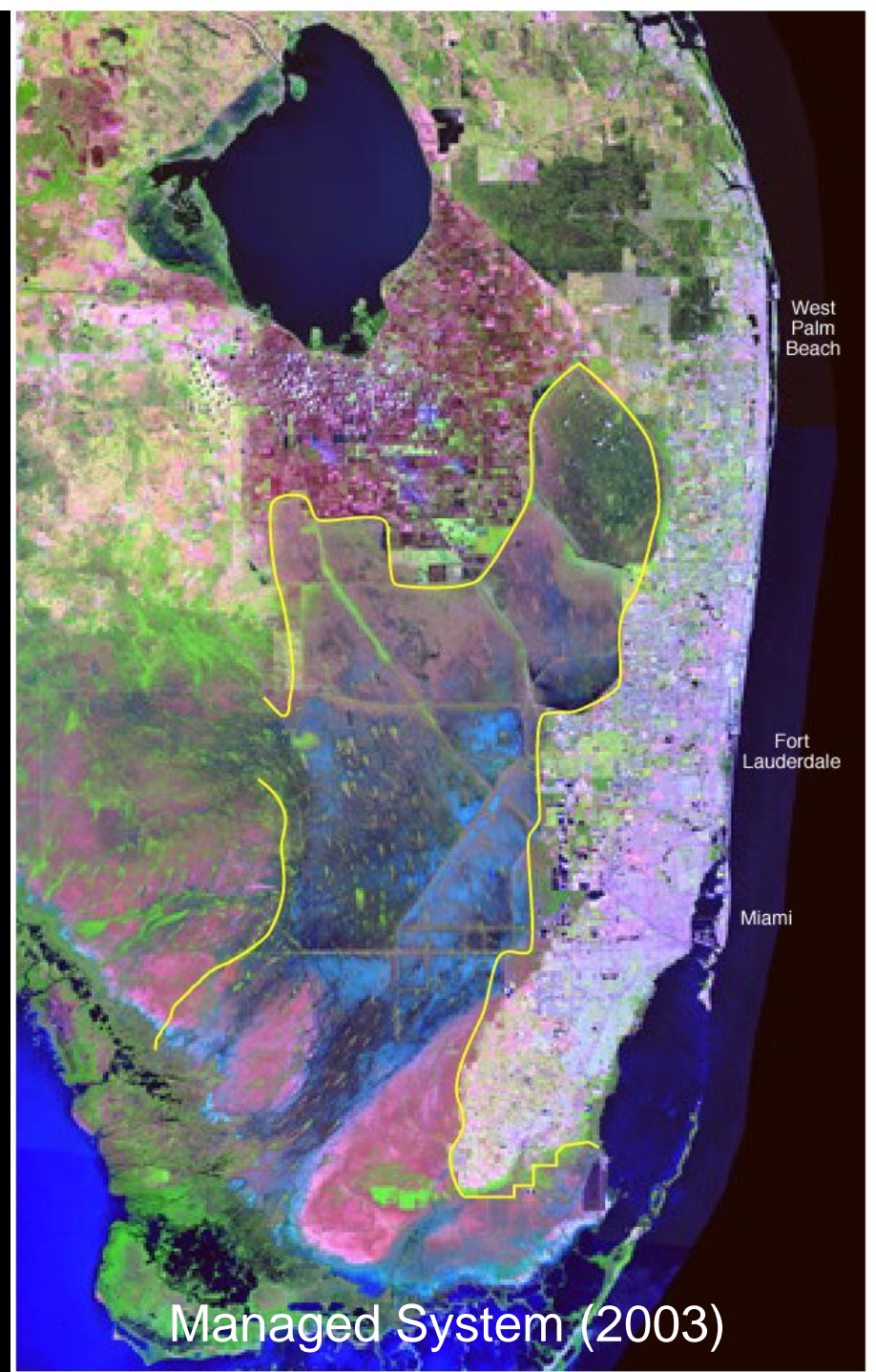
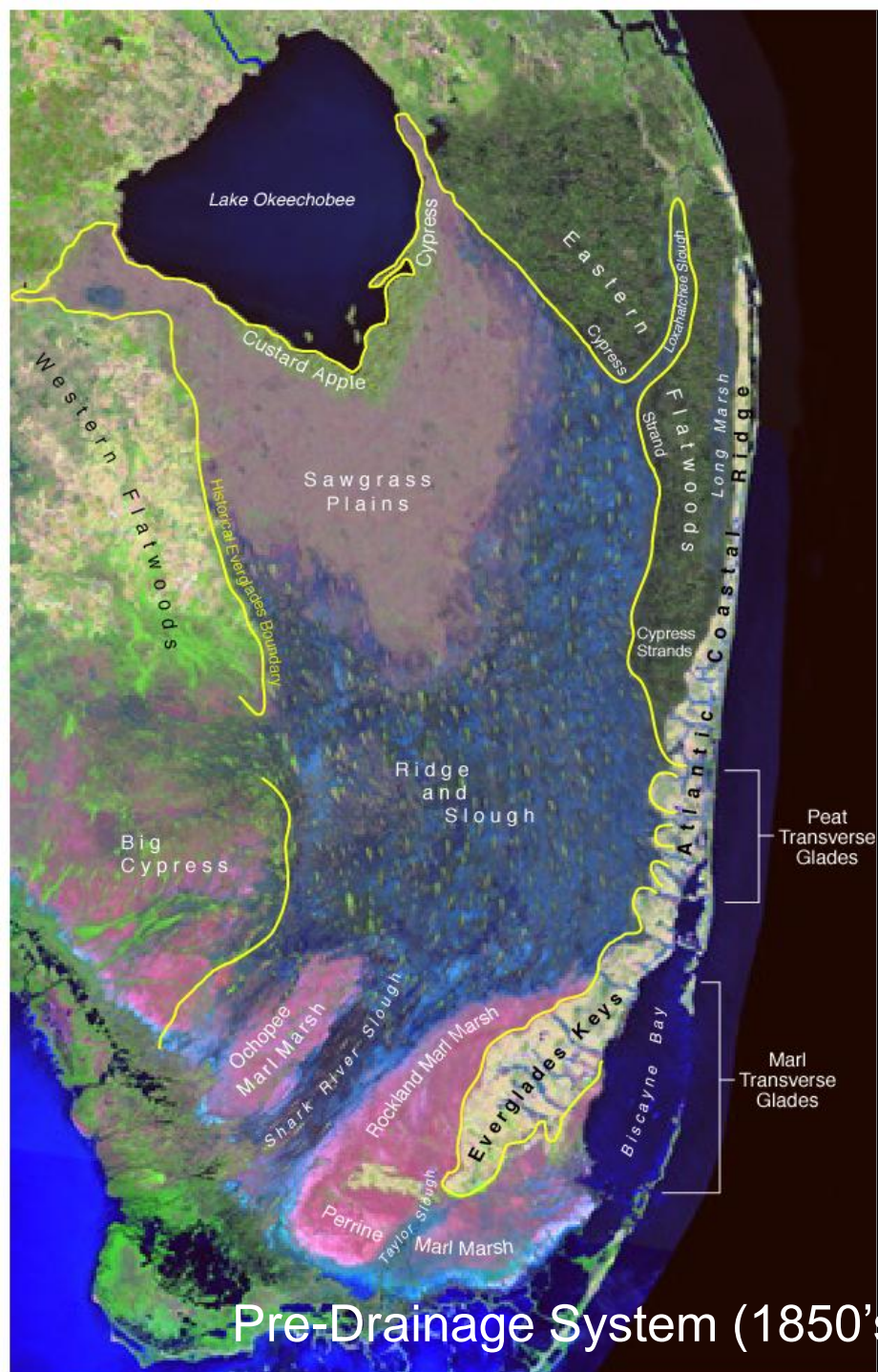


# **Everglades Stormwater Treatment Areas:**

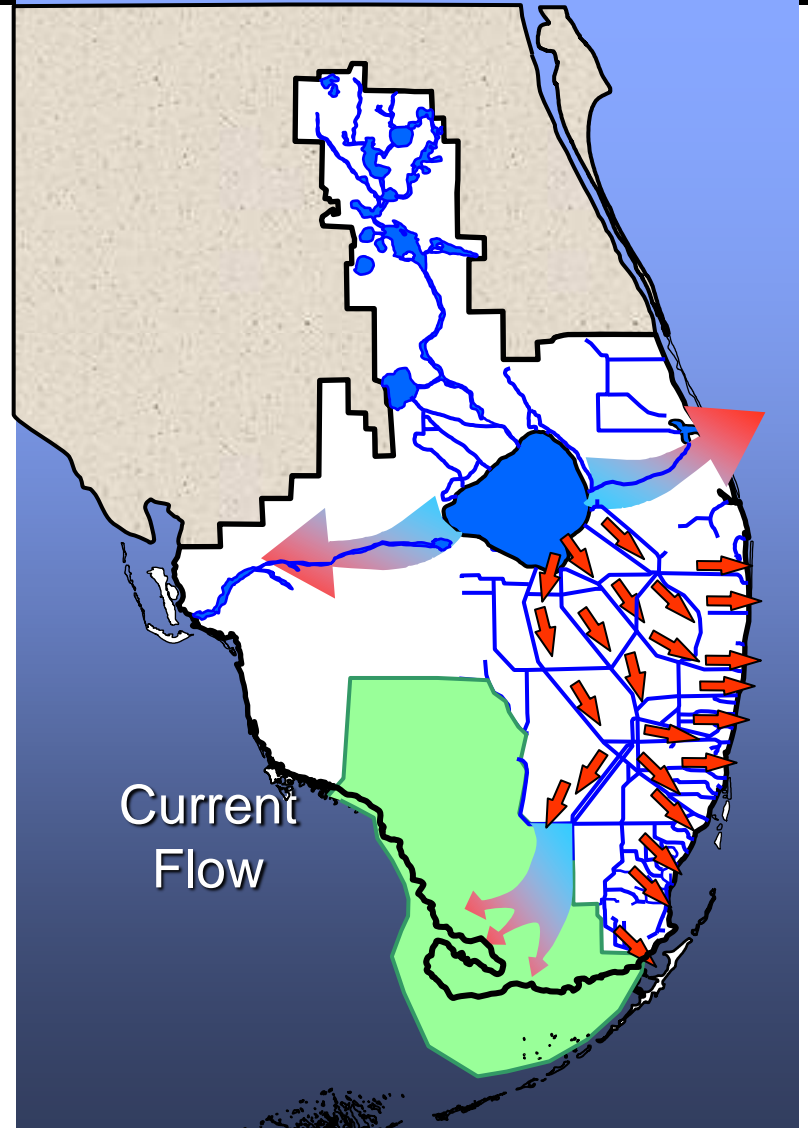
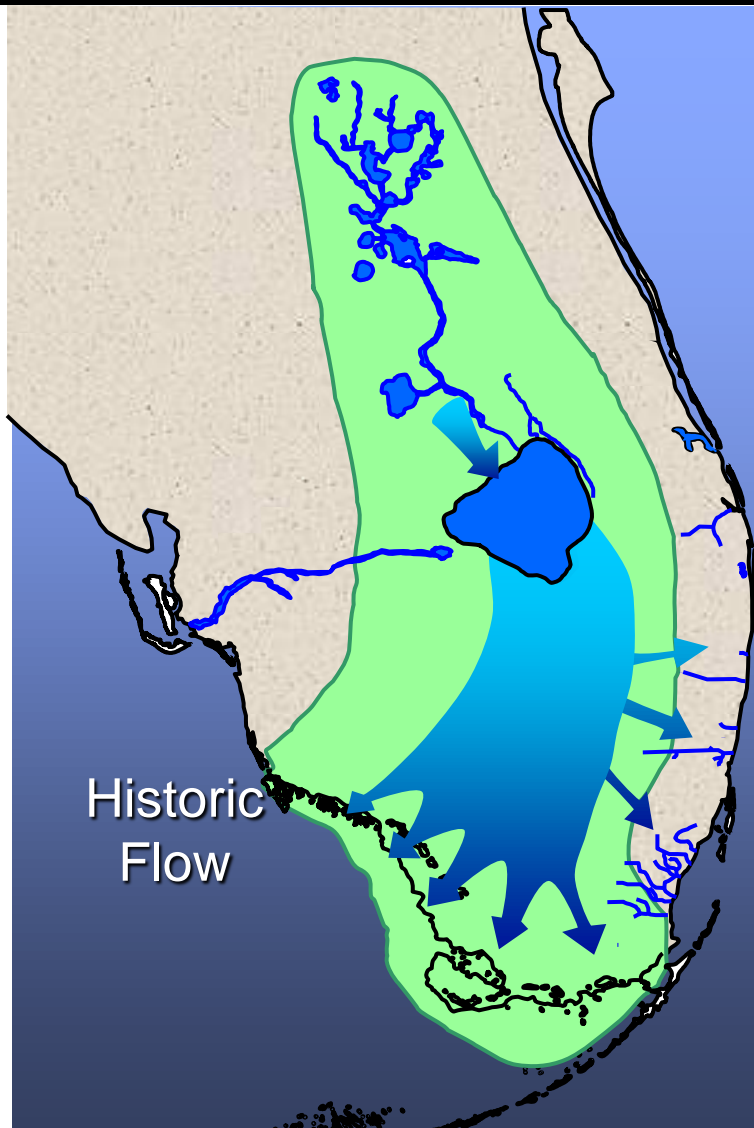
**Two Decades of Integrating Science and Engineering  
for Restoration -  
A Story of Litigators and Alligators**

**National Conference on Ecosystem Restoration Baltimore,  
Maryland  
August 1, 2011**

*Jeremy C. McBryan, Tracey T. Piccone, and Lawrence R. Gerry  
South Florida Water Management District, West Palm Beach, FL*



# Hydrologic Changes



# Consequences of Current System

- Degradation of water quality
- Too much or too little water for the Everglades ecosystem
- Massive reductions in wading bird populations
- Repetitive water shortages and saltwater intrusion
- Declining estuary health
- An average of 1.7 billion gallons of water a day wasted to tide due to lack of storage capacity



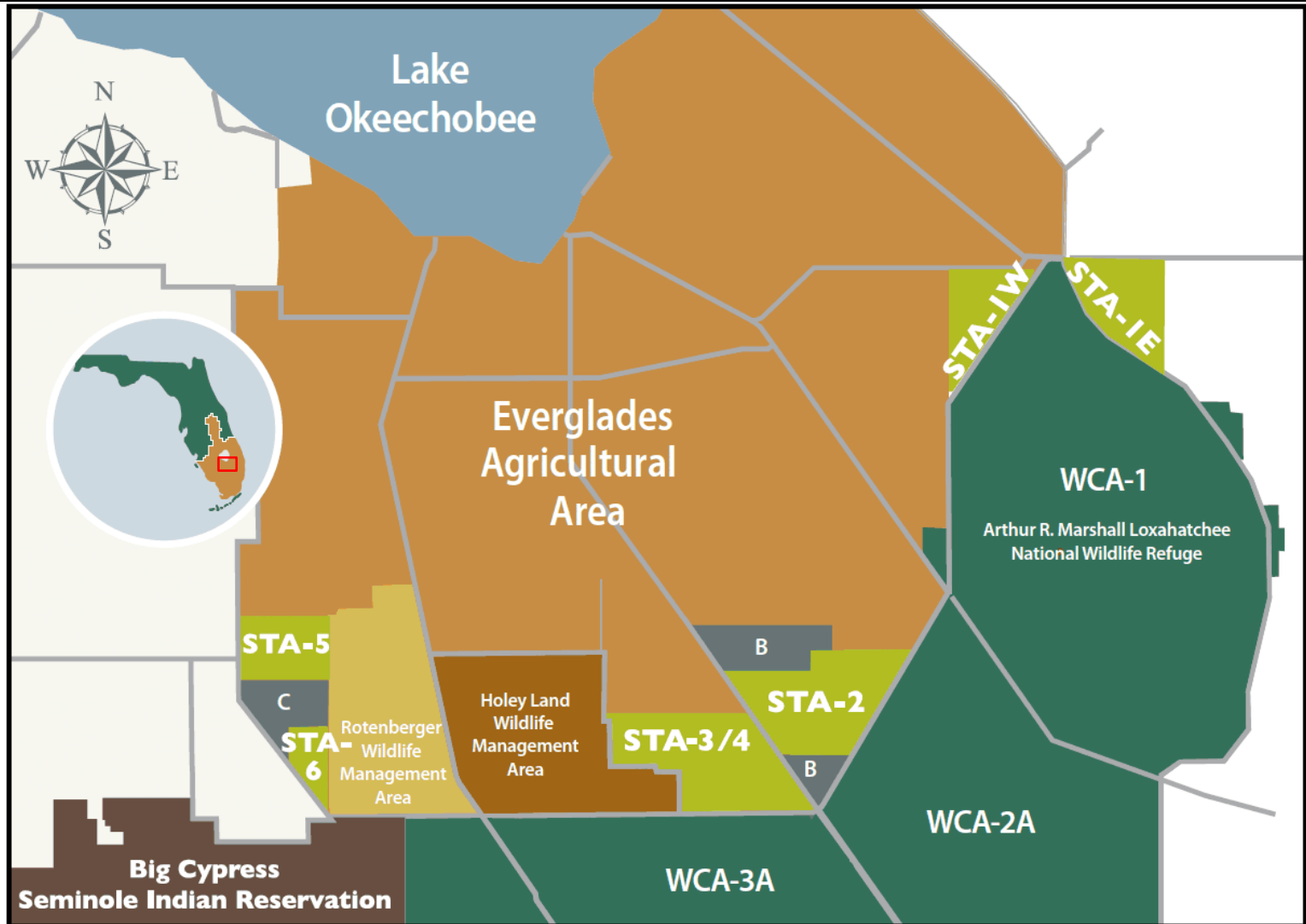
**1988 Federal Lawsuit – initiated the saga of “Litigators and Alligators”**

# Everglades Forever Act 1994

## Florida Legislature

- Build man-made wetlands (Stormwater Treatment Areas) to clean water entering Everglades
- Implement BMPs
- Established funding mechanism
  - Taxes on agriculture
  - Dedicated property taxes
- South Florida Water Management District constructed 56,500 acres of treatment wetlands

# Everglades Stormwater Treatment Areas



Areas in gray marked with a "B" or "C" represent the current expansion of existing Stormwater Treatment Areas

# STAs Require Management, Analysis and Maintenance



- Highly managed and maintained wetlands
  - Field staff: operations, maintenance, vegetation management
  - Part of flood control system with 24/7 operations
  - 25 pump stations and 300 water control structures
  - Continuous monitoring of water quality, water levels and flow data to optimize performance
  - Scientists, engineers, and operators attend weekly, bi-weekly and monthly communication and coordination meetings

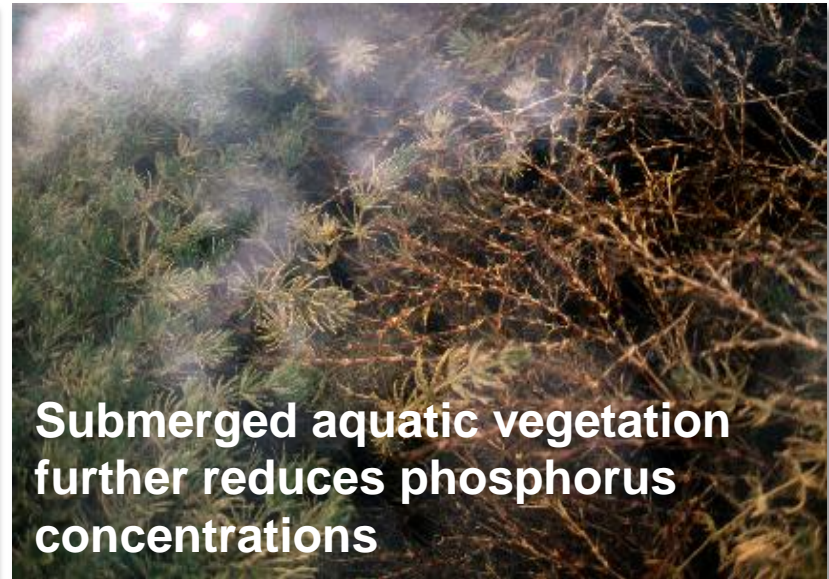


# Vegetation: The Foundation of Treatment

**Emergent vegetation  
provides initial treatment**



**Submerged aquatic vegetation  
further reduces phosphorus  
concentrations**



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





# Optimization Research

**Over \$50 million spent on optimization research since 1994**



- Cattail Flood Tolerance Study
- Cattail Drought Study
- Vegetation Management Strategies
- Field trials of different types of vegetation to improve sustainability
- Pre- and Post-Rehabilitation Monitoring

# Compartmentalization and Enhancements



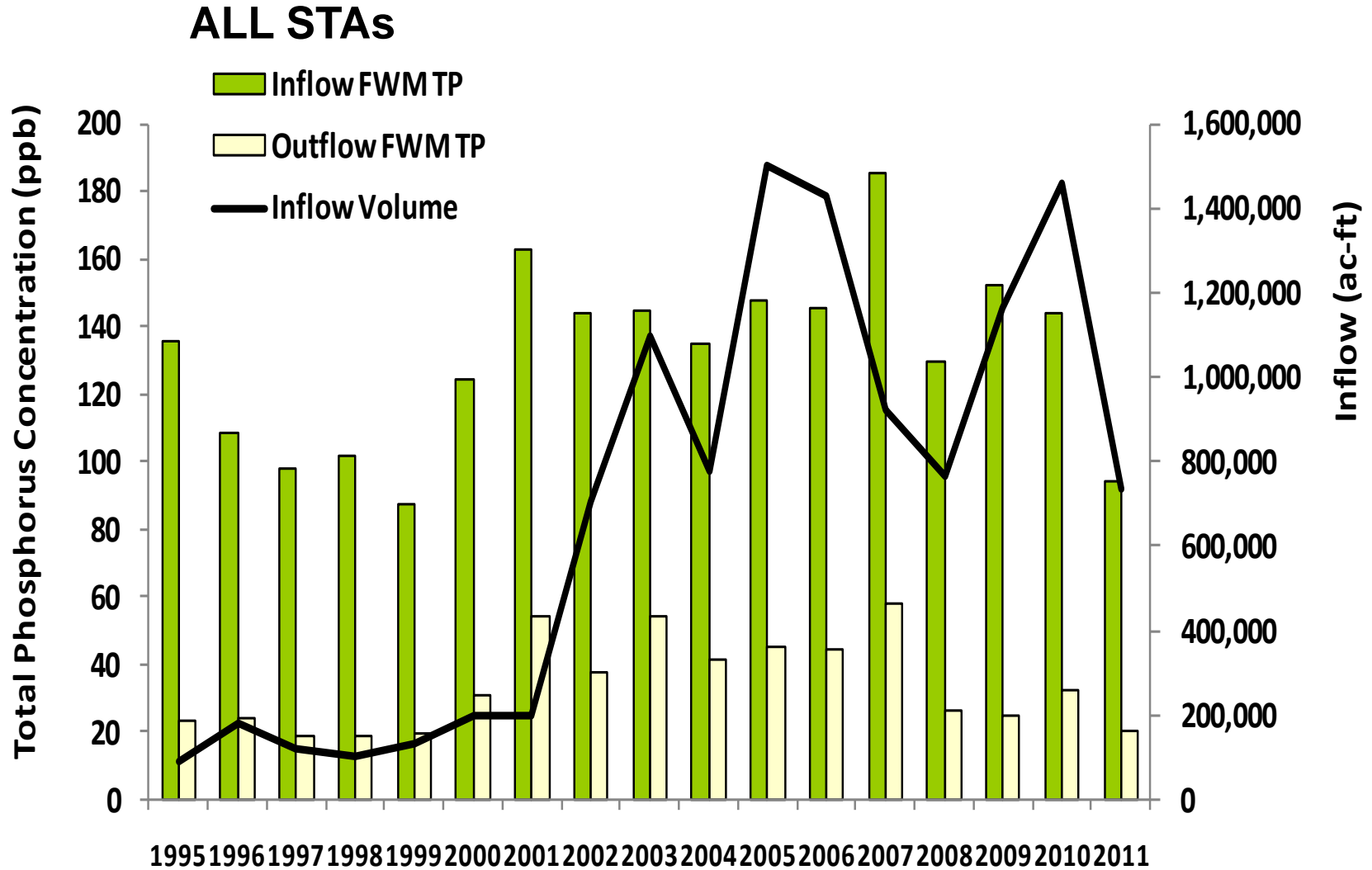
# Compartmentalization and Enhancements (cont.)



# STA Treatment Performance

- Water Year 2011 (May 1, 2010 – April 30, 2011):
  - Received 735,000 acre-feet of water
  - Provided 79% reduction in phosphorus load
  - Average inflow phosphorus concentration: 94 ppb
  - Average outflow phosphorus concentration: 20 ppb
- Since 1994:
  - Approximately 1,470 metric tons of phosphorus have been retained in the STAs that would have otherwise entered the Everglades
- STA-3/4 has discharged water with phosphorus levels as low as 13 ppb on an annual average

# STA Performance is Variable



# Factors Affecting STA Performance

- Antecedent land use
- Inflows
  - Chemistry (hardness)
  - Phosphorus concentrations
- Vegetation composition
- Soil type
- Topography
- Size / shape
- Hurricanes, floods, droughts
- Enhancement activities
- Regional operations
- Endangered Species and Migratory Birds



# Capital and Operating Costs

- Capital: ~ \$10,000 - 30,000 per acre
  - Includes land, design, construction
- Operation, Maintenance and Monitoring (OMM): \$400 - 550 per acre per year
- Total OMM costs to date: > \$125 million
- Total Capital and OMM costs to date: > \$1.2 billion



# Ongoing Challenges

- Elusive Water Quality Goal
- STAs are integral components of a complex water management system – too much water, too little water
- Continued STA expansion requires more supplemental water in droughts
- Science is still being developed to understand factors affecting STA sustainability and long-term performance





# Ongoing Challenges (cont.)

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





A large group of alligators is seen swimming in a body of water, likely a swamp or marsh. The alligators are dark in color and their heads and backs are visible above the water. The water is a light, greyish-blue color. There are some green plants and grasses scattered throughout the water.

**Questions?**