

2024 SFWMD Saltwater Interface Mapping Update Palm Beach County

Palm Beach County Water Resources Task Force Meeting
December 2, 2024



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Water Supply Bureau, Water Resources Division

SFWMD Staff Acknowledgements

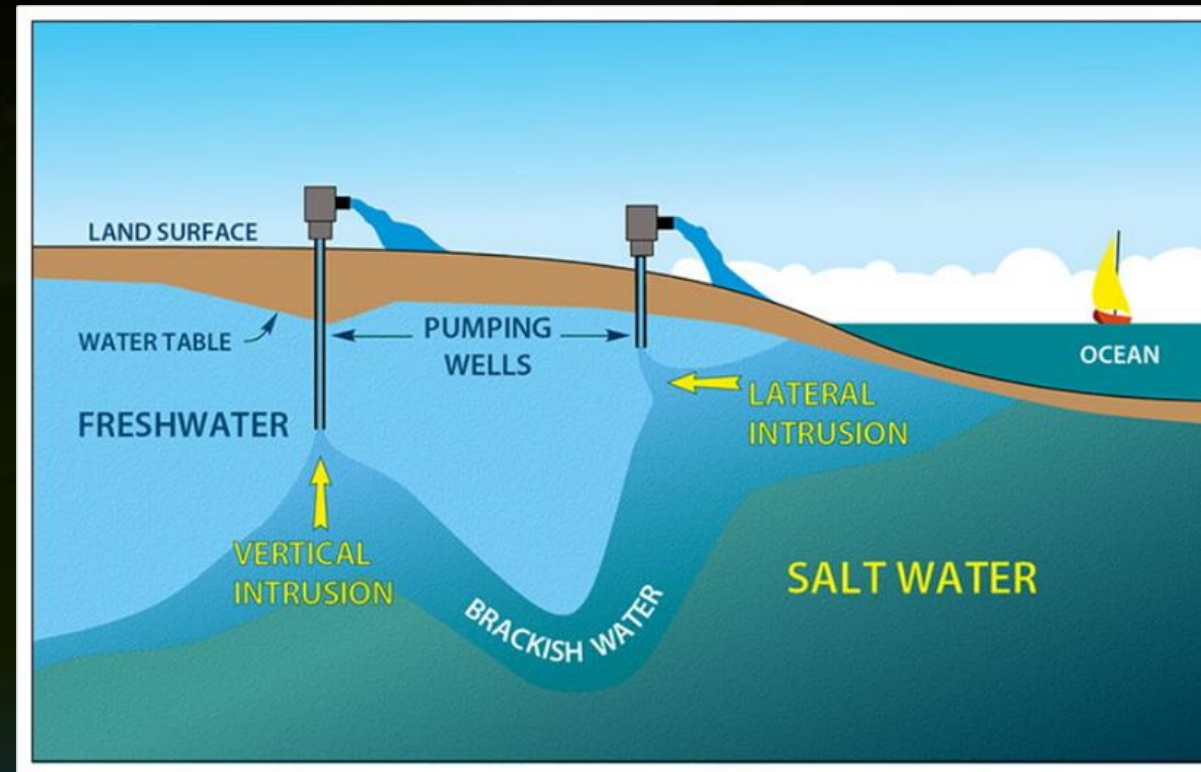
- Justin Zumbro, P.G., Lead Hydrogeologist
- Stacey Coonts, P.G., Senior Hydrogeologist
- Brian Moore, Senior Data Analyst
- Alexandra Hoffart, Geospatial Specialist
- Harshit (Sunny) Saini, P.G., Hydrogeologist 4
- Greg Cook, Hydrogeologist 2

Agenda

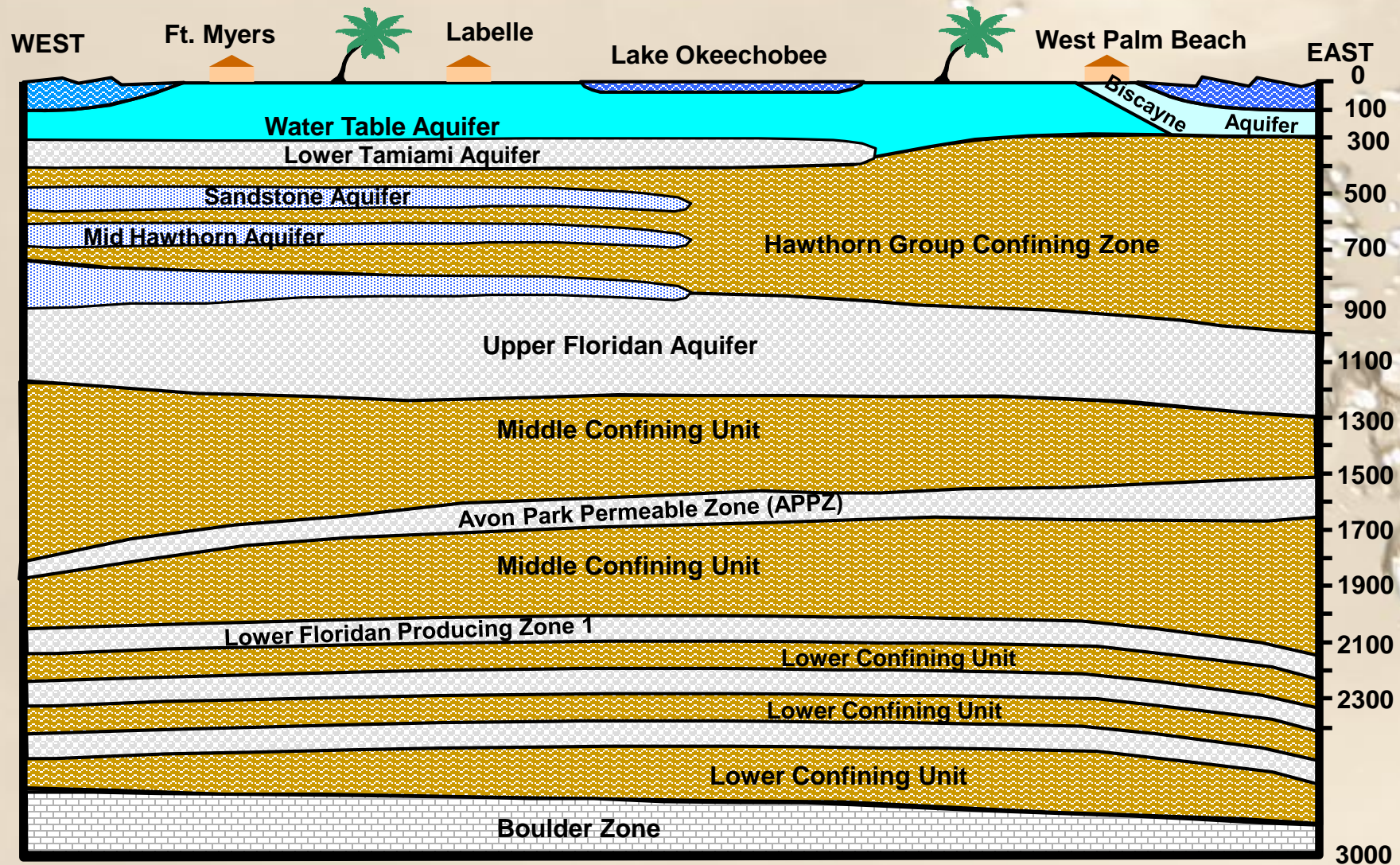
- Overview of saltwater intrusion and aquifers
- Importance to wellfields and infrastructure
- Project approach
- Results – Water Table, Lower Tamiami, Sandstone, Mid-Hawthorn, Biscayne aquifers (2009, 2014, 2019, and 2024)
- Conclusions
- Next steps

Common Sources of Saltwater Intrusion

- Lateral intrusion from the coast
- Vertical intrusion (upconing) from saltwater below
- Surface Infiltration -- estuaries, boat basins, saltwater marshes, saltwater canals, etc.
- Ancient (relict) seawater trapped in low permeability portions of aquifers



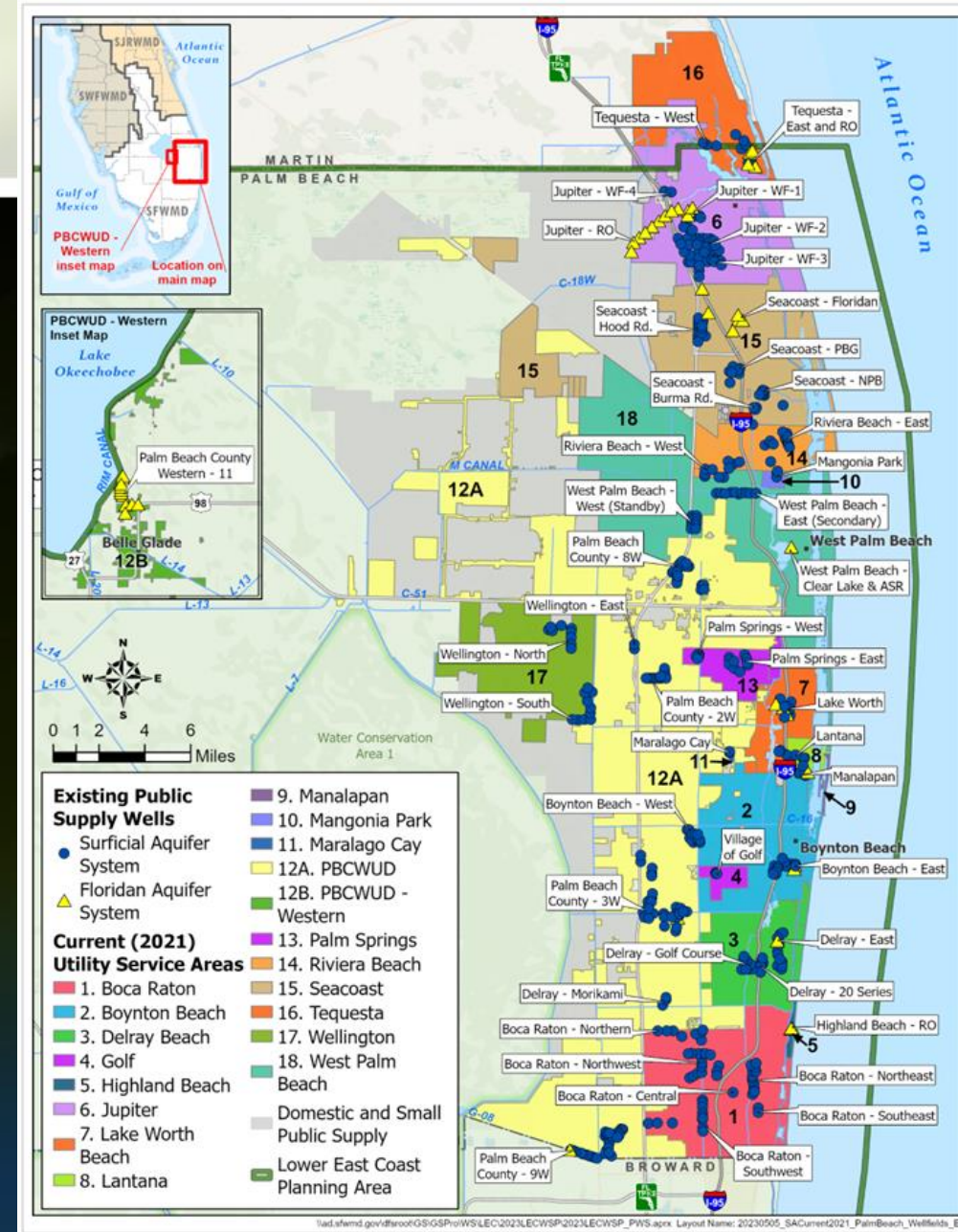
Generalized Hydrogeology of South Florida



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Why is this Important?

- Wellfields are a major water supply source – protect investment
- Once saltwater enters wells, very difficult – if not impossible -- to reverse
- Very expensive to relocate wellfields and associated infrastructure (pipelines, treatment plants and processes, etc.)
- Other sources of water more expensive to treat (e.g., Floridan aquifer – reverse osmosis)

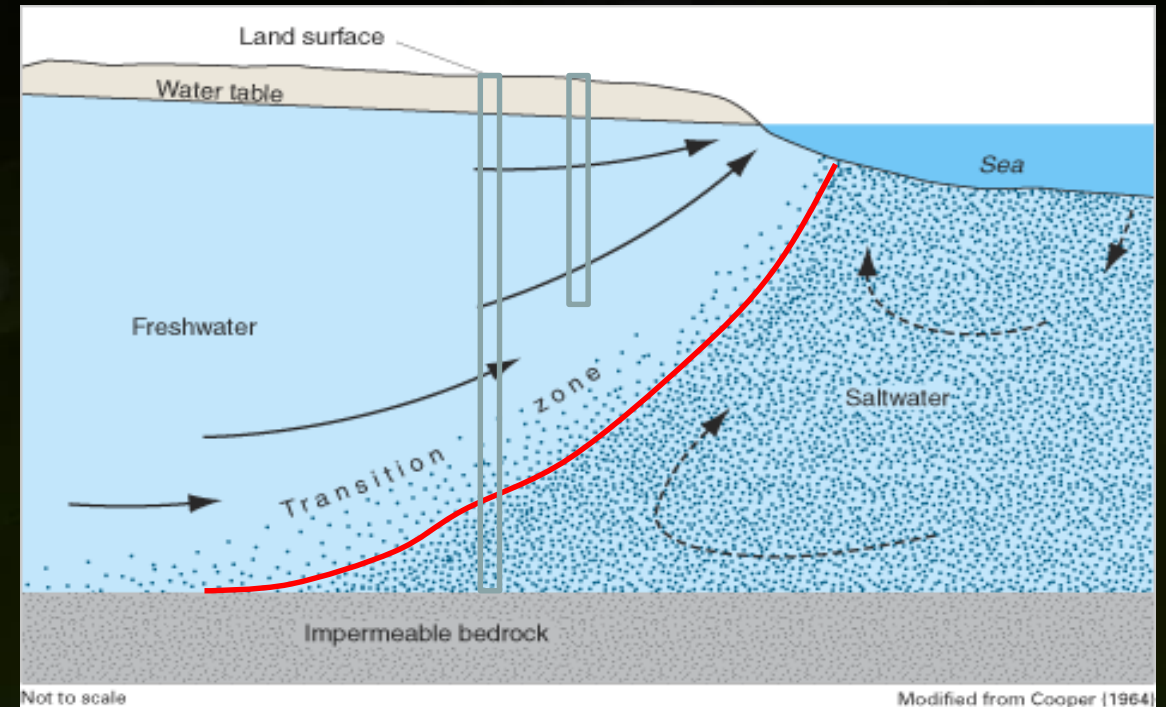


SFWMD Saltwater Interface Mapping Project

- Strategy -- Compare interface positions (i.e., 2009, 2014, 2019, 2024), note areas of concern, adjust monitoring, and adapt as necessary
- Update maps every 5 years
- Use all available data (USGS, SFWMD, Counties, Water Use Permittees)
- Furthest inland extent – dry season
- 250 milligrams per liter (mg/L) chlorides (isochlor)
- Coastal aquifers: Water Table, Lower Tamiami, Sandstone, Mid-Hawthorn, Biscayne

Mapping Challenges

- Representing a three-dimensional feature on a two-dimensional map
- Representing a dynamic interface with fixed-time snapshots
- Representing a diffuse front with a single line
- Mapping from data that may represent one of several saltwater intrusion pathways
- Some wells used in 2009 and 2014 and 2019 not available in 2024 (e.g., wells abandoned, destroyed, no longer required to be monitored, etc.)


























Data Compilation

Map ID	SFWMD Facility ID	Project Name	Well or Station Name	Facility Type	XCOORD	YCOORD	Cased Depth (feet bls)	Total Depth (feet bls)	2019 Chloride (mg/L)	2024 Chloride (mg/L)
1	115935	DEERFIELD BEACH PUBLIC WATER SUPPLY	D1-A (G2718) ID 115935	WELL	944746	725422	100	150	182	46
2	149498	DEERFIELD BEACH PUBLIC WATER SUPPLY	D11 (G2729) ID 149498	WELL	949765	725218	20	180	186	52
3	115984	DEERFIELD BEACH PUBLIC WATER SUPPLY	CW1 ID 115984	WELL	950221	724407	150	160	50	68
4	115976	DEERFIELD BEACH PUBLIC WATER SUPPLY	D12 (G2730) ID 115976	WELL	951147	724120	20	180	4,759	3,030
5	115985	DEERFIELD BEACH PUBLIC WATER SUPPLY	CWD ID 115985	WELL	950198	724065	190	200	2,250	2,750
6	115978	DEERFIELD BEACH PUBLIC WATER SUPPLY	D13 (G2731) ID 115978	WELL	950594	723439	20	170	602	315
7	149548	DEERFIELD BEACH PUBLIC WATER SUPPLY	D10 (2728) ID 149548	WELL	948052	722957	20	180	237	40
8	115943	DEERFIELD BEACH PUBLIC WATER SUPPLY	D7 (G2725) ID 115943	WELL	949933	722800	60	170	181	42
9	115979	DEERFIELD BEACH PUBLIC WATER SUPPLY	D14-A (G2733) ID 115979	WELL	951596	722753	100	150	181	46
10	115936	DEERFIELD BEACH PUBLIC WATER SUPPLY	D2-A (G2719) ID 115936	WELL	944329	722439	100	150	128	21
11	115982	DEERFIELD BEACH PUBLIC WATER SUPPLY	D17 (G2737) ID 115982	WELL	949053	722435	100	150	225	61
12	115980	DEERFIELD BEACH PUBLIC WATER SUPPLY	D15-A (G2735) ID 115980	WELL	951110	720940	100	150	234	52
13	115983	DEERFIELD BEACH PUBLIC WATER SUPPLY	DR-1 (G2738) ID 115983	WELL	942847	720664	170	170	110	48
14	115981	DEERFIELD BEACH PUBLIC WATER SUPPLY	D16 (G2736) ID 115981	WELL	952549	719549	10	260	245	83
15	6428	NORTH SPRINGS IMPROVEMENT DISTRICT	4 ID 6428	WELL	906867	718939	80	130	55	74
16	115942	DEERFIELD BEACH PUBLIC WATER SUPPLY	D6 (G2724) ID 115942	WELL	952492	717676	60	180	207	45
17	6431	NORTH SPRINGS IMPROVEMENT DISTRICT	9 ID 6431	WELL	902493	717446	80	130	60	76
18	6424	NORTH SPRINGS IMPROVEMENT DISTRICT	6 ID 6424	WELL	906227	716828	80	130	53	68
19	115973	DEERFIELD BEACH PUBLIC WATER SUPPLY	D9 (G2727) ID 115973	WELL	948468	715524	80	180	181	41
20	6425	NORTH SPRINGS IMPROVEMENT DISTRICT	7 ID 6425	WELL	906186	714820	80	130	55	74
21	136498	BROWARD COUNTY 2A/NORTH REGIONAL P W S	G-2893 ID 136498	WELL	953145	713873	167	177	1,130	2,240
22	6423	NORTH SPRINGS IMPROVEMENT DISTRICT	2A ID 6423	WELL	900319	713297	80	130	54	70
23	136493	BROWARD COUNTY 2A/NORTH REGIONAL P W S	G-2694 ID 136493	WELL	952025	712690	85	125	21	23
24	136492	BROWARD COUNTY 2A/NORTH REGIONAL P W S	G-2693 ID 136492	WELL	952000	712686	200	229	40	35
25*	261643080055901	USGS	G-2752	WELL	951331	708018	250	255	21	22
26	136873	TOWN OF HILLSBORO BEACH	HBB5W1(39th Street) ID 136873	WELL	951253	707989		257	58	62
27	136872	TOWN OF HILLSBORO BEACH	HBBMP1 (plant 110) ID 136872	WELL	947573	707104	110	110	52	57
28	136306	CITY OF POMPANO BEACH	SW14-D ID 136306	WELL	949589	700570		200	361	221
29	136307	CITY OF POMPANO BEACH	SW14-S ID 136307	WELL	949589	700570		120	374	222
30	136193	CITY OF POMPANO BEACH	SW11-D ID 136193	WELL	947553	698253		200	371	158
31	136299	CITY OF POMPANO BEACH	SW11-S ID 136299	WELL	947553	698253		120	371	156
32	261446080062801	USGS	G-2445	WELL	948655	696461	117	132	191	189
33	136326	CITY OF POMPANO BEACH	SW16-D ID 136326	WELL	947869	695023		200	397	231
34	136327	CITY OF POMPANO BEACH	SW16-S ID 136327	WELL	947869	695023		120	108	124
35	136308	CITY OF POMPANO BEACH	SW15-D ID 136308	WELL	946184	694742		200	154	62
36	136325	CITY OF POMPANO BEACH	SW15-S ID 136325	WELL	946184	694742		120	125	53
37	136304	CITY OF POMPANO BEACH	SW13-D ID 136304	WELL	950151	694391		180	8,820	8,328
38	136305	CITY OF POMPANO BEACH	SW13-S ID 136305	WELL	950151	694391		120	1,650	878
39	136302	CITY OF POMPANO BEACH	SW12-D ID 136302	WELL	946184	693443		180	168	105
40	136303	CITY OF POMPANO BEACH	SW12-S ID 136303	WELL	946184	693443		120	152	99
41	261403080070801	USGS	G-2149	WELL	945005	691852	135	137	38	32
42	136319	CITY OF POMPANO BEACH	PRW1 (Palm-Alire w wfl ID 136319	WELL	928857	690769		178		86
43		SFWMD	85-3	WELL	922104	619918	280	310		19
44	136301	CITY OF POMPANO BEACH	SW110-S ID 136301	WELL	950207	688843		130	174	181
45	136332	CITY OF POMPANO BEACH	SW19-D ID 136332	WELL	949904	688166		140	391	197
46	136333	CITY OF POMPANO BEACH	SW19-S ID 136333	WELL	949913	688160		130	381	202
47	261304080072501	USGS	G-2896	WELL	943527	685989	91	137	3,100	3,009
48	282737	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW2A ID 282737	WELL	931727	680983	5	200	125	133
49	212914	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW9 ID 212914	WELL	938540	676652	5	200	4,970	4,400
50*	261122080083401	USGS	G-1232	WELL	935983	675497	203	205	30	34
51	212899	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW1 ID 212899	WELL	928026	675330	5	200	119	108
52*	261100080140401	USGS	G-1212	WELL	934631	673297	221	223	63	66
53	136868	CORAL RIDGE COUNTRY CLUB	CRCCMW1 ID 136868	WELL	948594	671037	5	85	1,010	1,590
54	136869	CORAL RIDGE COUNTRY CLUB	CRCCMW2 ID 136869	WELL	946082	671022	5	95	46	2,660
55	261030080083301	USGS	G-2897	WELL	937399	670419	126	136	5,400	5,662
56	286493	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW-88 ID 286493	WELL	930752	663547	5	270	1,120	1,210
57*	260920080092201	USGS	G-2898	WELL	933021	663290	110	160	2,200	1,910
58	260804080092701	USGS	G-2899	WELL	931660	655578	115	165	1,020	1,622
59	282733	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW3A ID 282733	WELL	923133	650933	5	200	174	162
60	144160	FORT LAUDERDALE PUBLIC WATER SUPPLY	31-Dixie ID 144160	WELL	915290	650002	90	120		27
61	144152	FORT LAUDERDALE PUBLIC WATER SUPPLY	27-Dixie ID 144152	WELL	912952	647874	90	120		51
62	286505	FORT LAUDERDALE PUBLIC WATER SUPPLY	MW-100 ID 286505	WELL	915603	647064	5	280		2,660

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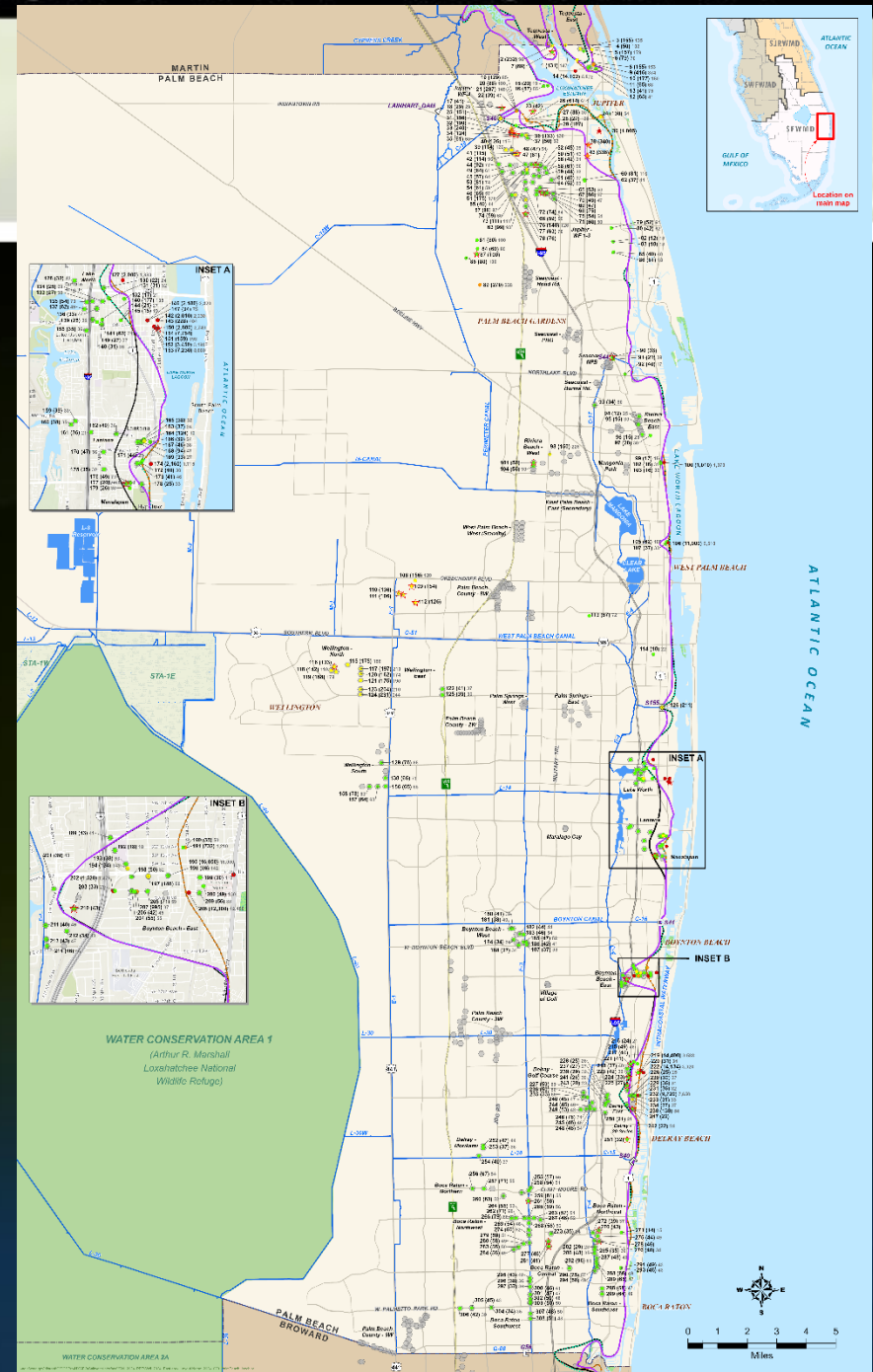
Legend

Structures	Chloride Sample Locations	Saltwater Interface: Estimated 250 mg/L Isochlor
 Culvert	 Well  New wells for 2024	 2024
 Lock	 Surface Water Station	 2024, location uncertain
 Pump	Chloride Concentration	 2019
 Spillway	 ≤ 100 mg/L	 2014
 Weir	 101 - 250 mg/L	 2009
Public Supply Wellfields	 251 - 1,000 mg/L	 Freshwater Bodies
	 > 1,000 mg/L	 Saline Water Bodies
Roads	Chloride Labels	 Mangrove and Saltwater Marshes
	 1 (135) 128 Map ID 2024 Chloride 2019 Chloride	

Palm Beach County

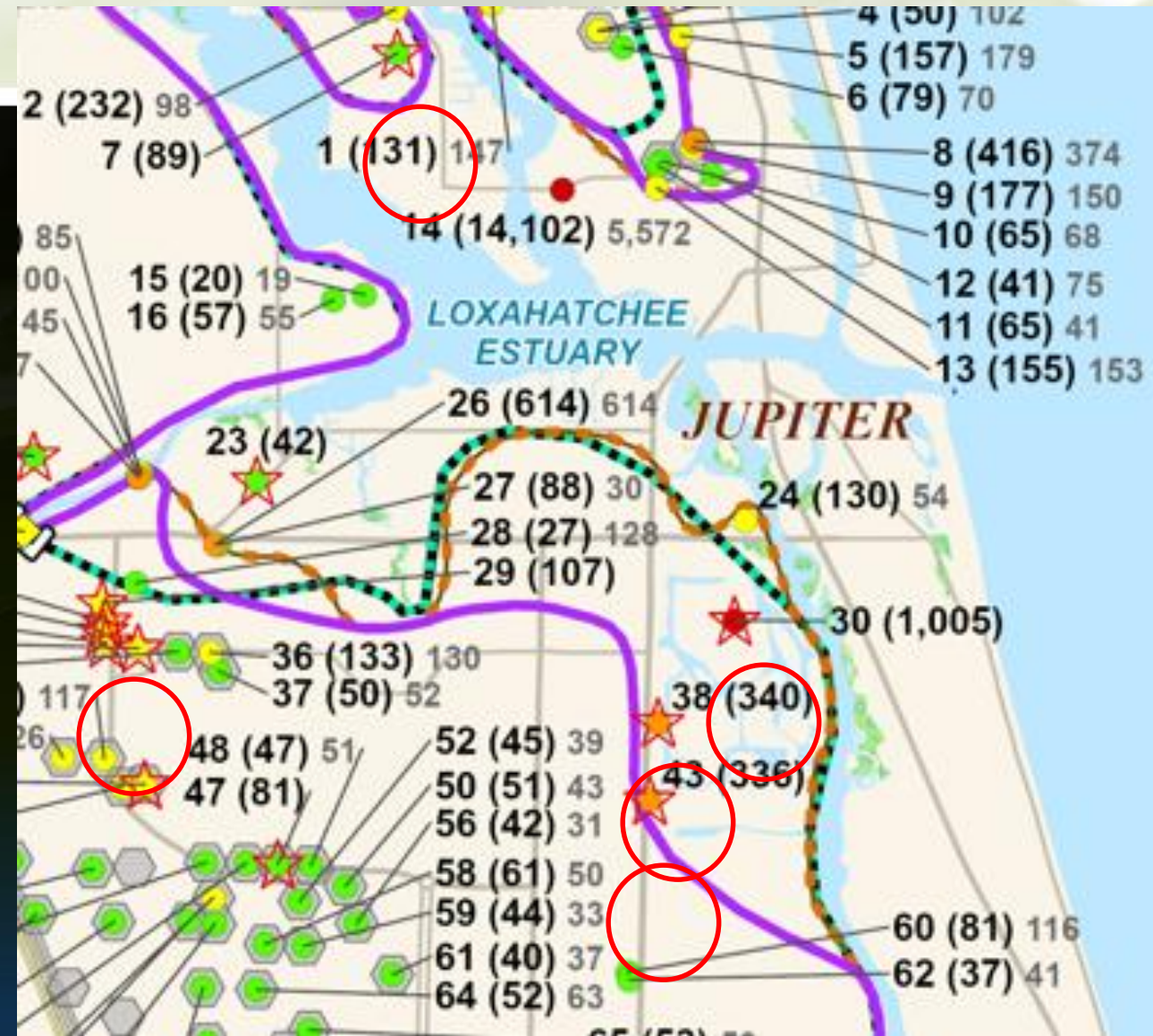
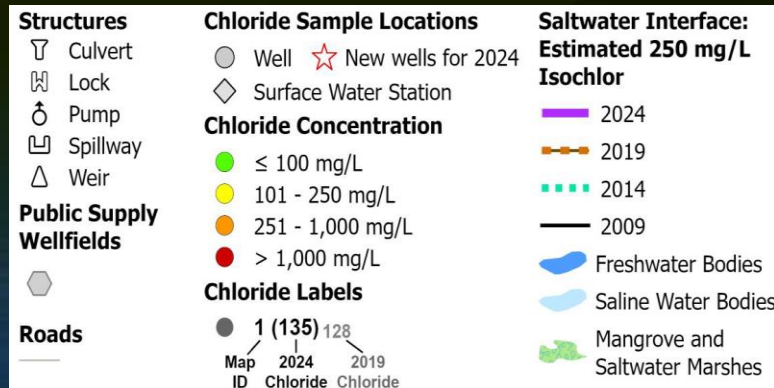
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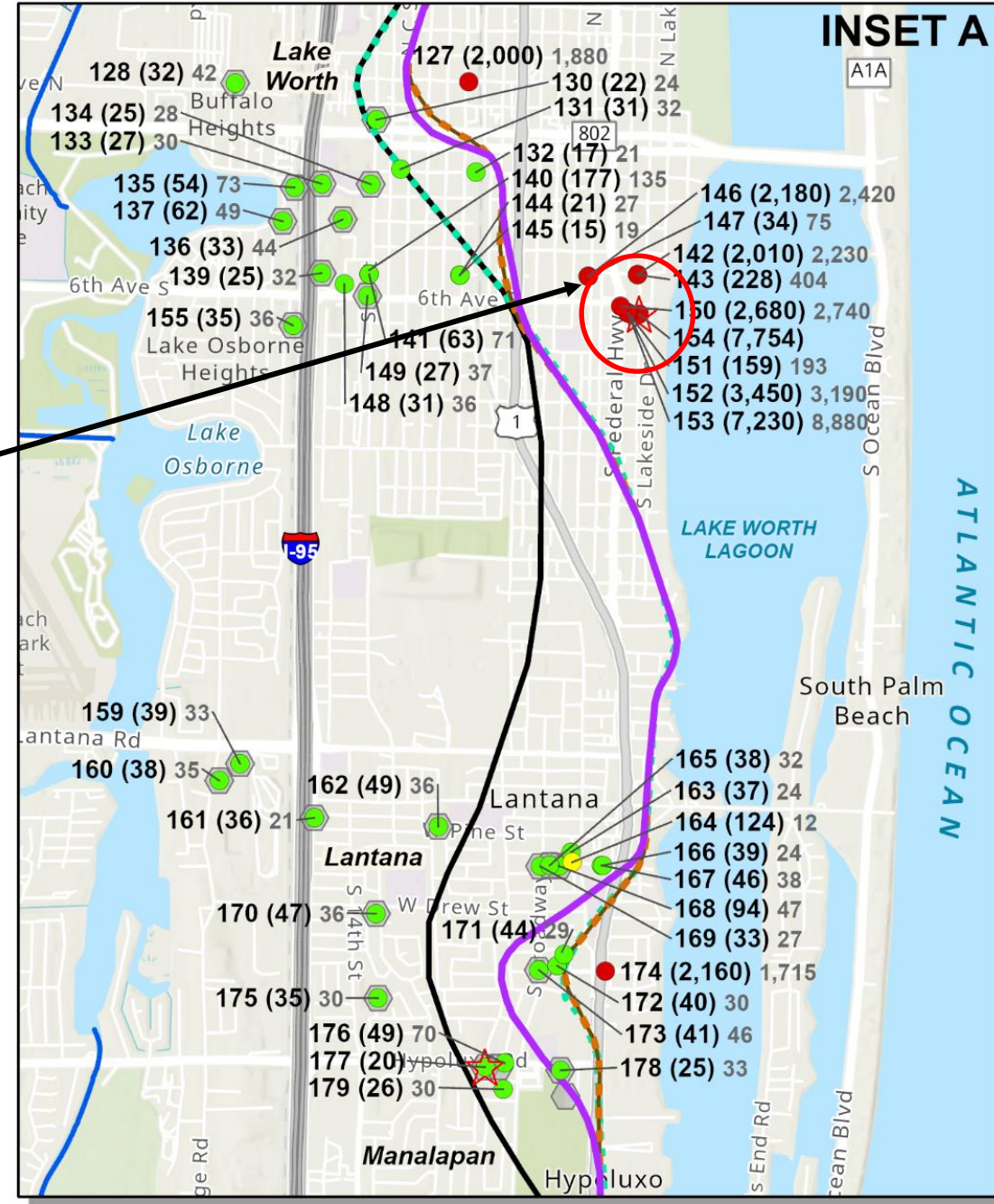
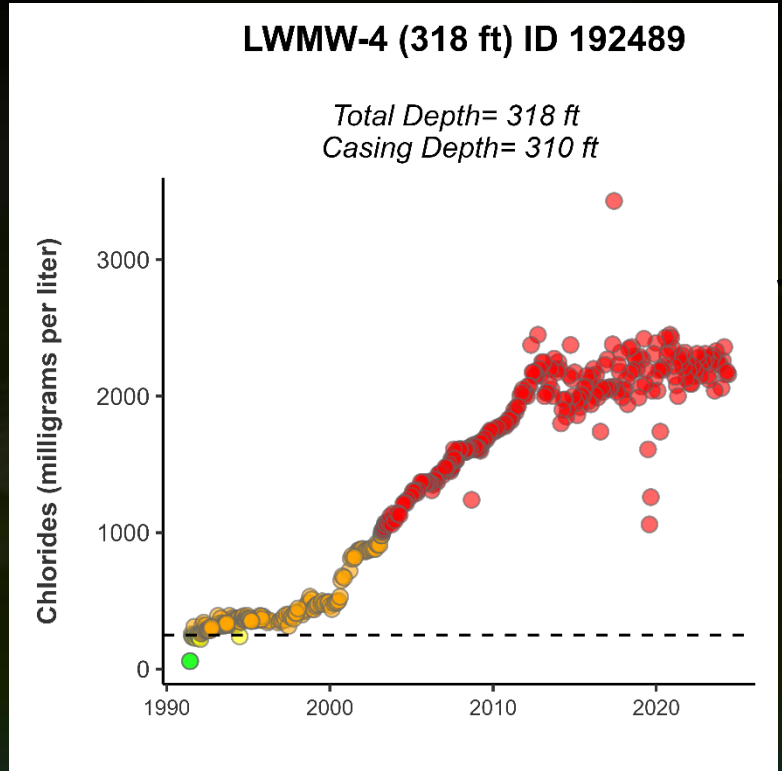
Jupiter

- New wells (red circles) better delineate interface (not necessarily interface movement)



Lake Worth Beach/Lantana

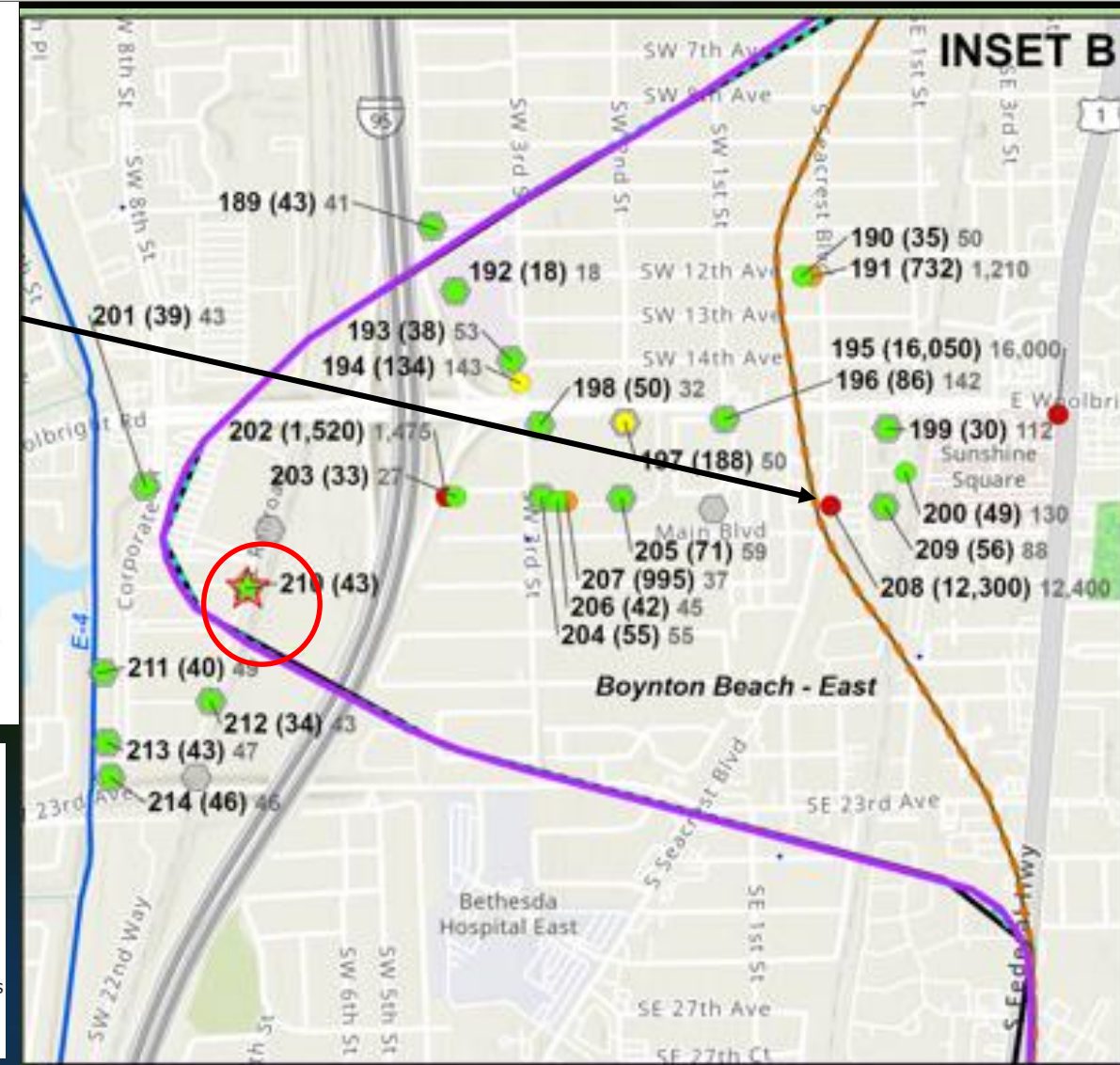
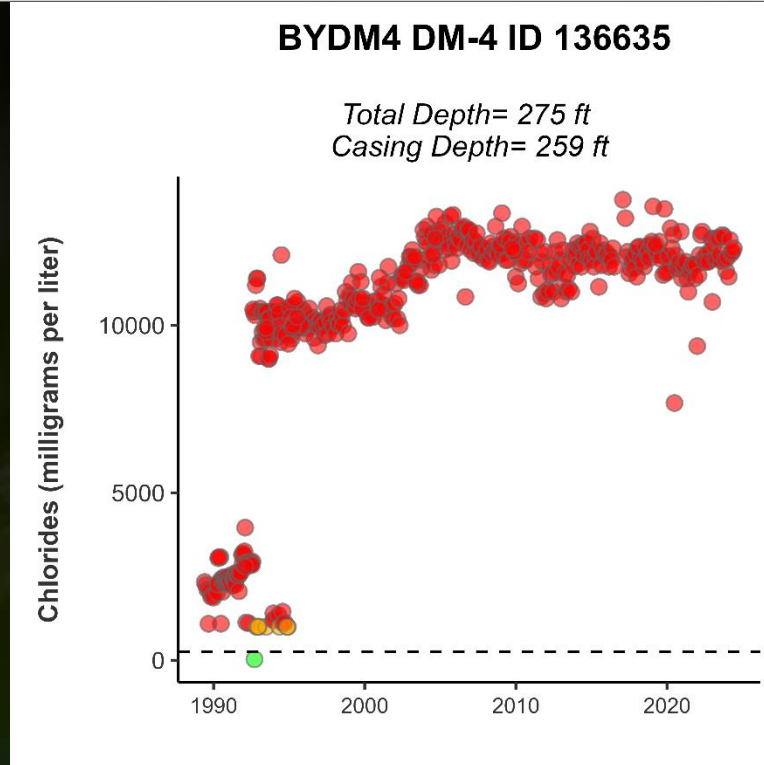
- Slight movement in Lake Worth Beach area
- Some inland movement in Lantana



Structures	Chloride Sample Locations	Saltwater Interface: Estimated 250 mg/L Isochlor
Culvert	Well New wells for 2024	2024
Lock	Surface Water Station	2019
Pump	Chloride Concentration	2014
Spillway	≤ 100 mg/L	2009
Weir	101 - 250 mg/L	Freshwater Bodies
Public Supply Wellfields	251 - 1,000 mg/L	Saline Water Bodies
Wellfield	> 1,000 mg/L	Mangrove and Saltwater Marshes
Roads	Chloride Labels	
Road	1 (135) 128	

Boynton Beach

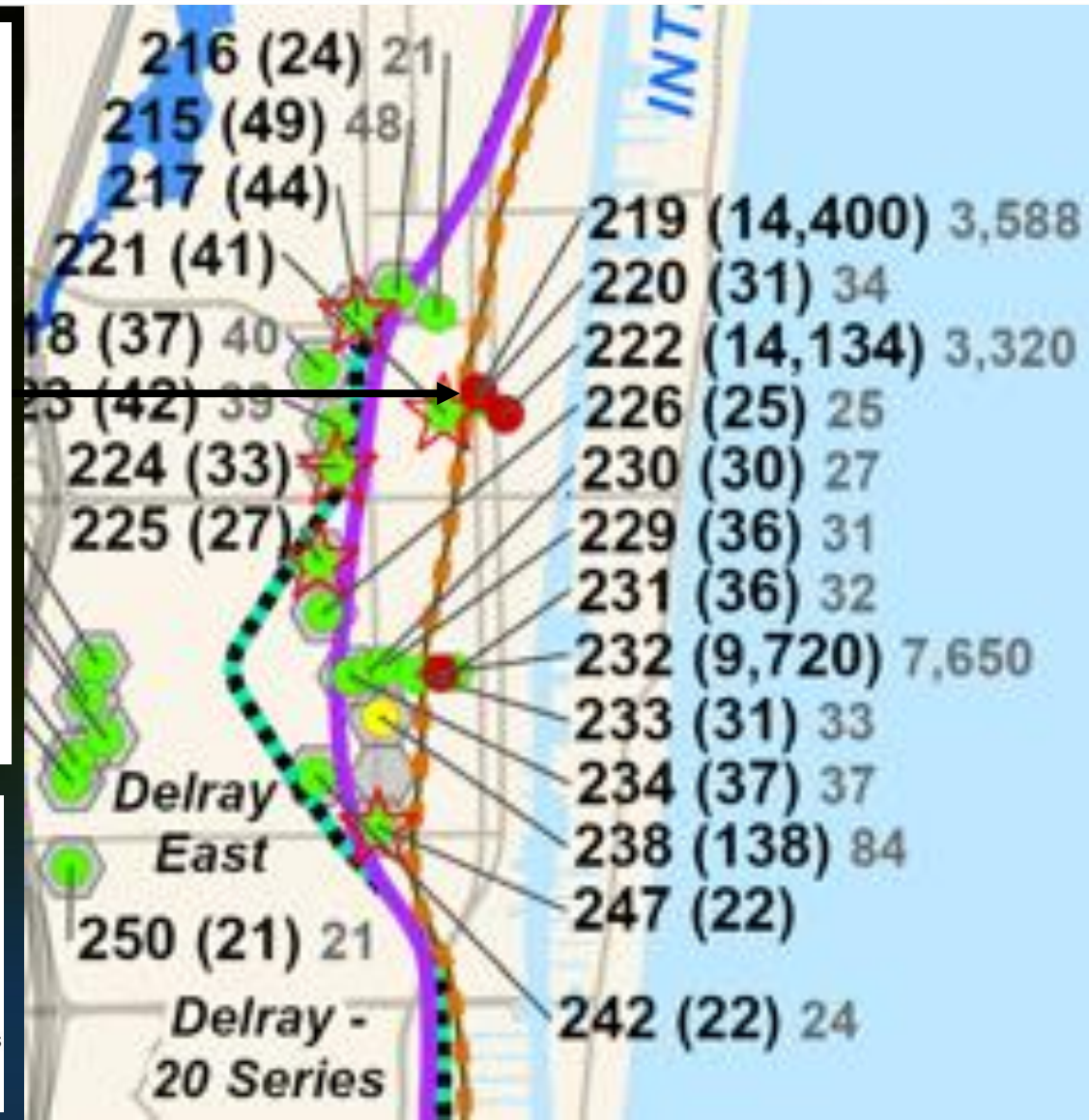
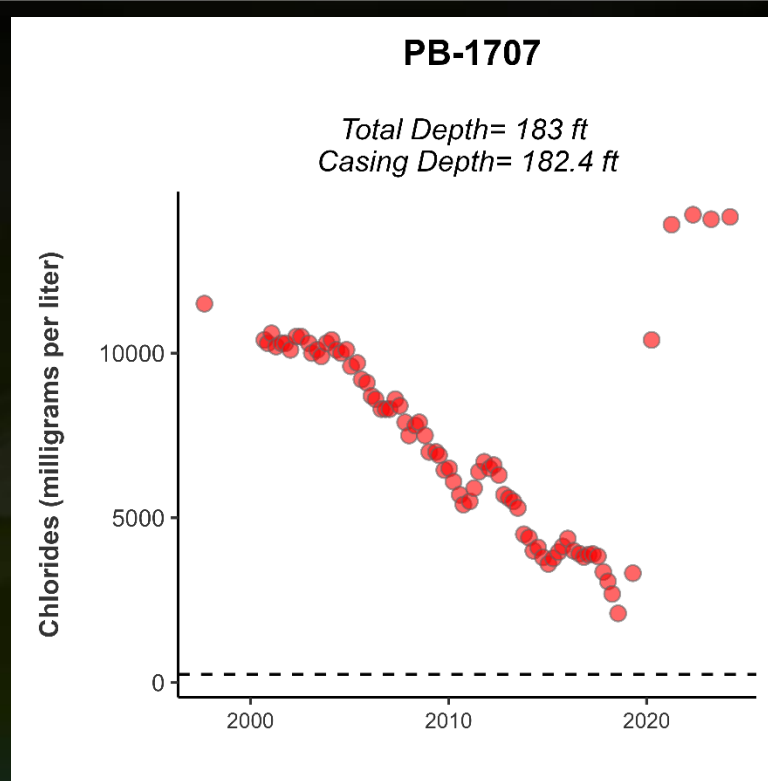
- Interface relatively stable
- Interface position updated to correctly emphasize data from deeper zones where saltwater is present



<p>Structures</p> <ul style="list-style-type: none"> ∩ Culvert ⊠ Lock ⊕ Pump ⊔ Spillway △ Weir <p>Public Supply Wellfields</p> <ul style="list-style-type: none"> ⬡ <p>Roads</p> <ul style="list-style-type: none"> — 	<p>Chloride Sample Locations</p> <ul style="list-style-type: none"> ○ Well ☆ New wells for 2024 ◇ Surface Water Station <p>Chloride Concentration</p> <ul style="list-style-type: none"> ● ≤ 100 mg/L ● 101 - 250 mg/L ● 251 - 1,000 mg/L ● > 1,000 mg/L <p>Chloride Labels</p> <ul style="list-style-type: none"> ● 1 (135) 128 <p>Map ID Chloride 2024 2019 Chloride</p>	<p>Saltwater Interface: Estimated 250 mg/L Isochlor</p> <ul style="list-style-type: none"> — 2024 — 2019 — 2014 — 2009 <p>Freshwater Bodies</p> <p>Saline Water Bodies</p> <p>Mangrove and Saltwater Marshes</p>
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Delray Beach

- Inland movement since 2019
- Sharp increase at Well PB-1707 and now stable



Structures	Chloride Sample Locations	Saltwater Interface: Estimated 250 mg/L Isochlor
<ul style="list-style-type: none"> ⌵ Culvert ⌘ Lock ⊕ Pump ⌘ Spillway △ Weir 	<ul style="list-style-type: none"> ● Well ★ New wells for 2024 ◇ Surface Water Station 	<ul style="list-style-type: none"> — 2024 — 2019 — 2014 — 2009
Public Supply Wellfields	Chloride Concentration	<ul style="list-style-type: none"> — Freshwater Bodies — Saline Water Bodies — Mangrove and Saltwater Marshes
<ul style="list-style-type: none"> ⬡ 	<ul style="list-style-type: none"> ● ≤ 100 mg/L ● 101 - 250 mg/L ● 251 - 1,000 mg/L ● > 1,000 mg/L 	
Roads	Chloride Labels	
—	<ul style="list-style-type: none"> ● 1 (135) 128 Map ID 2024 2019 Chloride Chloride 	

Conclusions

- Saltwater interface has noticeably moved inland in Delray Beach, with some inland movement in Lantana, and better delineation in Jupiter and Boynton Beach
- Saltwater interface has advanced or retreated depending on location, proximity to saltwater, wellfield pumpage, reclaimed water use, etc.
- Saltwater intrusion is occurring, emphasizing the importance of continued monitoring (laterally and vertically) and wellfield management
- New SFWMD monitor well to be installed in West Palm Beach in December 2024, which will improve our interpretation of the saltwater interface position
- Additional, localized monitoring may be required at select wellfields by permittees to protect water supplies
- Ongoing monitoring is important to evaluate the effects of future sea-level rise

Conclusions (continued)

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Next Steps

- Work with local governments, permittees, and others to:
 - Identify other existing wells to increase mapping accuracy for future maps
 - Identify funding to facilitate well replacement as needed
 - Evaluate need and identify funding for new wells (critical data gaps or areas of concern)

Questions and Discussion

Thank You

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2009, 2014, 2019 & 2024 maps available:
<https://www.sfwmd.gov/documents-by-tag/saltwaterinterface>