possible in

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all of the areas but is considered where practical.

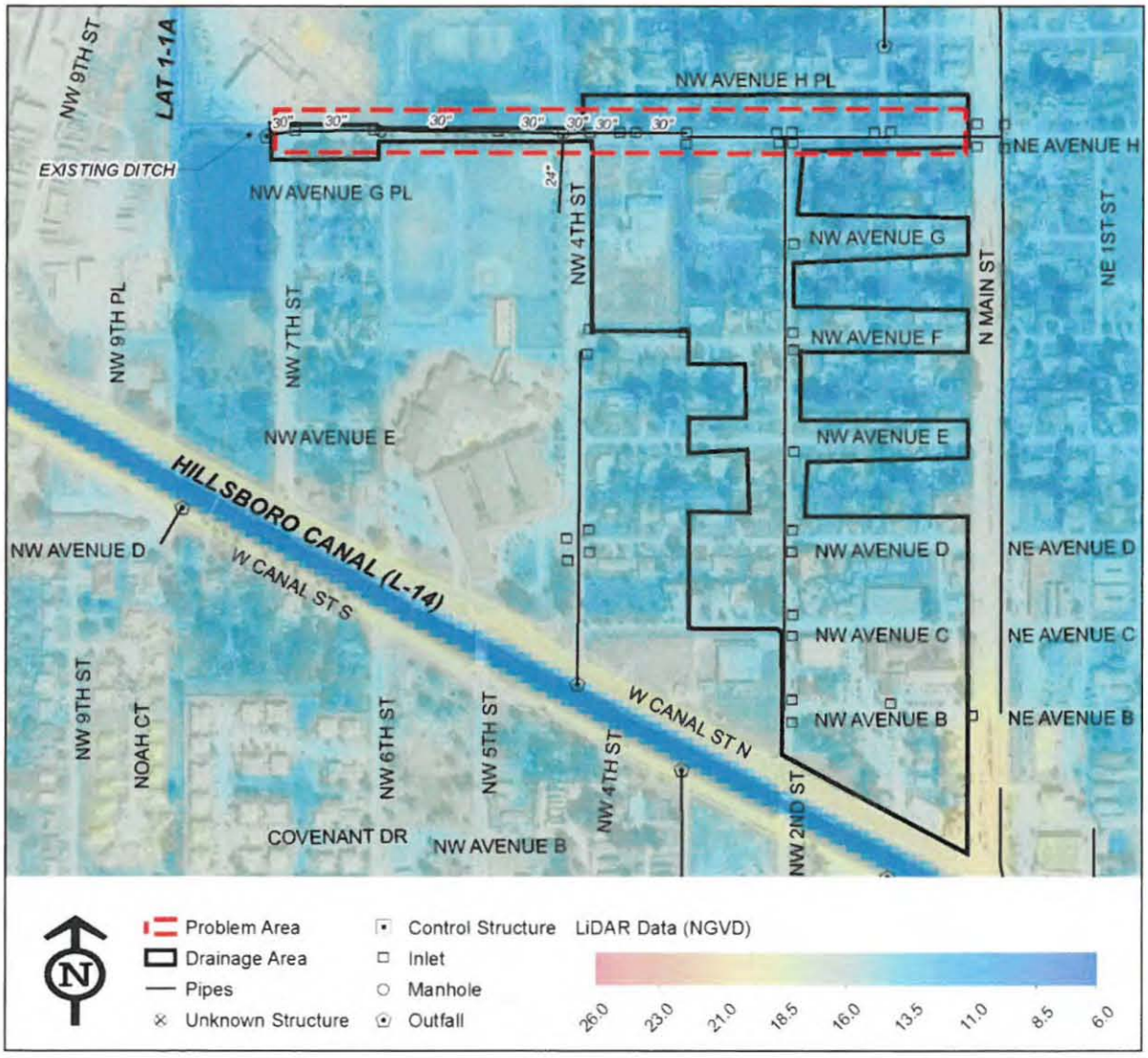
The entire project is within the South Florida Water Management District's (SFWMD) Everglades Agricultural Area drainage basin. The allowable discharge rate within this basin is limited to 20 cubic feet per second per square mile for the 5-year/3-day rain event. For SFWMD permitting, the proposed improvement's discharge rate will have to either comply with this criteria or it must be demonstrated that it does not exceed the pre-improvement discharge rate. If this is not possible, compensating storage for the additional discharge will be required for the improvements.

Site storage is not available to alleviate flooding in some areas. Flooding can only be alleviated by increasing the discharge rate from the site. If the increased rate exceeds the allowable discharge rate, compensating storage may be provided within the site's drainage basin. The compensating storage volume must be equivalent to the volume of water discharged above the allowable discharge volume for the design storm event. An analysis to determine the increased water volume discharged was completed for these areas.

Area B1 – NW Avenue H (Belle Glade)

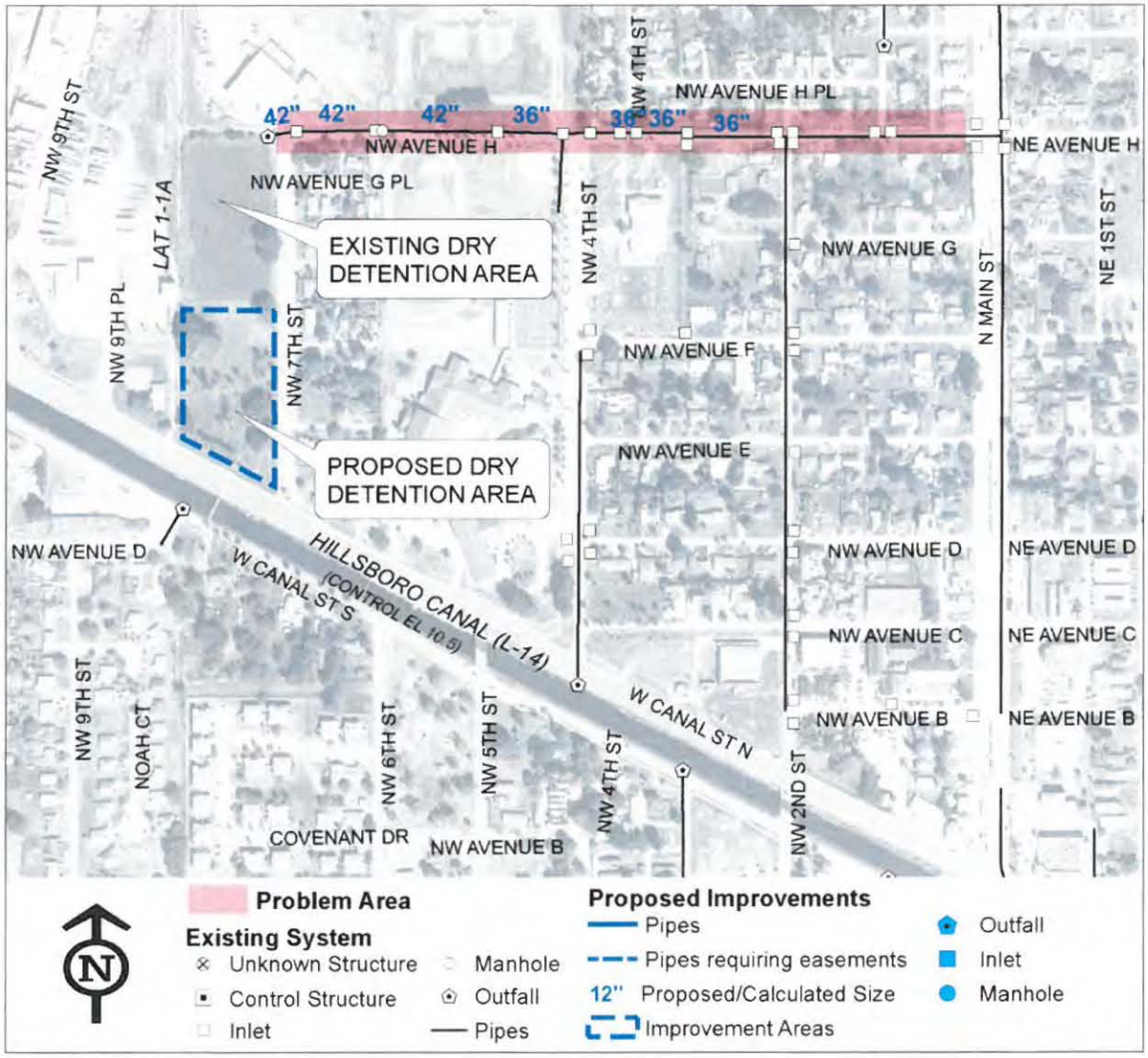
The storm system for this area has outfalls to the east and west with an apparent drainage divide at NW 2nd Street. It is assumed that approximately half of the runoff from the storm system along NW 2nd Street flows in each direction.

Data about the eastern outfall was not available, but since flooding was only reported along NW H Avenue, it is likely that the eastern portion of the system is functioning acceptably. Therefore, improvements are only proposed for the western portion of the drainage area. The western portion consists of inlets and piping that outfall to a ditch on private property. According to historic permits, the western pipes are 30 inches in size; however, recent permits adjacent to this area indicate the pipes near the western outfall are smaller in size, creating a bottleneck in the system. These downstream pipes may be filled with silt causing them to appear to be smaller in size. Field observation also indicated locations where inlets are covered in debris. Cleaning the storm system would very likely provide some immediate relief to the system.



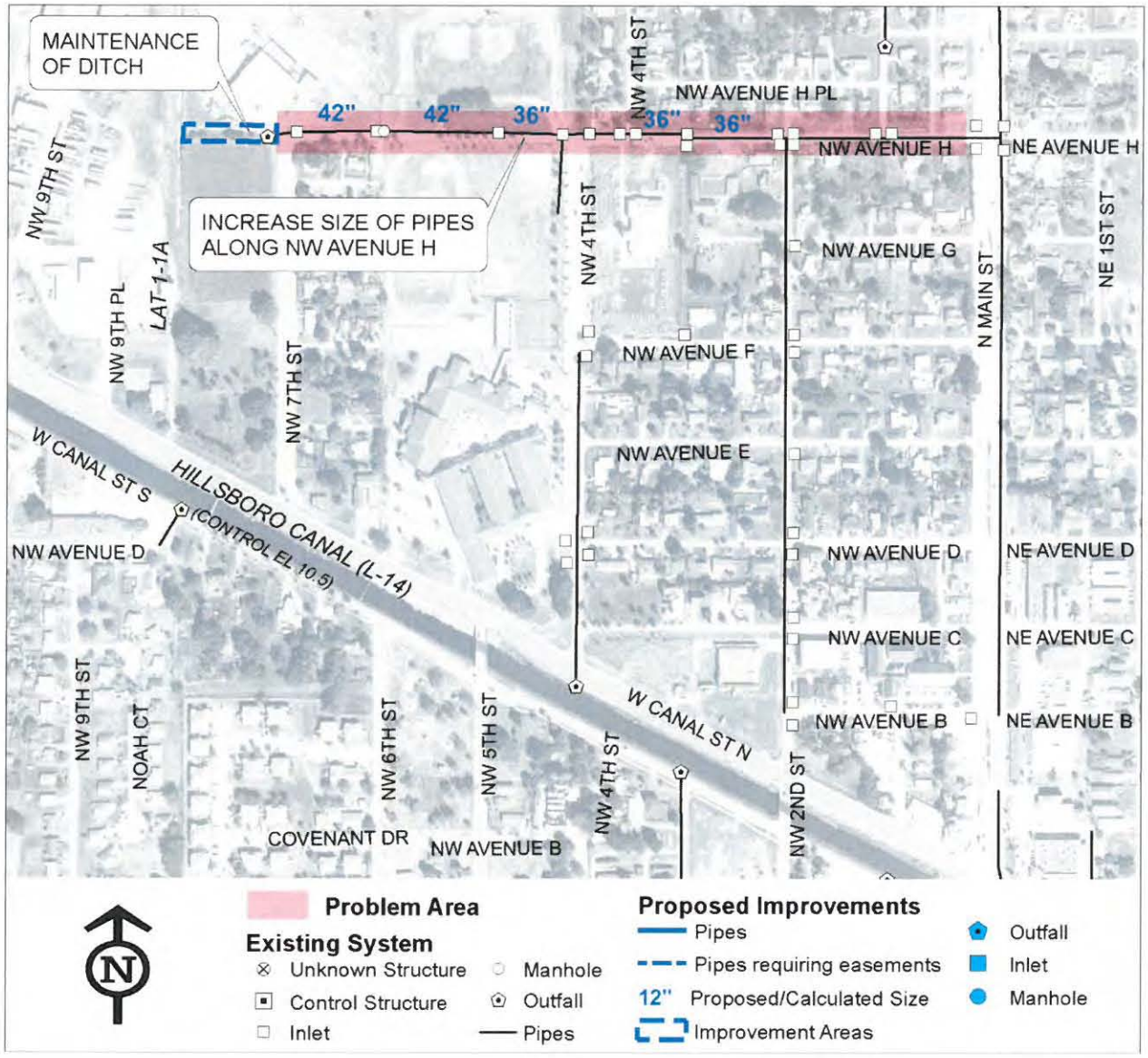
Area B1 – Option 1: Increase the size of storm pipes along the west half of NW H Avenue and add a proposed dry detention area with ultimate discharge to the Hillsboro Canal.

The increased pipe size will cause an increase in the discharge rate, but this would be offset by the proposed detention area and a control structure. The dry detention area location is proposed for the only undeveloped property within this area. It is currently owned by the School District of Palm Beach County. The NW H Avenue storm system outfall is not directly adjacent to this parcel; however, the School District has an existing dry detention area between this system and the proposed dry detention area. This system could discharge to the existing dry detention area and the proposed dry detention area be interconnected with the existing dry detention area. The School District's existing control structure is in compliance with District discharge requirements and could be modified to accommodate the increased drainage area.



Area B1 – Option 2: Increase the size of storm pipes along the west half of NW H Avenue, provide maintenance of the existing private ditch, and provide approximately 3 acre-feet of compensating storage somewhere else within the basin.

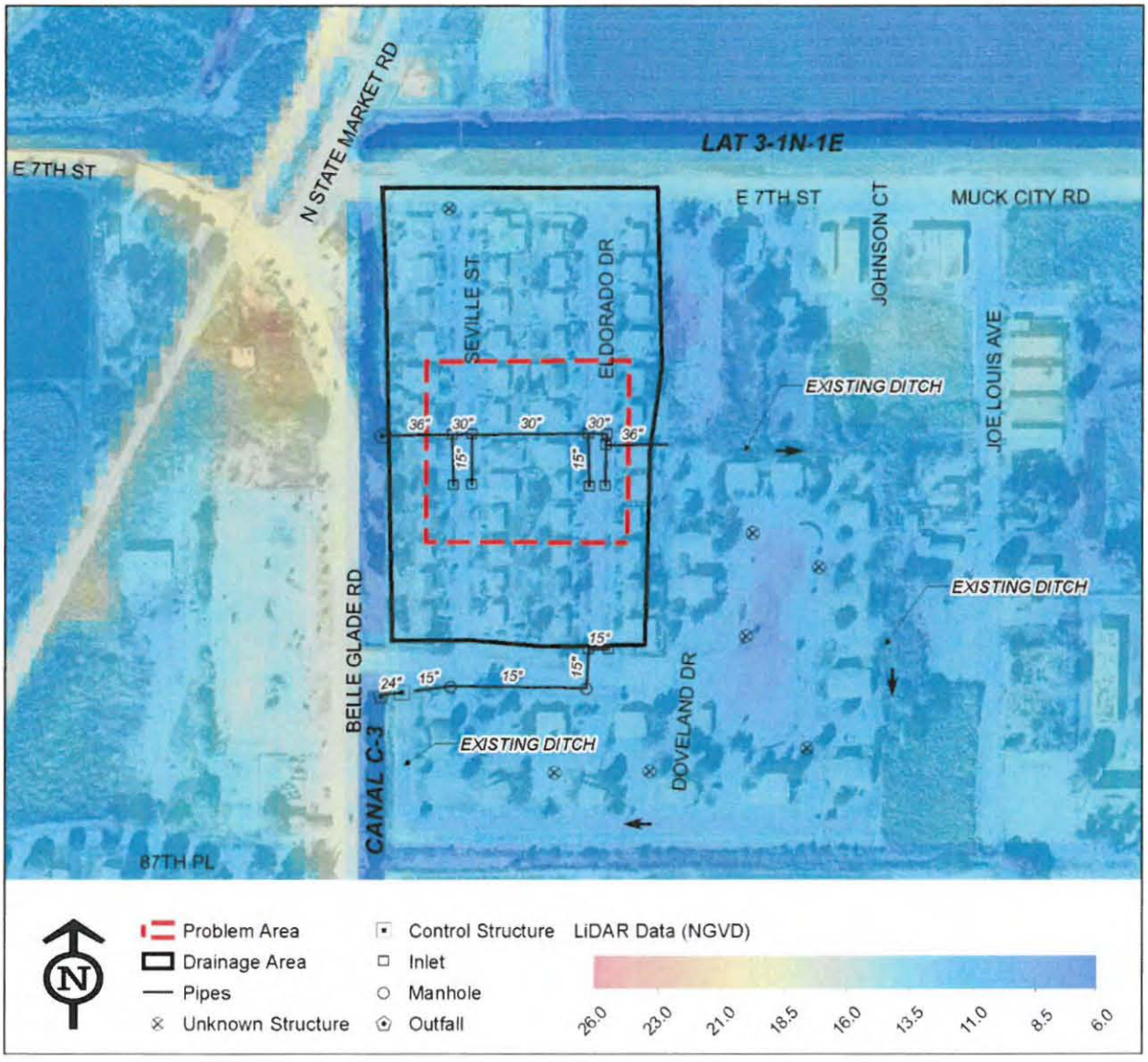
This option is similar to Option 1. The outfall is proposed to continue to discharge to the existing ditch and storage will be provided off site within the drainage basin. Cleaning of the existing ditch should be made a part of regular maintenance. This ditch is on private property. An easement from the land owner will be necessary to provide maintenance.



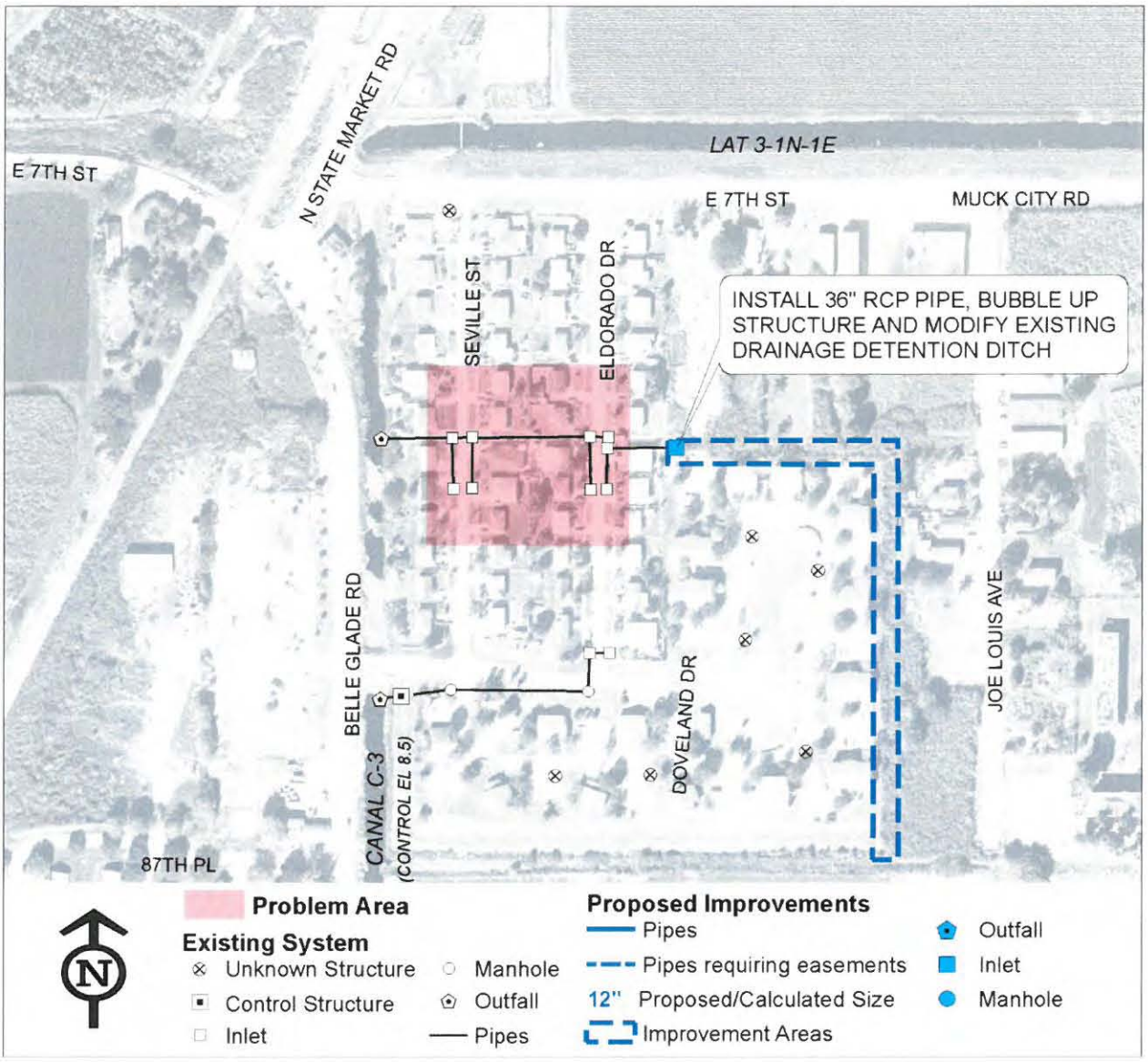
Area P1 – Seville Street and El Dorado Street (Pahokee)

The stormwater system along Seville and El Dorado Streets consists of swales, inlets and piping with outfall pipes to the east and west. The eastern outfall was designed to discharge to a detention ditch before discharging to Canal C3. It appears that this outfall is buried and does not provide discharge from the area. It was reported that the western outfall is unable to discharge during storm events because of high canal stages.

Research of this area revealed there was a second phase of construction for the storm water system that was never completed. Construction of a bubble-up structure at the end of the eastern outfall and re-grading of the existing detention ditch was to be included in the second phase. There is an existing 45' drainage easement for completion of the improvements. The existing control structure for the detention ditch appears to be damaged. It needs to either be repaired or replaced.

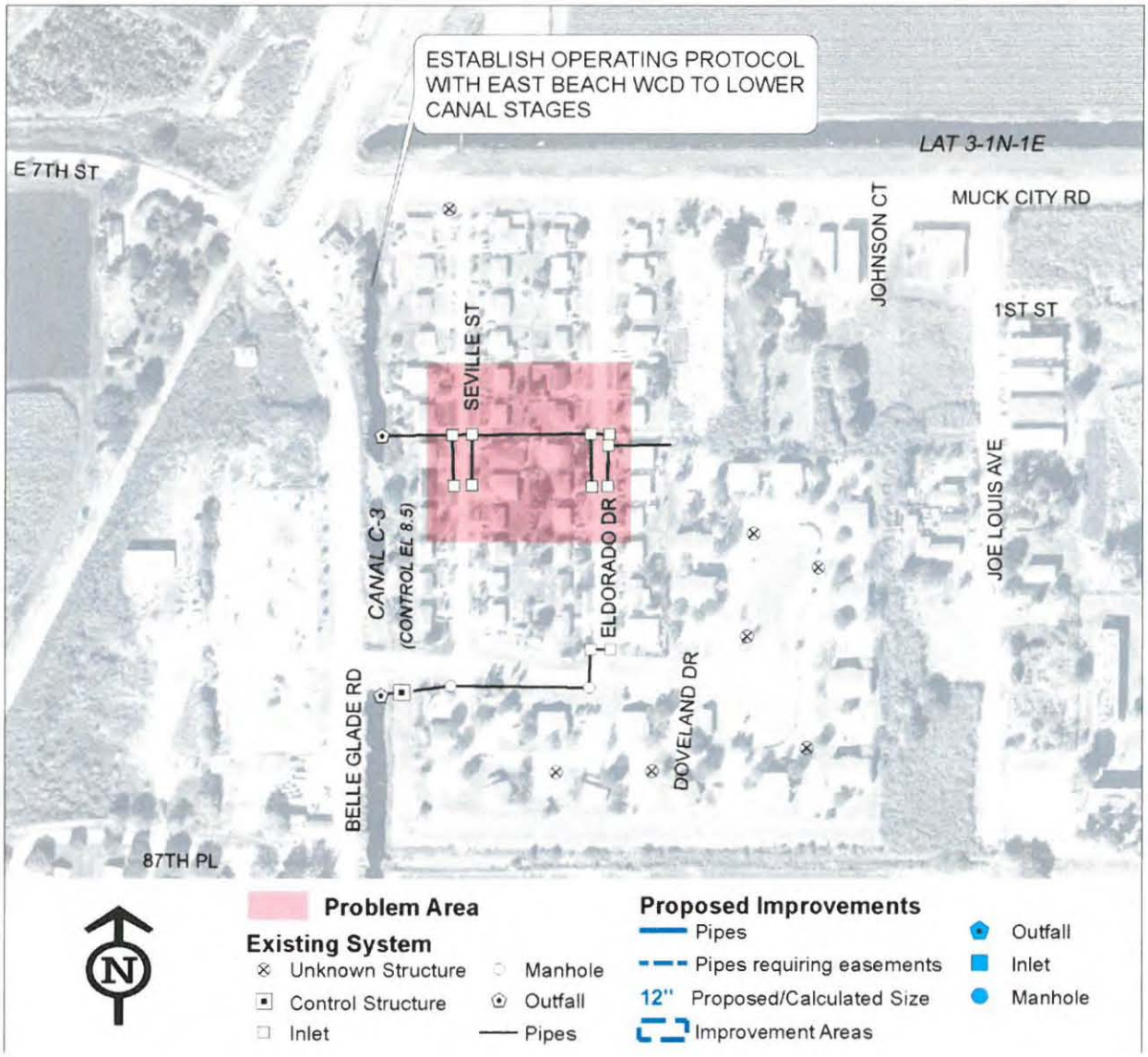


Area P1 – Option 1: Install bubble-up structure, modify the existing detention ditch, and repair or replace the existing control structure, as previously designed.



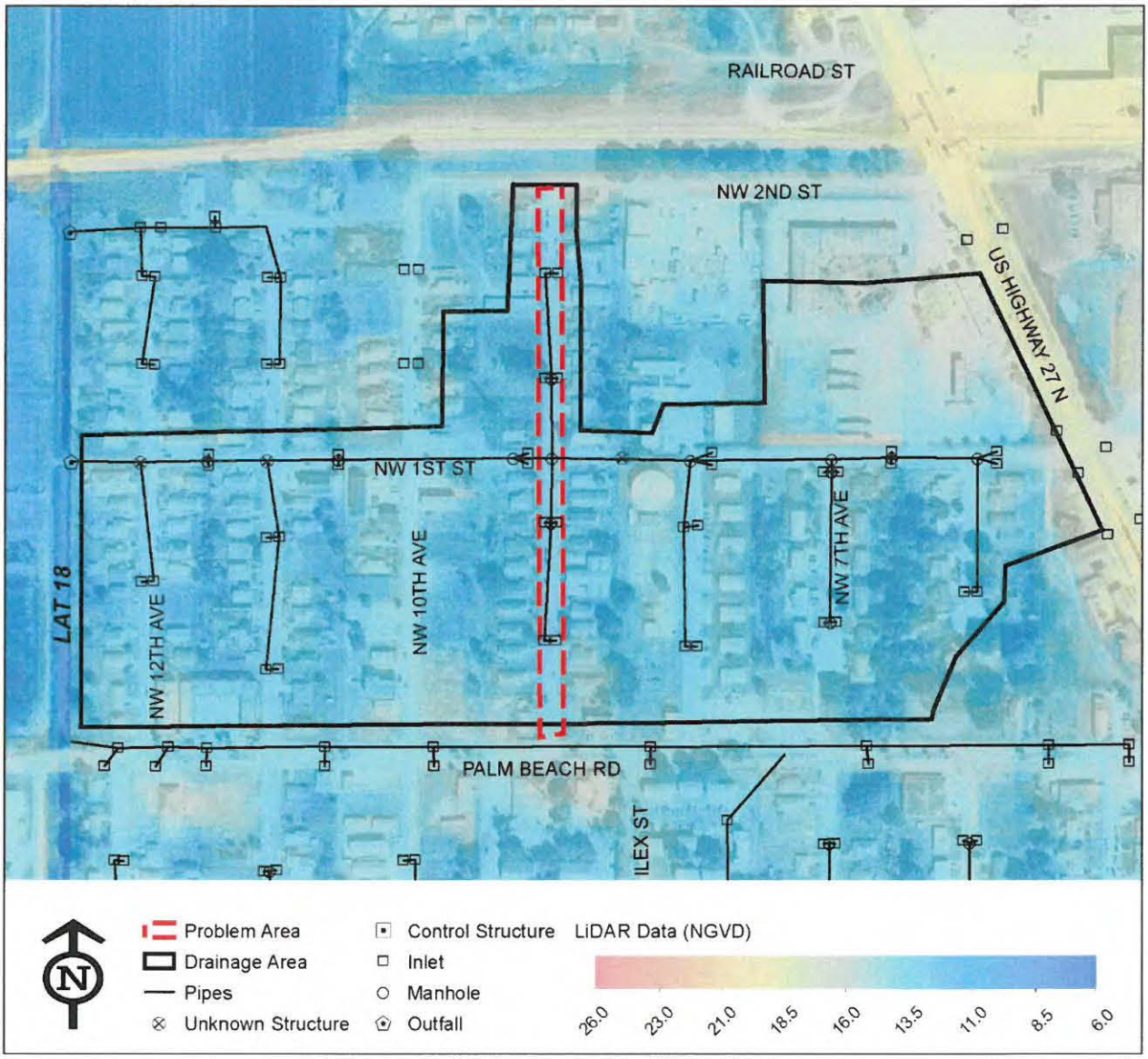
Area P1 – Option 2: Establish an operating protocol with East Beach WCD to provide drainage relief to this area via the Canal C-3 outfall when it is necessary.

The existing pipes are adequately sized for the contributing drainage area; however the discharge from the site is restricted by high canal stages in Canal C3. Development of an operating protocol for lowering canal stages before and/or during a storm event could alleviate flooding in the area.



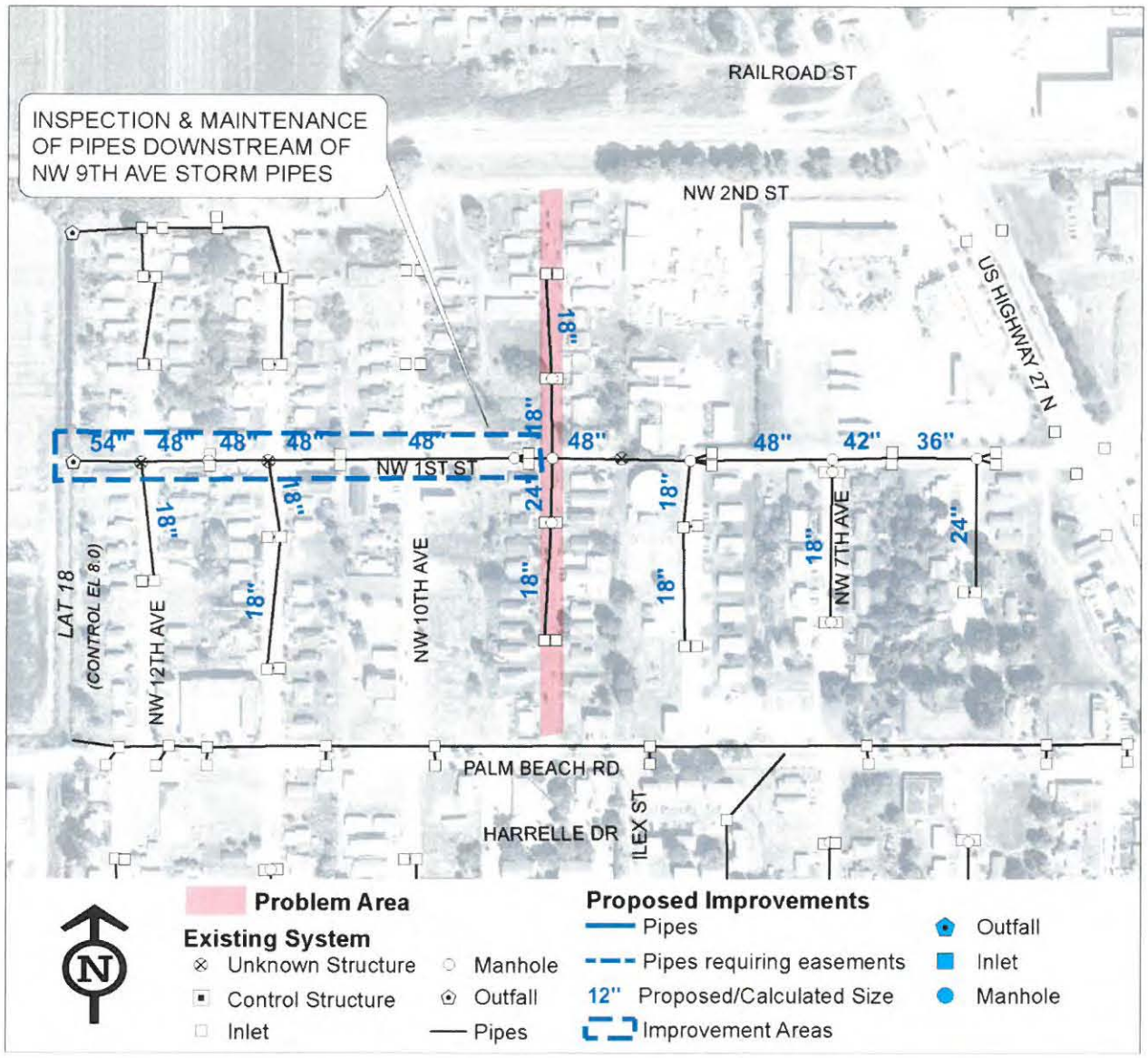
Area S1 – NW 9th Avenue (South Bay)

The stormwater system along NW 9th Avenue consists of curb and gutter, inlets and piping that outfall to South Shore WCD's Lateral 18. This street appears to flood because it is at the lowest elevation within the drainage area. The existing sizes of the storm pipes are unknown. It was reported that the outfall may be damaged, blocked and possibly undersized for the contributing drainage area.



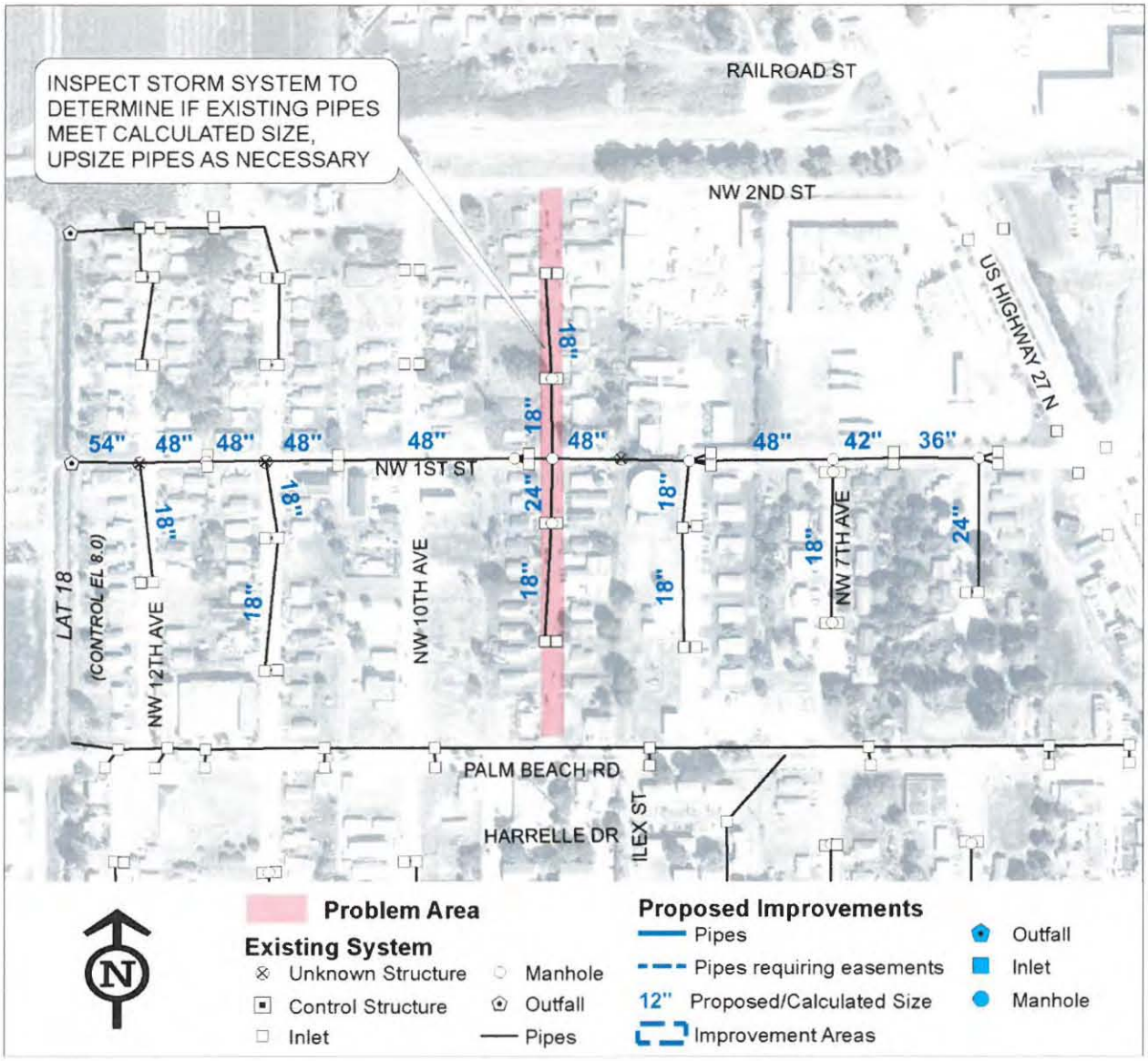
Area S1 – Option 1: Inspection and maintenance of existing pipes downstream of NW 9th Avenue.

An inspection of the system should be conducted to determine if maintenance and/or repair is necessary. Damaged pipes should be repaired and cleaning of these storm pipes should be made a part of regular maintenance.



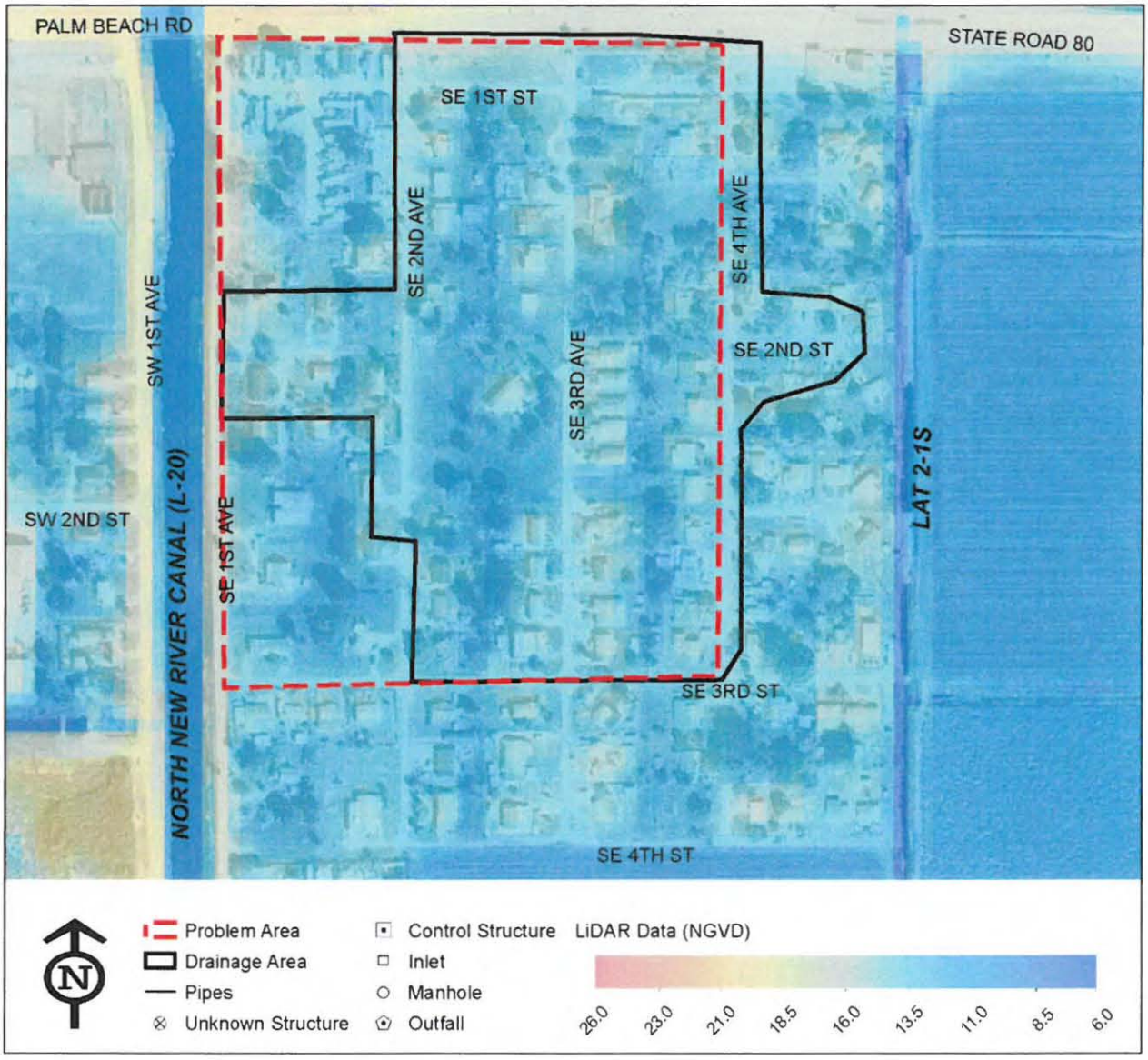
Area S1 – Option 2: Increase the size of existing storm pipes.

The calculated pipe sizes for the storm system are shown in the figure below. A survey of the storm system to determine the existing pipe sizes should be completed. If the pipes are not adequately sized and replacement is necessary, the increase in the discharge rate may require providing compensating storage within the basin. Assuming the existing pipe size is 36" in size, increasing the pipes as shown in the figure would require approximately 4 acre-feet of compensating storage somewhere else within the basin.



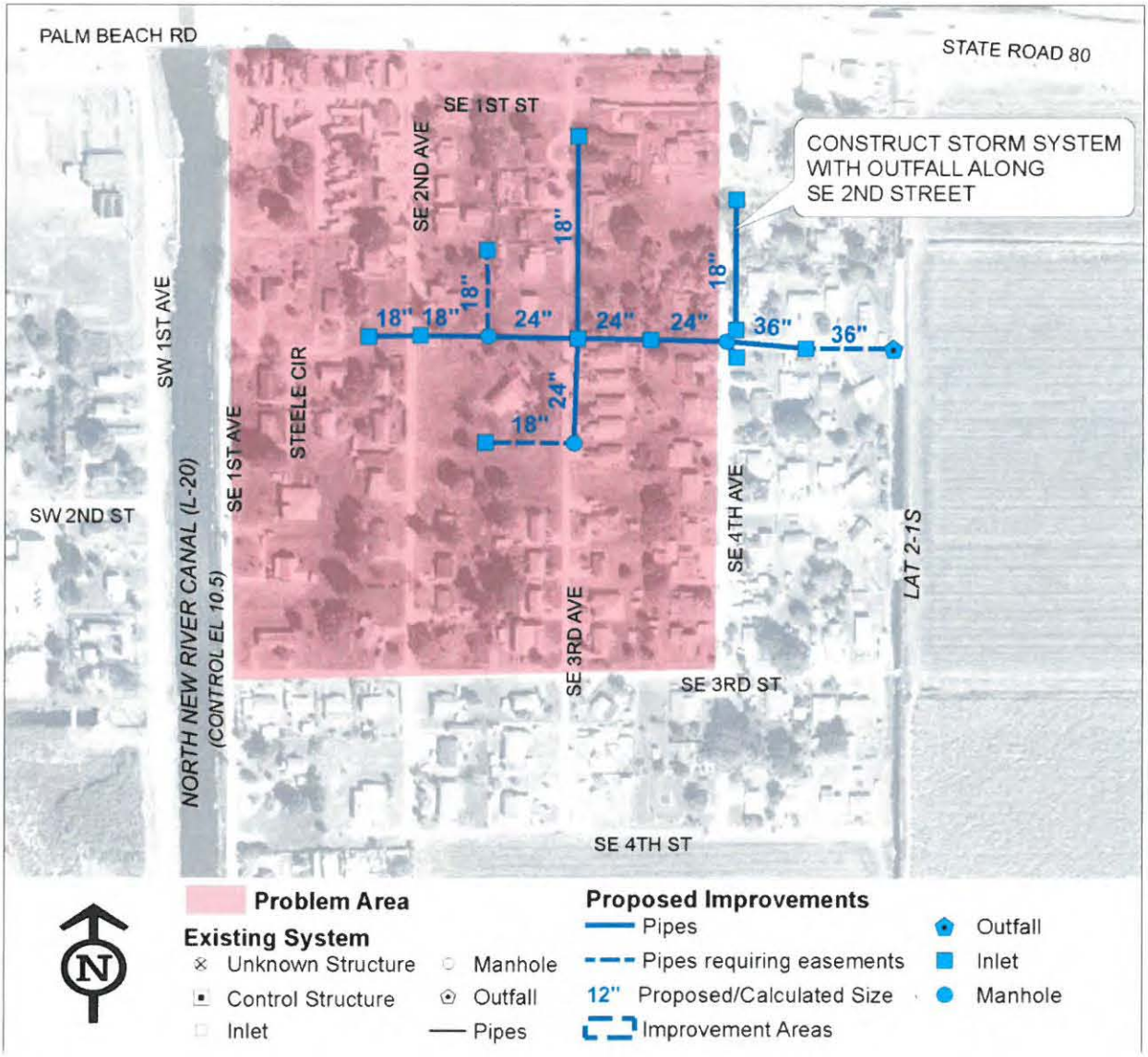
Area S2 – SE 2nd Ave (South Bay)

There is currently no formal drainage system in this area. Runoff flows to the lots, which are lower than the roadway. The water level must then rise above the roadway before it is able to discharge to South Florida Conservancy District's Lateral 2-1S.



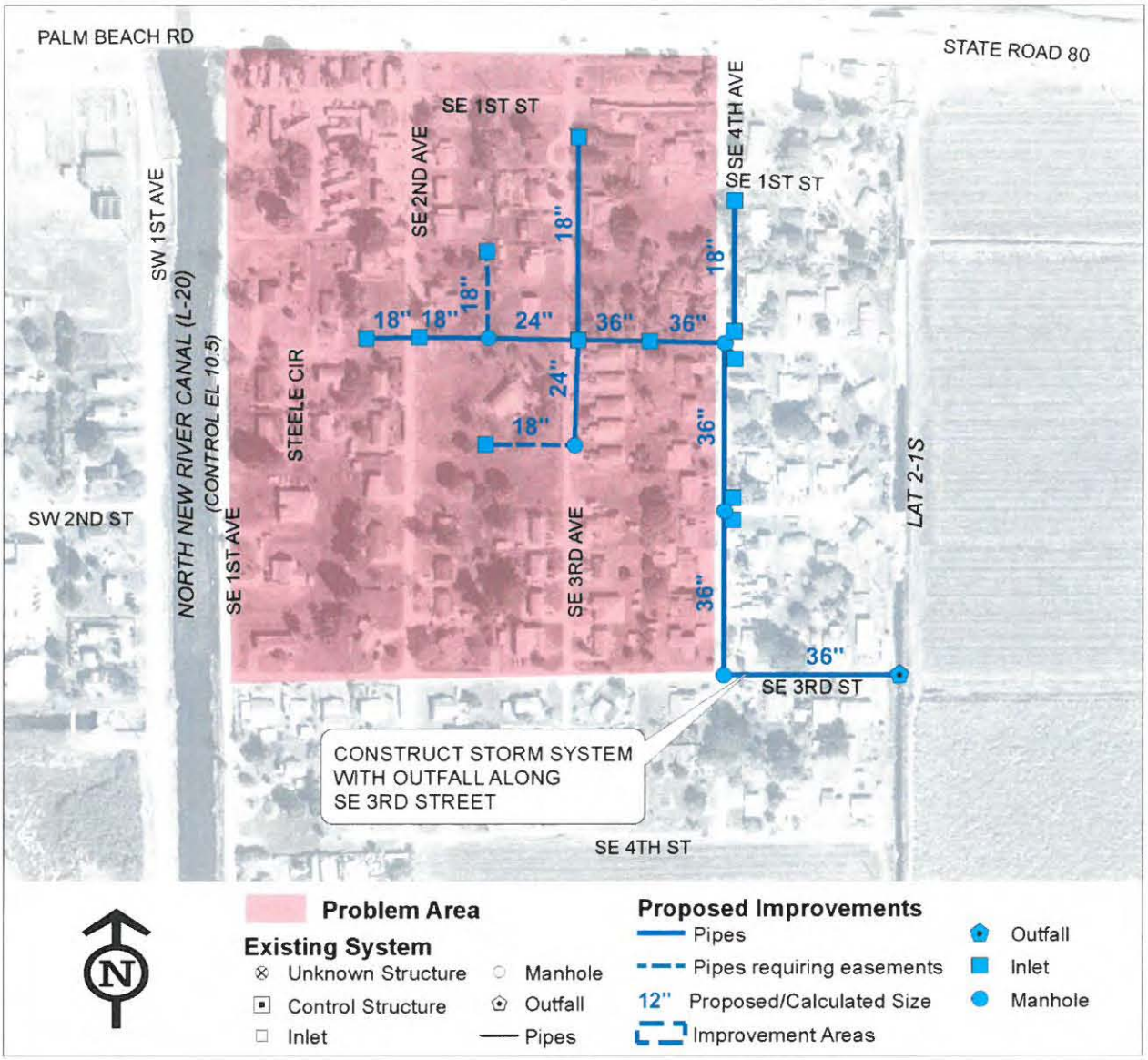
Area S2 – Option 1: Construct a storm system with an outfall along SE 2nd Street to Lateral 2-1S and provide approximately 9 acre-feet of compensating storage somewhere else within the basin.

Constructing the outfall along SE 2nd Street is the most direct route to outfall to Lateral 2-1S. However, an easement will be required for the outfall pipe. Because the lowest elevations in the area are in the lots, two sections of the storm system are proposed within private property (dashed lines in figure). These portions of the system will also require easements.



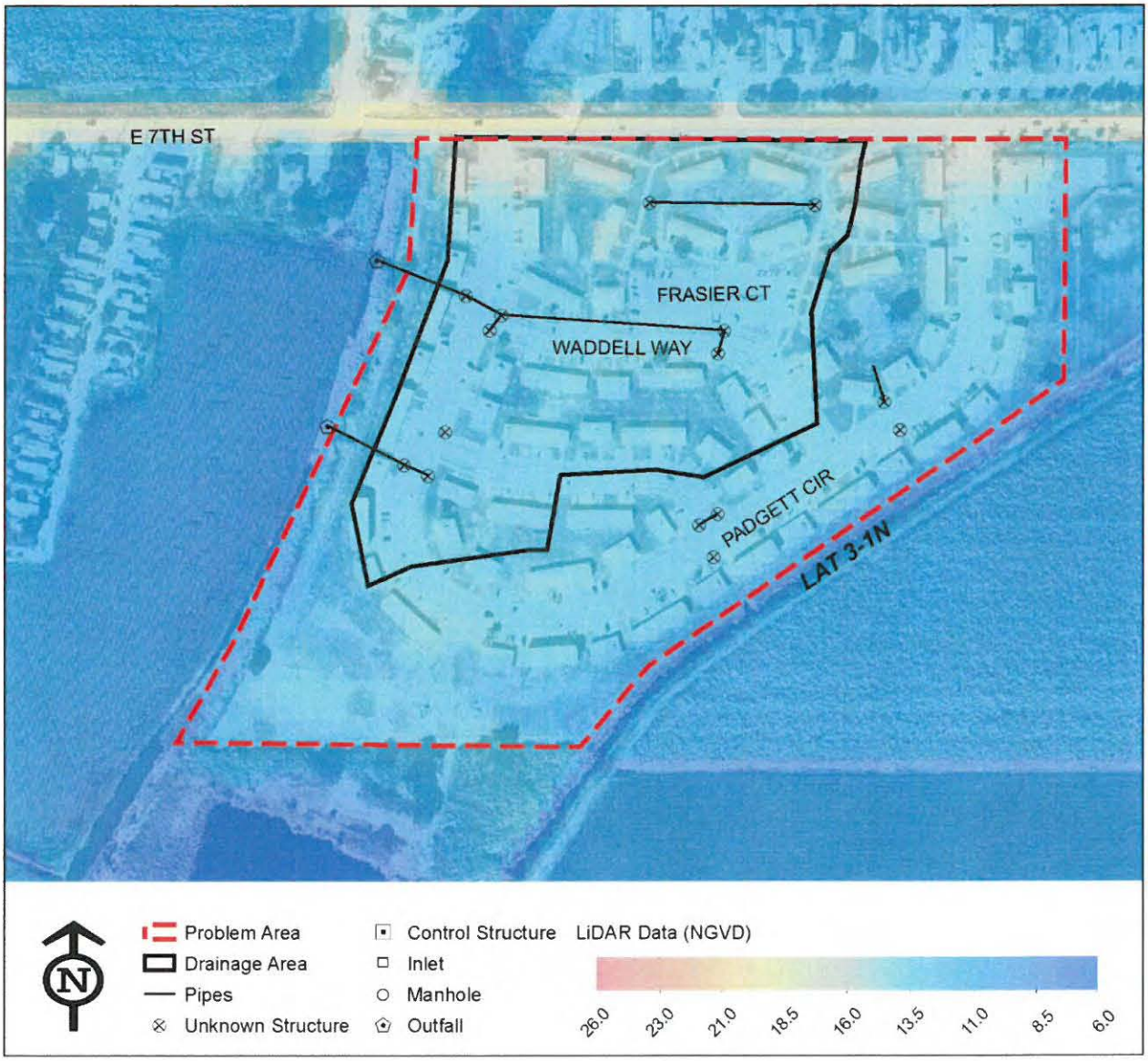
Area S2 – Option 2: Construct a storm system with an outfall along SE 3rd Street and provide approximately 9 acre-feet of compensating storage somewhere else within the basin.

This proposed storm system is similar to Option 1 with the exception of the outfall being constructed along SE 3rd Street. An easement for the outfall pipe would not be required in this option.



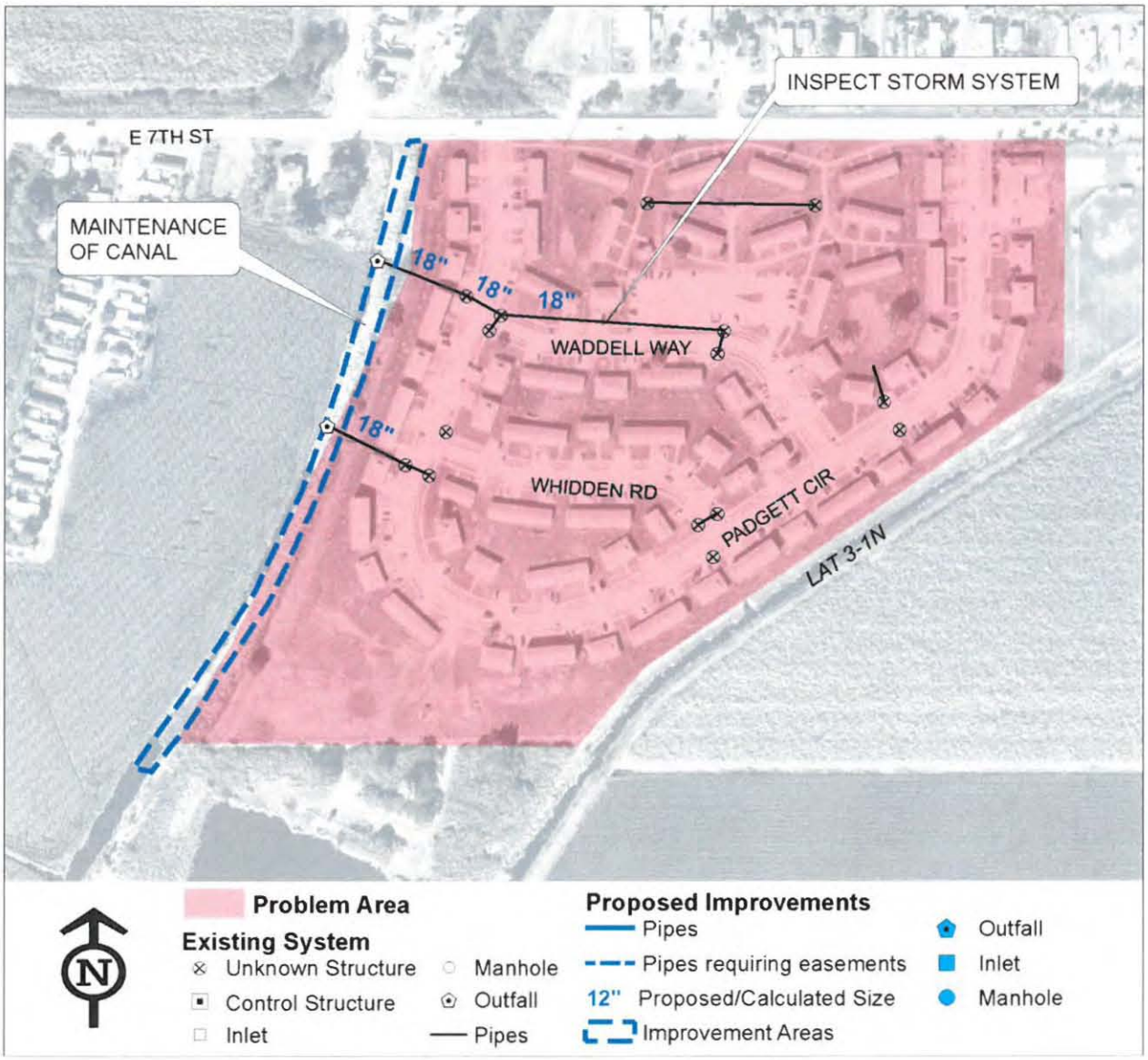
Area U1 – Padgett Island (Unincorporated Palm Beach County)

The stormwater system within Padgett Island consists of inlets, piping, and grassed detention areas that outfall to an unclaimed canal west of the development. The west side of the unclaimed canal is being maintained by the adjacent agricultural land owner but the entire canal requires maintenance. The size of the existing storm system is unknown.



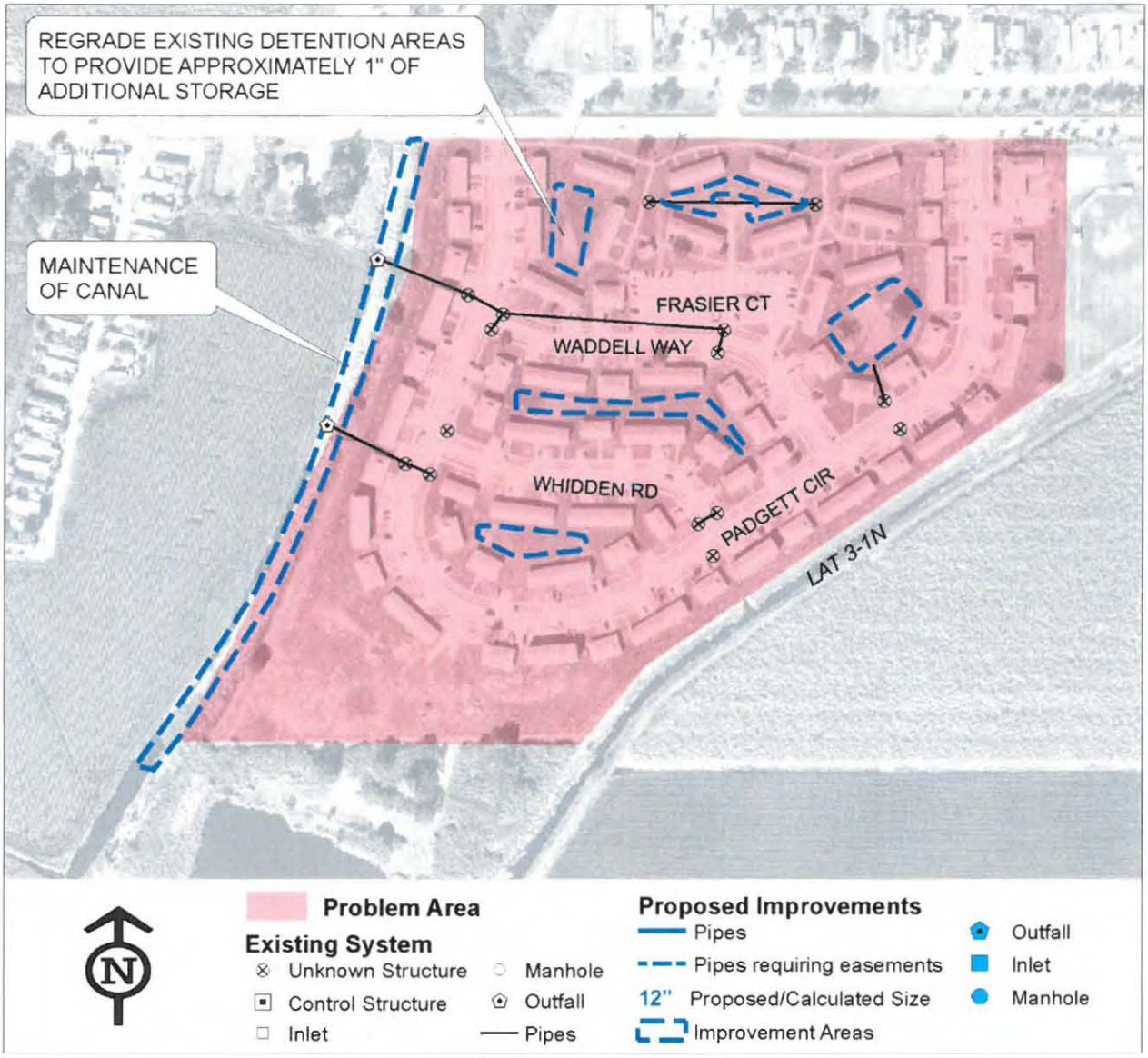
Area U1 – Option 1: Provide maintenance of the existing canal and inspection of the existing storm system.

The canal needs to be maintained to allow discharge from the site. An easement is necessary for providing maintenance of the canal. The calculated pipe sizes for the storm system are shown in the figure below. The calculated pipe sizes for this area are the typical minimum sizes installed for storm systems. It is not anticipated that an increase in pipe sizes will be necessary. However, if the existing pipes are not adequately sized and replacement is necessary, the increase in the discharge rate may require providing compensating storage within the basin.



Area U1 – Option 2: Re-grade existing detention areas.

Re-grading the existing detention areas may provide additional storage within the site and alleviate road flooding.



Summary

The conceptual alternatives propose increased pipe sizes, additional storage, and system maintenance as solutions for the drainage problems in each of the areas. A more detailed analysis during final project design may point to different options not included in this evaluation. In two of the areas, the existing pipe sizes are unknown. It is suggested that a survey of these areas be completed to determine this information before completion of conceptual drawings for the next task. This is currently not included in our scope of work.

An increase in pipe size typically increases the discharge from a site requiring compensating storage. Storage capacity may not be available in any of these areas. Finding a location within the basin to provide compensating storage may require an evaluation of a larger extent within the basin. It must be demonstrated that the additional discharge does not negatively impact neighboring areas within the basin. This evaluation would be completed during final project design.

System maintenance is vital for proper functioning of storm systems. Municipalities and the County should review the written procedures prepared for MS4 NPDES permit compliance, to confirm that sufficient inspection and maintenance activities are scheduled for these problem areas.

An option for each of the problem areas has been selected for further evaluation with input from PBC staff. Option 1 was chosen for Areas B1, P1, S1, and U1. Option 2 was chosen for Area S2. Conceptual drawings and construction costs will be completed for each chosen option. The analysis will be provided in the deliverable for Task 5.8.

Sincerely,

Ronald W. Last, P.E., LEED AP
President, Last Devenport, Inc.

Alan Wertepny, P.E.
Vice-President, Mock•Roos

July 31, 2014

Ms. Kristine Frazell-Smith
Palm Beach County Engineering and Public Works
2300 North Jog Road
West Palm Beach, FL 33411

Ref. No. B2014.00MR/12-016LDi
Subject: **Glades Region Master Plan**
Drainage System Inventory and Evaluation
Palm Beach County Project No. 2012057
Cost Estimates Report (Task ENG 3, 5.8 Deliverable)

Dear Kristine:

This letter report constitutes the third deliverable for the above-referenced County Project.

Background

The Palm Beach County Department of Economic Sustainability (PBCDES) has undertaken the task of developing a master plan for the Glades Region of Palm Beach County, with funding provided by a Community Challenge Planning Grant from the U.S. Department of Housing and Urban Development (HUD). DES designated a portion of the funding for the completion of a new Drainage System Inventory and Evaluation, to be overseen by the Palm Beach County Department of Engineering and Public Works (PBCENG).

PBCENG negotiated with Last Devenport, Inc., a general consultant with an existing PBCENG contract, for a scope of services to complete the tasks necessary to produce the Drainage System Inventory and Evaluation. This report is the third deliverable of that effort, documenting the sixth task of the Scope of Services (Task 5.8). This task includes the development of final conceptual design drawings and conceptual-level construction cost estimates for the two alternative solutions for the five prioritized problem areas identified under Task 5.4.

Conceptual Design Drawings and Estimates

The conceptual design drawings for each of the problem areas identified under Task 5.4 are attached as **Exhibit A**. The conceptual-level construction cost estimate for each alternative solution to the prioritized problem areas is included as **Exhibit B**.

Summary

A final conceptual design drawing and conceptual-level construction cost estimate is included for each chosen option. The report includes the deliverables for Task 5.8 and concludes the deliverables for the scope of the contract. Final Presentation Participation will be provided as specified by Palm Beach County.

Sincerely,

Ronald W. Last, P.E. LEED AP
President, Last Devenport, Inc.

Alan Wertepny, P.E.
Vice-President, Mock•Roos

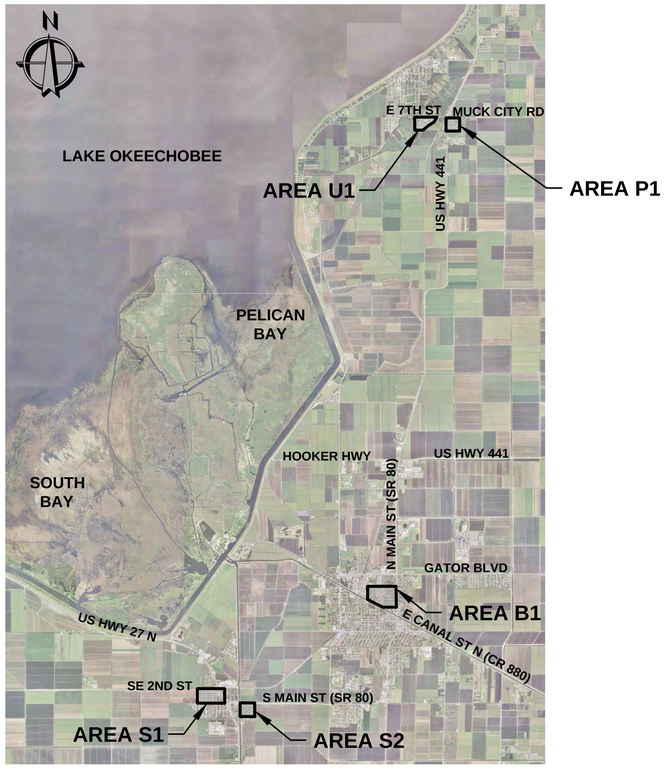
Exhibit A

Final Conceptual Design Drawings

CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION

PREPARED FOR
PALM BEACH COUNTY
FLORIDA

AUGUST 2014



VICINITY MAP

N.T.S.

SECTIONS 19, 20, TOWNSHIP 42 SOUTH, RANGE 37 EAST
SECTION 31, TOWNSHIP 43 SOUTH, RANGE 37 EAST
SECTION 14, TOWNSHIP 44 SOUTH, RANGE 36 EAST

INDEX OF SHEETS

SHEET NO.	SHEET TITLE
1 OF 6	COVER
2 OF 6	AREA B1 - NW AVENUE H (BELLE GLADE)
3 OF 6	AREA P1 - SEVILLE STREET AND EL DORADO STREET (PAHOKEE)
4 OF 6	AREA S1 - NW 9TH AVENUE (SOUTH BAY)
5 OF 6	AREA S2 - SE 2ND AVENUE (SOUTH BAY)
6 OF 6	AREA U1 - PADGETT ISLAND (UNINCORPORATED PALM BEACH COUNTY)

TOTAL NO. OF SHEETS - 6

BAR IS EQUAL TO ONE INCH ON ORIGINAL DRAWING
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CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION
PALM BEACH COUNTY
FLORIDA

DATE:	AUGUST 2014
P.A. NO.	B2014.00
DWG. NO.	42-37-19-09
SHEET:	1 OF 6

PLOT DATE: Aug 01, 2014 - 11:09am XREFS: IMAGES: H:\REF_DATA\LOGOS\BLDr.logo_9-1-09.jpg H:\REF_DATA\LOGOS\PBC Logo.jpg H:\REF_DATA\PROJECTS\2013\2013 Block 58\Sht\Area 4.dwt H:\REF_DATA\PROJECTS\2013\2013 Block 58\Sht\Area 7.dwt

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-2

REMOVE EXISTING STRUCTURE
PLUG AND ABANDON OUTFALL
PIPE IN PLACE
INSTALL TYPE E INLET S-1

INSTALL
TYPE E
BUBBLE-UP
STRUCTURE

CONSTRUCT 140'
OF 42" RCP

REMOVE EXISTING
STRUCTURE

REMOVE 660' OF EXISTING
30" STORM PIPE AND
INSTALL 660' OF 42" RCP
FROM S-1 TO S-3

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-3

REMOVE EXISTING
STRUCTURE
INSTALL TYPE E INLET S-4

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-5

REMOVE 900' OF EXISTING
30" STORM PIPE AND
INSTALL 900' OF 36" RCP
FROM S-3 TO S-9

REMOVE EXISTING
STRUCTURE INSTALL
TYPE E INLET S-8

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-7

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-6

REMOVE EXISTING STRUCTURE
INSTALL TYPE E INLET S-9

EXISTING INLET (TYP)

EXISTING CURB INLET
(TYP)

30" 30" 30" 30" 30" 30" 30" 30" 30" 30" 30" 60" 60" 24"

LATERAL 1-1A

NW 7TH ST

NW 4TH ST

N MAIN ST

NW AVE H PL

NW H AVE

NW AVE G

NW AVE F

NW AVE E

NW AVE D

NW AVE C

NW 2ND ST

UNK.

EXISTING DRY
DETENTION
AREA
BTTM EL 11.0

MODIFY EXISTING
CONTROL
STRUCTURE

INSTALL 36" STORM PIPE
WITH MITERED END
SECTIONS

PROPOSED TOP OF BANK
EL 13.5, CONSTRUCT 4:1
SLOPE TO BTTM EL 11.0

PROPOSED 2 ACRE
DRY DETENTION AREA
BTTM EL 11.0

INSTALL 6' HIGH BLACK
VINYL COATED CHAIN
LINK FENCE (N.300')

W CANAL ST N

W CANAL ST S

HILLSBORO CANAL (L-14)
CONTROL EL 10.5

GRAPHIC SCALE IN FEET
0 50 100 150 200

BAR IS EQUAL TO ONE INCH
ON ORIGINAL DRAWING
ADJUST ALL SCALED
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AREA B1 - NW AVENUE H (BELLE GLADE)

CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION
PALM BEACH COUNTY
FLORIDA

DATE: AUGUST 2014
P.A. NO. B2014.00
DWG. NO. 42-37-19-09
SHEET: 2 OF 6

FIELD: ____
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AREA P1 - SEVILLE STREET AND EL DORADO STREET (PAHOKEE)

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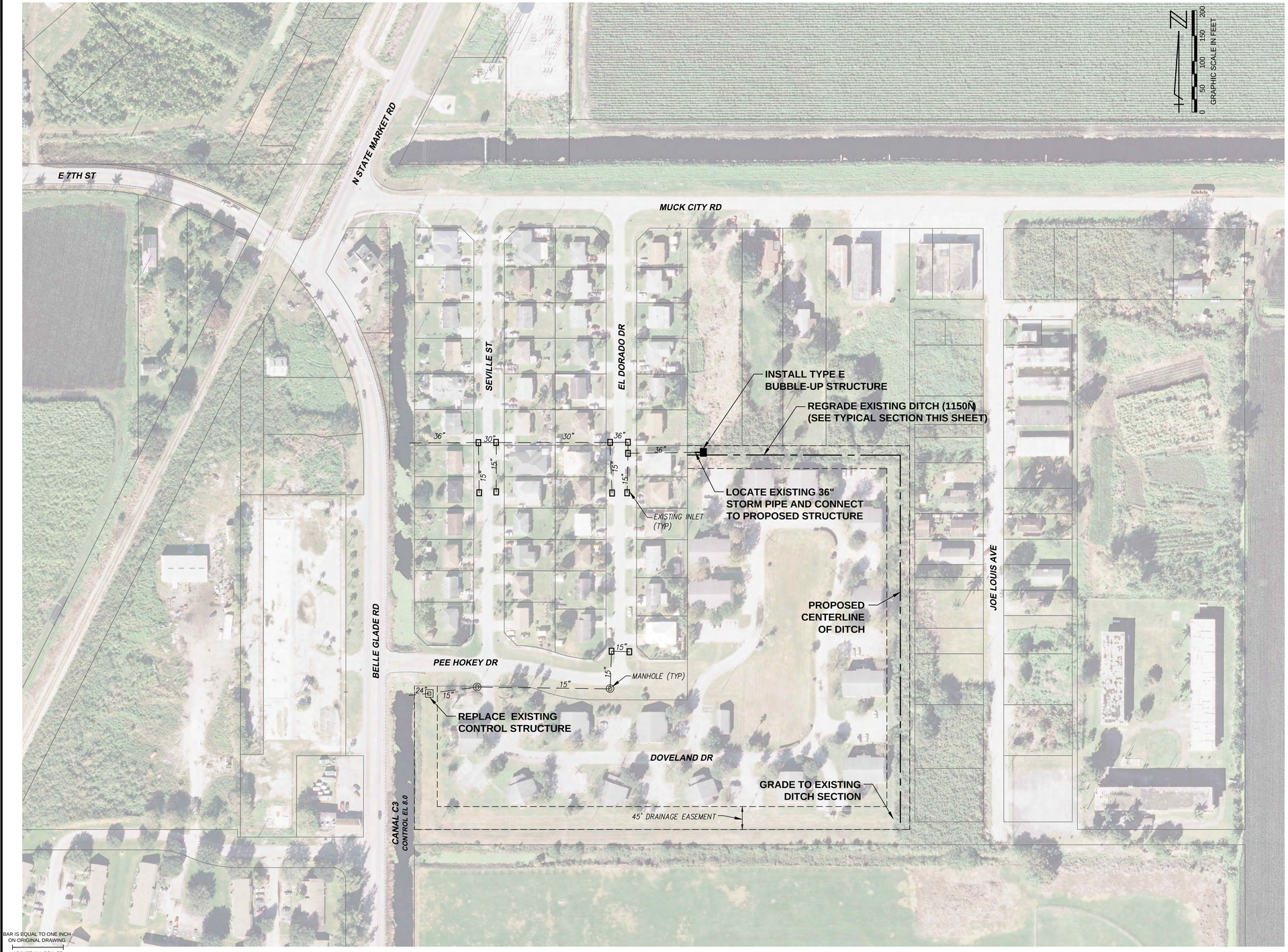
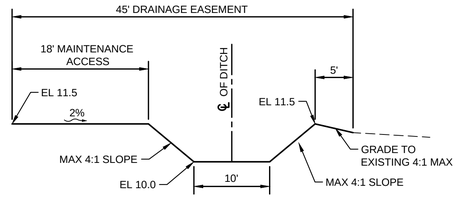
CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION
PALM BEACH COUNTY
FLORIDA

DATE: AUGUST 2014
P.A. NO. B2014.00
DWG. NO. 42-37-19-09
SHEET: 3 OF 6





TYPICAL DITCH SECTION

AREA S1 - NW 9TH AVENUE (SOUTH BAY)

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CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION
PALM BEACH COUNTY
FLORIDA

DATE:	AUGUST 2014
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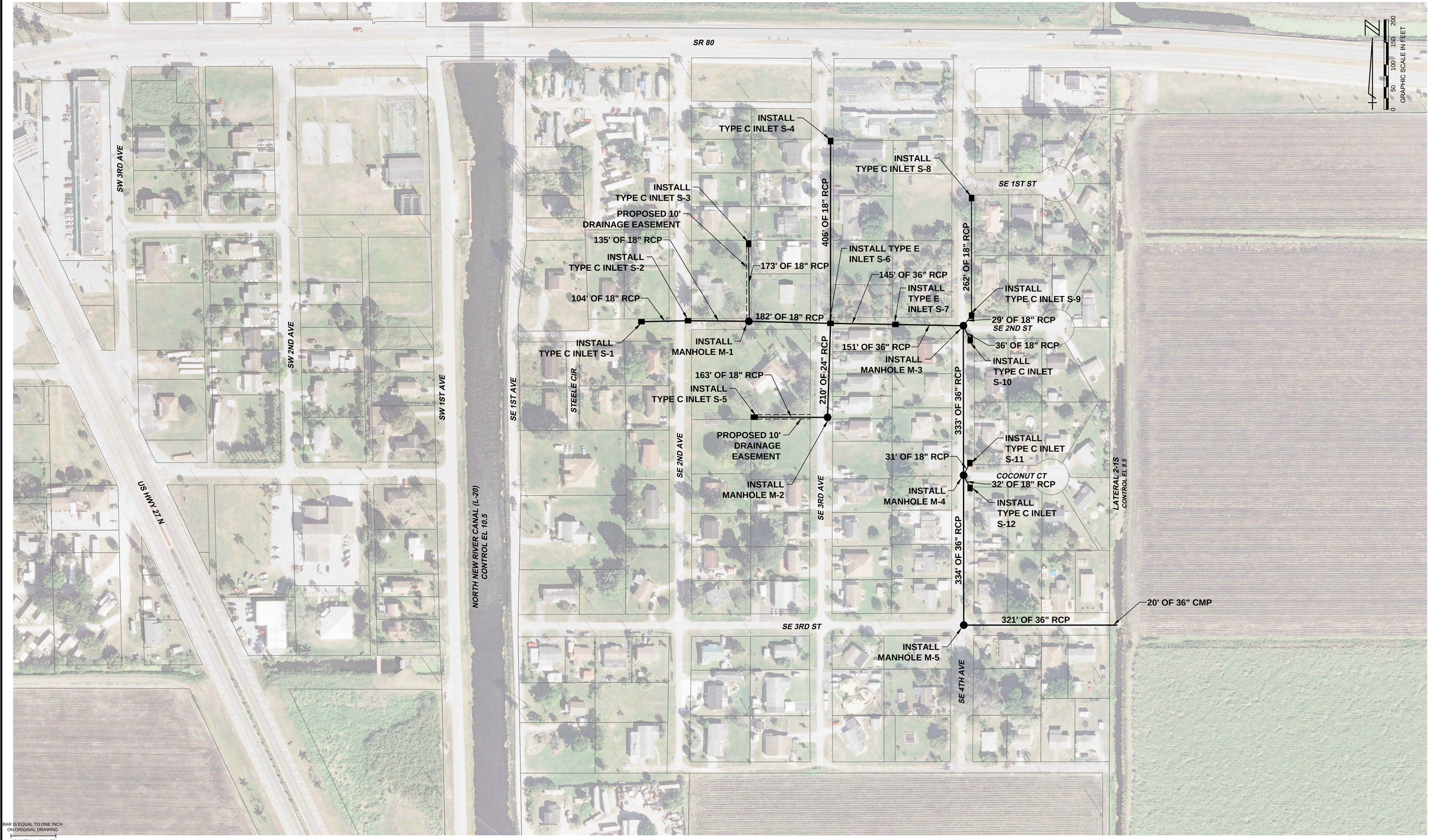
DWG. NO.	42-37-19-09
SHEET:	4 OF 6



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AREA S2 - SE 2ND AVENUE (SOUTH BAY)

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CONCEPTUAL STORM SYSTEM IMPROVEMENTS
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PALM BEACH COUNTY
FLORIDA

DATE:	AUGUST 2014
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DWG. NO.	42-37-19-09
SHEET:	5 OF 6

BAR IS EQUAL TO ONE INCH ON ORIGINAL DRAWING

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AREA U1 - PADGETT ISLAND (UNINCORPORATED PALM BEACH COUNTY)

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CONCEPTUAL STORM SYSTEM IMPROVEMENTS
GLADES REGION MASTER PLAN
DRAINAGE SYSTEM INVENTORY AND EVALUATION
PALM BEACH COUNTY
FLORIDA

DATE: AUGUST 2014
P.A. NO. B2014.00
DWG. NO. 42-37-19-09
SHEET: 6 OF 6

Exhibit B

Conceptual – Level Construction Cost Estimates

EXHIBIT B

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE

FOR

PALM BEACH COUNTY GLADES REGION MASTER PLAN

PBC Project No. 2012057

PALM BEACH COUNTY, FLORIDA

SUMMARY

ITEM	TOTAL	
AREA B1	$	1,121,200.00
AREA S1	$	37,800.00
AREA P1	$	146,000.00
AREA S2	$	715,300.00
AREA U1	$	132,800.00
TOTAL AMOUNT	**$**	**2,153,100.00**

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE
FOR
PALM BEACH COUNTY GLADES REGION MASTER PLAN
PBC Project No. 2012057
AREA B1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
ENGINEERING AND SURVEYING	1	LS	$120,000.00	$120,000.00
MOBILIZATION	1	LS	$70,000.00	$70,000.00
ACQUISTION OF DETENTION AREA (1)	1	LS	$225,000.00	$225,000.00
MAINTAINANCE OF TRAFFIC	1	LS	$15,000.00	$15,000.00
NPDES	1	LS	$8,000.00	$8,000.00
PAVEMENT REPAIR	1	LS	$40,000.00	$40,000.00
UTILITY CONFLICT ADJUSTMENT	1	LS	$20,000.00	$20,000.00
CLEAR & GRUBBING	1	LS	$40,000.00	$40,000.00
MODIFY EXISTING CONTROL STRUCTURE	1	EA	$3,000.00	$3,000.00
6' HIGH BLACK VINYL COATED FENCE	1,300	LF	$21.00	$27,300.00
36" STORM PIPE RCP	1,090	LF	$80.00	$87,200.00
MITERED END SECTIONS	2	EA	$2,400.00	$4,800.00
REMOVE EXISTING PIPE	1,600	LF	$15.00	$24,000.00
REMOVE EXISTING STRUCTURE	10	EA	$1,200.00	$12,000.00
TYPE E INLET	10	EA	$3,810.00	$38,100.00
42" STORM PIPE RCP	800	LF	$115.00	$92,000.00
EXCAVATE DETENTION AREA	1	LS	$105,000.00	$105,000.00
SODDING	10,000	SY	$5.00	$50,000.00
15% CONTINGENCIES				**$139,800.00**
SUBTOTAL				**$1,121,200.00**

NOTES: (1) ASSUME PURCHASE PROPERTY FROM THE SCHOOL BOARD. BASED ON PALM PALM BEACH COUNTY PROPERTY APPRAISER MARKET VALUE.
(2) PERMIT FEES NOT INCLUDED.

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE
FOR
PALM BEACH COUNTY GLADES REGION MASTER PLAN
PBC Project No. 2012057
AREA S1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
ENGINEERING AND SURVEYING	1	LS	$4,000.00	$4,000.00
MOBILIZATION	1	LS	$4,000.00	$4,000.00
MAINTENANCE OF TRAFFIC	1	LS	$3,000.00	$3,000.00
NPDES COMPLIANCE	1	LS	$2,000.00	$2,000.00
CLEAN AND TELEVISE STORM STRUCTURES	1,100	LF	$18.00	$19,800.00
			15% CONTINGENCIES	**$5,000.00**
			TOTAL	**$ 37,800.00**

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE
FOR
PALM BEACH COUNTY GLADES REGION MASTER PLAN
PBC Project No. 2012057
AREA P1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
ENGINEERING AND SURVEYING	1	LS	$20,000.00	$20,000.00
MOBILIZATION	1	LS	$10,000.00	$10,000.00
NPDES COMPLIANCE	1	LS	$8,000.00	$8,000.00
CLEAR & GRUBBING	1	LS	$25,000.00	$25,000.00
TYPE E INLET (BUBBLE UP)	1	EA	$3,810.00	$3,810.00
REMOVE AND REPLACE CONTROL STRUCTURE	1	EA	$8,000.00	$8,000.00
24" STORM PIPE	40	LF	$70.00	$2,800.00
36" STORM PIPE	25	LF	$80.00	$2,000.00
SODDING	5,750	SY	$5.00	$28,750.00
REGRADE DITCH	1,025	CY	$18.00	$18,450.00
			15% CONTINGENCIES	**$19,100.00**
			SUBTOTAL	**$146,000.00**

NOTES: (1) AGENCY PERMIT FEES NOT INCLUDED.

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE
FOR
PALM BEACH COUNTY GLADES REGION MASTER PLAN
PBC Project No. 2012057
AREA S2

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
ENGINEERING AND SURVEYING	1	LS	$90,000.00	$90,000.00
MOBILIZATION	1	LS	$95,000.00	$95,000.00
NPDES	1	LS	$15,000.00	$15,000.00
CLEAR & GRUBBING	1	LS	$60,000.00	$60,000.00
MOT	1	LS	$25,000.00	$25,000.00
PAVEMENT REPAIR	1	LS	$45,000.00	$45,000.00
UTILITY CONFLICT ADJUSTMENT	1	LS	$12,000.00	$12,000.00
TYPE C INLET	9	EA	$2,200.00	$19,800.00
TYPE E INLET	3	EA	$3,800.00	$11,400.00
MANHOLE (P-7)	2	EA	$2,000.00	$4,000.00
MANHOLE (J-7)	3	EA	$5,800.00	$17,400.00
18" RCP	1553	LF	$60.00	$93,180.00
24" RCP	210	LF	$70.00	$14,700.00
36" RCP	1284	LF	$80.00	$102,720.00
SODDING	2000	SY	$5.00	$10,000.00
ACQUIRE DRAINAGE EASEMENT (10' WIDE)	336	LF	$20.00	$6,720.00
			15% CONTINGENCIES	**$93,300.00**
			SUBTOTAL	**$715,300.00**

NOTES: (1) AGENCY PERMIT FEES NOT INCLUDED.

ENGINEER'S CONCEPTUAL-LEVEL CONSTRUCTION COST ESTIMATE
FOR
PALM BEACH COUNTY GLADES REGION MASTER PLAN
PBC Project No. 2012057
AREA U1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
ENGINEERING AND SURVEYING	1	LS	$10,000.00	$10,000.00
MOBILIZATION	1	LS	$9,000.00	$9,000.00
MAINTENANCE OF TRAFFIC	1	LS	$5,000.00	$5,000.00
NPDES COMPLIANCE	1	LS	$2,000.00	$2,000.00
CLEAR & GRUBBING	1	LS	$25,000.00	$25,000.00
RESHAPE CANAL BANK	1250	LF	$20.00	$25,000.00
SODDING	4200	SY	$5.00	$21,000.00
CLEAN AND TELEVISE STORM STRUCTURE	1020	LF	$18.00	$18,360.00
			15% CONTINGENCIES	**$17,400.00**
			SUBTOTAL	**$132,800.00**

APPENDIX F

Glades Region Master Transit Plan –
Center for Urban Transportation Research
(University of South Florida), June 2014

CUTR REPORT

Glades Region Master Transit Plan

Final Report

June 2014

PREPARED FOR

Palm Beach County's Public Transportation System

Center for Urban Transportation Research
University of South Florida
4202 E. Fowler Ave., CUT100, Tampa, FL 33620-5375

Glades Region Master Transit Plan
Final Report

Prepared for:

Palm Beach County's Public Transportation System

Prepared by:

USF Center for Urban Transportation Research
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Final Report

June 2014

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Executive Summary

Introduction

The Glades Area is comprised of three (3) agricultural communities: Belle Glade, South Bay and Pahokee; and the surrounding unincorporated areas. The Glades communities, a rural area southeast of Lake Okeechobee (population 38,000), encompasses some of the highest unemployment (14%-16%) and poverty levels (29.01%) in Palm Beach County. Decades of community and economic development activities have targeted the Glades, but have not resulted in the types or numbers of jobs necessary to bring stability and growth to the area.

To fulfill the transit mobility objectives of the Glades Region Master Plan, PalmTran has requested the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF) to conduct a Glades Region Master Transit Plan. This study will entail a system assessment of the Palm Tran existing fixed route(s) 40, 47 and 48 bus schedules in the Glades region. Utilizing Trapeze scheduling software to examine different scenarios, scheduling strategies such as peak/off peak travel times and schedule frequency will be tested to increase fixed route scheduling efficiency of the selected Glades routes and any proposed new route to serve the proposed Inland Logistics Center. The goals of the project in priority order are to provide a solution to serve the Inland Logistics Center with fixed route bus service that improves reliability, service efficiency, service effectiveness, and customer satisfaction.

This project is expected to produce the following outcomes/benefits:

- Additional and improved fixed-route bus service in the Glades Region for working commuters providing frequent and well-located access to employment centers.
- Connectivity between bus routes for ease of transfers and efficient travel patterns for riders through a transfer center with coordinated bus schedules.
- Provide customer convenience with bus stop amenities to include shelters, benches, and ADA accessible boarding/alighting areas.

Existing Conditions Documentation and Discussion

The study examined existing transit mobility in the Glades region and documented service routing, frequency, span, and service hours for the following:

- PalmTran Routes 40, 47 and 48
- Local Transit Service in Belle Glade – The Belle Glade Express

A series of data collection and reporting activities were undertaken to inform the assessment of existing services in the Glades Region. Data analyzed:

- Runcuts and Reliefs
- Annual Revenue Hours
- Primary Travel Corridors

- Transfer Locations
- Daily Departures at Transfer Locations
- Existing Ridership
- Current Transit Travel Times

Glades Region Master Plan Scenarios for Mobility

One primary task for reorienting service in the Glades region is to determine a primary transfer center uniting Belle Glade, Pahokee, West Palm Beach, and the Inland Logistics Center. CUTR has developed two scenarios to address a regional master transit plan for the Glades area focusing on the future Inland Logistics Center (ILC):

- Scenario I: West Tech as primary transfer center; and
- Scenario II: The Inland Logistics Center as primary transfer center.

Each of these scenarios has advantages and challenges which will be discussed below. The scenarios incorporate new express routes, increased frequency on existing routes, and expansion of the span of service to routes serving the Glades area.

Scenario I – West Tech as Primary Transfer Center

One issue with Glades service, as it related to West Palm Beach, is the service area is an inverted “T”, with the north south orientation between Belle Glade and Pahokee as the top of the “T” and SR 80 between Belle Glade and West Palm Beach as the bottom part of the “T”. West Tech lies at the intersection of the lower and upper part of the T. Located on SR 715; it is the central point between Pahokee and Belle Glade and is served by the Route 48. West Tech is also near Lakeside Medical Center.

Scenario I focuses on West Tech located on S.R. 715 as the main transfer center for all routes serving the Glades area. Route 47 would be re-routed to serve West Tech and Routes 40, 48, the local Glades routes, would serve West Tech and will provide service 365 days a year from 5:00 a.m. until 11:00 p.m. The ILC would be served with 20 minute frequencies by Routes 47 and 48. An additional 12,152 revenue hours and an additional two buses for each route would be needed to provide this improved frequency and span of service.

The Route 40, which currently serves the West Palm Beach Intermodal Center (ITC) to Belle Glade via the Mall at Wellington Green (MWG), would discontinue serving from the ITC to MWG and would operate 20 minute service, 365 days per year from 5:00 a.m. until 11:00 p.m., between MWG and West Tech. An additional 23,300 revenue hours and four additional buses would be needed to enhance this service. The routing for Route 43 with service from Palm Tran’s Intermodal Transit Center (ITC) to the Mall at Wellington Green but the span of service and frequency would be consistent with the other routes serving the Glades area. An additional 12,150 revenue hours and two additional buses would be required to enhance the Route 43.

Finally, a new route with express/limited stop service from the ITC to West Tech would operate with 20 minute frequencies from 5:00 a.m. until 11:00 p.m. Nine new buses and 51,200 revenue hours would be needed to provide this service. The cost for this service would be $13.4 million and a total of 19 additional buses. Scenario I's route configuration can be seen in Figure ES-1 below.

Scenario I Advantages and Challenges

Since the ILC is at the extreme southern end of the transit service area in the Glades region, West Tech is an ideal central location that, ideally, would support the ILC with a state of the art training center for companies located at the ILC. There is sufficient property on site to design, engineer and construct a transit transfer center with safe access to buses. West Tech would make timed transfers more achievable and the ILC would be served every 20 minutes by the Routes 47, 48 and the new express service from the West Palm Beach ITC.

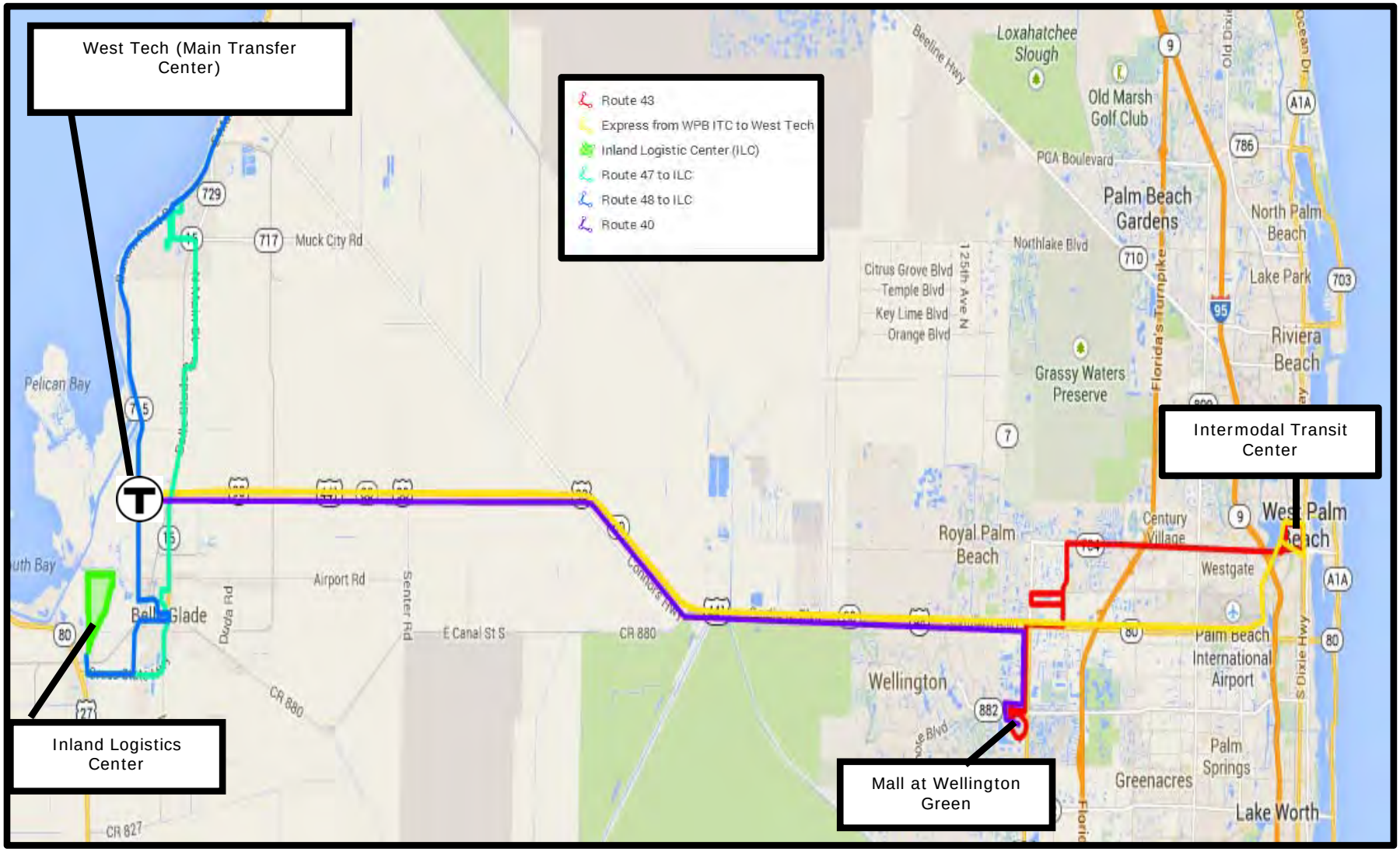
The challenge for this site is that as a primary transfer center, PalmTran customers traveling throughout the PalmTran system might have to make a transfer prior to arriving at West Tech, which would then impose an undue number of transfers on them. One possibility to consider is that West Tech could be a secondary transfer center instead of the primary transfer center.

Cost of Scenario I based on Need

An additional 30,019 annual revenue hours would be needed to make all of the improvements associated with Scenario I, with an additional vehicle requirement of 19 buses. Based on the current hourly rate of $122 per hour supplied by PalmTran, the current annual cost of service is $9.88 million for 80,970 annual revenue hours. This cost would increase by $3.66 million to $13.54 million. Table ES-1 below displays the annual hours and costs.

ES-1. Annual hours and costs

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Net New Annual Operating Costs
Truncate Route 40 at Mall at Wellington Green (MWG) while increasing frequency to 20 minute service from MWG to West Tech (main transfer center)	20,295	4	23,314	$2,844,308
Increase frequency on Route 43 to one bus every 20 minutes from ITC to MWG	25,984	2	12,152	$1,482,544
Create new route – direct express/limited stop connection between ITC to West Tech	N/A	9	51,219	$6,248,718
Increase frequency on Route 47 to 20 minute service, extend southern terminus to the ILC, extend to West Tech (main transfer center)	19,009	2	12,152	$1,482,544
Increase frequency on Route 48 to 20 minute service, extend southern terminus to the ILC	15,682	2	12,152	$1,482,544
Totals	**80,970**	**19**	**110,989**	**$13,540,658**



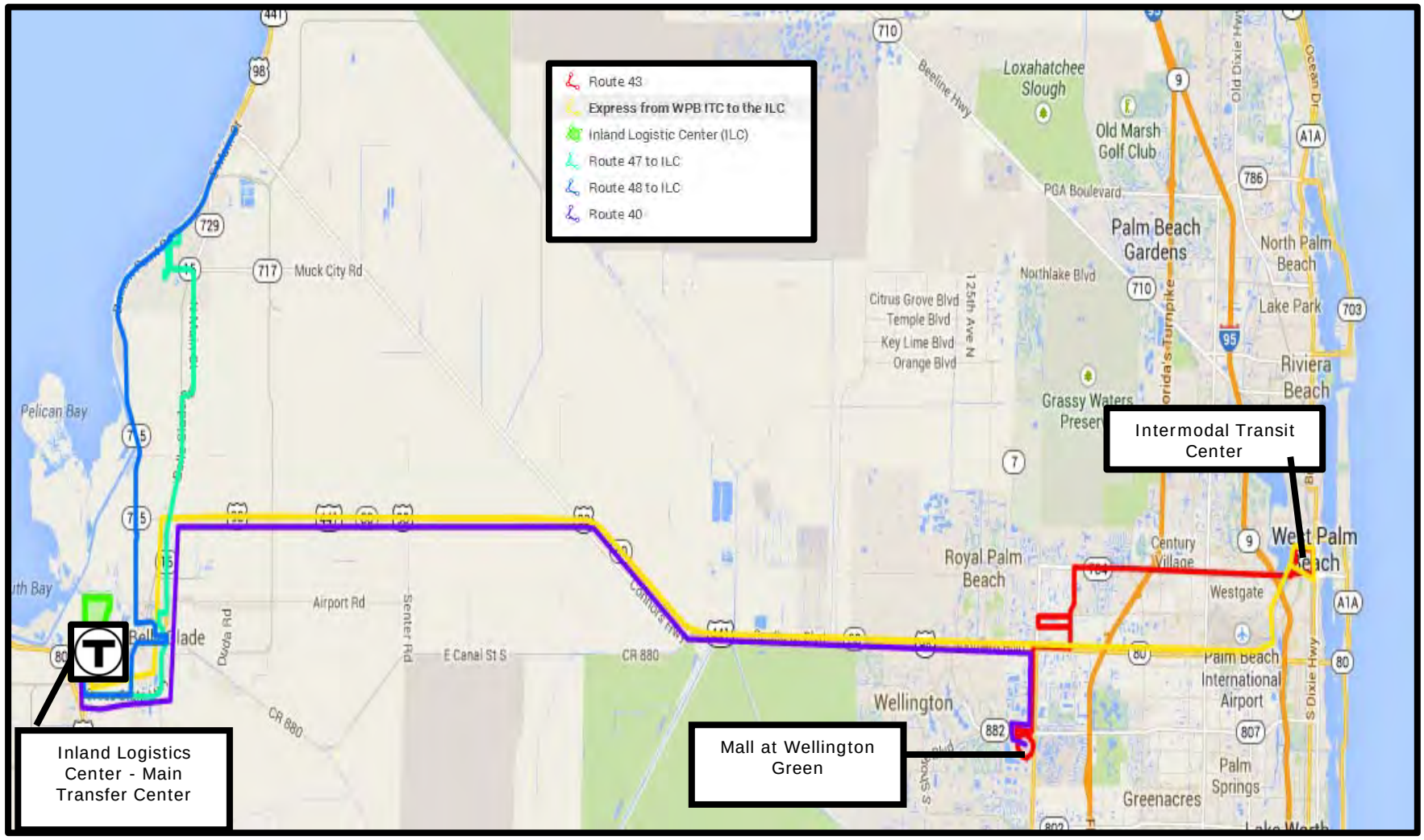
ES-2. Scenario I Map

Scenario II – Inland Logistics Center as Primary Transfer Center

Scenario II focuses on the ILC as the main transfer center for all routes serving the Glades area. Route 47 and 48 routing would be extended in this scenario to serve the ILC and will provide service 365 days a year from 5:00 a.m. until 11:00 p.m. and serve the ILC with 20 minute frequencies. An additional 13,140 revenue hours and two additional buses for each route would be needed to provide this service.

As in Scenario I, the Route 40 would discontinue serving between the West Palm Beach ITC but would serve from the Mall at Wellington Green to the ILC 365 days per year from 5:00 a.m. until 11:00 p.m. with 20 minute frequencies. An additional 26,280 revenue hours four additional buses would be needed to increase this service. The routing for Route 43 with service from Palm Tran's Intermodal Transit Center (ITC) to the Mall at Wellington Green would remain the same but the span of service and frequency would be consistent with the other routes serving the Glades area. An additional 13,140 revenue hours and two additional buses would be required to provide this enhancement to Route 43.

Finally, as in Scenario I, a new route with express/limited stop service from the ITC to the ILC would operate with 20 minute frequencies from 5:00 a.m. until 11:00 p.m. Nine new buses and 59,130 revenue hours would be needed to provide this service. The cost for this service would be $15.2 million and a total of 19 additional buses. This scenario's route configuration can be seen in Figure ES-3 below.



ES-3. Scenario II Map

Scenario II Advantages and Challenges

The Inland Logistics Center will become the prime employment destination for the Glades region and, correspondingly, having all service converge on the ILC would be ideal. Presumably, there would be sufficient space available to design, engineer and construct a transit transfer center and West Tech would be served every 20 minutes via the Routes 47 and 48, just as the ILC is served every 20 minutes under Scenario I.

The primary challenge to the ILC as the primary transfer center is that its location adds miles and hours to every route and thus will be more costly to operate.

Cost of Scenario II Based on Need

An additional 43,860 annual revenue hours would be needed to make all of the improvements associated with Scenario II, with an additional vehicle requirement of 19 buses. Based on the current hourly rate of $122 per hour supplied by PalmTran, the current annual cost of service is $9.88 million for 80,970 annual revenue hours. This cost would increase by $5.35 million to $15.23 million. Table ES-4 below displays the annual hours and costs.

ES-4. Annual Hours and Costs

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Annual Operating Costs
Truncate Route 40 at Mall at Wellington Green while increasing frequency to 20 minute service from MWG to ILC	20,295	4	26,280	$3,206,160
Increase frequency on Route 43 to one bus every 20 minutes from ITC to MWG	25,984	2	13,140	$1,603,080
Create new route – direct express/limited stop connection between ITC to ILC	N/A	9	59,130	$7,213,860
Increase frequency on Route 47 to 20 minute service, extend southern terminus to the ILC	19,009	2	13,140	$1,603,080
Increase frequency on Route 48 to 20 minute service, extend southern terminus to the ILC	15,682	2	13,140	$1,603,080
Totals	**80,970**	**19**	**124,830**	**$15,229,260**

GLADES REGION MASTER TRANSIT PLAN

Introduction

The Glades Area is comprised of three (3) agricultural communities: Belle Glade, South Bay and Pahokee; and the surrounding unincorporated areas. The Glades communities, a rural area southeast of Lake Okeechobee (population 38,000), encompasses some of the highest unemployment (14%-16%) and poverty levels (29.01%) in Palm Beach County. Decades of community and economic development activities have targeted the Glades, but have not resulted in the types or numbers of jobs necessary to bring stability and growth to the area.

In 2011, the Palm Beach County Board of County Commissioners applied for and was awarded a grant under USHUD's Community Challenge Grants. This program aims to reform and reduce barriers to achieving affordable, economically vital, and sustainable communities. The funds are awarded to communities, large and small, to address local challenges to integrating transportation and housing. Such efforts may include amending or updating local master plans, zoning codes, and building codes to support private sector investment in mixed-use development, affordable housing, and the re-use of older buildings. Other local efforts may include retrofitting main streets to provide safer routes for children and seniors, or preserving affordable housing and local businesses near new transit stations.

The County is using the funds to develop a master plan for the entirety of the Glades Region (GR). This will include the provision of more transportation choices and equitable/affordable housing, enhancement of economic competitiveness, existing communities support, policy coordination, investment leveraging, and valuing communities and neighborhoods. The GR is widely recognized as one of the poorest areas in the State of Florida, experiencing pervasive economic, social and health problems. The GR lacks a major economic engine, resulting in high rates of unemployment, low incomes, and high poverty rates. With a new plan for a privately financed major logistics center, the GR will create a master plan to take full advantage of this infusion of private capital investment. The plan will identify all the types and mix of land uses and attendant infrastructure needed to serve planned development/ redevelopment to ensure that its implementation will result in the achievement of the anticipated project benefits mentioned below.

Anticipated Project Benefits:

- Enhance economic competitiveness via the provision of a multimodal transportation system, resulting in reliable, timely access to employment centers, goods and other basic services to residents/employees while expanding business access to markets
- Leverage government investment with private equity/financing and in-kind resources from partner agencies
- Provide amenities, services, and employment in an area which has existing, occupied affordable housing stock.

Source: Portal.hud.gov

To fulfill the objectives of the Glades Region Master Plan, PalmTran has requested the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF) to conduct a Glades Region Master Transit Plan. This study will entail a system assessment of the Palm Tran existing fixed route(s) 40, 47 and 48 bus schedules in the Glades region. Utilizing Trapeze scheduling software to examine different scenarios, scheduling strategies such as peak/off peak travel times and schedule frequency will be tested to increase fixed route scheduling efficiency of the selected Glades routes and any proposed new route to serve the proposed Inland Logistics Center. The goals of the project in priority order are to provide a solution to serve the Inland Logistics Center with fixed route bus service that improves reliability, service efficiency, service effectiveness, and customer satisfaction.

This project is expected to produce the following outcomes/benefits:

- Additional and improved fixed-route bus service in the Glades Region for working commuters providing frequent and well-located access to employment centers.
- Connectivity between bus routes for ease of transfers and efficient travel patterns for riders through a transfer center with coordinated bus schedules.
- Provide customer convenience with bus stop amenities to include shelters, benches, and ADA accessible boarding/alighting areas.

Existing Conditions Documentation and Discussion

Route 40 – West Palm Beach to Belle Glade via S.R. 80 (Limited Stop Service)

The Route 40 operates weekdays and Saturdays in Belle Glade and provides hourly service from West Tech Educational Center to West Palm Beach Tri-Rail Station but only provides service within Belle Glade during peak hours. Table 1 shows the Limited Stop Service provided within Belle Glade. During those hours the Route 40 serves Belle Glade Library, West Tech, Palm Tran Park-n-Ride, Pahokee Airport, Jeff Readon Park, and Loula V. York Public Library. Figure 7 displays the existing route map for Route 40.

Table 1. Route 40 - West Palm Beach to Belle Glade via S.R. 80 (Limited Stop Service)

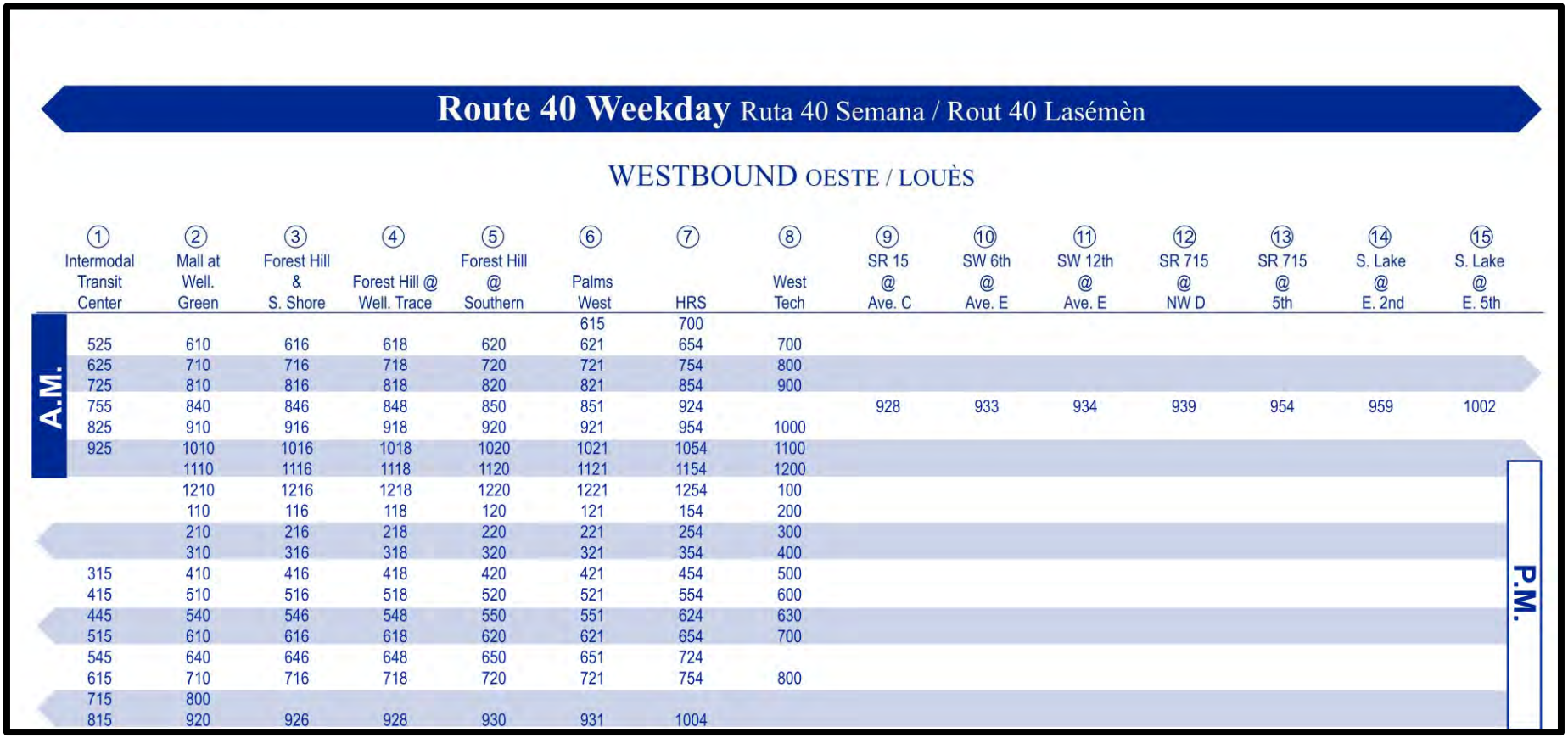
Route 40			Service within Belle Glade	
Days of Service	**Hours of Service**	**Frequency**	**Hours of Service**	**Frequency**
Monday through Friday	5:02 am to 10:04 pm	30 min. peak 60 min. off-peak	5:02 am to 5:36 am 9:28 am to 10:42 am 3:08 pm to 3:42 pm	N/A
Saturdays	7:08 am to 10:04 pm	60 min.	7:08 am to 7:42 am 12:08 pm to 12:42 pm 3:08 pm to 3:42 pm	N/A
Sundays	10:10 am to 7:00 pm	60 min.	No Service	N/A

Route 40 Weekday Ruta 40 Semana / Rout 40 Lasémèn

EASTBOUND ESTE / LÈS

	⑮ S. Lake @ E. 5th	⑭ S. Lake @ E. 2nd	⑬ SR 715 @ 5th	⑫ SR 715 @ NW D	⑪ SW 12th @ Ave. E	⑩ SW 6th @ Ave. E	⑨ SR 15 @ Ave. C	⑧ West Tech	⑦ HRS	⑥ Palms West	⑤ Forest Hill @ Southern	④ Forest Hill @ Well. Trace	③ Forest Hill & S. Shore	② Mall at Well. Green	① Intermodal Transit Center	
A.M.	502	505	510	525	530	531	536		540	608	609	611	613	624	700	
								605	611	644	645	647	649	710	745	
									710	743	744	746	748	754	829	
								705	711	744	745	747	749	810	845	
								805	811	844	845	847	849	910	945	
								905	911	944	945	947	949	1000		
								1005	1011	1049	1045	1047	1049	1100		
	1008	1011	1016	1031	1036	1037	1042		1046	1119	1120	1122	1124	1130		
								1105	1111	1144	1145	1147	1149	1200		
								1205	1211	1244	1245	1247	1249	100		
								105	111	144	145	147	149	200		
								205	211	244	245	247	249	310	345	
								305	311	344	345	347	349	410	445	
	308	311	316	331	336	337	342		346	419	420	422	424	440	515	
								405	411	444	445	447	449	510	545	
								505	511	544	545	547	549	610	645	
								605	611	644	645	647	649	710	745	
								705	711	744	745	747	749	810	845	
								805	811	844	845	847	849	900		P.M.

Figure 1. Route 40 - Weekday – Eastbound.

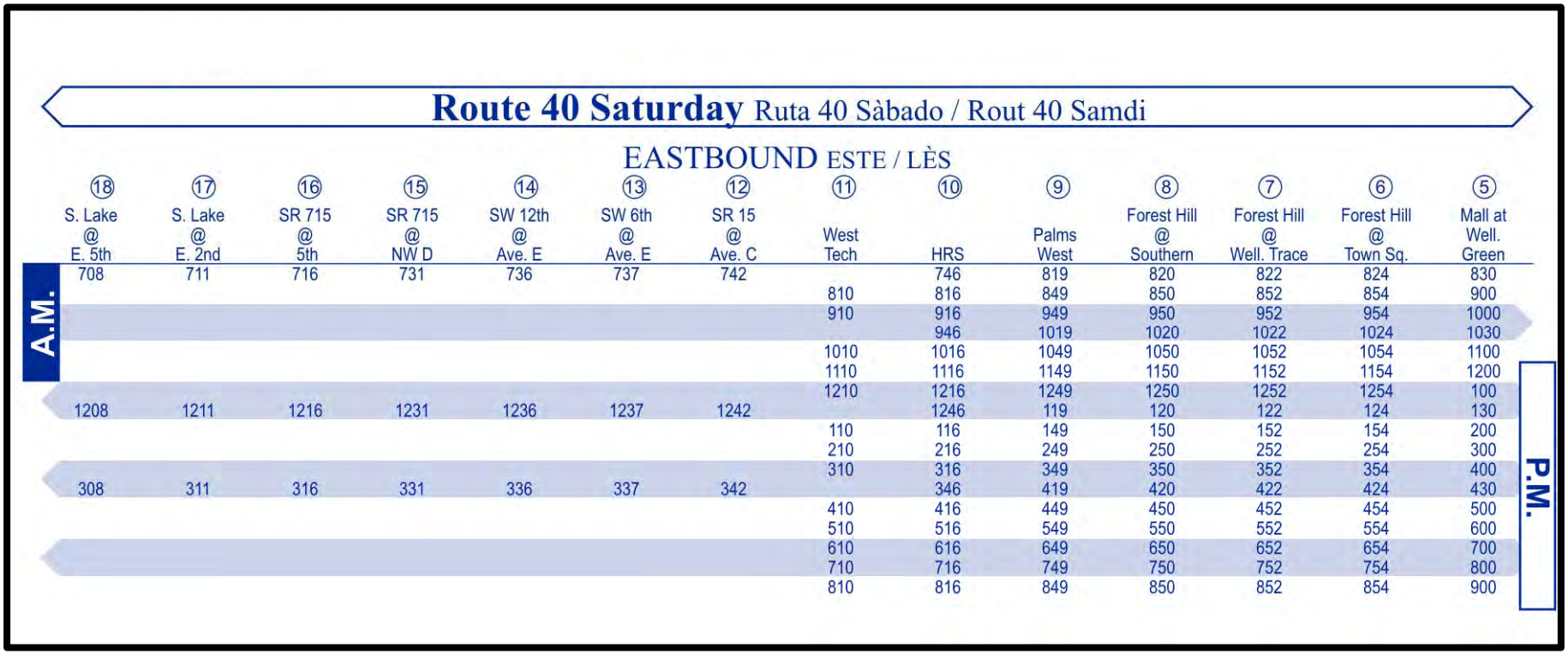


Route 40 Weekday Ruta 40 Semana / Rout 40 Lasémèn

WESTBOUND OESTE / LOUÈS

	① Intermodal Transit Center	② Mall at Well. Green	③ Forest Hill & S. Shore	④ Forest Hill @ Well. Trace	⑤ Forest Hill @ Southern	⑥ Palms West	⑦ HRS	⑧ West Tech	⑨ SR 15 @ Ave. C	⑩ SW 6th @ Ave. E	⑪ SW 12th @ Ave. E	⑫ SR 715 @ NW D	⑬ SR 715 @ 5th	⑭ S. Lake @ E. 2nd	⑮ S. Lake @ E. 5th
A.M.						615	700								
	525	610	616	618	620	621	654	700							
	625	710	716	718	720	721	754	800							
	725	810	816	818	820	821	854	900							
	755	840	846	848	850	851	924		928	933	934	939	954	959	1002
	825	910	916	918	920	921	954	1000							
	925	1010	1016	1018	1020	1021	1054	1100							
		1110	1116	1118	1120	1121	1154	1200							
		1210	1216	1218	1220	1221	1254	100							
		110	116	118	120	121	154	200							
		210	216	218	220	221	254	300							
		310	316	318	320	321	354	400							
	315	410	416	418	420	421	454	500							
	415	510	516	518	520	521	554	600							
	445	540	546	548	550	551	624	630							
	515	610	616	618	620	621	654	700							
	545	640	646	648	650	651	724								
	615	710	716	718	720	721	754	800							
	715	800													
P.M.	815	920	926	928	930	931	1004								

Figure 2. Route 40 – Weekday – Westbound.

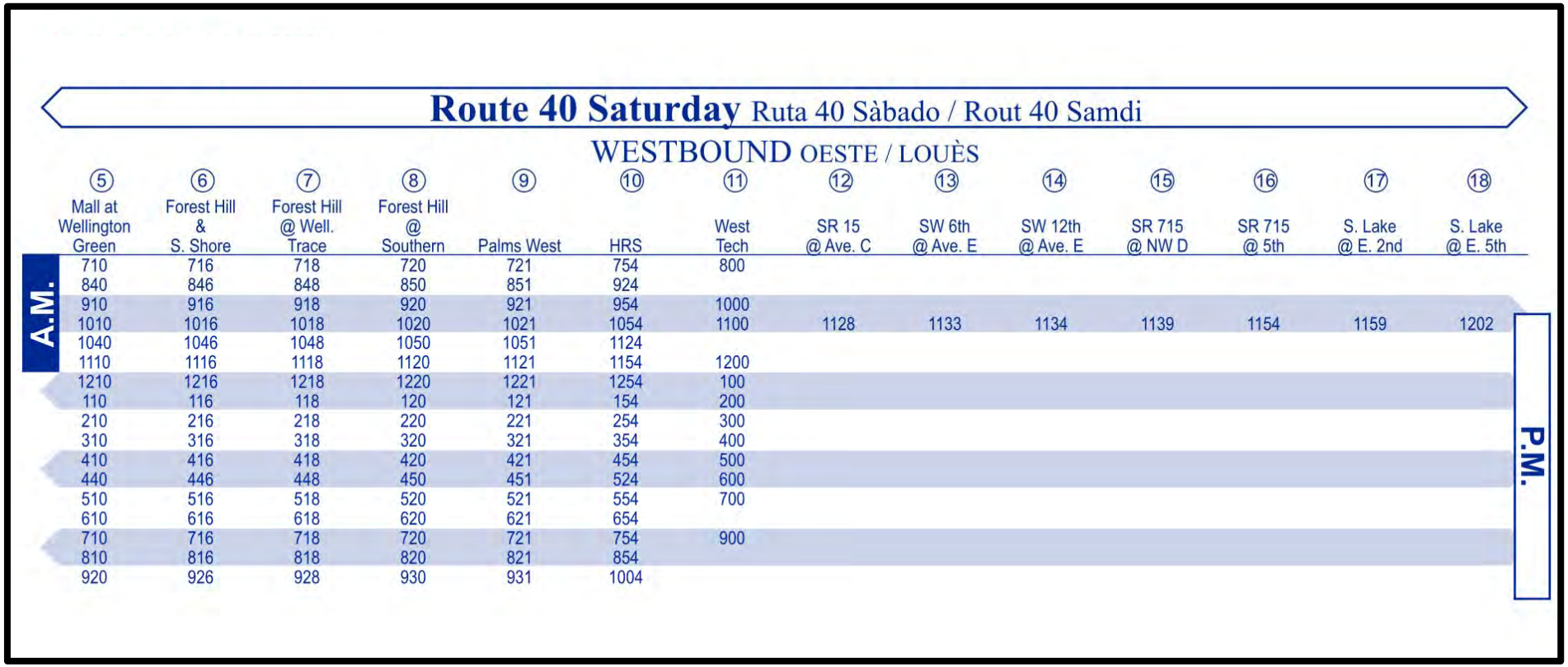


Route 40 Saturday Ruta 40 Sàbado / Rout 40 Samdi

EASTBOUND ESTE / LÈS

	⑱ S. Lake @ E. 5th	⑰ S. Lake @ E. 2nd	⑯ SR 715 @ 5th	⑮ SR 715 @ NW D	⑭ SW 12th @ Ave. E	⑬ SW 6th @ Ave. E	⑫ SR 15 @ Ave. C	⑪ West Tech	⑩ HRS	⑨ Palms West	⑧ Forest Hill @ Southern	⑦ Forest Hill @ Well. Trace	⑥ Forest Hill @ Town Sq.	⑤ Mall at Well. Green
A.M.	708	711	716	731	736	737	742		746	819	820	822	824	830
								810	816	849	850	852	854	900
								910	916	949	950	952	954	1000
									946	1019	1020	1022	1024	1030
								1010	1016	1049	1050	1052	1054	1100
								1110	1116	1149	1150	1152	1154	1200
								1210	1216	1249	1250	1252	1254	100
	1208	1211	1216	1231	1236	1237	1242		1246	119	120	122	124	130
								110	116	149	150	152	154	200
								210	216	249	250	252	254	300
								310	316	349	350	352	354	400
	308	311	316	331	336	337	342		346	419	420	422	424	430
								410	416	449	450	452	454	500
								510	516	549	550	552	554	600
								610	616	649	650	652	654	700
								710	716	749	750	752	754	800
P.M.								810	816	849	850	852	854	900

Figure 3. Route 40 - Saturday – Eastbound.

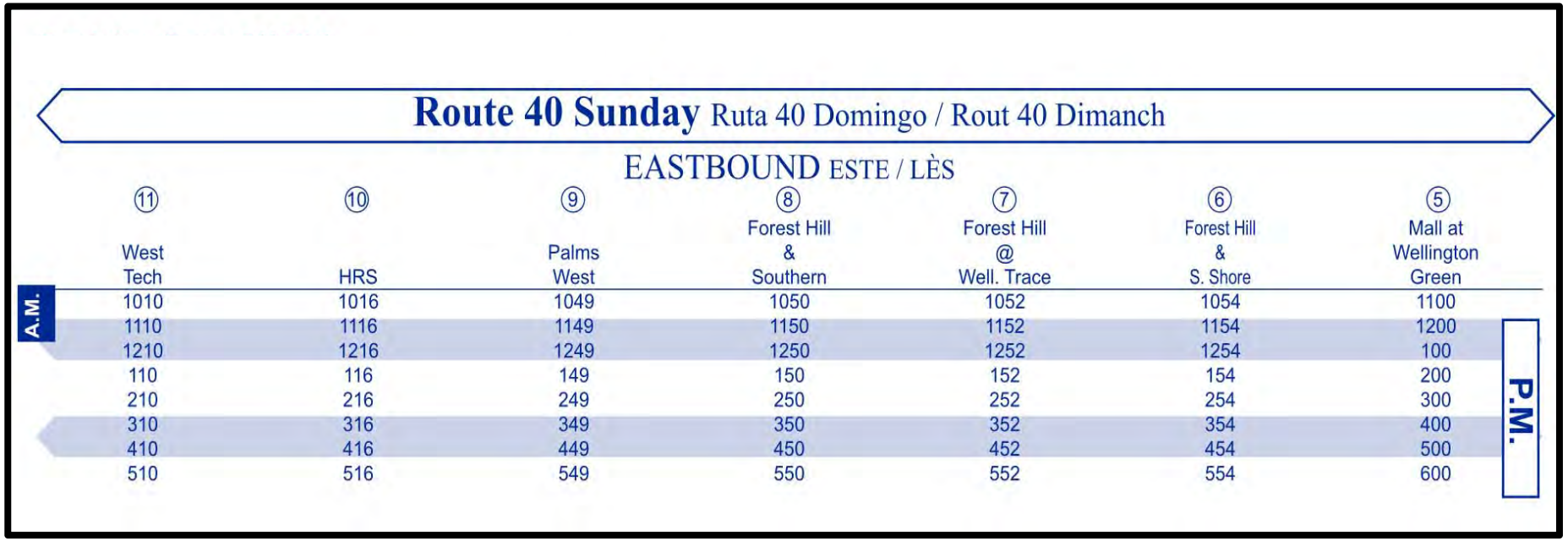


Route 40 Saturday Ruta 40 Sàbado / Rout 40 Samdi

WESTBOUND OESTE / LOUÈS

	⑤ Mall at Wellington Green	⑥ Forest Hill & S. Shore	⑦ Forest Hill @ Well. Trace	⑧ Forest Hill @ Southern	⑨ Palms West	⑩ HRS	⑪ West Tech	⑫ SR 15 @ Ave. C	⑬ SW 6th @ Ave. E	⑭ SW 12th @ Ave. E	⑮ SR 715 @ NW D	⑯ SR 715 @ 5th	⑰ S. Lake @ E. 2nd	⑱ S. Lake @ E. 5th	
A.M.	710	716	718	720	721	754	800								
	840	846	848	850	851	924									
	910	916	918	920	921	954	1000								
	1010	1016	1018	1020	1021	1054	1100	1128	1133	1134	1139	1154	1159	1202	
	1040	1046	1048	1050	1051	1124									
	1110	1116	1118	1120	1121	1154	1200								
	1210	1216	1218	1220	1221	1254	100								
	110	116	118	120	121	154	200								
	210	216	218	220	221	254	300								
	310	316	318	320	321	354	400								
	410	416	418	420	421	454	500								
	440	446	448	450	451	524	600								
	510	516	518	520	521	554	700								
	610	616	618	620	621	654									
	710	716	718	720	721	754	900								
	810	816	818	820	821	854									
	920	926	928	930	931	1004									P.M.

Figure 4. Route 40 - Saturday – Westbound.



Route 40 Sunday Ruta 40 Domingo / Rout 40 Dimanch

EASTBOUND ESTE / LÈS

	⑪ West Tech	⑩ HRS	⑨ Palms West	⑧ Forest Hill & Southern	⑦ Forest Hill @ Well. Trace	⑥ Forest Hill & S. Shore	⑤ Mall at Wellington Green	
A.M.	1010	1016	1049	1050	1052	1054	1100	
	1110	1116	1149	1150	1152	1154	1200	
	1210	1216	1249	1250	1252	1254	100	
	110	116	149	150	152	154	200	
	210	216	249	250	252	254	300	
	310	316	349	350	352	354	400	
	410	416	449	450	452	454	500	
	510	516	549	550	552	554	600	P.M.

Figure 5. Route 40 - Sunday – Eastbound.

Route 40 Sunday Ruta 40 Domingo / Rout 40 Dimanch

WESTBOUND OESTE / LOUÈS

	⑤ Mall at Wellington Green	⑥ Forest Hill & S. Shore	⑦ Forest Hill @ Well. Trace	⑧ Forest Hill @ Southern	⑨ Palms West	⑩ HRS	⑪ West Tech	
A.M.	1010	1016	1018	1020	1021	1054	1100	
	1110	1116	1118	1120	1121	1154	1200	
	1210	1216	1218	1220	1221	1254	100	
	110	116	118	120	121	154	200	
	210	216	218	220	221	254	300	
	310	316	318	320	321	354	400	
	410	416	418	420	421	454	500	
	510	516	518	520	521	554	600	
	610	616	618	620	621	654	700	P.M.

Figure 6. Route 40 - Sunday – Westbound.

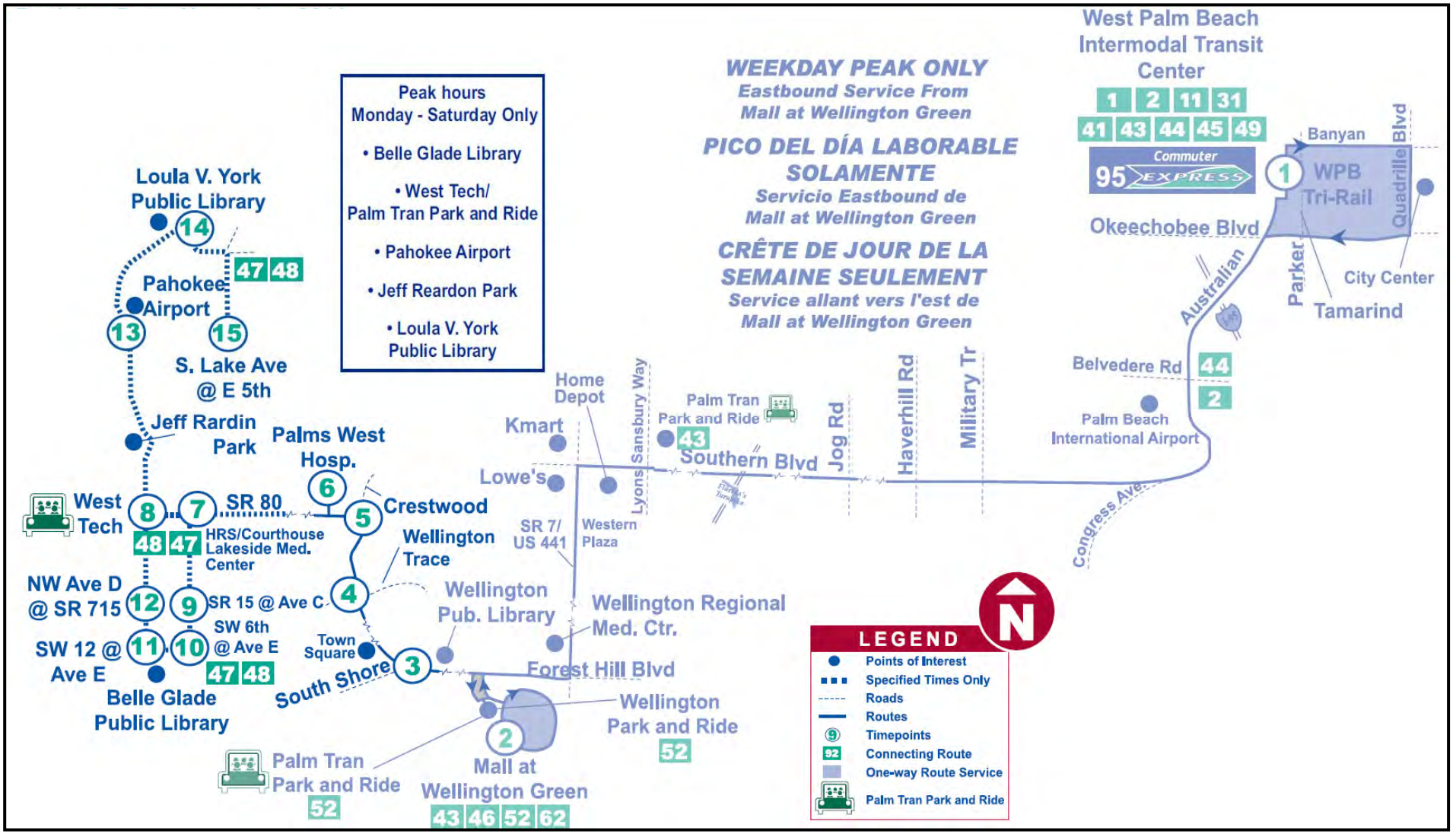


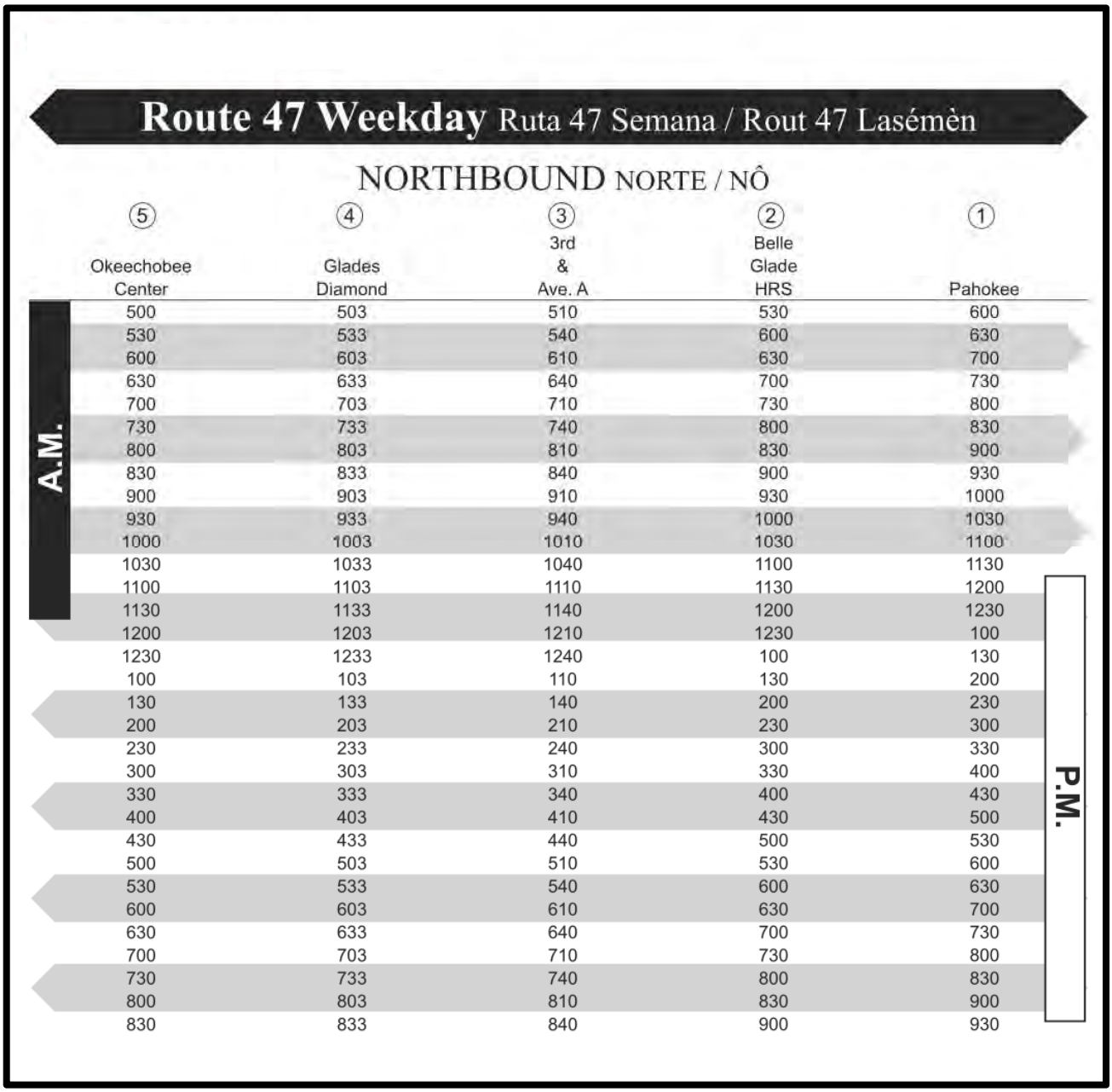
Figure 7. Route 40 - Existing route map.

Route 47 – Pahokee to Belle Glade via S.R. 15

The Route 47 operates in Belle Glade service area weekdays, Saturdays, and Sundays. Table 2 shows the existing service characteristics for Route 47. During those hours the Route 47 serves Pahokee City Hall, Pahokee, Lakeside Medical Center, HRS, Belle Glade Airport, Palm Beach County Library, and the Okeechobee Center. Figure 14 displays the existing route map for Route 47.

Table 2. Route 47- Pahokee to Belle Glade via S.R. 15

Days of Service	Hours of Service	Frequency
Monday through Friday	5:00 am to 9:30 pm	Every 30 minutes
Saturdays	8:30 am to 9:02 pm	Every 60 minutes
Sundays	9:30 am to 7:30 pm	Every 60 minutes



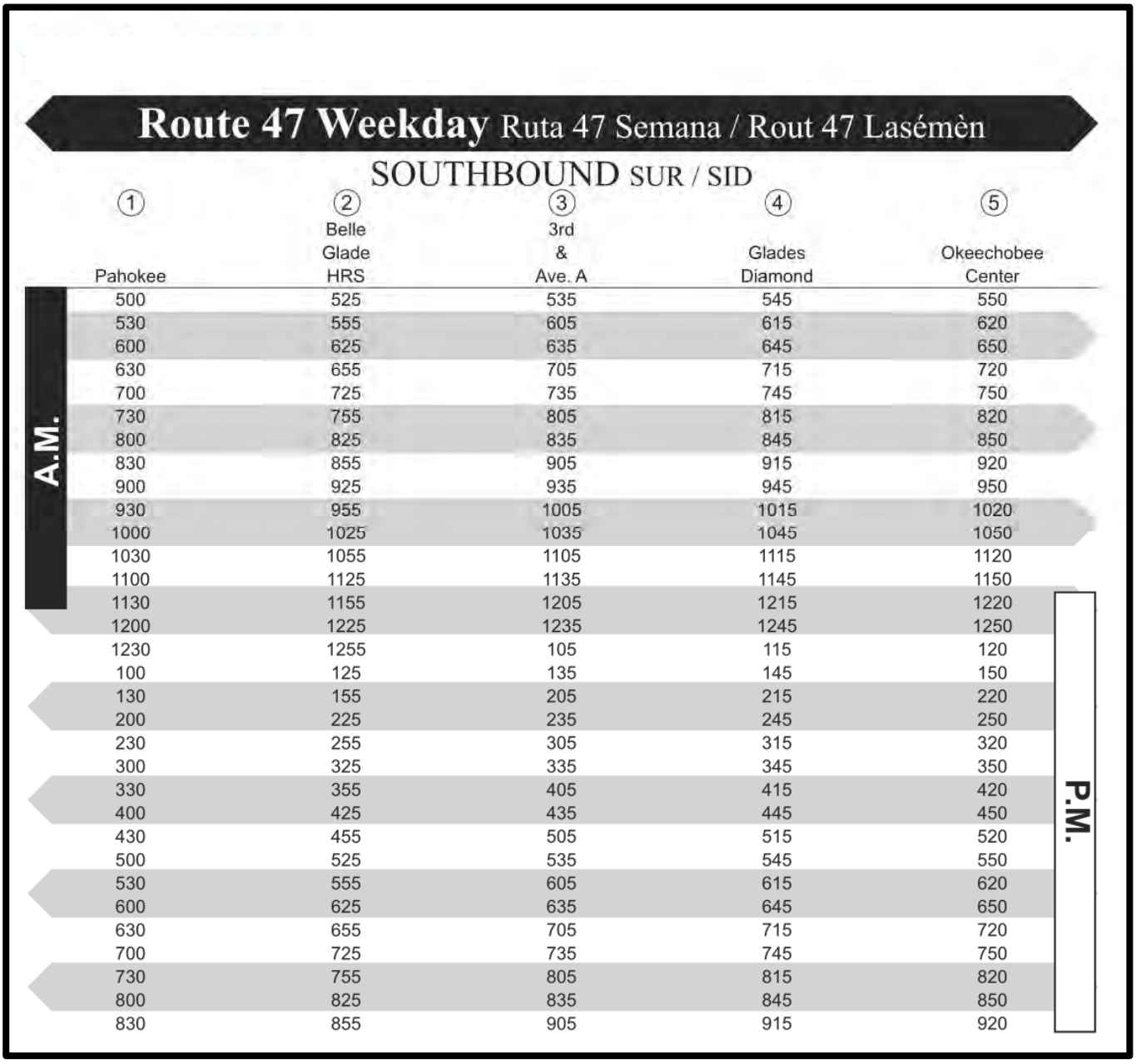
Route 47 Weekday Ruta 47 Semana / Rout 47 Lasémèn

NORTHBOUND NORTE / NÔ

	⑤ Okeechobee Center	④ Glades Diamond	③ 3rd & Ave. A	② Belle Glade HRS	① Pahokee
A.M.	500	503	510	530	600
	530	533	540	600	630
	600	603	610	630	700
	630	633	640	700	730
	700	703	710	730	800
	730	733	740	800	830
	800	803	810	830	900
	830	833	840	900	930
	900	903	910	930	1000
	930	933	940	1000	1030
	1000	1003	1010	1030	1100
	1030	1033	1040	1100	1130
	1100	1103	1110	1130	1200
	1130	1133	1140	1200	1230
	1200	1203	1210	1230	100
	1230	1233	1240	100	130
	100	103	110	130	200
	130	133	140	200	230
	200	203	210	230	300
	230	233	240	300	330
	300	303	310	330	400
	330	333	340	400	430
	400	403	410	430	500
	430	433	440	500	530
	500	503	510	530	600
	530	533	540	600	630
	600	603	610	630	700
	630	633	640	700	730
	700	703	710	730	800
	730	733	740	800	830
	800	803	810	830	900
	830	833	840	900	930

P.M.

Figure 8. Route 47 - Weekday – Northbound.

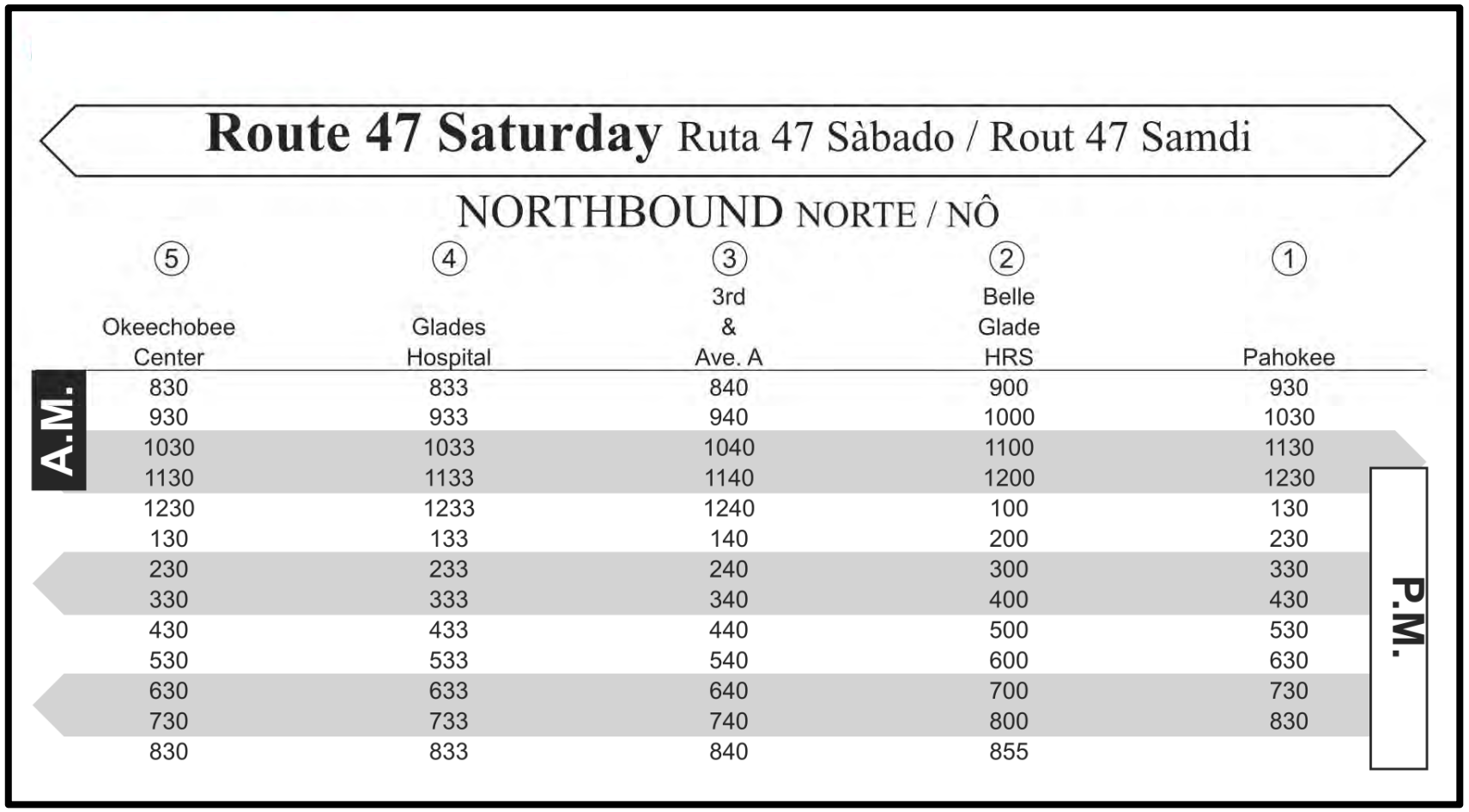


Route 47 Weekday Ruta 47 Semana / Rout 47 Lasémèn

SOUTHBOUND SUR / SID

	① Pahokee	② Belle Glade HRS	③ 3rd & Ave. A	④ Glades Diamond	⑤ Okeechobee Center	
A.M.	500	525	535	545	550	
	530	555	605	615	620	
	600	625	635	645	650	
	630	655	705	715	720	
	700	725	735	745	750	
	730	755	805	815	820	
	800	825	835	845	850	
	830	855	905	915	920	
	900	925	935	945	950	
	930	955	1005	1015	1020	
	1000	1025	1035	1045	1050	
	1030	1055	1105	1115	1120	
	1100	1125	1135	1145	1150	
	1130	1155	1205	1215	1220	
	1200	1225	1235	1245	1250	
	1230	1255	105	115	120	
	100	125	135	145	150	
	130	155	205	215	220	
	200	225	235	245	250	
	230	255	305	315	320	
	300	325	335	345	350	
	330	355	405	415	420	
	400	425	435	445	450	
	430	455	505	515	520	
	500	525	535	545	550	
	530	555	605	615	620	
	600	625	635	645	650	
	630	655	705	715	720	
	700	725	735	745	750	
	730	755	805	815	820	
	800	825	835	845	850	
	830	855	905	915	920	P.M.

Figure 9. Route 47 - Weekday – Southbound.

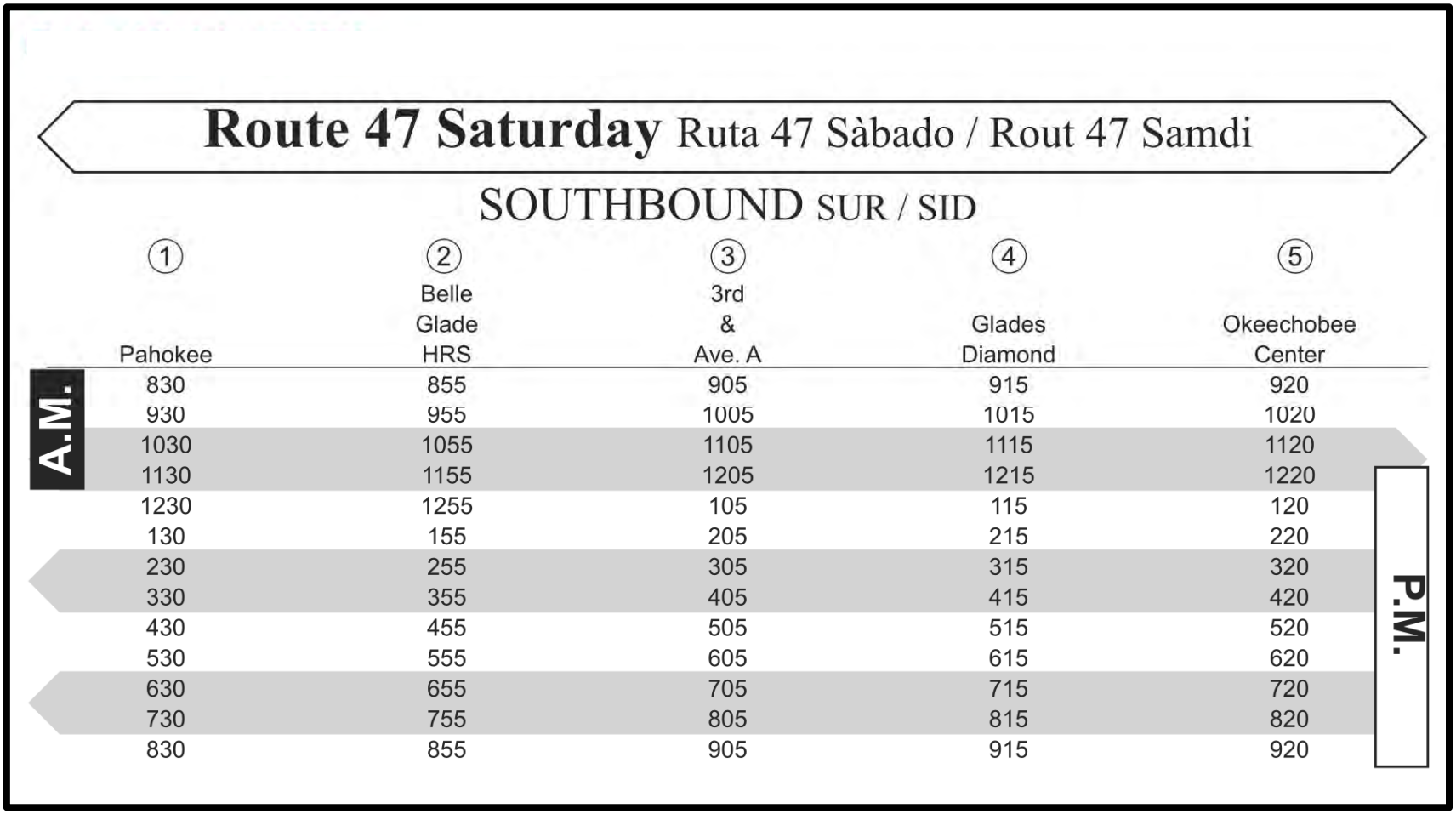


Route 47 Saturday Ruta 47 Sàbado / Rout 47 Samdi

NORTHBOUND NORTE / NÔ

	⑤ Okeechobee Center	④ Glades Hospital	③ 3rd & Ave. A	② Belle Glade HRS	① Pahokee
A.M.	830	833	840	900	930
	930	933	940	1000	1030
	1030	1033	1040	1100	1130
	1130	1133	1140	1200	1230
	1230	1233	1240	100	130
	130	133	140	200	230
	230	233	240	300	330
	330	333	340	400	430
	430	433	440	500	530
	530	533	540	600	630
	630	633	640	700	730
	730	733	740	800	830
	830	833	840	855	P.M.

Figure 10. Route 47 - Saturday – Northbound.

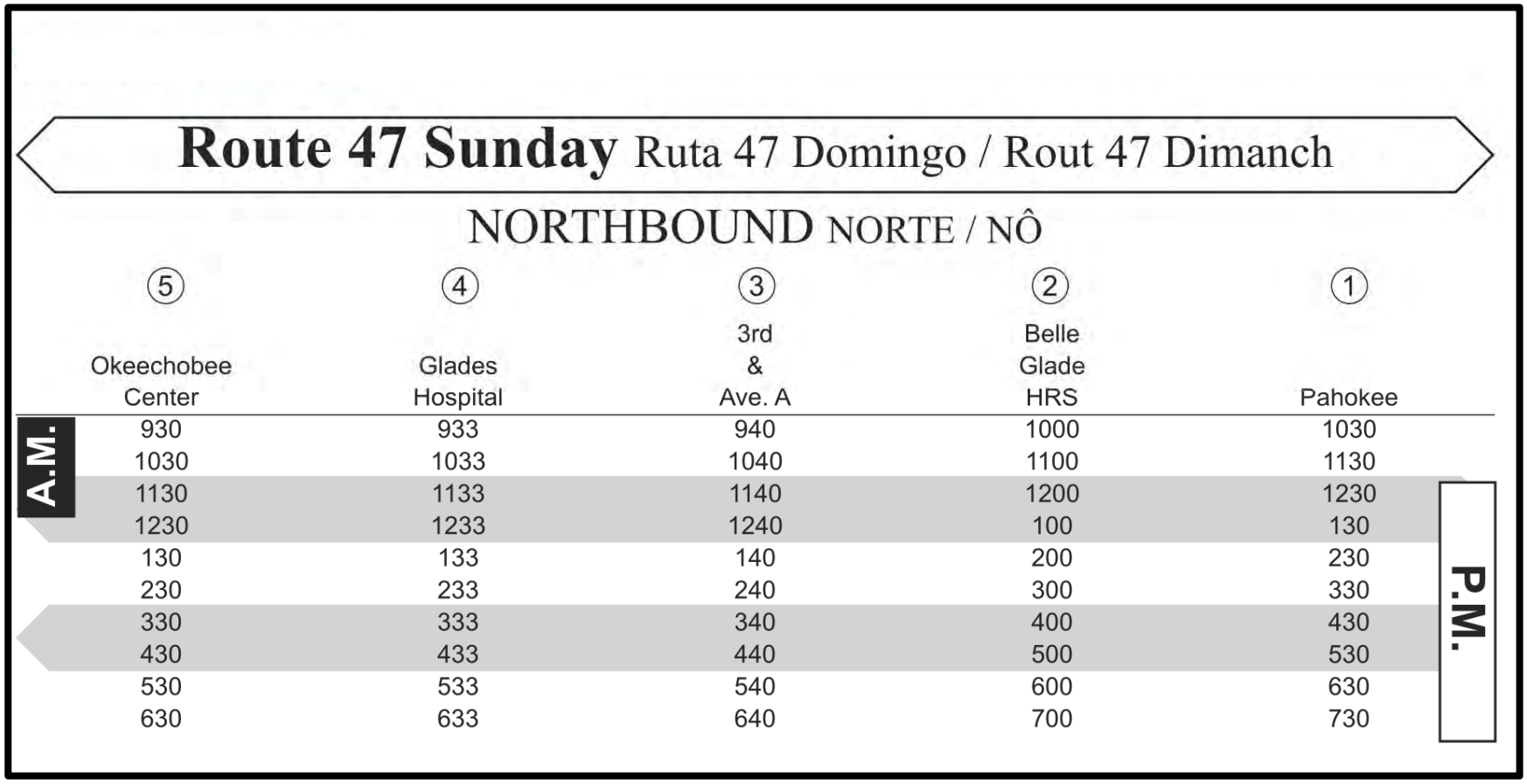


Route 47 Saturday Ruta 47 Sàbado / Rout 47 Samdi

SOUTHBOUND SUR / SID

	① Pahokee	② Belle Glade HRS	③ 3rd & Ave. A	④ Glades Diamond	⑤ Okeechobee Center	
A.M.	830	855	905	915	920	
	930	955	1005	1015	1020	
	1030	1055	1105	1115	1120	
	1130	1155	1205	1215	1220	
	1230	1255	105	115	120	
	130	155	205	215	220	
	230	255	305	315	320	
	330	355	405	415	420	
	430	455	505	515	520	
	530	555	605	615	620	
	630	655	705	715	720	
	730	755	805	815	820	
	830	855	905	915	920	P.M.

Figure 11. Route 47 - Saturday – Southbound.



Route 47 Sunday Ruta 47 Domingo / Rout 47 Dimanch

NORTHBOUND NORTE / NÔ

	⑤ Okeechobee Center	④ Glades Hospital	③ 3rd & Ave. A	② Belle Glade HRS	① Pahokee
A.M.	930	933	940	1000	1030
	1030	1033	1040	1100	1130
	1130	1133	1140	1200	1230
	1230	1233	1240	100	130
	130	133	140	200	230
	230	233	240	300	330
	330	333	340	400	430
	430	433	440	500	530
	530	533	540	600	630
	630	633	640	700	730
P.M.					

Figure 12. Route 47 - Sunday – Northbound.

Route 47 Sunday Ruta 47 Domingo / Rout 47 Dimanch

SOUTHBOUND SUR / SID

	① Pahokee	② Belle Glade HRS	③ 3rd & Ave. A	④ Glades Diamond	⑤ Okeechobee Center	
A.M.	940	955	1005	1015	1020	
	1030	1055	1105	1115	1120	
	1130	1155	1205	1215	1220	
	1230	1255	105	115	120	
	130	155	205	215	220	
	230	255	305	315	320	
	330	355	405	415	420	
	430	455	505	515	520	
	530	555	605	615	620	
	635	700	710			P.M.

Figure 13. Route 47 - Sunday – Southbound.

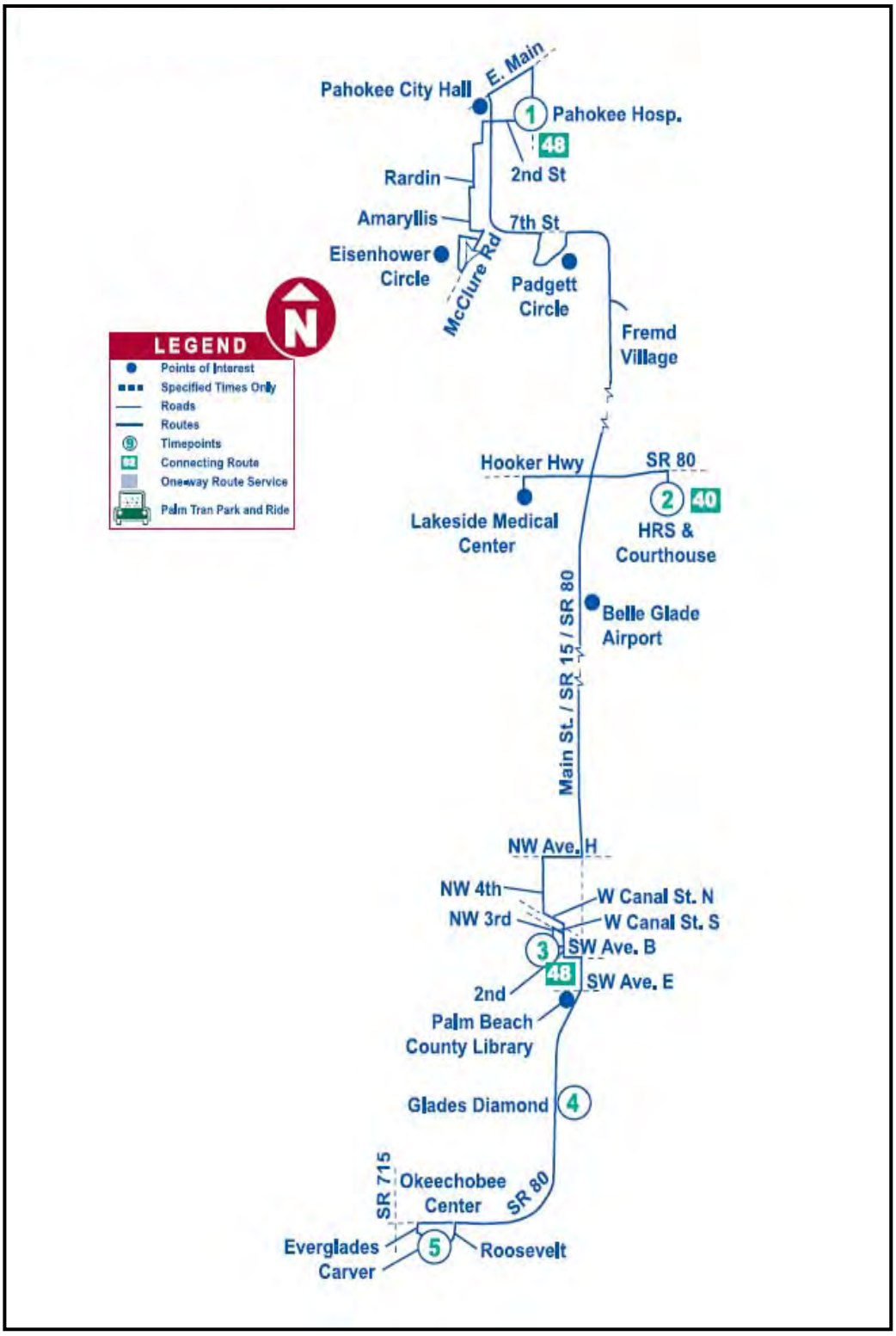


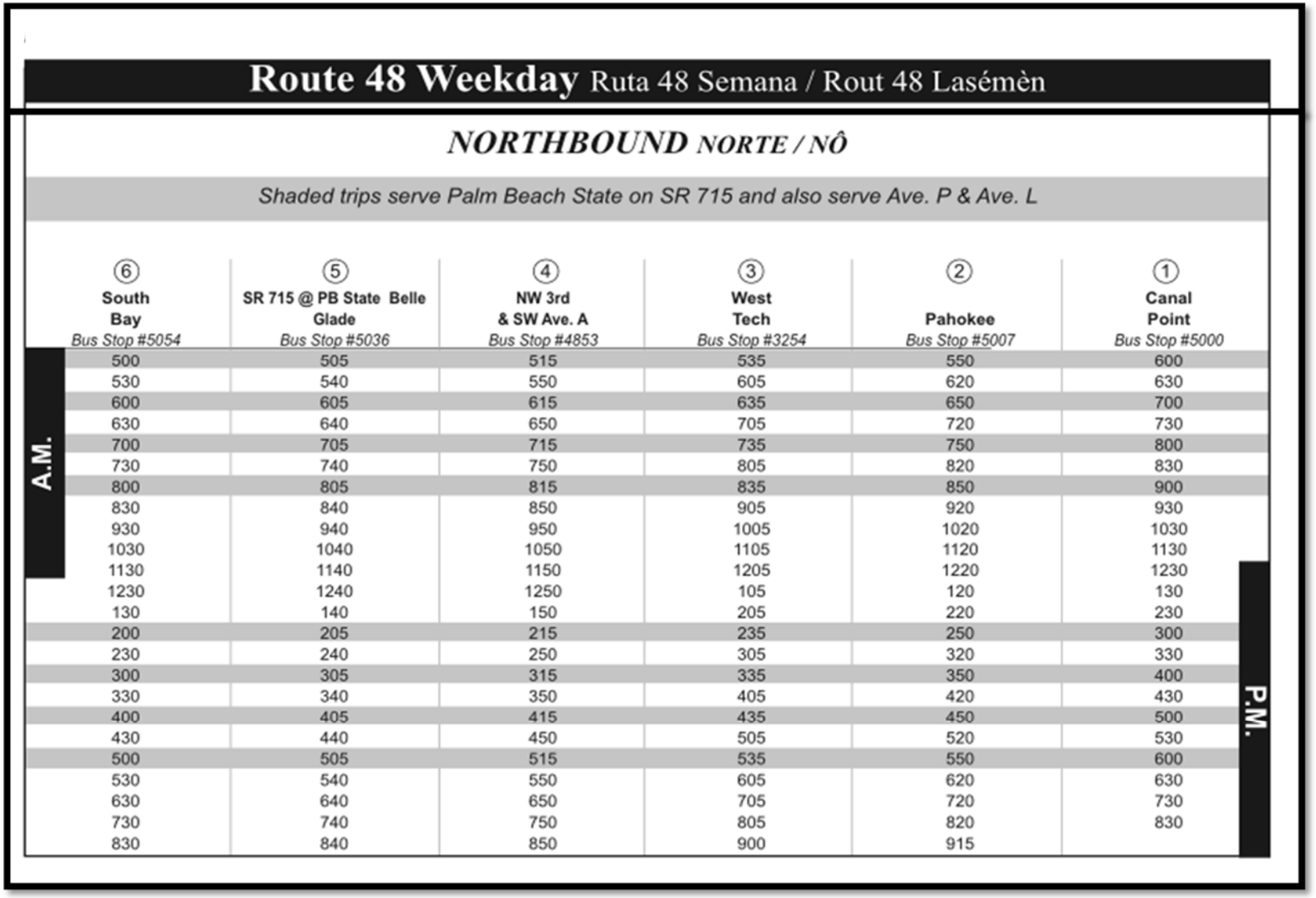
Figure 14. Route 47 - Existing route map.

Route 48 – South Bay to Canal Point via S.R. 715

The Route 48 operates in Belle Glade service area weekdays, Saturdays, and Sundays. Table 3 shows the existing service characteristics for Route 48. During those hours the Route 48 serves the Okeechobee Center, Clarence E. Anthony Library, Glades Central High School, Palm Beach State College, Belle Glade Library, Osceola Center, West Tech Educational Center, Padgett Park, Pahokee Airport, Loula V. York Library, Pahokee City Hall, and Canal Point. Figure 21 displays the existing route map for Route 48.

Table 3. Route 48 - South Bay to Canal Point via S.R. 715

Days of Service	Hours of Service	Frequency
Monday through Friday	5:00 am to 9:15 pm	Every 30 minutes peak/ 60 minutes off-peak
Saturdays	6:30 am to 9:10 pm	Every 60 minutes
Sundays	9:30 am to 7:35 pm	Every 60 minutes



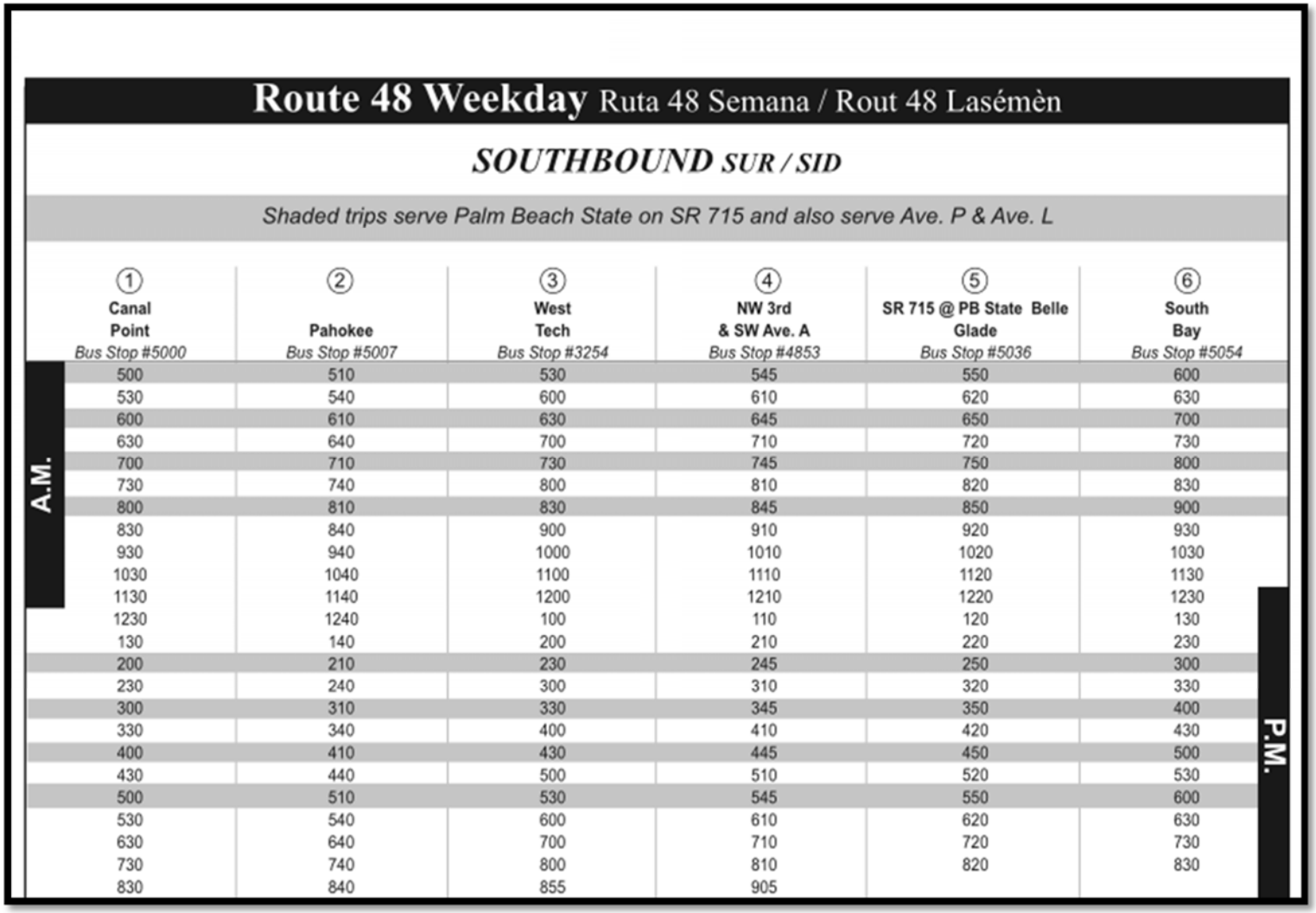
Route 48 Weekday Ruta 48 Semana / Rout 48 Lasémèn

NORTHBOUND NORTE / NÔ

Shaded trips serve Palm Beach State on SR 715 and also serve Ave. P & Ave. L

	⑥ South Bay *Bus Stop #5054*	⑤ SR 715 @ PB State Belle Glade *Bus Stop #5036*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	③ West Tech *Bus Stop #3254*	② Pahokee *Bus Stop #5007*	① Canal Point *Bus Stop #5000*	
A.M.	500	505	515	535	550	600	
	530	540	550	605	620	630	
	600	605	615	635	650	700	
	630	640	650	705	720	730	
	700	705	715	735	750	800	
	730	740	750	805	820	830	
	800	805	815	835	850	900	
	830	840	850	905	920	930	
	930	940	950	1005	1020	1030	
	1030	1040	1050	1105	1120	1130	
	1130	1140	1150	1205	1220	1230	
	1230	1240	1250	105	120	130	
	130	140	150	205	220	230	
	200	205	215	235	250	300	
	230	240	250	305	320	330	
	300	305	315	335	350	400	
	330	340	350	405	420	430	
	400	405	415	435	450	500	
	430	440	450	505	520	530	
	500	505	515	535	550	600	
	530	540	550	605	620	630	
	630	640	650	705	720	730	
	730	740	750	805	820	830	
	830	840	850	900	915		P.M.

Figure 15: Route 48 - Weekday – Northbound.



Route 48 Weekday Ruta 48 Semana / Rout 48 Lasémèn

SOUTHBOUND SUR / SID

Shaded trips serve Palm Beach State on SR 715 and also serve Ave. P & Ave. L

	① Canal Point *Bus Stop #5000*	② Pahokee *Bus Stop #5007*	③ West Tech *Bus Stop #3254*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	⑤ SR 715 @ PB State Belle Glade *Bus Stop #5036*	⑥ South Bay *Bus Stop #5054*	
A.M.	500	510	530	545	550	600	
	530	540	600	610	620	630	
	600	610	630	645	650	700	
	630	640	700	710	720	730	
	700	710	730	745	750	800	
	730	740	800	810	820	830	
	800	810	830	845	850	900	
	830	840	900	910	920	930	
	930	940	1000	1010	1020	1030	
	1030	1040	1100	1110	1120	1130	
	1130	1140	1200	1210	1220	1230	
	1230	1240	100	110	120	130	
	130	140	200	210	220	230	
	200	210	230	245	250	300	
	230	240	300	310	320	330	
	300	310	330	345	350	400	
	330	340	400	410	420	430	
	400	410	430	445	450	500	
	430	440	500	510	520	530	
	500	510	530	545	550	600	
	530	540	600	610	620	630	
	630	640	700	710	720	730	
	730	740	800	810	820	830	
	830	840	855	905			P.M.

Figure 16. Route 48 - Weekday – Southbound.

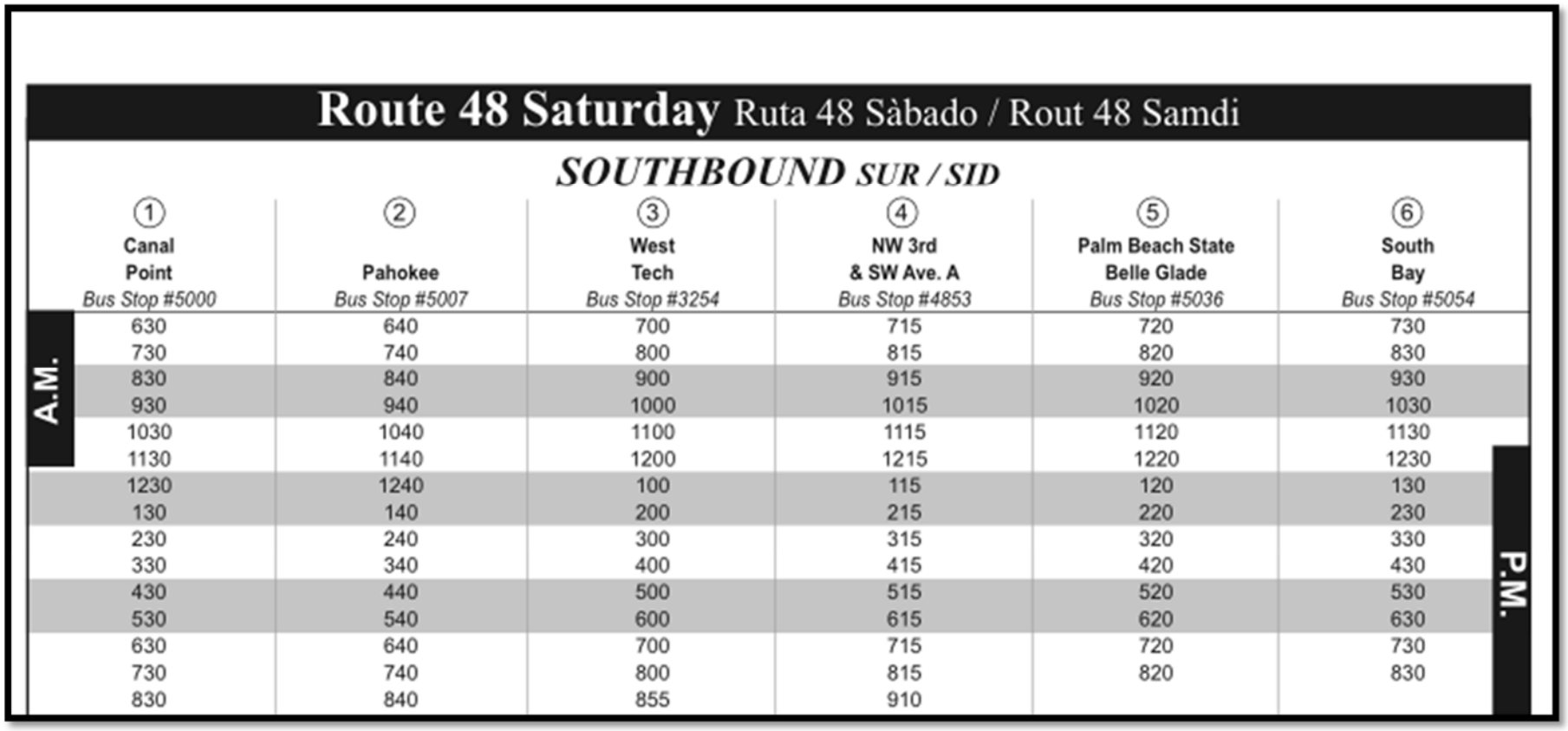
Route 48 Saturday Ruta 48 Sàbado / Rout 48 Samdi

NORTHBOUND NORTE / NÔ

	⑥ South Bay *Bus Stop #5054*	⑤ Palm Beach State Belle Glade *Bus Stop #5036*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	③ West Tech *Bus Stop #3254*	② Pahokee *Bus Stop #5007*	① Canal Point *Bus Stop #5000*
A.M.	730	735	745	805	820	830
	830	835	845	905	920	930
	930	935	945	1005	1020	1030
	1030	1035	1045	1105	1120	1130
	1130	1135	1145	1205	1220	1230
	1230	1235	1245	105	120	130
	130	135	145	205	220	230
	230	235	245	305	320	330
	330	335	345	405	420	430
	430	435	445	505	520	530
	530	535	545	605	620	630
	630	635	645	705	720	730
	730	735	745	805	820	830
	830	835	845			

P.M.

Figure 17. Route 48 - Saturday – Northbound.



Route 48 Saturday Ruta 48 Sàbado / Rout 48 Samdi

SOUTHBOUND SUR / SID

	① Canal Point *Bus Stop #5000*	② Pahokee *Bus Stop #5007*	③ West Tech *Bus Stop #3254*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	⑤ Palm Beach State Belle Glade *Bus Stop #5036*	⑥ South Bay *Bus Stop #5054*	
A.M.	630	640	700	715	720	730	
	730	740	800	815	820	830	
	830	840	900	915	920	930	
	930	940	1000	1015	1020	1030	
	1030	1040	1100	1115	1120	1130	
	1130	1140	1200	1215	1220	1230	
	1230	1240	100	115	120	130	
	130	140	200	215	220	230	
	230	240	300	315	320	330	
	330	340	400	415	420	430	P.M.
	430	440	500	515	520	530	
	530	540	600	615	620	630	
	630	640	700	715	720	730	
	730	740	800	815	820	830	
	830	840	855	910			

Figure 18. Route 48 - Saturday – Southbound.

Route 48 Sunday Ruta 48 Domingo / Rout 48 Dimanch

NORTHBOUND NORTE / NÔ

	⑥ South Bay *Bus Stop #5054*	⑤ Palm Beach State Belle Glade *Bus Stop #5046*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	③ West Tech *Bus Stop #3254*	② Pahokee *Bus Stop #5007*	① Canal Point *Bus Stop #5000*	
A.M.	930	935	945	1005	1020	1030	
	1030	1035	1045	1105	1120	1130	
	1130	1135	1145	1205	1220	1230	
	1230	1235	1245	105	120	130	
	130	135	145	205	220	230	
	230	235	245	305	320	330	
	330	335	345	405	420	430	
	430	435	445	505	520	530	
	530	535	545	605	620	630	
	630	635	645	705	720		P.M.

Figure 19. Route 48 - Sunday – Northbound.

Route 48 Sunday Ruta 48 Domingo / Rout 48 Dimanch

SOUTHBOUND SUR / SID

	① Canal Point *Bus Stop #5000*	② Pahokee *Bus Stop #5007*	③ West Tech *Bus Stop #3254*	④ NW 3rd & SW Ave. A *Bus Stop #4853*	⑤ Palm Beach State Belle Glade *Bus Stop #5046*	⑥ South Bay *Bus Stop #5054*	
A.M.		945	1000	1015	1020	1030	
	1030	1040	1100	1115	1120	1130	
	1130	1140	1200	1215	1220	1230	
	1230	1240	100	115	120	130	
	130	140	200	215	220	230	
	230	240	300	315	320	330	
	330	340	400	415	420	430	
	430	440	500	515	520	530	
	530	540	600	615	620	630	P.M.

Figure 20. Route 48 - Sunday – Southbound.

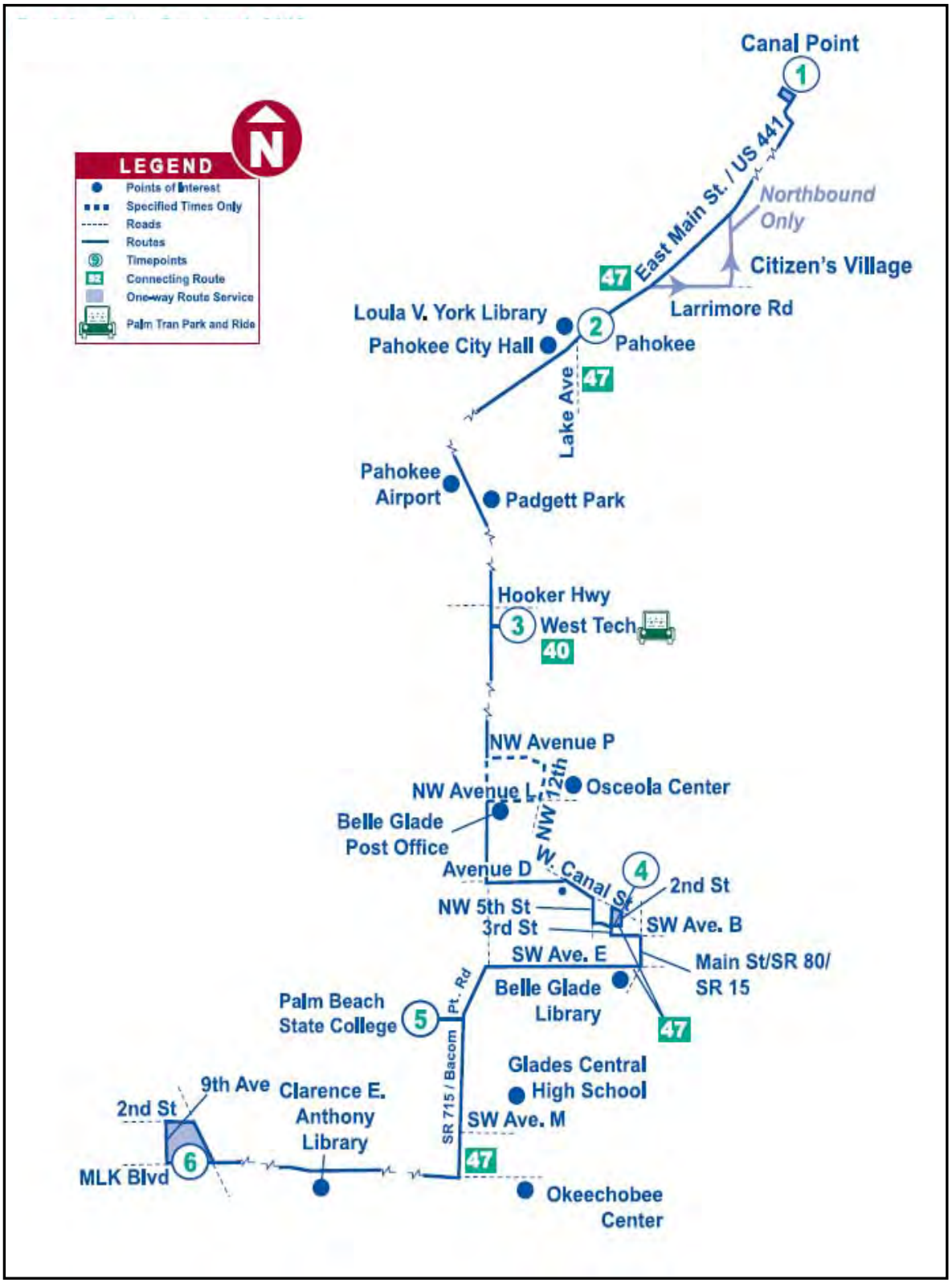


Figure 21. Route 48 - Existing route map.

Local Transit Service in Belle Glade – The Belle Glade Express

The City of Belle Glade recognized the need to promote economic growth for citizens by offering public transportation that could provide greater access to jobs throughout the various areas of business, agriculture, medical, and other service type industries. The City researched Palm Tran Service (Palm Beach County) which provides three routes (Route 40, 47, and 48) with a number of pickup stops on the three primary state roads. The new Belle Glade Express transit service avoids duplication, while providing transit service and better access to the Palm Tran routes which provide transportation to other destinations within Palm Beach County.

The Metropolitan Planning Organization (MPO) was extremely interested and supportive of the City's management group and the City Commission's involvement in the public transit system and helped with every facet of the design and layout of the City routes.

The City's objective was to provide transit to the walking public, the elderly, and the transportation challenged. Routes were planned, with the MPO's guidance, for the following:

- Elderly Living Facilities
- Medical Offices & Hospital
- Senior Care and/or Entertainment Centers
- Migrant & very low income housing areas
- Food & Services areas
- Downtown Area
- Key Exchange points for the Palm Tran Pickups/Drop offs
- Schools, College & training Centers
- Utilities

Once the design was completed the MPO & FDOT provided support with the transit system grant application. The initial first year grant was awarded for $350,000, years two and three awards were for approximately $750,000. These two grants provided funding for operations of the four bus routes and can be seen in Figure 22.

Year three funding for the routes provided a funding opportunity for an ARRA grant which would provide funding for expansion of a new route and expansion of hours that would also support the citizen's ability to travel to jobs, and facilitated more opportunities for the unemployed seeking jobs. The hourly expansion increased from 8 hours per day to 15 hours per day, Monday thru Friday. The weekend hours remained the same. An additional bus route was added and this route (Purple Route) provided hourly service and allowed travel beyond the City limits, better access to large facilities, and more job opportunities, This also provided the elderly with more social and medical support with service to:

- Social Security Offices
- Medical Offices Centre
- County Health Center
- Lakeside Hospital

- Glades Utility Authority
- County Senior Center, and
- County Court System & Palm Beach County Sheriff Department

When designing the routes consideration was given in order to not duplicate the Palm Tran Routes more than 25 percent and within reason since there are a few main roads that must be used to go from one area to the other. For cost effectiveness, each bus would run one short route every half hour in order to cover the North, South, East, & West areas within the City limits. The routes were planned to include the densely populated areas. Route maps & schedules were designed by City Staff & Lyons Printing, and route schedules were timed and laid out by City Staff & Coach America (now owned by Horizon Coach Lines) who was the transit system corporation that won the bid and were contracted for buses and full operation of transit service.

Due to the reduction in funding opportunities, two changes were instituted to reduce costs and increase the fare revenue. Fares were increased from $0.25 to $0.75 and weekend hours were reduced, due to a reduction in available grants. More importantly the grant that had two more renewals with $280,000 and an additional $215,000 are for the provision of access to work for the transit challenged public. The total daily revenue hours of operation are 45. The provider of the service Midnight Sun is compensated at an hourly rate of $46.82. The Belle Glade express annual budget is approximately $548,000. Total ridership for the last three years was as follows:

- 2010 = 29,000
- 2011 = 44,000
- 2012 = 54,000

Source: City of Belle Glade

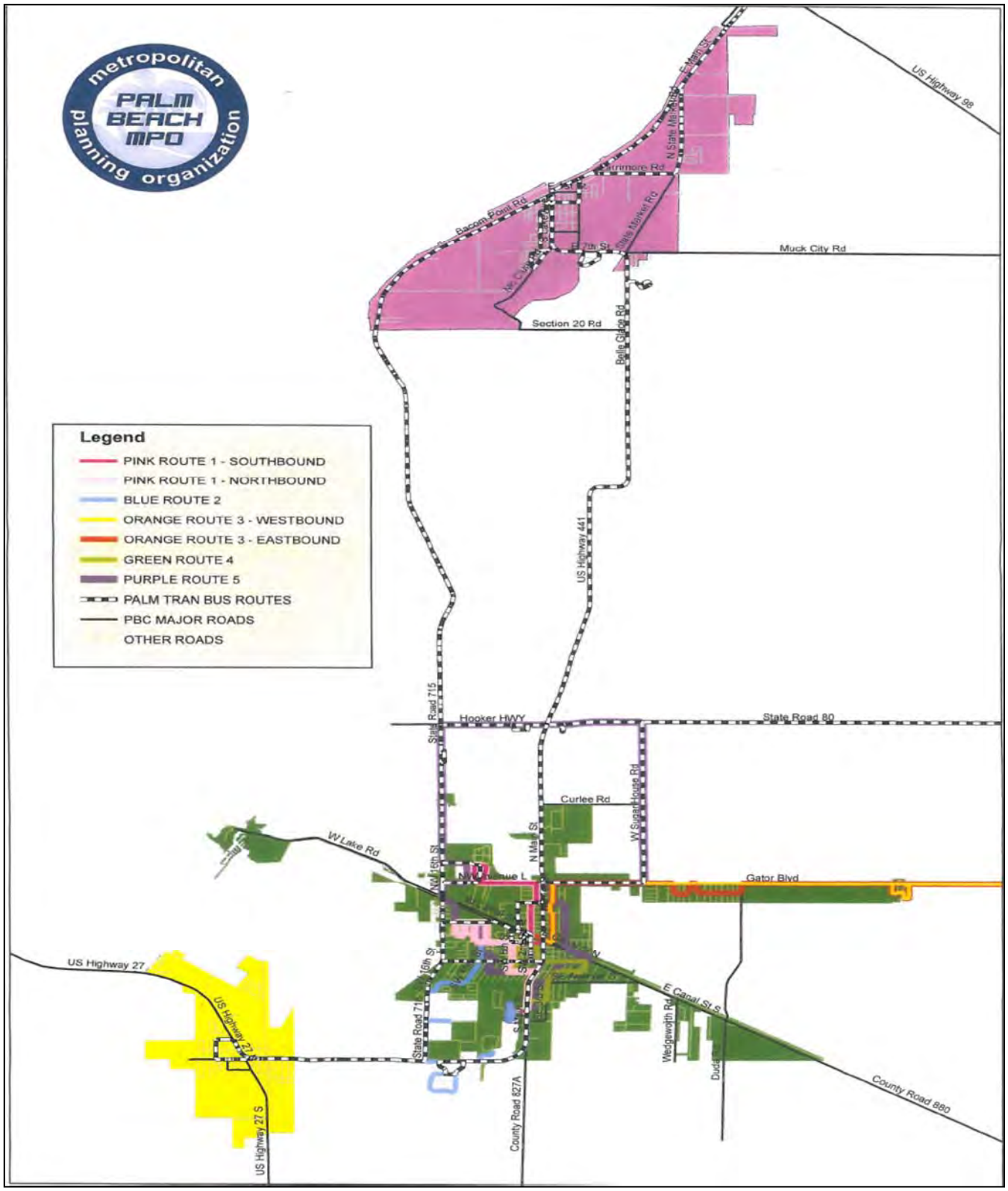


Figure 22. Belle Glade Express System Map

Data Collection Activities

This section entails a series of data collection and reporting activities undertaken by CUTR to inform the assessment of existing services in the Glades Region. Analyzed in this section are:

- Runcuts and Reliefs
- Annual Revenue Hours
- Primary Travel Corridors
- Transfer Locations
- Daily Departures at Transfer Locations
- Existing Ridership
- Current Transit Travel Times

Summary of Runcuts and reliefs

Run Number, Line Group and Block Number

The runcuts for three routes, the Route 40, the Route 47, and the Route 48 are included in this section. For any given shift, the run number refers to a unique operator work assignment. The Block number refers to the buses operating on a route and the line group refers to the unique route numbers within the PalmTran system. These numbers are used to organize scheduled service into increments that can be operated on weekdays, Saturdays and Sundays.

Start and Relief Locations

Start locations for bus pullouts include the Glades facility in Belle Glade and PalmTran's main facility located at 3201 Electronics Way. Relief locations are all located in Belle Glade and are listed below in Table 4 with the associated scheduling codes.

Table 4. Relief locations

Schedule Code	Location
GLADES	PalmTran's operating facility located in Belle Glade
MAIN	PalmTrans main operating facility located at 3201 Electronics Way in West Palm Beach
WTEC	West Technical Education Center located at 2625 State Road 715
3AVA	Third Avenue A located in Downtown Belle Glade
BHRS	HRS Office located at 38754 State Road 80 in Belle Glade
GDIA	Housing development located at 100 Downs Circle in Belle Glade
IMTC	Intermodal Transit Center located in Downtown West Palm Beach
MAWG	The Mall at Wellington Green located at 10300 West Forest Hill Boulevard in Wellington

Platform Times

Platform time refers to the time that the bus is in service and the operator is picking up and dropping off passengers. This is in contrast to report time and deadhead time which are other types of pay time for operators.

Run Types

Run types refer to nature of the times for each assignment. There are straight runs which are either of a duration of 8 or 10 hours, two piece runs that have a spread time between two assignments and are either of a 8 or 10 hour duration, and part-time, less than 8 hours.

Pullouts and Reliefs

A pullout refers to a shift that begins at the garage. Reliefs refer to shifts in which operators report to a different location to assume service other than the garage. On weekdays, there are a total of 13 pullouts and 8 reliefs. On Saturday, there are 7 pullouts and 5 reliefs. On Sunday there are 5 pullouts and 3 reliefs.

Total Daily Revenue Hours – Weekday, Saturday and Sunday

There are a total of 186.78 revenue hours of service for the three routes on weekdays, annualized to 47,069 revenue hours at 252 weekdays. On Saturday, there are 93.5 revenue hours annualized to 4,862 revenue hours at 52 Saturdays. On Sunday, there are 59.83 revenue hours annualized to 3,111 revenue hours at 52 Sundays. Total annual revenue hours for the three routes are 55.042. Tables 5, 6, and 7 display the runcuts for the PalmTran Routes 40, 47, and 48 operating out of the Glades facility. Tables 8, 9, and 10 displays the runcuts for the three routes operating out of the Main facility.

Table 5. Weekday Run cut – Routes 40, 47 and 48 – Glades Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
2001	GLADES	4:40	13:15	8:35		BHRS	47	4701	AM Str 8	P
2002	GLADES	4:42	12:00	7:18		GLADES	40	4001	AM Str 8	P
2003	GLADES	4:45	13:10	8:25		3AVA	47	4702	AM Str 8	P
2004	GLADES	5:05	13:00	7:55		WTEC	48	4804	AM Str 8	P
2005	GLADES	5:10	12:15	7:05		GDIA	47	4703	AM Str 8	P
2006	GLADES	5:10	13:45	8:35		3AVA	48	4803	AM Str 8	P
2007	GLADES	5:15	13:40	8:25		3AVA	47	4704	AM Str 8	P
2008	WTEC	13:00	21:35	8:35		GLADES	48	4804	PM Str 8	R
2009	3AVA	13:10	21:05	7:55		GLADES	47	4702	PM Str 8	R
2010	BHRS	13:15	21:20	8:05		GLADES	47	4701	PM Str 8	R
2011	3AVA	13:45	21:20	7:35		GLADES	48	4803	PM Str 8	R
2401	GDIA	12:15	21:50	9:35		GLADES	47	4703	AM Str 10	R
2402	BHRS	12:16	22:14	9:58		GLADES	40	4003	PM Str 10	R
2403	GLADES	4:35	9:25	4:50		GLADES	48	4802	2Pce 10	P
2403	GLADES	13:40	18:20	4:40		GLADES	48	4806	2Pce 10	P
2404	GLADES	4:40	9:20	4:40		GLADES	48	4801	2Pce 10	P
2404	GLADES	13:35	18:25	4:50		GLADES	48	4805	2Pce 10	P
2405	GLADES	5:55	10:16	4:21		BHRS	40	4003	2Pce 10	P
2405	GLADES	14:48	19:34	4:46		GLADES	40	4007	2Pce 10	P
2406	BHRS	10:16	12:16	2:00		BHRS	40	4003	2Pce 10	R
2406	3AVA	13:40	21:35	7:55		GLADES	47	4704	2Pce 10	R
	Totals			146:03:00	146.05					

Table 6. Saturday Runcut – Routes 40, 47 and 48 – Glades Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
2001	GLADES	6:05	13:45	7:40		3AVA	48	4832	AM Str 8	P
2002	GLADES	6:50	14:00	7:10		GLADES	40	4031	AM Str 8	P
2003	BHRS	12:54	21:05	8:11		GLADES	40	4033	PM Str 8	R
2004	3AVA	13:45	21:20	7:35		GLADES	48	4832	PM Str 8	R
2005	GLADES	7:05	12:00	4:55		WTEC	48	4831	2Pce 8	P
2005	GLADES	14:48	17:34	2:46		GLADES	40	4034	2Pce 8	P
2401	GLADES	8:05	17:55	9:50		BHRS	47	4731	AM Str 10	P
2402	WTEC	12:00	22:14	10:14		GLADES	48	4831	PM Str 10	R
2403	GLADES	8:15	14:05	5:50		3AVA	47	4732	2Pce 10	P
2403	BHRS	17:55	21:35	3:40		GLADES	47	4731	2Pce 10	R
2404	GLADES	9:05	12:54	3:49		BHRS	40	4033	2Pce 10	P
2404	3AVA	14:05	21:05	7:00		GLADES	47	4732	2Pce 10	R
				78:40:00	78.67					

Table 7. Sunday Runcut – Routes 40, 47 and 48 – Glades Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
2001	GLADES	9:20	16:55	7:35		BHRS	47	4762	AM Str 8	P
2002	GLADES	10:05	18:05	8:00		GLADES	40	4062	AM Str 8	P
2003	3AVA	12:45	19:40	6:55		GLADES	48	4862	PM Str 8	R
2004	GLADES	9:25	12:45	3:20		3AVA	48	4862	2Pce 8	P
2004	WTEC	16:00	19:50	3:50		GLADES	48	4861	2Pce 8	R
2401	GLADES	9:15	19:15	10:00		GLADES	47	4761	AM Str 10	P
2402	GLADES	9:15	16:00	6:45		WTEC	48	4861	2Pce 10	P
2402	BHRS	16:55	19:50	2:55		GLADES	47	4762	2Pce 10	R
	Totals			49:20:00	49.33					
	Grand Total			274:03:00	274.05					

Table 8. Weekday Runcut – Routes 40 – Main Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
1018	IMTC	9:25	16:45	7:20		IMTC	40	4002	AM Str 8	R
1040	MAIN	15:05	20:30	5:25		MAIN	40	4009	2Pce 8	P
1427	MAIN	5:15	9:25	4:10		IMTC	40	4002	2Pce 10	P
1431	MAIN	5:40	8:39	2:59		MAIN	40	4004	2Pce 10	P
1437	MAIN	16:35	19:30	2:55		MAIN	40	4010	2Pce 10	P
1455	IMTC	16:45	20:55	4:10		MAIN	40	4002	2Pce 10	R
1456	MAIN	7:15	10:30	3:15		MAIN	40	4006	2Pce 10	P
1457	MAIN	14:40	21:30	6:50		MAIN	40	4008	2Pce 10	P
1805	MAIN	6:15	9:55	3:40		MAIN	40	4005	AM PT	P
	Totals			40:44:00	40.73					

Table 9. Saturday Runcut – Routes 40, 47 and 48 – Main Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
1008	MAIN	6:40	15:00	8:20		MAWG	40	4032	AM Str 8	P
1423	MAWG	15:00	21:30	6:30		MAIN	40	4032	2Pce 10	R
				14:50	14.83					

Table 10. Sunday Runcut – Routes 40, 47 and 48 – Main Facility

Run Number	From	Time On	Time Off	Platform Time	Converted to Decimals	To	Line Group	Block	Run Type	Pullout or Relief
1408	MAIN	9:40	20:10	10:30		MAIN	40	4061	AM Str 10	P
	Total			10:30	10.5					
	Grant Total			66:04:00	66.07					

Annual Revenue Hours

Aggregated hours between the Main and Glades facilities yield that there are 186.78 weekday revenue hours, 93.5 Saturday revenue hours, and 59.83 Sunday revenue hours of service (see Table 11). Annualized, there are a total of 55,542.23 annual revenue hours of service in the Glades Region.

Table 11. Annual Revenue Hours of Service – Glades Region

Garage	Total Weekday Revenue Hours	Total Annual Weekday Revenue Hours	Total Saturday Revenue Hours	Total Annual Saturday Revenue Hours	Total Sunday Revenue Hours	Total Annual Sunday Revenue Hours
Main	40.73	10,386.15	14.83	771.16	10.50	535.50
Glades	146.05	37,242.75	78.67	4,090.84	49.33	2,515.83
Total	186.78	47,628.90	93.50	4,862.00	59.83	3,051.33

Primary Travel Corridors

There are three primary travel corridors in the western service area; two are north/south corridors and one is east/west. The east/west corridor is Southern Boulevard which is also SR-80 and US-441. The eastern north/south corridor is Main Street which is also SR-80, SR-15, and US-441, served by the Routes 40 and 47. The western north/south corridor is SR-715, served by the Route 48.

Transfer Locations

On the West Palm Beach side, the Route 40 serves the Intermodal Transit Center in Downtown West Palm Beach and the Mall at Wellington Green. Dedicated transfer centers in the Glades region include West Tech where the Routes 40 and 48 meet and West County HRS where the Routes 40 and 47 meet. However, there are other locations where on-street transfers are possible for all three routes, especially in Belle Glade and Pahokee.

Daily Departures at Transfer Locations

Daily departures at transfer centers are a good indicator for the number of opportunities that passengers have each day to transfer between routes. As indicated above, the Route 40 serves the Intermodal Transit Center and the Mall at Wellington Green, but then intersects with the Route 47 at West County HRS and Route 48 at West Tech. The Route 40 has 15 departures in the eastbound and 15 departures in the westbound directions at West Tech whereas the Route 48 has 24 departures in the northbound and 24 departures in the southbound directions at West Tech. The Route 47 has 32 departures during the weekdays from the West

County HRS. Table 12, 13, and 14 display the daily departures at transfer locations for the Weekday, Saturday, and Sunday on the three routes.

Table 12. Daily Departures at Transfer Centers – Weekday

Transfer Location	Weekday daily departures in each direction at each location for the Routes:					
	40		47		48	
	Westbound	Eastbound	Northbound	Southbound	Northbound	Southbound
Intermodal Transit Center	14	12	N/A	N/A	N/A	N/A
Mall at Wellington Green	19	19	N/A	N/A	N/A	N/A
West Tech	15	15	N/A	N/A	24	24
West County HRS	19	19	32	32	N/A	N/A

Table 13. Daily Departures at Transfer Centers - Saturday

Transfer Location	Saturday daily departures in each direction at each location for the Routes:					
	40		47		48	
	Westbound	Eastbound	Northbound	Southbound	Northbound	Southbound
Intermodal Transit Center	N/A	N/A	N/A	N/A	N/A	N/A
Mall at Wellington Green	17	17	N/A	N/A	N/A	N/A
West Tech	12	13	N/A	N/A	13	15
West County HRS	17	17	13	13	N/A	N/A

Table 14. Daily Departures at Transfer Centers - Sunday

Transfer Location	Sunday daily departures in each direction at each location for the Routes:					
	40		47		48	
	Westbound	Eastbound	Northbound	Southbound	Northbound	Southbound
Intermodal Transit Center	N/A	N/A	N/A	N/A	N/A	N/A
Mall at Wellington Green	9	8	N/A	N/A	N/A	N/A
West Tech	9	8	N/A	N/A	10	10
West County HRS	9	8	10	10	N/A	N/A

Existing Ridership

In Fiscal Year 2012, the combined ridership in the Glades region was 635,000 passenger trips with 84 percent of passengers traveling on weekdays and 16 percent on weekends. The Glades Region productivity is also quite strong with 11 to 22 passengers per trip on weekdays and 13 to 15 passenger trips on Saturday. Passengers per hour are also strong for a rural region. Tables 15, 16, and 17 below display ridership for the Glades Region in FY 2012.

Table 15. Weekday Ridership – Glades Region – FY 2012

Route	Annual Ridership	Daily Average	# of One-Way Trips	Average Weekday Passengers per Trip	Average Weekday Passengers per Hour
40	215,274	841	39	22	15.27
47	187,885	734	64	11	12.83
48	132,782	519	48	11	11.11
Totals	535,941				
Daily Average		2,094			

Table 16. Saturday Ridership – Glades Region – FY 2012

Route	Annual Ridership	Daily Average	# of One-Way Trips	Average Saturday Passengers Per Trip	Average Saturday Passengers per Hour
40	26,386	507	34	15	16.57
47	21,932	422	26	16	17.89
48	20,020	385	29	13	13.74
Totals	68,338				
Daily Average		1,314			

Table 17. Sunday Ridership – Glades Region – FY 2012

Route	Annual Ridership	Daily Average	# of One-Way Trips	Average Sunday Passengers Per Trip	Average Sunday Passengers per Hour
40	12,534	261	17	15	18.31
47	9,858	205	20	10	11.54
48	7,907	165	20	8	8.42
Totals	30,299				
Daily Average		631			

Current Transit Travel Times

CUTR examined transit travel times for certain north/south and east/west destinations. Most notable is the current transit travel time between the Intermodal Transit Center in West Palm Beach and South Bay, which is the proxy location for the new Inland Logistics Center. That travel time is 2 hours and 5 minutes and entails a transfer between the Route 40 and the Route 48 at West Tech. For the three trips a day that serves the entire length of the Route 40, the travel time from South Lake Avenue/East 5th to the Intermodal Transit Center is 2 hours and 7 minutes. Regardless of whether a customer uses the Route 47 or 48, the travel time between Downtown Belle Glade and Downtown Pahokee is 35 minutes.

Travel time between Canal Point Community Center (northernmost point of service) to South Bay (southernmost point of service) is 60 minutes. From Canal Point Community Center to West Tech (transfer center) is on the Route 48 is 30 minutes while the travel time from South Bay to West Tech is also 30 minutes. From Okeechobee Center on the Route 47 to West County HRS (transfer center) the travel time is 25 minutes while the travel time from Pahokee to West County HRS is also 25 minutes.

Table 18. Current Transit Travel Times

From	To	Route	Transfer	Minutes	Minutes Converted to Hours
Canal Point Community Center	South Bay: MLK Blvd./9th Ave. Belle Glade	48		60	1.00
Canal Point Community Center	West Tech	48		30	0.50
Pahookee	West County HRS	47		30	0.50
South Bay: MLK Blvd./9th Ave. Belle Glade	West Tech	48		30	0.50
Okeechobee Center	West County HRS	47		30	0.50
Intermodal Transfer Center	South Bay: MLK Blvd./9th Ave. Belle Glade	40, 48	West Tech	125	2.08
S. Lake Ave./E. 5th Ave.*	Intermodal Transfer Center	40		127	2.12
Downtown Belle Glade	Downtown Pahookee	48		35	0.58
Downtown Belle Glade	Downtown Pahookee	47		35	0.58
Downtown Belle Glade	South Bay: MLK Blvd./9th Ave. Belle Glade	48		27	0.25
* Three trips daily.					

Pull-out and relief locations

All of the Route 40 runs that originate at the Intermodal Transit Center in West Palm Beach, whether pull-outs or reliefs, originate at PalmTran's main garage on Electronics. Correspondingly, all of the Route 47 and 48 runs, which remain in the Glades Region, have pull-outs and reliefs from the Belle Glade operating facility. Therefore, the pull-out and relief locations are optimized.

Operator Shifts

Of 30 total shifts on weekdays, 12 are straight 8-hour shifts and 2 are straight 10-hour shifts, for a total of 47 percent straight shifts. The remaining 53 percent are two piece 8-hours (one shift) and two piece 10-hour shifts (14 shifts) and one part-time shift. On Saturday, there are 7 straight shifts and 7 two piece shifts. On Sunday, there are 5 straight shifts and 4 two piece shifts. Without knowing the manner in which the remaining routes of PalmTran system routes are scheduled, CUTR's observation is that the agency should work to have as many straight shifts as possible to maximize productivity and reduce non-revenue time.

Route design in relation to Glades Service Area and PalmTran Service Area

Overall, the assessment of route design in the Glades Region is very positive. Routes are direct and provide good connectivity in both north-south directions and east-west directions. Ends-of-line are appropriately located as are transfer locations. Transfers between routes are timed to ensure the most seamless travel experiences for customers.

Service Frequencies

The assessment of service frequencies in the Glades region is also very favorable when comparing this rural service area to rural service areas in other counties and

regions. On weekdays, there is hourly service between West Tech and the ITC on Route 40 and 30 minutes frequency on Route 47. The Route 48 maintains 30 minute frequencies during the peak and 60 minute frequency during the off-peak. Service frequencies are at least hourly on weekends albeit with short spans of service.

Service span (Hours of Service)

The span (or hours of service) in the Glades region is very strong with most routes operating from approximately 5:00 a.m. to 10:00 p.m. on weekdays, which is a 17 hour span of service. However, span of service may need to be expanded once it is known whether the Inland Logistics Center is anticipated to be a 16- or 24-hour operation.

Weekday vs. Saturday vs. Sunday Service

Saturday service hours are 50% of weekday. Sunday service hours are 33 percent of weekday service hours. While this is a typical ratio of weekend to weekday service, Saturday and Sunday service may need to be increased if the Inland Logistics Center is a 7-day per week operation.

Peak vs. Off-peak Service Levels

Given the strong ridership levels and high productivity measures (passengers per hour), CUTR does not observe that peak vs. off-peak service is called for at this time.

Transit and pedestrian infrastructure

Since the HUD Challenge Grant initiative is significantly tied to necessary infrastructure improvements, combined with the fact that requirements of ADA bus stop accessibility have been strengthened over the past several years, a comprehensive study, and assessment of pedestrian infrastructure is needed to determine where new sidewalks and boarding pads should be located and constructed. This need is similar to the water and sewer infrastructure needs that have been identified in the Glades area. Route 47 deviates to serve Padgett Circle and Frend Village. The roadway is not ADA accessible due to guard rails along the roadway.

Utilization and effectiveness of Transfer Locations

Transfer locations are well located and well-utilized between the Routes 40, 47 and 48. There is an opportunity to provide greater linkages between the Glades Region and the Mall at Wellington Green while possibly de-emphasizing the Intermodal Transfer Center.

Below are ideas for future development of transit in the Glades region based on the overall HUD challenge grant. CUTR will discuss these with PalmTran staff for the next tech memo.

Opportunities for Future Development

In order to achieve a comprehensive mobility system serving the Inland Logistics Center as a major engine of economic development in the Glades region, the following existing and new services are complicated:

- At least one of the Belle Glade Express route will be extended to serve the Inland Logistics Center;
- PalmTran service will have a frequency standard of one bus every 20 minutes;
- Span of service will be increased to 18 hours per day from 5:00 a.m. to 11:00 p.m. to accommodate varied shifts spanning 24 hours; and
- Saturday and Sunday service will be greatly expanded to accommodate weekend shifts.

Glades Region Master Plan Scenarios for Mobility

One primary task for reorienting service in the Glades region is to determine a primary transfer center uniting Belle Glade, Pahokee, West Palm Beach, and the Inland Logistics Center. CUTR has developed two scenarios to address a regional master transit plan for the Glades area focusing on the future Inland Logistics Center (ILC):

- Scenario I: West Tech as primary transfer center; and
- Scenario II: The Inland Logistics Center as primary transfer center.

Each of these scenarios has advantages and challenges which will be discussed below. The scenarios incorporate new express routes, increased frequency on existing routes, and expansion of the span of service to routes serving the Glades area.

Scenario I – West Tech as Primary Transfer Center

One issue with Glades service, as it related to West Palm Beach, is the service area is an inverted "T", with the north south orientation between Belle Glade and Pahokee as the top of the "T" and SR 80 between Belle Glade and West Palm Beach as the bottom part of the "T". West Tech lies at the intersection of the lower and upper part of the T. Located on SR 715; it is the central point between Pahokee and Belle Glade and is served by the Route 48. West Tech is also near Lakeside Medical Center.

Scenario I focuses on West Tech located on S.R. 715 as the main transfer center for all routes serving the Glades area. Route 47 would be re-routed to serve West Tech and Routes 40, 48, the local Glades routes, would serve West Tech and will provide service 365 days a year from 5:00 a.m. until 11:00 p.m. The ILC would be served with 20 minute frequencies by Routes 47 and 48. An additional 12,152 revenue hours and an additional two buses for each route would be needed to provide this improved frequency and span of service.

The Route 40, which currently serves the West Palm Beach Intermodal Center (ITC) to Belle Glade via the Mall at Wellington Green (MWG), would discontinue serving from the ITC to MWG and would operate 20 minute service, 365 days per year from 5:00 a.m. until 11:00 p.m., between MWG and West Tech. An additional 23,300 revenue hours and four additional buses would be needed to enhance this service. The routing for Route 43 with service from Palm Tran's Intermodal Transit Center (ITC) to the Mall at Wellington Green but the span of service and frequency would be consistent with the other routes serving the Glades area. An additional 12,150 revenue hours and two additional buses would be required to enhance the Route 43.

Finally, a new route with express/limited stop service from the ITC to West Tech would operate with 20 minute frequencies from 5:00 a.m. until 11:00 p.m. Nine new buses and 51,200 revenue hours would be needed to provide this service. The cost for this service would be $13.4 million and a total of 19 additional buses. Scenario I's route configuration can be seen in Figure 23 below.

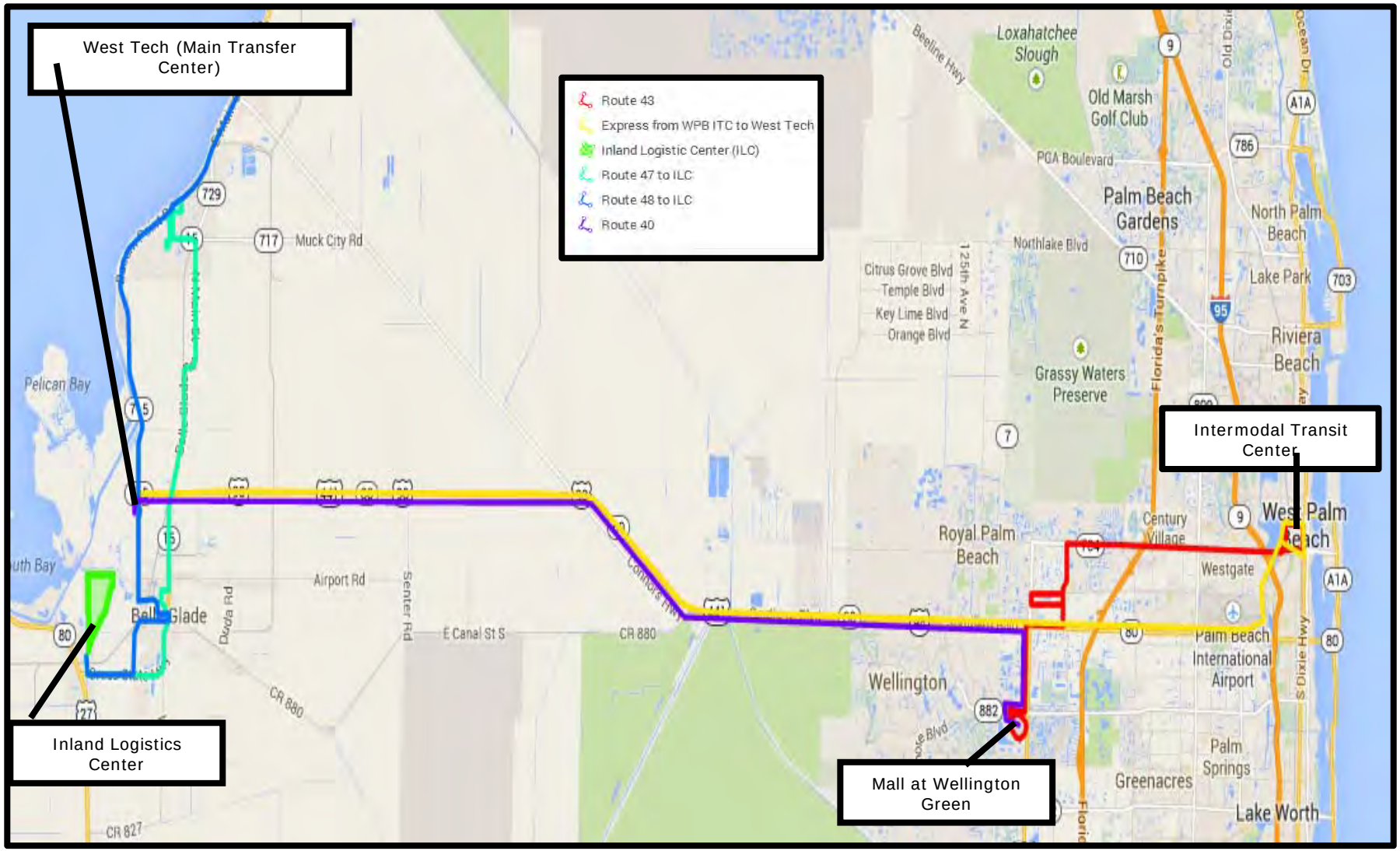


Figure 23. Scenario I Map

Scenario I Advantages and Challenges

Since the ILC is at the extreme southern end of the transit service area in the Glades region, West Tech is an ideal central location that, ideally, would support the ILC with a state of the art training center for companies located at the ILC. There is sufficient property on site to design, engineer and construct a transit transfer center with safe access to buses. West Tech would make timed transfers more achievable and the ILC would be served every 20 minutes by the Routes 47, 48 and the new express service from the West Palm Beach ITC.

The challenge for this site is that as a primary transfer center, PalmTran customers traveling throughout the PalmTran system might have to make a transfer prior to arriving at West Tech, which would then impose an undue number of transfers on them. One possibility to consider is that West Tech could be a secondary transfer center instead of the primary transfer center.

Cost of Scenario I based on Need

An additional 30,019 annual revenue hours would be needed to make all of the improvements associated with Scenario I, with an additional vehicle requirement of 19 buses. Based on the current hourly rate of $122 per hour supplied by PalmTran, the current annual cost of service is $9.88 million for 80,970 annual revenue hours. This cost would increase by $3.66 million to $13.54 million. Table 19 below displays the annual hours and costs.

Table 19. Annual hours and costs

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Net New Annual Operating Costs
Truncate Route 40 at Mall at Wellington Green (MWG) while increasing frequency to 20 minute service from MWG to West Tech (main transfer center)	20,295	4	23,314	$2,844,308
Increase frequency on Route 43 to one bus every 20 minutes from ITC to MWG	25,984	2	12,152	$1,482,544
Create new route – direct express/limited stop connection between ITC to West Tech	N/A	9	51,219	$6,248,718
Increase frequency on Route 47 to 20 minute service, extend southern terminus to the ILC, extend to West Tech (main transfer center)	19,009	2	12,152	$1,482,544
Increase frequency on Route 48 to 20 minute service, extend southern terminus to the ILC	15,682	2	12,152	$1,482,544
Totals	**80,970**	**19**	**110,989**	**$13,540,658**

Scenario II – Inland Logistics Center as Primary Transfer Center

Scenario II focuses on the ILC as the main transfer center for all routes serving the Glades area. Route 47 and 48 routing would be extended in this scenario to serve the ILC and will provide service 365 days a year from 5:00 a.m. until 11:00 p.m. and serve the ILC with 20 minute frequencies. An additional 13,140 revenue hours and two additional buses for each route would be needed to provide this service.

As in Scenario I, the Route 40 would discontinue serving between the West Palm Beach ITC but would serve from the Mall at Wellington Green to the ILC 365 days per year from 5:00 a.m. until 11:00 p.m. with 20 minute frequencies. An additional 26,280 revenue hours four additional buses would be needed to increase this service. The routing for Route 43 with service from Palm Tran's Intermodal Transit Center (ITC) to the Mall at Wellington Green would remain the same but the span of service and frequency would be consistent with the other routes serving the Glades area. An additional 13,140 revenue hours and two additional buses would be required to provide this enhancement to Route 43.

Finally, as in Scenario I, a new route with express/limited stop service from the ITC to the ILC would operate with 20 minute frequencies from 5:00 a.m. until 11:00 p.m. Nine new buses and 59,130 revenue hours would be needed to provide this service. The cost for this service would be $15.2 million and a total of 19 additional buses. This scenario's route configuration can be seen in Figure 24 below.

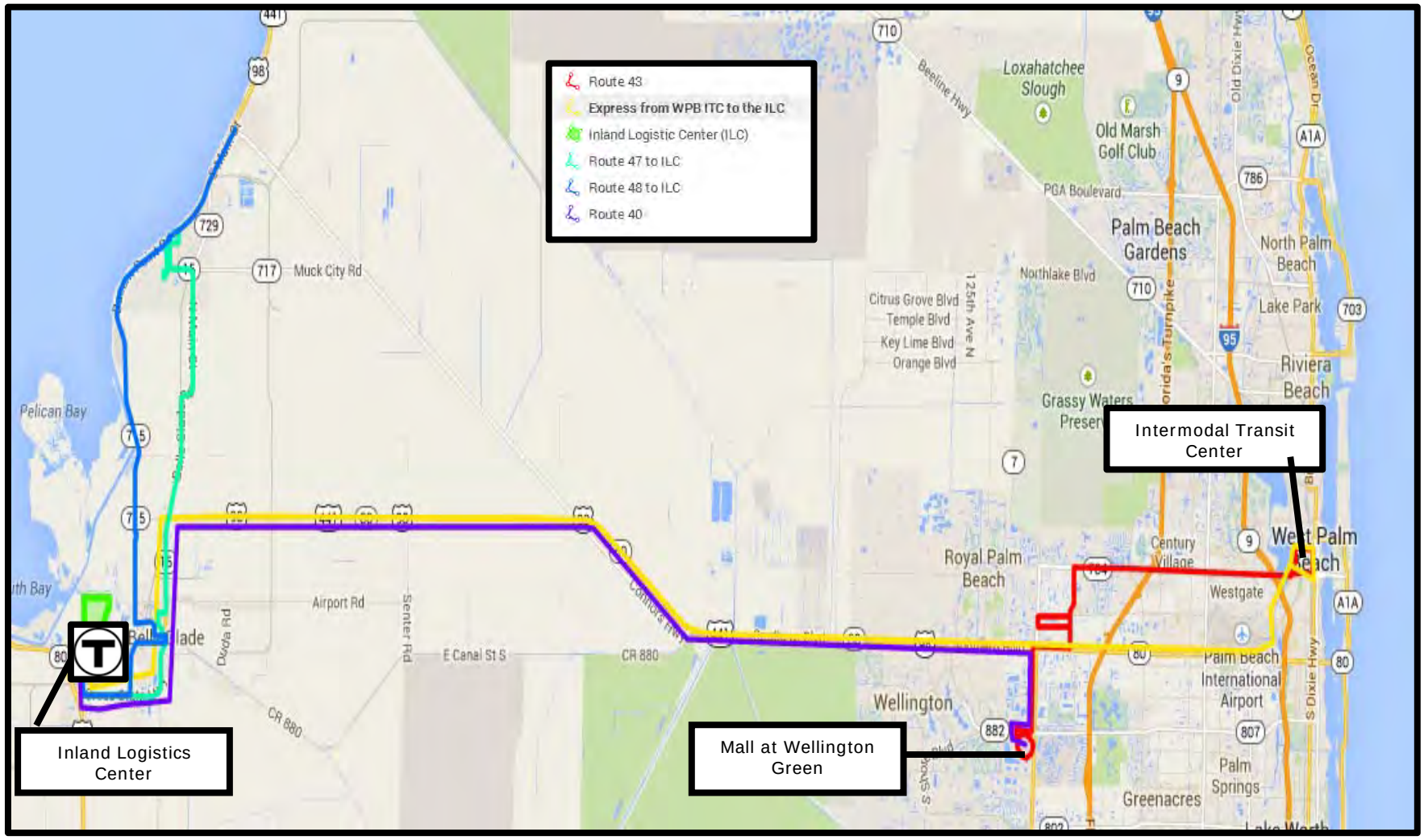


Figure 24. Scenario II Map

Scenario II Advantages and Challenges

The Inland Logistics Center will become the prime employment destination for the Glades region and, correspondingly, having all service converge on the ILC would be ideal. Presumably, there would be sufficient space available to design, engineer and construct a transit transfer center and West Tech would be served every 20 minutes via the Routes 47 and 48, just as the ILC is served every 20 minutes under Scenario I.

The primary challenge to the ILC as the primary transfer center is that its location adds miles and hours to every route and thus will be more costly to operate.

Cost of Scenario II Based on Need

An additional 43,860 annual revenue hours would be needed to make all of the improvements associated with Scenario II, with an additional vehicle requirement of 19 buses. Based on the current hourly rate of $122 per hour supplied by PalmTran, the current annual cost of service is $9.88 million for 80,970 annual revenue hours. This cost would increase by $5.35 million to $15.23 million. Table 20 below displays the annual hours and costs.

Table 20. Annual Hours and Costs

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Annual Operating Costs
Truncate Route 40 at Mall at Wellington Green while increasing frequency to 20 minute service from MWG to ILC	20,295	4	26,280	$3,206,160
Increase frequency on Route 43 to one bus every 20 minutes from ITC to MWG	25,984	2	13,140	$1,603,080
Create new route – direct express/limited stop connection between ITC to ILC	N/A	9	59,130	$7,213,860
Increase frequency on Route 47 to 20 minute service, extend southern terminus to the ILC	19,009	2	13,140	$1,603,080
Increase frequency on Route 48 to 20 minute service, extend southern terminus to the ILC	15,682	2	13,140	$1,603,080
Totals	**80,970**	**19**	**124,830**	**$15,229,260**

Preferred Scenario

Ultimately, Scenario II is the preferred scenario with all services transferring at the Inland Logistics Center (ILC). The cost of the preferred scenario may require phases of implementation. CUTR is recommending a phased approach based on improvements, not on timelines.

- Phase I – truncate the Route 40 at MWG and commence new service from the ITC to the ILC
- Phase II – make frequency and span improvements to the Routes 47 and 48
- Phase III – make frequency improvements to the Route 43 to supplement service between the ITC and the MWG.

However, if there is a delay or postponement to the ILC becoming operational, then Scenario I would replace Scenario II as the preferred scenario (detailed description of Scenario I can be found on page 42 of the final 'Glades Master Transit Plan' report).

Costs of Implementation

Tables 21 through 23 below display the cost of implementation for Phase I, Phase II, and Phase III.

Table 21. Phase I

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Annual Operating Costs
Truncate Route 40 at Mall at Wellington Green while increasing frequency to 20 minute service from MWG to ILC	20,295	4	26,280	$3,206,160
Create new route – direct express/limited stop connection between ITC to ILC	N/A	9	59,130	$7,213,860
Totals	**20,295**	**13**	**85,410**	**$10,420,020**

Table 22. Phase II

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Annual Operating Costs
Increase frequency on Route 47 to 20 minute service, extend southern terminus to the ILC	19,009	2	13,140	$1,603,080
Increase frequency on Route 48 to 20 minute service, extend southern terminus to the ILC	15,682	2	13,140	$1,603,080
Totals	**34,691**	**4**	**26,280**	**$3,206,160**

Table 23. Phase III

Description	Current Annual Revenue Hours	Additional Vehicle Requirement	Net New Annual Service Hours	Annual Operating Costs
Increase frequency on Route 43 to one bus every 20 minutes from ITC to MWG	25,984	2	13,140	$1,603,080
Totals	**25,984**	**2**	**13,140**	**$1,603,080**

APPENDIX G

Hooker Highway and Avenue E Alignment Study –
Civil Design, Inc., June 2014

Hooker Highway & Avenue E Alignment Study

PBC Project No. 2012057

Prepared for:
Palm Beach County Department of Engineering and Public Works

Roadway Production Division

Gabriel Burden
Florida License No. 75425
June 16, 2014

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Certificate of Authorization 9664

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Hooker Highway and Avenue E Alignment Study

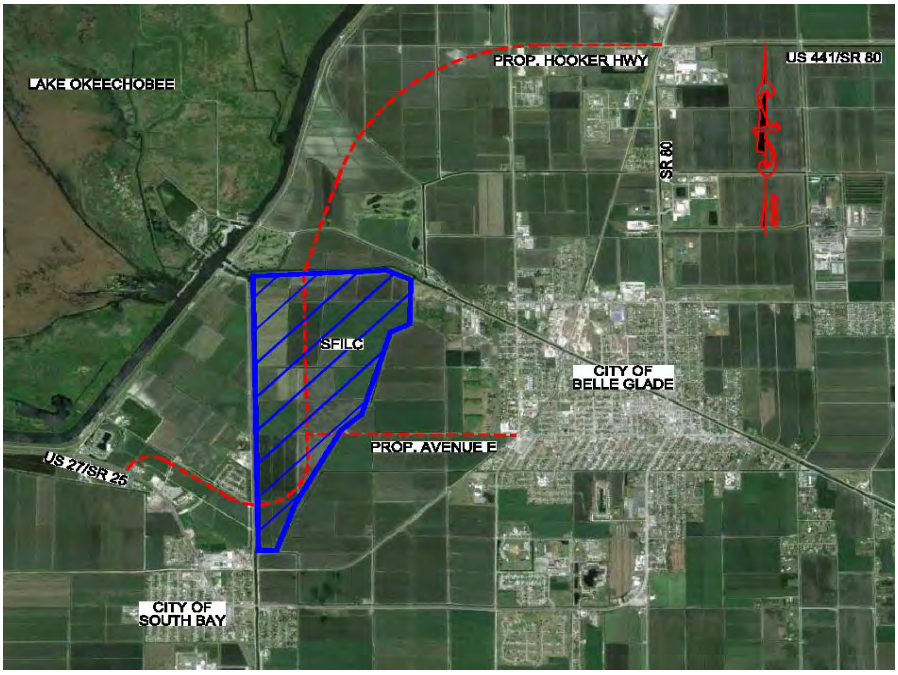
Palm Beach County, Florida
June 16, 2014

Introduction

Civil Design, Inc. (CDI) was contracted by the Palm Beach County Department of Engineering and Public Works Roadway Production Division to perform an analysis of proposed alignments to serve as a bypass route around the cities of Belle Glade and South Bay and to serve the proposed South Florida Intermodal Logistics Center (SFILC). The following report covers estimated costs, impacts to properties and environmental impacts associated with each alignment. The purpose of this study is to identify and develop alternative alignments for this area and to provide a recommendation for the final roadway alignment in order to minimize each of the preceding factors.

Background

CDI was contracted by PBC to conduct a study in which to connect existing Hooker Highway from its present terminus at SR 715 through the SFILC while intersecting the proposed Ave. E and ultimately terminating at US 27 in South Bay. After extensive meetings with PBC, the proposed road north of the SFILC commencing at SR 715 is to be considered a rural highway with a design speed of 55 MPH along with a 220' RW. The road commencing at the SFILC and heading southwest and ultimately terminating at US 27 is to be an urban highway section with 45 MPH design speed with a 120' RW. Avenue E is a 120' RW with a design speed of 45 MPH commencing at its terminus at SR 715 and extending through the SFILC and terminating at the future Hooker Highway.



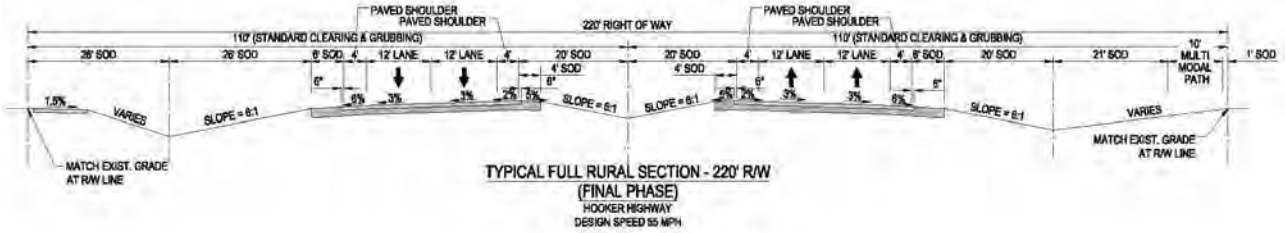
Roadway Design

Hooker Highway & Avenue E Phasing

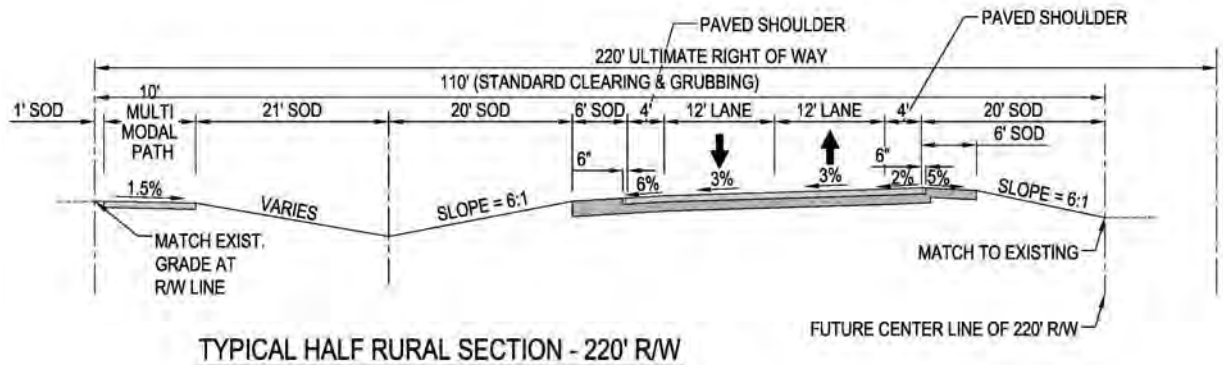
The proposed roadways in this study are to be completed in 2 phases. The half sections are to be completed first, once the half section meets capacity then the second half of the full section will be constructed.

North of SFILC – Hooker Highway

The proposed roadway to the north of the SFILC is to have a design speed of 55 MPH with the proposed design sections and design elements below:



TYPICAL FULL RURAL SECTION - 220' R/W
(FINAL PHASE)
HOOKER HIGHWAY
DESIGN SPEED 55 MPH

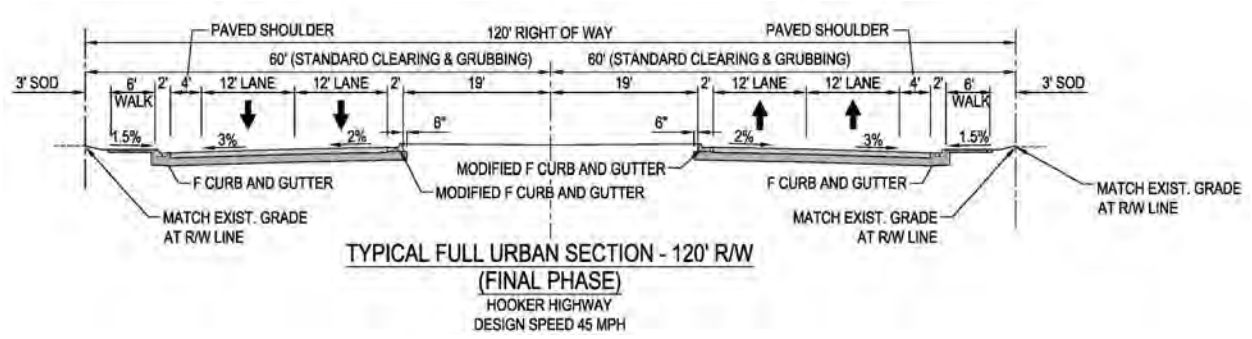


TYPICAL HALF RURAL SECTION - 220' R/W
(INITIAL PHASE)
HOOKER HIGHWAY
DESIGN SPEED 55 MPH

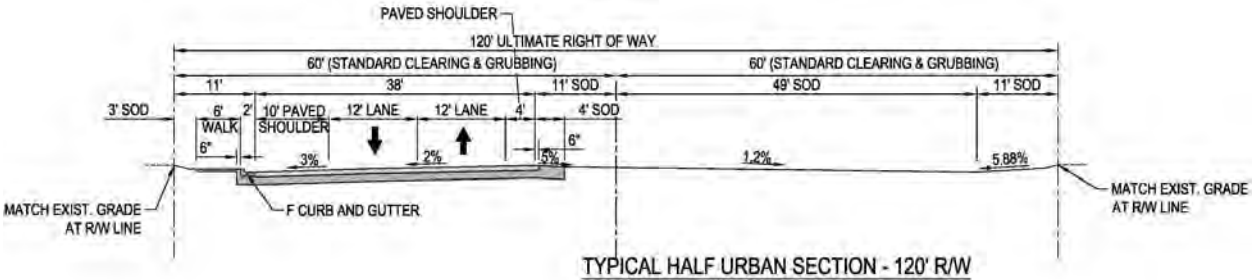
ROADWAY AND DESIGN ELEMENTS Table 1 Rural Highway North of SFILC			
Design Elements		**Design Standard**	**Source**
General	Design Speed	55 MPH	
	Lane Width	12 Feet	P.B.C. Design Standards
	Shoulder Width	10 Feet (4 Paved)	P.B.C. Design Standards
	Clear Zone	24 Feet	Table 3-12 (Greenbook)
	Multimodal Path Width	10 Feet	P.B.C. Design Request
	Minimum Median Width	40 Feet	Table 3-11 (Greenbook)
Horizontal Alignment	Maximum Curve Radius (e=.05)	2,865 FT	FDOT Index 510
	Maximum Degree of Curve (e=.05)	2°0'0"	FDOT Index 510
	Maximum Curve Radius (e=0.0)	11,460 FT	FDOT Index 510
	Maximum Curve Radius (e=0.0)	0° 30'	FDOT Index 510

Within and South of SFILC – Hooker Highway

The roadway section through and to the southwest of the SFILC is to have a design speed of 45 MPH with the proposed design section below:



TYPICAL FULL URBAN SECTION - 120' R/W
(FINAL PHASE)
HOOKER HIGHWAY
DESIGN SPEED 45 MPH

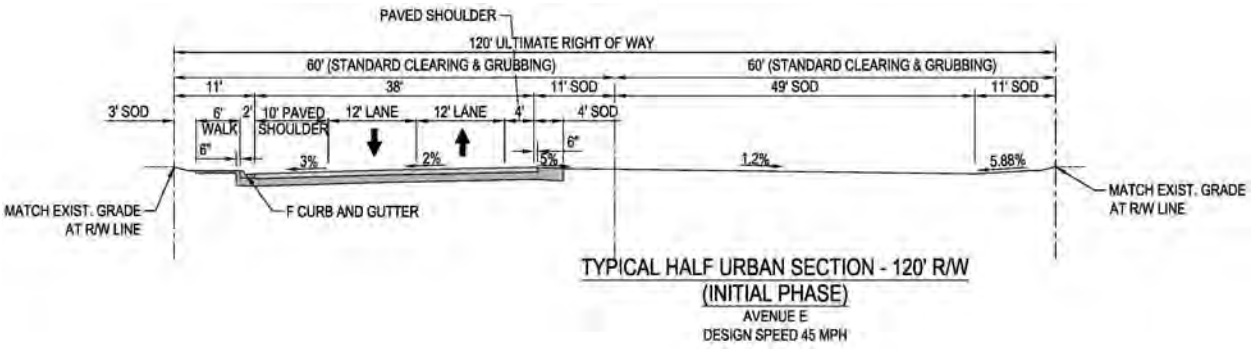


TYPICAL HALF URBAN SECTION - 120' R/W
(INITIAL PHASE)
HOOKER HIGHWAY
DESIGN SPEED 45 MPH

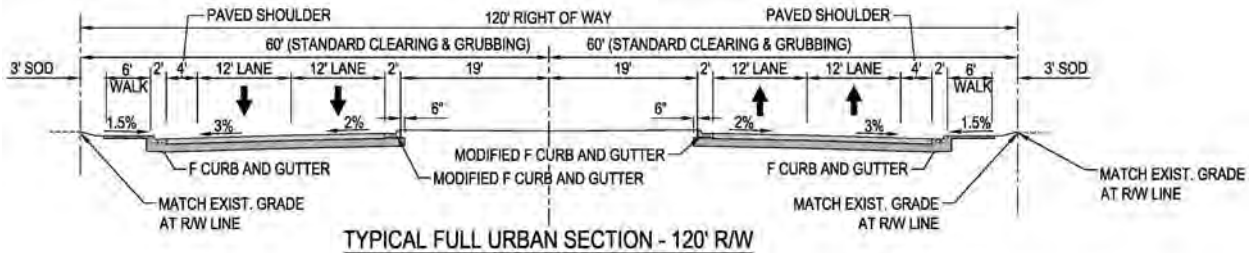
ROADWAY AND DESIGN ELEMENTS Table 2 Urban HighwayThrough and Southwest of SFILC			
Design Elements		**Design Standard**	**Source**
General	Design Speed	45 MPH	
	Lane Width	12 Feet	P.B.C. Design Standards
	Shoulder Width	10 Feet (4 Paved)	P.B.C. Design Standards
	Clear Zone	4 Feet	Table 3-12 (Greenbook)
	Multimodal Path Width	10 Feet	P.B.C. Design Request
	Minimum Median Width	15.5 Feet	Table 3-11 (Greenbook)
Horizontal Alignment	Maximum Curve Radius (e=.05)	694 FT	FDOT Index 511
	Maximum Degree of Curve (e=.05)	8°15'0"	FDOT Index 511
	Maximum Curve Radius (e=0.0)	2,083 FT	FDOT Index 511
	Maximum Curve Radius (e=0.0)	2° 45' 0"	FDOT Index 511

Avenue E

Avenue E is to have a design speed of 45 MPH with the proposed design section below:



TYPICAL HALF URBAN SECTION - 120' R/W
(INITIAL PHASE)
AVENUE E
DESIGN SPEED 45 MPH



TYPICAL FULL URBAN SECTION - 120' R/W
(FINAL PHASE)
AVENUE "E"
DESIGN SPEED 45 MPH

ROADWAY AND DESIGN ELEMENTS Table 3 Avenue E			
Design Elements		**Design Standard**	**Source**
General	Design Speed	45 MPH	
	Lane Width	12 Feet	P.B.C. Design Standards
	Shoulder Width	8 and 10 Feet	P.B.C. Design Standards
	Clear Zone	4 Feet	Table 3-12 (Greenbook)
	Multimodal Path Width	6 Feet	P.B.C. Design Request
	Minimum Median Width	15.5 Feet	Table 3-11 (Greenbook)
Horizontal Alignment	Maximum Curve Radius (e=.05)	694 FT	FDOT Index 511
	Maximum Degree of Curve (e=.05)	8°15'0"	FDOT Index 511
	Maximum Curve Radius (e=0.0)	2,083 FT	FDOT Index 511
	Maximum Curve Radius (e=0.0)	2° 45' 0"	FDOT Index 511

Alignment Analysis:

All roadways will be designed in accordance with the latest edition of the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Florida Green Book), FDOT Design Standards and Palm Beach County Thoroughfare Road Design Procedures.

The design study consisted of three different proposed alignments for each of the roadway sections surrounding the SFILC (North Hooker Highway, South Hooker Highway and Avenue E). The primary basis for each of these alignments is the location of the SFILC. The Hooker Highway alignments are to pass through the SFILC from the north and out the southwest portion of the SFILC and Avenue E will connect to the existing Avenue E extension in the City of Belle Glade. The North Hooker Highway alignments begin at the Hooker Highway SR 715 terminus and continue to the North property line of the proposed SFILC. The South Hooker Highway alignments begin at the north property line of the SFILC and are terminated at Highway US 27 northwest of Fire Station No. 74 and NW 4th street, both terminating at existing full median openings on US 27 for a future signalized intersection. The Avenue E alignments begin at the terminus of existing Avenue E and continue through the SFILC with a west terminus at the proposed Hooker Highway. The alignment lengths include all of the right of way up to the boundary line of the proposed SFILC. Locations for all alignments were coordinated with the proposed site plan for the SFILC.

North Alignments – Hooker Highway

Alternative A (Red Alignment)

The Alternative A alignment connects Hooker Highway to the SFILC using two horizontal curves with the minimum radii and maximum super-elevation which have lengths of 3,762 and 689 linear feet respectively. Each horizontal curve will require a super elevation of 0.05 or 5.0%. The proposed alignment including the horizontal curves is 15,137 linear feet in length.

Alternative B (Green Alignment)
The Alternative B alignment connects Hooker Highway to the SFILC using two horizontal curves the first of which is the minimum radii and maximum super-elevation, but the second has a much larger radius and will require no super-elevation which will have lengths of 3,943 and 2,469 linear feet respectively. The curve C-1 horizontal curve will require a super elevation of 0.05 or 5.0%. The proposed alignment including the horizontal curves is 15,074 linear feet in length.

Alternative C (Blue Alignment)
The Alternative C alignment connects Hooker Highway to the SFILC using three horizontal curves with lengths of 2,446, 1,019 and 968 linear feet respectively. The first two horizontal curves C-1 and C-2 will require a super elevation of 0.05 or 5.0% and use the minimum radii. Horizontal curve C-3 requires no super-elevation and has a larger radius. The proposed alignment including the horizontal curves is 13,605 linear feet.

SFILC Interior Alignments – Hooker Highway

All interior alignments are to be 1400 LF from the West R/W line of the SFILC as shown on the SFILC site plan from the North Property line to Ave E. The Interior Alignments South of Ave E to the South West property line are independent due to the connection with the South Alignments. All of the interior alignments are to be without cost of land acquisition in this alignment study. The approximate total length of the interior alignments range from 10143 LF to 10,349 LF from the north property line of the SFILC to the southwest property line of the SFILC.

South Alignments – Hooker Highway (Outside SFILC)

Alternative D (Magenta Alignment)
The Alternative D alignment connects the SFILC to US 27 using two horizontal curves. The curve C-1 has a length of 1,794 linear feet and has a super elevation of 2.0%. The curve C-2 has a length of 875 LF with no super elevation. The connection to US 27 will be at the existing median crossing for NW 4th Street, which is approximately 2,920 LF from the closest signalized intersection. The proposed alignment from the SFILC to US 27 including the horizontal curves is 2,699 linear feet. The primary goal of this alignment was to provide an alternative intersecting location to US 27 from the Alternatives E and F.

Alternative E (Blue Alignment)
The Alternative E alignment connects the SFILC to US 27 using two horizontal curves with lengths of 1,662 and 696 linear feet respectively and a 2.0% super elevation. The connection to US 27 will be at the existing road to the northwest of the Palm Beach County Fire Rescue Station 74 site with an existing full median opening. The proposed alignment from the SFILC to US 27 including the horizontal curves is 2,950 linear feet. The primary goal of this alignment was to provide an alternative intersecting location to US 27 from Alternative D and to have only one curve from south west property line of the proposed SFILC to US 27.

Alternative F (Green Alignment)
The Alternative F alignment connects the SFILC to US 27 using three horizontal curves. Curve C-1 has a length of 1,792 linear feet and super elevation of 2.0%. Curve C-2 has a length of and 697 linear feet and no super elevation. Curve C-3 has a length of 840 linear feet and super elevation of 2.0%. The connection to US 27 will be at the existing road to the northwest of the Palm Beach County Fire Rescue Station 74 site with an existing full median opening. The proposed alignment from the SFILC to US 27 including the horizontal curves is 2,963 linear feet. The primary goal of this alignment was to provide an alternative intersecting location to US 27 from the Alternatives D and to intersect the existing SFWMD canal and existing NW 1st Ave at a 90 degree angle.

Avenue E Alignments

Alternative G (Blue Alignment)
The Alternative G alignment connects the existing terminus of Avenue E to the proposed Hooker Highway alignment located within the SFILC. This alignment is centered on the existing property lines. The proposed alignment alternative has a length of 7,645 linear feet with a 1°00’00” deflection at Challancin Rd.

Alternative H (Magenta Alignment)
The alternative H alignment connects the existing terminus of Avenue E a to the proposed Hooker Highway alignment located within the SFILC. This Alternative holds the existing property lines as the future South right-of-way (R/W) line and right-of-way (R/W) acquisition will only be from the North. The proposed alignment alternative has a length of 7,643 linear feet with a 0°20’10” deflection 2,374 linear feet west of the existing Avenue E terminus.

Alternative I (Yellow Alignment)
The alternative G alignment connects the existing terminus of Avenue E to the proposed Hooker Highway alignment located within the SFILC. This Alternative holds the existing property lines as the future North right-of-way (R/W) line and right-of-way (R/W) acquisition will only be from the South. The proposed alignment alternative has a length of 7,646 linear feet with three deflections. The three deflections, 1°00'00" deflection 1,435 linear feet west of the existing Avenue E terminus the 2nd deflection of 1°00'00" 336 LF west of the 1st deflection, and another 1°00'00" deflection at Challancin Rd.

Drainage Impacts and Permitting

The stormwater management facilities for the proposed project will be designed in accordance with the East Beach Water Control District (EBWCD), South Shore Water Control District (SSWCD), South Florida Water Management District (SFWMD) and Palm Beach County Engineering Department (PBCED) regulations and requirements.

North Alternatives
Each of the north alternatives from SR 715 to W Lake Road with a 220' right of way will be drained into roadside swales without the requirement of a piped drainage system. The 120' right-of-way (R/W) from W Lake Road to the SFILC will require a ±1.31 acre lake to support the proposed 120' road section. Each of the lake sections could be within the Stein Farms parcel (PCN: 00364325000005000) located adjacent to the SFILC, with outfall to the Hillsboro (L-14) canal.

South Alternatives
Each of the south alternatives will require a lake for the drainage of the roadway from the SFILC to US 27. Alternatives D and E will require a ±2.03 acre lake while alternative F requires approximately a 2.25 acre lake. Each of the lake sections could be within the City of South Bay parcel located adjacent to the SFILC, with outfall to the L-20 canal.

Avenue E Alternatives
The Avenue E alternatives which run from the existing terminus to the proposed Hooker Highway alignment will require multiple lakes of various sizes for the necessary drainage. Each of the alternatives will require a total of 5.25 acres of lake. The lake system divided into 2.25 acre, 2.00 acre and a 1 acre lake respectively to serve the various roadway sections.

Permitting

The proposed roadways will require drainage permits from East Beach Water Control District (EBWCD), South Shore Water Control District (SSWCD) and South Florida Water Management District (SFWMD). Drainage system design for both the water management aspects as well as the collection conveyance system will require approval of the Palm Beach County Engineering Department. Florida Department of Environmental Protection (FDEP) permits for National Pollution Elimination System (NPDES) activity will be required.

Environmental Analysis

The three alignments generally transect existing, active agricultural lands. Based on previous project experience in the Glades region, these lands are known to contain muck and organic soils. Further, due to the nature of farming operations, these soils tend to contain high nutrient and arsenic levels. Based on the alternatives, no one alignment is deemed less suitable than the other for soils properties. These generalities will need to be confirmed via site specific soils testing and Phase I reports once an alignment is adopted.

A formal wetland determination was not made or conducted for the proposed alignment routes. As the routes are generally located in active agricultural areas, there are no obvious jurisdictional wetland areas observed via the aerial overlay. Further, based on the alternatives, no one alignment is deemed less suitable than the other for potential impacts or required mitigation. These generalities will need to be confirmed via site specific surveys and determinations once an alignment is adopted.

Alignment Recommendations

North Alignment

Several factors were considered in developing a recommended North Alignment. The safety for the north takes into account the angle with West Lake Avenue and the super-elevation of each of the curves. Alternative C gives the angle between West Lake Ave and the proposed Hooker Highway closest to 90 degrees while maintaining the shortest distance between the SFILC and the Hooker Hwy terminus. Alternative C provides no impact to existing structures and would minimize the number of “sliver” pieces required for right-of-way (R/W) acquisition.

The cost analysis for Alternative C was compared to the cost of the other alternatives and was found to be approximately 1-2 million less than Alternates A & B. The environmental impacts have little effect on the recommendation of this alignment alternative. See reference matrix in appendix C.

South Alignment
Several factors were considered in developing a recommended South Alignment. Alternative E provides the best alignment connecting the southwest portion of the SFILC to existing US 27. Alternative E provides connection to US 27 at the existing Palm Beach County Fire Rescue Station 74 in South Bay, Florida, while maintaining the least amount of curves in the alignment.

The cost analysis for Alternative E was compared to the cost of the other alternatives and was found to be less than Alternates D & F. The Alternative E will require the smallest lake of the other alternatives. See reference matrix in appendix C.

Avenue E Alignment
The recommended Avenue E Alignment is Alternative G. This alternative requires only one minimal deflection and is centered on the existing right of way. Cost differences for the three alignments are negligible. All of the alignments require the same lake size and are equally safe, maintaining anywhere between 88 degree and 90 degree intersection with the proposed Hooker Highway through the SFILC. See reference matrix in appendix C

Land Owner Breakdowns

See Appendix A

Cost Analysis

See Appendix B

SCALE Factors

See Appendix C

Alignment Configurations

See Appendix D

Appendix A

HOOKER HWY & AVENUE E ALIGNMENT STUDY

Palm Beach County, Florida

Rural Road Alignments North and Within of SFILC

North "RED" Affected Parcel Information (See Plan Sheet 4)

220' & 120' Right of Way

Red-North (Including SFILC from North to Ave E.)		
PCN.	Owner	S.F. Affected
00-36-43-24-01-000-0010	JAMES BALL III	241,364
00-36-43-13-01-000-0240	BALL FAMILY PARTNERSHIP	105,842
00-36-43-13-01-000-0230	ELEANOR SCHLECHTER	55,405
00-36-43-13-01-000-0221	BALL FAMILY PARTNERSHIP	19,657
00-36-43-13-01-000-0170	KATHERINE W. BALL	32,105
	Existing Palm Beach County ROW	204,693
00-36-43-13-01-000-0040	BALL FAMILY PARTNERSHIP	14,361
00-36-43-24-01-000-0030	BALL FAMILY PARTNERSHIP	187,613
00-36-43-24-01-000-0040	BALL FAMILY PARTNERSHIP	300,578
00-36-43-24-01-000-0050	STEIN FARMS LLC	18,036
00-36-43-23-00-000-0010	BALL FAMILY PARTNERSHIP	409,373
00-36-43-14-00-000-5010	BALL FAMILY PARTNERSHIP	137,160
00-36-43-23-00-000-0070	STEIN FARMS LLC	594,220
00-36-43-26-00-000-1020	JOHN SPOONER	492,812
00-36-43-25-00-000-5000	STEIN FARMS LLC	203,820
00-36-43-26-00-000-3070	SOUTH FLA WATER MGMT DIST	44,032
00-36-43-25-00-000-5000	STEIN FARMS LLC (WTR MGT TRACT)	57,064
00-36-43-25-00-000-5020, 5030, 5040	CLOSTER FARMS, INC. (INSIDE SFILC)	755,280
	Total (S.F.)	3,873,415
	Total (Ac.)	88.92

HOOKER HWY & AVENUE E ALIGNMENT STUDY

Palm Beach County, Florida

Rural Road Alignments North and Within of SFILC

North "GREEN" Affected Parcel Information (See Plan Sheet 5)

220' & 120' Right of Way

Green-North (Including SFILC from North to Ave E.)		
PCN.	Owner	S.F. Affected
00-36-43-24-01-000-0010	JAMES BALL III	230,102
00-36-43-13-01-000-0221	BALL FAMILY PARTNERSHIP	26,227
00-36-43-13-01-000-0040	BALL FAMILY PARTNERSHIP	27,818
00-36-43-13-01-000-0230	ELEANOR SCHLECHTER	64,230
00-36-43-13-01-000-0170	KATHERINE W. BALL	34,947
00-36-43-13-01-000-0240	BALL FAMILY PARTNERSHIP	122,385
	Existing Palm Beach County ROW	210,231
00-36-43-24-01-000-0030	BALL FAMILY PARTNERSHIP	169,240
00-36-43-13-01-000-0210	BALL FAMILY PARTNERSHIP	15,301
00-36-43-24-01-000-0040	BALL FAMILY PARTNERSHIP	266,358
00-36-43-23-00-000-0010	BALL FAMILY PARTNERSHIP	380,358
00-36-43-14-00-000-5010	BALL FAMILY PARTNERSHIP	106,759
00-36-43-23-00-000-0070	STEIN FARMS LLC	613,296
00-36-43-26-00-000-3010	STEIN FARMS LLC	453,916
00-36-43-26-00-000-1020	JOHN SPOONER	171,842
00-36-43-26-00-000-3020	STEIN FARMS LLC	22,142
00-36-43-25-00-000-5000	STEIN FARMS LLC	193,870
00-36-43-26-00-000-3070	SOUTH FLA WATER MGMT DIST	43,206
00-36-43-25-00-000-5000	STEIN FARMS LLC (WTR MGT TRACT)	57,064
00-36-43-25-00-000-5020, 5030, 5040	CLOSTER FARMS, INC. (INSIDE SFILC)	755,280
	Total (S.F.)	3,964,572
	Total (Ac.)	91.01

HOOKER HWY & AVENUE E ALIGNMENT STUDY

Palm Beach County, Florida

Rural Road Alignments North and Within of SFILC

North "BLUE" Affected Parcel Information (See Plan Sheet 6)

220' & 120' Right of Way

Blue-North (Including SFILC from North to Ave E.)		
PCN.	Owner	S.F. Affected
	Existing Palm Beach County ROW	192,605
00-36-43-24-01-000-0010	JAMES BALL III	271,442
00-36-43-13-01-000-0240	BALL FAMILY PARTNERSHIP	59,474
00-36-43-13-01-000-0170	KATHERINE W. BALL	32,103
00-36-43-13-01-000-0230	ELEANOR SCHLECHTER	34,462
00-36-43-24-01-000-0030	BALL FAMILY PARTNERSHIP	337,570
00-36-43-24-01-000-0130	STEIN FARMS LLC	859
00-36-43-24-01-000-0050	STEIN FARMS LLC	446,542
00-36-43-23-00-000-0010	BALL FAMILY PARTNERSHIP	153,281
00-36-43-14-00-000-5010	BALL FAMILY PARTNERSHIP	72,733
00-36-43-23-00-000-0070	STEIN FARMS LLC	395,352
00-36-43-26-00-000-3010	STEIN FARMS LLC	468,423
00-36-43-26-00-000-3020	STEIN FARMS LLC	75,316
00-36-43-26-00-000-1020	JOHN SPOONER	119,654
00-36-43-25-00-000-5000	STEIN FARMS LLC	191,997
00-36-43-26-00-000-3070	SOUTH FLA WATER MGMT DIST	43,216
00-36-43-25-00-000-5000	STEIN FARMS LLC (WTR MGT TRACT)	57,064
00-36-43-25-00-000-5020, 5030, 5040	CLOSTER FARMS, INC. (INSIDE SFILC)	755,280
	Total (S.F.)	3,707,373
	Total (Ac.)	85.11

HOOKER HWY & AVENUE E ALIGNMENT STUDY

Palm Beach County, Florida

Urban Road Alignments South of Avenue E

South "Magenta" Affected Parcel Information (See Plan Sheet 8)

120' Right of Way

Magenta-South (Including SFILC from South West to Ave E.)		
PCN.	Owner	S.F. Affected
58-36-44-11-00-000-1000	SOUTH FLA WATER MGMT DIST	37,607
58-36-44-11-00-000-3140	SOUTH BAY CITY OF	179,215
58-36-44-11-00-000-7020	SOUTH BAY CITY OF	2,863
58-36-44-11-00-000-7260	SOUTH BAY CITY OF	17,617
00-36-44-11-00-000-3110	HUGH B BRANCH JR REVOCABLE TRUST	10,180
58-36-44-11-00-000-5120	HUGH BRANCH LLC	4,858
58-36-44-11-00-000-7230	HUGH B BRANCH JR REVOCABLE TRUST	4,261
58-36-44-11-00-000-7250	HUGH BRANCH LLC	39,443
58-36-44-11-00-000-7180	MARQUEZ CANDIDO J & HILDA C	22,133
58-36-44-11-00-000-3140	SOUTH BAY CITY OF (WTR MGT TRACT)	88,427
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	461,988
	Total (S.F.)	868,592
	Total (Ac.)	19.94

HOOKER HWY & AVENUE "E" ALIGNMENT STUDY

Palm Beach County, Florida

Urban Road Alignments South of Avenue E

South "BLUE" Affected Parcel Information (See Plan Sheet 9)

120' Right of Way

Blue-South (Including SFILC from South West to Ave E.)		
PCN.	Owner	S.F. Affected
58-36-44-11-00-000-1000	SOUTH FLA WATER MGMT DIST	38,141
58-36-44-11-00-000-3140	SOUTH BAY CITY OF	252,817
58-36-44-11-00-000-7260	SOUTH BAY CITY OF	23,141
58-36-44-11-00-000-7140	SOUTH BAY CITY OF	2,921
58-36-44-11-00-000-7240	SOUTH BAY CITY OF	22,678
58-36-44-11-00-000-3020	SOUTH BAY CITY OF	16,566
58-36-44-11-00-000-3140	SOUTH BAY CITY OF (WTR MGT TRACT)	88,427
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	486,869
	Total (S.F.)	931,560
	Total (Ac.)	21.39

HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Palm Beach County, Florida

Urban Road Alignments South of Avenue E

South "GREEN" Affected Parcel Information (See Plan Sheet 10)

120' Right of Way

Green-South (Including SFILC from South West to Ave E.)		
PCN.	Owner	S.F. Affected
58-36-44-11-00-000-1000	SOUTH FLA WATER MGMT DIST	37,567
58-36-44-11-00-000-3140	SOUTH BAY CITY OF	249,011
58-36-44-11-00-000-7260	SOUTH BAY CITY OF	26,749
58-36-44-11-00-000-7140	SOUTH BAY CITY OF	2,921
58-36-44-11-00-000-7240	SOUTH BAY CITY OF	16,566
58-36-44-11-00-000-3020	SOUTH BAY CITY OF	22,678
58-36-44-11-00-000-3140	SOUTH BAY CITY OF (WTR MGT TRACT)	98,010
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	461,988
	Total (S.F.)	915,490
	Total (Ac.)	21.02

HOOKER HWY & AVENUE "E" ALIGNMENT STUDY

Palm Beach County, Florida

Urban Road Alignments East of Hooker Hwy

Avenue E "BLUE" Affected Parcel Information (See Plan Sheet 12)

120' Right of Way

Blue-Avenue E		
PCN.	Owner	S.F. Affected
00-36-43-36-01-015-0060	RINKER MATERIALS CORP	22,093
00-36-43-36-01-009-0000	Donald Sellers & Stein Fritz	59,400
00-36-43-36-01-011-0000	US SUGAR CORP	27,176
00-36-44-01-00-000-5000	US SUGAR CORP	221,679
00-36-44-12-00-000-5000	US SUGAR CORP	224,671
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE	140,361
	Existing Palm Beach County ROW	35,722
00-37-44-37-00-000-0018	FLORIDA EAST COAST RAILWAY LLC	1,978
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	43,560
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	98,010
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE (WTR MGT TRACT)	87,120
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	185,189
	Total (S.F.)	1,146,959
	Total (Ac.)	26.33

HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Palm Beach County, Florida

Urban Road Alignments East of Hooker Hwy

Avenue E "Magenta" Affected Parcel Information (See Plan Sheet 13)

120' Right of Way

Magenta-Avenue E		
PCN.	Owner	S.F. Affected
00-36-43-36-01-015-0060	RINKER MATERIALS CORP	30,614
00-36-43-36-01-009-0000	Donald Sellers & Stein Fritz	33,513
00-36-43-36-01-011-0000	US SUGAR CORP	4,582
00-36-44-12-00-000-5000	US SUGAR CORP	386,820
00-36-44-01-00-000-5000	US SUGAR CORP	63,222
	Existing Palm Beach County ROW	35,722
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE	178,564
00-37-44-37-00-000-0018	FLORIDA EAST COAST RAILWAY LLC	1,988
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	43,560
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	98,010
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE (WTR MGT TRACT)	87,120
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	181,570
	Total (S.F.)	1,145,285
	Total (Ac.)	26.29

HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Palm Beach County, Florida

Urban Road Alignments East of Hooker Hwy

Avenue E "Yellow" Affected Parcel Information (See Plan Sheet 14)

120' Right of Way

Yellow-Avenue E		
PCN.	Owner	S.F. Affected
00-36-43-36-01-015-0060	RINKER MATERIALS CORP	25,580
00-36-43-36-01-009-0000	Donald Sellers & Stein Fritz	109,256
00-36-43-36-01-011-0000	US SUGAR CORP	61,469
	Existing Palm Beach County ROW	35,722
00-36-44-01-00-000-5000	US SUGAR CORP	439,159
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE	52,945
00-37-44-37-00-000-0018	FLORIDA EAST COAST RAILWAY LLC	1,844
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	43,560
00-36-44-12-00-000-5000	US SUGAR CORP (WTR MGT TRACT)	98,010
00-37-44-37-00-000-0010	US SUGAR CORP LESSEE (WTR MGT TRACT)	87,120
00-36-43-25-00-000-5020	CLOSTER FARMS, INC. (INSIDE SFILC)	193,322
	Total (S.F.)	1,147,987
	Total (Ac.)	26.35

Appendix B

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

NORTH ALIGNMENTS FULL SECTIONS

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (NORTH OF SFILC)
NORTH RED ALIGNMENT ALTERNATIVE A FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	1,908,400.00	$1,908,400.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	65.57	AC	7,700.00	$504,915.30
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	405,129	CY	10.00	$4,051,290.00
5	EMBANKMENT	365,124	CY	18.00	$6,572,232.00
6	SODDING	230,895	SY	3.00	$692,685.00
7	TYPE S-III ASPHALTIC CONCRETE (INCLUDING MULTI-MODAL PATH) (1" THICK)	6,100	TN	108.00	$658,800.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	8,440	TN	102.00	$860,880.00
9	BASEROCK (8") (2-4" LIFTS)	101,215	SY	12.00	$1,214,580.00
10	12" STABILIZED SUBGRADE	117,030	SY	3.60	$421,308.00
11	4" THICK CONCRETE SIDEWALK	2,550	SY	24.00	$61,200.00
12	CONCRETE TRACTOR CROSSING	8	EA	5,000.00	$40,000.00
13	VARIOUS SIZE DRAINAGE STRUCTURES	10	EA	3,000.00	$30,000.00
14	LAKE EXCAVATION	8,500	CY	2.15	$18,275.00
15	BRIDGE CROSSING (L-14 CROSSING)	21,600	SF	175.00	$3,780,000.00
16	VARIOUS CULVERT CANAL CROSSING	5	EA	5,000.00	$25,000.00
17	CONCRETE PIPE CULVERT (36")	1,910	LF	80.00	$152,800.00

SUBTOTAL (BASE BID) = $21,042,365.30
CONSTRUCTION CONTINGENCY (15%) = $3,156,354.80
TOTAL = $24,198,720.10

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	57,064	S.F	1.00	$57,064.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	2,856,378	S.F	1.00	$2,856,378.00

RIGHT OF WAY COSTS = $2,913,442.00

NORTH ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (NORTH OF SFILC)
NORTH GREEN ALIGNMENT ALTERNATIVE B FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	1,956,650.00	$1,956,650.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	74	AC	7,700.00	$567,407.27
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	405,129	CY	10.00	$4,051,290.00
5	EMBANKMENT	365,124	CY	18.00	$6,572,232.00
6	SODDING	227,913	SY	3.00	$683,739.00
7	TYPE S-III ASPHALTIC CONCRETE (INCLUDING MULTI-MODAL PATH) (1" THICK)	6,775	TN	108.00	$731,700.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	10,162	TN	102.00	$1,036,524.00
9	BASEROCK (8") (2-4" LIFTS)	113,705	SY	12.00	$1,364,460.00
10	12" STABILIZED SUBGRADE	118,540	SY	3.60	$426,744.00
11	4" THICK CONCRETE SIDEWALK	2,375	SY	35.00	$83,125.00
12	CONCRETE TRACTOR CROSSING	8	EA	5,000.00	$40,000.00
13	VARIOUS SIZE DRAINAGE STRUCTURES	10	EA	3,000.00	$30,000.00
14	LAKE EXCAVATION	8,500	CY	2.15	$18,275.00
15	BRIDGE CROSSING (L-14 CROSSING)	21,600	SF	175.00	$3,780,000.00
16	VARIOUS CULVERT CANAL CROSSING	7	EA	5,000.00	$35,000.00
17	CONCRETE PIPE CULVERT (36")	1,825	LF	80.00	$146,000.00

SUBTOTAL (BASE BID) = $21,573,146.27
CONSTRUCTION CONTINGENCY (15%) = $3,235,971.94
CONSTRUCTION TOTAL = $24,809,118.21

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	57,064	S.F	1.00	$57,064.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	2,941,997	S.F	1.00	$2,941,997.00

RIGHT OF WAY COSTS = $2,999,061.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

NORTH ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (NORTH OF SFILC)
NORTH BLUE ALIGNMENT ALTERNATIVE C FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	1,761,500.00	$1,761,500.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	68	AC	7,700.00	$521,834.62
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	349,465	CY	10.00	$3,494,650.00
5	EMBANKMENT	311,245	CY	18.00	$5,602,410.00
6	SODDING	227,780	SY	3.00	$683,340.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	6,085	TN	108.00	$657,180.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	7,800	TN	102.00	$795,600.00
9	BASEROCK (8") (2-4" LIFTS)	111,140	SY	12.00	$1,333,680.00
10	12" STABILIZED SUBGRADE	127,430	SY	3.60	$458,748.00
11	4" THICK CONCRETE SIDEWALK	2,418	SY	24.00	$58,032.00
12	CONCRETE TRACTOR CROSSING	9	EA	5,000.00	$45,000.00
13	VARIOUS SIZE DRAINAGE STRUCTURES	10	EA	3,000.00	$30,000.00
14	LAKE EXCAVATION	8,500	CY	2.15	$18,275.00
15	BRIDGE CROSSING (L-14 CROSSING)	21,600	SF	175.00	$3,780,000.00
16	VARIOUS CULVERT CANAL CROSSING	4	EA	5,000.00	$20,000.00
17	CONCRETE PIPE CULVERT (36")	1,452	LF	80.00	$116,160.00

SUBTOTAL (BASE BID) = $19,426,409.62
CONSTRUCTION CONTINGENCY (15%) = $2,913,961.44
TOTAL = $22,340,371.06

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	57,064	S.F	1.00	$57,064.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	2,702,424	S.F	1.00	$2,702,424.00

RIGHT OF WAY COSTS = $2,759,488.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

SOUTH ALIGNMENTS FULL SECTIONS

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (SOUTH OF AVE E. (SFILC INCLUDED))
SOUTH MAGENTA ALTERNATIVE ALIGNMENT D FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	714,160.00	$714,160.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	20	AC	7,700.00	$153,538.99
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	52,365	CY	10.00	$523,650.00
5	EMBANKMENT	46,765	CY	18.00	$841,770.00
6	SODDING	18,295	SY	3.00	$54,885.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,315	TN	108.00	$250,020.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,460	TN	102.00	$352,920.00
9	BASEROCK (8") (2-4" LIFTS)	47,105	SY	12.00	$565,260.00
10	12" STABILIZED SUBGRADE	49,600	SY	3.60	$178,560.00
11	4" THICK CONCRETE SIDEWALK	4,790	SY	24.00	$114,960.00
12	F CURB & GUTTER	18,736	LF	25.00	$468,400.00
13	CONCRETE TRACTOR CROSSING	3	EA	5,000.00	$15,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	22	EA	3,000.00	$66,000.00
15	LAKE EXCAVATION	13,100	CY	2.15	$28,165.00
16	BRIDGE CROSSING (L-19 CROSSING)	18,900	SF	175.00	$3,307,500.00
17	VARIOUS CULVERT CANAL CROSSING	1	EA	5,000.00	$5,000.00
18	CONCRETE PIPE CULVERT (36")	2,699	LF	80.00	$215,920.00

SUBTOTAL (BASE BID) = $7,905,708.99
CONSTRUCTION CONTINGENCY (15%) = $1,185,856.35
TOTAL = $9,091,565.34

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
19	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	88,427	S.F	1.00	$88,427.00
20	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	318,177	S.F	1.00	$318,177.00

RIGHT OF WAY COSTS = $406,604.00

SOUTH ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (SOUTH OF AVE E (SFILC INCLUDED))
SOUTH BLUE ALTERNATE ALIGNMENT E FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	766,680.00	$766,680.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	21	AC	7,700.00	$164,669.70
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	58,500	CY	10.00	$585,000.00
5	EMBANKMENT	52,050	CY	18.00	$936,900.00
6	SODDING	19,095	SY	3.00	$57,285.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,435	TN	108.00	$262,980.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,650	TN	102.00	$372,300.00
9	BASEROCK (8") (2-4" LIFTS)	51,050	SY	12.00	$612,600.00
10	12" STABILIZED SUBGRADE	55,030	SY	3.60	$198,108.00
11	4" THICK CONCRETE SIDEWALK	9,370	SY	35.00	$327,950.00
12	F CURB & GUTTER	19,990	LF	25.00	$499,750.00
13	CONCRETE TRACTOR CROSSING	1	EA	5,000.00	$5,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	22	EA	3,000.00	$66,000.00
15	LAKE EXCAVATION	13,100	CY	2.15	$28,165.00
16	BRIDGE CROSSING (L-19 CROSSING)	18,900	SF	175.00	$3,307,500.00
17	VARIOUS CULVERT CANAL CROSSING	1	EA	5,000.00	$5,000.00
18	CONCRETE PIPE CULVERT (36")	2,969	LF	80.00	$237,520.00

SUBTOTAL (BASE BID) = $7,666,727.70
CONSTRUCTION CONTINGENCY (15%) = $1,150,009.15
TOTAL = $8,816,736.85

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
19	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	88,427	S.F	1.00	$88,427.00
20	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	356,264	S.F	1.00	$356,264.00

RIGHT OF WAY COSTS = $444,691.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

SOUTH ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
HOOKER HIGHWAY (SOUTH OF AVE E (SFILC INCLUDED))
SOUTH GREEN ALIGNMENT ALTERNATIVE F FULL SECTION
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	751,480.00	$751,480.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	21	AC	7,700.00	$161,829.04
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	58,430	CY	10.00	$584,300.00
5	EMBANKMENT	52,165	CY	18.00	$938,970.00
6	SODDING	19,125	SY	3.00	$57,375.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,360	TN	108.00	$254,880.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,535	TN	102.00	$360,570.00
9	BASEROCK (8") (2-4" LIFTS)	50,030	SY	12.00	$600,360.00
10	12" STABILIZED SUBGRADE	55,290	SY	3.60	$199,044.00
11	4" THICK CONCRETE SIDEWALK	9,040	SY	24.00	$216,960.00
12	F CURB & GUTTER	19,550	LF	25.00	$488,750.00
13	CONCRETE TRACTOR CROSSING	1	EA	5,000.00	$5,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	22	EA	3,000.00	$66,000.00
15	LAKE EXCAVATION	14,520	CY	2.15	$31,218.00
16	BRIDGE CROSSING (L-19 CROSSING)	18,900	SF	175.00	$3,307,500.00
17	VARIOUS CULVERT CANAL CROSSING	1	EA	5,000.00	$5,000.00
18	CONCRETE PIPE CULVERT (36")	2,962	LF	80.00	$236,960.00

SUBTOTAL (BASE BID) = $8,316,196.04
CONSTRUCTION CONTINGENCY (15%) = $1,247,429.41
TOTAL = $9,563,625.45

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
19	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	98,010	S.F	1.00	$98,010.00
20	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	355,492	S.F	1.00	$355,492.00

RIGHT OF WAY COSTS = $453,502.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

AVENUE E ALIGNMENTS FULL SECTIONS

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
AVENUE E BLUE ALIGNMENT ALTERNATIVE G FULL SECTION (INCLUDES INSIDE SFILC)
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	769,860.00	$769,860.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	26	AC	7,700.00	$202,745.28
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	141,170	CY	10.00	$1,411,700.00
5	EMBANKMENT	126,315	CY	18.00	$2,273,670.00
6	SODDING	30,575	SY	3.00	$91,725.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,645	TN	108.00	$285,660.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,965	TN	102.00	$404,430.00
9	BASEROCK (8") (2-4" LIFTS)	64,540	SY	12.00	$774,480.00
10	12" STABILIZED SUBGRADE	71,000	SY	3.60	$255,600.00
11	4" THICK CONCRETE SIDEWALK	10,220	SY	35.00	$357,700.00
12	F CURB & GUTTER	31,457	LF	25.00	$786,425.00
13	CONCRETE TRACTOR CROSSING	2	EA	5,000.00	$10,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	50	EA	3,000.00	$150,000.00
15	LAKE EXCAVATION	33,880	CY	2.15	$72,842.00
16	VARIOUS CULVERT CANAL CROSSING	2	EA	5,000.00	$10,000.00
17	CONCRETE PIPE CULVERT (36")	7,645	LF	80.00	$611,600.00

SUBTOTAL (BASE BID) = $8,518,437.28
CONSTRUCTION CONTINGENCY (15%) = $1,277,765.59
TOTAL = $9,796,202.87

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	228,690	S.F	1.00	$228,690.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	697,358	S.F	1.00	$697,358.00

RIGHT OF WAY COSTS = $926,048.00

AVENUE E ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
AVENUE E MAGENTA ALTERNATE ALIGNMENT H FULL SECTION (INCLUDES INSIDE SFILC)
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	765,040.00	$765,040.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	26	AC	7,700.00	$202,449.37
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	144,935	CY	10.00	$1,449,350.00
5	EMBANKMENT	129,085	CY	18.00	$2,323,530.00
6	SODDING	30,575	SY	3.00	$91,725.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,645	TN	108.00	$285,660.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,965	TN	102.00	$404,430.00
9	BASEROCK (8") (2-4" LIFTS)	64,540	SY	12.00	$774,480.00
10	12" STABILIZED SUBGRADE	71,000	SY	3.60	$255,600.00
11	4" THICK CONCRETE SIDEWALK	10,190	SY	24.00	$244,560.00
12	F CURB & GUTTER	30,572	LF	25.00	$764,300.00
13	CONCRETE TRACTOR CROSSING	2	SY	5,000.00	$10,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	50	EA	3,000.00	$150,000.00
15	LAKE EXCAVATION	33,880	CY	2.15	$72,842.00
16	VARIOUS CULVERT CANAL CROSSING	2	EA	5,000.00	$10,000.00
17	CONCRETE PIPE CULVERT (36")	7,643	LF	80.00	$611,440.00

SUBTOTAL (BASE BID) = $8,465,406.37
CONSTRUCTION CONTINGENCY (15%) = $1,269,810.96
TOTAL = $9,735,217.32

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	228,690	S.F	1.00	$228,690.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	699,303	S.F	1.00	$699,303.00

RIGHT OF WAY COSTS = $927,993.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

AVENUE E ALIGNMENTS FULL SECTIONS CONTINUED

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
AVENUE E YELLOW ALIGNMENT ALTERNATIVE I FULL SECTION (INCLUDES INSIDE SFILC)
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	381,460.00	$381,460.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	26	LS	7,700.00	$202,926.99
4	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	144,990	CY	10.00	$1,449,900.00
5	EMBANKMENT	129,135	CY	18.00	$2,324,430.00
6	SODDING	30,585	SY	3.00	$91,755.00
7	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,550	TN	108.00	$275,400.00
8	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,825	TN	102.00	$390,150.00
9	BASEROCK (8") (2-4" LIFTS)	64,570	SY	12.00	$774,840.00
10	12" STABILIZED SUBGRADE	71,030	SY	3.60	$255,708.00
11	4" THICK CONCRETE SIDEWALK	10,200	SY	24.00	$244,800.00
12	F CURB & GUTTER	30,584	LF	25.00	$764,600.00
13	CONCRETE TRACTOR CROSSING	2	EA	5,000.00	$10,000.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	50	EA	3,000.00	$150,000.00
15	LAKE EXCAVATION	33,880	CY	2.15	$72,842.00
16	VARIOUS CULVERT CANAL CROSSING	2	EA	5,000.00	$10,000.00
17	CONCRETE PIPE CULVERT (36")	7,646	LF	80.00	$611,680.00

SUBTOTAL (BASE BID) = $8,060,491.99
CONSTRUCTION CONTINGENCY (15%) = $1,209,073.80
TOTAL = $9,269,565.79

RIGHT OF WAY COSTS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
18	PROPOSED LAKE RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	228,690	S.F	1.00	$228,690.00
19	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	690,253	S.F	1.00	$690,253.00

RIGHT OF WAY COSTS = $918,943.00

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

INSIDE SFILC N OF AVE E FULL SECTIONS

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS
INSIDE SFILC NORTH OF AVE E
June 16, 2014

GENERAL CONDITIONS

ITEM	DESCRIPTION	QNTY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION (10% OF CONSTRUCTION)	1	LS	312,310.00	$312,310.00
2	MAINTENANCE OF TRAFFIC	1	LS	50,000.00	$50,000.00
3	CLEARING AND GRUBBING	17	LS	7,700.00	$133,509.09
4	RIGHT OF WAY ACQUISITION (OUTSIDE SFILC)	755,280	S.F	0.00	$0.00
5	EXCAVATION (INCLUDING DEMUCKING UP TO 8')	138,000	CY	10.00	$1,380,000.00
6	EMBANKMENT	127,568	CY	18.00	$2,296,224.00
7	SODDING	24,500	SY	3.00	$73,500.00
8	TYPE S-III ASPHALTIC CONCRETE (1" THICK)	2,175	TN	108.00	$234,900.00
9	TYPE S-1 ASPHALTIC CONCRETE (1 1/2" THICK)	3,265	TN	102.00	$333,030.00
10	BASEROCK (8") (2-4" LIFTS)	39,170	SY	12.00	$470,040.00
11	12" STABILIZED SUBGRADE	43,090	SY	3.60	$155,124.00
12	4" THICK CONCRETE SIDEWALK	8,392	SY	24.00	$201,408.00
13	F CURB & GUTTER	12,590	LF	25.00	$314,750.00
14	VARIOUS SIZE DRAINAGE STRUCTURES	50	EA	3,000.00	$150,000.00
15	CONCRETE PIPE CULVERT (36")	6,294	LF	80.00	$503,520.00

SUBTOTAL (BASE BID) = $6,608,315.09
CONSTRUCTION CONTINGENCY (15%) = $991,247.26
TOTAL = $7,599,562.35

Appendix C

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN - ENGINEERED RESULTS

ALIGNMENT ALTERNATIVES FOR
AVENUE E
FROM EXISTING TERMINUS TO PROPOSED HOOKER HIGHWAY (SFILC INCLUDED)
PBC PROJECT NO. 2012057

	ALTERNATIVES			
CRITERIA	**G (BLUE) Recommended**	**H (MAGENTA)**	**I (YELLOW)**	**NO BUILD**
LENGTH OF ROADWAY	7,645 LF	7,638 LF	7,647 LF	0
TRANSPORTATION SYSTEM (LONG RANGE PLANNING)	SATISFIES NETWORK	SATISFIES NETWORK	SATISFIES NETWORK	FAILS TO SATISFIES NETWORK
LOCAL TRAFFIC SERVICE	CONNECT SFILC WITH BELLE GLADE	CONNECT SFILC WITH SOUTH BAY	CONNECT SFILC WITH SOUTH BAY	DOES NOT CONNECT SFILC WITH SOUTH BAY
PUBLIC SAFETY	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	NO IMPRROVEMENTS
ENVIRONMENTAL IMPACTS	NEGLIGABLE	NEGLIGABLE	NEGLIGABLE	NONE
RIGHT OF WAY ACQUISITION COSTS*	$926,048.00	$927,993.00	$918,943.00	$0.00
CONSTRUCTION COSTS	$9,796,202.87	$9,735,217.32	$9,269,565.79	$0.00
TOTAL COSTS	$10,722,250.87	$10,663,210.32	$10,188,508.79	$0.00

IMPACTS TO PROPERTIES (IN S.F.)				
OCCUPIED LOTS AFFECTED	**AREA**	**AREA**	**AREA**	**AREA**
(00-36-43-36-01-015-0060) RINKER MATERIALS CORP	22,093	30,614	25,580	0
(00-36-43-36-01-009-0000) Donald Sellers & Stein Fritz	59,400	33,513	109,256	0
(00-36-43-36-01-011-0000) US SUGAR CORP	27,176	4,582	61,469	0
(00-36-44-01-00-000-5000) US SUGAR CORP	221,679	63,222	439,159	0
(00-36-44-12-00-000-5000) US SUGAR CORP	224,671	386,820	0	0
(00-37-44-37-00-000-0010) US SUGAR CORP LESSEE	140,361	178,564	52,945	0
Existing Palm Beach County ROW	35,722	35,722	35,722	0
(00-37-44-37-00-000-0018) FLORIDA EAST COAST RAILWAY LLC	1,978	1,988	1,844	0
(00-36-44-12-00-000-5000) US SUGAR CORP (WTR MGT TRACT)	43,560	43,560	43,560	0
(00-36-44-12-00-000-5000) US SUGAR CORP (WTR MGT TRACT)	98,010	98,010	98,010	0
(00-37-44-37-00-000-0010) US SUGAR CORP LESSEE (WTR MGT TRACT)	87,120	87,120	87,120	0
(00-36-43-25-00-000-5020) CLOSTER FARMS, INC. (INSIDE SFILC)	185,189	181,570	193,322	0
Total (S.F.)	1,146,959	1,145,285	1,147,987	0
Total (Ac.)	26.33	26.29	26.35	0

* LAND VALUES FOR ROW COSTS OF ADJACENT PROPERTIES ESTIMATED AT $1.00 PER SQUARE FOOT, DOES NOT INCLUDED BUSINESS DAMAGES
* RIGHT OF WAY LAND COSTS DO NOT INCLUDE LAND INSIDE THE PROPOSED SFILC

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN · ENGINEERED RESULTS

ALIGNMENT ALTERNATIVES FOR
HOOKER HIGHWAY
SOUTH OF AVE E. (SFILC INCLUDED)
PBC PROJECT NO. 2012057

	ALTERNATIVES			
CRITERIA	**D (MAGENTA)**	**E (BLUE) Recommended**	**F (GREEN)**	**NO BUILD**
LENGTH OF ROADWAY	6,669 LF	7,026 LF	6,812 LF	0
TRANSPORTATION SYSTEM (LONG RANGE PLANNING)	SATISFIES NETWORK	SATISFIES NETWORK	SATISFIES NETWORK	FAILS TO SATISFIES NETWORK
LOCAL TRAFFIC SERVICE	CONNECT SFILC WITH SOUTH BAY	CONNECT SFILC WITH SOUTH BAY	CONNECT SFILC WITH SOUTH BAY	DOES NOT CONNECT SFILC WITH SOUTH BAY
PUBLIC SAFETY	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	NO IMPRROVEMENTS
ENVIRONMENTAL IMPACTS	NEGLIGABLE	NEGLIGABLE	NEGLIGABLE	NONE
RIGHT OF WAY ACQUISITION COSTS	$406,604.00	$444,691.00	$453,502.00	$0.00
CONSTRUCTION COSTS	$9,091,565.34	$8,816,736.85	$9,563,625.45	$0.00
TOTAL COSTS	$9,498,169.34	$9,261,427.85	$10,017,127.45	$0.00

IMPACTS TO PROPERTIES (IN S.F.)				
OCCUPIED LOTS AFFECTED	**AREA**	**AREA**	**AREA**	**AREA**
(58-36-44-11-00-000-1000) SOUTH FLA WATER MGMT DIST	37,607	38,141	37,567	0
(58-36-44-11-00-000-3140) SOUTH BAY CITY OF	179,215	252,817	249,011	0
(58-36-44-11-00-000-7260) SOUTH BAY CITY OF	17,617	23,141	26,749	0
(58-36-44-11-00-000-7140) SOUTH BAY CITY OF	0	2,921	2,921	0
(58-36-44-11-00-000-7240) SOUTH BAY CITY OF	0	22,678	16,566	0
(58-36-44-11-00-000-3020) SOUTH BAY CITY OF	0	16,566	22,678	0
(58-36-44-11-00-000-3140) SOUTH BAY CITY OF (WTR MGT TRACT)	88,427	88,427	98,010	0
(00-36-43-25-00-000-5020) CLOSTER FARMS, INC. (INSIDE SFILC)	461,988	486,869	461,988	0
(58-36-44-11-00-000-7020) SOUTH BAY CITY OF	2,863	0	0	0
(00-36-44-11-00-000-3110) HUGH B BRANCH JR REVOCABLE TRUST	10,180	0	0	0
(58-36-44-11-00-000-5120) HUGH BRANCH LLC	4,858	0	0	0
(58-36-44-11-00-000-7230) HUGH B BRANCH JR REVOCABLE TRUST	4,261	0	0	0
(58-36-44-11-00-000-7250) HUGH BRANCH LLC	39,443	0	0	0
(58-36-44-11-00-000-7180) MARQUEZ CANDIDO J & HILDA C	22,133	0	0	0
Total (S.F.)	868,592	931,560	915,490	0
Total (Ac.)	19.94	21.39	21.02	0

* LAND VALUES FOR ROW COSTS OF ADJACENT PROPERTIES ESTIMATED AT $1.00 PER SQUARE FOOT, DOES NOT INCLUDED BUSINESS DAMAGES
* RIGHT OF WAY LAND COSTS DUE NOT INCLUDE LAND INSIDE THE PROPOSED SFILC

CIVIL DESIGN, INC.
SERVICE DRIVEN DESIGN · ENGINEERED RESULTS

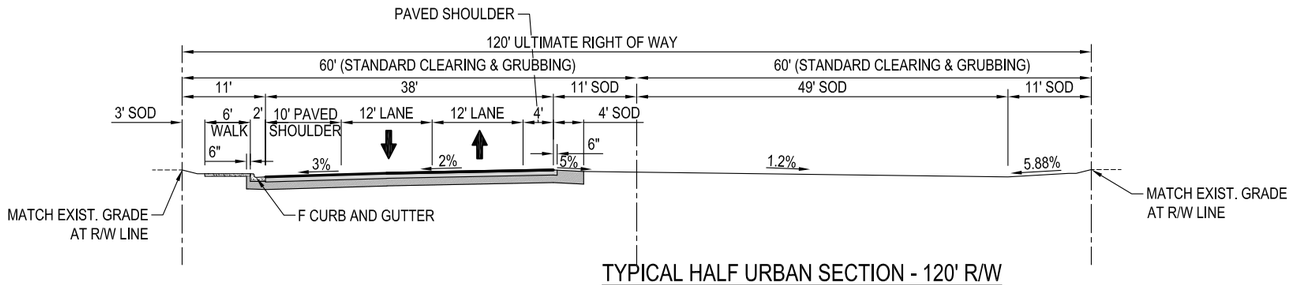
ALIGNMENT ALTERNATIVES FOR
HOOKER HIGHWAY
NORTH OF SFILC
PBC PROJECT NO. 2012057

	ALTERNATIVES			
CRITERIA	**A (RED)**	**B (GREEN)**	**C (BLUE) Recommended**	**NO BUILD**
LENGTH OF ROADWAY	14,676 LF	15,118 LF	13,984 LF	0
TRANSPORTATION SYSTEM (LONG RANGE PLANNING)	SATISFIES NETWORK	SATISFIES NETWORK	SATISFIES NETWORK	FAILS TO SATISFIES NETWORK
LOCAL TRAFFIC SERVICE	CONNECT SFILC WITH BELLE GLADE & SOUTH BAY	CONNECT SFILC WITH BELLE GLADE & SOUTH BAY	CONNECT SFILC WITH BELLE GLADE & SOUTH BAY	DOES NOT CONNECT SFILC WITH BELLE GLADE & SOUTH BAY
PUBLIC SAFETY	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	ENHANCED SAFETY ALTERNATE ROUTE	NO IMPRROVEMENTS
ENVIRONMENTAL IMPACTS	NEGLIGABLE	NEGLIGABLE	NEGLIGABLE	NONE
RIGHT OF WAY ACQUISITION COSTS	$2,913,442.00	$2,999,061.00	$2,759,488.00	$0.00
CONSTRUCTION COSTS	$24,198,720.10	$24,809,118.21	$22,340,371.06	$0.00
TOTAL COSTS	$27,112,162.10	$27,808,179.21	$25,099,859.06	$0.00

IMPACTS TO PROPERTIES (IN S.F.)				
OCCUPIED LOTS AFFECTED	**AREA**	**AREA**	**AREA**	**AREA**
(00-36-43-24-01-000-0010) JAMES BALL III	241,364	230,102	271,442	0
(00-36-43-13-01-000-0240) BALL FAMILY PARTNERSHIP	105,842	122,385	59,474	0
(00-36-43-13-01-000-0230) ELEANOR SCHLECHTER	55,405	64,230	34,462	0
(00-36-43-13-01-000-0221) BALL FAMILY PARTNERSHIP	19,657	26,227	0	0
(00-36-43-13-01-000-0170) KATHERINE W. BALL	32,105	34,947	32,103	0
Existing Palm Beach County ROW	204,693	210,843	192,605	0
(00-36-43-13-01-000-0040) BALL FAMILY PARTNERSHIP	14,361	27,818	0	0
(00-36-43-24-01-000-0030) BALL FAMILY PARTNERSHIP	187,613	169,240	337,570	0
(00-36-43-24-01-000-0040) BALL FAMILY PARTNERSHIP	300,578	0	0	0
(00-36-43-24-01-000-0050) STEIN FARMS LLC	18,036	0	446,542	0
(00-36-43-23-00-000-0010) BALL FAMILY PARTNERSHIP	409,373	380,358	153,281	0
(00-36-43-14-00-000-5010) BALL FAMILY PARTNERSHIP	137,160	106,759	72,733	0
(00-36-43-23-00-000-0070) STEIN FARMS LLC	594,220	613,296	395,352	0
(00-36-43-26-00-000-1020) JOHN SPOONER	492,812	171,842	119,654	0
(00-36-43-25-00-000-5000) STEIN FARMS LLC	203,820	193,870	191,997	0
(00-36-43-26-00-000-3070) SOUTH FLA WATER MGMT DIST	44,032	43,206	43,216	0
(00-36-43-25-00-000-5000) STEIN FARMS LLC (WTR MGT TRACT)	57,064	57,064	57,064	0
(00-36-43-13-01-000-0210) BALL FAMILY PARTNERSHIP	0	15,301	0	0
(00-36-43-24-01-000-0040) STEIN FARMS LLC	0	266,358	0	0
(00-36-43-26-00-000-3010) STEIN FARMS LLC	0	453,916	468,423	0
(00-36-43-26-00-000-3020) STEIN FARMS LLC	0	22,142	75,316	0
(00-36-43-24-01-000-0130) STEIN FARMS LLC	0	0	859	0
Total (S.F.)	3,118,135	3,209,904	2,952,093	0
Total (Ac.)	71.58	73.69	67.77	0

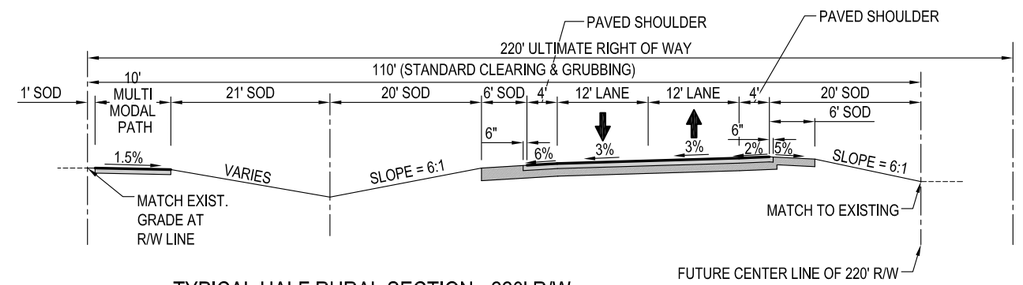
* LAND VALUES FOR ROW COSTS OF ADJACENT PROPERTIES ESTIMATED AT $1.00 PER SQUARE FOOT, DOES NOT INCLUDED BUSINESS DAMAGES
* RIGHT OF WAY LAND COSTS DUE NOT INCLUDE LAND INSIDE THE PROPOSED SFILC

Appendix D



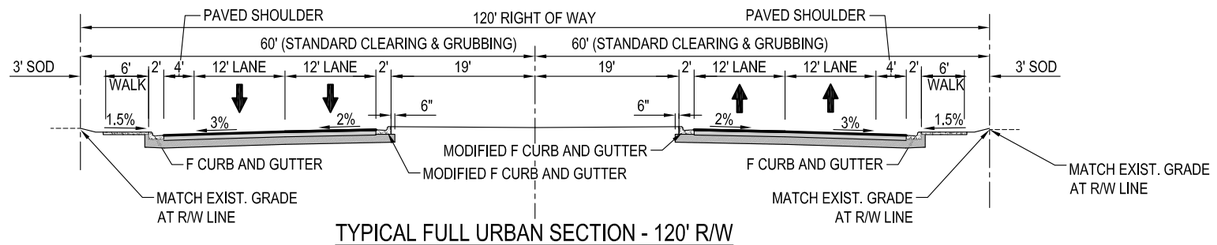
TYPICAL HALF URBAN SECTION - 120' R/W
(INITIAL PHASE)

HOOKER HIGHWAY
AVENUE E
DESIGN SPEED 45 MPH



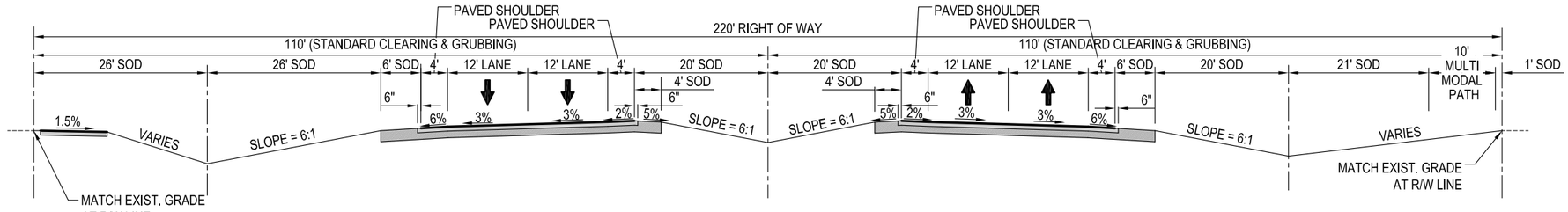
TYPICAL HALF RURAL SECTION - 220' R/W
(INITIAL PHASE)

HOOKER HIGHWAY
DESIGN SPEED 55 MPH



TYPICAL FULL URBAN SECTION - 120' R/W
(FINAL PHASE)

HOOKER HIGHWAY
AVENUE "E"
DESIGN SPEED 45 MPH



TYPICAL FULL RURAL SECTION - 220' R/W
(FINAL PHASE)

HOOKER HIGHWAY
DESIGN SPEED 55 MPH

CIVIL DESIGN, INC.
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Engineering Business No. 9664
CDI Project No. 12340

NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No.	PG.
DESIGNED	x		SHEET SIZE	SCALE:
DRAWN	CJ		24"x36"	AS NOTED
CHECKED	JT			
APPROVED	JT		11"X17"	N.T.S.

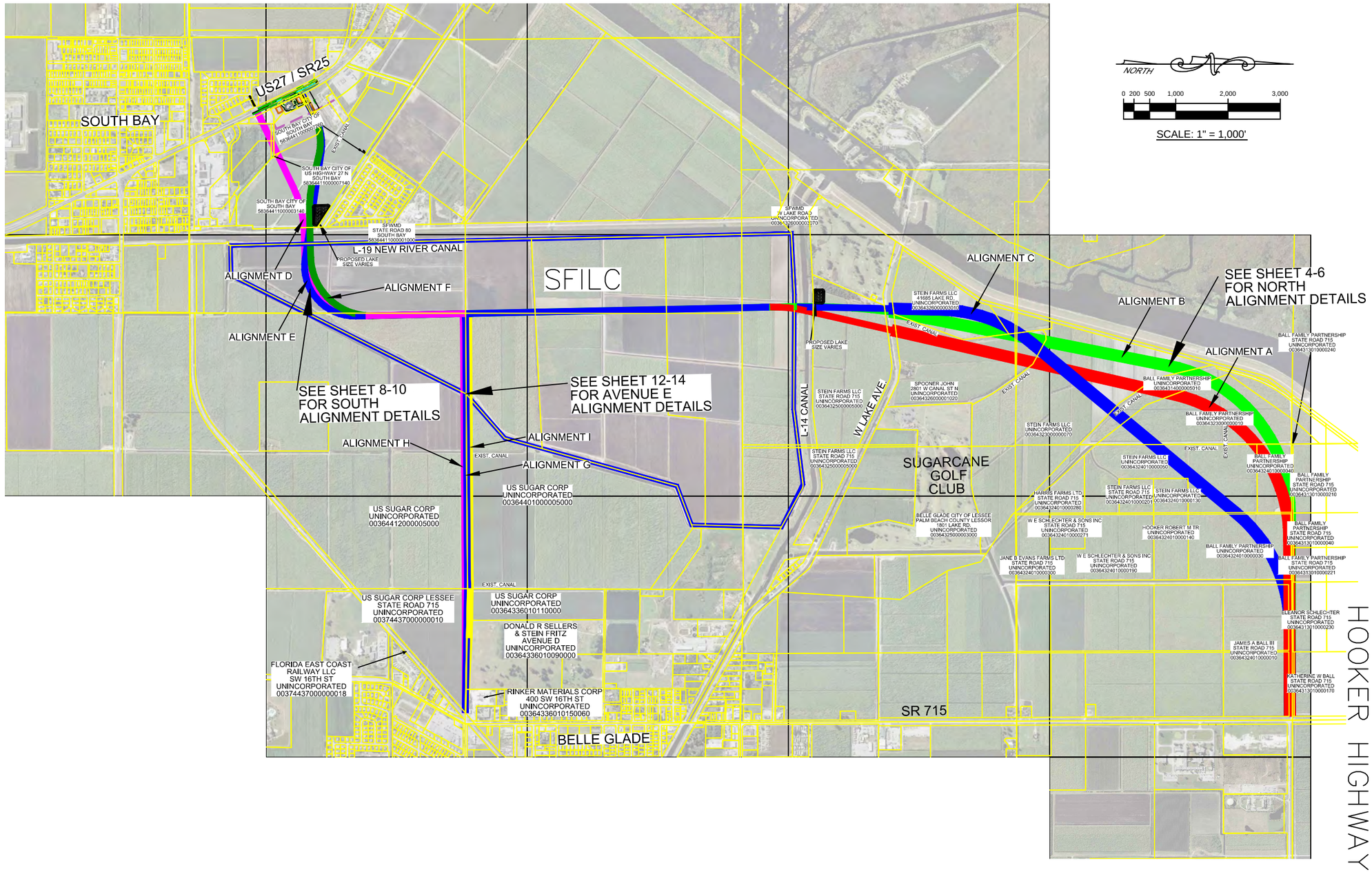
Jeff Trompeter, P.E.
Florida License No. 51045

Project: HOOKER HWY & AVENUE "E"

ALIGNMENT STUDY

ROADWAY TYPICAL SECTIONS

SHEET 1
OF: 14
PROJECT NO.
2012057



HOOKER HIGHWAY ALTERNATIVE ALIGNMENTS

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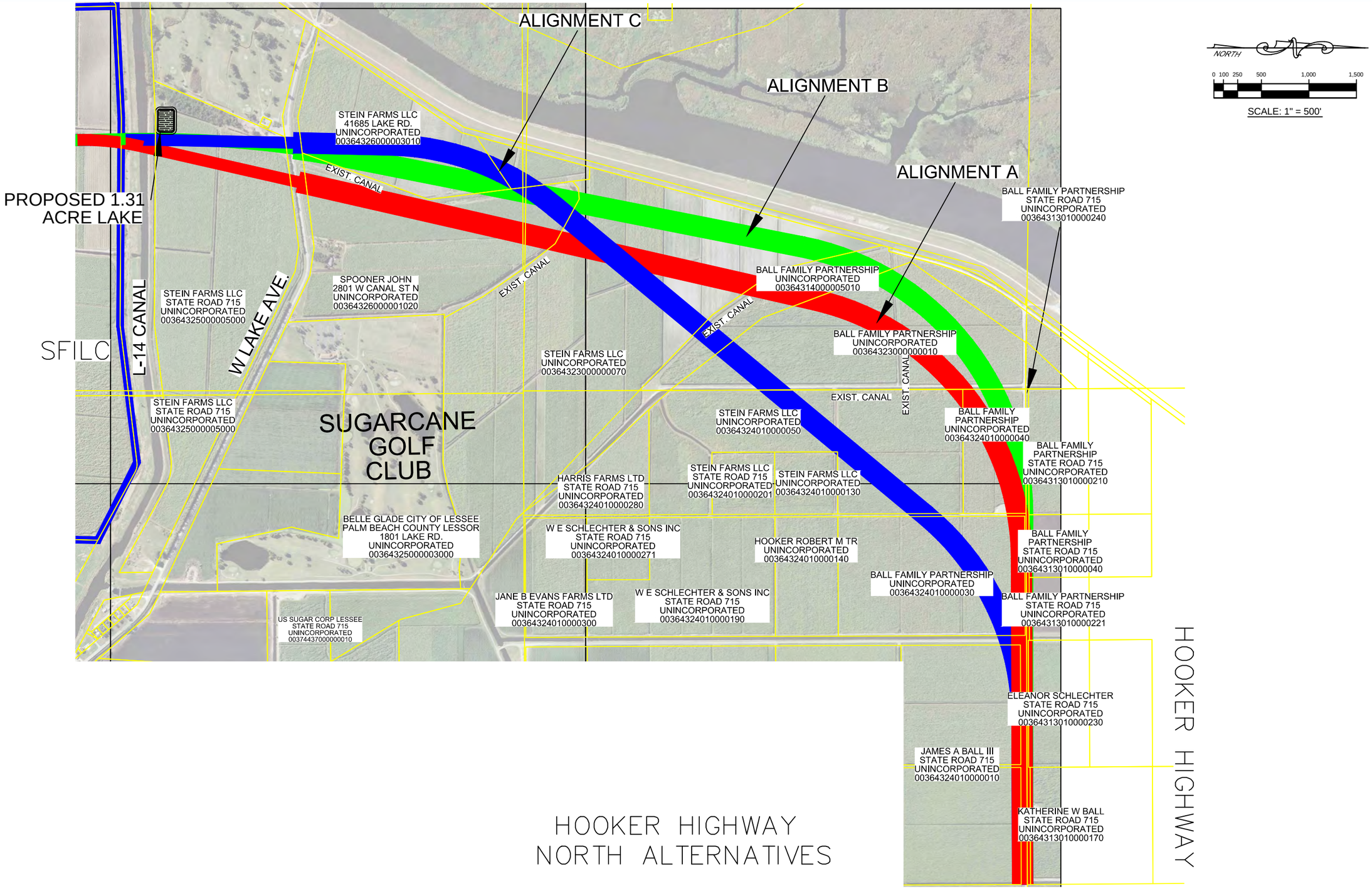
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36"
CHECKED	JT		11"X17"
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Hooker Highway Alternative Alignments

SHEET 2
OF: 14
PROJECT NO. 2012057



HOOKER HIGHWAY NORTH ALTERNATIVES

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NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36" 1" = 500'
CHECKED	JT		11"X17" 1" = 1000'
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"

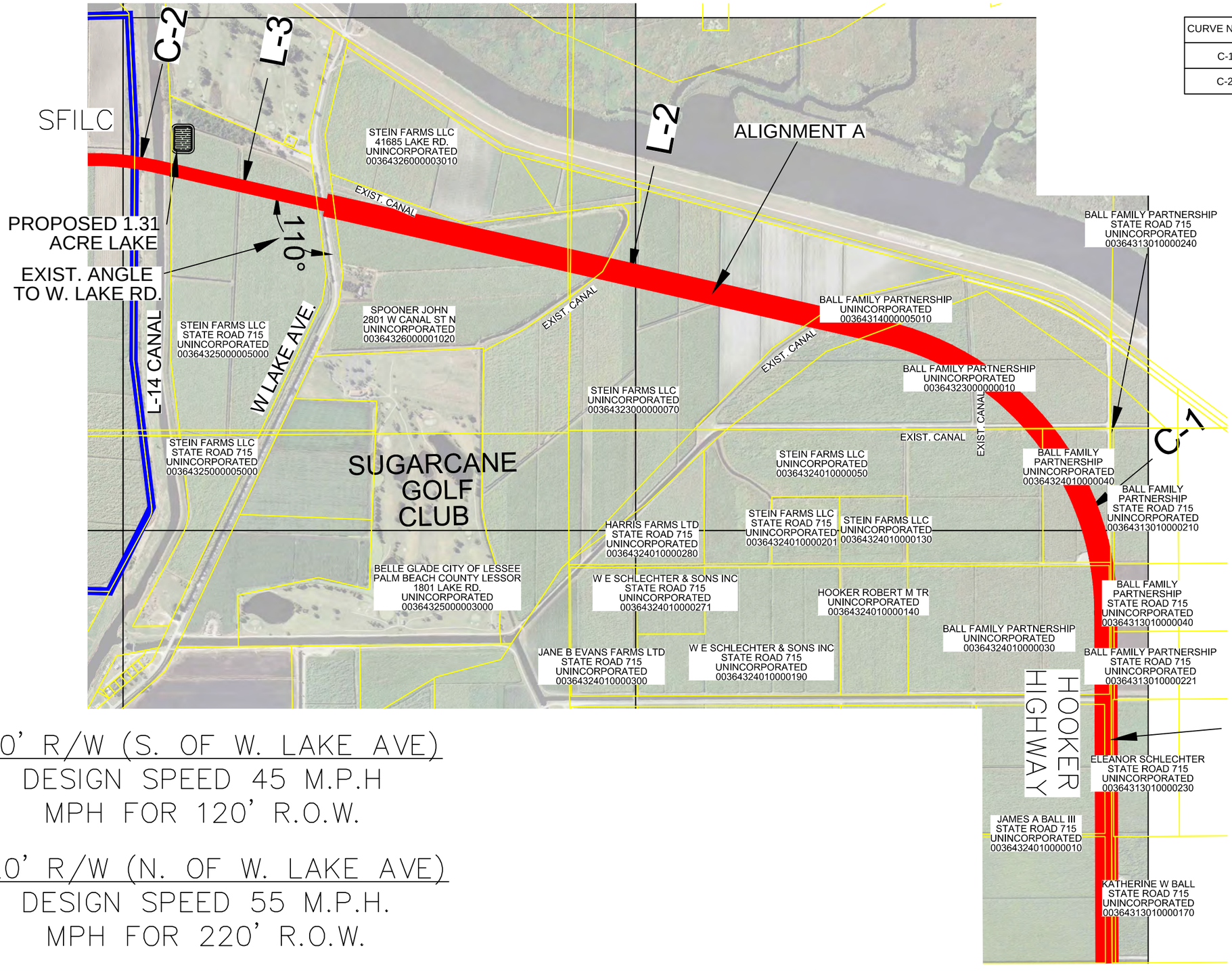
ALIGNMENT STUDY

North Alternative Alignments

SHEET 3 OF: 14
PROJECT NO. 2012057

CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	3,762 LF	2,865' (2°0'0")	76°57'56"	0.05	220'
C-2	689 LF	2,865' (2°0'0")	21°58'42"	0.05	120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (220')	3,432 LF
L-2 (220')	5,572 LF
L-3 (120')	1,682 LF



NORTH

0 100 250 500 1,000 1,500

SCALE: 1" = 500'

120' R/W (S. OF W. LAKE AVE)
DESIGN SPEED 45 M.P.H
MPH FOR 120' R.O.W.

220' R/W (N. OF W. LAKE AVE)
DESIGN SPEED 55 M.P.H.
MPH FOR 220' R.O.W.

HOOKER HIGHWAY NORTH ALIGNMENT ALTERNATIVE "A"

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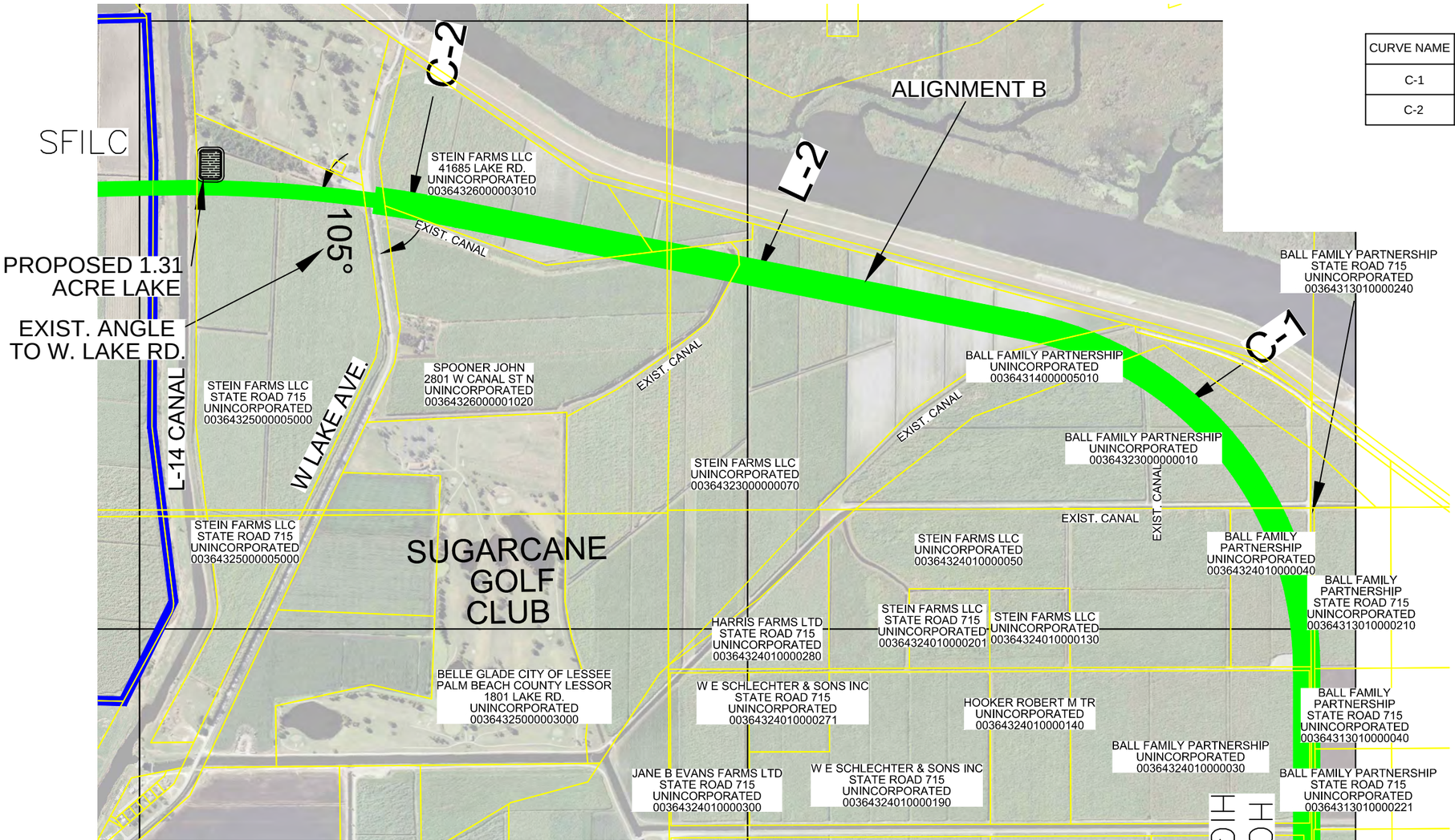
PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36" 1" = 500'
CHECKED	JT		11"X17" 1" = 1000'
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Alternative "A" Alignment

SHEET 4
OF: 14
PROJECT NO. 2012057



CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	3,943 LF	2,865' (2°0'0")	12°20'33"	0.05	220'
C-2	2,469 LF	11,460' (0°30'0")	78°50'6"	0.00	220' & 120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (220')	4,766 LF
L-2 (220')	3,896 LF

120' R/W (S. OF W. LAKE AVE)
DESIGN SPEED 45 M.P.H
MPH FOR 120' R.O.W.

220' R/W (N. OF W. LAKE AVE)
DESIGN SPEED 55 M.P.H.
MPH FOR 220' R.O.W.

HOOKER HIGHWAY NORTH ALIGNMENT ALTERNATIVE "B"

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CDI Project No. 12340

NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36" 1" = 500'
CHECKED	JT		11"X17" 1" = 1000'
APPROVED	JT		

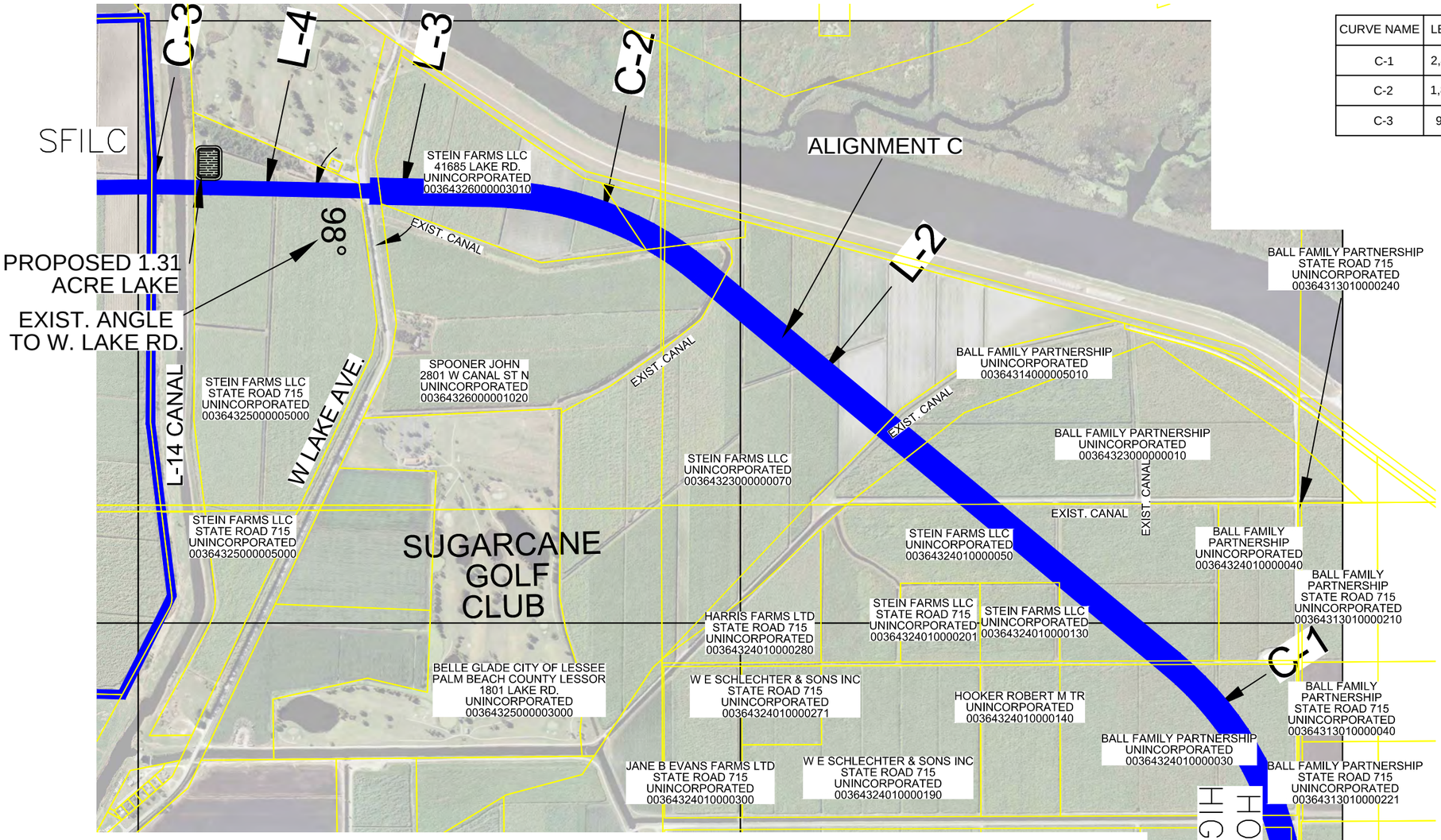
Gabriel Burden P.E.
Florida License No. 75425

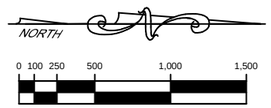
Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Alternative "B" Alignment

SHEET 5 OF: 14
PROJECT NO. 2012057

CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	2,446 LF	2,865' (2°0'0")	50°2'21"	0.05	220'
C-2	1,882 LF	2,865' (2°0'0")	14°25'8"	0.05	220'
C-3	968 LF	22,920' (0°15'0")	2°25'11	0.00	120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (220')	1,738 LF
L-2 (220')	5,087 LF
L-3 (220')	1,019 LF
L-4 (120')	1,328 LF





SCALE: 1" = 500'

120' R/W (S. OF W. LAKE AVE)
DESIGN SPEED 45 M.P.H
MPH FOR 120' R.O.W.

220' R/W (N. OF W. LAKE AVE)
DESIGN SPEED 55 M.P.H.
MPH FOR 220' R.O.W.

HOOKER HIGHWAY NORTH ALIGNMENT ALTERNATIVE "C"

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PALM BEACH COUNTY
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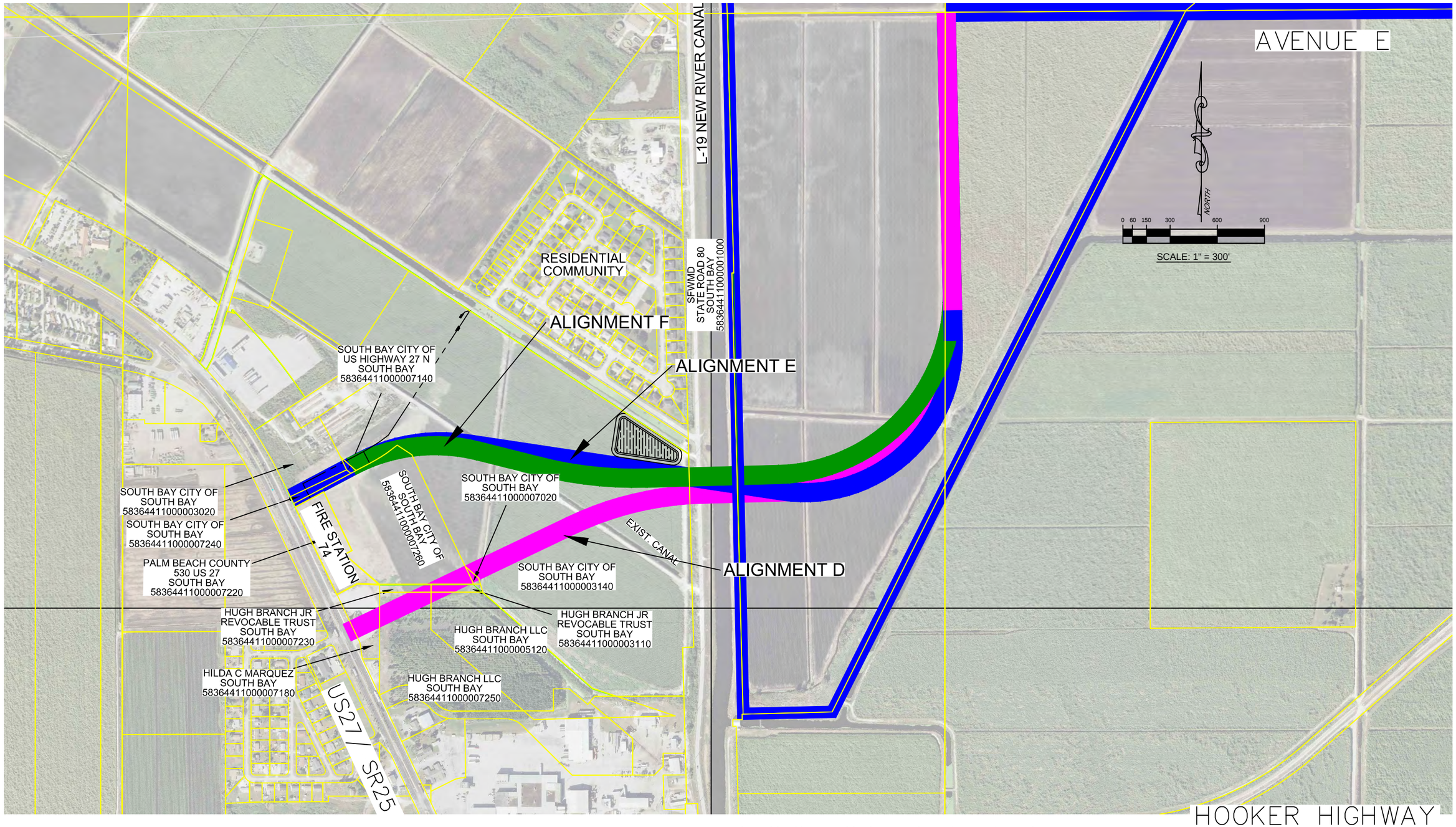
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

			BOOK No.	PG.
FIELD	x			
DESIGNED	x		SHEET SIZE	SCALE:
DRAWN	CJ		24"x36"	1" = 500'
CHECKED	JT		11"X17"	1" = 1000'
APPROVED	JT			

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
Alternative "C" Alignment

SHEET 6
OF: 14
PROJECT NO. 2012057



DESIGN SPEED 45 M.P.H.
120' R.O.W.

HOOKER HIGHWAY
SOUTH ALIGNMENT
ALTERNATIVES

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ENGINEERING CONSULTANTS

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CDI Project No. 12340

NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

			BOOK No.	PG.
FIELD	x			
DESIGNED	x		SHEET SIZE	SCALE:
DRAWN	CJ		24"x36"	1" = 300'
CHECKED	JT		11"X17"	1" = 600'
APPROVED	JT			

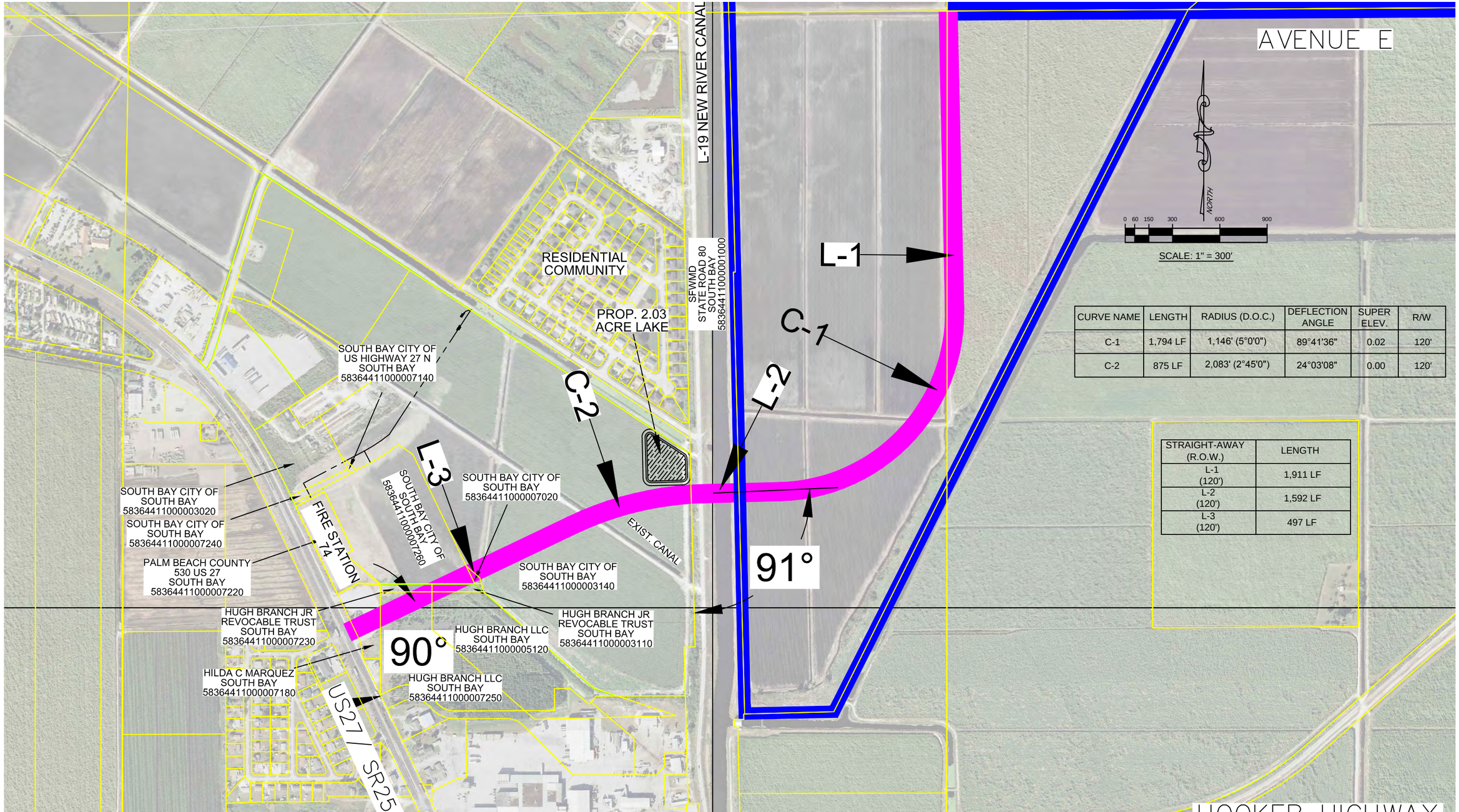
Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"

ALIGNMENT STUDY

South Alternative Alignments

SHEET 7
OF: 14
PROJECT NO. 2012057



CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	1,794 LF	1,146' (5°0'0")	89°41'36"	0.02	120'
C-2	875 LF	2,083' (2°45'0")	24°03'08"	0.00	120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	1,911 LF
L-2 (120')	1,592 LF
L-3 (120')	497 LF

DESIGN SPEED 45 M.P.H.
120' R.O.W.

HOOKER HIGHWAY SOUTH ALIGNMENT ALTERNATIVE "D"

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CDI Project No. 12340

NO.	DATE	REVISIONS	BY

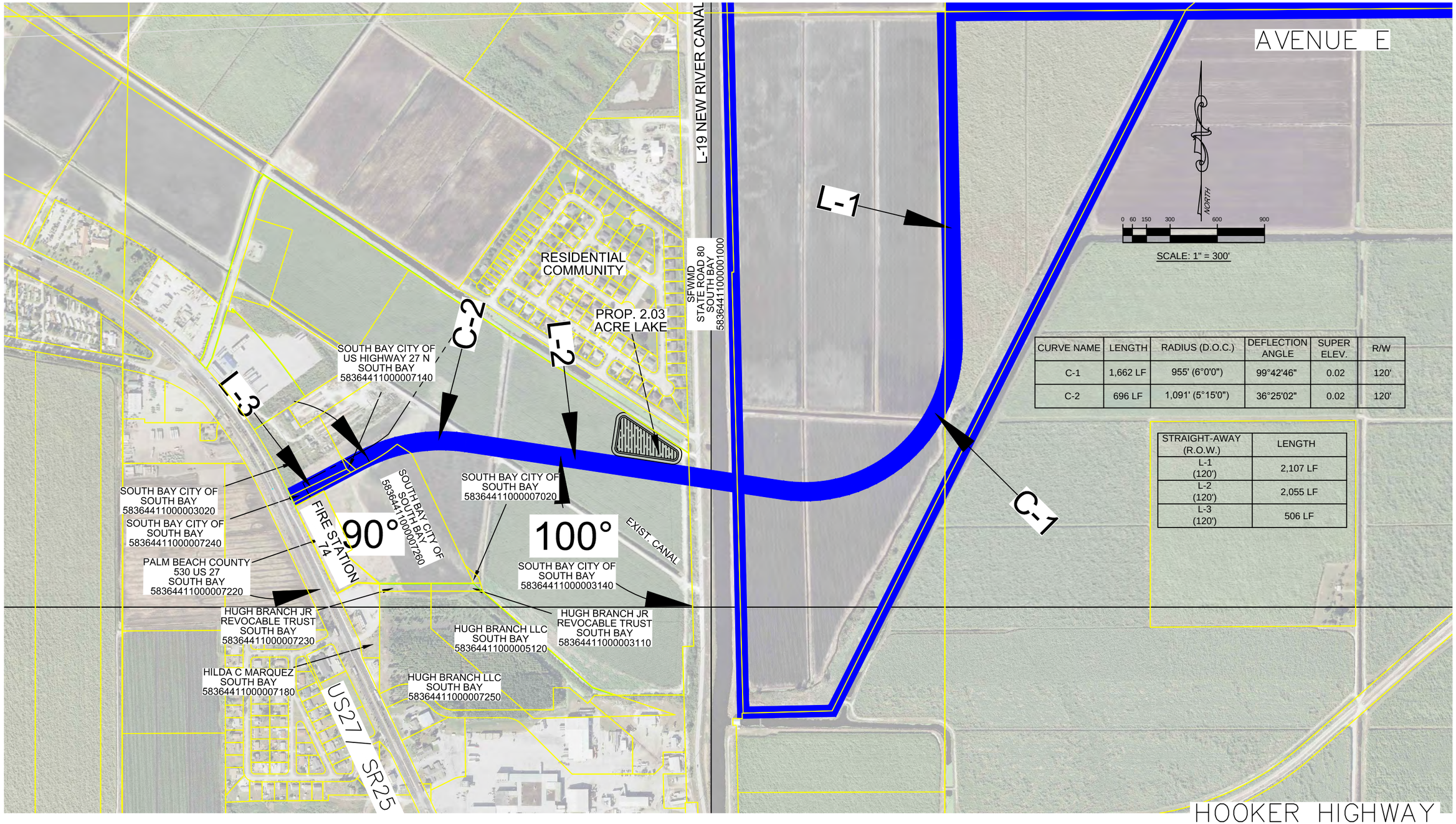
PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

			BOOK No.	PG.
FIELD	x			
DESIGNED	x		SHEET SIZE	SCALE:
DRAWN	CJ		24"x36"	1" = 300'
CHECKED	JT		11"X17"	1" = 600'
APPROVED	JT			

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
South Alternative "D" Alignments

SHEET 8 OF: 14
PROJECT NO. 2012057



CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	1,662 LF	955' (6°0'0")	99°42'46"	0.02	120'
C-2	696 LF	1,091' (5°15'0")	36°25'02"	0.02	120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	2,107 LF
L-2 (120')	2,055 LF
L-3 (120')	506 LF

DESIGN SPEED 45 M.P.H.
120' R.O.W.

HOOKER HIGHWAY SOUTH ALIGNMENT ALTERNATIVE "E"

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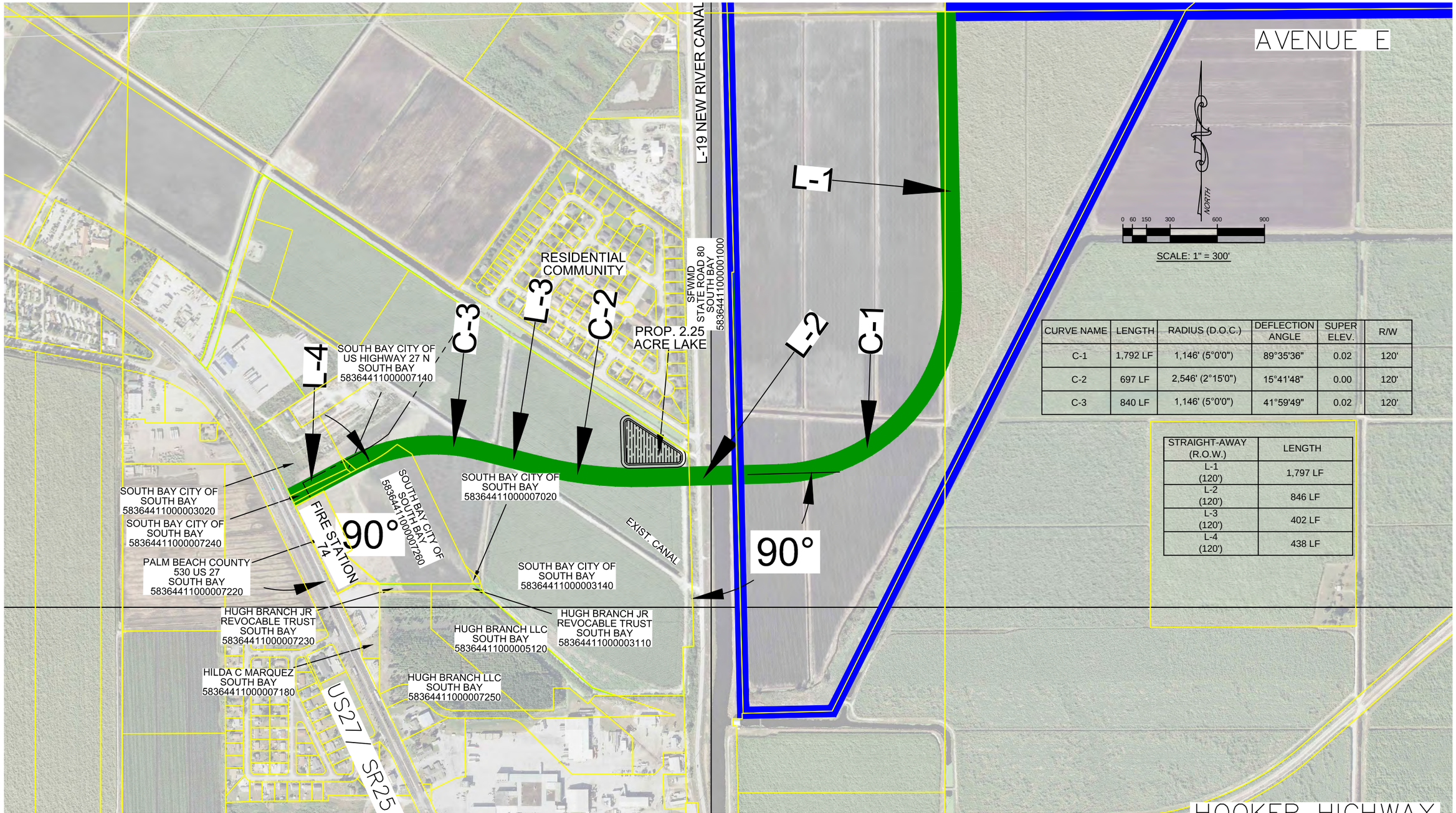
PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36" 1" = 300'
CHECKED	JT		11"X17" 1" = 600'
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
South Alternative "E" Alignments

SHEET 9
OF: 14
PROJECT NO. 2012057



CURVE NAME	LENGTH	RADIUS (D.O.C.)	DEFLECTION ANGLE	SUPER ELEV.	R/W
C-1	1,792 LF	1,146' (5°0'0")	89°35'36"	0.02	120'
C-2	697 LF	2,546' (2°15'0")	15°41'48"	0.00	120'
C-3	840 LF	1,146' (5°0'0")	41°59'49"	0.02	120'

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	1,797 LF
L-2 (120')	846 LF
L-3 (120')	402 LF
L-4 (120')	438 LF

DESIGN SPEED 45 M.P.H.
120' R.O.W.

HOOKER HIGHWAY SOUTH ALIGNMENT ALTERNATIVE "F"

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NO.	DATE	REVISIONS	BY

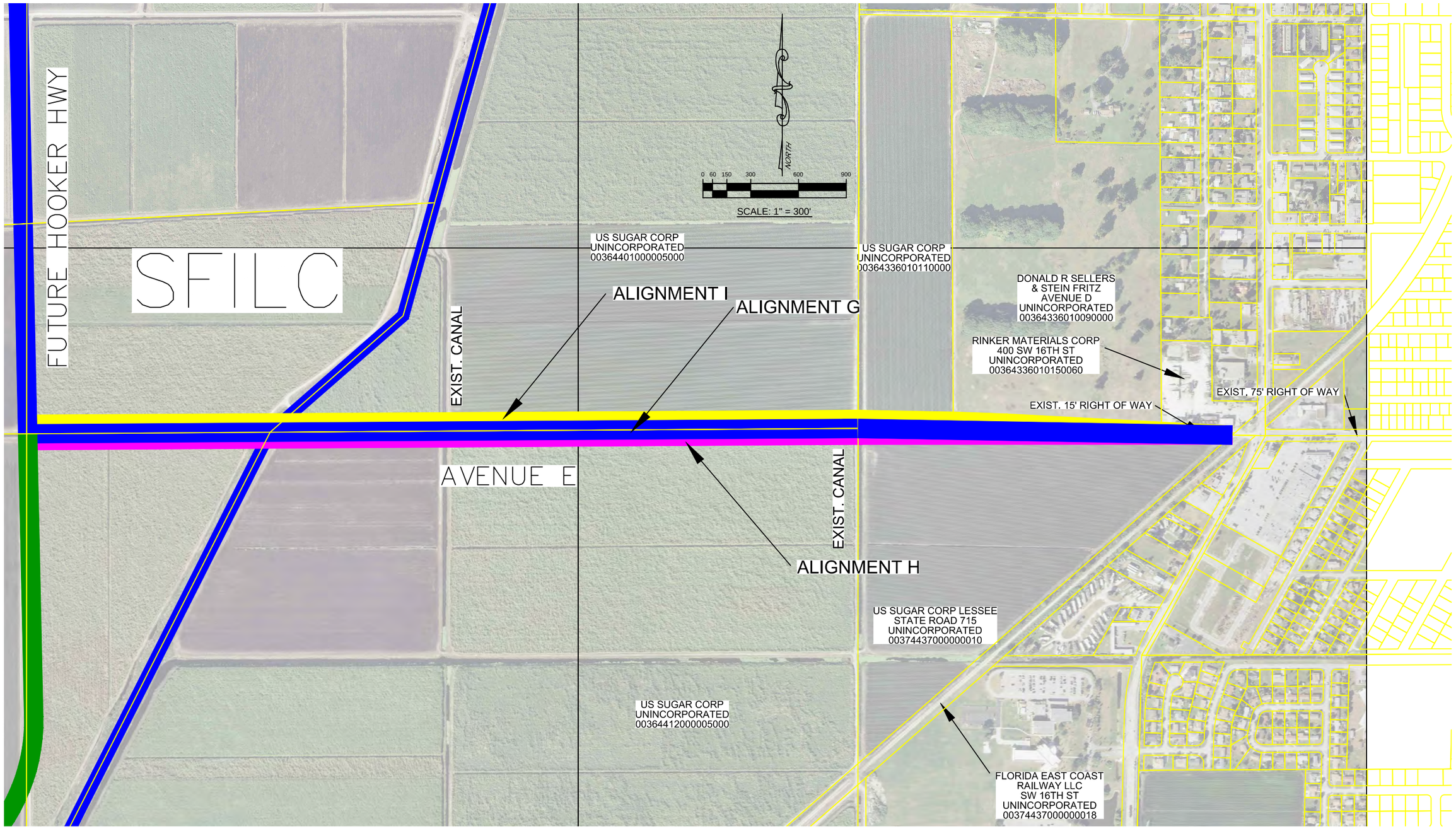
PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE: 24"x36" / 11"X17" SCALE:
DRAWN	CJ		
CHECKED	JT		
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
South Alternative "F" Alignments

SHEET 10
OF: 14
PROJECT NO. 2012057



AVENUE E ALTERNATIVE ALIGNMENTS

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P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE / SCALE:
DRAWN	CJ		24"x36" 1" = 300'
CHECKED	JT		
APPROVED	JT		11"X17" 1" = 600'

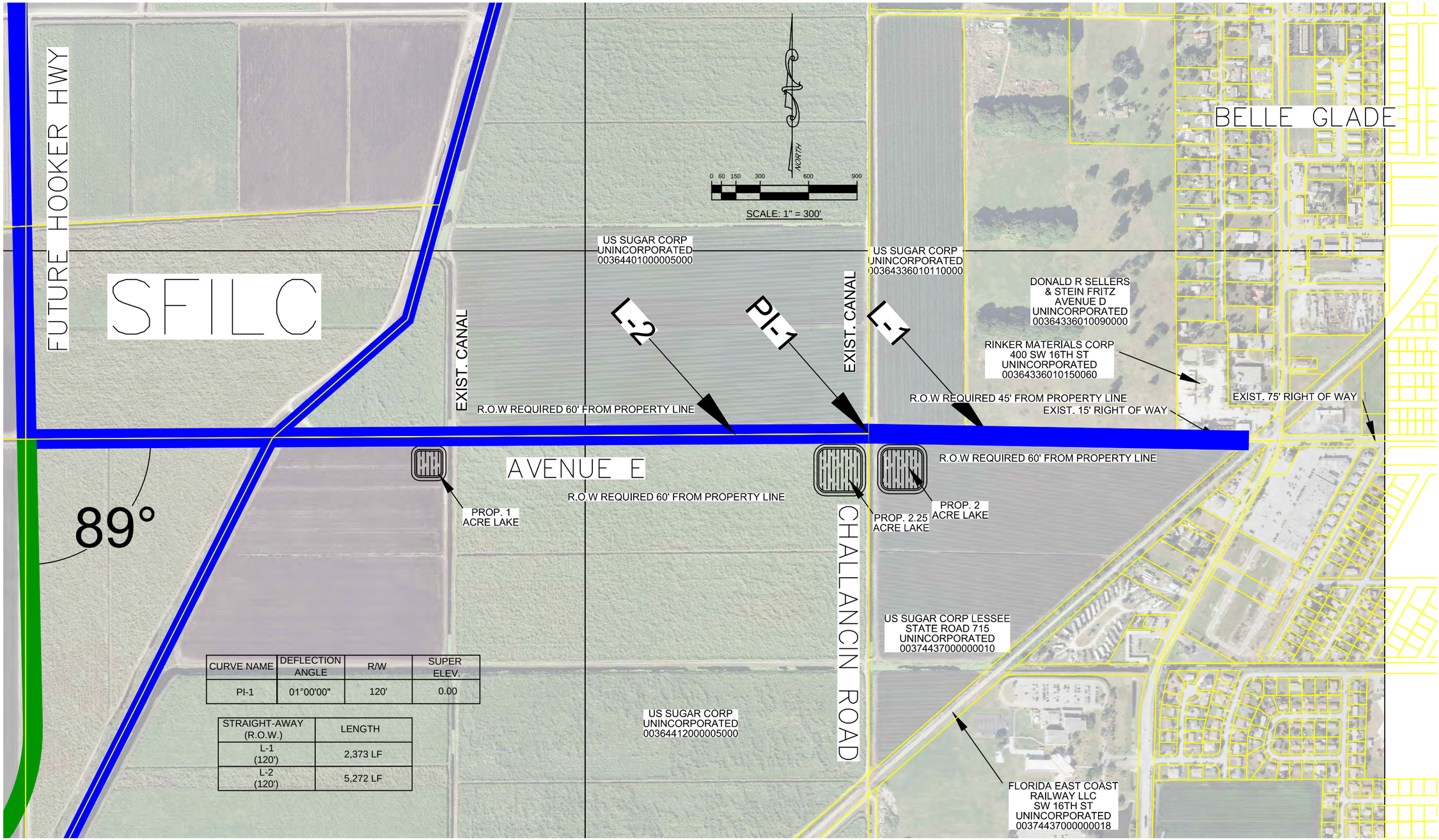
Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"

ALIGNMENT STUDY

Avenue E Alternative Alignments

SHEET 11
OF: 14
PROJECT NO. 2012057



CURVE NAME	DEFLECTION ANGLE	R/W	SUPER ELEV.
PI-1	01°00'00"	120'	0.00

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	2,373 LF
L-2 (120')	5,272 LF

DESIGN SPEED 45 M.P.H
120' R.O.W.

AVE. E ALIGNMENT
ALTERNATIVE "G"

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NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

			BOOK No.	PG.
FIELD	x			
DESIGNED	x		SHEET SIZE	SCALE:
DRAWN	CJ		24"x36"	1" = 300'
CHECKED	JT		11"X17"	1" = 600'
APPROVED	JT			

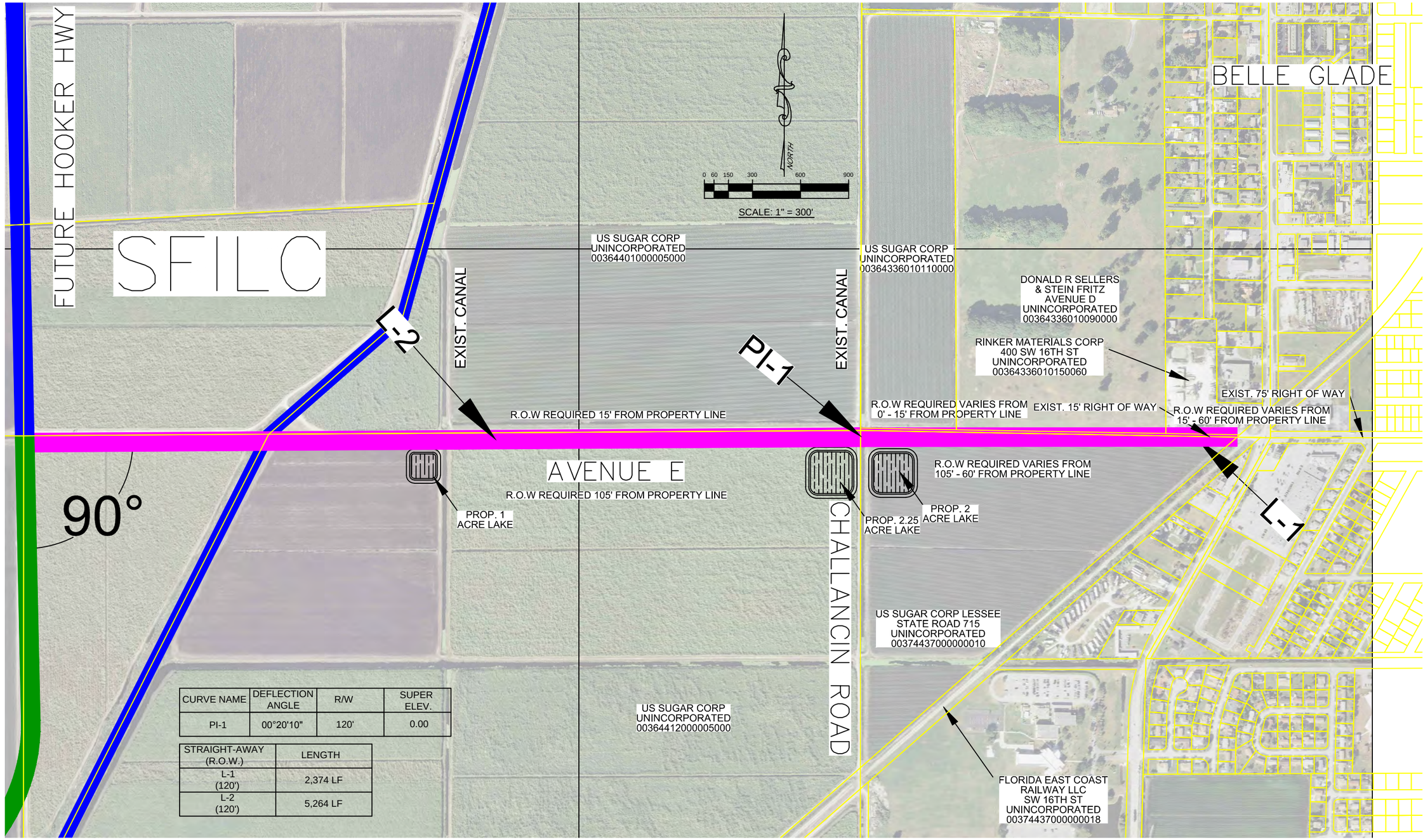
Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"

ALIGNMENT STUDY

AVENUE E Alternative Alignments

SHEET 12
OF: 14
PROJECT NO. 2012057



CURVE NAME	DEFLECTION ANGLE	R/W	SUPER ELEV.
PI-1	00°20'10"	120'	0.00

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	2,374 LF
L-2 (120')	5,264 LF

DESIGN SPEED 45 M.P.H
120' R.O.W.

AVE. E ALIGNMENT
ALTERNATIVE "H"

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NO.	DATE	REVISIONS	BY

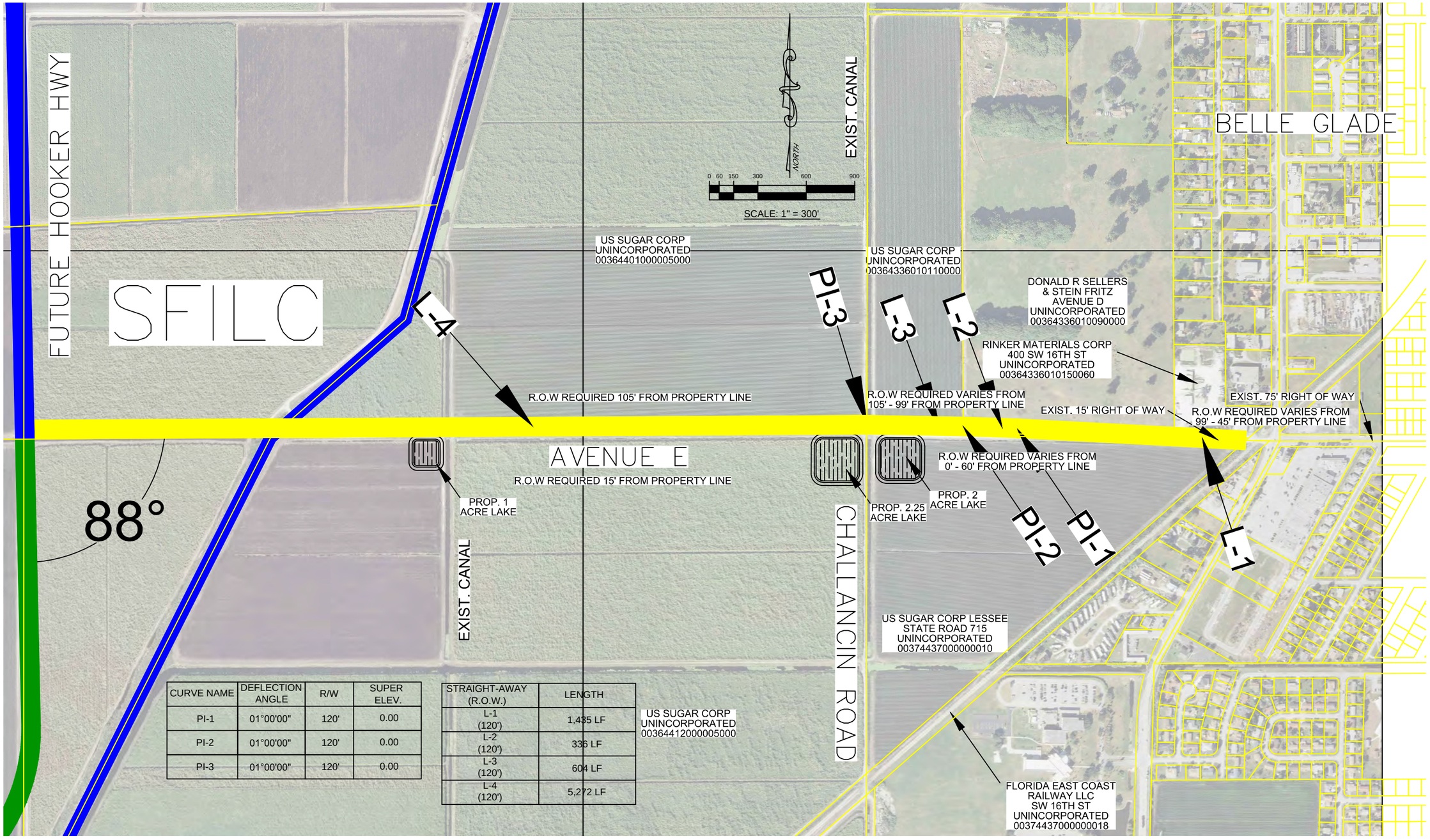
PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x	BOOK No.	PG.
DESIGNED	x	SHEET SIZE	SCALE:
DRAWN	CJ	24"x36"	1" = 300'
CHECKED	JT	11"X17"	1" = 600'
APPROVED	JT		

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"
ALIGNMENT STUDY
AVENUE E Alternative Alignments

SHEET 13
OF: 14
PROJECT NO.
2012057



CURVE NAME	DEFLECTION ANGLE	R/W	SUPER ELEV.
PI-1	01°00'00"	120'	0.00
PI-2	01°00'00"	120'	0.00
PI-3	01°00'00"	120'	0.00

STRAIGHT-AWAY (R.O.W.)	LENGTH
L-1 (120')	1,435 LF
L-2 (120')	336 LF
L-3 (120')	604 LF
L-4 (120')	5,272 LF

DESIGN SPEED 45 M.P.H
120' R.O.W.

AVE. E ALIGNMENT
ALTERNATIVE "I"

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NO.	DATE	REVISIONS	BY

PALM BEACH COUNTY
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION
P. O. BOX 21229, WEST PALM BEACH, FLORIDA

FIELD	x		BOOK No. PG.
DESIGNED	x		SHEET SIZE: SCALE:
DRAWN	CJ		24"x36"
CHECKED	JT		
APPROVED	JT		11"X17"

Gabriel Burden P.E.
Florida License No. 75425

Project: HOOKER HWY & AVENUE "E"

ALIGNMENT STUDY

AVENUE E Alternative Alignments

SHEET 14
OF: 14
PROJECT NO. 2012057

APPENDIX H

Roadway and Railroad Improvements – Palm Beach County Engineering Traffic Division, December 2014

Roadway and Railroad Improvements For Glades CCPG

EXECUTIVE SUMMARY:

Palm Beach County Engineering & Public Works (PBCENG) entered into a Memorandum of Understanding (MOU) with Palm Beach County Department of Economic Development and Sustainability (DES) for participation in the development of Glades Regional Master Plan (GRMP). This task is to provide services related to current and future roadway and railroad conditions. The Glades Regional Master Plan is intended to be a guiding document. This task is intended to look at existing roadway conditions, the need for future roadway widening and the feasibility of future railroad extensions.

INTRODUCTION:

The DES has undertaken the task of developing the master plan for the Glades Region of Palm Beach County, with funding provided by a Community Challenge Planning Grant (CCPG) from the U.S. Department of Housing and Urban Development (HUD). DES designated a portion of the funding for an inventory of the existing roadway conditions, future roadway needs with and without the planned Inland Logistic Center (ILC) and a review of a study of the feasibility of extending a railroad line to the Glades Region.

The Palm Beach County Engineering and Public Work's Traffic Division was responsible for determining the long range traffic impacts of the Inland Logistic Center on the Glades Region. The Traffic Division also performed a macro review of the existing roadways and railroads in the region.

EXISTING CONDITION:

Review of Existing Roadways

The Traffic Division, in coordination with the Palm Beach County Roadway Production Division, completed a review of the existing roadway conditions in the Glades region. Although, the current long range analysis does not identify any capacity related issues with the existing roadway network, there are extensive existing deficiencies associated with the existing conditions of the roadways. Specifically, the presence of muck within the roadway limits. Maps 1 through 18 identify the existing conditions of the major roadways in the Glades region.

2035 Long Range Traffic Study

The Palm Beach County Traffic Division, in coordination with the Metropolitan Planning Organization (MPO), contracted with Leftwich Consulting Engineers, Inc. (Consultant) to evaluate the potential long range roadway impacts of the proposed Inland Logistics Center (ILC). The evaluation was based upon various factors including, but not limited to, the existing land use of the ILC, the extension of Hooker Highway through the ILC site, the extension of Avenue E to Hooker Highway, estimated ILC employees and various other long range assumptions.

There are various 2035 traffic models available that may be utilized for long range traffic forecasting. Recently, the MPO and Florida Department of Transportation (FDOT) updated the 2035 South East Regional Planning Model (SERPM) to reflect the latest Palm Beach County land use data, therefore the 2035 SERPM model was determined to be the preferred model available to evaluate the long range traffic forecast for the ILC.

Utilizing the SERPM, a new traffic analysis zone (TAZ) was created for the ILC. The new TAZ incorporated 3,000 employees, generating approximately 8,100 daily trips. Additionally, two (2) new roadway links were added to the model roadway network, the westward extension of Avenue E to the ILC site and the extension of Hooker Highway through the ILC site connecting to US-27. The SERPM model was run under the 'select zone' scenario to evaluate how the model was distributing the ILC traffic and to evaluate the 2035 traffic volumes with and without the ILC. The model's traffic distribution pattern for the ILC was satisfactory and generally reflected the ILC traffic distribution pattern in the 'Inland Logistics Center LUPA' report prepared by Kimley-Horn and Associates in June 2010.

As with all models, the 2035 model outputs are validated in coordination with the consultant and through a process that requires comparing the model outputs with future traffic forecasts using straight line growth factors that are based on historical growth and engineering judgment. Additionally, consideration was given to the diversion of traffic that may be created with the extension of Avenue E and Hooker Highway to the regional roadway network.

Based upon the various factors and long range assumptions noted above and in the model, including the extension of Avenue E and Hooker Highway through the ILC site, the existing roadway links are within capacity. Although the need for the widening of existing roadways is not identified at this time, the character of the roadway will be significantly impacted by the increase in vehicle and truck traffic.

The attached table, Exhibit 'A', identifies the forecasted 2035 traffic volumes on the various roadway links throughout the Glades region and specifically identifies the projected ILC project traffic. For example, SR-80 (Southern Boulevard) is an existing 4-lane roadway from 20-Mile Bend to Seminole-Pratt Whitney Road owned and maintained by FDOT. The average daily traffic volume in 2013 was 15,476 vehicles per day. The ILC is anticipated to generate an additional 1,631 trips on this segment of SR-80 every day by the year 2035. Therefore, based upon the 2035 SERPM model, which includes but is not limited to, historical growth, background traffic and the proposed ILC, the total traffic volume anticipated on this segment of SR-80 in 2035 is 22,260.

In addition to evaluating the roadway links, various intersections were also analyzed utilizing Synchro software. With the increase in traffic volume, the lack of existing turn lanes and other factors such as the geometric configuration of certain intersections, the following intersections were determined to be deficient and require improvements when the ILC is developed.

Intersections
Proposed Improvements and Cost Estimate

Intersection	Proposed Needed Improvement	Estimated Costs*
SR-715 & SW Avenue E	Addition of NB and EB left turn lane and SB right turn lane	Included in the cost of Avenue E extension
SR-715 & Hooker Highway	Addition of NB and EB left turn lanes and SB right turn lane	$600,000
SR-80 & CR-880	Addition of NB right turn lane	$100,000
US-27 (SR-80) & Hooker Highway/PBC Fire Station #74	Addition of SB right turn land and traffic signal	Included in the cost of Hooker Highway extension

**Estimated costs include design construction and CEI services. The cost estimates do not include the removal of muck, if required. Additional detailed geotechnical evaluations are recommended to further define construction costs.*

Recommended Roadway Improvements and Alternative Solutions:
The single most important issue associated with addressing the roadways in the Glades region is the presence of muck within the roadway limits. There are various options and/or alternatives to address the muck, such as:

- Removal of the muck (de-mucking) and replacing it with approved back fill material
- Surcharging the existing muck
- Construction of a geo-grid

Each option noted above has its benefits and issues, therefore a thorough geotechnical evaluation is recommended for the various roadways. The evaluation will identify the limits of the muck and determine the best cost feasible options available to address the muck.

In many instances the mitigation of the muck may not be feasible, due to either cost or constructability, therefore the leveling and overlay of the existing roadway was also evaluated. The cost associated with the leveling and overlaying of the existing roadway is significantly less than the costs to mitigate the muck and reconstruct the roadway. Although, if the muck is not removed, the roadway will continue to prematurely fail and require continuous leveling and overlay. The frequency of the leveling and overlay would be determined by the deterioration of the structural capacity of the roadway ('waffling' of the asphalt) due to various factors including but not limited to the depth of the muck, traffic volumes and truck traffic. Exhibit 'B' identifies Glades region roadways that had a fair and/or poor condition and/or base rating and the associated costs to reconstruct the roadways utilizing geo-grid and the costs to level and overlay the roadway.

For example, Hooker Highway from SR 715 to SR 80/US 441/Main Street will experience an increase in traffic with the extension of Hooker Highway through the ILC site, therefore the reconstruction of the existing road may be desired. The reconstruction of the roadway would also include upgrading the road to the latest County standards, including but not limited to the addition of paved shoulders and the installation of guardrail, if required. The estimated cost to reconstruct the approximately one (1) mile of Hooker Highway is $5,400,000 and the estimated cost to level and overlay the existing asphalt is approximately $175,000. Several factors should be considered in determining if the roadway should be reconstructed or overlayed, such as the function of the roadway as it relates to the overall grid system servicing the Glades region, the geotechnical evaluation and the feasibility and costs associated with the reconstruction of the roadway.

In summary, the completion of a thorough geotechnical evaluation of the various roadways is recommended to identify the scope and mitigation options associated with the presence of muck. The geotechnical evaluation is critical in further detailing the cost and constructability of roadway improvements. Additionally, identifying the timing, location and level of development in the Glades region would be beneficial in determining the prioritization of the various roadway improvements.

Existing Glades Area Rail Network

The Florida Department of Transportation commissioned the US-27 Multimodal Planning and Conceptual Engineering (PACE) Study to determine the feasibility of a rail corridor generally following the US-27 corridor from the Homestead Extension of the Florida Turnpike in Miami-Dade County to the Palm Beach/Hendry County line. The purpose of the rail corridor is to meet South Florida's growing transportation needs for freight and passenger movement associated with the potential development of inland logistic centers in Palm Beach County, Glades County and St. Lucie County. The study consisted of approximately 72 miles of roadway on US-27 and reviewed existing traffic conditions, travel demand created by the proposed inland logistics centers, and multimodal alternatives.

South Florida is served by three (3) freight railroads, the FEC Railway, the CSX Railroad and the South Central Florida Express (SCFE). The FEC and CSX railways run mainly through Palm Beach County's urban areas. The FEC Railroad carries freight and is the corridor for the proposed All Aboard Florida passenger rails service between Miami and Orlando. The CSX Railroad carries freight and is the corridor for the TriRail commuter rail service and Amtrack. The SCFE is owned and operated by U.S. Sugar and runs mainly around the southern and eastern perimeter of Lake Okeechobee. Additionally, the SCFE has multiple rail spurs along the main track servicing the agriculture lands adjacent to Lake Okeechobee.

Future Glades Area Rail Network

The development of a new rail corridor along US-27 would connect Port Miami with the SCFE railway and provide a reliever for the FEC and CSX railways, located mostly along the coast, and divert some long haul truck traffic to the new rail corridor.

The PACE Study concluded a new railroad corridor is feasible within the US-27 right of way. There are multiple constraints and/or issues that would have to be addressed such as the limited right of way width of US-27 in the South Bay area, intersection configurations, adjacent canals and major drainage control structures. The estimated cost of the development of a US-27 railroad is approximately $1.2 billion.

The PACE Study sets the stage for future studies and includes key issues that may be used to assist with determining the final railroad location. The study also encourages continued monitoring and evaluation of travel demand on US-27, the development of Inland Logistic Centers and the growth of Port Miami.

Exhibit 'A'

Long Range Transportation Plan for the Glades Region

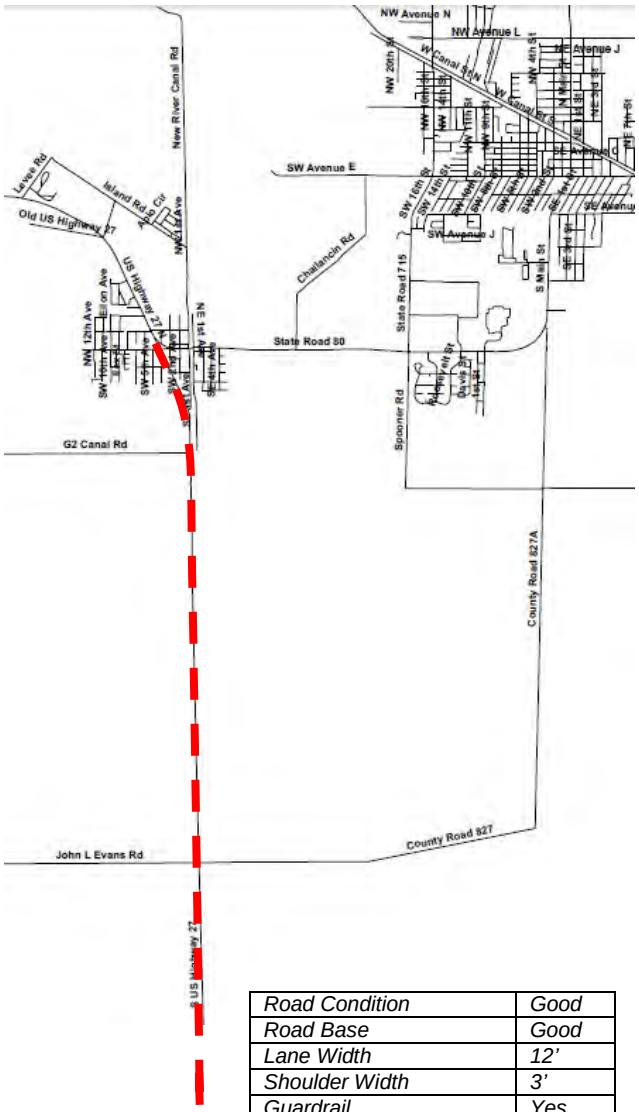
Road name	From	To	# Lanes	Owner	Daily Traffic 2013 AADT	Length of Segment (Miles)	Type of Road Surface	ILC Traffic AADT	Validated 2035 AADT w/ILDC	Map/Figure Number
US-27	Hendry Co.	Hooker Highway	4	FDOT	11,600	11.6	Paved	815	22,675	N/A
US-27	Hooker Highway	SR-80	4	FDOT	19,149	1	Paved	1,541	18,885	N/A
US-27	SR-80	Broward Co.	4	FDOT	10,996	25.8	Paved	815	16,889	1
SR 80/Main St	U.S. 27	Hooker Hwy	4/2	FDOT	17,529	7.2	Paved	163	18,807	2
SR 15/US 441	SR 80	SR 729/N State Market	4	FDOT	7,941	6.3	Paved	408	8,403	3
CR 827A	U.S. 27	SR 80/Main St	2	PBC	1,985	6	Paved	49	6,635	4
CR 880	SE Ave E/MLK Blvd	SR 80/20-Mile Bend	2	PBC	4,755	19.4	Paved	49	7,452	5
Ave E/MLK Blvd	SR 715	E Canal St S	4	PBC	7,384	1.5	Paved/ Cracks	220	8,443	6
Ave E MLK Blvd Ext	Hooker Hwy	SR 715	N/A	PBC	N/A	N/A	N/A	2,267	9,277	N/A
S Canal St	SR 715	SE Ave E/MLK Blvd	2	PBC	2,500	1.7	Paved	261	2,360	7
N Canal St	SR 715	SE Ave E Bridge	4	FDOT	3,670	1.7	Paved	212	3,364	8
NW Ave L	SR 715	SR 80/Main St	4	PBC	7,200	1	Paved	416	7,709	9
Gator Blvd	SR 80/Main St	Hatton Hwy	2	PBC	8,771	5.7	Paved	359	12,232	10
Curlee Rd	SR 80/Main St	E Sugarhouse Rd	2	PBC	1,258	1	Paved	33	1,250	11
Hatton Hwy	SR 700/US 98	Gator Blvd	2	PBC	2,079	2.1	Paved	179	2,039	12
Hooker Hwy	SR 715	SR 80/US 441/Main St	2	PBC	5,414	1.1	Paved	1,549	10,533	13
Hooker Hwy	SR 715	MLK Ext/site	N/A	N/A	N/A	NA	NA	2,520	6,481	N/A
Hooker Hwy Ext	MLK Ext/Site	US 27	N/A	N/A	N/A	NA	NA	3,359	7,320	N/A
NW 16th Street/SR 715	Hooker Highway	SR 80/ Spooner	2	FDOT	12,799	4.3	Paved	840	13,639	14
SR 80	US 441/Main St	20-Mile Bend	4	FDOT	9,777	18.1	Paved	1,549	12,328	15
SR 80/Southern Blvd	20 Mile Bend	Seminole Pratt	4	FDOT	15,476	4.8	Paved	1,631	22,260	16
SR 15/S Lake Ave/E 7th St	E Main St	US 441/N. State Mkt Rd	2	FDOT	8,554	1.5	Paved	253	13,295	17
Muck City Rd/CR 717	SR 15/US 441	SR 700/US 98	2	PBC	2,249	5.6	Paved	0	7,608	18
SR 715/US 98/US 441	E Main St/N State Mkt Rd	Martin County line	2	FDOT	4,255	8.5	Paved	506	5,261	19
SR 700/US 98/Conners Hwy	SR 715	SR 80/20-Mile Bend	2	FDOT	4,308	19.8	Paved	0	254,912	20

Exhibit 'B'

Resurfacing Costs							
Road Name	**From**	**To**	**Base Condition**	**Road Condition**	**Approximate Length (Miles)**	**Estimated Repaving Costs**	**Estimated Reconstruction Costs**
CR-880	SE Ave E/MLK Blvd	SR-80/20 Mile Bend	Poor	Good/Fair	19.0	$3,600,000	$102,600,000
Avenue E*	SR-715	E Canal Street South	Fair/Poor	Fair	1.7	$575,000	$12,900,000
Canal Street South	SR-715	SE Ave E/MLK Blvd	Poor	Poor	1.7	$305,000	$9,200,000
Gator Blvd	SR-80/Main Street	Hatton Hwy	Poor	Good/Fair	7.0	$1,275,000	$37,800,000
Hatton Hwy	SR-700/US-98	Gator Blvd	Poor	Poor	8.0	$375,000	$43,200,000
Hooker Hwy	SR-715	SR-80/US-441/Main Street	Fair	Fair	1.0	$175,000	$5,400,000

**The estimated reconstruction costs for Avenue E are based upon the reconstruction of the urban section and mitigation of the muck. The feasibility of mitigating the muck and maintaining access to the adjacent business is questionable. Therefore, further evaluation of the constructability of improvements to Avenue E is required.*

At CR 827



NORTH

Road Condition	*Good*
Road Base	*Good*
Lane Width	*12'*
Shoulder Width	*3'*
Guardrail	*Yes*
Clear Zone	*NA*

To Broward County

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

US 27
From SR 80
To Broward County Line

MAP
1
8-13-14

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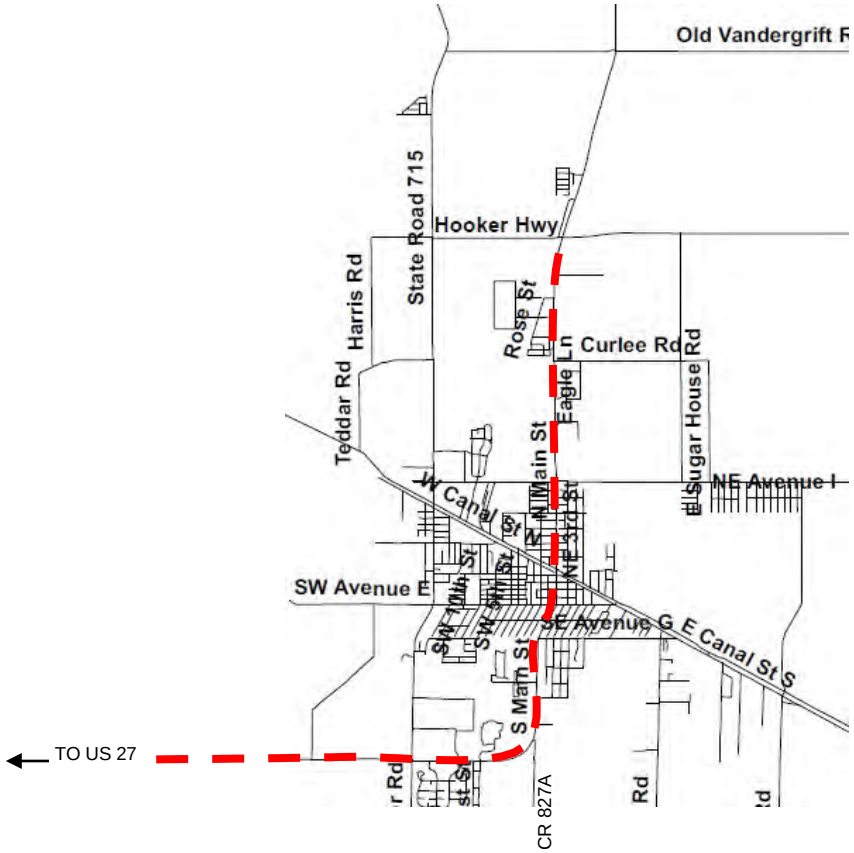
At CR 827A (looking north)



NORTH

Road Condition	*Good*
Road Base	*Good*
Lane Width	*12'*
Shoulder Width	*2'*
Guardrail	*NA*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

SR 80/Main St
From US 27 to Hooker Hwy

MAP
2
8-13-14

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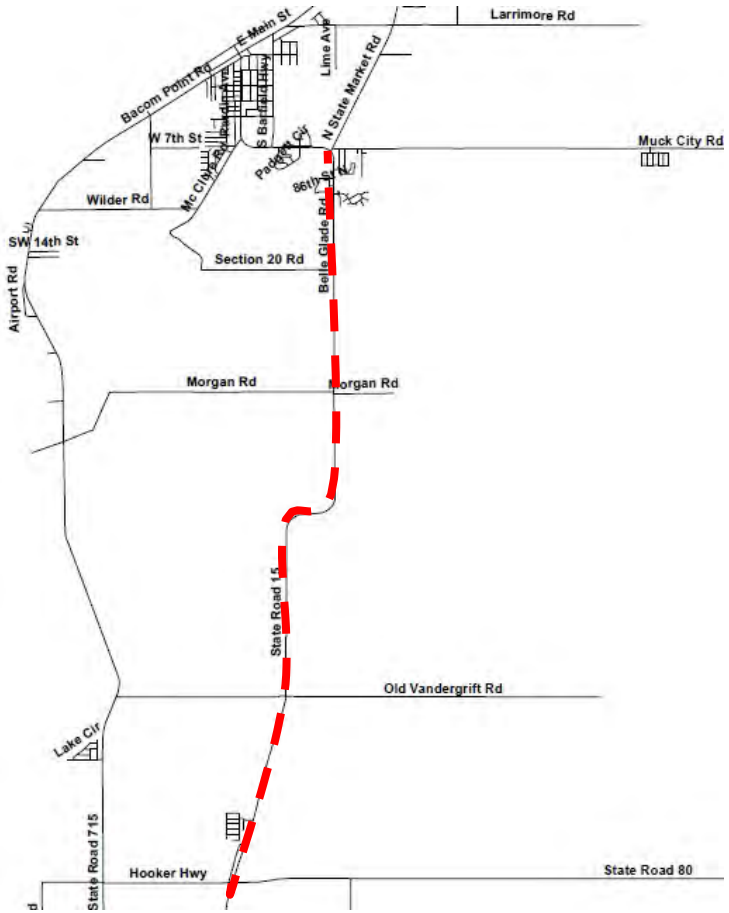
At Morgan Rd



NORTH

Road Condition	*Good*
Road Base	*Good*
Lane Width	*11'*
Shoulder Width	*4'/6'*
Guardrail	*Yes*
Clear Zone	*No*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

SR 15/US 441
From SR 80/Hooker Hwy
To US 441/N State Market Rd

MAP
3
8-13-14

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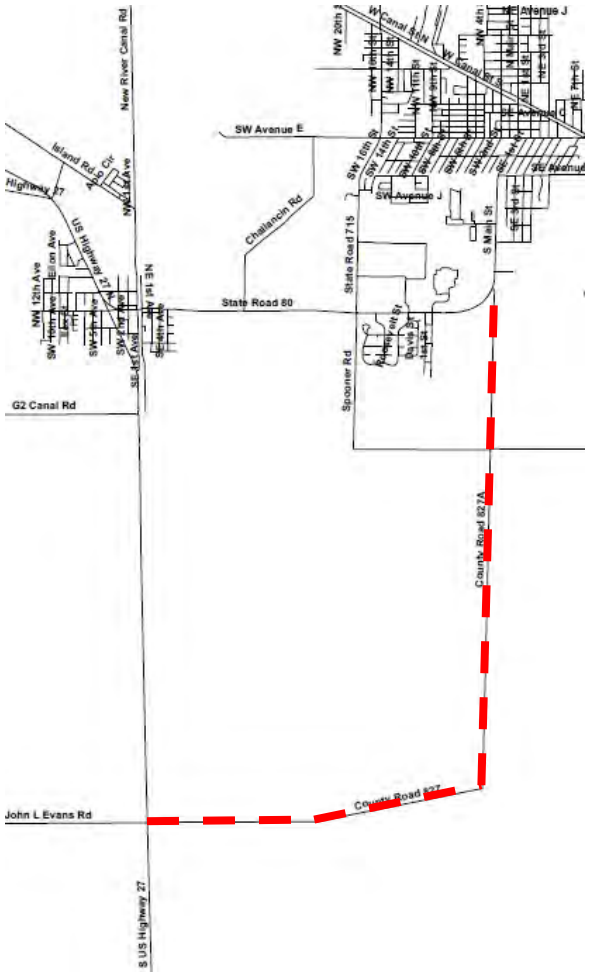
East US 27



Road Condition	*Good*
Road Base	*Fair*
Lane Width	*12'*
Shoulder Width	*4'*
Guardrail	*Yes*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

CR 827A
From US 27 to SR 80/Main St

MAP
4
8-13-14

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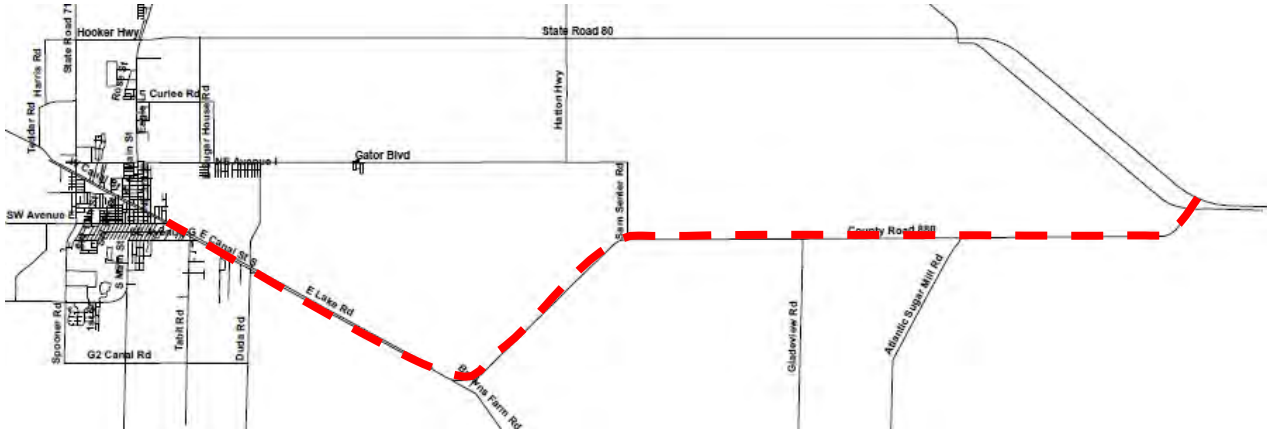
NORTH



At Sam Senter (looking east)

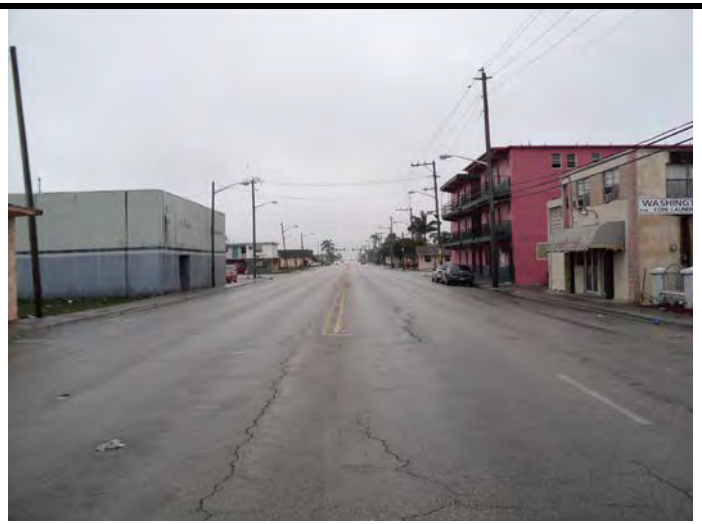
Road Condition	*Good/Fair*
Road Base	*Poor*
Lane Width	*12'*
Shoulder Width	*4'/2'*
Guardrail	*Yes*
Clear Zone	*NA*

location

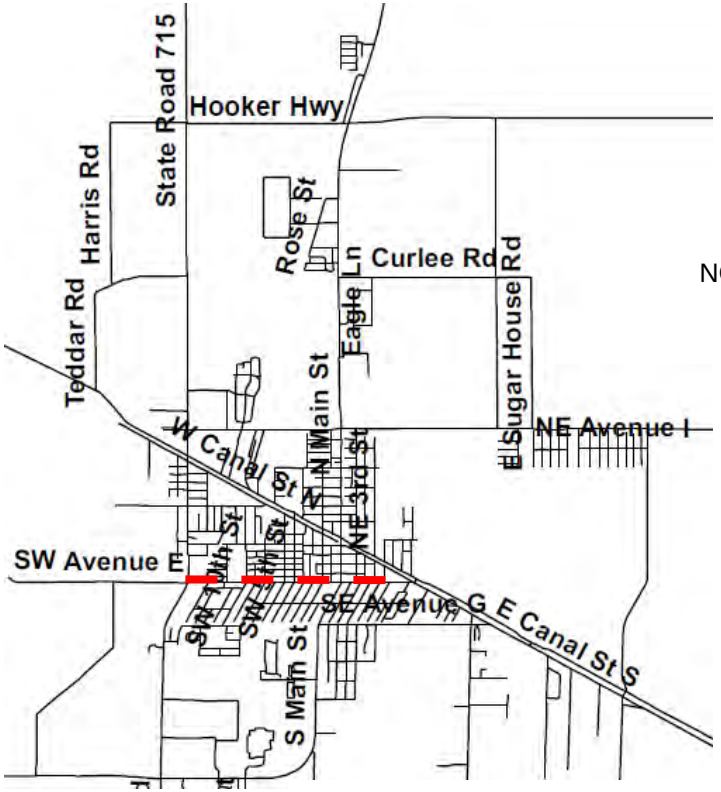
LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

CR 880
From SE Ave E/MLK Blvd
to SR 80/20 Mile Bend

MAP
5
8-13-14



At SW 7th St



NORTH

Road Condition	*Fair*
Road Base	*Fair/Poor*
Lane Width	*11'*
Shoulder Width	*NA*
Guardrail	*Yes/No*
Clear Zone	*NA*

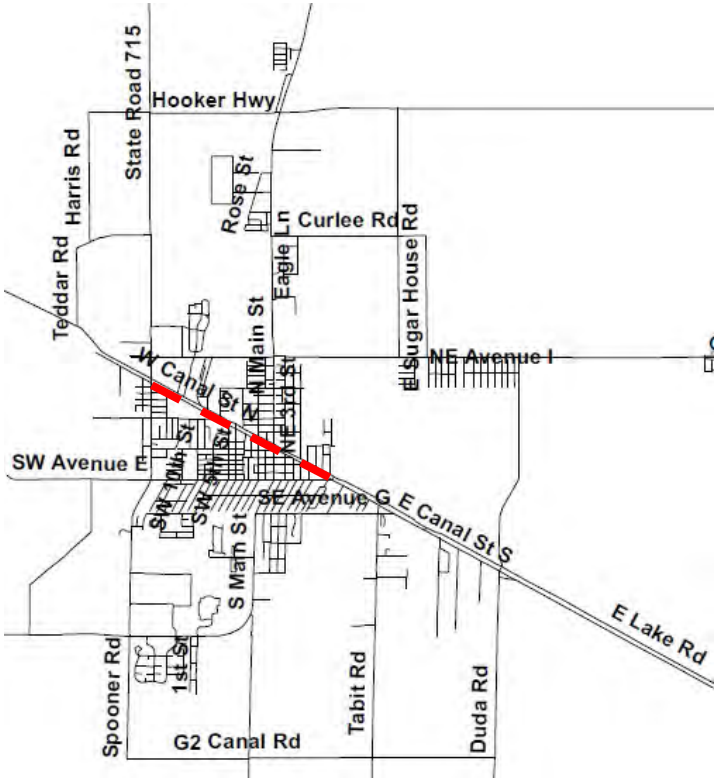
location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Ave E/MLK Blvd
From SR 715 to E Canal St S

MAP
6
8-13-14

East of SR 715



NORTH

Road Condition	*Poor*
Road Base	*Poor*
Lane Width	*10'/12'*
Shoulder Width	*NA*
Guardrail	*No*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Canal St S
From SR 715 to SE Ave E/MLK Blvd

MAP
7
8-13-14

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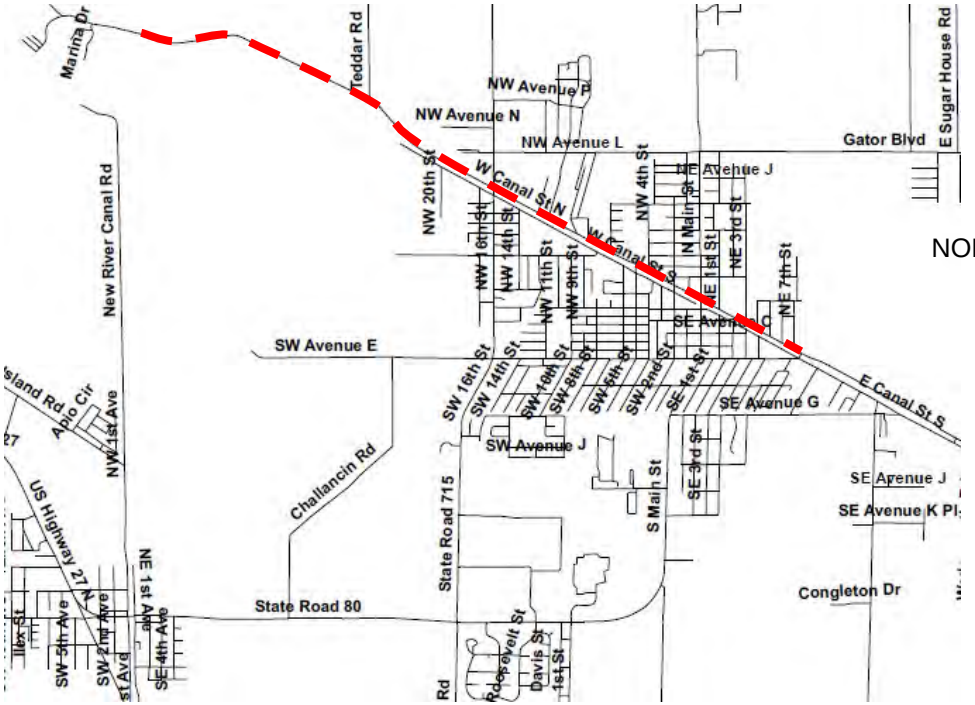
W of Tedder Rd



Road Condition	*Fair*
Road Base	*Fair*
Lane Width	*11'*
Shoulder Width	*NA*
Guardrail	*Yes/No*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Canal St N
From Torry Island Rd to SE Ave E

MAP
8
8-13-14

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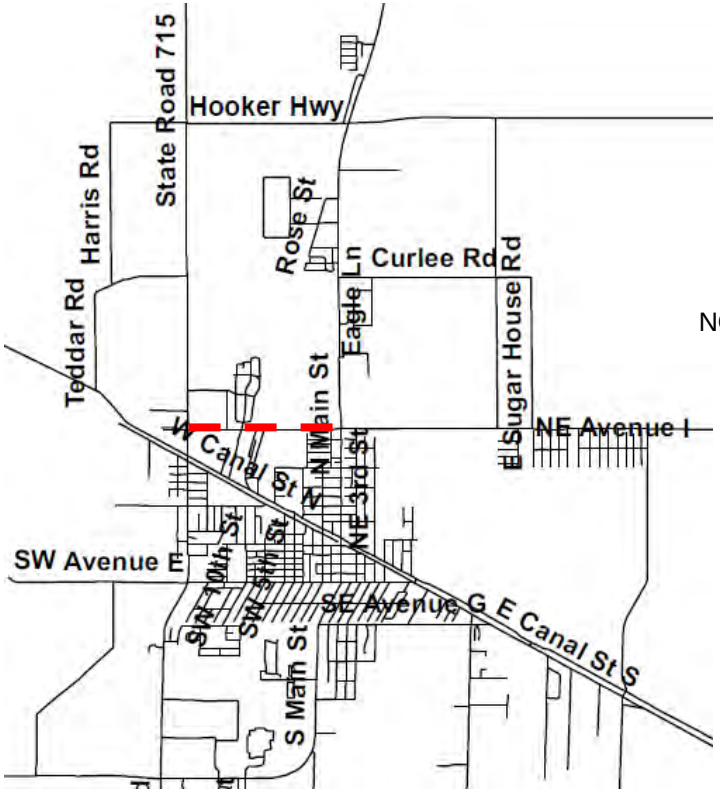
East of SR 715



NORTH

Road Condition	*Good*
Road Base	*Good*
Lane Width	*11'*
Shoulder Width	*NA*
Guardrail	*NA*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

NW Ave L
From SR 715 to SR 80/Main St

MAP
9
8-13-14

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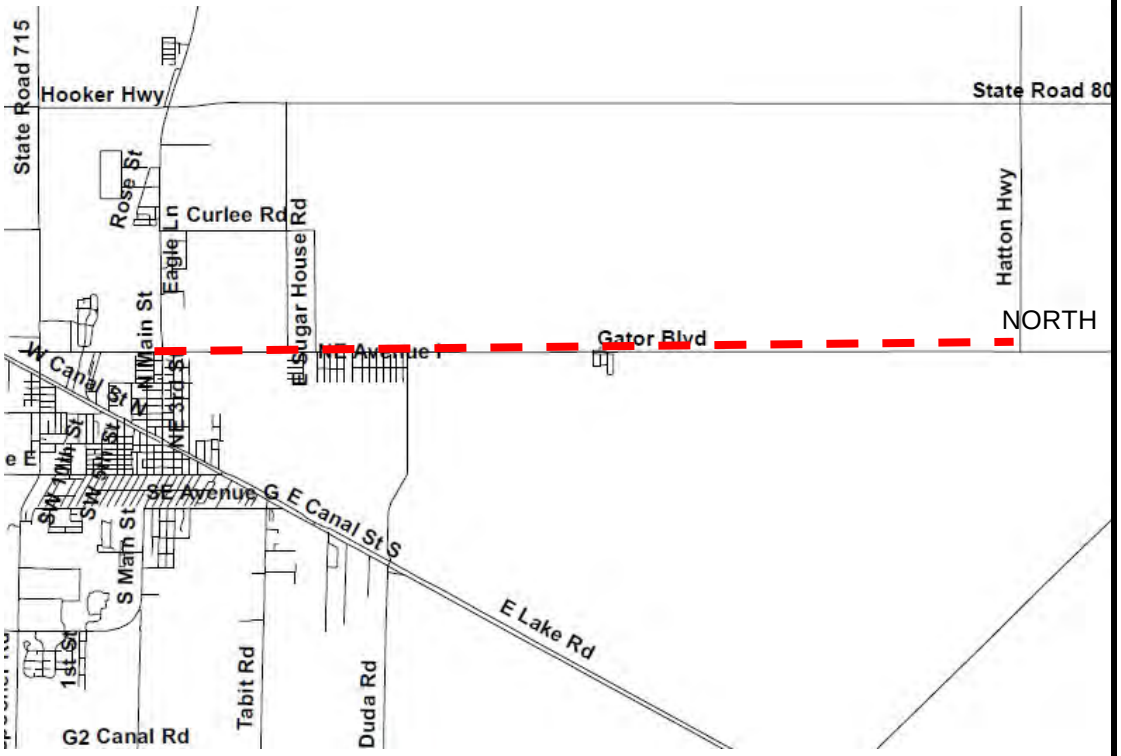
At NE 24th St

West of Duda Rd

location



Road Condition	*Good/Fair*
Road Base	*Poor*
Lane Width	*11'*
Shoulder Width	*NA/4'*
Guardrail	*N/Y*
Clear Zone	*Yes*

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Gator Blvd
From SR80/Main St to Hatton Hwy

MAP
10
8-13-14

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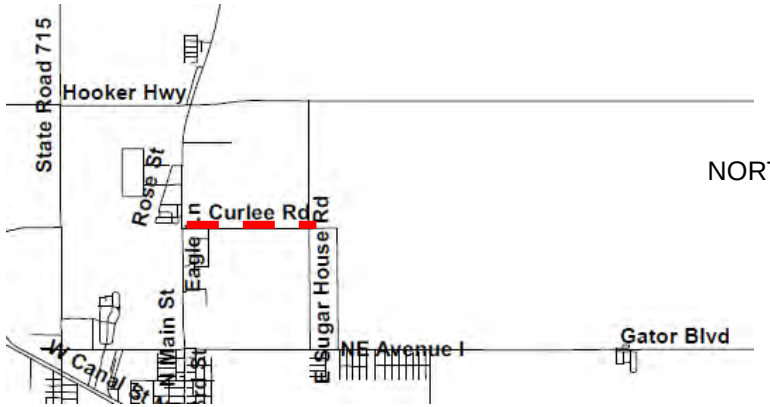
East of Main St



Road Condition	*Poor*
Road Base	*Poor*
Lane Width	*11'*
Shoulder Width	*NA*
Guardrail	*NA*
Clear Zone	*NA*

location

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Curlee Rd
From SR80/Main St to E Sugarhouse Rd

MAP
11
8-13-14

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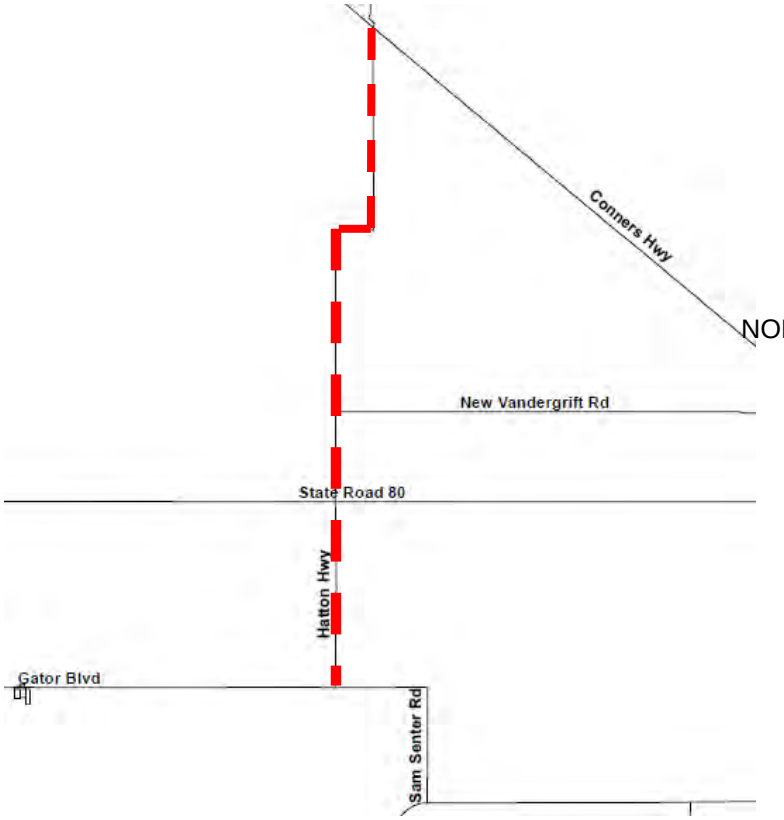
North of SR 80

1 mile north of Gator Blvd (looking south)

location

Road Condition	*OK*
Road Base	*Good*
Lane Width	*11'*
Shoulder Width	*18"/NA*
Guardrail	*No*
Clear Zone	*Yes*



Road Condition	*Poor*
Road Base	*Poor*
Lane Width	*11'*
Shoulder Width	*NA*
Guardrail	*Yes/No*
Clear Zone	*Yes*

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Hatton Hwy
From SR 700 to SR 80

MAP
12
8-13-14

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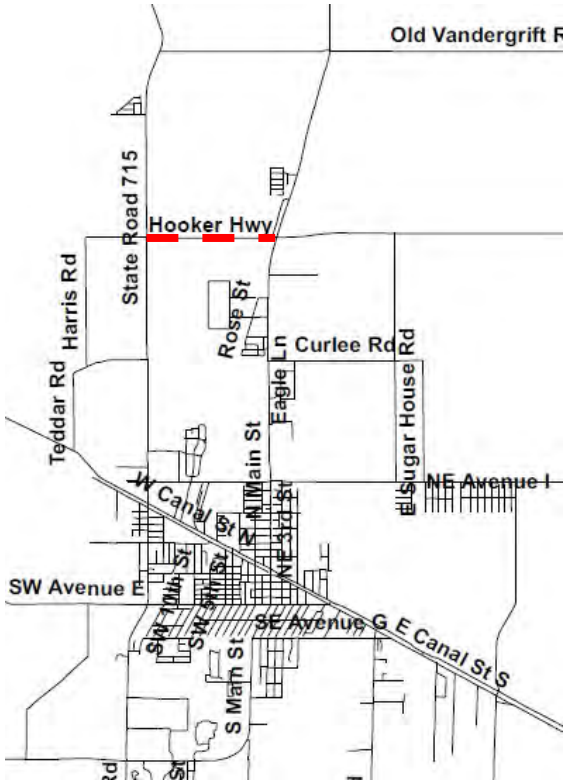
West of SR 80

East of SR 715

location



NORTH

Road Condition	*Fair*
Road Base	*Fair*
Lane Width	*12'*
Shoulder Width	*4'/NA*
Guardrail	*Yes*
Clear Zone	*No*

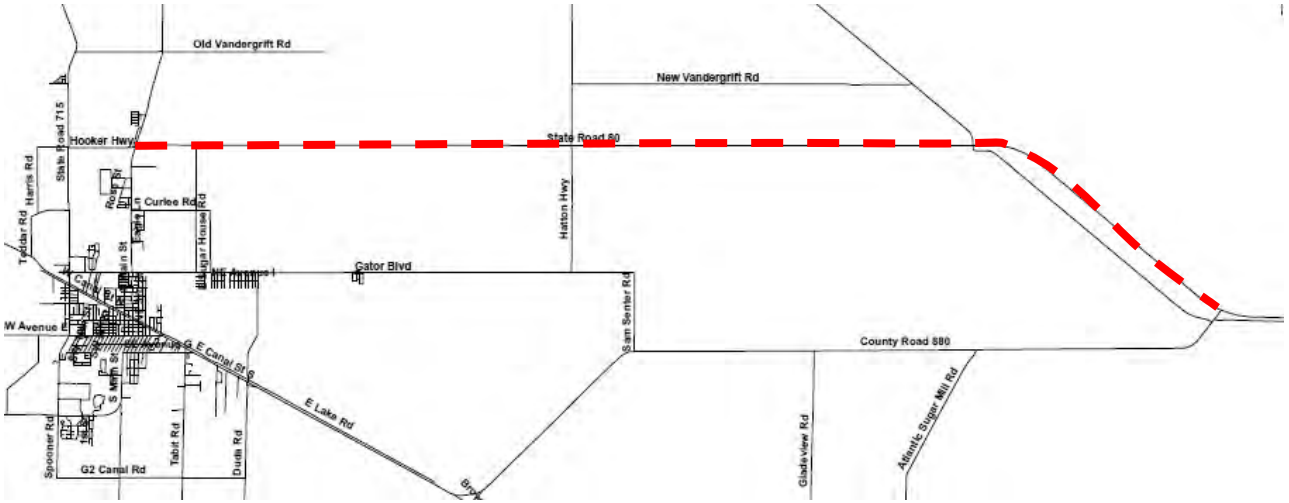
LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Hooker Hwy
From SR 715 to SR 80/US 441/Main St

MAP
13
8-13-14

N:\TRAFFIC\DATA SECTION\COUNTS\SPECIAL COUNTS\GLADES REGION TRANSPORTATION PLAN\FIGURES\18 Hooker

NORTH



West of Hatton Hwy

location

Road Condition	*Good*
Road Base	*Good*
Lane Width	
Shoulder Width	
Guardrail	*Yes*
Clear Zone	*NA*

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

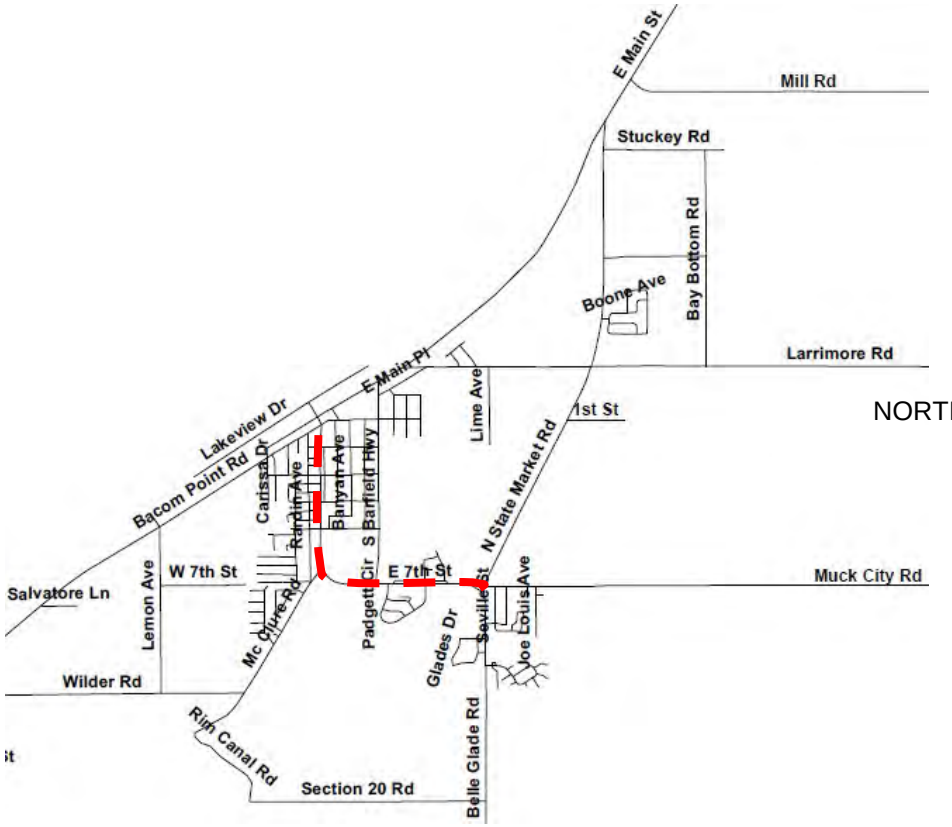
SR 80
From US 441/Main St
To 20 Mile Bend

MAP
14

Between Adams St and W 3rd St

East of McClure Rd

location



Road Condition	*Good*
Road Base	*Good*
Lane Width	*12'*
Shoulder Width	*6'*
Guardrail	*NA*
Clear Zone	*NA*

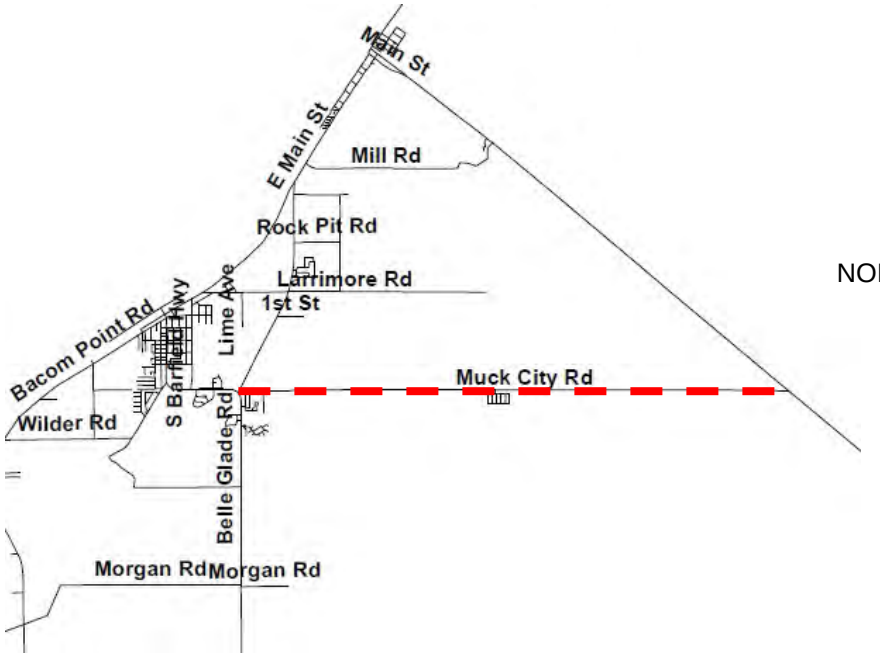
LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

SR 15/S Lake Ave/E 7th St From E Main St to US 441/N State Market Rd

MAP 15

8-13-14

2 miles east of State Market Rd



NORTH

Road Condition	*Good*
Road Base	*Good*
Lane Width	*11 ½'*
Shoulder Width	*NA*
Guardrail	*NA*
Clear Zone	*NA*

location

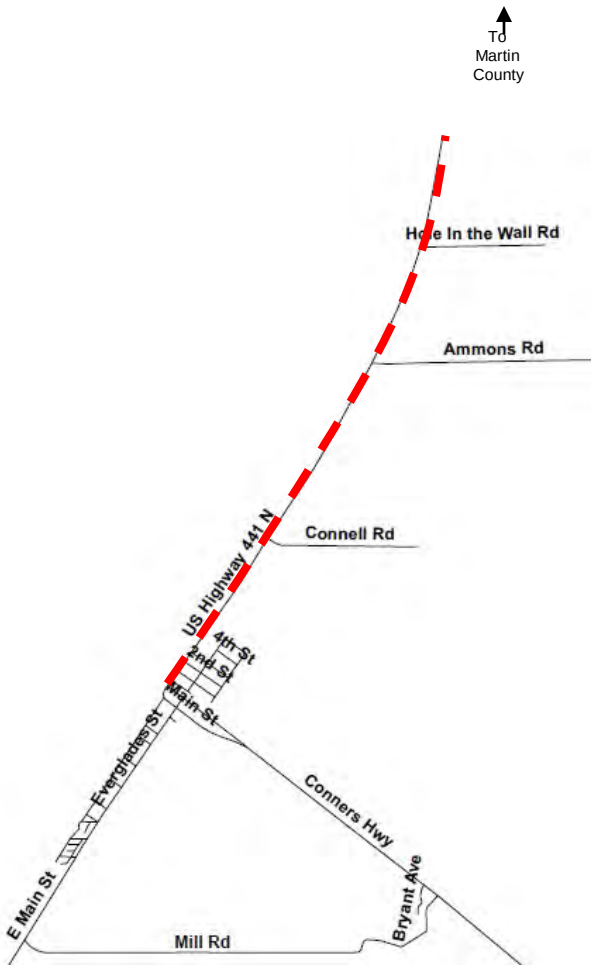
LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

Muck City Rd/CR 717
From SR 15/US 441 to SR 700/US 98

MAP
16
8-13-14

N:\TRAFFIC\DATA SECTION\COUNTS\SPECIAL COUNTS\GLADES REGION TRANSPORTATION PLAN\FIGURES\25 Muck City Rd.doc

1 mile south of Martin County line



Road Condition	*Good*
Road Base	*Good*
Lane Width	*12'*
Shoulder Width	*4'*
Guardrail	*NA*
Clear Zone	*NA*

location

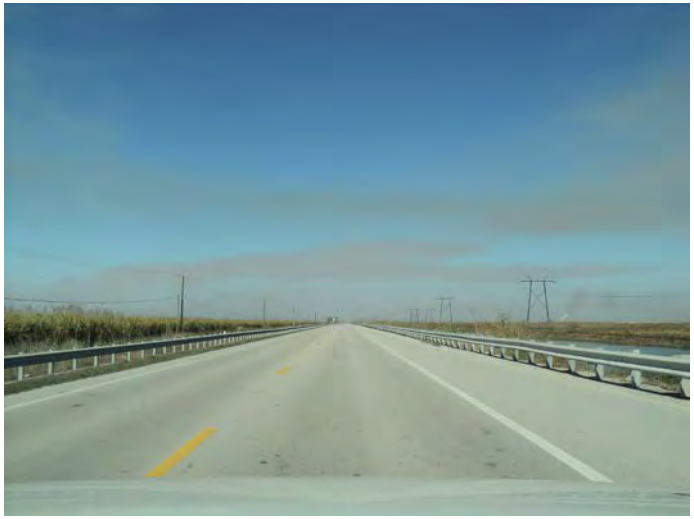
LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

SR 715/US 98/US 441
From E Main St/N State Market
to Martin County Line

MAP
17
8-13-14

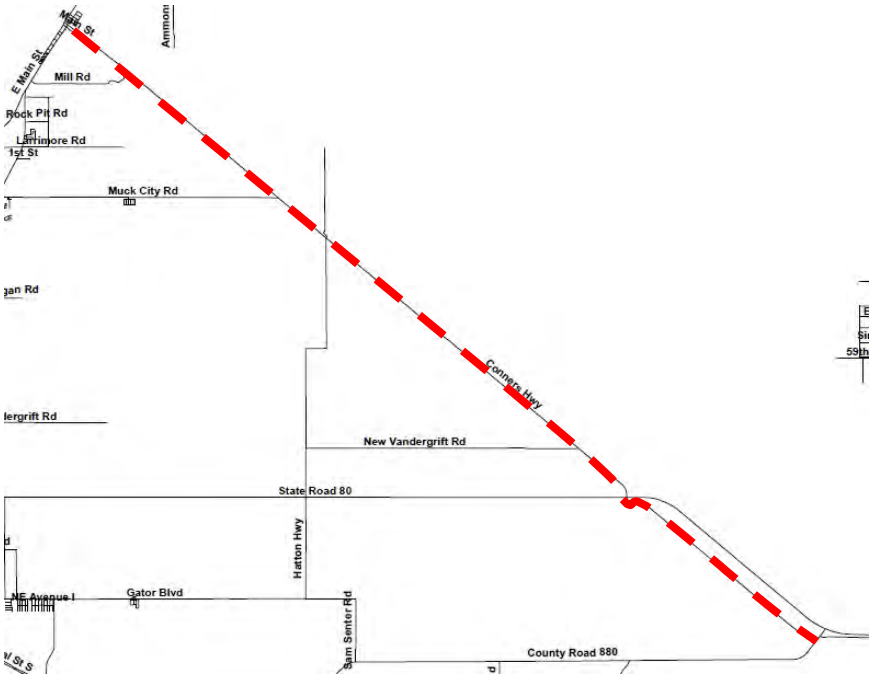
N:\TRAFFIC\DATA SECTION\COUNTS\SPECIAL COUNTS\GLADES REGION TRANSPORTATION PLAN\FIGURES\26 SR 715-US 98-US 441.doc

1 mile NW of SR 80



5 miles NW of SR 80

location



Road Condition	*Good*
Road Base	*Good*
Lane Width	*12'*
Shoulder Width	
Guardrail	*Y*
Clear Zone	*NA*

LONG RANGE TRANSPORTATION PLAN FOR THE GLADES REGION

SR 700/US 98/Connors Hwy From SR 715 to SR80/20 Mile Bend

MAP 18

8-13-14

N:\TRAFFIC\DATA SECTION\COUNTS\SPECIAL COUNTS\GLADES REGION TRANSPORTATION PLAN\FIGURES\27 SR 700-US 98-Connors Hwy.doc

APPENDIX I

Community Challenge Planning Grant Glades Region Master Plan – Palm Beach County Planning, Zoning and Building Department

Community Challenge Planning Grant
Glades Region Master Plan

Planning, Zoning and Building Department

Executive Summary

Summary: Palm Beach County Planning and Zoning Divisions staff participated in the master plan process in order to provide input and recommendations to assist with development and redevelopment in the Glades Area. This report presents an assessment of various issues affecting the Glades communities and possible actions that may be included in the Comprehensive Plan and Unified Land Development Code through the Glades Region Master Plan supported by the Community Challenge Planning Grant. The desired long-term outcome of these efforts is to: have increased citizen participation and decision-making, and increased private and public investment. Findings from this report focus on development of additional policies and recommendations for the local government governing the Glades Urban Service Area.

Recommendations: Based on the findings of the report, Planning and Zoning staff recommend the following:

- Acknowledge the Glades Master Plan as the guiding plan applied to the Glades Urban Service Area (GUSA) in the County Comprehensive Plan.
- The County will work with the communities in the western areas to assist in the development of local regulations that will create incentives for new development.
- The County will continue to encourage the preservation and rehabilitation of properties with the potential for historic designation.
- The County will delete outdated policies in the Comprehensive Plan.
- The County will provide policies with additional flexibility to promote economic growth in the Glades.
- The County will coordinate with the cities to prioritize areas in need of annexation and redevelopment within their future annexation areas;
- The County will develop policies to encourage intergovernmental coordination.
- The County will review the residential and non-residential densities/intensities.
- The County will encourage the Glades area to jointly establish goals & solutions to foster investment in logical development patterns for the Glades Region.
- The County will work on transferring applicable recommendations in the GRMP to a graphic representation on a Master Plan supplemented with text regulations.
- The County will encourage use of the overlay provisions to the local governments to provide development incentives, including a less restrictive approval process and more flexible property development regulations.

Introduction

The Community Challenge Planning Grant (CCPG) was awarded to Palm Beach County by the Department of Housing and Urban Development (HUD). The Grant was utilized to fund the project, known as the Glades Region Master Plan (GRMP), to serve as a guiding blueprint to enhance economic competitiveness focusing on major employment centers. As part of the project team, the Planning, Zoning and Building Department (PZB) participated in the development of the GRMP. The scope of services required the Planning and Zoning Divisions to: participate in periodic meetings with all of the stakeholders; provide data and support to the partners and stakeholders; participate in the Treasure Coast Regional Planning Council workshops with each of the Glades communities; develop strategies to implement the findings of the Master Plan for the Glades region; and prepare Comprehensive Plan amendments needed to implement the Master Plan.

PZB staff participated in periodic meetings with partners and stakeholders of the project. County staff joined efforts to review the existing conditions in the Glades Urban Service Area and review policies and land development regulations to develop guidelines where the County could address the livability principals: promoting affordable housing; enhancing economic competitiveness; supporting existing communities; coordinating policies and leveraging investments; valuing communities and neighborhoods; and providing more transportation choices.

County staff reviewed the existing conditions as well as reviewed the existing Comprehensive Plan policies related to the Glades, as shown in **Exhibit 3**. Staff developed a number of policies to include in the Comprehensive Plan based on the findings of the Glades Region Master Plan, relative to land use and associated plans and regulations. Additionally, County staff provided the following deliverables:

- Created a comprehensive data report to establish current conditions, included in **Exhibit 1** of this report.

- Developed concepts for the County's Comprehensive Plan Amendment Round 15-2 for preparation of amendments for the unincorporated area, needed to implement the GRMP.

- Developed a sample land development regulation for the cities to consider which could be used to address and enhance economic development within the city limits, included in **Exhibit 2** of this report.

Existing Conditions

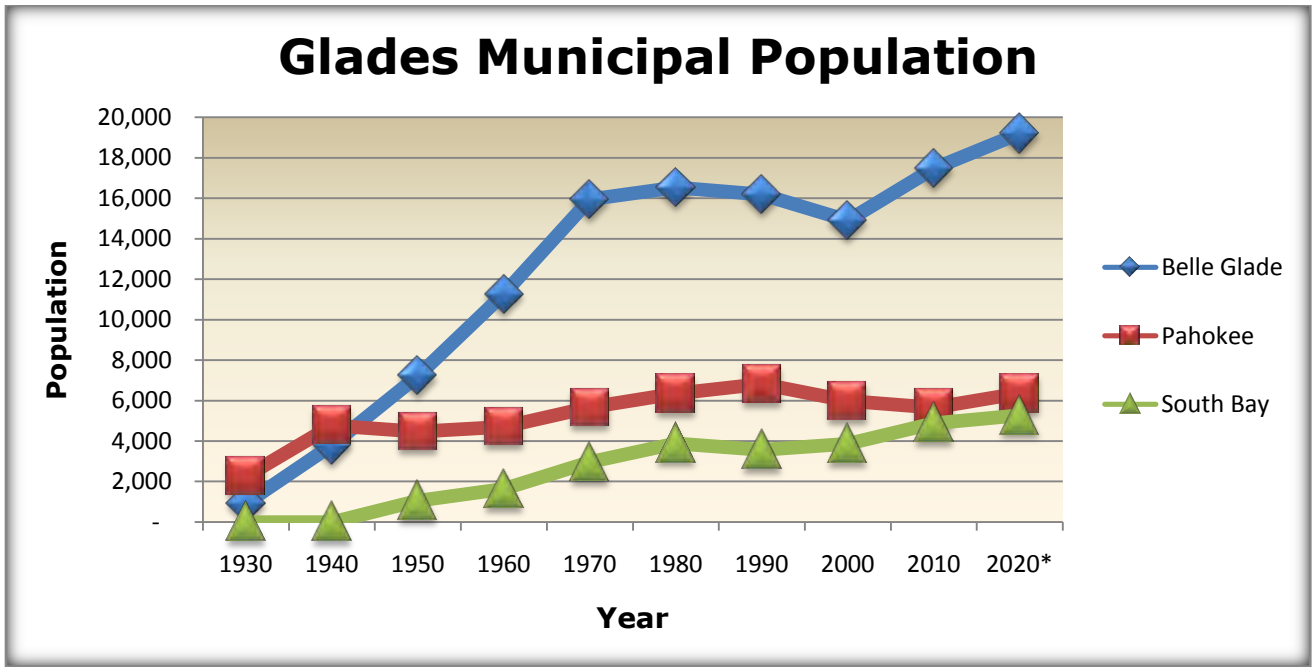
The Glades Urban Service Area is generally located west of the Conservation areas in the Glades Tier and includes both incorporated and unincorporated areas. The incorporated areas include: City of Belle Glade, City of South Bay, and City of Pahokee. For more detailed demographic data, see **Exhibit 1**.

Population: The total population in the Glades Urban Service Area is approximately 33,000 residents (28,000 incorporated and 5,000 unincorporated). According to the Bureau of Economic and Business Research (BEBR), population in the Glades area has been mostly level, with a slight incline between 2000 and 2010, while the rest of the County has seen a significant increase in population. Opportunities for significant growth currently exist in the unincorporated lands as these future land use designations could accommodate significantly more residential development. The table below shows the population trends from 1930 through 2010, with a population projection through 2020 for each of the cities.

Population Trends - Glades Cities

	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020*
Belle Glade	926	3,806	7,219	11,273	15,949	16,535	16,177	14,906	17,467	19,201
Pahokee	2,256	4,766	4,472	4,709	5,663	6,346	6,822	5,985	5,649	6,359
South Bay	-	-	1,050	1,631	2,958	3,886	3,558	3,859	4,876	5,275

Source: 1930 through 2010 - Census Data
2020 Source - Projection based on 2010 Census and BEBR 2012 Estimates*



Household Income: The median household income is lower than the rest of the County in the Glades Urban Service Area. The weighted average of the median household incomes is $30,315 for the 13 Census block groups in the Glades Urban Service Area, from the American Community Survey 2008-2012. There has been a decrease in the median household income for most of the Glades area since the Census in 2000. The cost of living has increased while the quality of housing has decreased with the occurrence of multiple hurricanes and a lack of new housing development, as well as aging of the existing housing stock.

Economic Conditions: Economic growth has been negative as job opportunities have decreased. The Glades Urban Service Area has not experienced the economic development that other areas of the County have had, with limited employment opportunities for the population in the area. Economic growth has been stagnant and is primarily driven by a single industry: agriculture. In recent years, focus on this region has increased in the hopes of increasing economic growth.

Large-scale restoration projects have been started or approved, including the purchase of lands for Everglades' restoration. An Inland Logistics Center in the region was also approved and is still in the process of moving towards development. The Glades Urban Service Area provides many tourism opportunities. Lake Okeechobee Scenic Trail Overlay is beneficial to the area. Several efforts adjacent to the Scenic Trail include: improvements to Belle Glade marina, enhancement of Torrey Island, and the renovation of the Pahokee Marina.

Employment Conditions: Many local, regional and state facilities in the Urban Service Area exist near or within the cities. These include state penitentiaries, government offices, the Belle Glade regional hospital, two local airports and regional water supply facilities. However, job opportunities have declined as increased mechanization of agricultural production has reduced workforce demands, and little private investment has occurred to generate new job opportunities.

Based on the American Community Survey 2008-2012, the overall unemployment rate for the Glades area, including Lake Harbor and Canal Point, is 20%. This unemployment rate is high compared to other areas of Florida, but has significantly decreased from 2009 when unemployment was at an all time high. This is compared to 6.1% for the County as a whole. The lack of job opportunities contributes to high rates of poverty which in turn lead to disinvestment throughout this region. Unemployment is an aggravating factor in the effort to improve quality of living.

Land: The Glades Urban Service Area is surrounded by agricultural production. This use is regarded as having both environmental benefits and disadvantages. Recent efforts to secure large tracts of land for water control and environmental restoration has been viewed as a potential boon to the region, creating new jobs and tourist opportunities, while at the same time leading to a loss of acreage in active agricultural production and a resultant job loss.

County staff compared the existing land uses (how the land is being used currently) and future land uses (how the land is able to develop) as designated in each local government's comprehensive plan, including that of the County. Existing land uses are heavily tilted towards agriculture, institutional and government. The Future Land Use designations, however, are primarily residential, with current densities allowing for approximately 80,000 residential units.

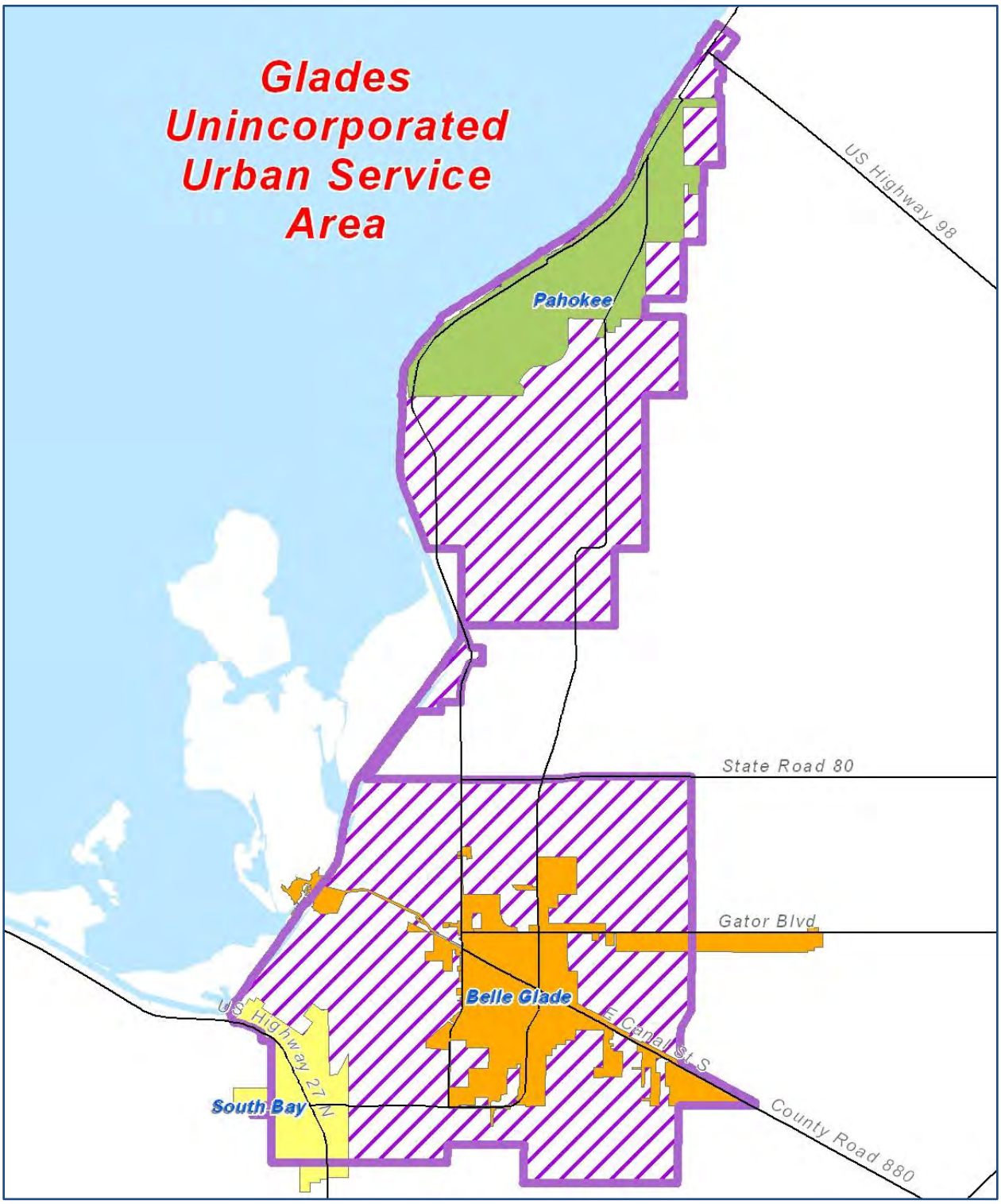
The table below shows the distribution of acres that are built, un-built, non-buildable and other government lands. This developable category was assigned to each parcel within the Glades Urban Service Area. This category is based on an assessment of each individual parcel of land's existing land use compared to the parcel's future land use designation adopted by the applicable local government.

Glades Urban Service Area
Land Distribution in Acres

	Total GUSA	Unincor-porated	Belle Glade	Pahokee	South Bay
Built	4,170.04	1,154.83	1,973.19	649.90	392.12
Un-built[1]	13,968.25	12,284.26	504.55	899.99	279.44
Non-Buildable[2]	1,511.91	262.01	6.76	1,134.50	108.64
Other Gov't Lands[3]	6,035.38	5,342.27	195.03	201.20	297.89
TOTAL	**25,686.58**	**19,043.37**	**2,679.53**	**2,885.59**	**1,078.09**

Source: PBC Planning Division Existing Land Use 2013 Dev13
[1]Un-built: Unbuilt with Future Land Use of Residential, Commercial, Industrial, Institutional, Mixed Use
[2]Non-buildable: Water, Rights-of-Way, Conservation and Agriculture
[3]Government Owned: District lands, Government Facilities and other government-owned lands

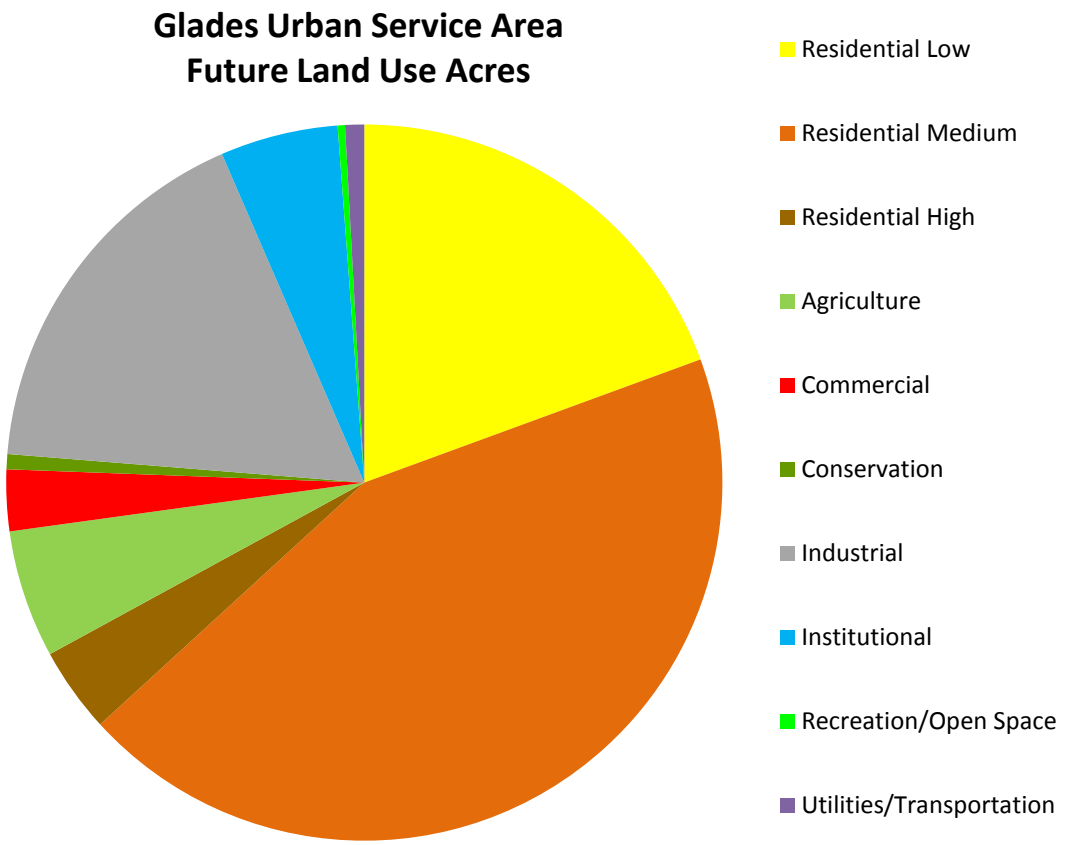
Glades Urban Service Area



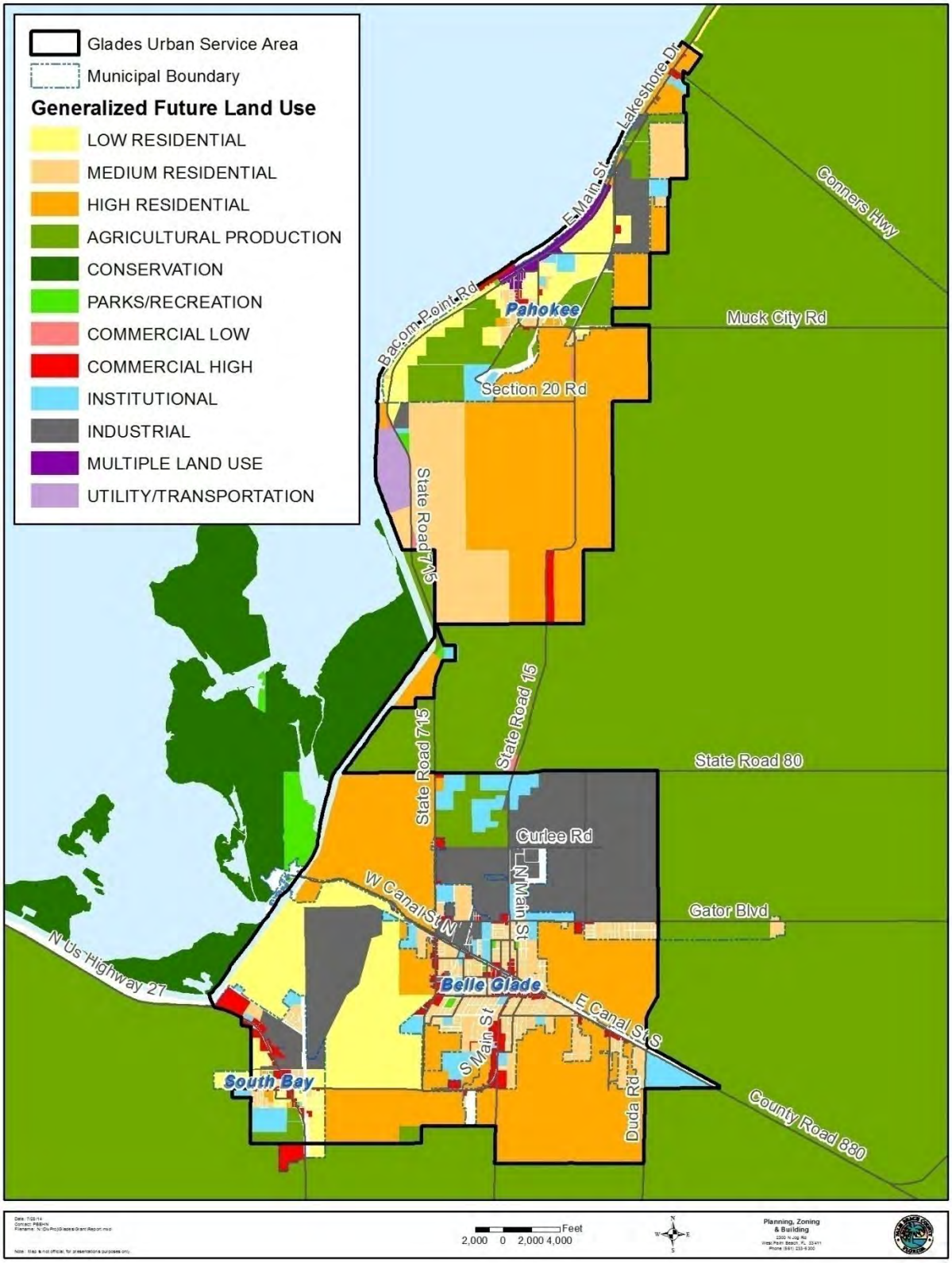
Generalized Future Land Uses (FLU)
Glades Urban Service Area

FLU Generalized	# of Parcels	Map Acres	Units	Res Impact
Residential Low	1,385	4,943.68	1,182	10,351
Residential Medium	3,859	11,152.22	6,171	66,567
Residential High	720	980.38	2,407	6,600
Agriculture	60	1,469.64	61	169
Commercial	1,092	706.22	1,032	42
Conservation	1	173.64	-	-
Industrial	280	4,385.29	180	-
Institutional	88	1,354.30	161	-
Recreation/Open Space	24	84.86	-	-
Utilities/Transportation	4	217.90	-	-
Water	9	218.45	-	-
TOTAL	**7,522**	**25,686.58**	**11,194**	**83,729**

Source: Existing Land Use (EXLU) 2013

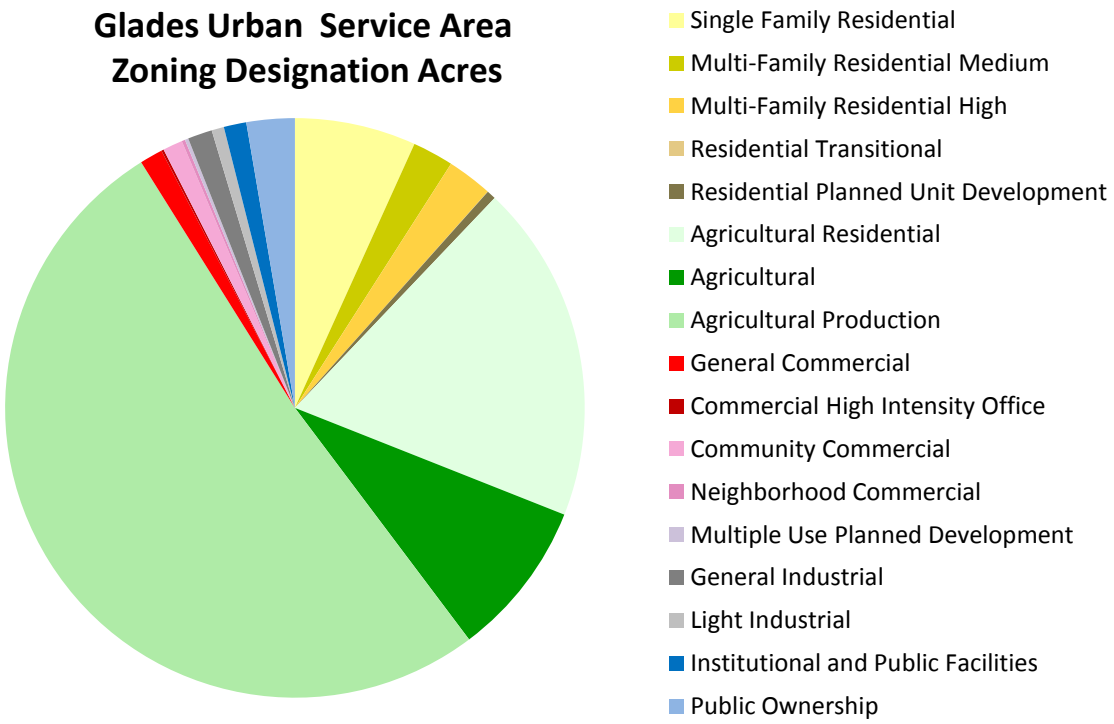


Generalized Future Land Use Map
Glades Urban Service Area

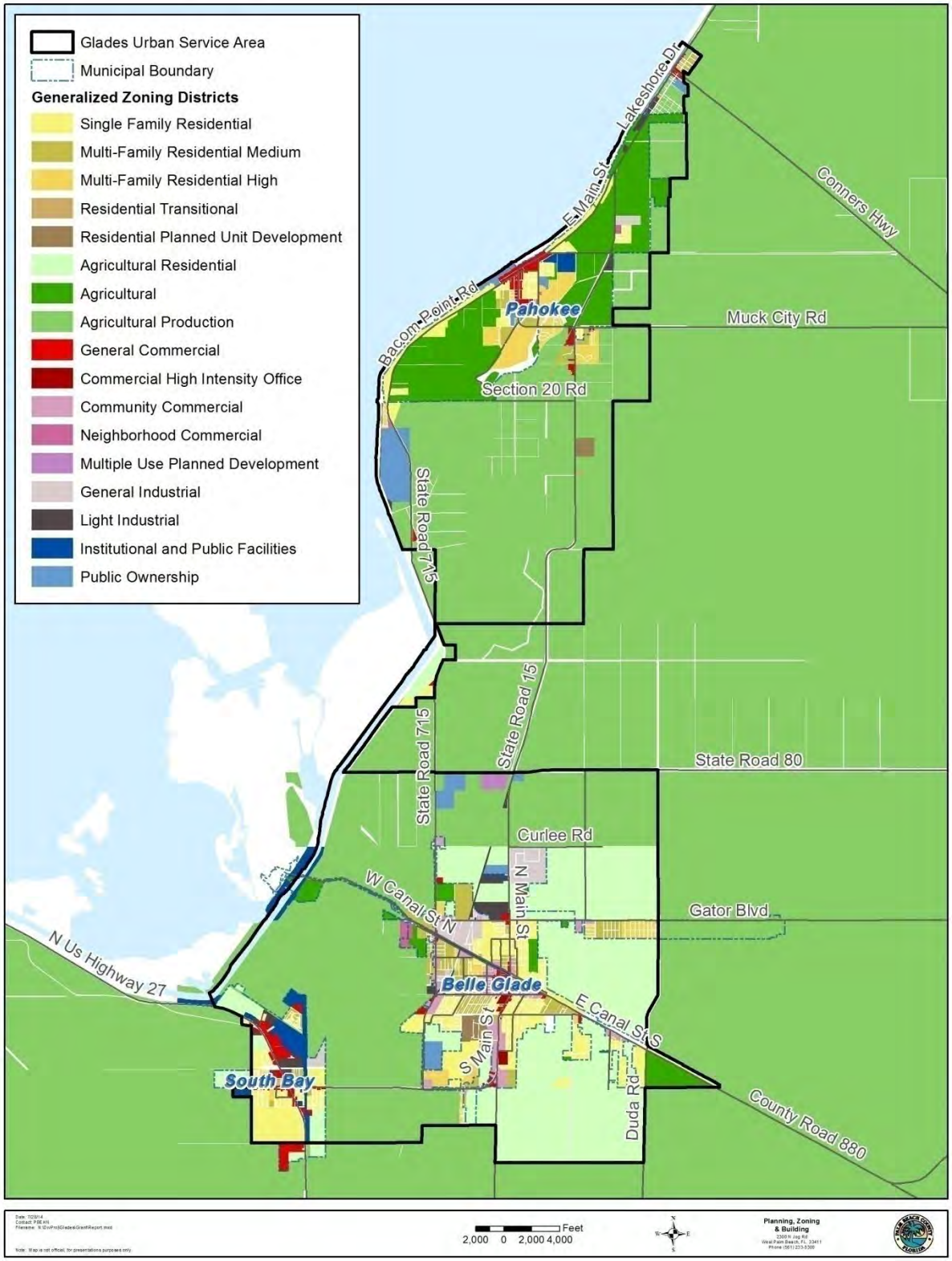


Generalized Zoning Designations
Glades Urban Service Area

Zoning Generalized	# of Parcels	Map Acres	Units	Res Impact
Single Family Residential	3,015	1,738.42	3,259	1,500
Multi-Family Residential Medium	1,316	587.78	2,692	1,041
Multi-Family Residential High	941	650.33	2,743	1,783
Residential Transitional	1	3.14	0	25
Residential Planned Unit Development	193	129.64	176	414
Agricultural Residential	141	4,854.59	65	23,761
Agricultural	168	2,242.93	54	2,482
Agricultural Production	256	13,192.99	522	52,108
General Commercial	575	329.55	481	262
Commercial High Intensity Office	54	34.29	57	4
Community Commercial	506	282.94	902	55
Neighborhood Commercial	18	48.52	11	0
Multiple Use Planned Development	1	50	0	0
General Industrial	207	350.39	29	129
Light Industrial	67	177.36	196	20
Institutional and Public Facilities	26	323.12	0	0
Public Ownership	37	690.59	7	145
TOTAL	**7,522**	**25,686.58**	**11,194**	**83,729**



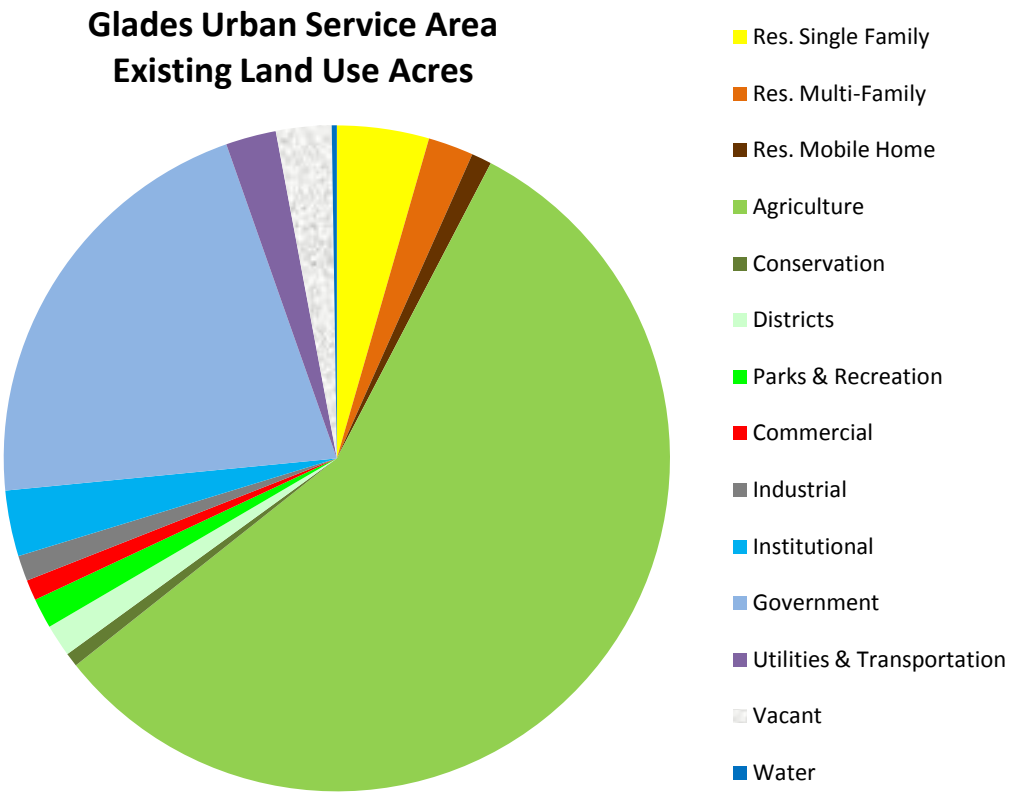
Generalized Zoning Designation Map
Glades Urban Service Area



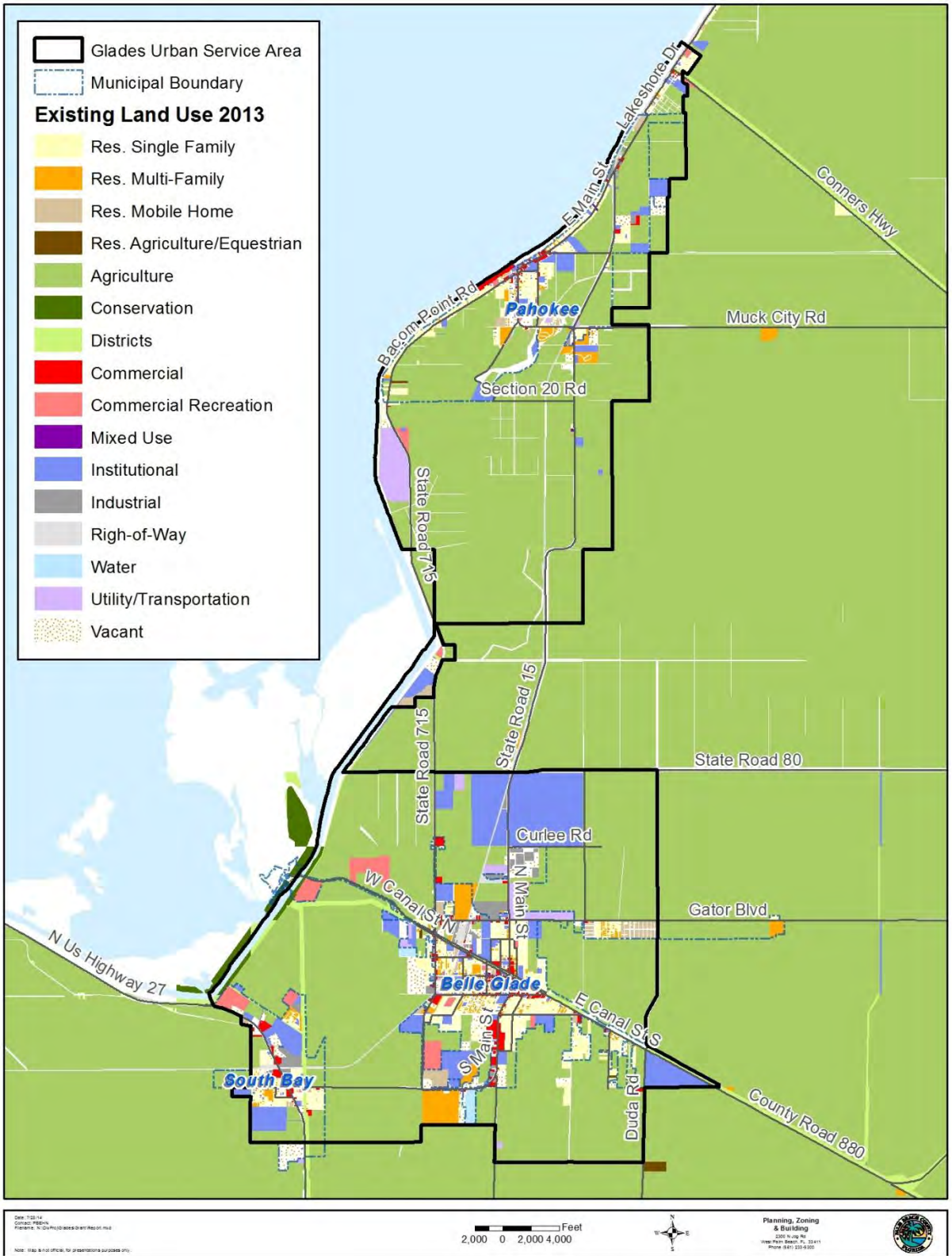
Existing Land Uses (EXLU)
Glades Urban Service Area

EXLU Generalized	# of Parcels	Map Acres	Units	Res Impact
Res. Single Family	3,827	1,147.66	3,836	245
Res. Multi-Family	697	565.62	5,554	-
Res. Mobile Home	447	251.70	1,461	-
Agriculture	338	14,558.81	4	79,668
Conservation	1	173.64	-	-
Districts	28	401.24	-	-
Parks & Recreation	27	375.30	-	-
Commercial	444	256.17	275	-
Industrial	161	318.22	-	39
Institutional	186	820.63	6	2
Government	133	5,434.35	57	360
Utilities/Transport	73	627.38	-	-
Vacant	1,156	692.94	1	3,415
Water	4	62.92	-	-
TOTAL	**7,522**	**25,686.58**	**11,194**	**83,729**

Source: EXLU2013



Existing Land Use Map
Glades Urban Service Area



Scenarios

In an effort to identify and discuss possible scenarios related to scope of services for the Glades Region Master Plan, this section provides information on specific County land development regulations and processes that the municipalities may take into consideration. Currently, there are three Overlays: the Glades Area Overlay (GAO); the Westgate Community Redevelopment Area Overlay (WCRAO); and the Infill Redevelopment Overlay (IRO) that the Board of County Commissioners adopted flexible regulations to encourage development and redevelopment in the unincorporated properties. The following summarizes the purpose and intent of each Overlay, some of which are not specific to the Glades but may be applicable to the Glades:

GAO
The GAO is to provide flexibility in the range of uses and property development regulations allowed in specific areas of the Glades Tier, and to accommodate uses, which, if deemed appropriate, will increase job opportunities and improve the economic vitality of the area. In addition, the GAO provides a set of regulations that recognize the character of the area. See excerpt of the Unified Land Development Code (ULDC) in **Exhibit 4**.

IRO
The IRO provides optional development regulations to facilitate revitalization of commercially designated lands in the Urban/Suburban Tier of the County. The intent is to allow the incremental retrofit of commercial corridors and isolated land uses with sustainable development that creates a sense of place, improves streetscapes and successfully integrates into the surrounding community.

The ULDC offers property development incentives that will encourage developers, property or business owners to utilize the IRO (e.g. reduced setbacks and parking ratios, increased Floor Area Ratio (FAR), and flexible landscaping regulations) to maximize the efficient use of property. The IRO promotes non-residential and residential mixed use; respect market realities, industry trends, and property rights; and, establish an expedited review process.

WCRAO
The Westgate/Belvedere Homes Community Redevelopment Agency (WCRA) was created to remove blighted conditions, enhance Palm Beach County's tax base, improve living conditions, and preserve areas of low and moderate cost housing in the WCRAO.

The use of community redevelopment powers enables the Board of County Commissioners (BCC) and the WCRA to make public improvements that encourage and enhance investment while providing neighborhood stability, prevent continuation of inefficient and incompatible land use patterns, and assist revitalization and rehabilitation of older commercial and residential areas in the Westgate/Belvedere Homes area.

The WCRAO encourages development and redevelopment of the Westgate/Belvedere Homes area through regulatory incentives; arresting deterioration of property values; preserving and protecting existing, viable affordable housing; providing opportunity for the future development of affordable housing; implementing the 2004 Westgate/Belvedere Homes Community Redevelopment Plan (WCRA Plan); providing for mixed use development; and providing for increased residential densities and commercial intensities, without amendment to the Plan.

Generally, the WCRAO and IRO encourage the application of Smart Growth and Form Base Coding principles. The design principles are to ensure a more predictable built form, while achieving enhanced streetscape and pedestrian realm. In turn, the developers/business owners will have more flexible development options.

The chart on the following page compares the approval processes and property development regulations of the 3 Overlays that could be considered for application to new development and redevelopment in the Glades Regional Area.

Comparison of County Redevelopment Overlays

	GAO	WCRAO	IRO
Nonconformities	Nonconforming use may be expanded subject to a Special Permit	Allow 100% expansion for nonconforming uses subject to physical improvements of site and structures	N/A
Class A Conditional Use	Subject to Administrative approval after compliance with regulations	Go through Class B Conditional use for lands that has a gross acreage of 2 acres or less	N/A
Property Development Regulations	Must comply with ULDC. *However, it should be considered for amendment to the Code, to provide setback reduction scenarios	Allow Setback reductions – based on Form Base Code	Allow Setback reductions – based on Form Base Code
Increase in density and intensity	May allow to exceed maximum subject to BCC's Type II Waiver process	Density Bonus Pool	Allow Intensity Bonus Incentive
Location of Structures	Allow in right-of-way of certain arterial/collector streets subject to approval of County Engineer	Mandate Form Based Code	Mandate Form Based Code
Rezoning	Must comply with ULDC. *However, it should be considered for amendment to the Code, to allow flexibility in the rezoning requirements	No rezoning for industrial land located in PBIA or commercial land that were not designated on the FLU Atlas as of the Plan's August 31 1989 adoption.	No rezoning for land that has Commercial FLU designations subject to specific criteria.
Parking	May be requested to reduce via a Type II Variance. *However, if should be considered for amendment to the Code, to allow flexibility in parking reductions based for Mixed Use	Allow Mixed Use Parking deviations	Allow Mixed Use Parking deviations. Allow alternative parking lot design options
Uses not permitted	Uses not otherwise permitted in the non-residential may be permitted as Class A conditional uses in the GAO district after compliance with the conditional use regulations and after the BCC determines that the proposed use meets specific criteria.	N/A	N/A

Future Improvements and Recommendations

The Comprehensive Plan acknowledges the cities' planning efforts, recognizes the different nature of the Glades and has policies to promote economic growth in the unincorporated areas of the Glades. To further this effort, County staff will include additional policies in the County's Comprehensive Plan to promote and support the Glades Region Master Plan within the 15-2 Amendment Round.

The County will research and develop a staff report to recommend updates to the Comprehensive Plan to support the following:

- **GRMP:** Acknowledge the Glades Region Master Plan as the guiding plan applied to the Glades Urban Service Area in the Comprehensive Plan.

- **Flexible Regulations:** Work with the communities in the western areas to assist in the development of local regulations that will create incentives for new development. A sample description of a Planned Development District as a potential incentive of development within the incorporated area is included in **Exhibit 2**. There are opportunities within cities to react quickly to development that may not be as possible in the unincorporated areas. This sample district is intended to encourage the implementation of innovative land planning and site designs that create enhanced living and working environments by providing flexible land use and design regulations. This district would allow small to large-scale areas to be developed with a variety of residential types and nonresidential uses that may contain both individual building sites and common property, which are planned and developed as a unified district. Smaller local governments within Palm Beach County have successfully utilized this approach to accommodate development.

- **Historic Resources:** Develop regulations to encourage the preservation and rehabilitation of properties with the potential for historic designation and develop policies to continue protecting historic resources. Economic Development in the Glades area may be enhanced through historic preservation and heritage tourism efforts to preserve and celebrate the Glades history, place and culture. There are large archaeological sites located close to Lake Okeechobee and East of Canal Point. These include the second largest archeological site in Florida, a ceremonial complex that was used from about 500 B.C. until A.D. 1650. The County's Comprehensive Plan has a Historic Element with many policies encouraging historic resources in the County and may be enhanced with additional policies encouraging these efforts in the Glades area.

- **Outdated Policies:** Remove or revise outdated policies in the Comprehensive Plan on tasks that were already accomplished in the Glades.

- **Economic Growth:** Provide policies with additional flexibility to promote economic growth in the Glades. In addition, the County will continue to work with the property owner of the Inland Logistics Center, located within the unincorporated area in the Glades Urban Service Area, to prepare the site for development. In 2014, the County processed two Comprehensive plan amendments.

- **Annexation Strategies:** Provide the Glades cities with possible annexation strategies within their future annexation areas. This includes coordinating with the cities to prioritize areas in need of annexation and redevelopment. These efforts can help to ensure sound urban development and accommodation of growth, ensure the efficient provision of urban services to areas that become urban in character, and ensure that areas are not annexed unless municipal services can be provided to those areas.

- **Coordination:** Develop policies to encourage and promote intergovernmental coordination between all of the local governments and agencies.

- **Density Review:** Review the residential and non-residential densities and intensities, including evaluating the consistency between the unincorporated future land use and the unincorporated zoning designations.

- **Technical Assistance:** Provide technical assistance to the Glades Communities through Interlocal Agreement(s). This includes providing localized neighborhood planning assistance to unincorporated areas such as Canal Point and providing planning services that coincide with the Glades Region Master Plan to the cities in areas of neighborhood planning and citizen participation.

- **Joint Government Regulations and Process:** Encourage the Municipalities and Unincorporated County to jointly establish a clear vision with goals and solutions to foster investment in logical development patterns for the Glades Region Master Plan area. Once clear goals and solutions are established, examine the existing regulations of each municipality and the County.

  The joint governments could evaluate existing incentives and obstacles to development in the Area, and explore ways to enhance the incentives and address the obstacles with new or revised regulations. This will increase the efficiency and effectiveness of local governments, striving for a more uniform approach for development application review and approval processes.

- **Graphic Master Plan for the GRMP:** All applicable recommendations in the GRMP could be transferred into a graphic representation on a Master Plan supplemented with text regulations, will be used to guide future development in the Glades Regional Areas.

- **County's Development Options for Consideration:** Consider the overlay provisions provided, which were established to provide development incentives in specific areas of the County. These incentives include, but are not limited to a less restrictive approval process and more flexible property development regulations. Consideration will be given to amending the Glades Area Overlay to allow specific areas of flexibility as noted under "Scenarios".

Based on data analysis and public input, the primary challenge by far is the lack of economic opportunity and growth in this region. Through these efforts, County staff anticipates that the Glades Region Master Plan will be a guide for the Glades area to help increase economic development; create employment opportunities for the Glades communities; and serve as a comprehensive document to secure funding for significant infrastructure projects in the Glades.

Exhibit 1

Demographic Data for Pahokee, Belle Glade, South Bay and the Unincorporated Areas of the Glades Service Area was compiled from the 2008-2012 American Community Survey, 2013 Population Allocation Model.

	Pahokee	Belle Glade	South Bay	Glades Unincorporated County	Urban/Suburban Glades Tier
Population 2010	5,649	17,467	4,876	5,119	33,111
Population 2015	6,008	17,769	4,697	5,964	34,438
Population 2020	6,359	18,879	5,275	6,897	37,410
Population 2025	6,839	20,496	6,177	8,741	42,253
Population 2030	7,393	21,925	7,156	10,774	47,248
Population 2035	7,793	22,990	8,018	12,829	51,630
Population by sex					
Male	2,909	8,628	3,251	3,816	18,604
Female	2,927	8,969	1,604	2,178	15,678
Population by Race	5,863	17,597	4,855	5,967	34,282
White Alone	2,029	6,194	1,542	1,970	11,735
Black Alone	3,426	10,817	2,963	3,816	21,022
Am Indian	-	57	-	-	57
Asian Alone	-	9	29	-	38
Pacific Islanders	-	-	13	9	22
Other Race	241	387	193	89	910
Two or More Races	140	133	115	110	498
Hispanic	1,761	5,245	1,229	1,358	9,593
Population by Age					
0-5	344	1,261	232	342	2,179
5-9	439	1,513	332	282	2,566
10-14	506	1,255	354	509	2,624
15-19	505	1,476	321	689	2,991
20-24	394	1,330	263	643	2,630
25-29	408	1,291	602	426	2,727
30-34	267	796	534	564	2,161
35-39	244	1,245	464	323	2,276
40-44	282	1,041	481	570	2,374
45-49	411	1,350	414	454	2,629
50-54	461	1,069	255	462	2,247
55-59	600	1,302	245	252	2,399
60-64	256	633	146	161	1,196
65-69	353	739	74	36	1,202
70-74	93	496	44	124	757
75-79	135	304	47	97	583
80-84	45	277	36	14	372
85 and over	93	219	11	46	369
Median Age	35.6	34.2	32.8	28.1	33.18

Source: 2008-2012 American Community Survey, 2013 Population Allocation Model

	Pahokee	Belle Glade	South Bay	Glades Unincorporated County	Urban/Suburban Glades Tier
Total Household	1,804	5,661	664	1,283	9,412
Family Household	1,232	3,784	588	943	6,547
Husband_wife family	773	1,809	314	443	3,339
With own children under 18 years	345	639	154	220	1,358
Male householder_no wife	183	363	31	159	736
With own children under 18 years	70	154	26	92	342
Female Householder_no hus	276	1,612	243	341	2,472
With own children under 18 years	82	975	126	257	1,440
Non Family Households	572	1,877	76	340	2,865
Householder living alone	543	1,502	50	272	2,367
65 year and older	261	456	17		
Avg Household Size	3.14	3.09	4.3	3.37	3.23
Pop in households	5,665	17,516	2,854	4,329	30,364
Median Household Income	$35,392	$28,495	$26,667	$21,586	$28,746
Median Family Income	$40,630	$34,608	$27,037	$46,474	$36,770
Per Capita Income	$14,341	$14,482	$6,008	$9,324	$12,360
Poverty Rate (All people)	26.7%	35.1%	42.3%	52.1%	36.7%
Unemployment Rate*	27.0%	18.7%	22.1%	19.4%	20.8%
Education Attainment					
Pop 25 and above	3648	10762	3353	3529	21,292
Less than 9th grade	26.5%	21.3%	11.8%	20.8%	20.6%
9th to 12th grade, no diploma	15.1%	18.9%	19.1%	21.9%	18.8%
High school graduate (includes equivalency)	30.4%	29.0%	43.1%	36.2%	32.7%
Some college, no degree	16.3%	12.8%	16.2%	12.5%	13.9%
Associate's degree	2.5%	4.7%	4.4%	3.0%	4.0%
Bachelor's degree	7.1%	8.9%	3.4%	4.7%	7.0%
Graduate or professional degree	2.1%	4.4%	2.0%	0.8%	3.0%
Percent high school graduate or higher	58.3%	59.8%	69.1%	57.3%	60.6%
Percent bachelor's degree or higher	9.2%	13.3%	5.4%	5.6%	10.1%

Source: 2008-2012 American Community Survey, 2013 Population Allocation Model

**Unemployment Rate: the Urban Suburban Glades Tier unemployment rate is the weighted average for all of the block groups in the Glades cities and unincorporated areas, including Lake Harbor and Canal Point.*

	Pahokee	Belle Glade	South Bay	Glades Unincorporated County	Urban/Suburban Glades Tier
Place of Birth					
Native	80.7%	73.0%	84.3%	NA	NA
Born in United States	78.4%	71.8%	83.7%	NA	NA
State of residence	60.4%	56.9%	58.9%	NA	NA
Different state	18.0%	14.9%	24.9%	NA	NA
Born in Puerto Rico, U.S. Islands, or abroad to American parent(s)	2.3%	1.2%	0.6%	NA	NA
Foreign born	19.3%	27.0%	15.7%	NA	NA
Language spoken at Home for pop >5 yrs.	5492	16336	4623	5,652	32,103
English only	67.1%	59.9%	74.7%	70.6%	65.1%
Language other than English	32.9%	40.1%	25.3%	29.4%	34.9%
Speak English less than "very well"	17.6%	22.6%	9.9%	15.7%	18.7%
Spanish	28.6%	29.0%	21.3%	22.3%	26.6%
Speak English less than "very well"	14.4%	15.3%	9.0%	14.0%	14.0%
Other Indo-European languages	4.4%	10.1%	3.4%	6.7%	7.6%
Speak English less than "very well"	3.2%	7.1%	0.9%	1.8%	4.6%
Asian and Pacific Islander languages	0.0%	0.0%	0.6%	0.0%	0.1%
Speak English less than "very well"	0.0%	0.0%	0.0%	0.0%	0.0%
Other languages	0.0%	1.0%	0.1%	0.2%	0.6%
Speak English less than "very well"	0.0%	0.1%	0.0%	0.1%	0.1%
Housing Units	1,984	6700	921	1,635	11240
Vacant	180	875	257	238	1550
Seasonal/Migrant	0	164	0	114	278
Occupied	1804	5661	664	1,283	9412
Owner Occupied	1077	2446	390	403	4316
Renter Occupied	727	3215	274	880	5096
PPH owner occupied	3.5	3.4	4.44	2.73	3.46
PPH renter occupied	2.61	2.86	4.1	3.67	3.03
Median Value (owner occupied)	$112,700	$113,300	$105,800	$103,580	$111,565
Median Gross Rent (renter occupied)	$581	$653	$807	$444	$615
YEAR STRUCTURE BUILT					
Built 2010 or later	0.00%	0.04%	0.00%	0.02%	0.03%
Built 2000 to 2009	9.5%	6.5%	2.3%	0.8%	5.9%
Built 1990 to 1999	9.2%	11.0%	12.7%	9.6%	10.6%
Built 1980 to 1989	21.1%	20.8%	31.4%	29.2%	22.9%
Built 1970 to 1979	24.9%	24.1%	35.8%	26.2%	25.5%
Built 1960 to 1969	16.6%	19.5%	9.9%	19.1%	18.1%
Built 1950 to 1959	8.9%	13.6%	5.4%	10.2%	11.6%
Built 1940 to 1949	6.9%	3.9%	1.6%	1.7%	3.9%
Built 1939 or earlier	2.9%	0.5%	0.9%	3.5%	1.4%

Source: 2008-2012 American Community Survey, 2013 Population Allocation Model

Exhibit 2

Glades Planned Development District (PDD)

Purpose of District

1. The Glades Planned Development District (GPDD) is intended to encourage the implementation of innovative land planning and site designs that create enhanced living and working environments by providing flexible land use and design regulations. A GPDD would allow small- to large-scale areas to be developed with a variety of residential types and nonresidential uses that may contain both individual building sites and common property, which are planned and developed as a unified district.

2. The GPDD is designed and organized so as to be capable of satisfactory use and operation as a separate entity without necessarily needing the participation of other building sites or other common property, in order to function as a neighborhood. This section specifically encourages innovations so that the demands of residential and nonresidential uses may be met by a greater variety in type, design, and siting of buildings and by the conservation and more efficient use of land.

   Where utilization of the GPDD is found to be appropriate, property may seek to rezone to this category. In doing so, conventional use and dimensional specifications are replaced by an approval process in which an approved plan becomes the basis for continuing land use controls. This provides the mechanism by which the Board of County Commissioners (BCC) may approve land development plans which meet or exceed the level of development quality required by adopted county zoning standards.

   It is intended that this district offer development design flexibility to developers in order to encourage imaginative, functional, high quality development planning. The use of this district shall be limited to those development projects which will result in desirable community environmental qualities, and development which is compatible with the surrounding lands and activities and consistent with the permitted uses of the Comprehensive Plan and Unified Land Development Code. These design guidelines shall become a part of the GPDD rezoning.

Design Guidelines

3. Petitioner shall submit a master development plan as part of the rezoning request. The master plan shall contain design guidelines that shall include, but not be limited to, the following:

   A. Signage.
   B. Housing type.
   C. Minimum lot size.

D. Minimum lot frontage.
E. Minimum square footage and, building type for residential and nonresidential structures.
F. Maximum height.
G. Front, side, rear street side yard setbacks.
H. Setbacks for accessory uses (pools, patios, etc.).
I. Typical landscape for a detached residential unit.
J. Street landscape.
K. Common area landscape.
L. Buffer landscape.
M. Lighting.
N. Drainage.
O Internal circulation.
P. Common open space.

4. Land Use regulations.

- no minimum acreage shall be required for this category
- minimum Lot area, distance between structures, frontage, setbacks, and height regulations.
- no minimum lot size shall be required within a GPDD except as specified by the master development plan , however, in no case shall the minimum lot size be less than the smallest lot permitted in any zoning category.
- no minimum distance between structures shall be required within a GPDD, except as specified by the master development plan or by the Florida Building Code.

5. Density and intensity of land uses. The density and intensity of land uses permitted within a GPDD shall conform with the Future Land Use Element of the County's Comprehensive Plan.

Exhibit 3

Existing Objectives and Policies in the County's Comprehensive Plan

Future Land Use Element

SUB-OBJECTIVE 1.6.1 Glades Area Economic Development Overlay

Palm Beach County shall use existing mechanisms or develop new strategies to assist Glades communities, residents and organizations to promote economic diversification, cultural preservation, greenways planning, local revitalization and redevelopment, area beautification and coordinated future land use planning while complying with all applicable environmental regulations and constraints by applying the provisions of the Glades Area Economic Development Overlay.

Policy 1.6.1-a: The Glades Area Economic Development Overlay (GA-O) shall apply to all land within the Urban Service Area in the Glades, including the State-designated enterprise zone for the municipalities of Belle Glade, South Bay and Pahokee.

Policy 1.6.1-b: Within the GA-O, the County shall provide flexibility in the range of uses and land development regulations allowed to accommodate uses which, if deemed appropriate, will increase job opportunities and improve the economic vitality of the area.

Policy 1.6.1-c: By January 2002, the County shall review and revise the Glades Economic Overlay Zone to increase opportunities for establishing home-based businesses and other mixed future land uses.

SUB-OBJECTIVE 1.6.2 Sugar Cane Growers Cooperative of Florida Protection Area Overlay

The purpose of the Sugar Cane Growers Cooperative of Florida Protection Area Overlay (Sugar Cane Growers Cooperative Overlay) area is to provide for the protection of the sugar industry, a significant agricultural industry from encroachment of incompatible uses and activities*;* as well as to provide opportunities for the location of accessory, auxiliary, and supporting industrial uses in close proximity to the existing SCGCF mill and related facilities.

Policy 1.6.2-a: The Sugar Cane Growers Cooperative Overlay is depicted on the Special Planning Areas Map in the Map Series, and is generally described as the area east of State Road 15, east and north of Belle Glade's city limits south of State Road 80, and west of the adopted Urban Service Area for the Glades. The overlay includes all of Sections 21, and 28, the eastern half of sections 20 and 29, Township 43 Range 37, excluding completely the western half of Section 29, which has been selected by the City of Belle Glade to build a Business Park and

as a potential future annexation area. The specific boundaries of the Sugar Cane Growers Cooperative of Florida Protection Area Overlay are depicted on the Special Planning Areas Map in the Map Series.

Policy 1.6.2-b: All lands within the Sugar Cane Growers Cooperative Overlay shall be designated as Industrial on the Future Land Use Atlas. Uses permitted in and adjacent to the Overlay shall be limited to those, including agriculture, that are compatible with or complement the operations of the Sugar Cane Growers Cooperative of Florida, and the purpose of the Overlay, and allow the continuation and future development of the sugarcane industry.

Policy 1.6.2-c: Uses permitted within and adjacent to the Sugar Cane Growers Cooperative Overlay shall be compatible with or complement the operations of the purpose of the Overlay, and allow the continuation and future development of the sugarcane industry.

Policy 1.6.2-d: Should production and processing at the Sugar Cane Growers Cooperative of Florida be discontinued, this Overlay and Sub-objective 1.6.2 of the Future Land Use Element will be revisited, and will also be reviewed as part of the Evaluation and Appraisal Review (EAR) process for the Comprehensive Plan.

SUB-OBJECTIVE 1.6.3 Lake Okeechobee Scenic Trail Overlay

The purpose of the Lake Okeechobee Scenic Trail Overlay is to increase job opportunities and improve the economic vitality of the area by supporting the development of tourist-related facilities in conjunction with the Lake Okeechobee Scenic Trail, a segment of the Florida National Scenic Trail atop of the Herbert Hoover Dike.

Policy 1.6.3-a: The Lake Okeechobee Scenic Trail Overlay (LOST-O) consists of the area shown outside the Urban/Suburban Tier on the Managed Growth Tier System Map located between the Herbert Hoover Dike and 250 feet South of U.S. 27, and between the Herbert Hoover Dike and 250 feet East of Conners Highway as depicted on the Special Planning Areas Map in the Map Series.

Policy 1.6.3-b: The LOST-O shall accommodate uses such as inns, cabins, restaurants, and trail outfitters (e.g. bicycle and boat rentals) which support outdoor recreational activities. Within the Overlay, such tourist-related uses shall be allowed in all Future Land Use designations.

Policy 1.6.3-c: Only properties which represent a lot of record as of December 31, 2000, at least 50% of which lies within the LOST-O, may utilize the provisions of the
LOST-O.

Intergovernmental Coordination Element

GOAL 2 GLADES REVITALIZATION

It is the **GOAL** of Palm Beach County to revitalize the Glades area through cooperative efforts with the Glades Communities, residents and organizations in a manner consistent with the goals, objectives and policies of the Palm Beach County Comprehensive Plan.

OBJECTIVE 2.1 Glades Enhancement and Economic Diversification

Palm Beach County shall use existing mechanisms or develop new strategies to assist Glades communities, residents and organizations to promote economic diversification, cultural preservation, greenways planning, local redevelopment, area beautification and coordinated land use planning.

Policy 2.1-a: The County shall continue to coordinate with community organizations and local governments to promote opportunities to expand the types of business and jobs available to Glades residents, including business expansion and development, tourism development and agricultural enhancement.

Policy 2.1-b: Palm Beach County Office of Economic Development shall assist business formation or expansion in the Glades area using, but not limited to, the following strategies:

1. Provide financial and technical assistance for small business development
2. Encourage use of the Glades Economic Overlay Zone
3. Promote benefits of the Enterprise Zones
4. Coordinate with private and non-profit business development entities
5. Procure business development grants

Policy 2.1-c: The County shall continue to provide technical assistance pursuant to the joint planning agreement with the cities of Belle Glade, South Bay, Pahokee and the Glades Community Development Corporation to promote community revitalization, cultural preservation, and comprehensive planning.

OBJECTIVE 2.2 Communication with Glades Communities

Palm Beach County shall increase communication and participation with Glades Communities, organizations and residents on Glades and Countywide matters through formal agreements, appointed committees, County programs and other informal efforts.

Policy 2.2-a: The Office of Community Revitalization (with the assistance of the Planning, Zoning and Building Department) and other appropriate agencies shall

provide an annual report to the BCC and the Glades Technical Advisory Committee (GTAC) summarizing County and GTAC revitalization initiatives.

Policy 2.2-b: The County shall maintain or increase the number of Glades representatives on County boards, agencies and committees.

Policy 2.2-c: The Office of Community Revitalization (OCR) shall continue to organize and staff a regular Glades Technical Advisory Committee meeting. The OCR shall work through GTAC to facilitate communication and collaboration with the Glades communities, and work with appropriate agencies, residents and other community stakeholders to promote Glades revitalization efforts. The purpose of GTAC is to:

1. Coordinate stabilization, revitalization and economic development initiatives in the Glades communities;
2. Identify and share information regarding programs, services, and other community resources that could be beneficial to Glades revitalization efforts;
3. Link Glades community groups and organizations with service providers, convey community needs and desires to elected and appointed officials, and facilitate public participation;
4. Provide local residents with an opportunity to be better informed about and more involved in County and city government, and how to solve problems and access resources; and
5. Provide periodic updates to the Board of County Commissioners on GTAC activities and areas needing County attention.

Exhibit 4

Existing Land Development Regulations in the County's Unified Land Development Code

Section 4 GAO, Glades Area Overlay

A. Purpose and Intent

A GAO district is to provide flexibility in the range of uses and PDRs allowed in the underlying districts in the Glades Tier and to accommodate uses which, if deemed appropriate, will increase job opportunities and improve the economic vitality of the area. In addition, the GAO district will provide a set of regulations that recognize the character of the area.

B. Applicability

All development orders within the GAO district shall also comply with all applicable Joint Planning Area Agreements, pursuant to Florida Statutes.

C. Boundaries

The GAO shall apply to all land within the USA in the Glades Tier. **[Ord. 2005 – 002]**

D. Use Regulations

In the GAO district, use shall be permitted as follows: **[Ord. 2005 – 002]**

1. Permitted Uses

Uses permitted as of right in the underlying district are permitted as of right in the GAO.

2. Special Uses

Uses allowed as special uses in the underlying district shall be permitted in the GAO district after compliance with the special use standards. In addition:

a. Nonconforming Use

Any nonconforming use may be expanded subject to a Special Permit. **[Ord. 2006-036]**

3. Conditional Uses

Uses allowed as conditional uses in the non-residential district shall be permitted by the DRO in the GAO district after compliance with the conditional use regulations. Uses not otherwise permitted in the non-residential may be permitted as Class A conditional uses in the GAO district after compliance with the conditional use regulations and after the BCC determines that the proposed use meets the following criteria:

a. increases the number of jobs or provides needed housing;
b. does not adversely affect adjacent land uses;

c. is consistent with the goals, objectives and policies of the Plan; and
d. helps to support existing or encourage additional Glades Area economic development.

4. Property Development Regulations (PDRs)

a. General
All development within the GAO district shall be subject to the (PDRs) of the underlying district, except as otherwise provided below.

b. Type II Waiver - Minimum Density
The BCC may consider the waiver of the minimum density requirement as a Type II Waiver for proposed development in the Glades area when: **[Ord. 2012-027]**

1) The proposed development is consistent with the provisions of any applicable Joint Planning Area Agreement, and;

2) An analysis is completed that addresses:

a) the impact of a reduced density development on the overall infrastructure system;
b) the compatibility of the proposed development with adjacent land uses; and
c) the effect of the reduced density development on the ability of PBC to meet its goals, objectives and policies related to affordable housing. If the development is located in a municipal annexation area, the analysis must be performed by the annexing municipality.

c. Maximum Density and Intensity
Maximum density and intensity of uses within the GAO district may be allowed to exceed those imposed by the underlying district and shall be determined by the BCC during the conditional use review process.

c. Location of Structures
Building permits in the GAO district may be permitted between the 120 foot and 220 foot R-O-W line within the R-O-W of State Road 700 through Canal Point, from Third Street on the north to Triangle Park on the east, subject to approval of the County Engineer.