SOUTH FLORIDA WATER MANAGEMENT DISTRICT

WRAC Issues Workshop - Phase I Planning
September 2, 2009

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RESTORATION PLANNING

Recap from August Workshop

- Restoration Concepts
  - Right flows, right depths
  - Storage, Treatment and Delivery
    - Must have adequate storage + treatment
    - Use of new land in EAA
    - Increased spatial extent
    - Store/treat water for existing landscape
- Hydrologic and Ecologic Analysis and Targets
  - Lake Okeechobee, Northern Estuaries, Everglades
- Water Quality Targets and Feature Performance
  - STAs, Reservoirs/Ecoreservoirs, Flowways/Ecosloughs

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Hydrologic, Ecologic, and Water Quality Performance Relationships

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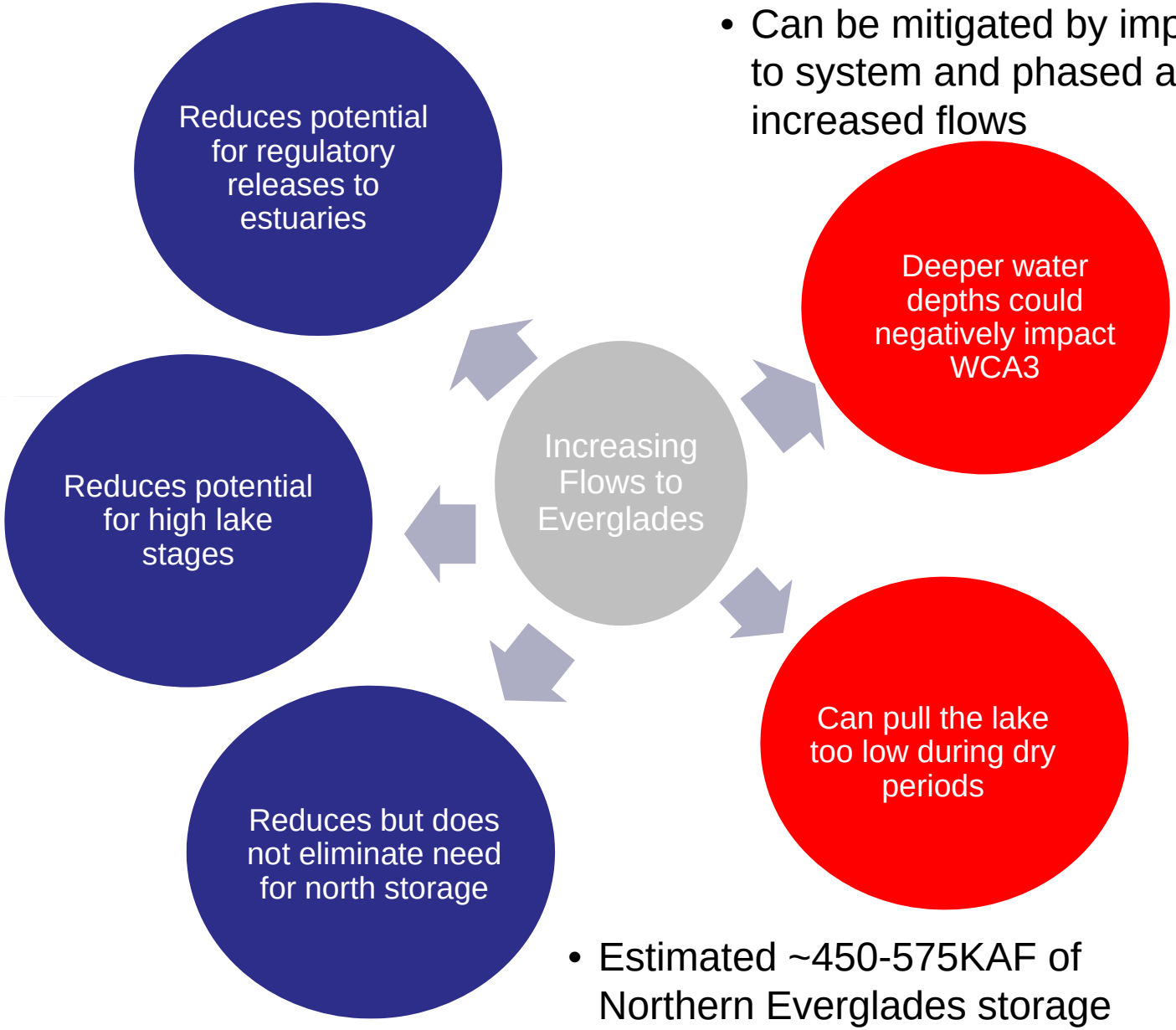
RESTORATION PLANNING

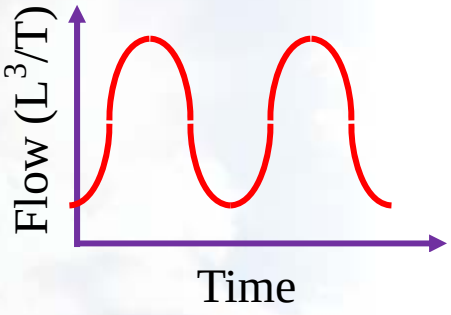
Hydrologic Relationships

- Need to evaluate constraints during Phase II
- Can be mitigated by improvements to system and phased approach to increased flows

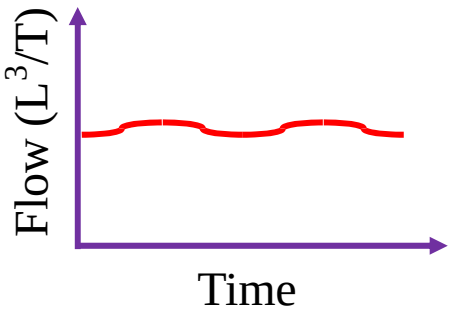


- Estimated ~450-575KAF of Northern Everglades storage needed

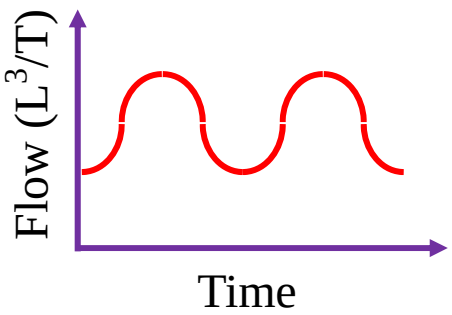
Water Quality Relationship to Hydrologic Targets



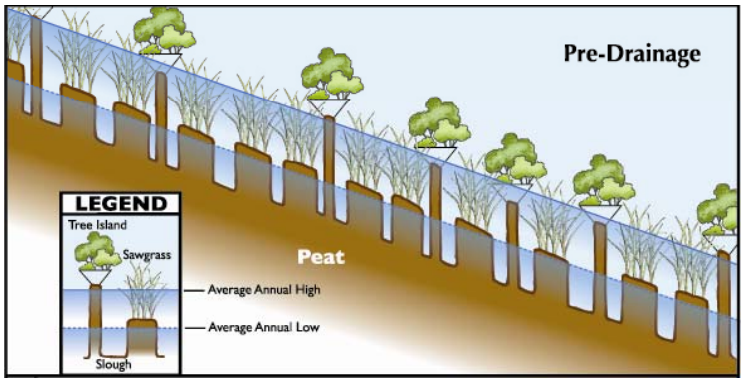
Storage- Inflows Highly Variable



Treatment- optimal at Steady-State Conditions

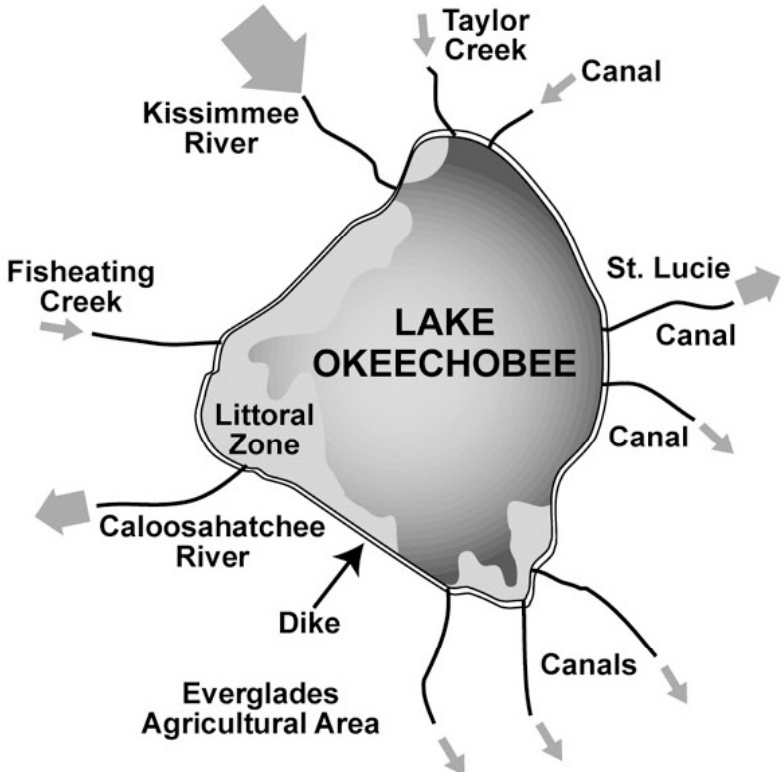


Target- Need to define peak flows, inter- and intra-annual variability (TBD in Phase II)



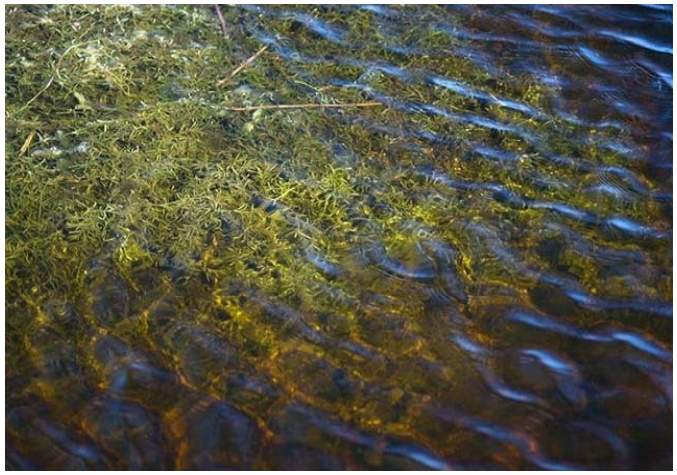
Lake Okeechobee Water Quality-
TP Concentrations in Lake Okeechobee Deliveries

- Assumed future Lake Okeechobee P concentrations significantly affect additional treatment area needed
  - Phase I analysis evaluated concentrations ranging from 40-200 ppb
  - STA acreage required can be 0% to 90% more at 200 ppb than at 40 ppb, depending on the base configuration
- Location of Lake Okeechobee deliveries influences TP levels
  - Eastern releases to West Palm Beach Canal ~41% higher than southern releases to North New River and Miami Canals



Water Quality Performance-
Relationship between Management and Performance

- High management level required to achieve optimal water quality treatment performance
  - Water Level, Flow, and Vegetation
- Water quality performance is highly dependant on whether the feature is maintained in a wet condition
  - Ensures viability of the highest performing treatment vegetation
  - Avoids dry-out of the soil which can release TP upon rewetting
- Evaluation of configurations included best case scenario (maintaining wet conditions) and a worst case scenario (allowed to go dry such that no TP removal occurred), with a large range of results



Wet vs Dry Footprints

Should minimum water levels be maintained in features?

Maintaining Wet Footprint

Improves water quality performance

Improves habitat within feature footprint

Allowing Footprint to Go Dry

Increases available storage

Stored water is available to meet targets

If wet footprint, then significantly greater storage volumes/acreage to achieve same performance

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Storage Evaluation

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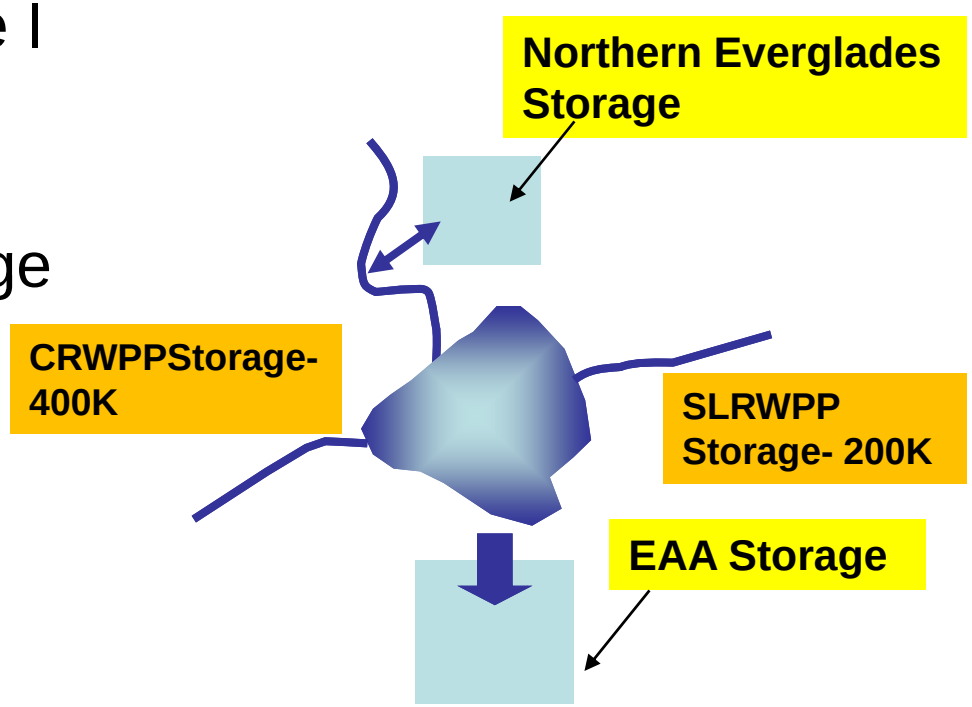
Storage Needs Evaluation- Northern Everglades and EAA Storage

- Based on evaluation of Phase I configurations
  - Estimated total Northern Everglades and EAA storage needs are 700,000-1,100,000 acre-ft
  - If a feature is to be maintained wet, then approximately 700,000 additional acre-ft will be required



- Improving Lake Okeechobee low level performance will also require additional storage (amount TBD in Phase II)

North Everglades Storage vs. EAA Storage Summary

- Need ~450-575 KAF north to address low lake stages
- Balance of total storage can be sited south

	North Everglades	EAA
Land Availability	*Unknown; would need to identify willing sellers for regional scale projects*	*Pending contract with USSC; potential for land swaps*
Siting Issues	*Significant cultural resources and T&E issues*	*Limited cultural resources and T&E issues*
Operational Flexibility	*Increased delivery options when water is stored north*	*Have ability to capture EAA runoff*

A combination of Northern Everglades and EAA storage will be needed

Deep vs Shallow Storage Features-
Shallow Storage

- Types - flow-ways, ecosloughs, shallow impoundments, and water management areas
- Most proponents of shallow storage prefer it because
  - Desire to increase **spatial extent** of Everglades-like habitat
  - Prefer more natural, less engineered approach
  - Want to reduce O&M - less managed features, gravity flows, reduced reliance on pumps and associated fuel needs
- Potential concerns with a shallow storage-only approach:
  - Increased land needs/larger footprints
  - Uncertainty regarding ability to create Everglades-like habitat within shallow storage features
  - Potential for higher O&M issues related to exotic management within large, shallow footprints
  - Performance capabilities/efficiency of shallow storage

Deep Storage vs. Shallow Storage – Phase I Findings

	Deep	Shallow
Spatial Extent	Smaller spatial extent per unit volume	Larger spatial extent per unit volume
ET	~ 15% to 30% of total inflow volume	~ 20% to 60% of total inflow volume
Design Criteria	Dam safety criteria; hardened slope protection; compartments may be required; seepage cutoff wall and collection system	Impoundment criteria; grass slope protection; no compartments required; may require seepage collection system
Costs	More expensive per unit volume than shallow	Less expensive per unit volume than deep; However if wet shallow storage, then will need significantly larger storage volume
Land Availability/ Economic Impact	Half as much land required per unit volume as compared to shallow	Twice as much land required; 1,000,000 ac-ft of shallow storage requires 278,000 acres of land

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Features Comparison

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Nine Proposed Stakeholder Configurations

- All configurations contained storage, treatment, and conveyance project features
- Ability to meet Everglades demand is the primary performance difference between configurations
- Other differences in configurations were related to approach. For example-
  - Restore EAA, increase habitat, or increase recreation
  - Minimize footprint, reduce economic impacts, or avoid conflict with inland port
  - Increase performance or increase cost-benefits
- Land acquisition requirements ranged from 19,000 acres to 229,000 acres
- Construction costs ranged from $4.3 billion to $25.8 billion

Project Features

- Reservoir
- Shallow Impoundment
- Reservoir within Lake Okeechobee
- Dispersed Storage
- Flowway
- Ecoreservoir
- Ecoslough
- Wetlands Management Area
- Stormwater Treatment Area

Feature Summary- Dispersed Storage

- Water retention/detention, load reduction, peak flow attenuation, and onsite hydrologic restoration
- Arrangement to use land for storage and treatment
- Potential to increase storage and evapotranspiration (ET)
- Limited modeling tools currently exist to evaluate hydrologic and water quality performance
- Uncertainty in obtaining Everglades benefits
- High uncertainty related to costs and costs-benefits

Feature Summary-
Deep Storage Reservoir

- Provides regional offsite benefits; not intended to provide natural habitat within footprint
  - Interior embankments not vegetated for erosion protection
- Capture/hold both normal and peak flows; discharge when water required
- Ability to stack water higher if land availability is an issue
- High uncertainty in water quality treatment capabilities
- Concerns with ability to prevent water quality degradation within reservoir
- Engineered system with design and operational flexibility to address issues
- Limitations to recreational access
- Higher construction costs, lower land requirements per acre-foot of storage

Feature Summary-
Reservoir within Lake Okeechobee

- Compartmentalize Lake Okeechobee to obtain more storage capability and regional offsite benefits
- No additional losses to evapotranspiration (ET)
- No additional land required
- Better able to manage water levels within remaining portions of Lake Okeechobee
- Does not mimic natural hydrology within the footprint
- Potential impacts to existing environmental, ecological, fishery and recreational capabilities within footprint
- Loss of interaction with the remaining portion of Lake Okeechobee
- Complex construction

Feature Summary- Ecoreservoir

- Above ground storage feature intended to mimic a natural setting
- Shallow-slope vegetated embankments; 12 to 1 side slopes
- Maximum water depth of 6 feet
- Extensive land requirements
- Intensive recreational uses; ecotourism
- Provide additional habitat for birds, fish, reptiles and aquatic vegetation
- Allowed to go dry in order to meet downstream water demands and meet performance goals
  - resulting ecological impacts may limit operations
- Significant vegetation management and exotics removal
- Construction cost 3 times higher due to larger embankment cross-section than a Reservoir with same storage and embankment height

Feature Summary- Flow-way

- Above ground shallow feature operated like a flowing wetland system
- Attempts to mimic the associated storage, water quality, hydraulics, and wildlife habitats within the footprint as envisioned by the historic River of Grass
- Potential operational constraints to protect created habitats
- Vegetated embankments; maximum water depth of 4 feet
- Unmanaged vegetation except for exotic removal, minimal engineered features, and existing topography within footprint
- Hydraulic limitations in meeting timing and quantity of Everglades water demands
- High uncertainty in water quality treatment capabilities
- Water requires further treatment prior to entering Everglades
- Recreational opportunities similar to other wetland habitat
- Lower construction costs, higher land requirements per acre-foot of storage

Feature Summary-
Flow-way (Wet vs. Dry)

- Maintained Wet
  - Maintained in a wetted condition (1/2 foot minimum water depth)
  - Requires supplemental water
- Allowed to go Dry
  - Flowing wetland system allowed to go dry or a floodplain with wetting only occurring during extreme weather events
  - Better at achieving downstream restoration targets than wet flow-way
  - No supplemental water required
  - When dry, impacts to ecology and habitats; potential operational restrictions

Feature Summary- Ecoslough

- Above ground treatment feature intended to mimic a natural setting
- Vegetated embankments; 12 to 1 side slopes; Maximum water depth 4 feet
- Extensive land requirements
- Intensive recreational uses; ecotourism
- Unmanaged vegetation except for exotic removal, minimal engineered features, and existing topography within footprint
- Hydraulic limitations in meeting timing and quantity of Everglades water demands
- High uncertainty in water quality treatment capabilities
- Treats discharge from Ecoreservoir; requires further treatment prior to entering Everglades
- Construction cost 2 times higher due to larger embankment cross-section than a Flow-way with same storage and embankment height

Feature Summary-
Wetlands Management Area

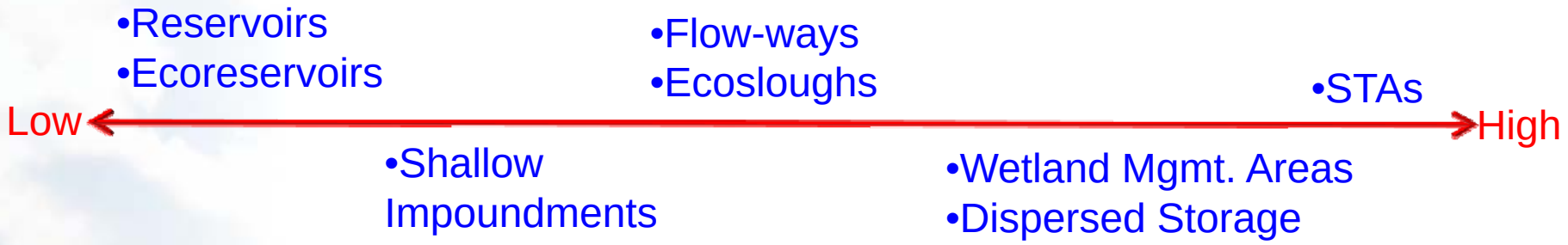
- Shallow features such as forested wetlands, emergent wetlands, or shallow lakes for the purpose of onsite restoration that are not designed to achieve a specific regional storage or treatment target
- Improves natural habitats
- Allowed to go dry but still actively managed
- Extremely high uncertainty in water quality treatment capabilities
- Water requires further treatment prior to entering Everglades
- High uncertainty of viable vegetation types if areas previously impacted by agricultural production or significant soil subsidence
- Compete for water with primary restoration features
- Recreational opportunities similar to other wetland habitat

Feature Summary-
Stormwater Treatment Area

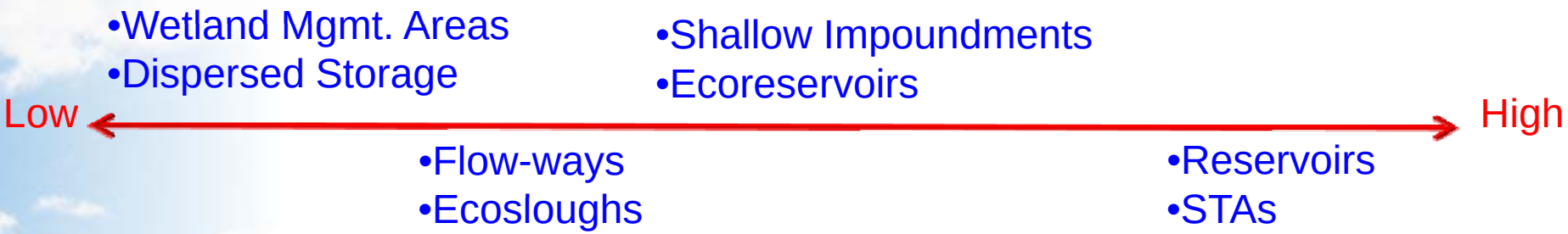
- Constructed and managed shallow treatment wetlands primarily for removal of total phosphorus (TP)
- Vegetated embankments; maximum water depth of 4 feet
- Highly managed vegetation and engineered hydraulics
- Proven water quality treatment capabilities; no additional treatment required prior to entering Everglades
- Ancillary onsite benefit of high quality wildlife habitat which can result in operational constraints to address protected species issues
- Maintained in a wetted condition; requires supplemental water
  - to achieve optimal water quality treatment
  - to ensure viability of the highest performing treatment vegetation
- Recreational opportunities similar to other wetland habitat

Relative Feature Performance

Water Quality- Phosphorus Treatment Performance

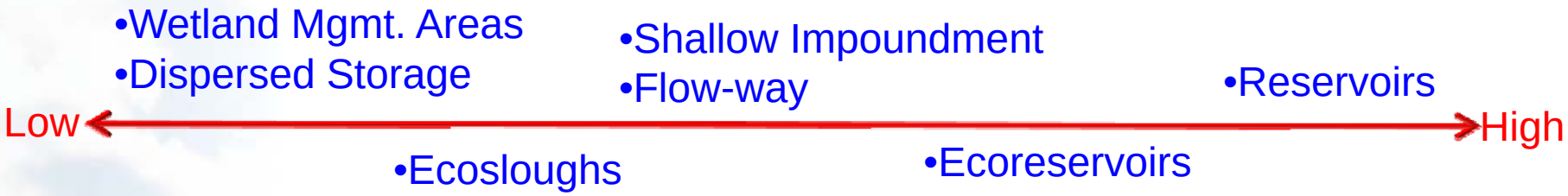


Management Intensity

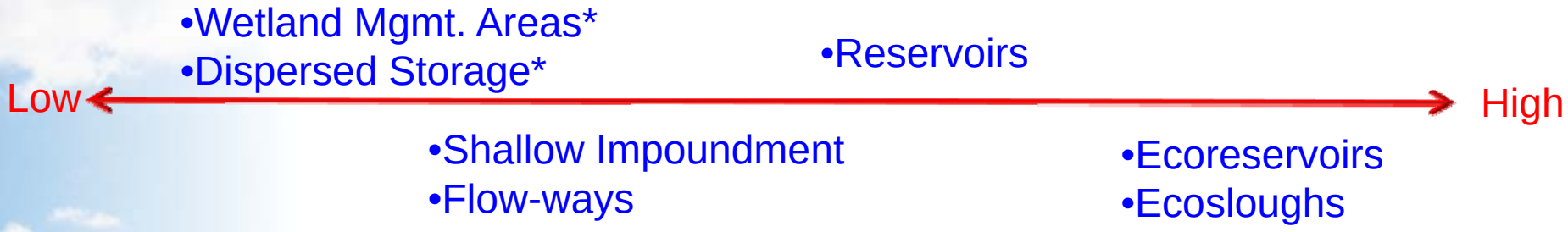


Relative Feature Performance

Storage per Acre



Cost per Acre-ft of Storage



* Costs highly variable, can range from low to higher than reservoir costs

Phase I Comparative Evaluation Summary of Combined Project Features

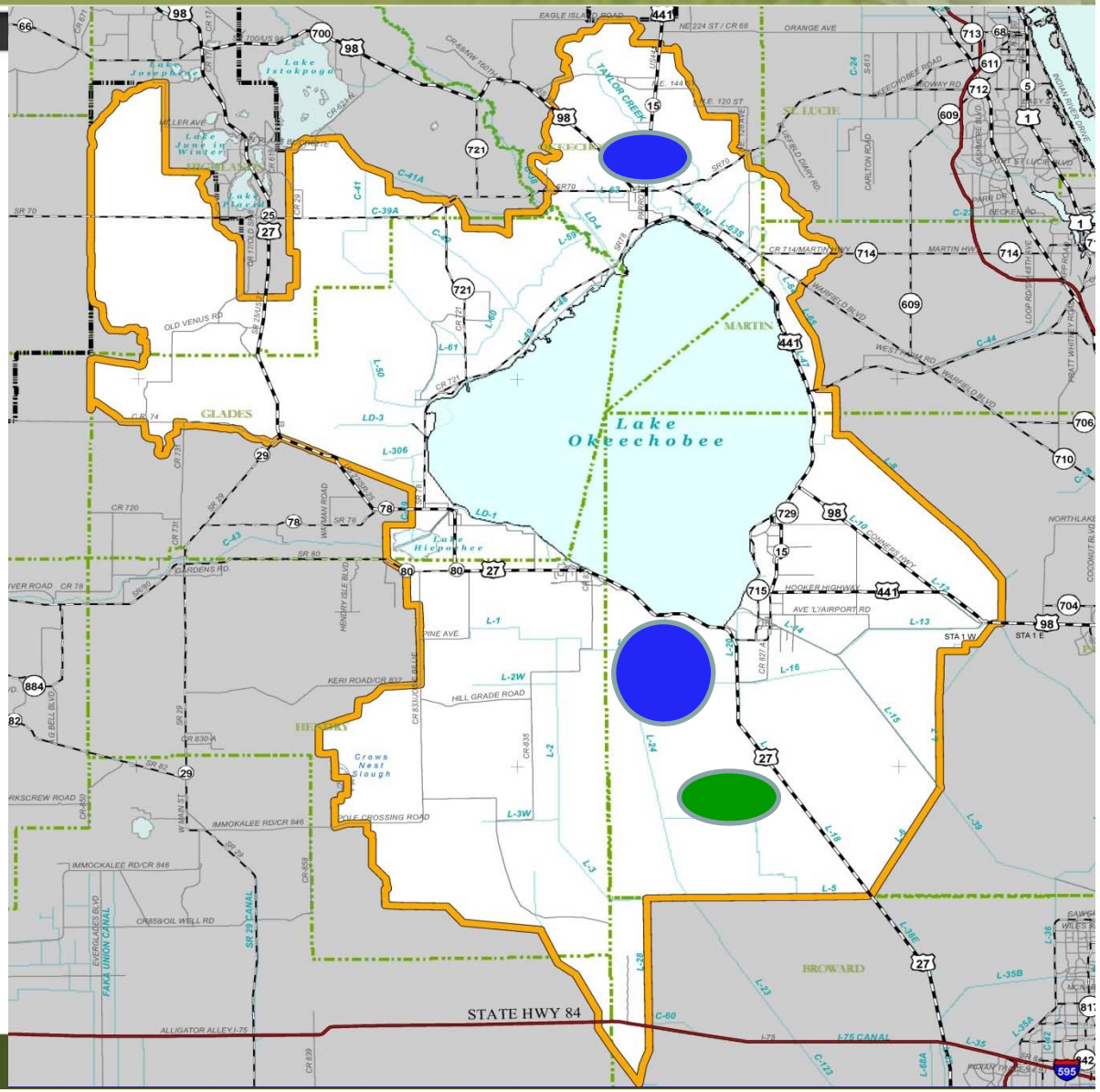
Deep Storage Reservoir With STAs

Everglades Restoration
High

EAA Wetlands
Low

Cost Estimate
Medium

Land/Economics
Medium



Phase I Comparative Evaluation Summary of Combined Project Features

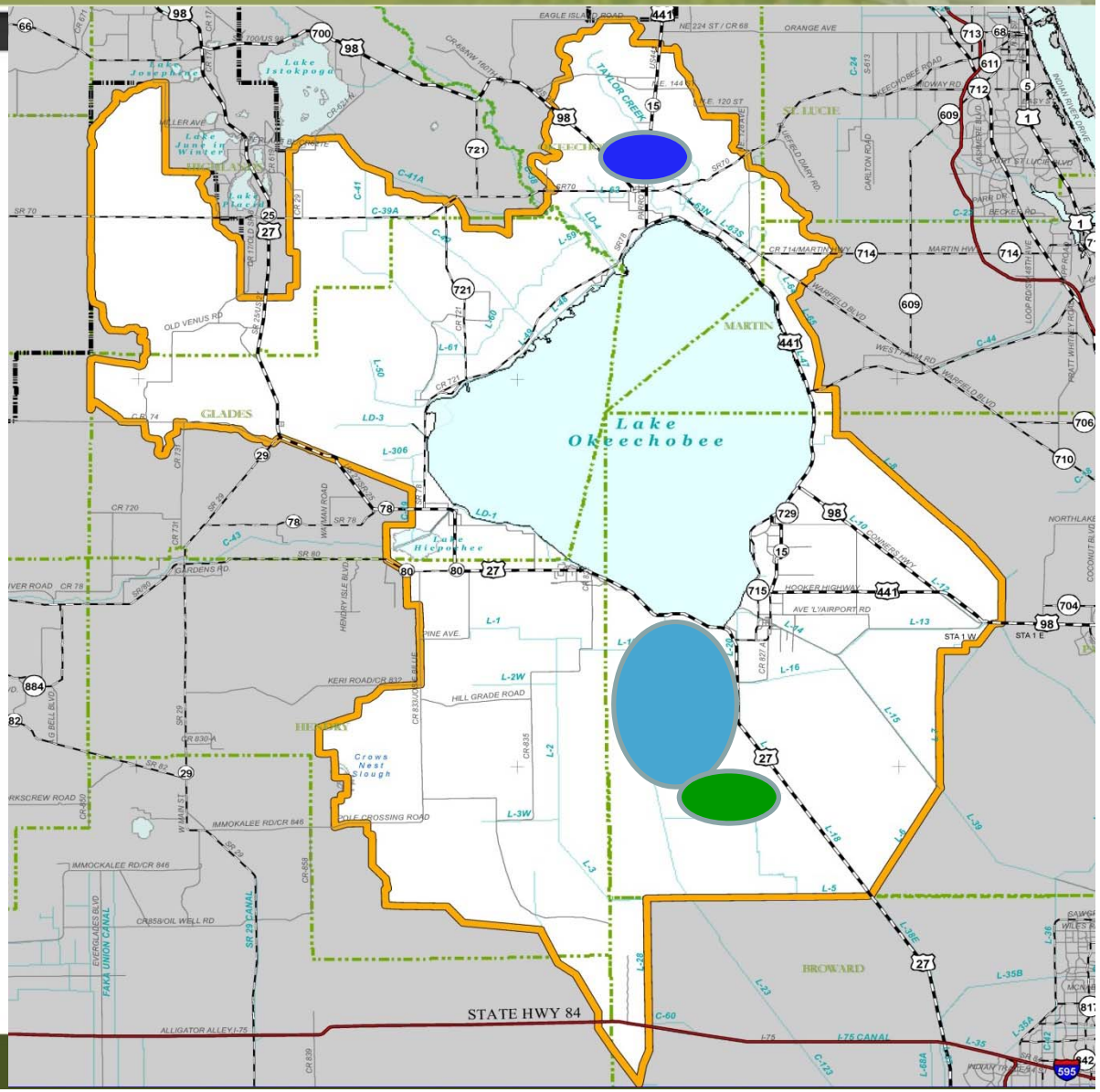
Shallow Dry Storage With STAs

Everglades Restoration
Low to Medium

EAA Wetlands
Low to Medium

Cost Estimate
Low to Medium

Land/Economics
Medium to High



Phase I Comparative Evaluation Summary of Combined Project Features

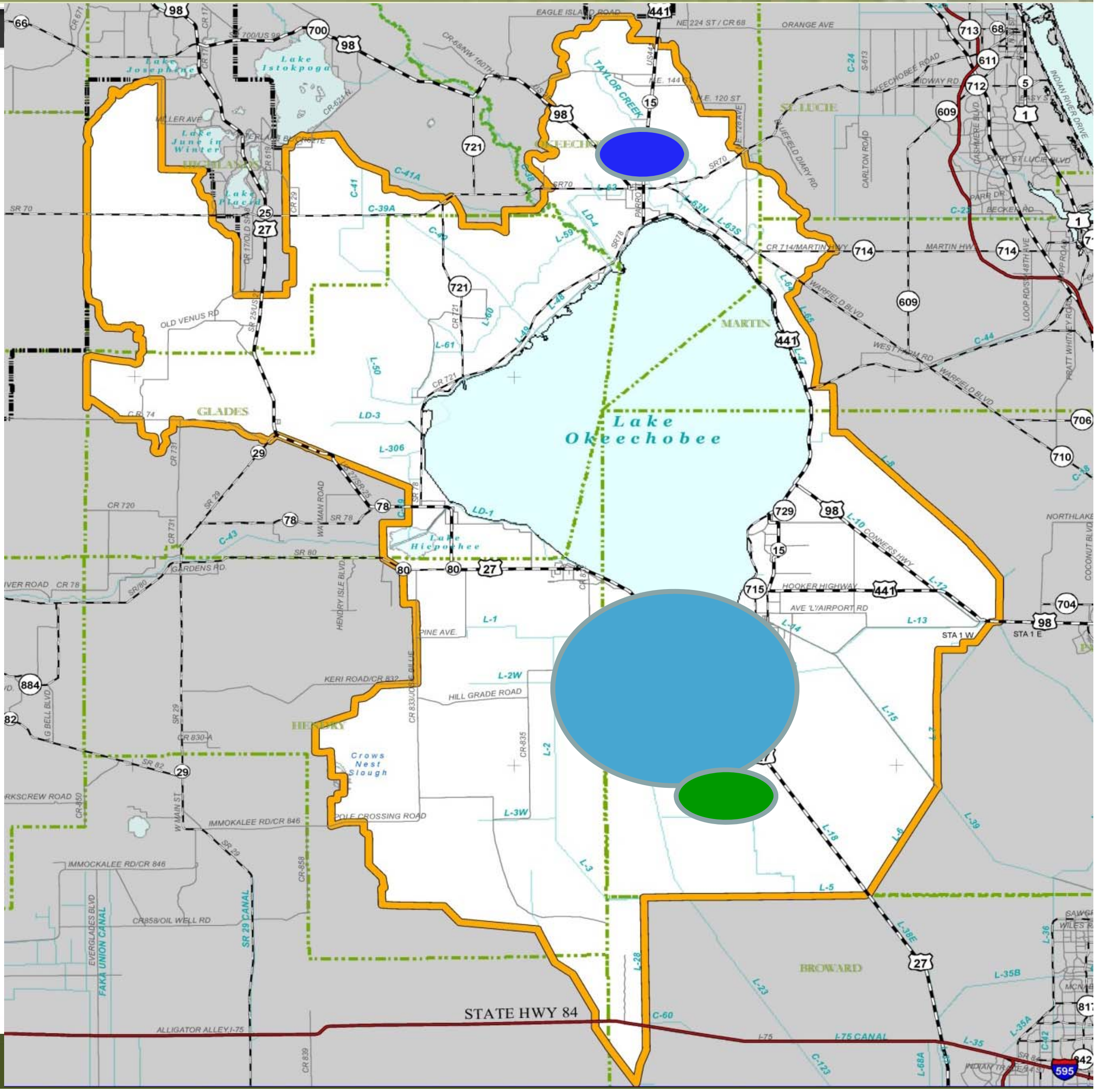
Shallow Wet Storage With STAs

Everglades Restoration
Low to Medium

EAA Wetlands
High

Cost Estimate
High

Land/Economics
High



Phase I Comparative Evaluation Summary of Combined Project Features

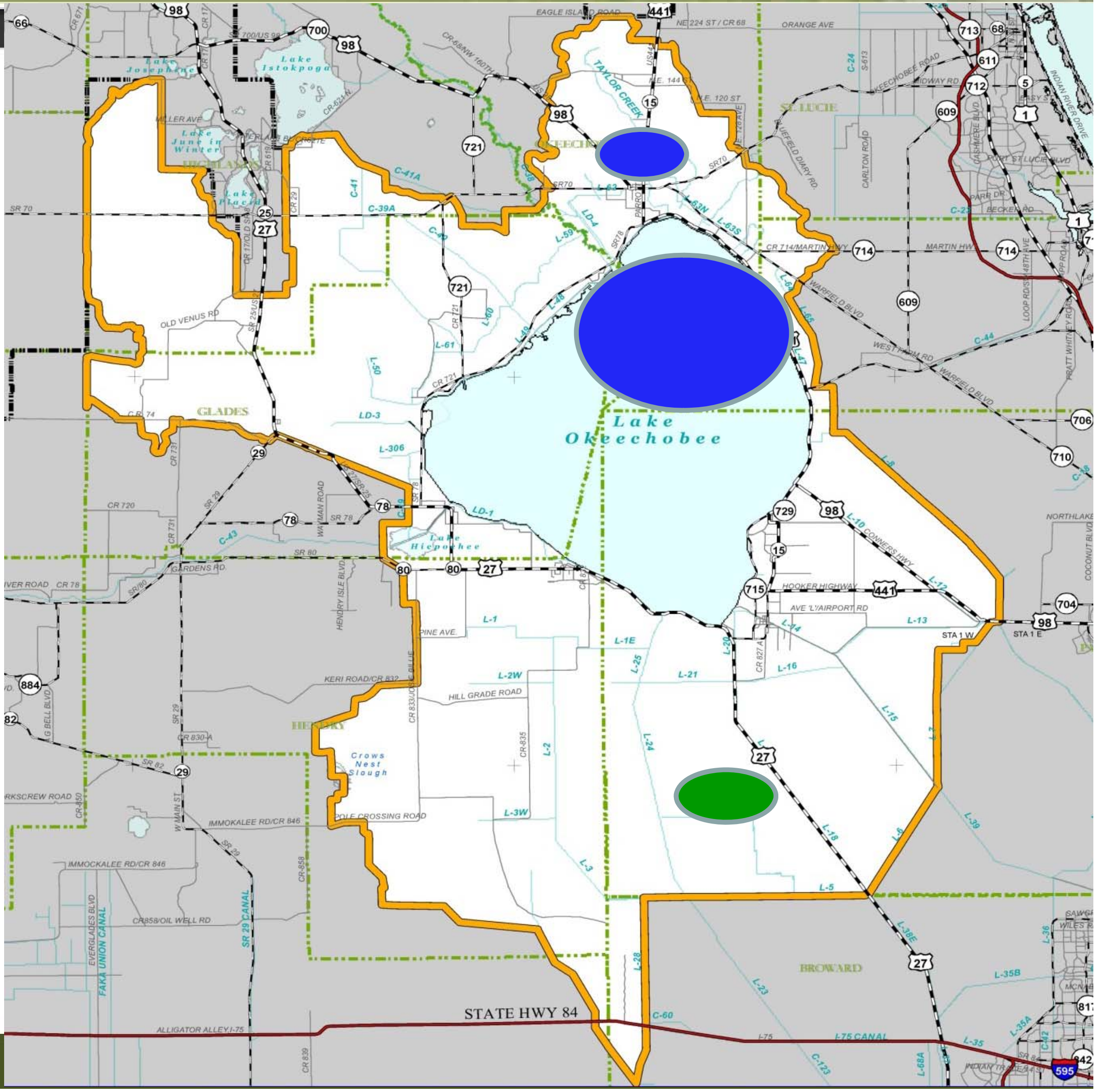
Deep Storage Within Lake Okeechobee With STAs

<u>Everglades Restoration</u>
Low

<u>EAA Wetlands</u>
Low

<u>Cost Estimate</u>
Medium

<u>Land/Economics</u>
Low



Phase I Comparative Evaluation Summary of Combined Project Features

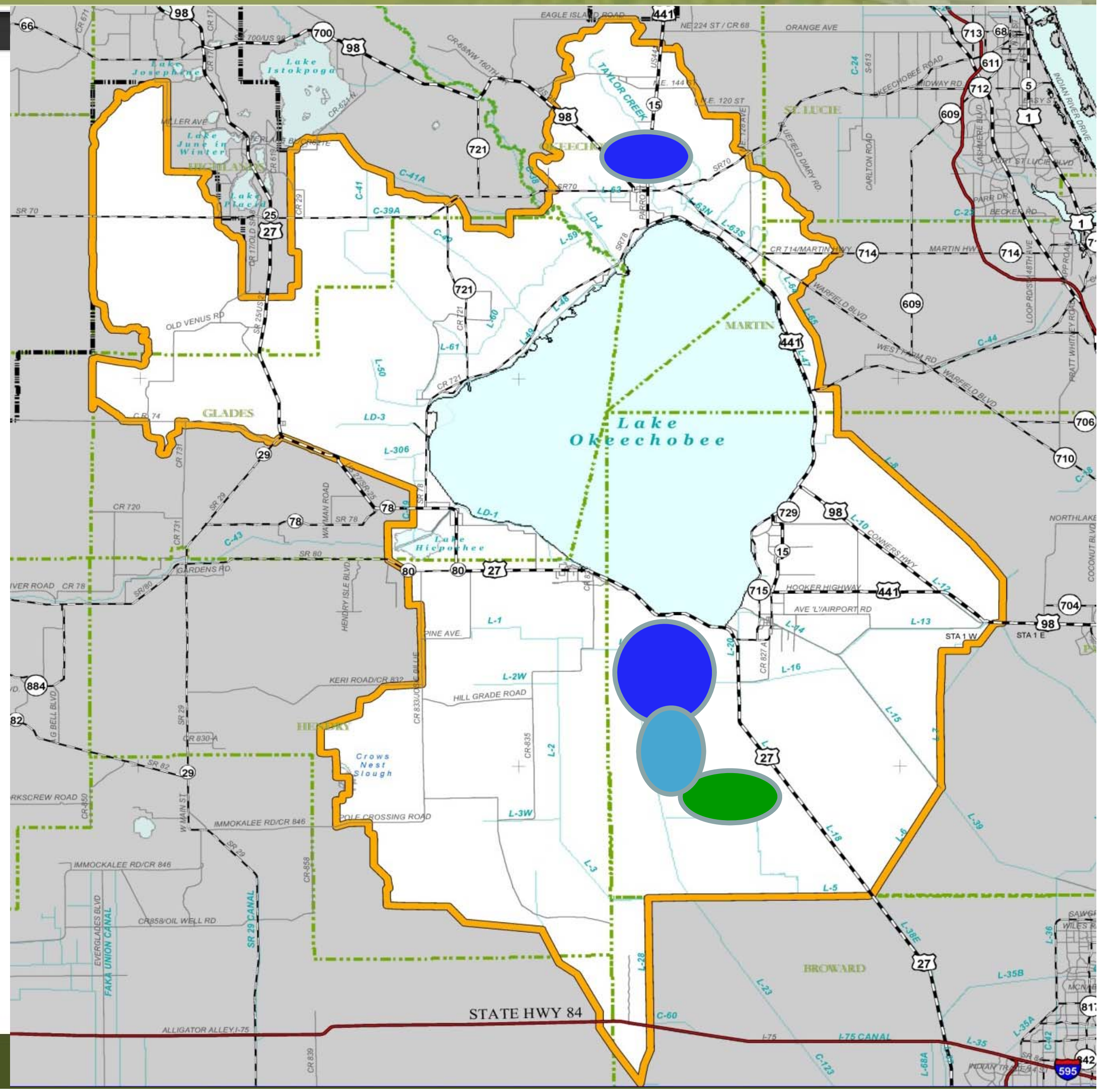
Deep Storage Reservoir and Shallow Storage With STAs

Everglades Restoration
Medium to High

EAA Wetlands
Low to Medium

Cost Estimate
Medium to High

Land/Economics
Medium to High



Common Project Elements with Nine Configurations

- Storage north of Lake Okeechobee
- Storage south of Lake Okeechobee
- Water quality treatment for additional flows to Everglades
- Features addressing flows/loads in excess of STA-1W and STA-1E treatment capacity
  - ECART canal conveyance improvements
  - Additional STA acreage for L-8/S-5A Basin Runoff

Common Project Elements with Nine Configurations

- No deep storage on EAA Talisman A1 site
  - Stormwater treatment area
  - Shallow storage
- Features addressing existing issues in East Caloosahatchee, S-4, and C-139 Basins
  - Lake Hicpochee storage and treatment
  - Disston Island/S-4 storage and treatment
  - C-139 storage and treatment

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Moving from Phase I to Phase II Planning

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RESTORATION PLANNING

Phase I Findings and Phase II Considerations

- **Everglades Targets-** need for greater Everglades flows particularly during dry periods
  - Phase I- Utilized Synthetic time series; ~1.9+ MAF
  - Phase II- Refine target through Target Workshop and more detailed modeling evaluation; consider constraints
- **Restoration Approaches-** all approaches require storage, treatment, and delivery system, but vary with regards to other features/attributes
  - Phase I- Viable approaches must meet restoration needs first and then can consider additional attributes (e.g., recreation, increased wetland extent)
  - Phase II- Develop alternatives that meet restoration needs and identify opportunities for incorporating additional attributes

Phase I Findings and Phase II Considerations

- **Constraints and Phasing-** need to evaluate constraints and develop phasing plan
  - Phase I- Did not consider system or land availability constraints
  - Phase II- Evaluate constraints with detailed model and develop detailed phasing plan
- **Wet vs Dry Footprints-** is active management to maintain wet footprints desirable
  - Phase I- Wet footprints require significantly greater storage volume to achieve same downstream performance
    - For same acreage, flow-way or reservoir allowed to go dry followed by an STA achieves better downstream hydrologic and water quality results than a wet flow-way
  - Phase II- If desired, can evaluate varying degrees of wet and magnitude of impact with detailed model

Phase I Findings and Phase II Considerations

- **Water Quality-** new flows require additional treatment facilities; feature water quality performance evaluation
  - Phase I- Since reservoirs, flow-ways, and other non-STA features can not reliably achieve concentrations less than 25 ppb, their discharges require further STA treatment prior to delivery to the Everglades
    - Lake Okeechobee concentrations have a significant impact on treatment needs
  - Phase II- Improve performance estimates utilizing dynamic model and potential pilot projects/testing
- **Shallow vs Deep Storage vs Combination-** what is preferred approach
  - Phase I- Shallow storage ET volumes up to 2x deep ET volumes; 2x as much land required for shallow storage
  - Phase II- Reassess with refined targets and detailed model to determine preferred approach

Phase I Findings and Phase II Considerations

- **Lake Okeechobee Performance-** improving low and high stages
  - Phase I- improved high stages but did not improve low stages over existing LORS-2008 condition
  - Phase II- needs to consider improvements to Lake's low stages
- **Storage Targets**
  - Phase I- Estimated total Northern Everglades and EAA storage needs are 700,000-1,100,000 acre-ft
    - If a feature is to be maintained wet, then approximately 700,000 additional acre-ft will be required
    - Appears that a range between 450,000-575,000 acre-ft Northern Everglades storage may be needed to address low lake stages
  - Phase II- Refine storage targets based on refined Everglades flow target

Phase I Findings and Phase II Considerations

- **Features and Combinations-** feature type and operations has significant impact on performance and costs
  - Phase I- Evaluated impact of feature type and operations on Everglades performance
    - Identified 5 primary combinations of features and did a comparative evaluation
  - Phase II- Further evaluate and optimize these feature combinations to determine preferred approach
- **Common Elements-** features common to most restoration proposals
  - Phase I- Identified features/common elements that were common to most/all restoration proposals
  - Phase II- Consider moving these features more quickly into design/implementation phases while detailed regional planning continues

Other Phase I Findings and Phase II Considerations

- **Public Planning Process-** utilizing public planning process has encouraged participation by stakeholders and staff and has improved communication and understanding
  - Restoration Vision and Value Systems
  - Targets and Inter-Relationships
  - Technical Issues and Challenges
- **Other Phase II Considerations-**
  - Role of ASR
  - Hydraulic limitations
  - Sea level rise
  - Evaluation of potential economic impacts and values

Phase II Recommended Approach

- Public Planning Process similar to Phase I
  - Scope: Identify recommended conceptual plans including footprint (options to include scenarios with land swaps and scenarios without)
  - Kick-off: Fall 2009
- Prepare comprehensive Phase II work plan, budget, and schedule
- Develop modeling toolbox and evaluation criteria
- Refine targets and evaluate constraints
- Identify parameters for sensitivity testing
- Develop work plans for Common Elements and Other Phase II Considerations
- Develop and evaluate optimized Phase II configurations
- Identify recommended conceptual plans including footprint

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Field Trip - Tour

RESTORATION PLANNING

Stormwater Treatment Area 1 West

When:

Thursday, October 1, 2009

Time:

10 a.m. to noon

Meeting Location:

Stormwater Treatment Area 1 West Public Access Site (map)

West of Wellington, Palm Beach County

RSVP:

Monday, September 21, 2009

To RSVP or for more information, please contact Matt Morrison, (561) 686-8800, Ext. 3718 or mjmorris@sfwmd.gov

Questions?

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