

# Five-Year Saltwater Intrusion Mapping Update

Palm Beach County  
Water Resources Task Force

January 30, 2020

Jonathan E. Shaw, PG  
Principal Hydrogeologist  
Water Supply Bureau, Water Resources Division

# Agenda

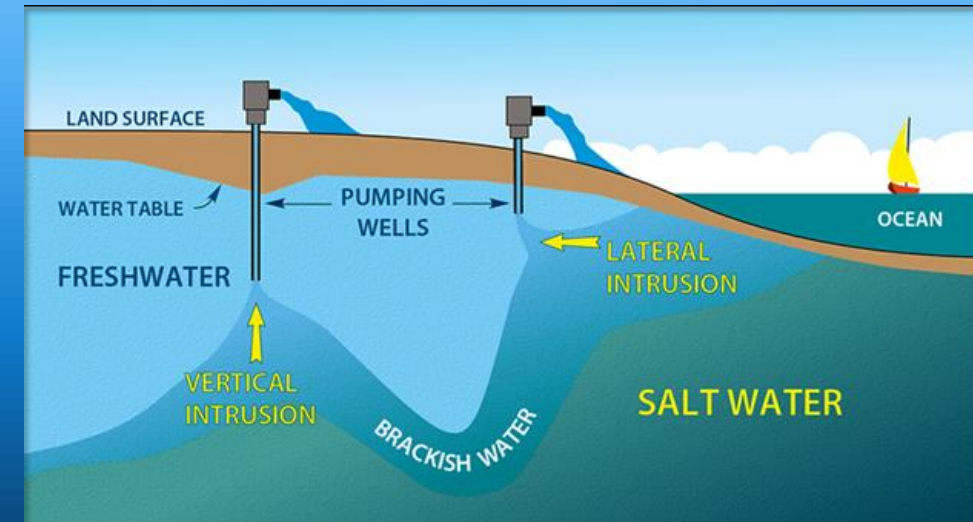
- Overview of Saltwater Intrusion and Aquifers
- Importance to Wellfields and Infrastructure
- Project Approach
- Results – Surficial Aquifer System – Palm Beach County
- Conclusions
- Next Steps

# SFWMD Staff Acknowledgements

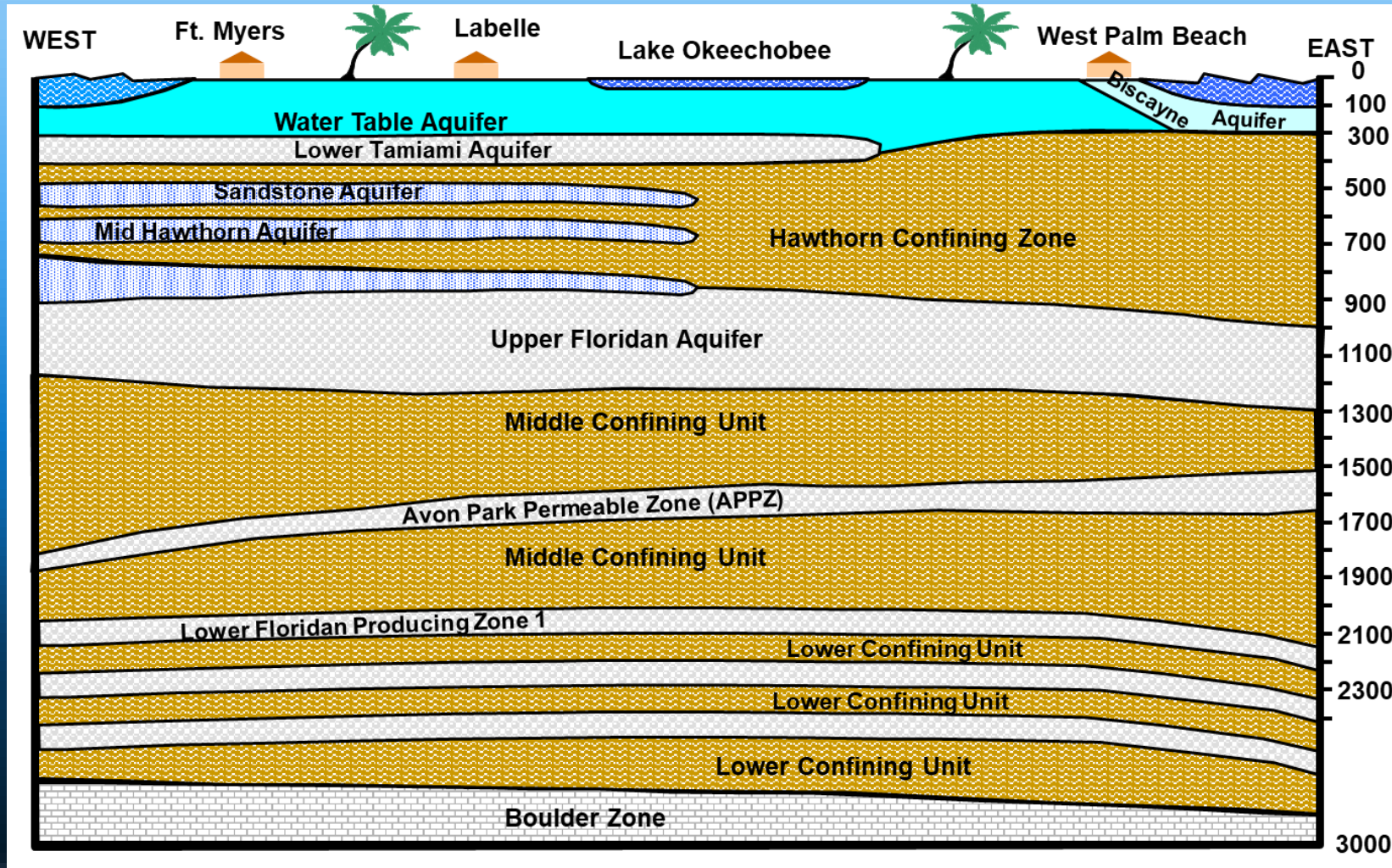
- Manual “Felipe” Zamorano, Senior Scientist
- Alexandra “Lexi” Hoffart, Geographer

# 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 (relic) seawater trapped in low permeability aquifers

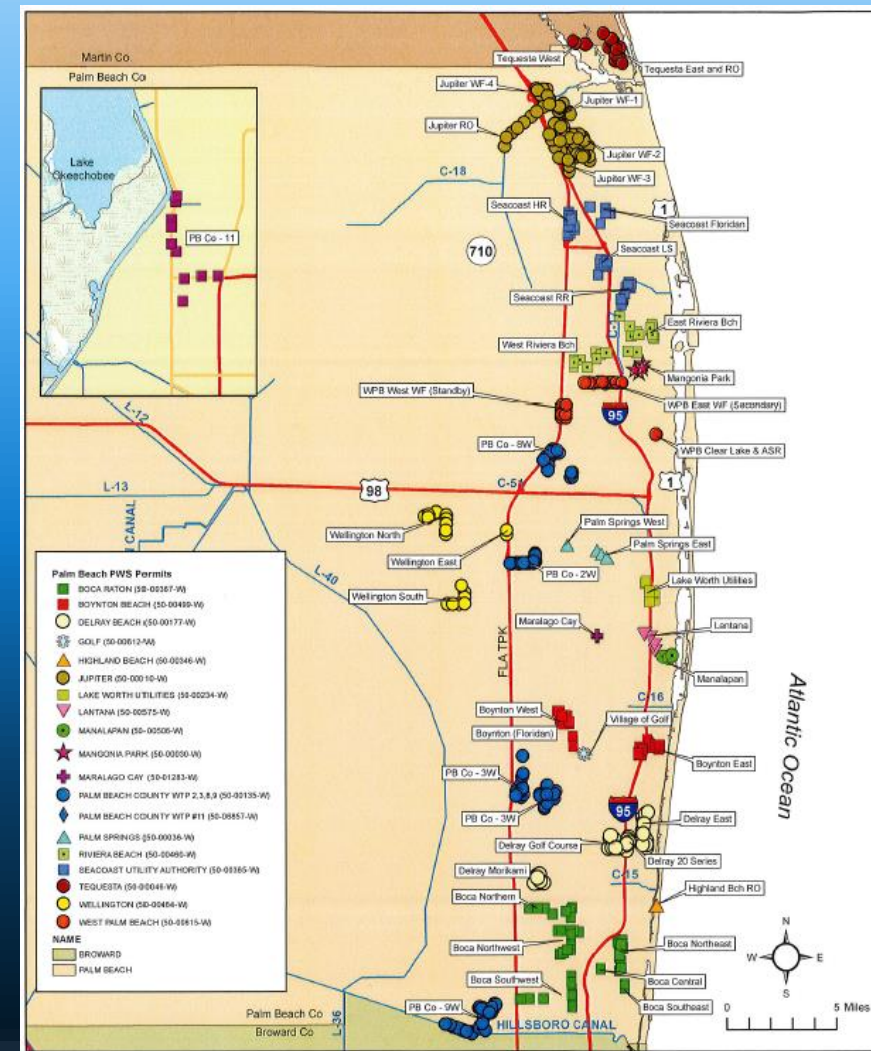


# Generalized Hydrogeology of South Florida



# 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)

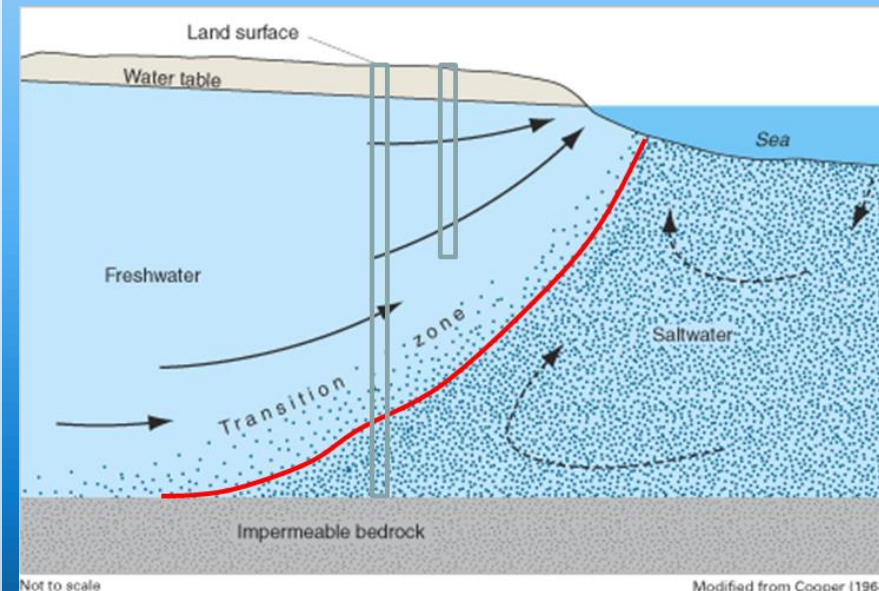


# SFWMD Saltwater Interface Mapping Project

- Strategy -- Compare interface positions (i.e., 2009, 2014, 2019), note areas of concern, and adjust monitoring as necessary
- Update Maps Every 5 Years
- Use all available data (USGS, SFWMD, Counties, Water Use Permittees)
- Furthest Inland Extent – Dry Season
- Maximum chloride value March/April/May 2019 (with some exceptions)
- 250 milligrams per liter (mg/L) chlorides – Drinking water standard
- Coastal aquifers: Water Table (Biscayne aquifer), Lower Tamiami, Sandstone, Mid-Hawthorn

# Mapping Challenges

- Representing a 3-D feature on a 2-D 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 may not be available in 2019 (abandoned, destroyed, no longer monitored, etc.)
- New wells added to 2019 may alter interpretation of isochlor line.
- Existing monitor well spacing, well depth, construction





# Other Considerations

- Standardized well construction (i.e. short screen vs long)
- Open interval position – base of aquifer
- Standardized sampling techniques
- Standardized parameters (chloride vs conductivity)
- Sampling frequency
- Analytical methodology (field and laboratory)

# Saltwater Intrusion Mapping

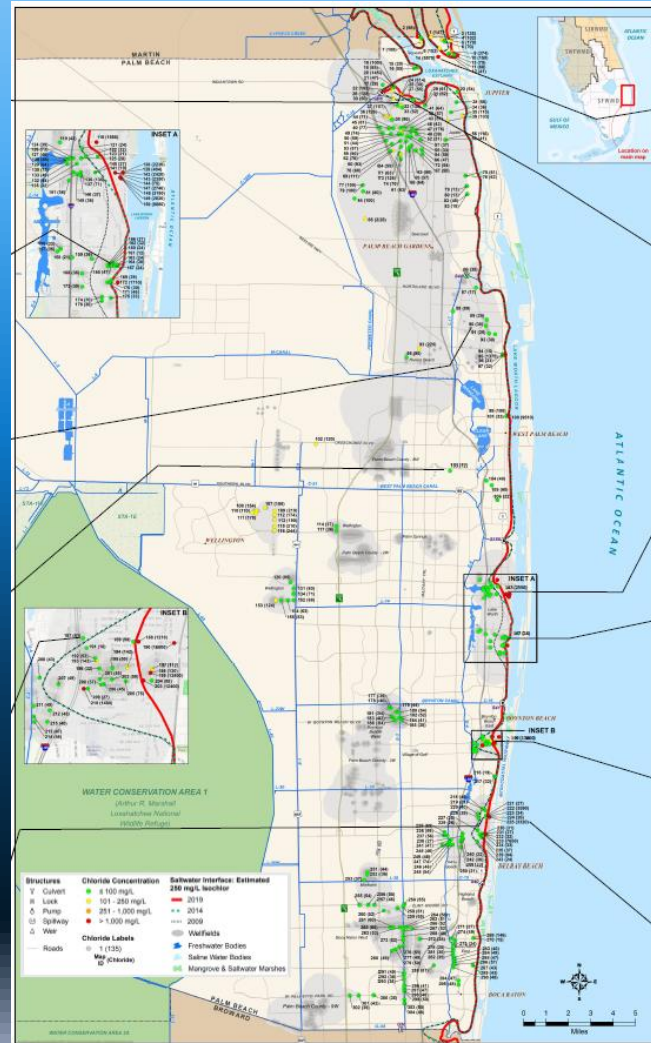
COUNTY	Aquifer	2009	2014	2019
Martin & St. Lucie	SAS	X	X	X
Palm Beach	SAS	X	X	X
Broward	SAS	X	X	X
Lee	WTA	X	X	X
Lee	MHA	X	X	-
Lee & Collier	SSA	X	X	X
Lee & Collier	LTA	X	X	X
Collier	WTA	X	X	X
Collier	MHA	X	X	-
Lee & Collier	MHA			X

## Notes:



















Miami-Dade County mapping performed by USGS

SAS	Surficial Aquifer System
WTA	Water Table Aquifer
MHA	Mid-Hawthorn Aquifer
SSA	Sandstone Aquifer
LTA	Lower Tamiami Aquifer

**Palm Beach County  
Estimated Position of the Saltwater Interface  
Surficial Aquifer System  
March/April/May 2019**



# Legend

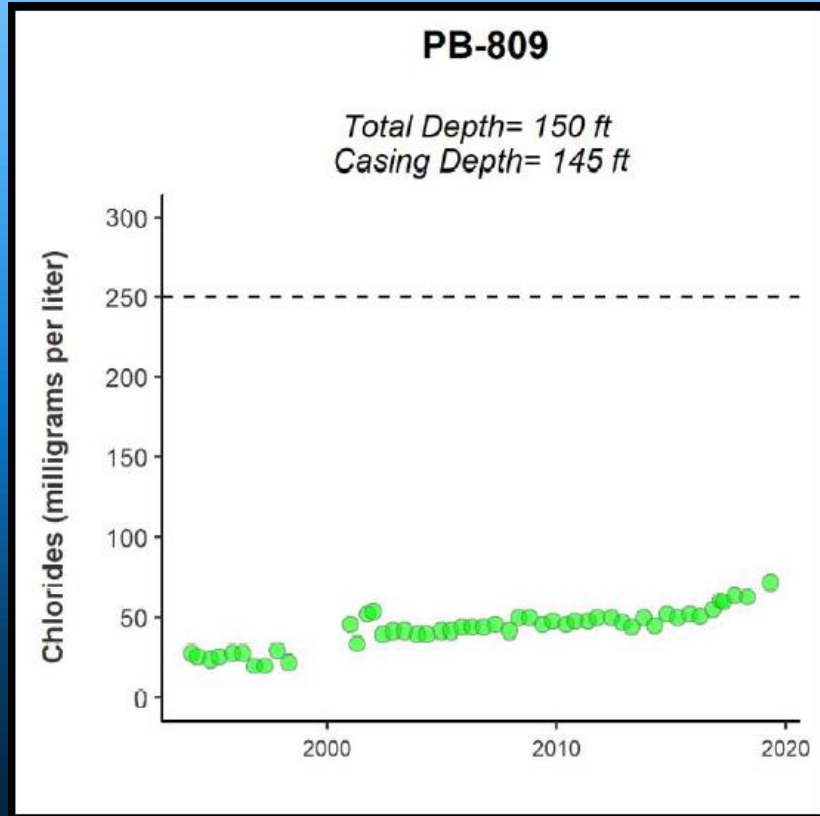
Structures	Chloride Concentration	Saltwater Interface: Estimated 250 mg/L Isochlor
 Culvert	 ≤ 100 mg/L	 2019
 Lock	 101 - 250 mg/L	 2014
 Pump	 251 - 1,000 mg/L	 2009
 Spillway	 > 1,000 mg/L	 Wellfields
 Weir		 Freshwater Bodies
 Roads	<p><b>Chloride Labels</b></p>  1 (135) Map ID (Chloride)	 Saline Water Bodies
		 Mangrove & Saltwater Marshes

# SOUTH FLORIDA WATER MANAGEMENT DISTRICT

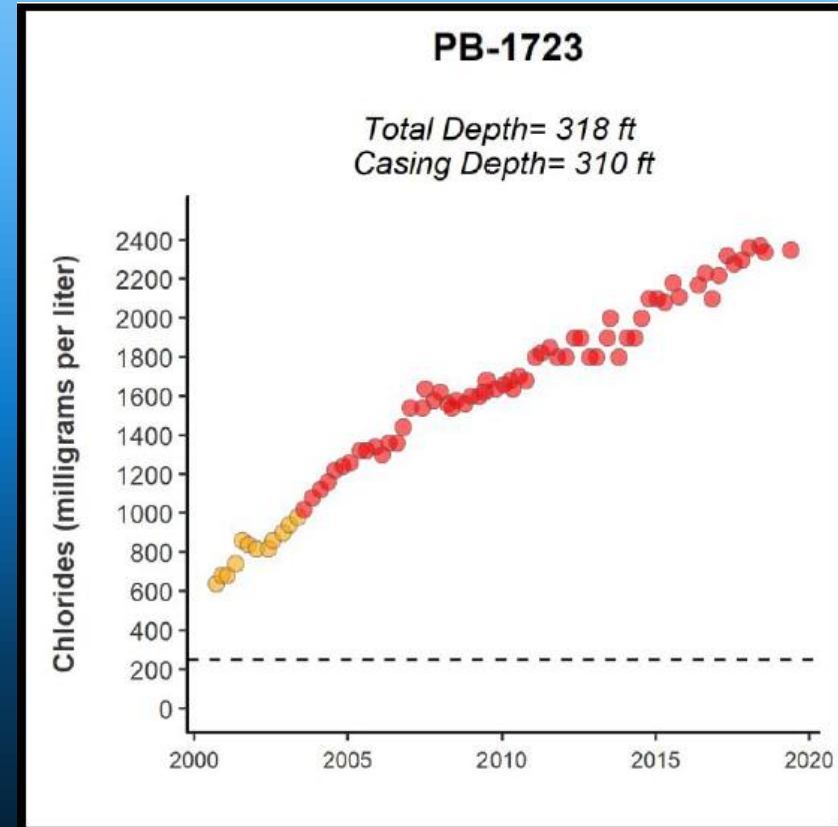
Map ID	SFWMD Facility ID	Project Name	Well Name	XCOORD	YCOORD	Cased Depth (feet lbs)	Total Depth (feet lbs)	Chloride (mg/L)
1	136200	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	TQT-5	947579	959541		69	147
2	136159	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	25D	945182	959413		120	98
3	136199	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	T23-1	950226	958873		100	135
4	6627	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	23	950224	958863	45	60	102
5	136196	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	TQD14	952272	958746		97	179
6	136179	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	PB727	950817	958463		63	70
7	2776	TEQUESTA COUNTRY CLUB	TEQCC-02	945238	958363	77	200	108
8	136198	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	TQRD-1	949661	956899		68	153
9	150807	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	D1-3	952610	956120		90	374
10	6626	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	8	952558	955960	50	70	150
11	6625	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	7	951788	955632	50	90	68
12	150808	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	T-7R-1	951685	955526		112	41
13	136183	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	PB932	953057	955298		60	75
14	136180	VILLAGE OF TEQUESTA - PUBLIC WATER SUPPLY	PB892	949331	954918		82	5570
15	150517	TOWN OF JUPITER WATER UTILITIES	JPX	944410	952314	20	23	19.5
16	150518	TOWN OF JUPITER WATER UTILITIES	JPW	943639	952185	231	252	55
17	224579	TOWN OF JUPITER WATER UTILITIES	CA-S	936197	948304	227	237	28.5
18	150519	TOWN OF JUPITER WATER UTILITIES	JPV	938817	947895	20	23	85.3
19	150516	TOWN OF JUPITER WATER UTILITIES	JPY	938875	947873	189	210	100
20	150520	TOWN OF JUPITER WATER UTILITIES	JPU	938806	947781	168	189	145
21	135940	TOWN OF JUPITER WATER UTILITIES	JPB	938795	947769		132	46.9
22		USGS	PB-1733	938354	947015	189	210	182
23	261054	WATER'S EDGE PROPERTY OWNERS ASSOCIATION	Well 1	953866	946696	25	30	54
24	150522	TOWN OF JUPITER WATER UTILITIES	JPS	940708	946108	273	282	614
25	150521	TOWN OF JUPITER WATER UTILITIES	JPT	940799	946103	20	23	30.3
26	135948	TOWN OF JUPITER WATER UTILITIES	JPQ	938726	945146	185	198	128
27		USGS	PB-1732	943361	944765	232	252	55
28	137201	JONATHANS LANDING	JLOW-08	953605	944214		180	56
29	185512	NORTH COUNTY AQUATIC COMPLEX	MW-1	946178	943466	110	120	61
30	23542	TOWN OF JUPITER WATER UTILITIES	13	939775	943440	136	200	50
31	185511	NORTH COUNTY AQUATIC COMPLEX	Well 2	946264	943435	40	120	62
32	23543	TOWN OF JUPITER WATER UTILITIES	14	940585	943420	117	201	130
33	259139	TOWN OF JUPITER WATER UTILITIES	19R	940802	942955	138	153	52
34	137202	JONATHANS LANDING	JLOW-9	952328	941837		180	36
35	137205	JONATHANS LANDING	JLWCS-4	955006	941181		180	115

# Chloride Time-Series Plots

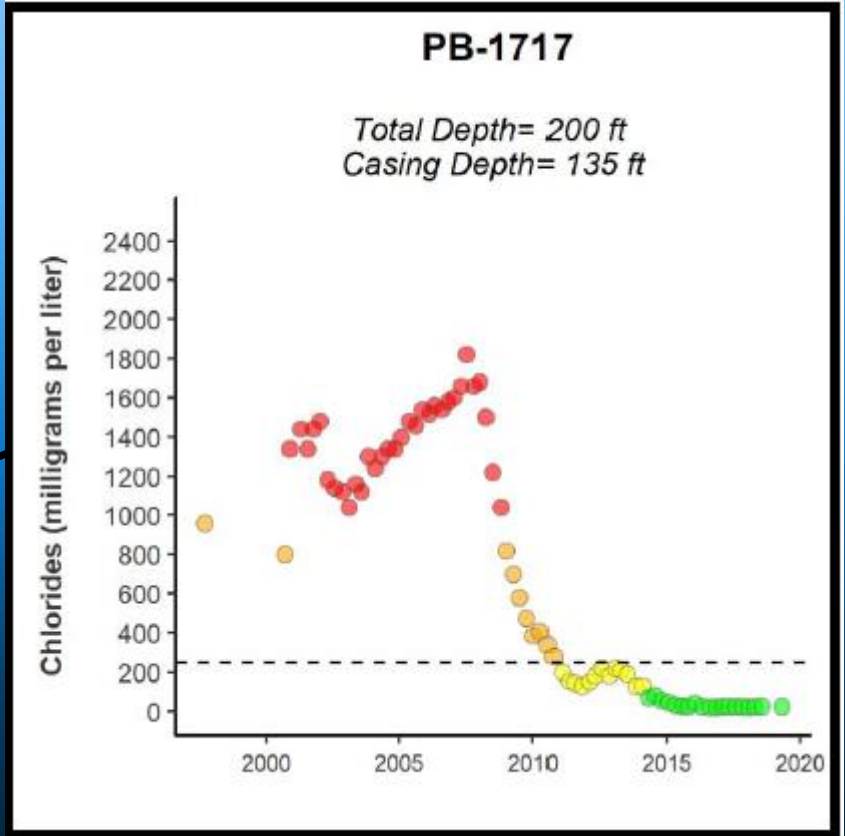
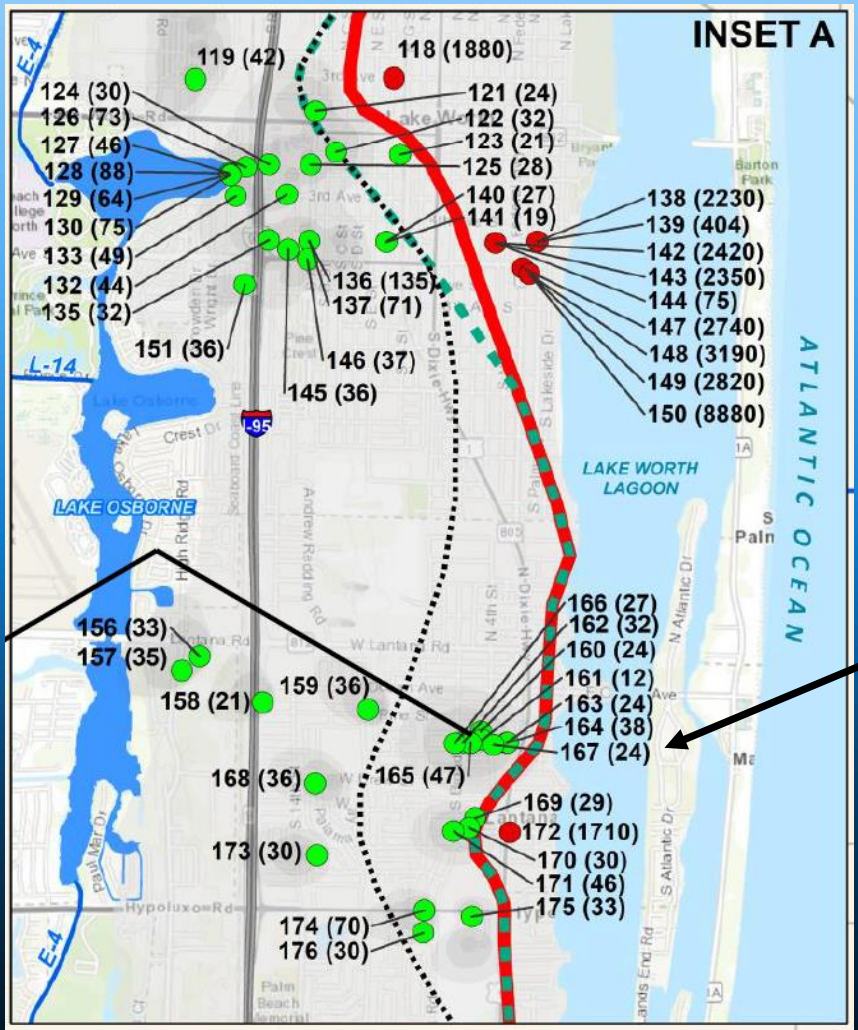
West



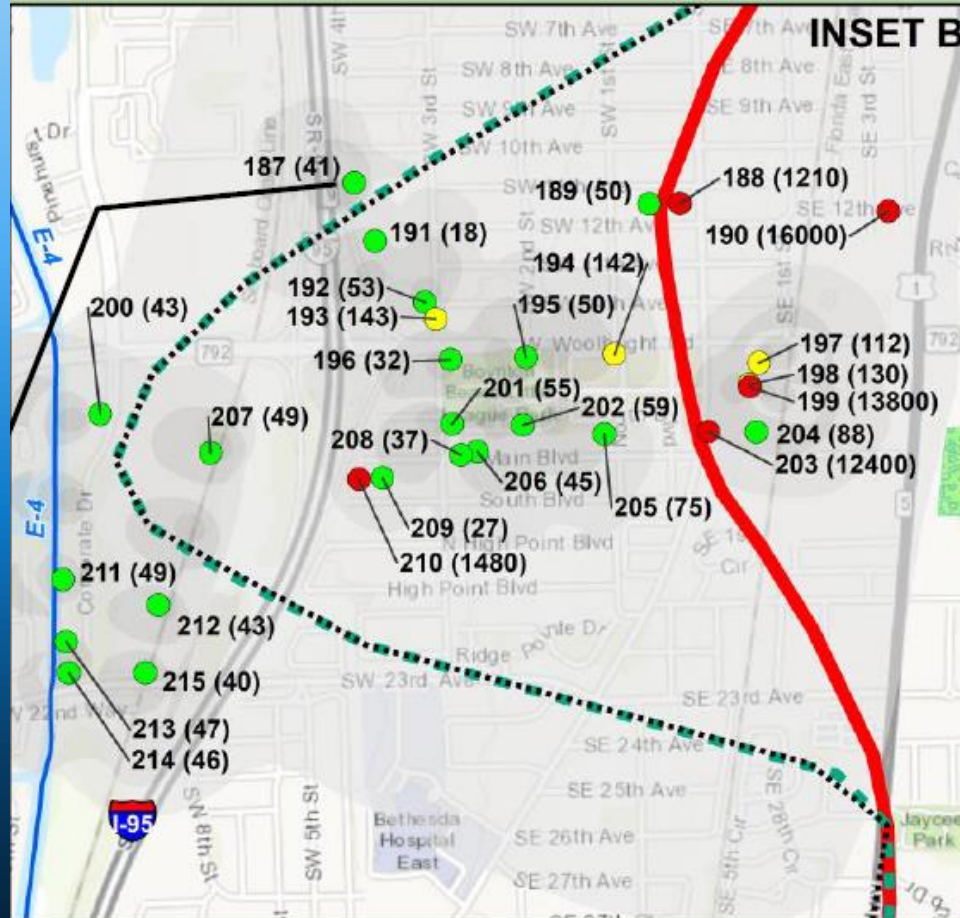
East



# Seaward Movement of SWI – Palm Beach County



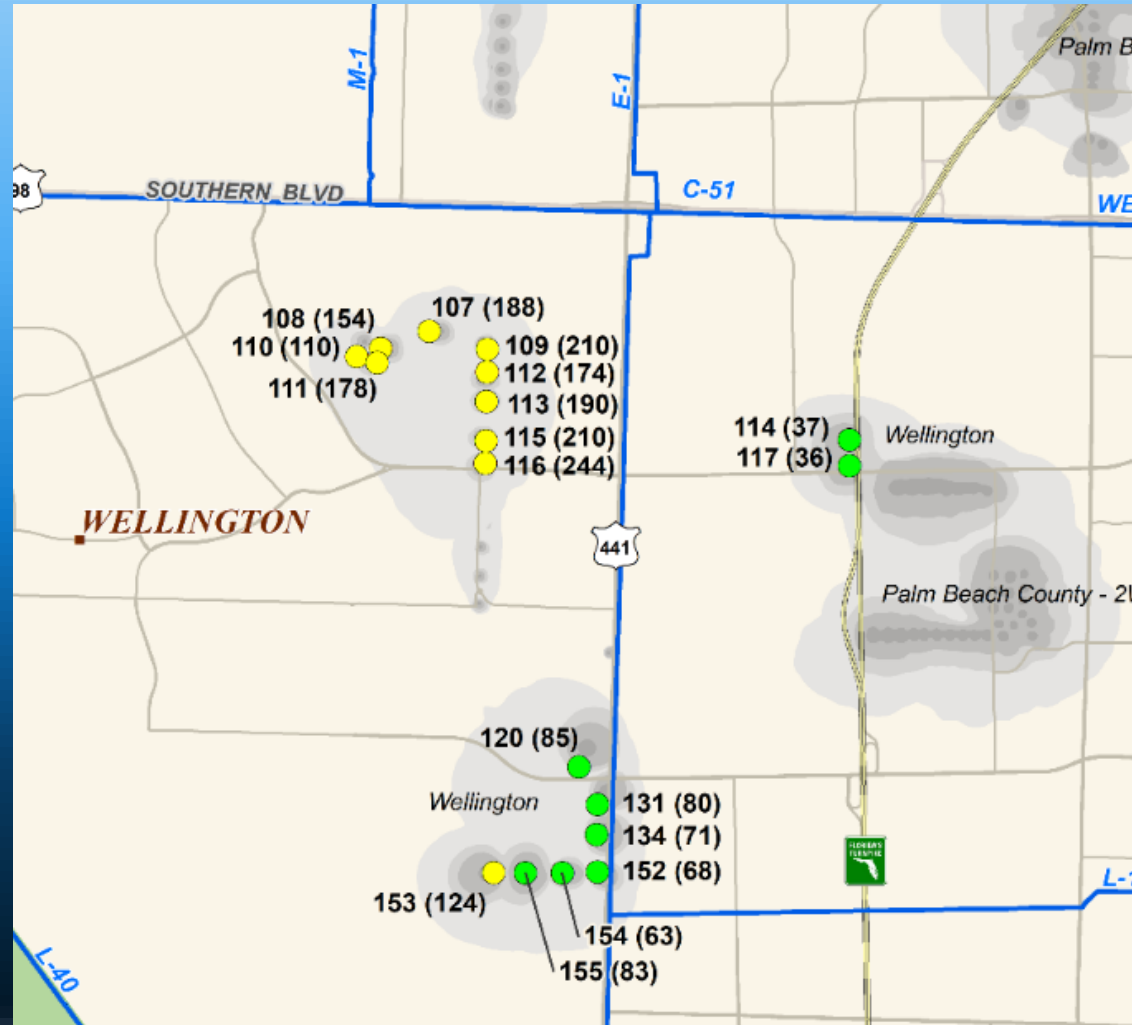
# Example of Well Depth Impact



209	152793	CITY OF BOYNTON BEACH PUBLIC WATER SUPPLY	BYHP2	959927	792825		280	26.8
210	152794	CITY OF BOYNTON BEACH PUBLIC WATER SUPPLY	BYHP1	959750	792815	340	350	1480



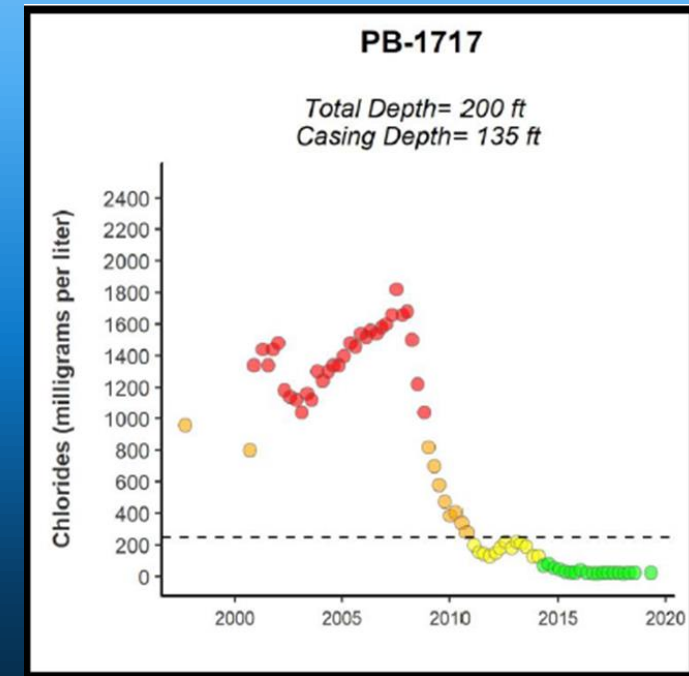
# Potential Upconing of Connate Water



# Conclusions

- Shifting of pumpage from E to W wellfields helps to prevent landward movement of the SWI
- Shifting pumpage to the Floridan aquifer system helps to prevent landward movement of the SWI
- Some changes may be due to new data points or a more refined interpretation
- In Palm Beach County, seaward movement of the SWI has occurred
- Potential for connate water in central PBC

Central Palm Beach County



# Next Steps

- Work with local governments, USGS, permittees and others to:
  - Identify other existing wells to increase mapping accuracy for future maps
  - Consider sampling frequency
  - Identify funding to facilitate well replacement, as needed
  - Evaluate needs and identify funding for new wells (critical data gaps or areas of concern)
  - Prevent saltwater encroachment of wellfields

## ➤ Questions and Discussion

2009 & 2014 maps available now  
2019 – to be posted

<https://www.sfwmd.gov/documents-by-tag/saltwaterinterface>

[JShaw@sfwmd.gov](mailto:JShaw@sfwmd.gov)

561-682-6849