

**SOUTH FLORIDA WATER MANAGEMENT DISTRICT**

# **Everglades Restoration Strategies: Optimizing the Performance of Stormwater Treatment Areas**

**Greater Everglades Ecosystem Restoration Conference**

**April 21-23, 2015**

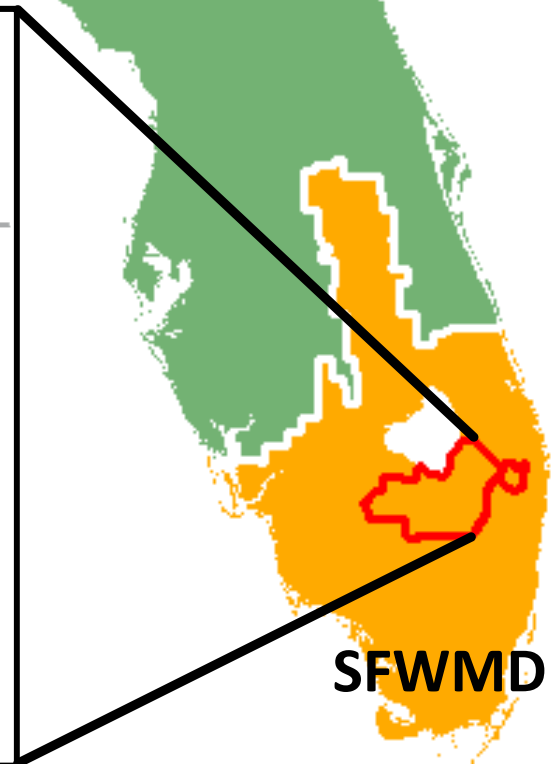
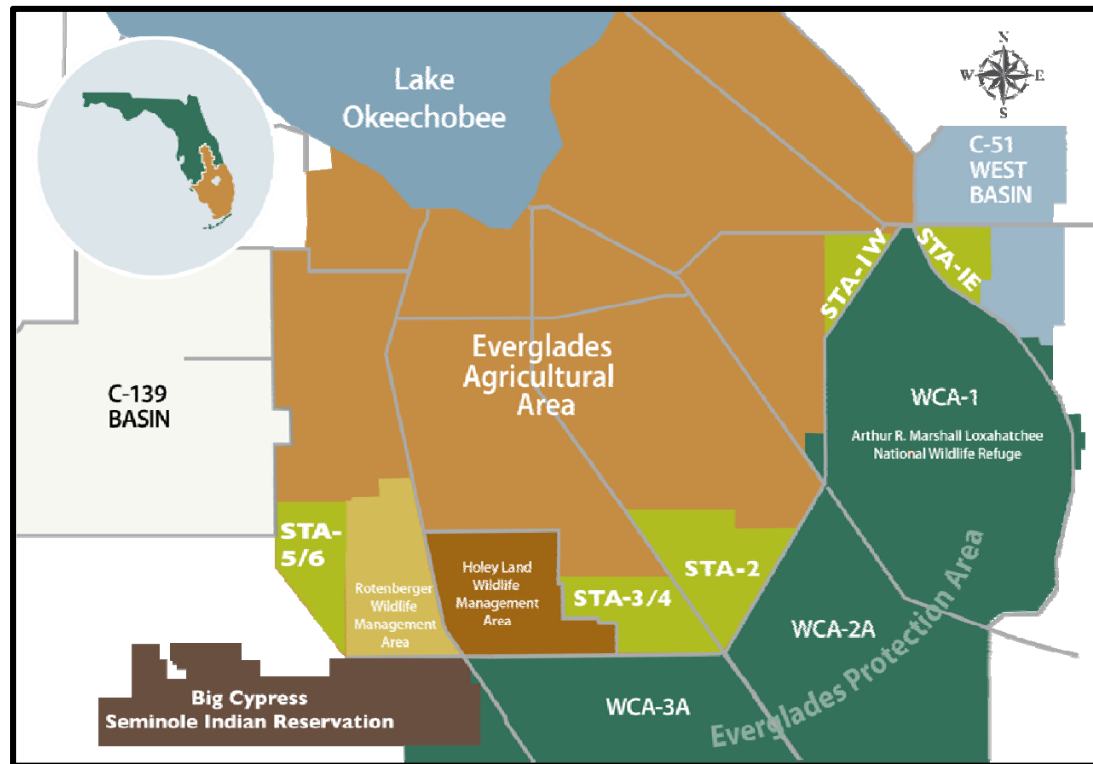
**Coral Springs, Florida USA**



**Jeremy C. McBryan, PE, CFM**

**Principal Engineer, South Florida Water Management District**

# Stormwater Treatment Areas (STAs)



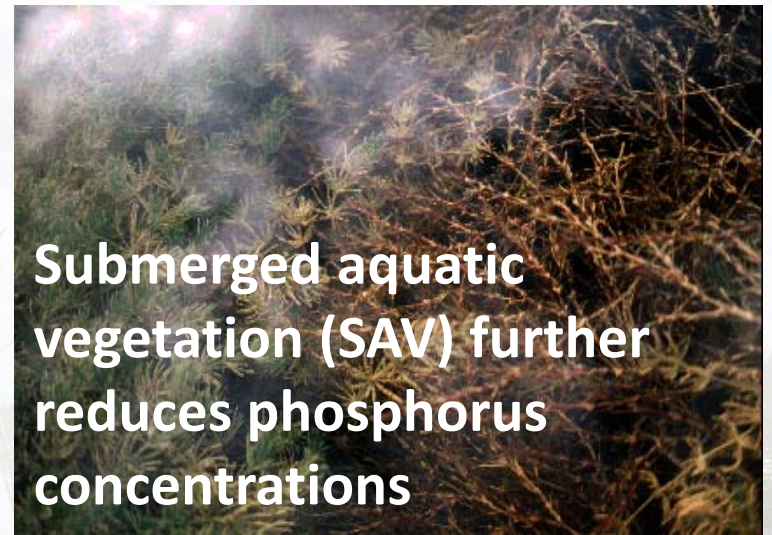
# Vegetation: The Foundation of Treatment

**Emergent aquatic vegetation (EAV) provides initial treatment**



**Periphyton-based Stormwater Treatment Areas (PSTAs) have potential for additional treatment**

**Submerged aquatic vegetation (SAV) further reduces phosphorus concentrations**



# Factors Affecting STA Operations and Performance

- Antecedent land use
- Inflow P concentrations
- Vegetation composition
- Soil type
- Topography
- Prolonged high water depths
- Hurricanes, floods, droughts
- Enhancement activities
- Regional operations
- Endangered Species, Exotic Species, Migratory Birds



# Ongoing Challenges

- Ultra-low limits on Total Phosphorus (TP) concentrations in STA discharges
- STAs are integral components of a complex water management system with multiple objectives and cannot be operated in isolation
- STA expansions require more supplemental water in dry periods
- Science is still being developed to understand factors affecting STA sustainability and long-term performance

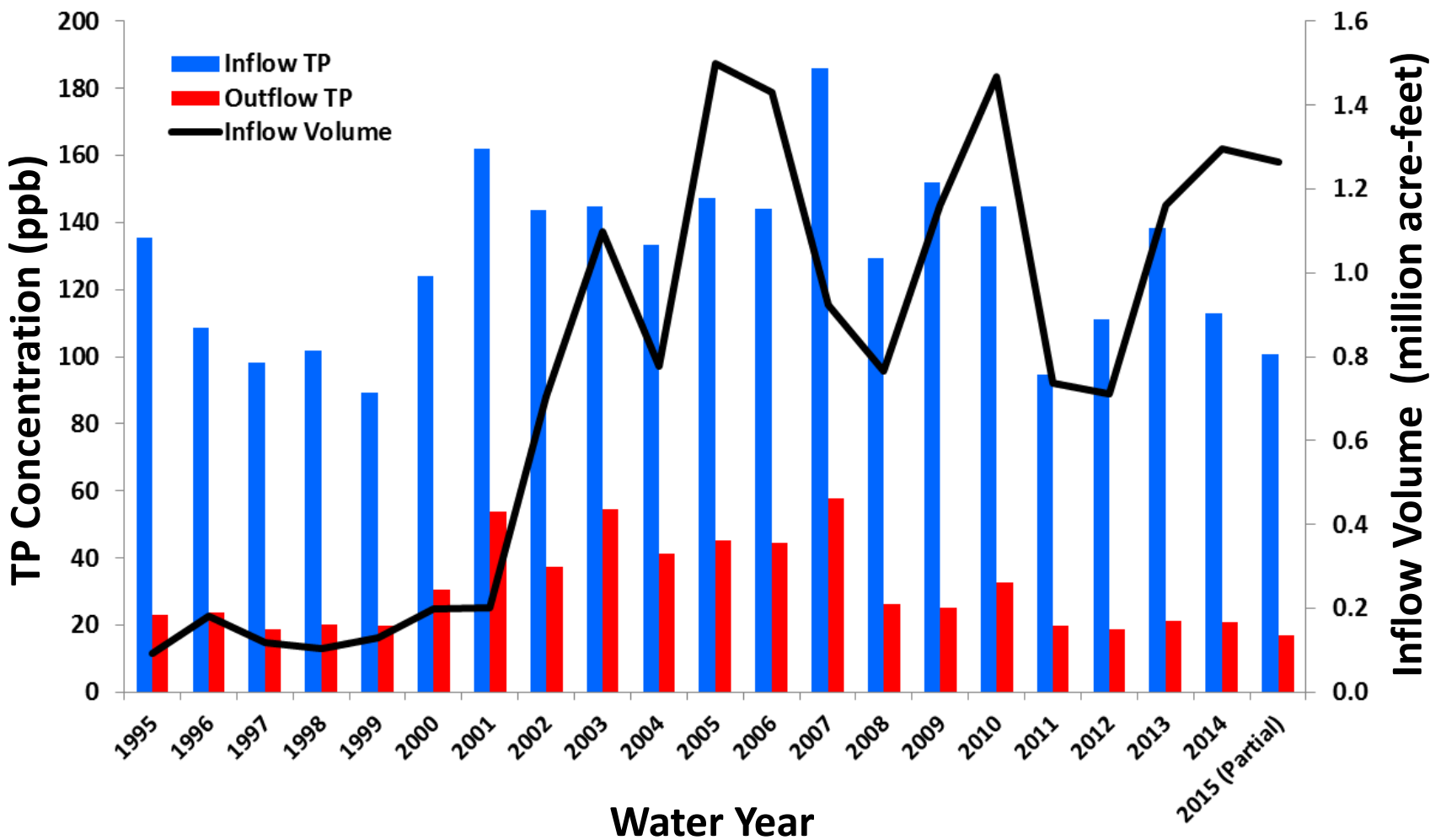


## Ongoing Challenges (cont'd)

- South Florida's sub-tropical climate (hurricanes, floods, and droughts)
- STA off-line time for repairs, enhancements and stabilization is unavoidable
- Wildlife / Exotic Species use of the STAs / Impact on Operations and Treatment Performance
- Migratory Bird Treaty Act, Endangered Species Act, Bald Eagle Protection Act and others



# STA Performance: 1995-2015



# Everglades Restoration Strategies

In response to continued litigation, federal and state parties worked together from 2010-2012 to develop a technical plan that included:

- Water Quality-Based Effluent Limit (WQBEL)
- Projects to achieve WQBEL
- Science Plan





## Approaches to Achieve Water Quality Based Effluent Limit

- Continue to reduce TP concentrations at the source with agricultural **BMPs**
- Add **storage and flow equalization** to improve STA performance
- Expand **STA acreage**
- Increase **operational flexibility**
- Continue **STA research** to improve and optimize the performance

## Water Quality Based Effluent Limit

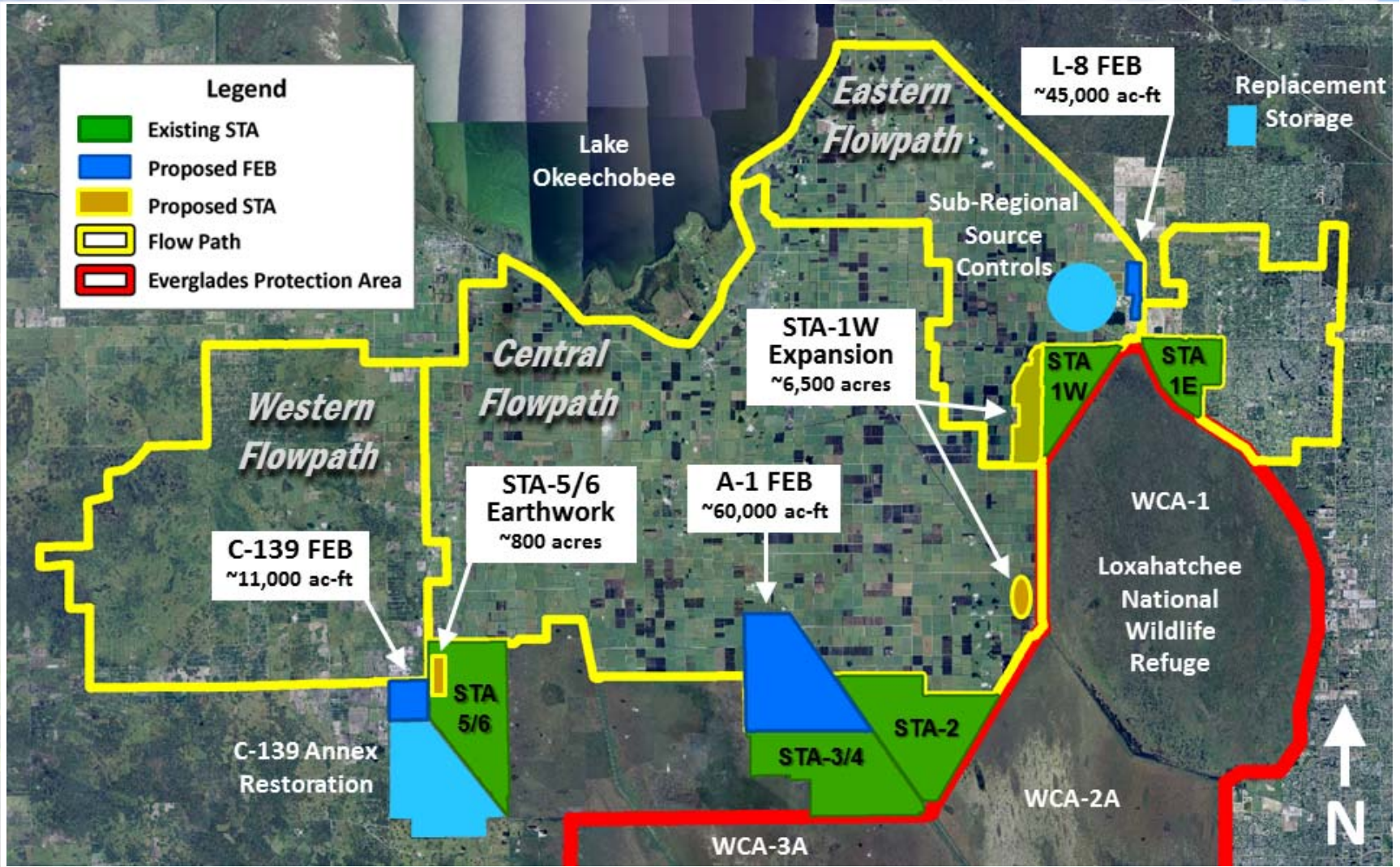
Developed to be protective of the Everglades and allow for the achievement of the Everglades phosphorus criterion (10 ppb)

### WQBEL

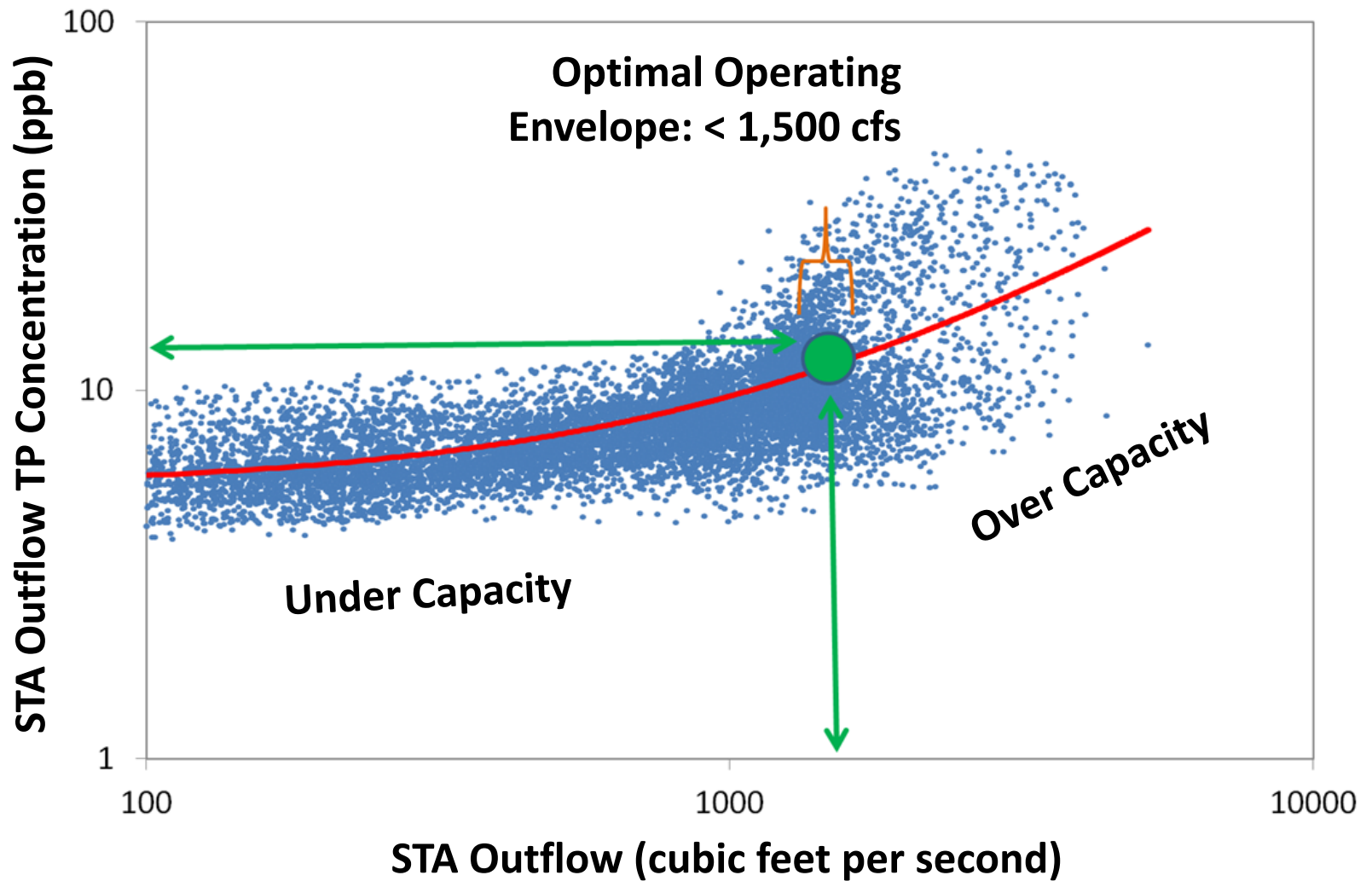
Total Phosphorus concentrations in the discharge from each STA shall not exceed:

- 19 ppb as an annual flow-weighted mean in any water year; and
- 13 ppb as an annual flow-weighted mean in more than 3 out of 5 water years on a rolling basis

# Everglades Restoration Strategies Key Projects



# Long-Term Model Simulations Provided Guidance for Developing STA Flow Targets



# Improving STA Performance Using Flow Equalization Basins (FEBs)



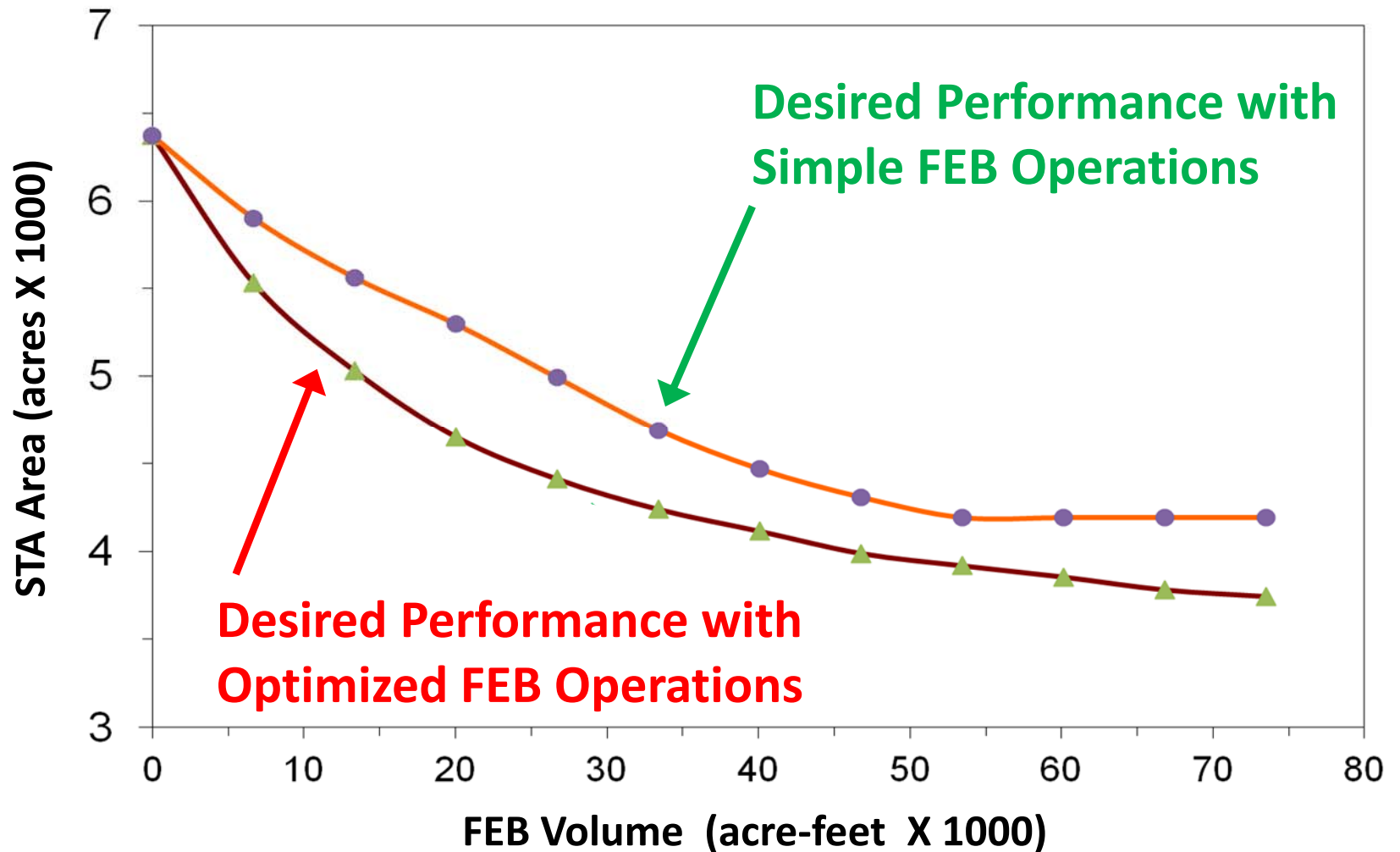
**Avoid STA Dryout**

**Avoid vegetation stress from prolonged high water levels**

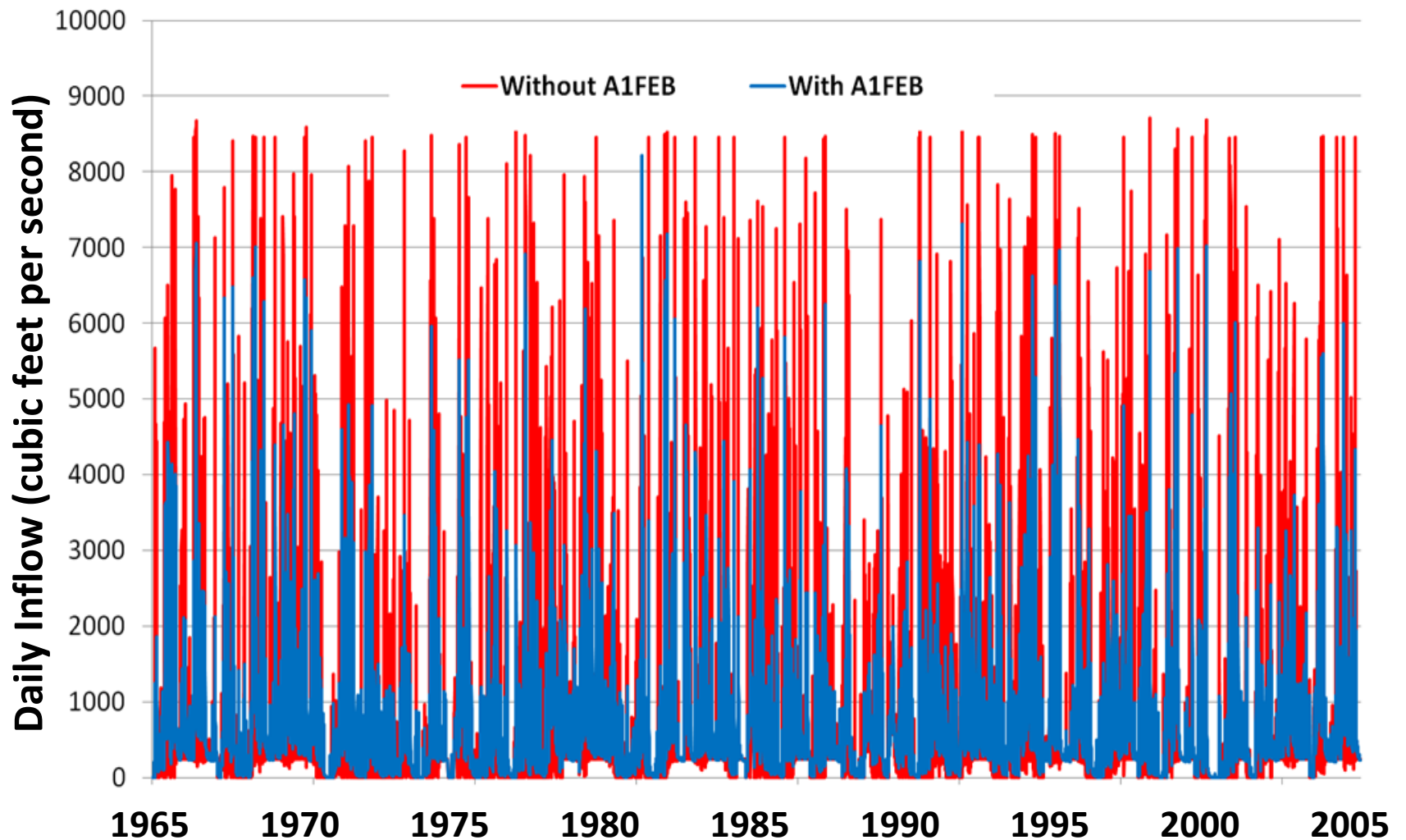


Restoration Strategies

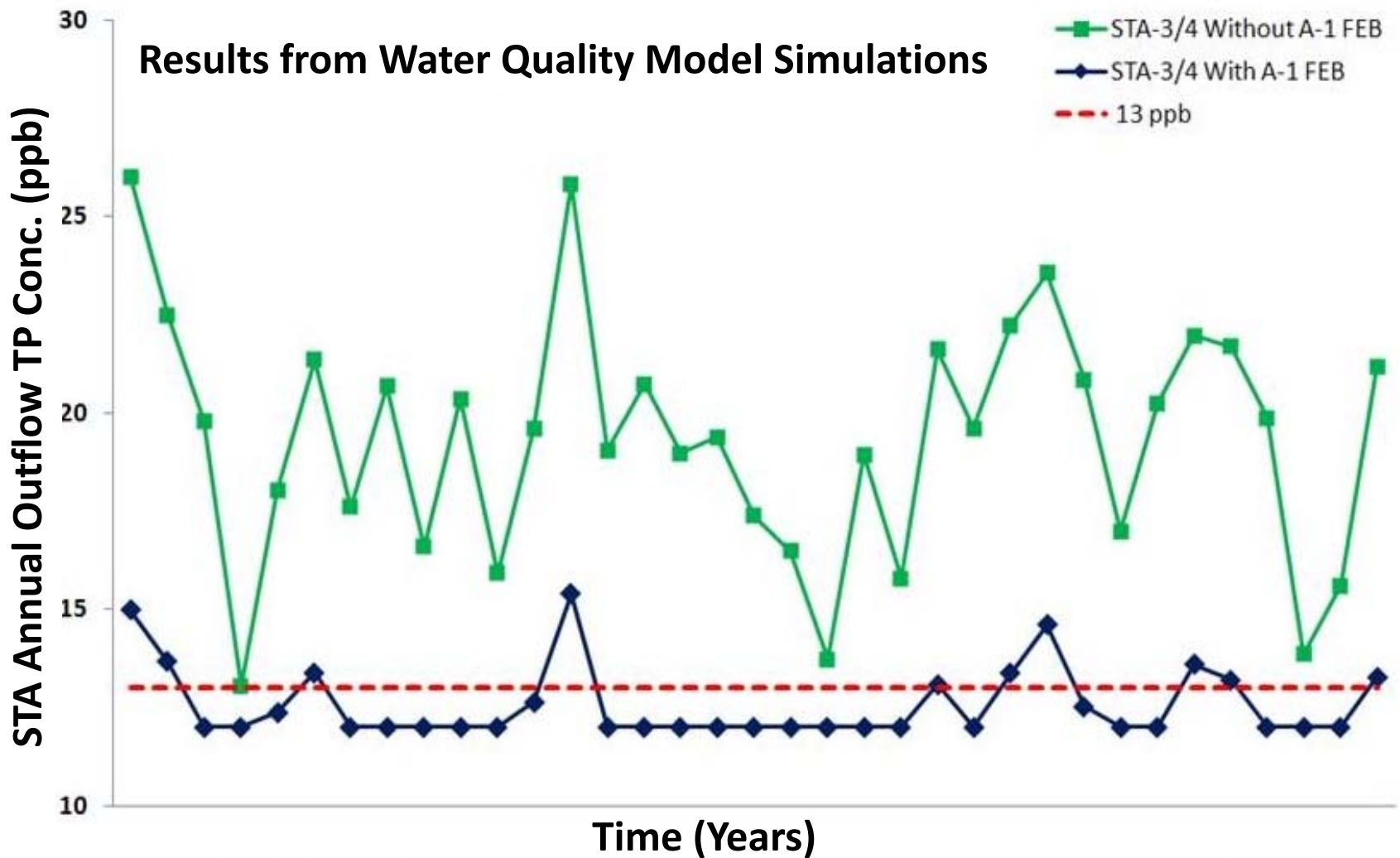
# STA Area vs. FEB Storage Volume



# Restoration Strategies Simulated STA-3/4 Inflows



# Restoration Strategies Simulated STA-3/4 Performance





# Restoration Strategies Design and Construction Schedule

## 2012

- 57,000 ac of STA

## 2012-2016

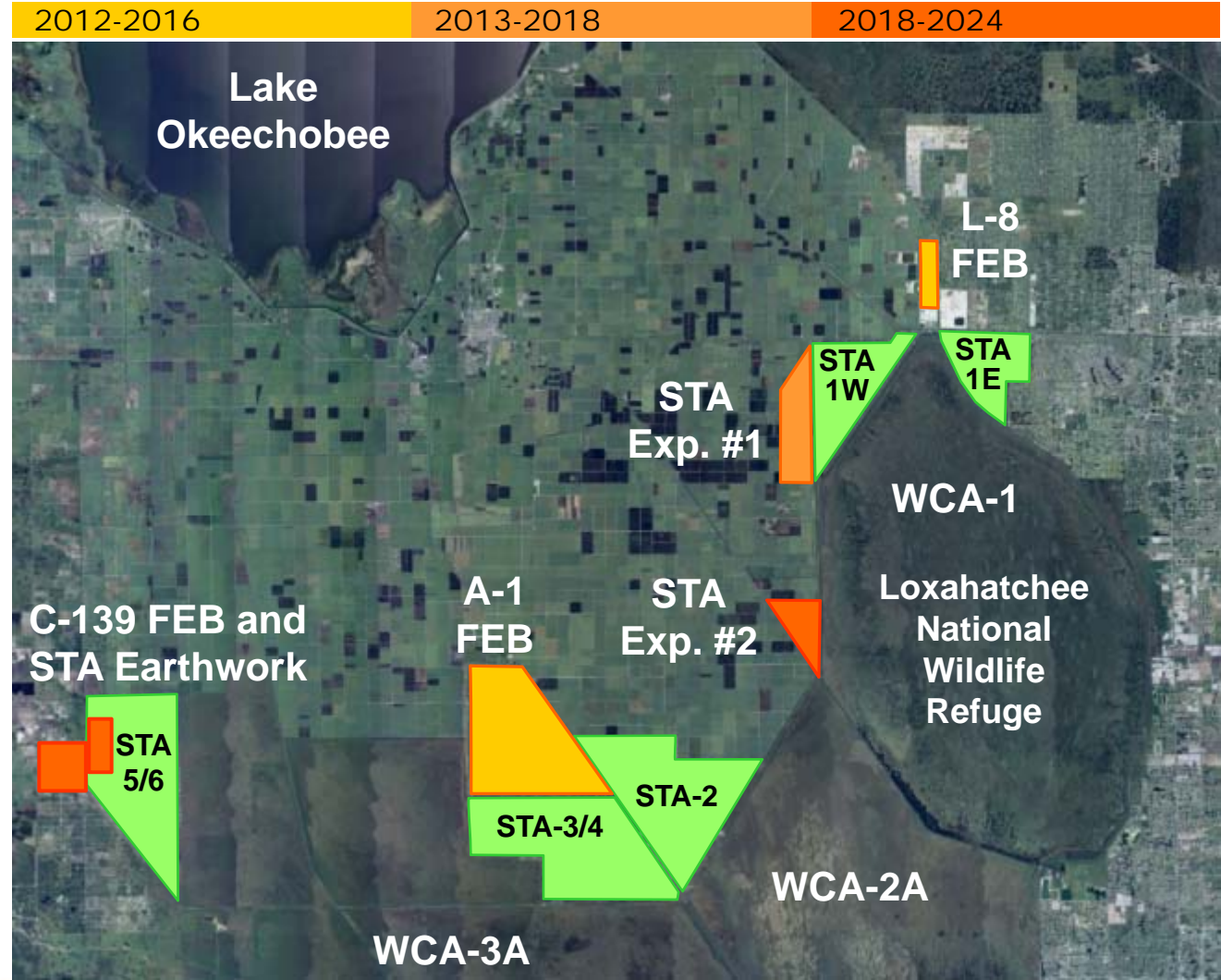
- L-8 FEB (45,000 ac-ft)
- A-1 FEB (60,000 ac-ft)

## 2013-2018

- STA (4,700 ac)

## 2018-2024

- STA (1,800 ac)
- C-139 FEB (11,000 ac-ft)
- STA Earthwork (800 ac)



**SOUTH FLORIDA WATER MANAGEMENT DISTRICT**



**Outflow Pump Station**

**Inflow Structure**

**L-8 FEB**

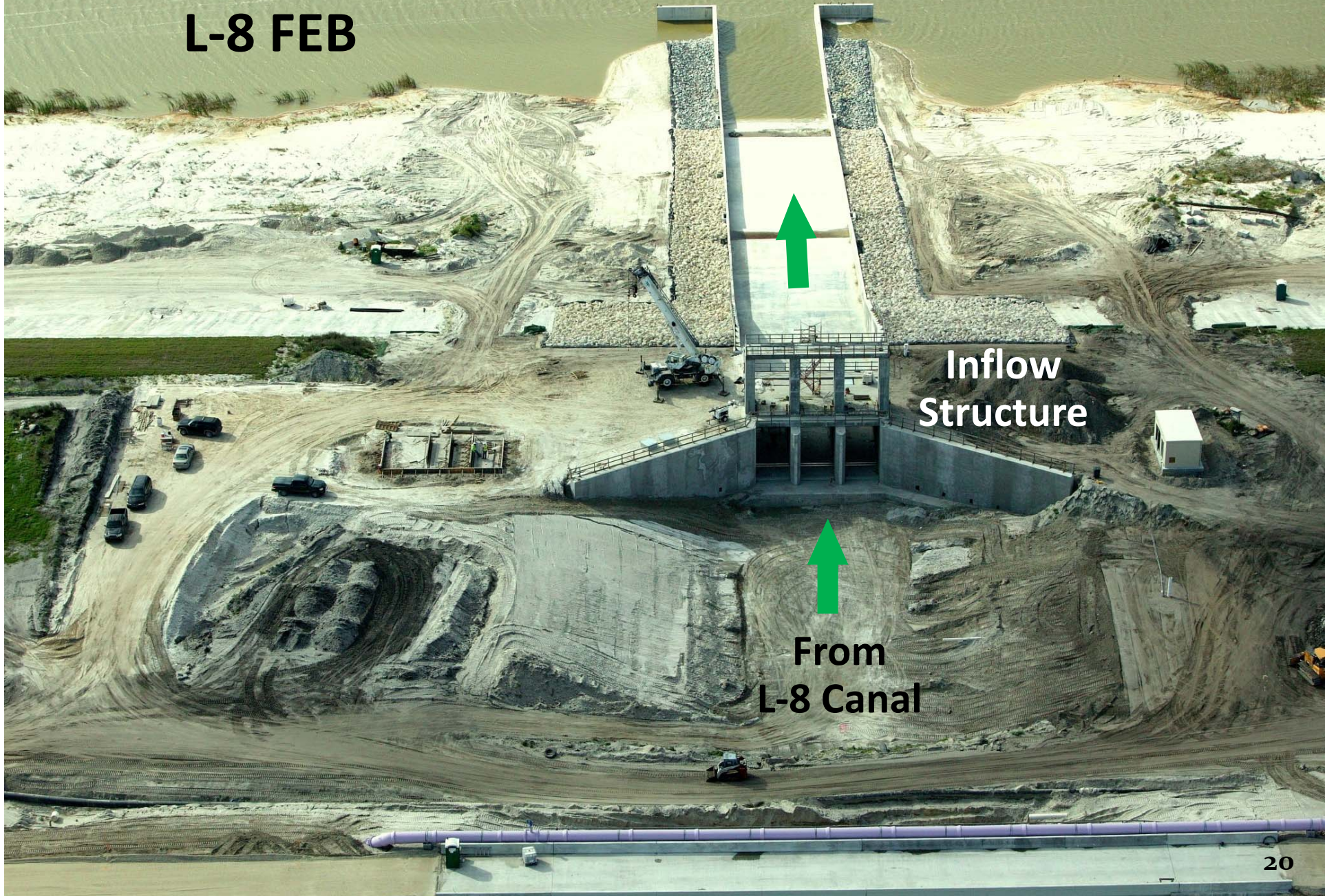


**L-8 Canal**



**L-8 FEB Outflow  
Pump Station**

L-8 FEB

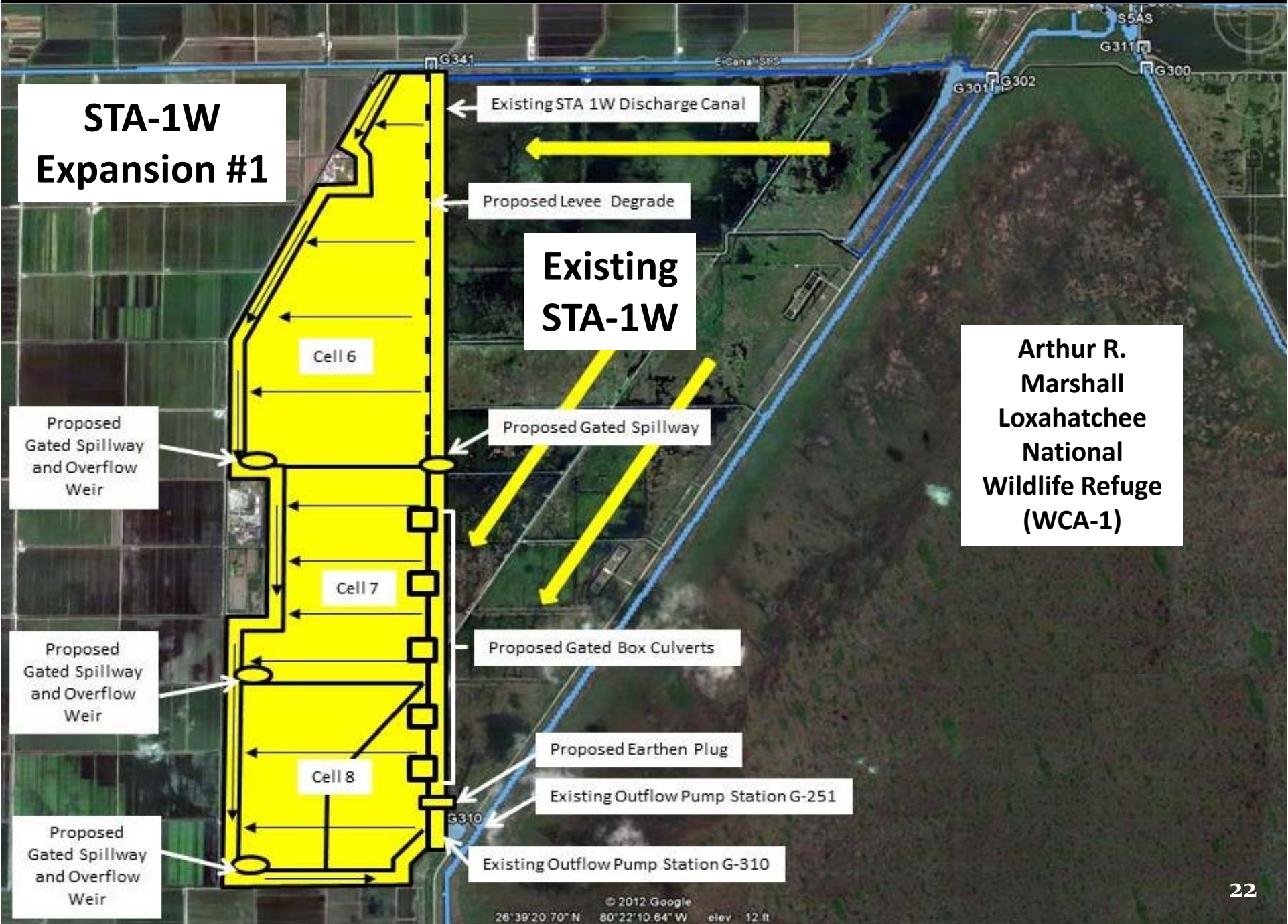


Inflow  
Structure

From  
L-8 Canal



# SOUTH FLORIDA WATER MANAGEMENT DISTRICT



**STA-1W  
Expansion #1**

**Existing  
STA-1W**

**Arthur R.  
Marshall  
Loxahatchee  
National  
Wildlife Refuge  
(WCA-1)**

**Questions?**

**For more information go to:**

**[www.sfwmd.gov/restorationstrategies](http://www.sfwmd.gov/restorationstrategies)**

**Session 21**

**2:00pm Hongying Zhao (STA-3/4 PSTA)**

**2:15pm Maria Loinaz (STA-1W Expansion)**

**2:30pm Patrick Keith (A-1 FEB)**