LQER

LAKE OKEECHOBEE & ESTUARY RECOVERY

Working Group Meeting
April 21, 2006

Susan Gray, Ph.D.

LOER Components and District Lead Responsibilities

- **Lake Okeechobee Fast Track Projects**
- Revise Lake Okeechobee Operating Schedule (will require significant District support)
- Set TMDLs for tributaries
- Mandatory fertilizer BMPs
- **ERP Revisions**
- **Alternative storage / disposal of excess surface water**
- Innovative land use planning
- Eliminate land application of wastewater treatment residuals
- **Lake Okeechobee Protection Program**
- **CERP Lake Okeechobee Watershed Project**

Lake Okeechobee and Estuary Recovery

- All LOER components are progressing
- At the request of the Governing Board in January, additional efforts have been incorporated including:
  - In-lake nutrient removal options
    - Marsh flow-ways
    - Sediment removal
  - Implement ASR
  - Feasibility of deep well injection

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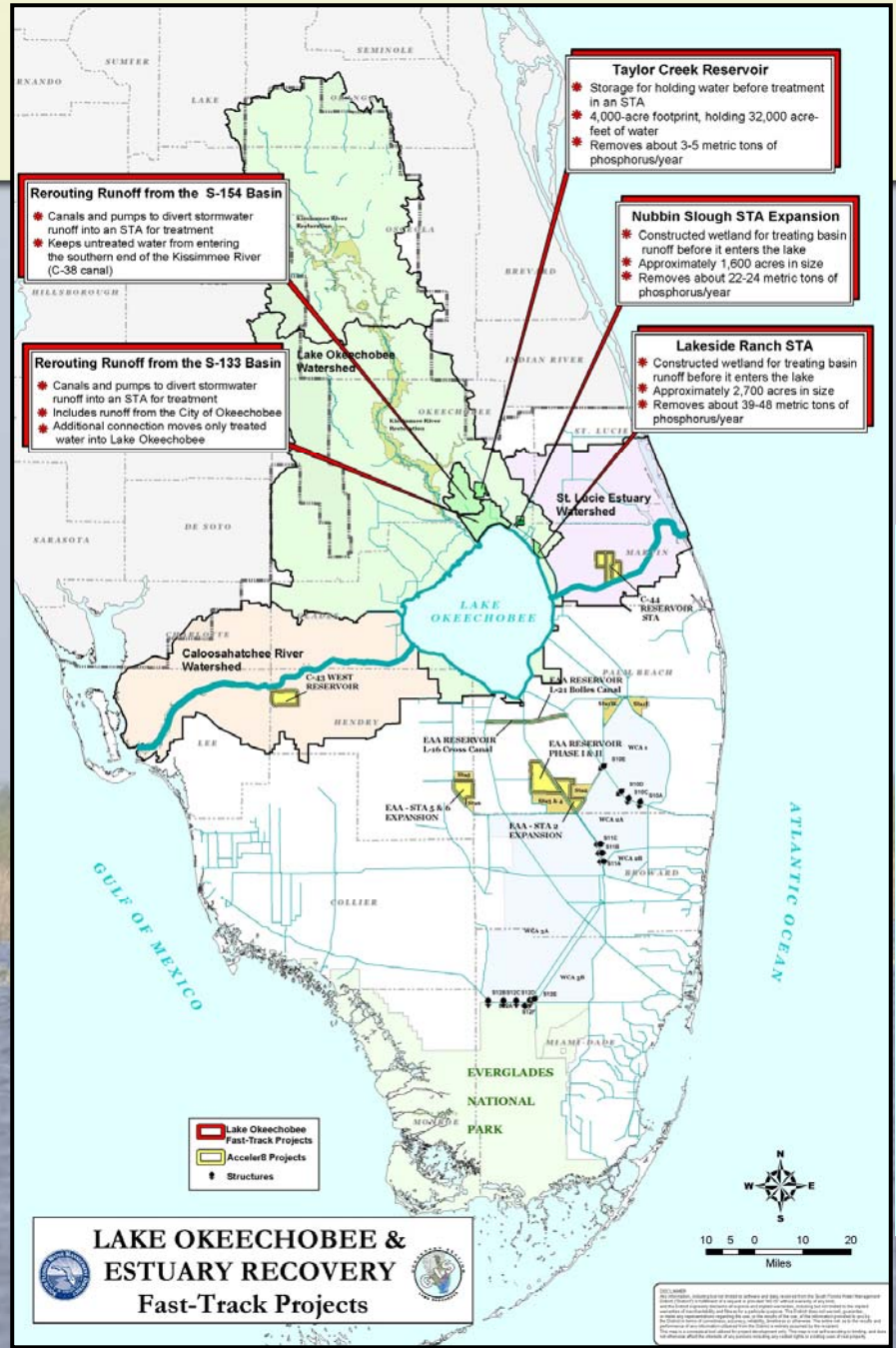

Lake Okeechobee Fast-Track Projects

5 construction projects north of Lake Okeechobee:

- **Nubbin Slough STA Expansion**
- **Taylor Creek Reservoir**
- **Lakeside Ranch STA**
- **Rerouting Runoff from the S-133 Basin**
- **Rerouting Runoff from the S-154 Basin**

Lake Okeechobee Fast Track Projects

Completed by May 31, 2006

- Complete design for Nubbin Slough expansion
- Issuance of work order to prepare BODR over the Lakeside Ranch STA, Taylor Creek Reservoir and Re-routing of water for S-154 & S-133 Basins
- Development of Fast Track Project Plan and Schedule

Initiated by May 31, 2006

- Permitting for Nubbin Slough STA expansion
- BODR for re-routing of water from the S-154 basin
- Geotechnical Investigation Program for Taylor Creek Reservoir and Lakeside Ranch STA
- Surveying of Taylor Creek Reservoir and Lakeside Ranch STA
- BODR for permanent forward pumps

Revise Lake Okeechobee Regulation Schedule

Work with U.S. Army Corps of Engineers to revise federal regulation schedule levels

- Achieve a better balance among lake management objectives

Revise Lake Okeechobee Regulation Schedule – USACE lead

Completed by May 31, 2006

- Temporary Forward Pumps bid process
- GB authorization for development of revisions to water shortage plan
- Alternative regulation schedules developed and under review

Initiated by May 31, 2006

- Revise Supply Side Management and water shortage rules
- Purchase temporary forward pumps and prepare installation sites

Revise ERP Criteria

Supplement the Environmental Resource Permit (ERP) criteria to better address the water quality impacts due to new development and land-use changes within the Kissimmee, Lake Okeechobee, Caloosahatchee Estuary and St. Lucie Estuary watersheds

Revise ERP Criteria

Completed by May 31, 2006

- GB authorization for development of revisions to ERP rule

Initiated by May 31, 2006

- Development of P loading methodology for assessing land use changes

Alternative Storage/Disposal of Excess Surface Water

- Identify alternative sites on public, private, and tribal lands for moving and storing excess water from the lake and its tributary basins to help reduce high discharge volumes to the estuaries

- Assess feasibility of deep well disposal and ASR options for Taylor Creek and the Brighton Reservation

Alternative Storage/Disposal of surface water

Completed by May 31, 2006

- Completed assessment of public land storage
- Lykes Basinger Groves water storage pilot – pump installed and operational 1/27/06
- Complete conceptual designs and cost estimates for public land water storage (multiple sites including Avon Park Bombing Range, Kissimmee Prairie State Park)
- Complete evaluation of cost-effectiveness of water storage options
- Seminole Brighton 800 ac. reservoir/STA conceptual design

Initiated by May 31, 2006

- Seminole Brighton 800 ac. reservoir/STA final design
- Construction of 4 pilot water storage facilities on private lands
- Assessment of private and tribal lands for potential water storage
- Feasibility study of deep well injection (work order under negotiation)
- Feasibility study of re-activation of Taylor Creek ASR well (work order under negotiation)
- Siting evaluation for construction of a 10 ASR well system (work order under negotiation)
- Siting and conceptual design of the Brighton Reservation ASR well (conducted by the Seminole Tribe)

Continued Implementation of the LOPP & CERP LOWP

Comprehensive, phased approach already under way to reduce phosphorus loadings and provide water storage to the lake by 2015

Continued Implementation of the LOPP & CERP LOWP

Completed by May 31, 2006

- Nubbin Slough Pilot STA (6.5 mt P reduced;1600 ac. ft. storage)
- Taylor Creek Pilot STA (2.8 mt P reduced;480 ac. ft. storage)
- Over 35 projects in the northern watershed for a combined load reduction of approximately 90 tons and storage of approximately 40,000 ac. ft.

Initiated by May 31, 2006

- Acquisition of lands for Lemkin Creek urban STA
- Re-mapping of lake sediments (work order under negotiation)

Ongoing projects

- BMP implementation on agricultural and urban areas (with FDACS and FDEP)
- CERP Lake Okeechobee Watershed Project PIR

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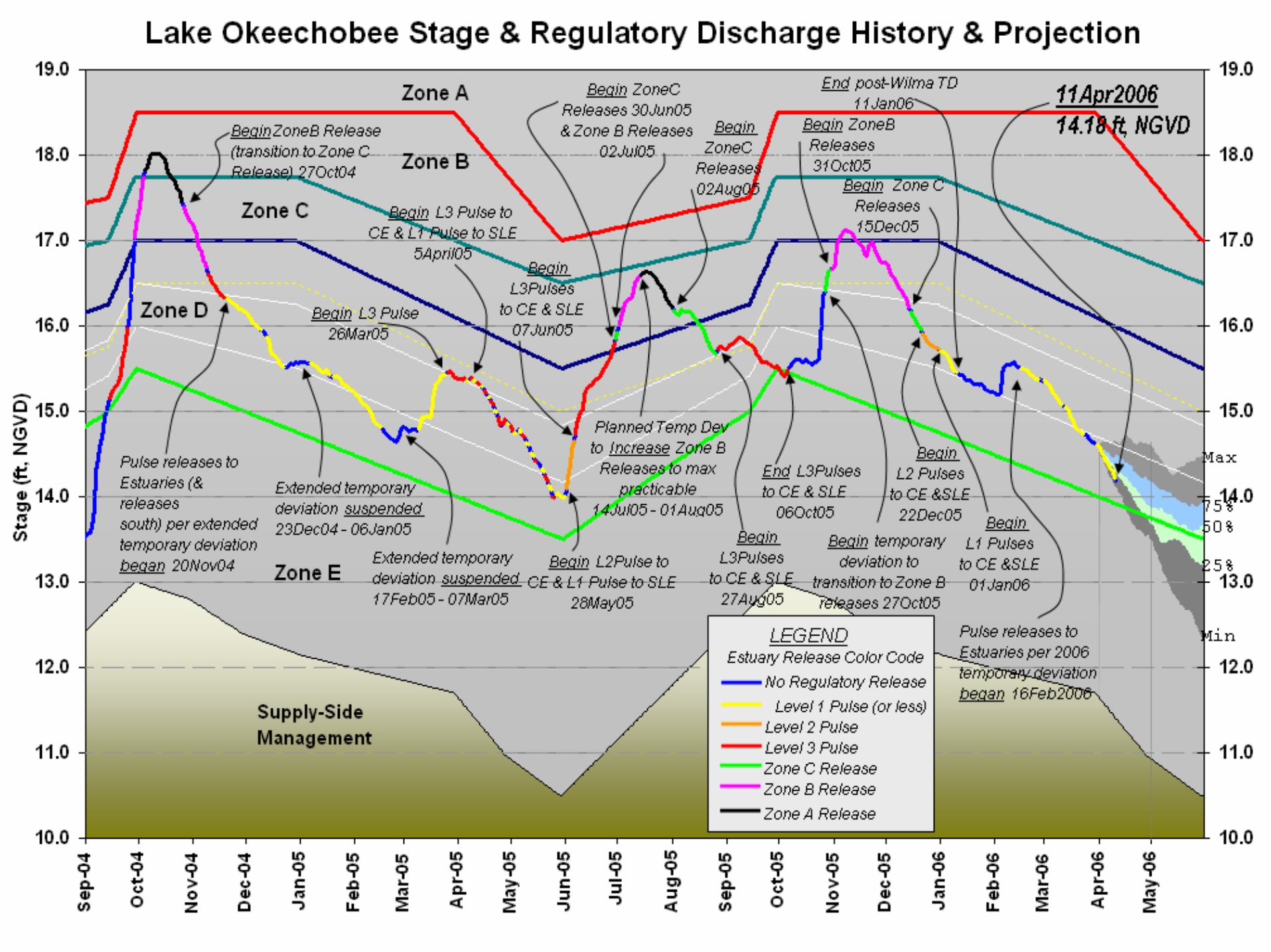
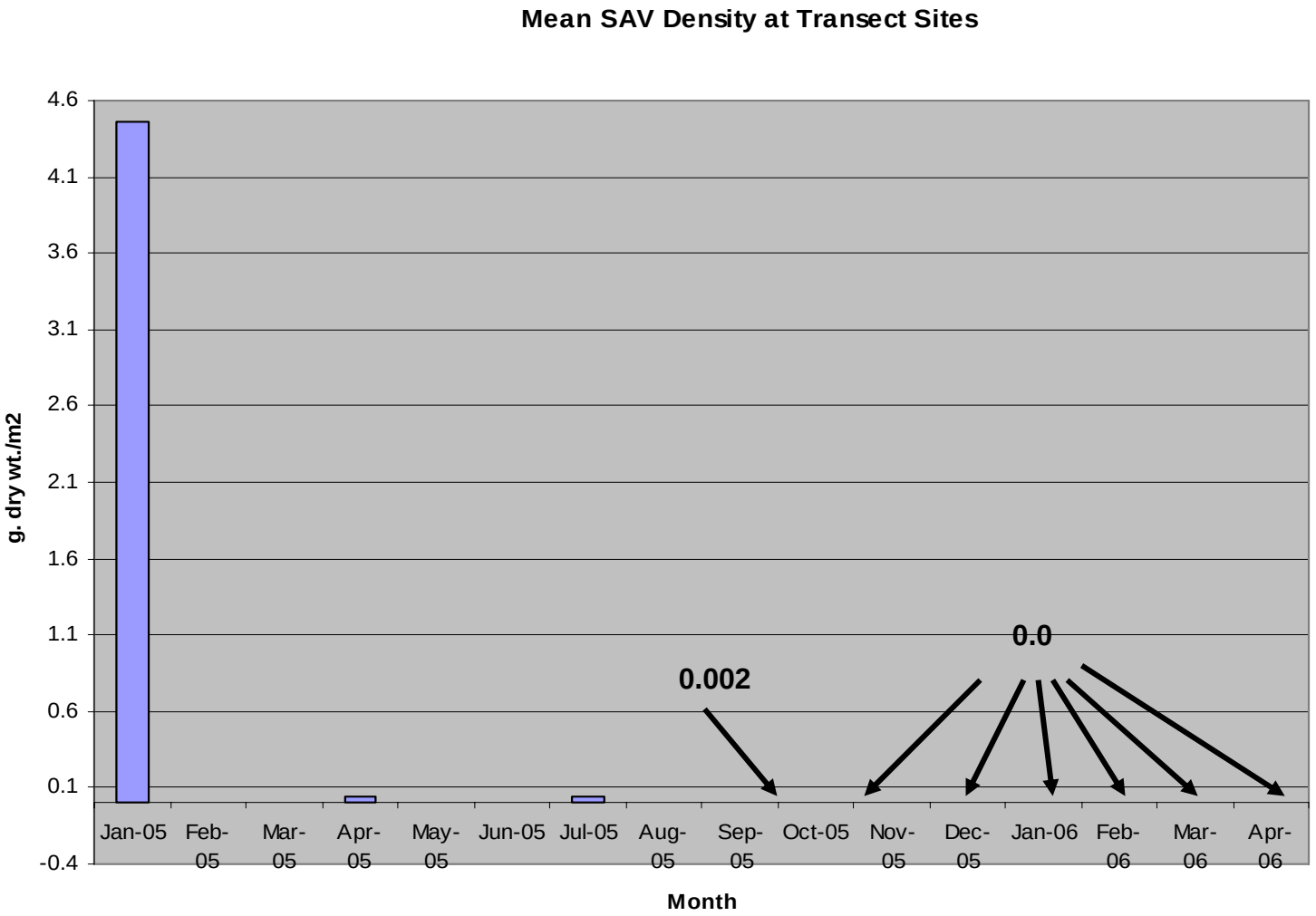
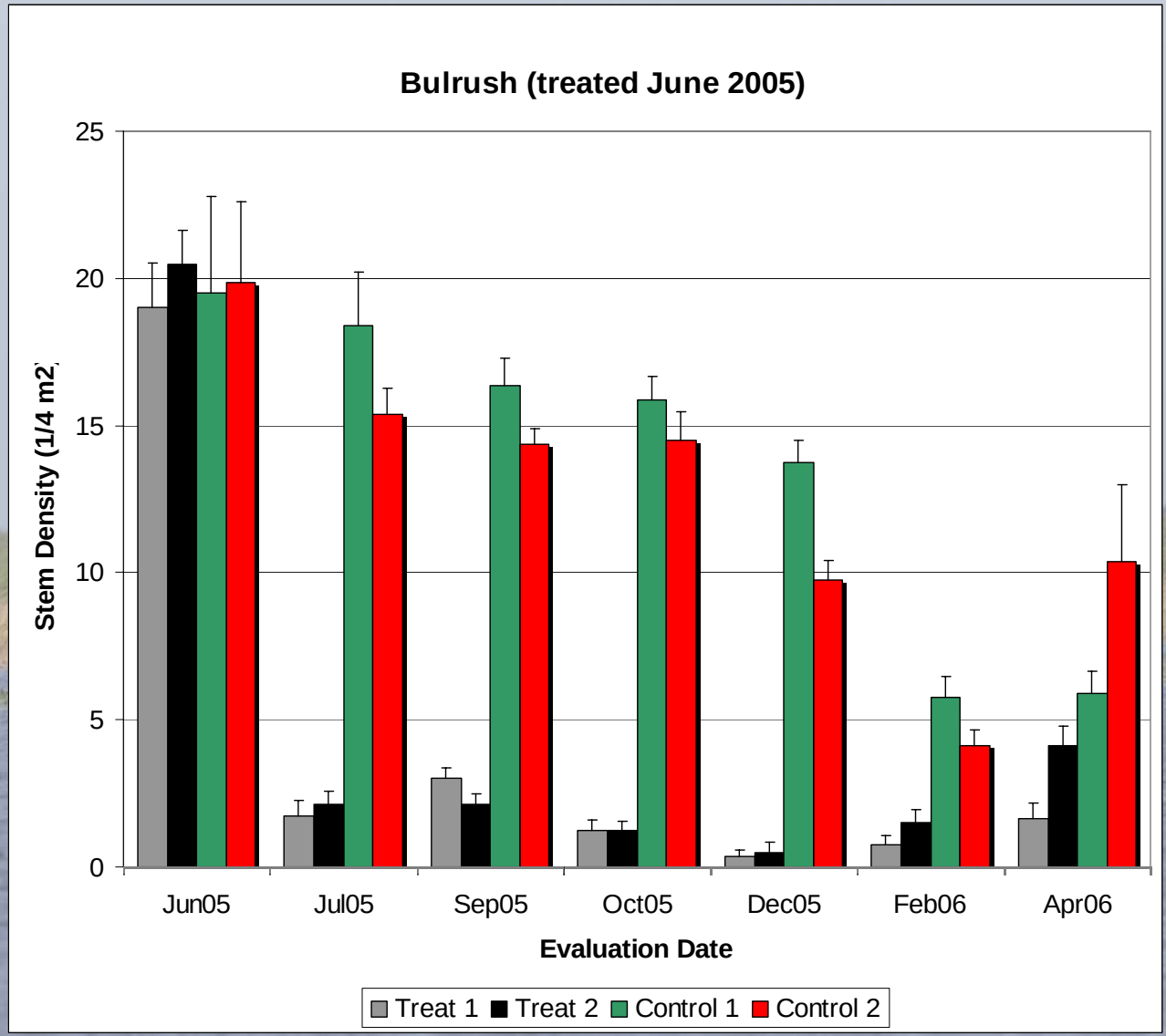
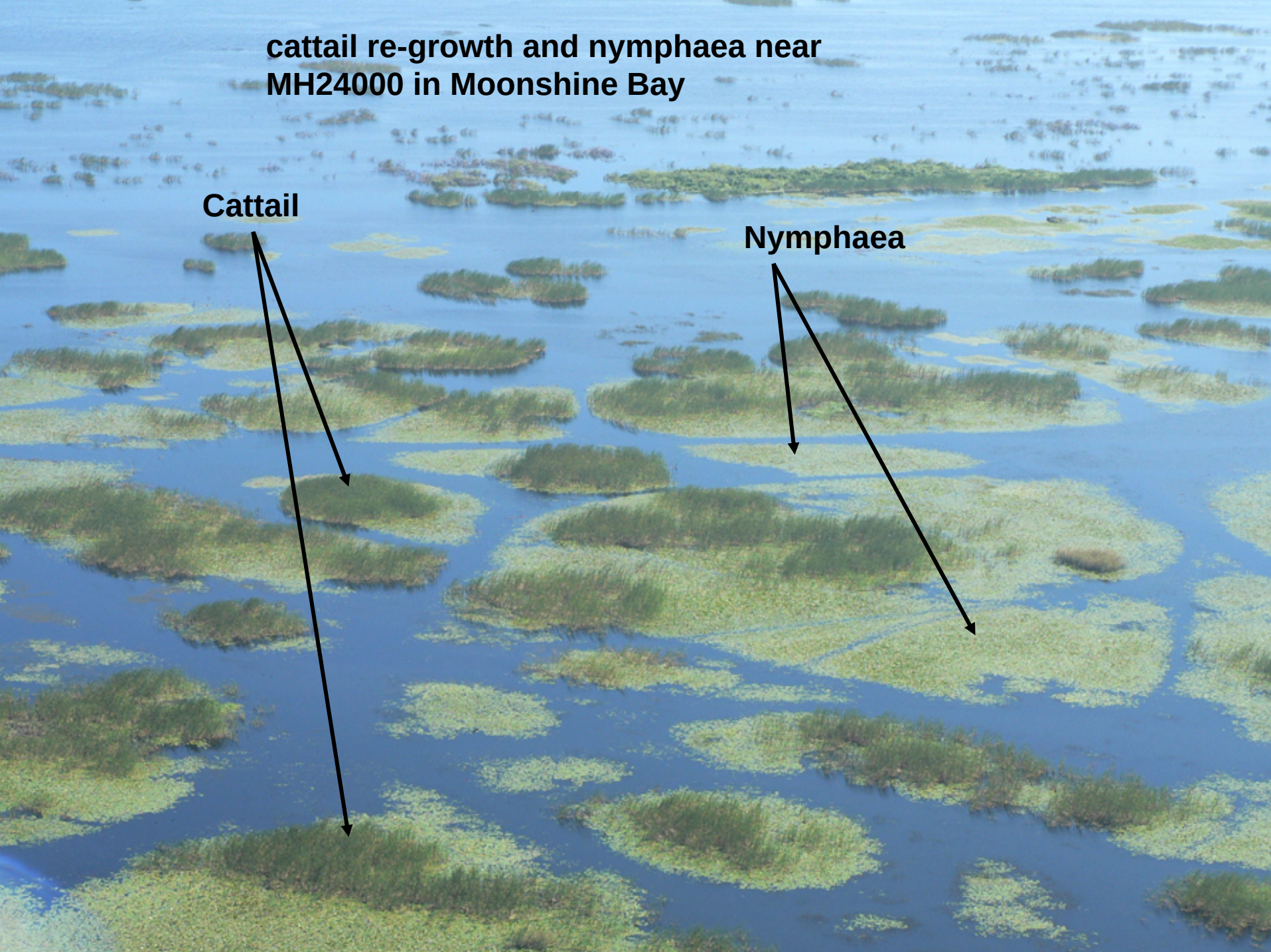
Okeechobee


Lake Okeechobee Stage & Regulatory Discharge History & Projection
Stage (ft, NGVD)
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
Sep-04
Oct-04
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Zone A
Zone B
Zone C
Zone D
Zone E
Supply-Side Management
11Apr2006
14.18 ft, NGVD
Max
75%
50%
25%
Min
Begin ZoneB Release (transition to Zone C Release) 27Oct04
Begin ZoneC Releases 30Jun05 & Zone B Releases 02Jul05
Begin ZoneC Releases 02Aug05
End post-Wilma TD 11Jan06
Begin ZoneB Releases 31Oct05
Begin Zone C Releases 15Dec05
Begin L3 Pulse to CE & L1 Pulse to SLE 5April05
Begin L3Pulses to CE & SLE 07Jun05
Begin L3 Pulse 26Mar05
Planned Temp Dev to Increase Zone B Releases to max practicable 14Jul05 - 01Aug05
End L3Pulses to CE & SLE 06Oct05
Begin L2 Pulses to CE &SLE 22Dec05
Begin L1 Pulses to CE &SLE 01Jan06
Pulse releases to Estuaries (& releases south) per extended temporary deviation began 20Nov04
Extended temporary deviation suspended 23Dec04 - 06Jan05
Extended temporary deviation suspended 17Feb05 - 07Mar05
Begin L2Pulse to CE & L1 Pulse to SLE 28May05
Begin L3Pulses to CE & SLE 27Aug05
Begin temporary deviation to transition to Zone B releases 27Oct05
Pulse releases to Estuaries per 2006 temporary deviation began 16Feb2006
LEGEND
Estuary Release Color Code
No Regulatory Release
Level 1 Pulse (or less)
Level 2 Pulse
Level 3 Pulse
Zone C Release
Zone B Release
Zone A Release

Submerged Aquatic Vegetation




Bulrush (treated June 2005)
Stem Density (1/4 m2)
25
20
15
10
5
0
Jun05
Jul05
Sep05
Oct05
Dec05
Feb06
Apr06
Evaluation Date
Treat 1
Treat 2
Control 1
Control 2


cattail re-growth and nymphaea near MH24000 in Moonshine Bay
Cattail
Nymphaea

Evaluation of new water quality treatment technologies

- On-going inquiries from outside vendors on the applicability of their technologies for water quality improvement

- District staff request data and/or documentation of performance and cost effectiveness through a Standard of Comparison process

In-Lake Restoration Efforts

Completed Projects

- Torry Island Restoration
- Pond Apple Planting
- Northwest Shore Berm Removal
- Pilot Dredging Study
- Sediment Management Feasibility Study

Next Steps – per Governing Board Direction

- Re-mapping of sediments
- Investigation of new technologies

Sediment Management Feasibility Study

- Examined 35 different management options to stabilize or remove sediments from the Lake
- Study focused on whole lake management
- Incorporated results of pilot dredging study

Sediment Management Feasibility Study Findings - 2003

Strategy	Benefit	Cost (2001 Dollars)	Comments	Recommendation
No In-Lake Action	Goal Reached in 50 to 70 years	No in-Lake costs	Must achieve The TMDL by 2015	Recommended course of action
Alum Addition	Goal Reached in 20 years	$500 Million	Unless TMDL is reached and maintained, will have to re-treat	Re-evaluate if the lake does not respond to external load reductions
Whole Lake Dredge	Goal reached in 50 to 70 years	$3 Billion	No significant Improvement over No In-Lake Action Strategy	Not Effective

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Next Steps- Lake Okeechobee Sediment Quality Mapping

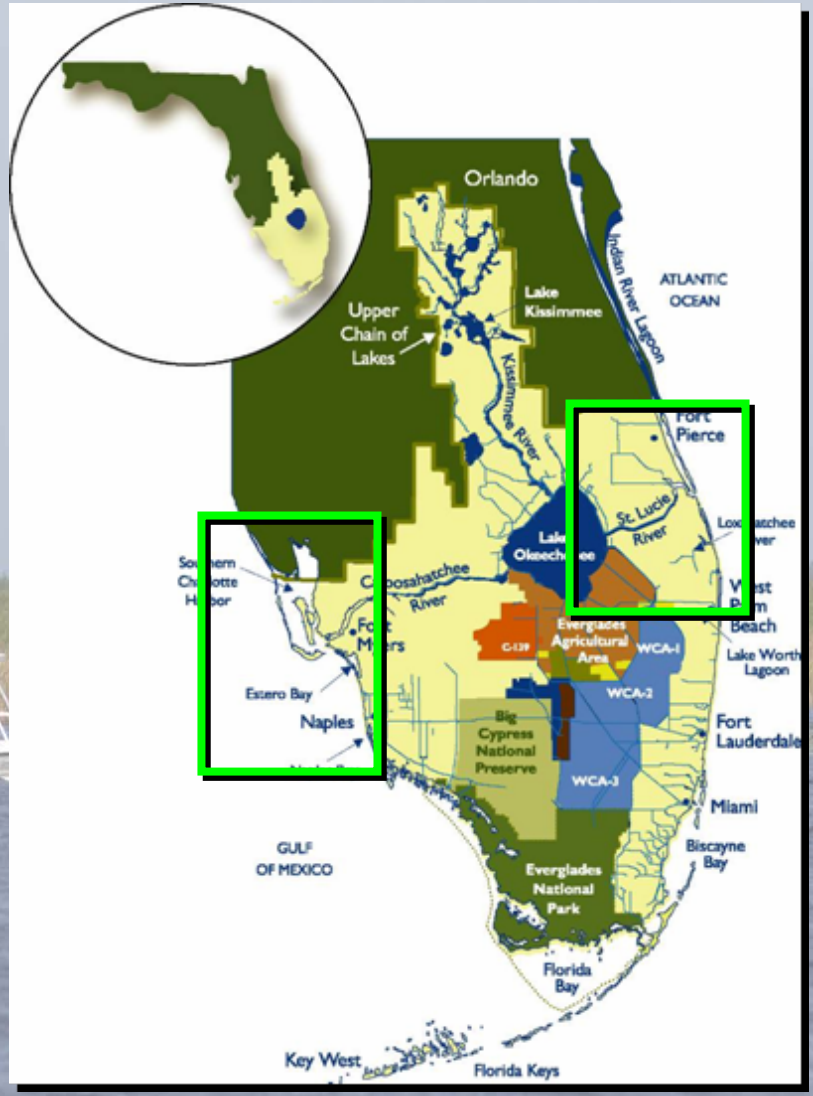
What are impacts of 2004 and 2005 hurricanes and continued excess P loading?

- Determine the extent and change in mud sediments throughout Lake Okeechobee
- Determine pools and forms of phosphorus and nitrogen in the sediments
- Determine extent and change of sediment nutrients throughout Lake Okeechobee

Next Steps - Mud Sediment Spot Dredging for Habitat Enhancement

- **Locate areas of mud sediment in littoral or nearshore region**
  - Identify suitable shallow, muddy, isolated areas (currently underway)
  - Map mud sediments
- **Identify new technologies – 7 inquiries to date**
- **Habitat Enhancement Study**
  - Establish baseline conditions for plants and benthic animals
  - Conduct sediment removal
  - Determine influence of sediment removal on plants and animals over time

St. Lucie and Caloosahatchee Estuaries



Lake Operations

High regulatory releases from Lake Okeechobee to the St. Lucie and the Caloosahatchee were terminated on January 12.

A series of 4 level 1 pulses have been made to both estuaries beginning on 2/16, 3/1, 3/13, 3/31

St. Lucie Estuary

- Salinity conditions in the estuary are good. Salinities at the US1 and A1A Bridges are within the preferred envelopes.
- Water clarity has improved significantly and is not limiting seagrass growth near the St. Lucie Inlet.
- Seagrasses in the vicinity of the St. Lucie Inlet remain sparse. Some new growth has been observed.
- No live oysters have been found upstream of the A1A Bridge.

Caloosahatchee Estuary

- Salinity conditions are good throughout the estuary and San Carlos Bay and the 30-day average discharge at S-79 is within the preferred range.
- Water clarity has improved and is not limiting to seagrass growth in the lower estuary or San Carlos Bay. Turbidity remains high in the upper estuary.
- The density of tape grass in the upper estuary and seagrasses in the lower estuary and San Carlos Bay remain sparse. Seagrasses have begun to produce new blades.
- No live oysters have been found upstream of Shell Point. Those located further downstream have survived. These populations typically begin to reproduce in May.

Conclusion

- Environmental conditions in both estuaries have improved since high freshwater discharges stopped.
- The growing season for seagrasses has begun.
- Recovery of plant and animal communities will continue as long as environmental conditions are favorable.

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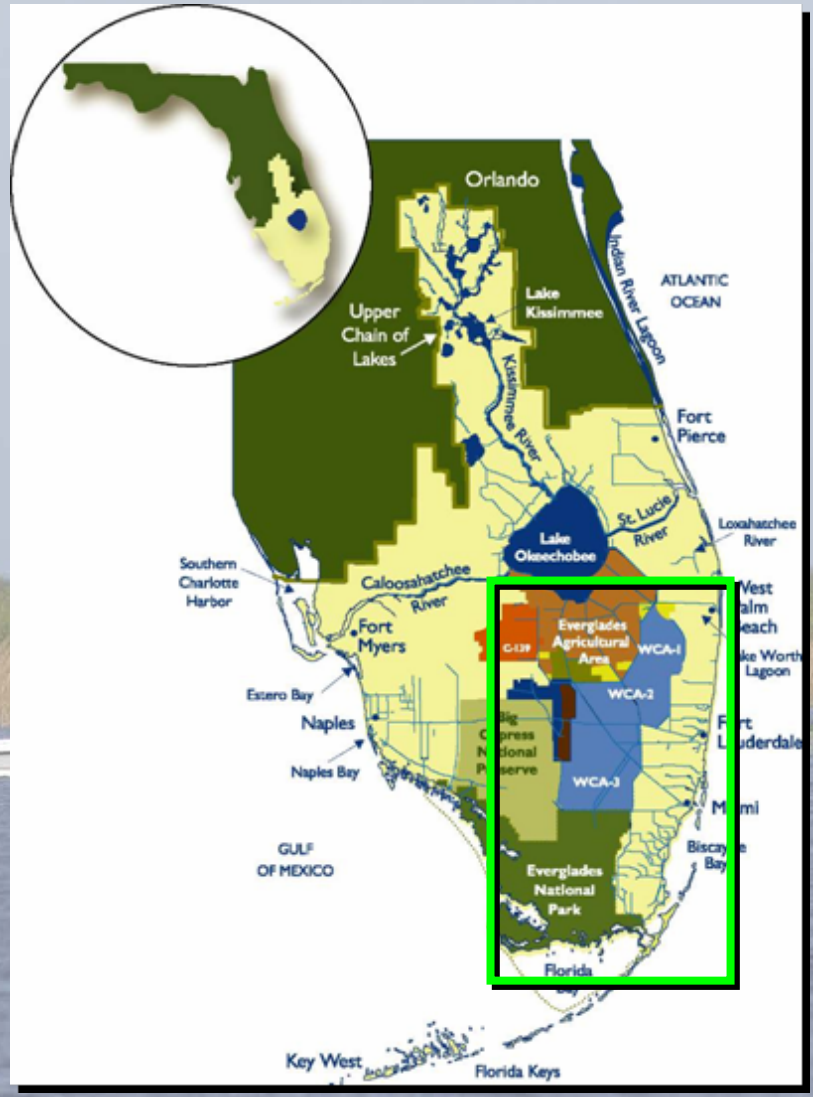
Everglades



Storage in the EAA: Is It Feasible ?

- **Numerous Issues**
  - Water quantity and quality
  - Socio-economic consequences
  - Financial, legal and engineering questions
- **Do benefits outweigh costs?**
- **Will it help the Lake, the Estuaries or the Everglades ?**
- **What will it cost ?**

Water Quantity Issues

Question:

Why have Lake Okeechobee discharges been so high in recent years?

Answer:

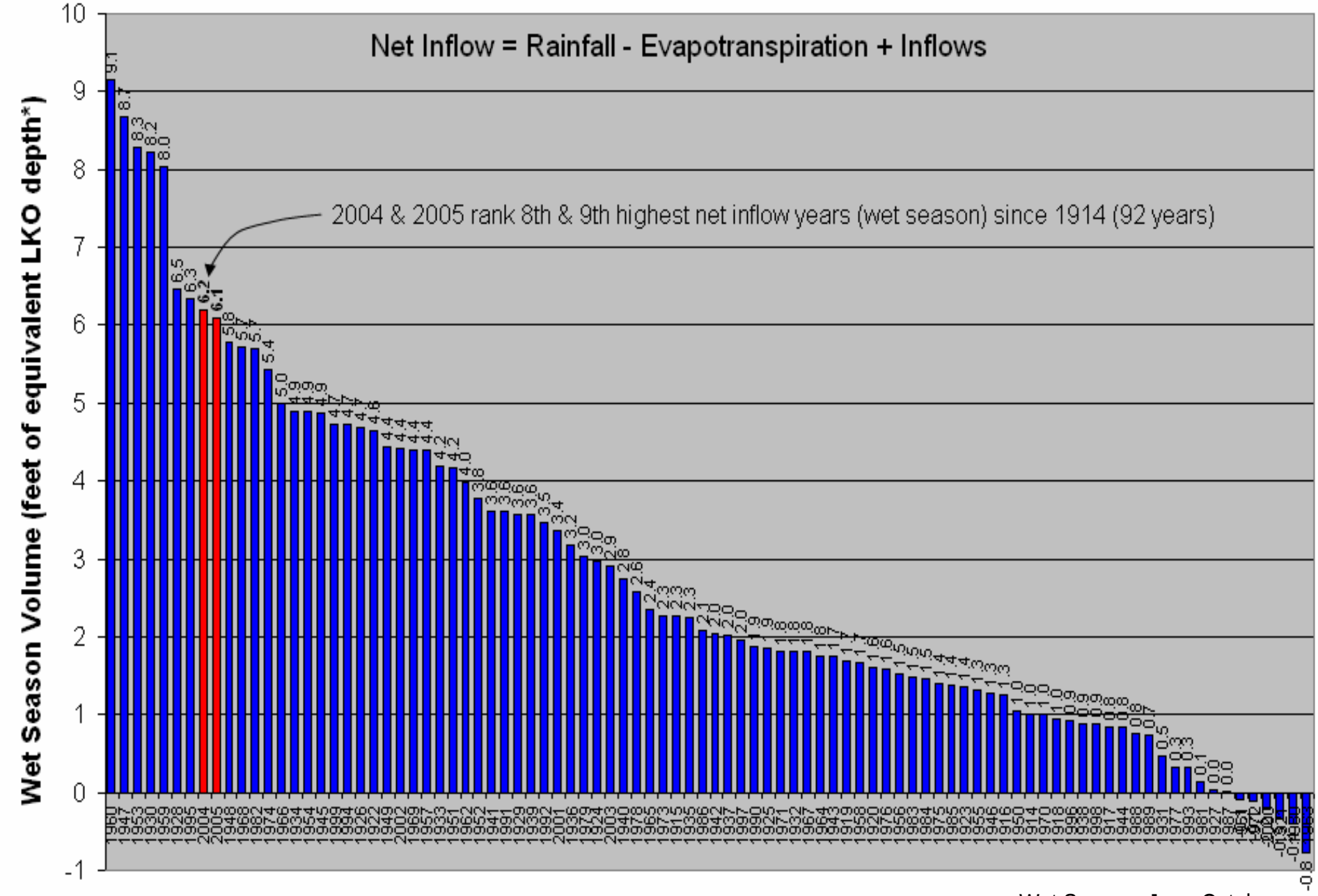
Climate indicators suggest a wet regime has returned to south Florida.

Rainfall during the 2004 & 2005 wet seasons produced very large inflows to Lake Okeechobee

- **Rainfall 13.5” above normal in Upper Kissimmee 2004 & 2005**
- **Inflows 8th & 9th highest since 1914**
- **7 higher years include 1928 & 1947**

By design, large releases from Lake Okeechobee to the estuaries have been required for the last 100 years.

Lake Okeechobee Wet Season Net Inflow



* Volume converted to equivalent depth using area of 467,000 acres

Wet Season: June-October

Flooding the EAA - Summary

An Extremely Expensive Undertaking.

- $4-8 billion for 400,000 acres of productive cane land
- Billions more to reimburse the investment in plant and equipment
- Additional costs to construct and operate water control facilities needed to flood the property

Social Costs Would be Enormous

- Thousands of jobs lost immediately
- Rural communities around the Lake destroyed

Bottom Line

- Huge Social and Economic Cost – Minimal Benefits

So What is the Solution?

- Implement LOER and Acceler8 Projects
- Evaluate additional ideas for storage and treatment north of the Lake and in the Caloosahatchee and St. Lucie watersheds

Water Quality Improvements

Stormwater Treatment Areas:

- Six STAs on-line
- More than 40,000 acres constructed
- STA 3/4 -- largest constructed wetland in world, has treated over 500,000 acre-feet of stormwater

Combined with BMPs, more than 2,200 metric tons of phosphorus removed since 1996

Water Quality Improvements

This past year alone:

Enhanced 11,236 acres of STAs

STAs treated more than 1.5 million acre-feet of stormwater

Water Quality Improvements

STAs achieved 71% phosphorus removal rate in WY2005*

2005 Results:

- 261 tons of phosphorus prevented from entering Everglades (this year)
- Phosphorus reductions in EAA better than double amount required by law

10 year total:

- BMPs: 1600 tons of phosphorus from entering Everglades
- Annual reductions ranged from 34-73% (25% required by law)

*Water Year 2005: May 1, 2004 – April 30, 2005

Opportunities for Local Government Participation

- Implement stormwater utilities and stormwater retrofits
- Assist with BMP implementation for low P fertilizer in urban settings
- Move forward to convert septic systems to central sewers
- Land acquisition for preservation & Restoration

Other Agency Actions

- Implement Modified Water Deliveries
- Removal of sediments and bank stabilization of the C-44
- Retrofit S-308 and S-77 for mid or top water releases