

# Linking Land Use & Water Supply Planning

## Palm Beach County Pilot Project

Contract 03-DR-37-10-60-01-002



Second Contract Deliverable  
Facility Capacity Analysis and 20-Year Work Plan  
January 28, 2003

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# EXECUTIVE SUMMARY

Palm Beach County has been designated by the Florida Department of Community Affairs as one of the five Pilot Communities providing an early implementation of new State requirements to link land use and water supply planning. These communities are located in each of the water management districts and were selected to provide a diversity of community situations and sizes. The intent of the pilot projects is to gain experience and fine-tune the State's assistance to local governments in Florida for the preparation of plan amendments and programs to link land use and water supply planning.

This document is submitted to satisfy the second contract deliverable for Palm Beach County's Pilot Project linking land use and water supply planning, as currently required by the State. Because of the complexity of the water supply situation in Palm Beach County, we are providing an extensive documentation of the requested information including groundwater modeling results verifying a sufficient supply of water is available to meet the projected demand for Palm Beach County.

## **Facility Capacity Analysis for Existing Conditions**

The 2005 population of 396,226 people will require an average daily raw water demand of 57.66 mgd to produce 50.00 mgd of potable water. Assuming Palm Beach County's two largest wells from each wellfield are out of service, the County will have 52 mgd of surplus raw water pumping capacity and 37 mgd of surplus treatment capacity. Nearly 15 percent of the average day raw water demand (8.50 mgd) will be provided from alternative water resources including wetland treatment and reclaimed water systems. The balance of the raw water demand will be withdrawn from the surficial aquifer.

## **Facility Capacity Analysis for Future Conditions**

Palm Beach County's capital improvements expansion program is structured to provide surplus raw water and treatment capacity through the year 2025. The projected 2025 population of 580,546 people will require an average daily raw water demand of 88.73 mgd to produce 73.26 mgd of potable water. Under normal operating conditions the County will have more than 61 mgd of surplus raw water pumping capacity and 37 mgd of surplus treatment capacity. The 2025 alternative water resources program will include two wetland treatment systems, four aquifer storage and recovery wells, and the reclaimed water system. Palm Beach County's use of alternative water resources will increase to 17.5 mgd under average day pumping conditions and to 38.50 mgd under maximum month pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

## **Water Supply Facility Needs for Future Conditions**

Palm Beach County has identified new water supply facilities that will be required to serve projected growth throughout the service area for the 20-year planning period through the year 2025. New surficial aquifer wells will be constructed as each treatment plant is expanded. Each wellfield has been designed to provide approximately 20 percent pumping capacity redundancy to ensure a reliable supply of raw water will be provided to each treatment facility. The 20 percent redundancy facilitates wellfield rotation and enables specific well maintenance and performance issues to be addressed without affecting total raw water supply.

### **Verification of Sufficient Water Supply for Future Conditions**

Palm Beach County has been working closely with the South Florida Water Management District to satisfy conditions required to receive a 20-year water use permit. The County provided reasonable assurance that the conditions of the permit would be met throughout the duration of the 20-year permit via a water supply development plan having 5-year intervals. The County demonstrated that the volumes of water withdrawn during a 1 in 10 year drought condition will be offset by alternative water sources. Palm Beach County has proposed multiple alternative water supply projects that collectively will eliminate the impact of additional water withdrawals on the Regional System. Palm Beach County has proposed that all additional demands (after December 2000) on the Lake Worth Drainage District and the Regional System be offset by equal amounts of alternative water supplies. The offset mechanisms include reclaimed water, aquifer storage and recovery, and created wetlands systems, among others. Palm Beach County's alternative water supply program completely offsets the impact of the increased allocation on the Lake Worth Drainage District canals and the Regional System.

## FACILITY CAPACITY ANALYSIS

Based upon the results of extensive comprehensive planning, master planning, and expected population growth, Palm Beach County has developed a capital improvements program to ensure adequate water supply and water treatment facilities will be available to satisfy projected demand through the year 2025. This evaluation presents demand and capacity information based upon average daily flow conditions. Historically, Palm Beach County has operated with a raw water per capita usage of 131 gallons per capita per day (gpcd) and finished water per capita usage of 126 gpcd. The finished water per capita usage does not change throughout the 20-year planning period. However, as the County increases use of membrane treatment technology, the raw water per capita rate increases by 11.8% to 146.5 gpcd in the year 2025. The increased raw water per capita is attributed to the membrane process that produces higher quality water by generating a concentrated waste stream. The waste stream is equivalent to 15 percent of the incoming raw water flow. Palm Beach County has instituted a program to optimize recycling of the membrane waste into its reclaimed water system.

A summary of Palm Beach County's facility capacity analysis is presented in Tables 1 through 5 for each of the 5-year planning increments. Palm Beach County's facility expansion strategy has been designed to have a surplus condition for both raw water and finished water facilities throughout the 20-year planning period. The tables indicate the portion of average daily flow to be provided from alternative water resources. Additional information on the alternative water resources program is presented in subsequent sections of this document.

### Existing Conditions – Year 2005

Palm Beach County's existing conditions are presented in **Table 1**. The population of 396,226 people will require an average daily raw water demand of 57.66 mgd to produce 50.00 mgd of potable water. Facilities to be utilized in the 2005 condition include two lime softening water treatment plants (WTP No.2 and No. 8) and two membrane softening treatment plants (WTP No. 3 and No. 9). Assuming the two largest wells from each wellfield to be out of service, the County will have 52.54 mgd surplus raw water pumping capacity. The Palm Beach County system is interconnected such that each treatment plant can distribute water throughout the service area. The overall service area will have 37.50 mgd surplus treatment capacity in 2005. Each individual wellfield and treatment plant will operate with surplus capacity. Nearly 15 percent of the average day raw water demand (8.50 mgd) will be provided from alternative water resources including wetland treatment and reclaimed water systems. Palm Beach County's use of alternative water resources will increase to 11.10 mgd under maximum month raw water pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

### Future Conditions – Year 2010

Palm Beach County's future 5-year projected conditions are presented in **Table 2**. The projected population of 441,736 people will require an average daily raw water demand of 62.98 mgd to produce 54.62 mgd of potable water. Facilities to be utilized in the 2010 condition include two lime softening water treatment plants (WTP No.2 and No. 8) and

two membrane softening treatment plants (WTP No. 3 and No. 9). Assuming the two largest wells from each wellfield to be out of service, the County will continue to have approximately 51 mgd of surplus raw water pumping capacity and 36 mgd of surplus treatment capacity. Each individual wellfield and treatment plant will operate with surplus capacity. More than 18 percent of the raw water demand (11.50 mgd) will be provided from alternative water resources including two wetland treatment systems, an aquifer storage and recovery well, and the reclaimed water system. Palm Beach County's use of alternative water resources will increase to 17.20 mgd under maximum month raw water pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

### **Future Conditions – Year 2015**

Palm Beach County's future 10-year projected conditions are presented in **Table 3**. The projected population of 485,611 people will require an average daily raw water demand of 69.53 mgd to produce 60.18 mgd of potable water. An additional membrane plant will be placed on-line by 2015. Facilities to be utilized in the 2015 condition include one lime softening water treatment plant (WTP No. 8) and three membrane softening treatment plants (WTP No. 2, No. 3, and No. 9). Assuming the two largest wells from each wellfield to be out of service, the County will have more than 70 mgd of surplus raw water pumping capacity and 46 mgd of surplus treatment capacity. Each individual wellfield and treatment plant will operate with surplus capacity. Palm Beach County's alternative water resources program is projected to provide nearly 20 percent (13.5 mgd) of the average day raw water demand. The 2015 alternative water resources program will include two wetland treatment, two aquifer storage and recovery wells, and the reclaimed water system. Palm Beach County's use of alternative water resources will increase to 21.30 mgd under maximum month raw water pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

### **Future Conditions – Year 2020**

Palm Beach County's future 15-year projected conditions are presented in **Table 4**. The projected population of 536,335 people will require an average daily raw water demand of 78.62 mgd to produce 66.41 mgd of potable water. An additional membrane plant will be placed on-line by 2020. All four water treatment facilities to be utilized in the 2020 condition will be membrane softening plants. Assuming the two largest wells from each wellfield to be out of service, the County will have more than 71 mgd of surplus raw water pumping capacity and 44 mgd of surplus treatment capacity. Each individual wellfield and treatment plant will operate with surplus capacity. Palm Beach County's alternative water resources program is projected to provide nearly 20 percent (15.5 mgd) of the average day raw water demand. The 2020 alternative water resources program will include two wetland treatment, three aquifer storage and recovery wells, and the reclaimed water system. Palm Beach County's use of alternative water resources will increase to 29.40 mgd under maximum month raw water pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

### **Future Conditions – Year 2025**

Palm Beach County's future 20-year projected conditions are presented in **Table 5**. The projected population of 580,546 people will require an average daily raw water demand of 88.73 mgd to produce 73.26 mgd of potable water. All four water treatment facilities

to be utilized in the 2025 condition will be membrane softening plants. Assuming the two largest wells from each wellfield to be out of service, the County will have more than 61 mgd of surplus raw water pumping capacity and 37 mgd of surplus treatment capacity. Each individual wellfield and treatment plant will operate with surplus capacity. Palm Beach County's alternative water resources program is projected to provide nearly 20 percent (17.5 mgd) of the average day raw water demand. The 2025 alternative water resources program will include two wetland treatment, four aquifer storage and recovery wells, and the reclaimed water system. Palm Beach County's use of alternative water resources will increase to 38.50 mgd under maximum month raw water pumping conditions. The balance of the raw water demand will be withdrawn from the surficial aquifer.

### **Summary of Facility Capacity Analysis**

Palm Beach County's capital improvements expansion program is structured to provide surplus raw water and treatment capacity through the year 2025. The majority of raw water will continue to be supplied from the surficial aquifer. The County has demonstrated to the South Florida Water Management District that all additional demands placed on the regional water supply system will be completely off-set with alternative water resources.

**TABLE 1**

**PALM BEACH COUNTY  
FACILITY CAPACITY ANALYSIS  
2005**

Facility	Population Served	Demand			Capacity		Facility Evaluation		Raw Water Source	
		Raw Water Average Daily Flow (mgd)	Raw Water 1-in-10 Year Drought Demand (mgd) <sup>(4)</sup>	Finished Water Average Daily Flow (mgd)	Raw Water Pumping Capacity (mgd) <sup>(1)</sup>	Finished Water Production Capacity (mgd)	Raw Water Surplus or (Deficiency) (mgd)	Finished Water Surplus or (Deficiency) (mgd)	Surficial Aquifer (mgd)	Alternative Water Resources (mgd) <sup>(5)</sup>
WTP No. 2 <sup>(2)</sup>	94,535	11.74	12.99	10.77	15.60	14.50	3.86	3.73	11.74	0.00
WTP No. 3 <sup>(3)</sup>	70,476	13.31	14.73	11.05	40.20	30.00	26.89	18.95	4.81	8.50
WTP No. 8 <sup>(2)</sup>	137,750	14.05	15.55	12.79	18.70	16.00	4.65	3.21	14.05	0.00
WTP No. 9 <sup>(3)</sup>	93,465	18.56	20.54	15.40	35.70	27.00	17.14	11.60	18.56	0.00
System-Wide	396,226	57.66	63.80	50.00	110.20	87.50	52.54	37.50	49.16	8.50

Notes: (1) Raw Water Pumping Capacity = Wellfield Capacity with two largest wells out of service.

(2) Finished Water Capacity = Lime Softening Plant

(3) Finished Water Capacity = Membrane Softening Plant with 15% Raw Water Blend

(4) Raw Water 1-in-10 Year drought demand based upon SFWMD June 1998 methodology using 1.1065 times average daily flow.

(5) Alternative resources to be provided for an average day condition. Amount will increase with maximum month pumping conditions.

**TABLE 2**

**PALM BEACH COUNTY  
FACILITY CAPACITY ANALYSIS  
2010**

Facility	Population Served	Demand			Capacity		Facility Evaluation		Raw Water Source	
		Raw Water Average Daily Flow (mgd)	Raw Water 1-in-10 Year Drought Demand (mgd) <sup>(4)</sup>	Finished Water Average Daily Flow (mgd)	Raw Water Pumping Capacity (mgd) <sup>(1)</sup>	Finished Water Production Capacity (mgd)	Raw Water Surplus or (Deficiency) (mgd)	Finished Water Surplus or (Deficiency) (mgd)	Surficial Aquifer (mgd)	Alternative Water Resources (mgd) <sup>(5)</sup>
WTP No. 2 <sup>(2)</sup>	109,271	11.69	12.93	10.66	15.60	14.50	3.91	3.84	11.69	0.00
WTP No. 3 <sup>(3)</sup>	83,312	18.70	20.69	15.71	40.20	30.00	21.50	14.29	7.20	11.50
WTP No. 8 <sup>(2)</sup>	150,802	13.92	15.40	12.56	23.00	20.00	9.08	7.44	13.92	0.00
WTP No. 9 <sup>(3)</sup>	98,351	18.67	20.66	15.68	35.70	27.00	17.03	11.32	18.67	0.00
System-Wide	441,736	62.98	69.69	54.62	114.50	91.50	51.52	36.88	51.48	11.50

Notes: (1) Raw Water Pumping Capacity = Wellfield Capacity with two largest wells out of service.

(2) Finished Water Capacity = Lime Softening Plant

(3) Finished Water Capacity = Membrane Softening Plant with 15% Raw Water Blend

(4) Raw Water 1-in-10 Year drought demand based upon SFWMD June 1998 methodology using 1.1065 times average daily flow.

(5) Alternative resources to be provided for an average day condition. Amount will increase with maximum month pumping conditions.

**TABLE 3**

**PALM BEACH COUNTY  
FACILITY CAPACITY ANALYSIS  
2015**

Facility	Population Served	Demand			Capacity		Facility Evaluation		Raw Water Source	
		Raw Water Average Daily Flow (mgd)	Raw Water 1-in-10 Year Drought Demand (mgd) <sup>(4)</sup>	Finished Water Average Daily Flow (mgd)	Raw Water Pumping Capacity (mgd) <sup>(1)</sup>	Finished Water Production Capacity (mgd)	Raw Water Surplus or (Deficiency) (mgd)	Finished Water Surplus or (Deficiency) (mgd)	Surficial Aquifer (mgd)	Alternative Water Resources (mgd) <sup>(5)</sup>
WTP No. 2 <sup>(3)</sup>	125,331	17.42	19.28	14.64	41.50	30.00	24.08	15.36	17.42	0.00
WTP No. 3 <sup>(3)</sup>	93,926	17.38	19.23	14.60	40.20	30.00	22.82	15.40	3.88	13.50
WTP No. 8 <sup>(2)</sup>	164,266	17.38	19.23	16.37	23.00	20.00	5.62	3.63	17.38	0.00
WTP No. 9 <sup>(3)</sup>	102,088	17.35	19.20	14.57	35.70	27.00	18.35	12.43	17.35	0.00
System-Wide	485,611	69.53	76.94	60.18	140.40	107.00	70.87	46.82	56.03	13.50

Notes: (1) Raw Water Pumping Capacity = Wellfield Capacity with two largest wells out of service.

(2) Finished Water Capacity = Lime Softening Plant

(3) Finished Water Capacity = Membrane Softening Plant with 15% Raw Water Blend

(4) Raw Water 1-in-10 Year drought demand based upon SFWMD June 1998 methodology using 1.1065 times average daily flow.

(5) Alternative resources to be provided for an average day condition. Amount will increase with maximum month pumping conditions.

**TABLE 4**

**PALM BEACH COUNTY  
FACILITY CAPACITY ANALYSIS  
2020**

Facility	Population Served	Demand			Capacity		Facility Evaluation		Raw Water Source	
		Raw Water Average Daily Flow (mgd)	Raw Water 1-in-10 Year Drought Demand (mgd) <sup>(4)</sup>	Finished Water Average Daily Flow (mgd)	Raw Water Pumping Capacity (mgd) <sup>(1)</sup>	Finished Water Production Capacity (mgd)	Raw Water Surplus or (Deficiency) (mgd)	Finished Water Surplus or (Deficiency) (mgd)	Surficial Aquifer (mgd)	Alternative Water Resources (mgd) <sup>(5)</sup>
WTP No. 2 <sup>(3)</sup>	143,266	19.68	21.78	16.63	41.50	30.00	21.82	13.37	19.68	0.00
WTP No. 3 <sup>(3)</sup>	110,239	19.65	21.74	16.60	40.20	30.00	20.55	13.40	4.15	15.50
WTP No. 8 <sup>(3)</sup>	177,198	19.65	21.74	16.60	33.10	24.00	13.45	7.40	19.65	0.00
WTP No. 9 <sup>(3)</sup>	105,632	19.64	21.73	16.58	35.70	27.00	16.06	10.42	19.64	0.00
System-Wide	536,335	78.62	86.99	66.41	150.50	111.00	71.88	44.59	63.12	15.50

Notes: (1) Raw Water Pumping Capacity = Wellfield Capacity with two largest wells out of service.

(2) Finished Water Capacity = Lime Softening Plant

(3) Finished Water Capacity = Membrane Softening Plant with 15% Raw Water Blend

(4) Raw Water 1-in-10 Year drought demand based upon SFWMD June 1998 methodology using 1.1065 times average daily flow.

(5) Alternative resources to be provided for an average day condition. Amount will increase with maximum month pumping conditions.

**TABLE 5**

**PALM BEACH COUNTY  
FACILITY CAPACITY ANALYSIS  
2025**

Facility	Population Served	Demand			Capacity		Facility Evaluation		Raw Water Source	
		Raw Water Average Daily Flow (mgd)	Raw Water 1-in-10 Year Drought Demand (mgd) <sup>(4)</sup>	Finished Water Average Daily Flow (mgd)	Raw Water Pumping Capacity (mgd) <sup>(1)</sup>	Finished Water Production Capacity (mgd)	Raw Water Surplus or (Deficiency) (mgd)	Finished Water Surplus or (Deficiency) (mgd)	Surficial Aquifer (mgd)	Alternative Water Resources (mgd) <sup>(5)</sup>
WTP No. 2 <sup>(3)</sup>	155,076	22.23	24.60	18.36	41.50	30.00	19.27	11.64	22.23	0.00
WTP No. 3 <sup>(3)</sup>	119,326	22.18	24.54	18.32	40.20	30.00	18.02	11.68	4.68	17.50
WTP No. 8 <sup>(3)</sup>	191,805	22.18	24.54	18.30	33.10	24.00	10.92	5.70	22.18	0.00
WTP No. 9 <sup>(3)</sup>	114,339	22.14	24.50	18.28	35.70	27.00	13.56	8.72	22.14	0.00
System-Wide	580,546	88.73	98.18	73.26	150.50	111.00	61.77	37.74	71.23	17.50

Notes: (1) Raw Water Pumping Capacity = Wellfield Capacity with two largest wells out of service.

(2) Finished Water Capacity = Lime Softening Plant

(3) Finished Water Capacity = Membrane Softening Plant with 15% Raw Water Blend

(4) Raw Water 1-in-10 Year drought demand based upon SFWMD June 1998 methodology using 1.1065 times average daily flow.

(5) Alternative resources to be provided for an average day condition. Amount will increase with maximum month pumping conditions.

**TABLE 6  
PALM BEACH COUNTY  
FACILITY EXPANSION SCHEDULE**

Facility	Source of Water to be Utilized	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	Total Estimated Construction Cost
9W ASR Well	Surficial and Floridan Aquifers	\$ 1,600,000	\$ 200,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,800,000
Winsberg Farms Constructed Wetlands	Secondary Effluent	\$ 2,000,000	\$ 9,000,000	\$ -	\$ -	\$ -	\$ 1,000,000	\$ 1,000,000	\$ -	\$ 13,000,000
WTP No. 3	Surficial and Floridan Aquifers	\$ 9,000,000	\$ 31,000,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 40,000,000
Reclaimed Water System Phase IV Expansion	Reclaimed Water	\$ -	\$ -	\$ 500,000	\$ 500,000	\$ 500,000	\$ 500,000	\$ 400,000	\$ -	\$ 2,400,000
WTP No. 2	Surficial and Floridan Aquifers	\$ -	\$ 4,000,000	\$ 4,500,000	\$ -	\$ -	\$ 15,000,000	\$ 15,000,000	\$ 11,500,000	\$ 50,000,000
8W ASR Well	Surficial and Floridan Aquifers	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,000,000
Reclaimed Water System Phase V Expansion	Reclaimed Water	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 300,000	\$ 3,200,000
2W ASR Well	Surficial and Floridan Aquifers	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,000,000
WTP No. 8	Surficial and Floridan Aquifers	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 50,000,000

Each of these facilities will take more than one year to complete, so the capital costs will be spread over several years in the Capital Improvement Element (CIE) tables (Example: the Winsberg Farms project has expenditures in FY03, FY04, FY08 and FY09, which is how the costs will appear in the CIE) . Also note that this schedule only includes alternate water resources, not water and sewer projects (as in the CIE Table 10). The source of funding for these projects will be Water Utilities Department user fees and balances brought forward.

## WATER SUPPLY NEEDS FOR FUTURE CONDITIONS

Palm Beach County has identified new water supply facilities that will be required to serve projected growth throughout the service area for the 20-year planning period through the year 2025. A general wellfield expansion schedule is presented in **Table 6**. New surficial aquifer wells will be constructed as each treatment plant is expanded. Each wellfield has been designed to provide approximately 20 percent pumping capacity redundancy to ensure a reliable supply of raw water will be provided to each treatment facility. The 20 percent redundancy facilitates wellfield rotation and enables specific well maintenance and performance issues to be addressed without affecting total raw water supply. Detailed information regarding the specific number of wells, capacity of each proposed future well, and location of future wells is provided on the attached pages taken from the County's Raw Water Master Plan (pages 2-7 through 2-16).

**TABLE 6 – WELLFIELD EXPANSION SCHEDULE**

	<b>Wellfield</b>	<b>2005 Wellfield Capacity (MGD)</b>	<b>2010 Wellfield Capacity (MGD)</b>	<b>2015 Wellfield Capacity (MGD)</b>	<b>2020 Wellfield Capacity (MGD)</b>	<b>2025 Wellfield Capacity (MGD)</b>	<b>2025 Total Wellfield Capacity (MGD)</b>
2W	Eastern Wellfield	8.4	8.4	14.1	14.1	14.1	
2W	Western Wellfield	10.1	10.1	16.6	16.6	16.6	
2W	Northern Wellfield	0.0	0.0	15.1	15.1	15.1	45.8
3W	Eastern Wellfield	18.4	18.4	18.4	18.4	18.4	
3W	Western Wellfield	26.9	26.9	26.9	26.9	26.9	
3W	Northern Wellfield	0.0	0.0	0.0	0.0	0.0	45.3
8W	Northern Wellfield	10.1	11.5	11.5	15.8	15.8	
8W	Central Wellfield	8.6	8.6	8.6	8.6	8.6	
8W	Southern Wellfield	3.6	6.5	6.5	12.2	12.2	36.6
9W	Eastern Wellfield	22.1	22.1	22.1	22.1	22.1	
9W	Western Wellfield	17.5	17.5	17.5	17.5	17.5	39.6
<b>RW Pumping Capacity</b>		<b>125.6</b>	<b>129.9</b>	<b>157.3</b>	<b>167.4</b>	<b>167.4</b>	<b>167.4</b>
Total FW Capacity		87.5	91.5	107.0	111.0	111.0	
RW Required for FW		101.3	105.5	126.6	134.7	134.7	
% RW Redundancy		19.3%	18.8%	19.5%	19.5%	19.5%	

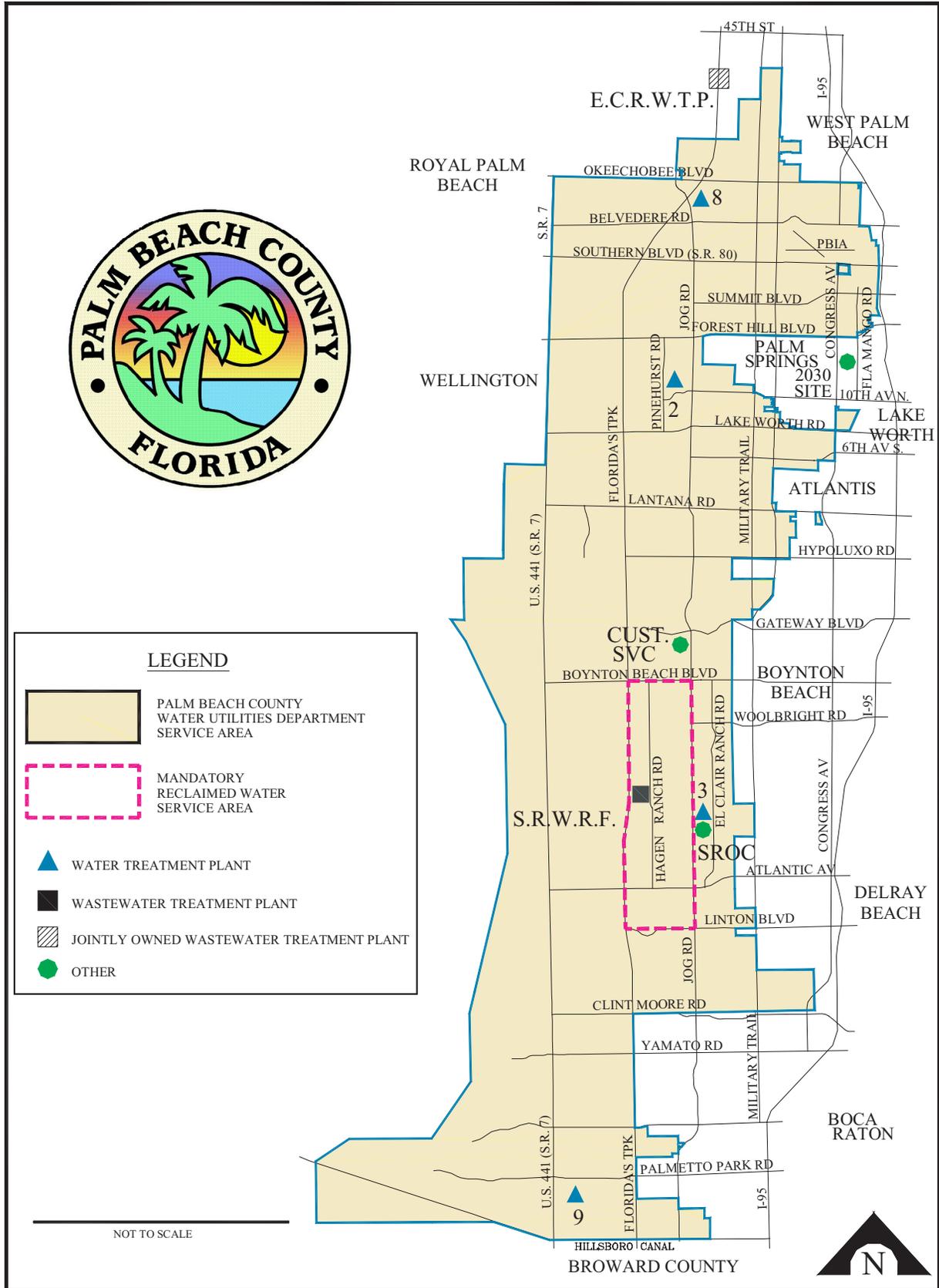


Figure 2-2  
Service Area Map

## WTP AND WELLFIELD DESCRIPTIONS

A description of each active WTP (2, 3, 8 and 9) and the associated wellfield is given below. The wellfields previously associated with Palm Beach County's WTPs 1 and 7 were assigned to WTP 8 and the wells are numbered accordingly. However, due to the location of these wells and the absence of raw water piping to physically connect the wells with WTP 8, they were plugged and abandoned in February, 2002 (WUD 00-136).

### WTP 2 Wellfield

WTP 2 is located to the east of Pinehurst Drive just north of 10<sup>th</sup> Avenue in West Palm Beach. The associated wellfield is located to the east and west of Pinehurst Drive, north of the L-10 canal crossings and south of Forest Hill Boulevard as shown on **Figure 2-3**. The wellfield currently consists of 14 wells with a total raw water pumping design capacity of 18.4 mgd. Wells 2W-1 through 2W-7 were constructed in the early 1970s and the remaining wells 2W-9 through 2W-15 were constructed between 1983 and 1996. The County proposes to replace the existing 14.5 mgd ozonated lime softening plant with a 30 mgd facility by the year 2015. The new plant will include a 25.5 mgd membrane softening plant with bypass and blend provisions for 4.5 mgd. Thirteen new production wells (27.4 mgd capacity) will be required to augment the existing wells and provide an adequate water source for the planned membrane softening WTP. A summary of the WTP 2 wellfield capacity is provided in **Table 2-3**.

The County and PBC Parks and Recreation have worked closely in the area of WTP 2 wellfield to design the Cholee Park lake system. This lake system will provide recharge to the groundwater in the vicinity of the wellfield and promote wetland preservation within the park. An interconnection with the LWDD L-10 Canal will maintain water level elevations in Cholee Park and provide groundwater recharge in the wellfield area.

### WTP 3 Wellfield

WTP 3 is located in Delray Beach east of Jog Road between LWDD's L-30 and L-31 canals. The existing WTP has a capacity of 15.3 mgd (9.3 mgd membrane softening plus 6 mgd lime softening). The County plans to decommission and demolish the lime softening plant after construction is completed for the membrane facility. The 25.5 mgd membrane plant will have provisions to use an additional 4.5 mgd of raw water bypass and blend capacity for a total finished water production capacity of 30 mgd. Construction of the membrane facility expansion began in 2002 and will be complete by 2005.

The WTP 3 Wellfield is currently located between Florida's Turnpike and just east of Jog Road between the LWDD's L-29 and L-31 canals as shown in **Figure 2-4**. The eastern portion of the wellfield was constructed during the 1970's and consist of wells 3W-1 through 3W-7. Since 1988, the County has added nine wells, 3W-8 through 3W-10 along Jog Road at the WTP 3 site and 3W-13 through 3W-18 west of Hagen Ranch Road. The existing wellfield pumping design capacity is 23.9 mgd. In two recent modifications of the County's existing water use permit (March 2001 and July 2001), wells 3W-1 through 3W-7 were up-rated to 1,000 gallons per minute and ten new production wells were approved by the SFWMD. The installation of new pump facilities for the existing wellfield is on-going and the new production wells will be constructed in 2002-2003 (WUD00-136). The wellfield capacity after improvement and expansion will be approximately 45.3 mgd. The existing and planned production wells will provide raw water adequate for the planned expansion of WTP 3. A summary of the WTP 3 wellfield capacity by well is provided in **Table 2-4**.

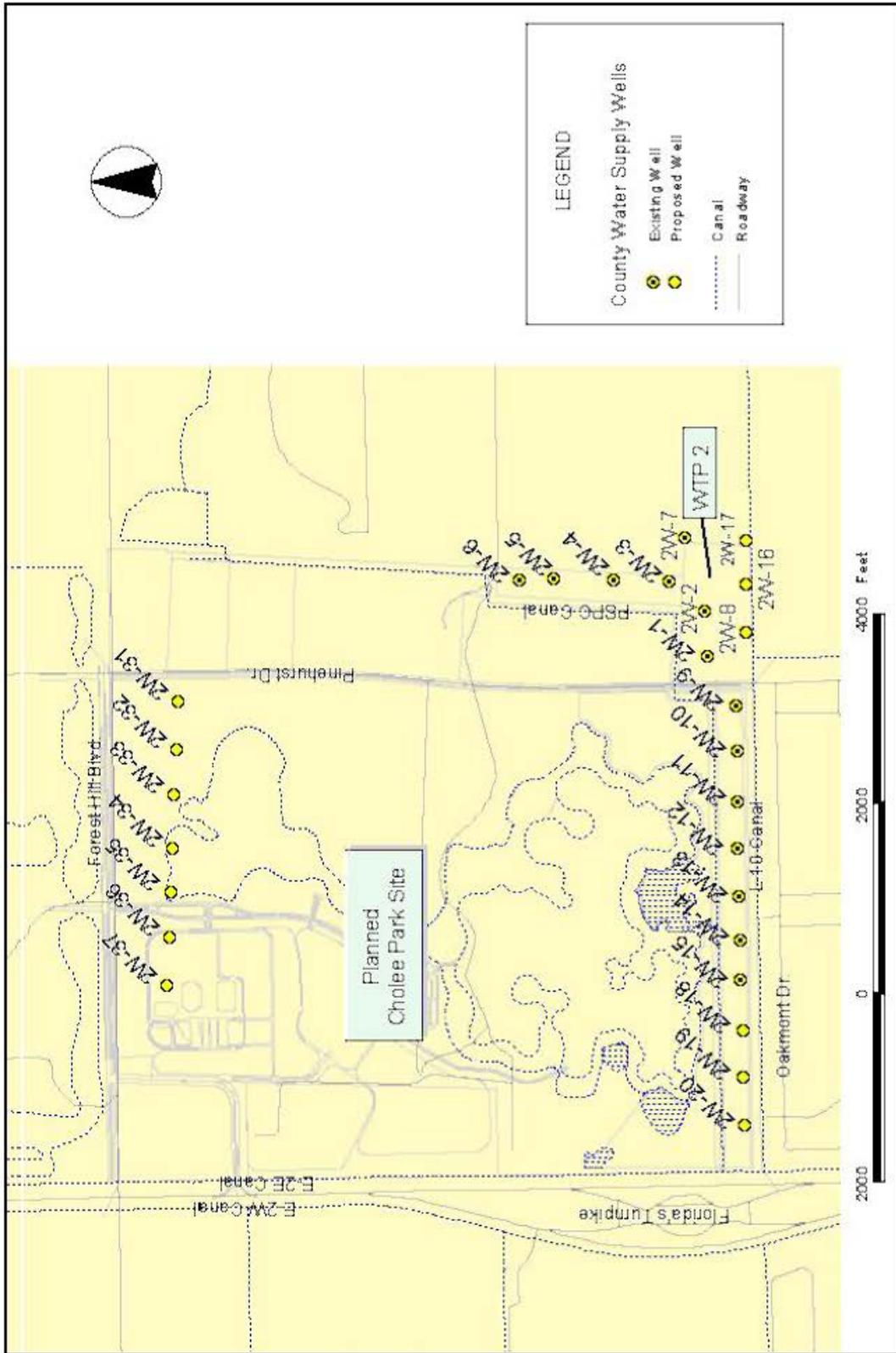


Figure 2-3  
WTP 2 Wellfield

Table 2-3  
Summary of the WTP 2 Wellfield

EXISTING WELLS YEAR 2000			NEW WELLS FOR MEMBRANE WTP YEAR 2015		
Well	Design Capacity (gpm)	Status	Well <sup>a</sup>	Design Capacity (gpm)	Status
2W-1	700	Existing	2W-1	700	Existing
2W-2	700	Existing	2W-2	700	Existing
2W-3	700	Existing	2W-3	700	Existing
2W-4	700	Existing	2W-4	700	Existing
2W-5	1,000	Existing	2W-5	1,000	Existing
2W-6	1,000	Existing	2W-6	1,000	Existing
2W-7	1,000	Existing	2W-7	1,000	Existing
2W-9	1,000	Existing	2W-9	1,000	Existing
2W-10	1,000	Existing	2W-10	1,000	Existing
2W-11	1,000	Existing	2W-11	1,000	Existing
2W-12	1,000	Existing	2W-12	1,000	Existing
2W-13	1,000	Existing	2W-13	1,000	Existing
2W-14	1,000	Existing	2W-14	1,000	Existing
2W-15	1,000	Existing	2W-15	1,000	Existing
			2W-8	1,000	Proposed
			2W-16	1,500	Proposed
			2W-17	1,500	Proposed
			2W-18	1,500	Proposed
			2W-19	1,500	Proposed
			2W-20	1,500	Proposed
			2W-31	1,500	Proposed
			2W-32	1,500	Proposed
			2W-33	1,500	Proposed
			2W-34	1,500	Proposed
			2W-35	1,500	Proposed
			2W-36	1,500	Proposed
			2W-37	1,500	Proposed

Well sites 2W-21 through 2W-30 have been  
deleted due to conflicts with land use.

TOTAL in gpm	12,800 gpm	TOTAL in gpm	31,800
TOTAL in mgd	18.4 mgd	TOTAL in mgd	45.8
<sup>b</sup> Capacity with two largest wells out of service	15.6 mgd	<sup>b</sup> Capacity with two largest wells out of service	41.5
Maximum raw water required	15.3 mgd	Maximum raw water required	36.4
Finished water production capacity	14.5 mgd	Finished water production capacity	30.0

<sup>a</sup> All new wells proposed to serve the 2015 membrane WTP are currently permitted by the SFWMD at 1,000 gpm.

<sup>b</sup> Capacity with two largest wells out of service is reported to show an acceptable level of raw water standby capacity.

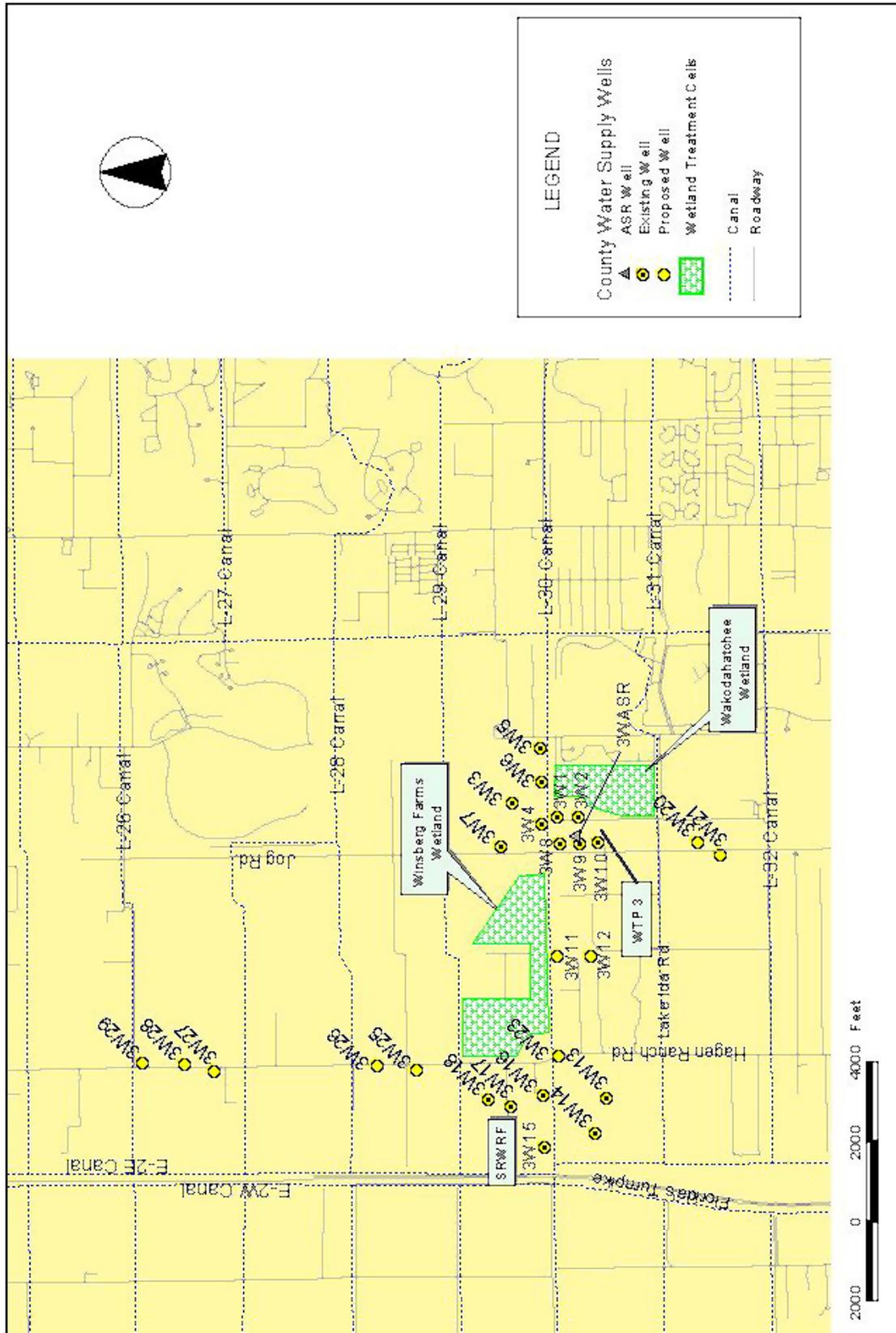


Figure 2-4  
WTP 3 Wellfield

Table 2-4  
Summary of the WTP 3 Wellfield

EXISTING WELLS YEAR 2000			NEW WELLS FOR MEMBRANE WTP YEAR 2002-2003		
Well	Design Capacity (gpm)	Status	Well	Design Capacity (gpm)	Status
3W-1	800	Existing	3W-1	1,000	Upated
3W-2	800	Existing	3W-2	1,000	Upated
3W-3	800	Existing	3W-3	1,000	Upated
3W-4	700	Existing	3W-4	1,000	Upated
3W-5	450	Existing	3W-5	1,000	Upated
3W-6	800	Existing	3W-6	1,000	Upated
3W-7	800	Existing	3W-7	1,000	Upated
3W-8	1,250	Existing	3W-8	1,250	Existing
3W-9	1,250	Existing	3W-9	1,250	Existing
3W-10	1,250	Existing	3W-10	1,250	Existing
3W-13	1,050	Existing	3W-13	1,050	Existing
3W-14	1,050	Existing	3W-14	1,050	Existing
3W-15	1,050	Existing	3W-15	1,050	Existing
3W-16	1,750	Existing	3W-16	1,750	Existing
3W-17	1,050	Existing	3W-17R	1,500	New
3W-18	1,750	Existing	3W-18	1,750	Existing
			3W-11	1,000	Existing
			3W-12	1,000	New
			3W-20	1,000	New
			3W-21	1,000	New
			3W-23	1,500	New
			3W-25	1,500	New
			3W-26	1,500	New
			3W-27	1,500	New
			3W-28	1,500	New
			3W-29	1,500	New
			Well sites 3W-19 and 3W-22 deleted due to conflicts with land use. Well site 3W-24 is a future contingency site.		
TOTAL in gpm		16,600 gpm	TOTAL in gpm		31,900
TOTAL in mgd		23.9 mgd	TOTAL in mgd		45.9
<sup>a</sup> Capacity with two largest wells out of service		18.9 mgd	<sup>a</sup> Capacity with two largest wells out of service		40.9
Maximum raw water required		17.9 mgd	Maximum raw water required		36.4
Finished water production capacity		15.3 mgd	Finished water production capacity		30.0

<sup>a</sup> Capacity with two largest wells out of service is reported to show an acceptable level of raw water standby capacity.

In addition to the wellfield, the County constructed a multi-purpose Aquifer Storage and Recovery (ASR) well in 1999. Once cycle testing is complete and final FDEP approval is granted, the well will be used to store raw water during lower demand periods for later use during high demand periods. ASR is one of the methods recommended by the SFWMD to relieve stress on the shallow aquifer during the dry season when demand is high.

### WTP 8 Wellfield

WTP 8 and the associated wellfield are located north of Belvedere Road east of Jog Road. The existing ozonated lime softening plant is served by 16 existing production wells with a total pumping design capacity of 23.0 mgd. The existing wells were constructed or acquired between 1982 and 1996. The County proposes to up-rate the 16 mgd facility to 20 mgd by the year 2010. In 2020 the ozonated lime softening plant is scheduled for demolition and replacement with a 20.5 mgd membrane softening WTP with 3.5 mgd of bypass and blend for a total finished water production capacity of 25 mgd. Seven new production wells will be required to supply raw water for the planned WTP. The expanded wellfield capacity by 2020 will be approximately 36.7 mgd.

Existing wells near the Palm Beach International Airport along Belvedere Road and at Century Village on Okeechobee Boulevard east of the intersection with Haverhill Road were abandoned in February, 2002. These wells were formerly associated with the County's WTPs 1 and 7 but could not be efficiently used to supply WTP 8 with raw water. Wells 8W-19 and 8W-20 located directly east of the WTP 8 site are also scheduled for abandonment by 2003. None of the abandoned wells are included in the statement of existing wellfield capacity above. The WTP 8 wellfield is shown on **Figure 2-5** and a summary of wellfield capacity is presented in **Table 2-5**.

### WTP 9 Wellfield

The WTP 9 wellfields are located in Boca Raton north of the Hillsboro canal and east of US 441. The existing 14.0 mgd lime softening plant is being replaced with a 27.0 mgd membrane softening facility. Wellfield 9 is located south of S.W. 65<sup>th</sup> Avenue and adjacent to Sandalfoot Cove Golf course and adjacent to the north side of the Hillsboro Canal as shown on **Figure 2-6**. This wellfield has a total of 24 wells with a total raw water pumping capacity of 39.6 mgd. Wells 9W-1 through 9W-7 were constructed in the early 1970's. Well 9W-1 was replaced in 1996 by 9W-1R. Wells 9W-8 through 9W-15 were constructed in 1982 and wells 9W-17 through 9W-25 were constructed along the Hillsboro Canal easement west of US 441 in 2000. Well site 9W-16 was dropped from construction due to land use conflicts. **Table 2-6** summarizes the wellfield capacity at WTP 9.

Wells 9W-17 through 9W-25 are located along the Hillsboro Canal to take advantage of the canal's capacity to recharge the Biscayne aquifer in this area. Wells 9W-21 through 9W-25 will also be used in conjunction with the Hillsboro ASR well currently under construction (WUD 98-66). This ASR well has been designed and permitted to store 5 mgd of raw water to minimize peak water supply demands at WTP 9. Actual recovery rates (i.e. flow, duration, etc.) will be determined during the operational testing phase of the well scheduled for 2002-2003.

**Table 2-7** below provides a summary of the existing and proposed wellfield capacity for the County raw water supply system through 2024. Photographs of each existing well are provided in **Appendix A**. Detailed information for each individual well in the County's raw water database, including: date of construction, well diameter, casing depth, screen interval, pump type, etc., is provided in **Appendix G**.

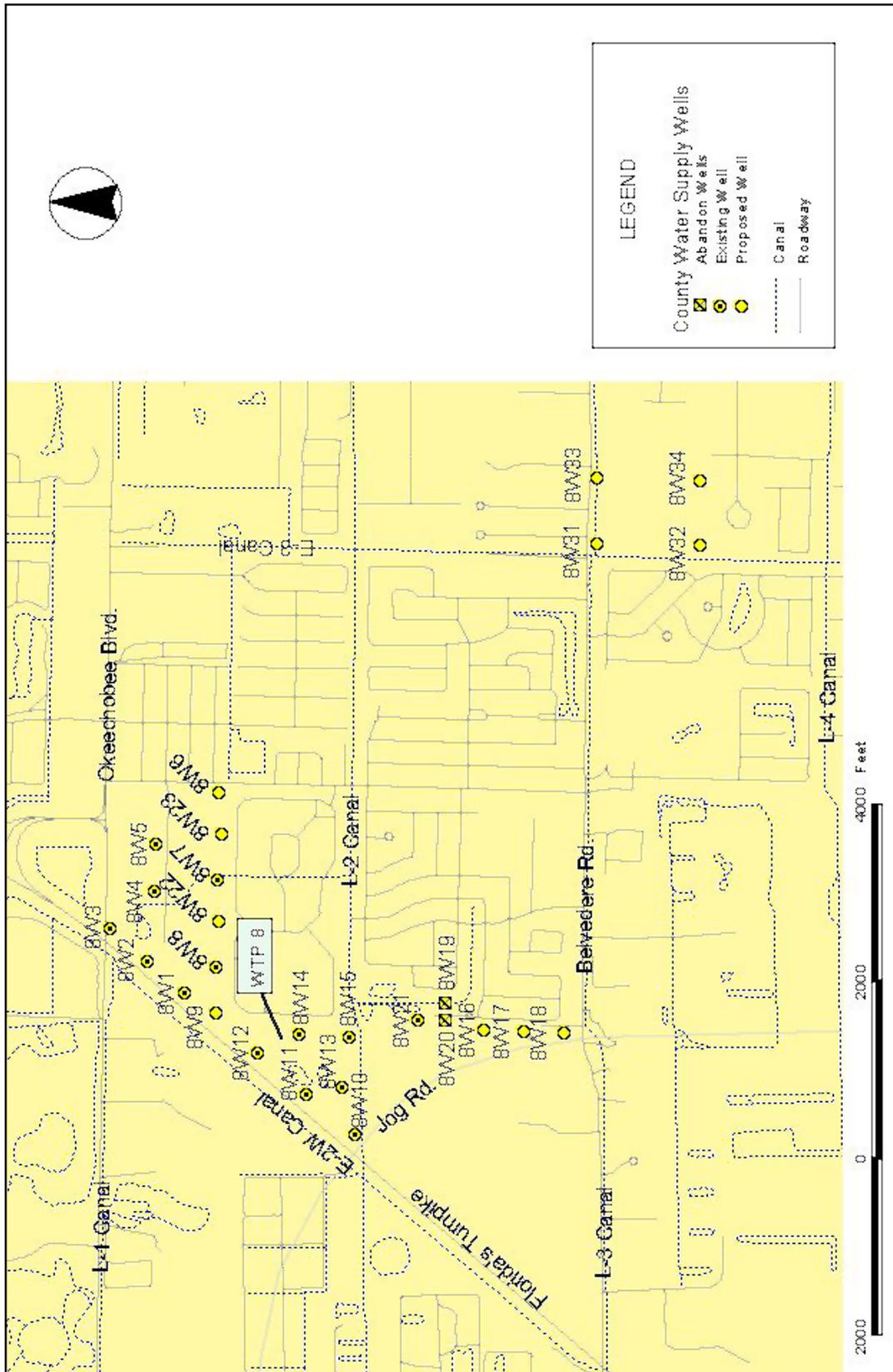


Figure 2-5  
WTP 8 Wellfield



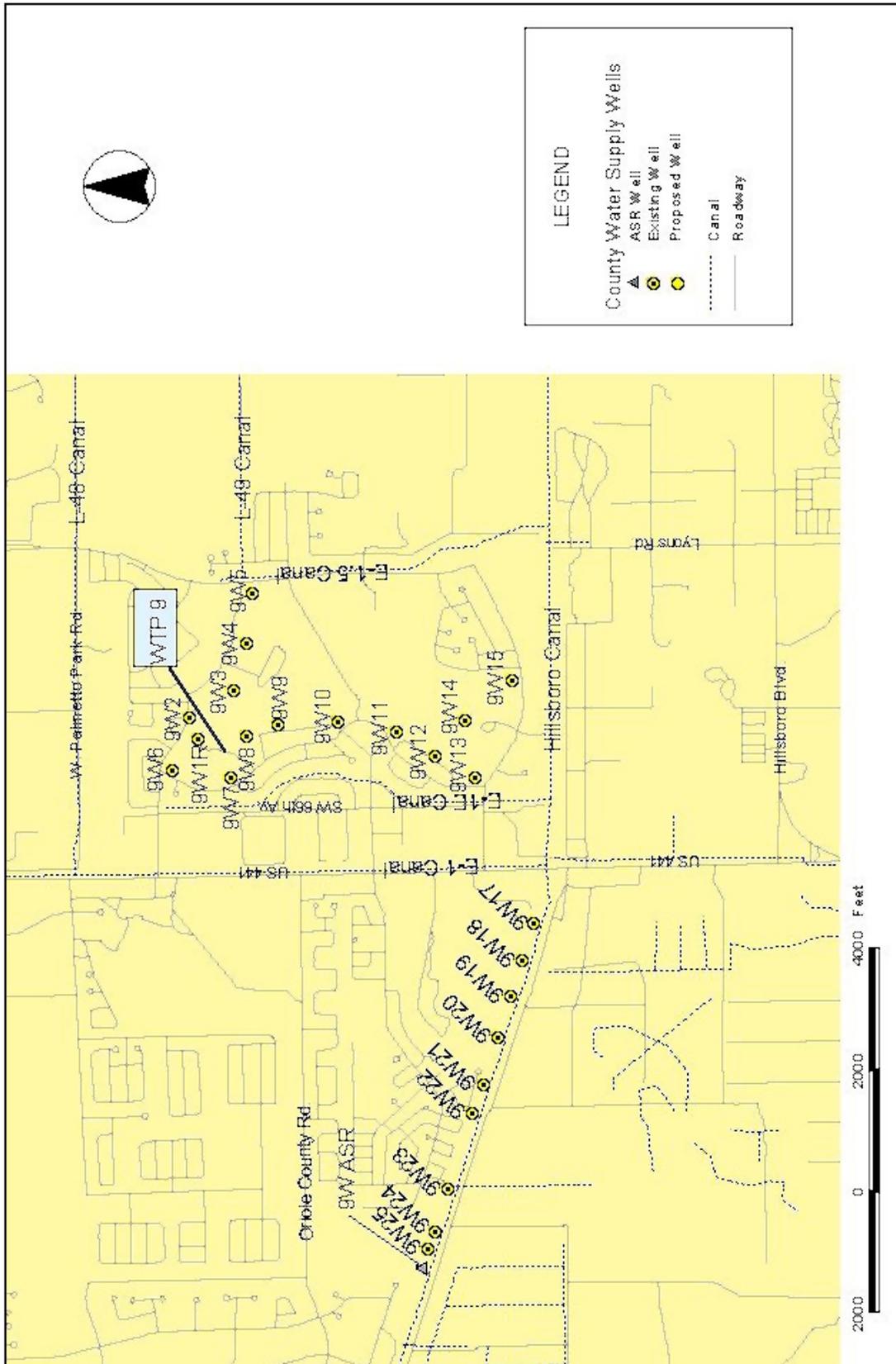


Figure 2-6  
WTP 9 Wellfield

**Table 2-6**  
**Summary of the WTP 9 Wellfield**

Well	Capacity (gpm)	Status
9W-1R	1,350	Existing
9W-2	1,000	Existing
9W-3	1,000	Existing
9W-4	1,000	Existing
9W-5	1,000	Existing
9W-6	1,000	Existing
9W-7	1,000	Existing
9W-8	1,000	Existing
9W-9	1,000	Existing
9W-10	1,000	Existing
9W-11	1,000	Existing
9W-12	1,000	Existing
9W-13	1,000	Existing
9W-14	1,000	Existing
9W-15	1,000	Existing
9W-16 was not constructed due to land use conflicts		
9W-17	1,350	Existing
9W-18	1,350	Existing
9W-19	1,350	Existing
9W-20	1,350	Existing
9W-21	1,350	Existing
9W-22	1,350	Existing
9W-23	1,350	Existing
9W-24	1,350	Existing
9W-25	1,350	Existing
<b>TOTAL in gpm</b>		<b>27,500 gpm</b>
<b>TOTAL in mgd</b>		<b>39.6 mgd</b>
<b>Capacity with two largest wells out of service</b>		<b>35.7 mgd</b>
<b>Maximum raw water required</b>		<b>32.8 mgd</b>
<b>Finished water production capacity</b>		<b>27.0 mgd</b>

<sup>a</sup> Capacity with two largest wells out of service is reported to show an acceptable level of raw water standby capacity.

**Table 2-7**  
**Summary of Existing and Proposed Well Capacity for the PBCWUD WTP Wellfield System**

WTP No.	Existing (2001)		Proposed (2002-2024)		Total through 2024	
	No. of Wells	Wellfield Capacity (mgd)	No. of Wells	Wellfield Capacity (mgd)	No. of Wells	Wellfield Capacity (mgd)
2	14	18.4	13	27.4	27	45.8
3	16	23.9	10	22.0	26	45.9
8	16	23.0	11	13.7	25 <sup>a</sup>	36.7
9	24	39.6	0	0	24	39.6
<b>Total System</b>	<b>70</b>	<b>104.9</b>	<b>34</b>	<b>62.5</b>	<b>102</b>	<b>167.4</b>

<sup>a</sup> Wells 8W-19 and 8W-20 will be abandon in 2002.

## VERIFICATION OF SUFFICIENT WATER SUPPLY

Palm Beach County has been working closely with the South Florida Water Management District (District) to satisfy conditions required to receive a 20-year water use permit. The County provided reasonable assurance that the conditions of the permit would be met throughout the duration of the 20-year permit via a water supply development plan having 5-year intervals. Impacts addressed by the County's plan included: proposed and existing withdrawal facilities, individual wellfield demands, and the resulting increase of surface water leakage from Lake Worth Drainage District canals, District canals, and L-40 Canal.

### **Water Supply Development Plan**

A copy of Palm Beach County's response to the District's Requests for Additional Information No. 3 and No. 4 are provided herein. This information provides the groundwater modeling results for the 2010, 2015, 2020, and 2025 planning horizons. The responses also include a water balance analysis, which quantifies reliance of Palm Beach County's wellfields on the regional water supply system.

The modeling used to evaluate the Palm Beach County wellfields was based on the District Type II model method. Type II models are generally regional, high-resolution, transient models that are run using 18 monthly stress periods. The first three stress periods represent average rainfall over March, April, and May. The next twelve stress periods represent 1-in-10 year rainfall conditions over the months of June through the following May as defined in the Basis of Review for Water Use Permit Applications. The final stress periods represent average conditions for the months of June, July, and August and serve mainly to verify rehydration of wetlands. The Palm Beach County models were used to evaluate water levels near Palm Beach County wellfields 2, 3, 8, and 9 for the planning horizons 2005, 2010, 2015, 2020, and 2025. Withdrawals for individual wellfields were calculated. Other legal users within the model limits were pumped at their current permitted average day allocations.

As demonstrated in Sections 3 and 4 of this RAI No. 3, a significant portion of the requested groundwater withdrawal allocations for the System 2, 3, and 9 Wellfields is derived from canal leakage. However, the majority of canal leakage is from the Lake Worth Drainage District canal network and not from the District canals. Conversely, requested groundwater withdrawal allocation through 2025 for the System 8 Wellfield is not dependent on canal leakage.

The balance of recharge to the System 2, 3 and 9 Wellfields will come from groundwater storage. Water level drawdowns in 2025 range from 1 to 4 feet. Given the proximity of these wellfields from the coast and minimal additional drawdown, withdrawal allocations are not expected to have any adverse impacts on groundwater quality. Almost all of the recharge to the System 8 Wellfield will come from groundwater storage and again due to a minimal increase in drawdown in 2025, pumping from this wellfield is not expected to have any adverse impacts to groundwater quality.

## **Alternative Water Resources**

The District also requested that Palm Beach County demonstrate that the volumes of water withdrawn during a 1 in 10 year drought condition will be offset by alternative water sources. Palm Beach County has proposed multiple alternative water supply projects that collectively will eliminate the impact of additional water withdrawals on the Regional System. Palm Beach County has proposed that all additional demands (after December 2000) on the Lake Worth Drainage District and the Regional System be offset by equal amounts of alternative water supplies. The offset mechanisms include reclaimed water, aquifer storage and recovery, and created wetlands systems, among others.

Palm Beach County's alternative water supply program completely offsets the impact of the increased allocation on the Lake Worth Drainage District canals and the Regional System. The benefits of the program under the maximum month pumping conditions are provided in **Table 7**. The affect on the regional system under average daily flow conditions is presented in **Table 8**.

**Table 7**  
**Summary of Net Impacts to the Regional Water System**  
**Due to Implementation of Alternative Water Supply Projects**  
**Under Maximum Month Pumping Conditions**

Alternative Water Supply Component	Maximum Month Average Daily Flow Contribution (mgd)				
	2005	2010	2015	2020	2025
WTP No. 2 ASR Well (Future)	0.0	0.0	0.0	0.0	4.5
WTP No. 3 ASR Well (Existing)	0.0	0.0	1.0	2.0	2.0
WTP No. 8 ASR Well (Future)	0.0	0.0	0.0	2.5	4.5
WTP No. 9 ASR Well (Hillsboro Canal) (Existing)	0.0	2.0	2.5	4.5	4.5
Winsberg Farm Wetlands (Future)	0.0	1.5	1.5	1.5	1.5
Wakodahatchee Wetlands (Existing)	0.7	0.7	0.7	0.7	0.7
Reclaimed Water <sup>1</sup>	10.4	13.0	15.6	18.2	20.8
Brackish Water Blend or Reverse Osmosis Treated	0.0	0.0	0.0	0.0	0.0
<u>Total Alternative Water Supply (mgd)</u>	11.1	17.2	21.3	29.4	38.5
Estimated Additional Demand met from the Regional System Before Alternative Water Supply Projects (mgd)	4.9	12.3	16.4	24.1	32.5
<b>Impact on Regional System Before Adjustment (mgd)</b>	+6.2	+4.9	+4.9	+5.3	+6.0
Adjustment for Reclaimed Water Lost to Evaporation (1.33 divisor)	(2.6)	(3.2)	(3.9)	(4.5)	(5.2)
<b>Net Impact on Regional System (mgd)</b>	+3.6	+1.7	+1.0	+0.8	+0.8
	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>
<sup>1</sup> Reclaimed water maximum month to average annual month peaking factor assumed to be 1.3.					

**Table 8**  
**Summary of Net Impacts to the Regional Water System**  
**Due to Implementation of Alternative Water Supply Projects**  
**Under Average Day Pumping Conditions**

Alternative Water Supply Component	Annual Average Daily Flow Contribution (mgd)				
	2005	2010	2015	2020	2025
WTP No. 2 ASR Well (Future)	0.0	0.0	0.0	0.0	0.0
WTP No. 3 ASR Well (Existing)	0.0	0.0	0.0	0.0	0.0
WTP No. 8 ASR Well (Future)	0.0	0.0	0.0	0.0	0.0
WTP No. 9 ASR Well (Hillsboro Canal) (Existing)	0.0	0.0	0.0	0.0	0.0
Winsberg Farm Wetlands (Future)	0.0	1.0	1.0	1.0	1.0
Wakodahatchee Wetlands (Existing)	0.5	0.5	0.5	0.5	0.5
Reclaimed Water	8.0	10.0	12.0	14.0	16.0
Brackish Water Blend or Reverse Osmosis Treated	0.0	0.0	0.0	0.0	0.0
<u>Total Alternative Water Supply (mgd)</u>	8.5	11.5	13.5	15.5	17.5
Estimated Additional Demand met from the Regional System Before Alternative Water Supply Projects (mgd)	0.0	0.0	0.0	0.0	4.0
<b>Impact on Regional System Before Adjustment (mgd)</b>	+8.5	+11.5	+13.5	+15.5	+13.5
Adjustment for Reclaimed Water Lost to Evaporation (1.33 divisor)	(2.0)	(2.5)	(3.0)	(3.5)	(4.0)
Additional Raw Water Demand for Recharging ASR Wells	0.0	(1.1)	(2.0)	(5.1)	(8.9)
<b>Net Impact on Regional System (mgd)</b>	+6.5	+7.9	+8.5	+6.9	+0.6
	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>	<b>Net Positive</b>