

# South Florida Water Management District Concept for Deep Injection Wells in the Northern Everglades

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Water Resources Advisory Commission  
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# Discussion

- Meaningful stakeholder input has been discussed at WRAC and project team meetings
- South Florida Water Management District (SFWMD) **draft** concept
- Analyses to protect estuaries with Deep Injection Wells
- Draft implementation timeline and cost
  - ✓ Needs further development

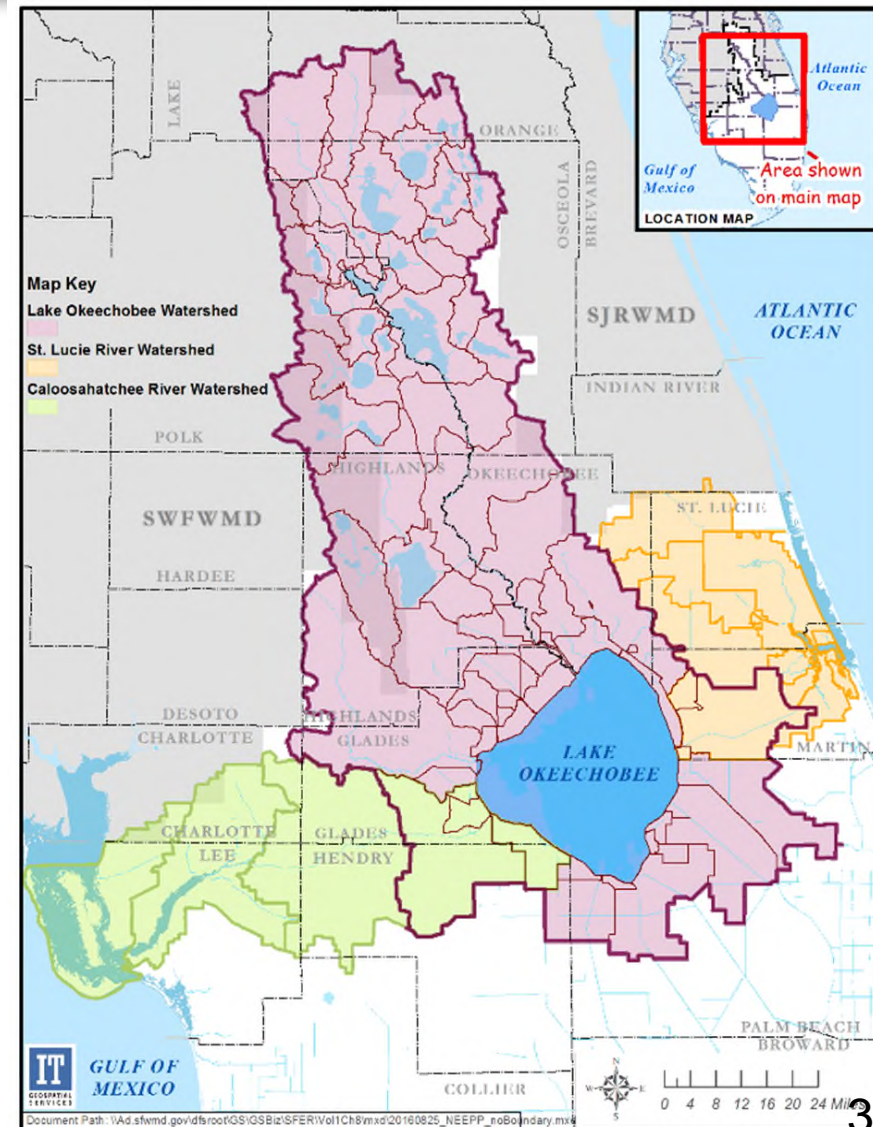


**Deep Injection Well at the Okeechobee Utility Authority, since 2009**

# Deep Injection Wells - SFWMD

## Concept to Reduce Estuary Discharges

- June 2007: DIW Feasibility Study
- February 2008: SFWMD/FDEP/FDACS Lake Okeechobee Watershed Project Phase II Technical Plan
- 2013 CERP ASR Regional Study model analysis of DIWs with ASR wells
- May 2017: USACE remove DIW from Lake Okeechobee Watershed Restoration Project
- June 1, 2017: Discussion at Water Resources Advisory Commission
- June 6, 2017: Governing Board directed staff to evaluate feasibility of a DIW program
- October 12, 2017: Staff to present to Governing Board



# Deep Injection Wells - SFWMD Concept to Reduce Estuary Discharges

- DIW could work in combination with reservoirs, ASR, and STAs
- Long term tool to help meet estuary restoration goals
- Would be used when discharges to tide become necessary



Deep Injection Well at Delray Beach South Central Facility

# **SFWMD Concept for Deep Injection Wells in the Northern Everglades Benefit Analysis**

Cal Neidrauer, P.E. – Chief Engineer – Hydrology and Hydraulics Bureau

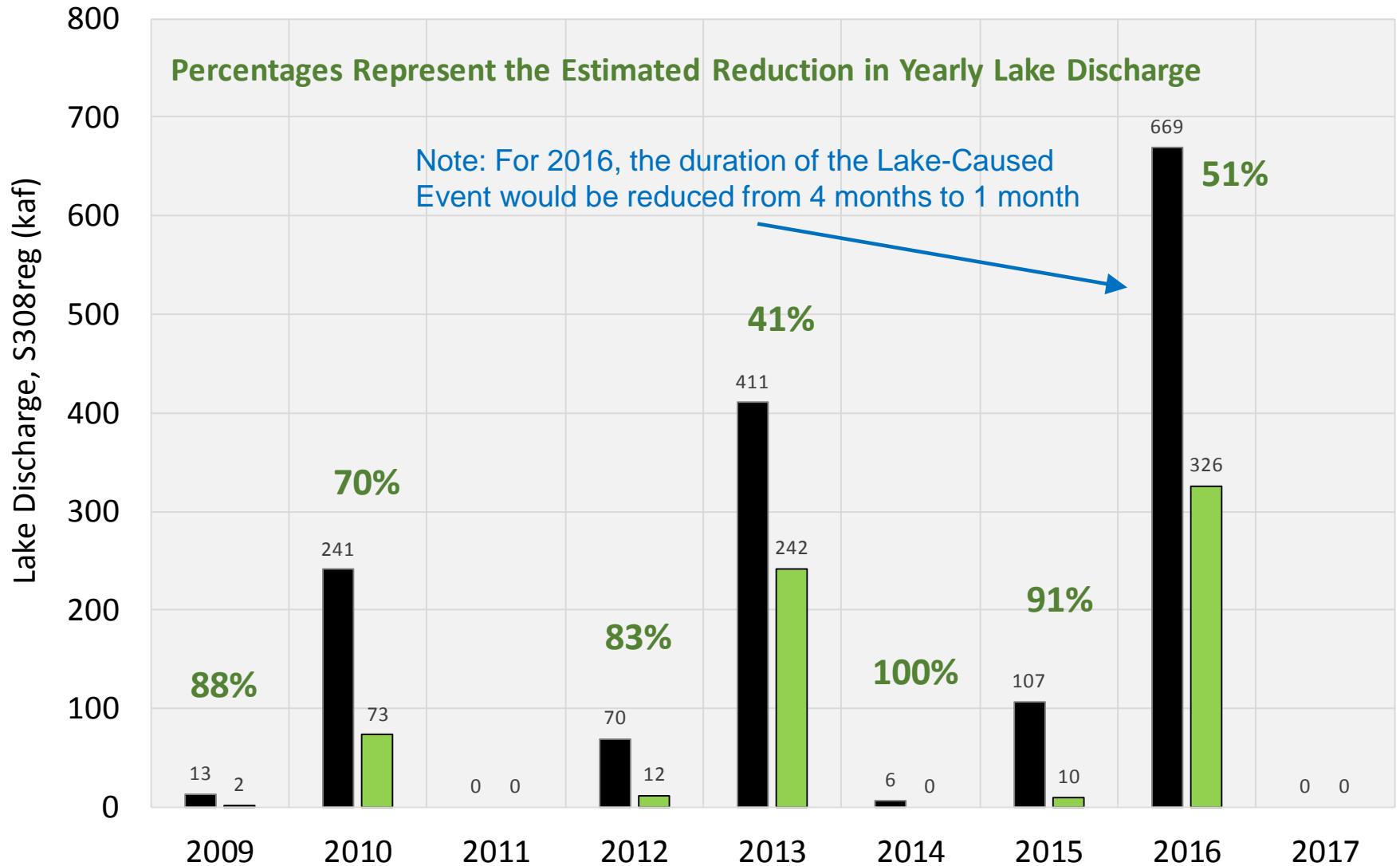
# Goals and Methods

- Analyses performed to evaluate current and future improvements when implementing DIWs
  - 50 wells at 15 million gallons per day each were assumed for demonstration purposes
    1. “Recent Historical” scenario focused on evaluation of recent historical discharge events assuming only existing infrastructure
    2. “Future” scenario explored the synergy of adding DIWs to other planned restoration efforts including the Central Everglades Planning Project, Lake Okeechobee Watershed Project, C-43 Reservoir, C-44 Reservoir/Stormwater Treatment Area and other anticipated projects
- In these analyses, **DIWs were only operated as an alternative discharge point in place of making flood control discharges to the Northern Estuaries (i.e., no impact to available water for restoration, or water supply. The only reduction is to flow already lost to tide)**

# Analysis of Recent Historical Conditions with 50 DIWs

## Annual Volume of Lake Discharge to St. Lucie Estuary

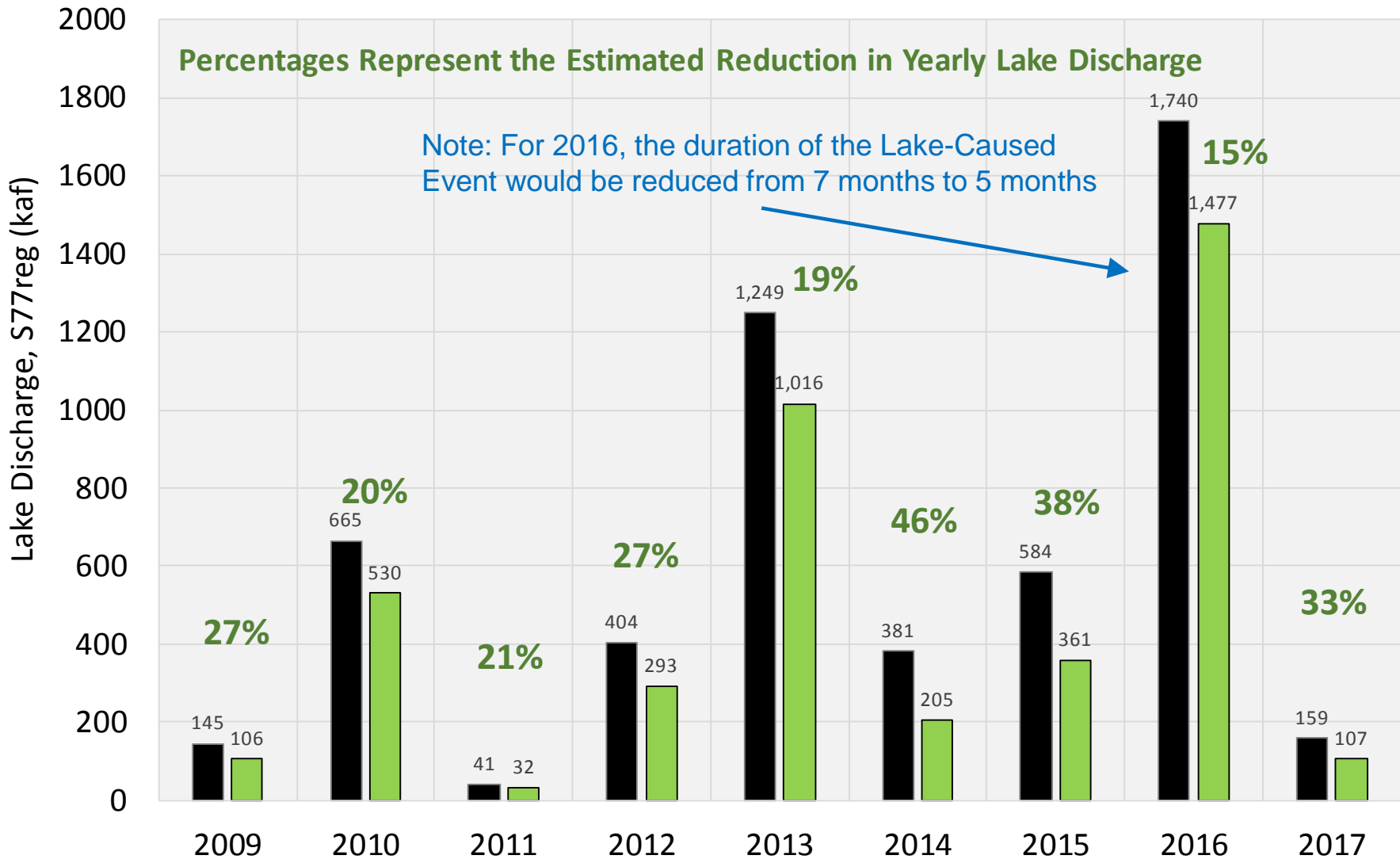
■ Observed (No Deep Injection Wells)     
 ■ With 50 Deep Injection Wells (15 MGD Each)



# Analysis of Recent Historical Conditions with 50 DIWs

## Annual Volume of Lake Discharge to Caloosahatchee Estuary

Observed (No Deep Injection Wells)
  With 50 Deep Injection Wells (15 MGD Each)

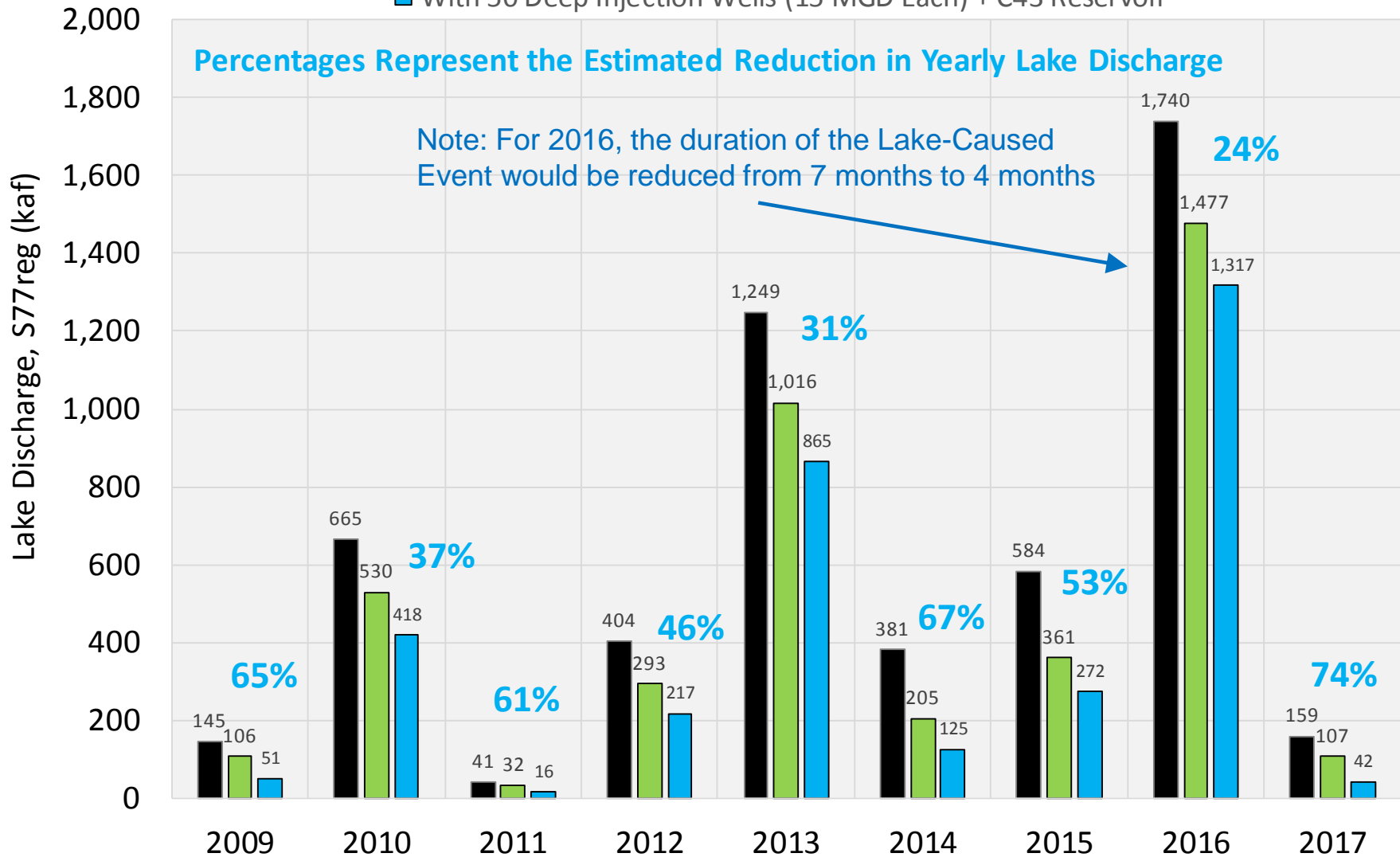




# Analysis of Recent Historical Conditions with 50 DIWs

## Annual Volume of Lake Discharge to Caloosahatchee Estuary

- Observed (No Deep Injection Wells)
- With 50 Deep Injection Wells (15 MGD Each)
- With 50 Deep Injection Wells (15 MGD Each) + C43 Reservoir



# Analysis of Future Conditions with 50 Deep Injection Wells

- Including the Central Everglades Planning Project, Lake Okeechobee Watershed Restoration Project, C-43 Reservoir, C-44 Reservoir/STA and other anticipated projects
- **Simulation of Future conditions indicate the DIW could operate in a complementary manner with other restoration projects**
  - Even with all CERP components, northern estuary discharges are not fully eliminated; so DIW would still have opportunity to improve performance
- **Restoration flows south are unaffected by DIW operations**

# Analysis of Future Conditions with 50 DIWs using RSM-BN Simulation Results (1965-2005 rainfall conditions)

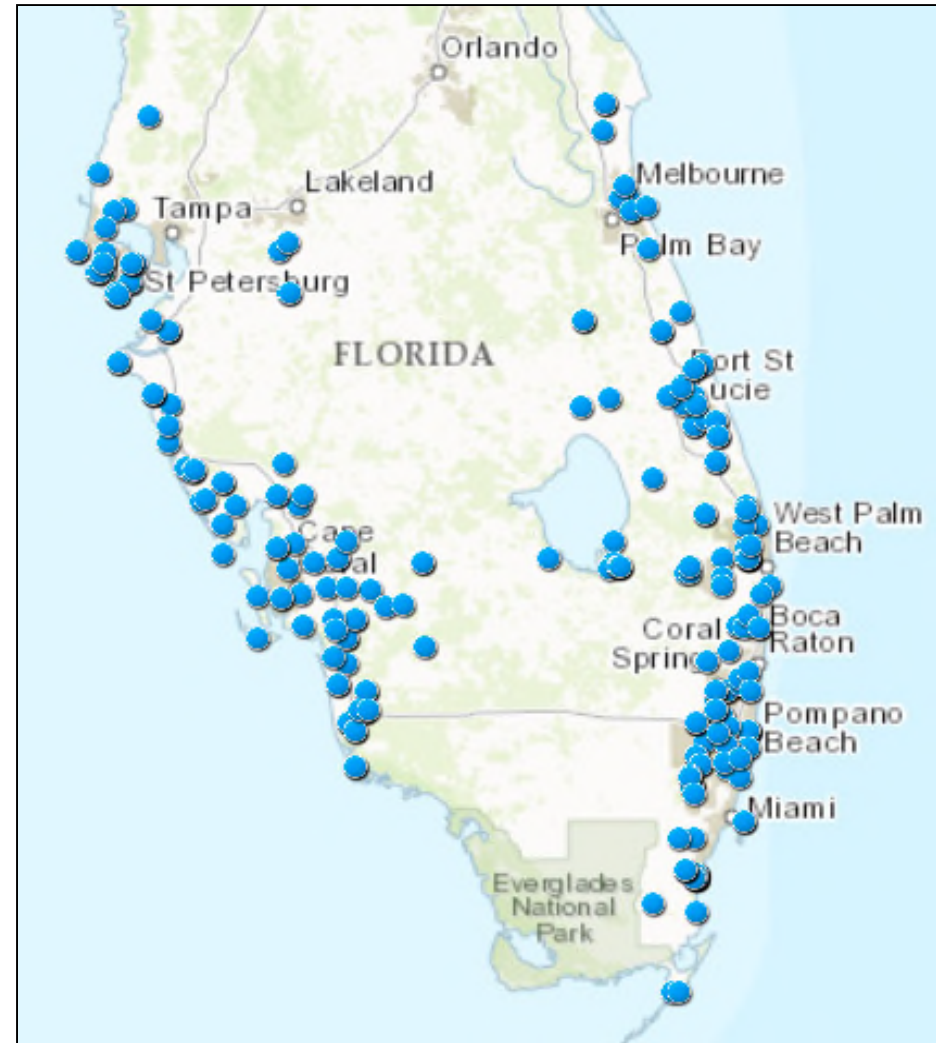
Simulation	Average Annual Lake O Regulatory Discharge (kac-ft)	% Estuary Regulatory Flow Reduction (relative to ECB)	Number of Months Lake O Causes a Damaging Event	% Estuary "Months with Impact" Reduction (relative to ECB)
	St Lucie Estuary		St Lucie Estuary	
Existing Condition Baseline (ECB) (For Comparison)	165		31	
Future with Restoration Projects (CEPP, LOWRP, C43, IRL, etc...)	96	42%	14	55%
Future with Restoration Projects + 50 Deep Injection Wells	54	67%	8	74%
	Caloosahatchee Estuary		Caloosahatchee Estuary	
Existing Condition Baseline (ECB) (For Comparison)	416		38	
Future with Restoration Projects (CEPP, LOWRP, C43, IRL, etc...)	161	61%	13	66%
Future with Restoration Projects + 50 Deep Injection Wells	97	77%	8	79%

# Deep Injection Well - SFWMD Concept Implementation and Cost

# Deep Injection Wells are nothing new...

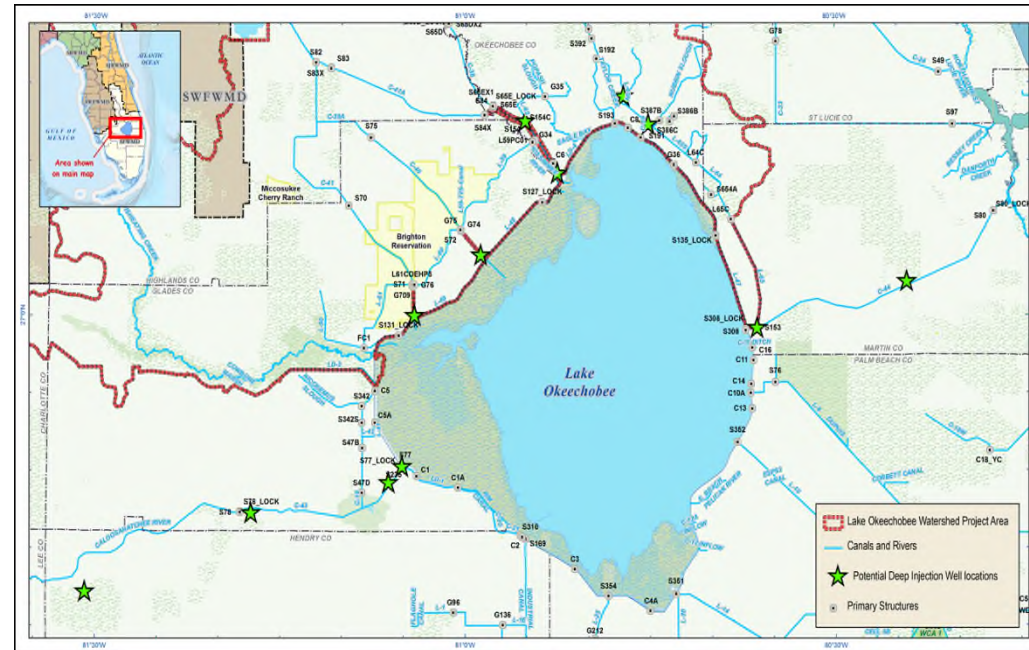
Over 200 active DIWs in Florida

- Almost all south of Orlando
- Most inject into the Boulder zone in the Floridan aquifer
- Stormwater not wastewater



# Initial Site Prioritization Considerations

- Site identified during previous studies
- SFWMD lands only
- Benefits could include nutrient load reductions
- Co-located with ASR wells, STAs and Reservoirs
- Favorable hydrogeologic conditions
- Existing wells on site
- Multi-well expandability
- Proximity to field services (Operations and Maintenance)



# Deep Injection Well Facilities Conceptual Plan

- Construction could be phased
- Process starts with exploratory well at recommended locations
- Site configuration dependent on exploratory well results
- Needs further development

## **YEARS 1 and 2**

Site investigations, design evaluations, and program development

**Year 3 through Year 10**  
**Construct 50+ DIWs**

# Estuary Protection in a Cost Effective Way

- Capital Costs: **\$6 million** per Facility
  - ✓ Well: \$3.5 million
  - ✓ Surface Facilities (piping, pump, monitor well, etc.): \$2.5 million
- Operations & Maintenance Cost: **\$140,000 - \$185,000** per facility per year
  - ✓ Based on usage and facility design
  - ✓ Assumes facility operates 4 months
  - ✓ Electrical cost (primary driver)
  - ✓ In-house or subcontracted
- Total Cost for 50 Facilities
  - ✓ Permitting, Design, and Capital Costs: **\$330 million**
  - ✓ Annual Operations & Maintenance Cost: ~ **\$7.7 million – \$10.2 million** (at full implementation)



# Discussion