Phase I Feature Types and Performance

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Phase I Feature Types

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

Phase I – Stakeholder Input

- General agreement regarding overarching goals
- Differences of opinion regarding -
  - Everglades target and need for dry season carryover storage
  - Managed versus natural features
  - Spatial extent versus minimizing footprint/economic impacts
  - Significance of evapotranspiration
  - Cost considerations
  - Recreational considerations
- 9 proposed stakeholder configurations
  - Varying emphasis - performance, costs, recreation, land needs

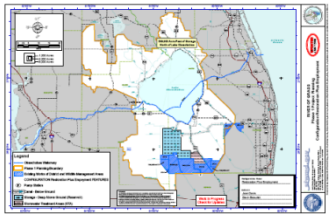
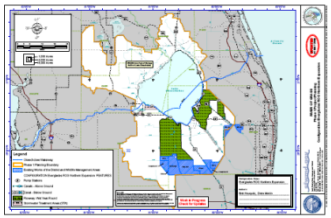
Phase I - Project Feature Types

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








Feature Type 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 Type 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
- Complex construction
- 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
- Ability to permit is questionable

Feature Type Summary
Shallow Storage

- Types - Impoundments, Flow-ways, Wetlands Management Areas, Ecoreservoir, Ecoslough and Dispersed
- 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; potential economic implications
  - 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

Feature Type Summary
Shallow Impoundment

- Provides regional offsite benefits; not intended to provide natural habitat within footprint
- Is not required to meet dam safety standards
- High uncertainty in water quality treatment capabilities
- Lower construction costs, higher land requirements per acre-foot of storage
- Could be a good first step in project phasing
  - Provide flow attenuation for STAs
  - Conversion to STA or Deep reservoir at minimal or no extra cost

Feature Type 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 Type 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
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
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 Type 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 Type 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
- Required at end of all feature trains ensure WQ Performance is met

Feature Type Performance

Phase I Findings
Deep Storage vs. Shallow Storage

	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	More stringent safety standards; hardened slope protection; compartments may be required	Less stringent safety standards; grass slope protection; no compartments required;
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

Phase I Findings
Wet vs Dry Footprints

Maintaining Wet Footprint

Requires Supplemental Water

Maintained in wetted condition >0.5’

Improves water quality performance

Improves habitat within feature footprint

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

Allowing Footprint to Go Dry

Requires No Supplemental Water

Flowing wetland system or flood plain allowed to go dry

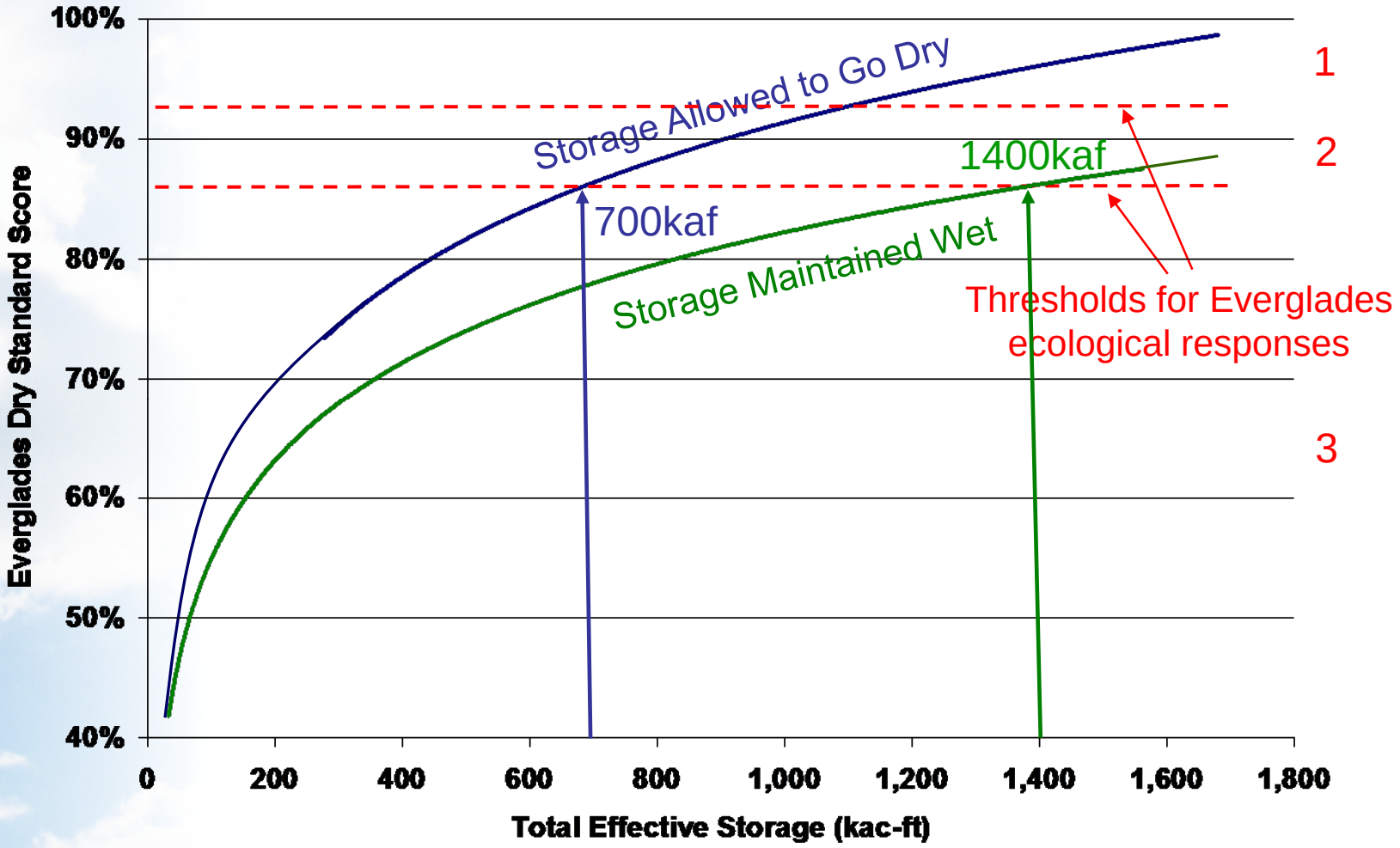
Increases available storage

Better at achieving downstream restoration targets

When dry impacts to ecology and habitats – potential operational restrictions and WQ concerns upon re-wetting

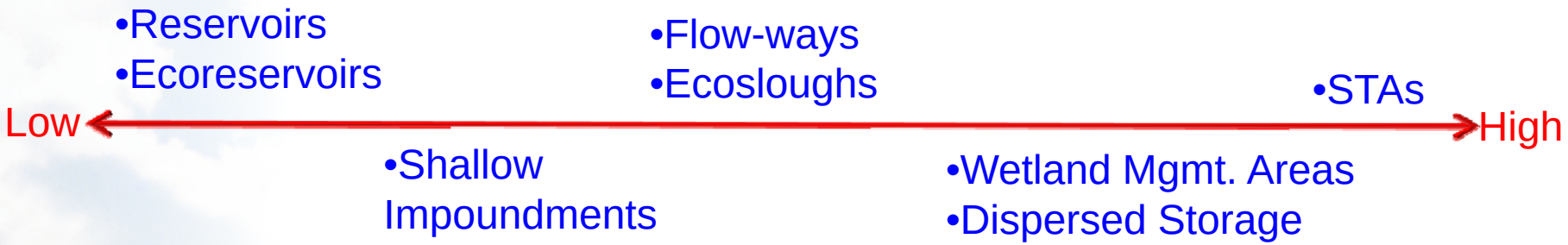
Phase I Findings - Hydrologic and Ecologic Targets

Observations, Thresholds and Diminishing Returns - Everglades

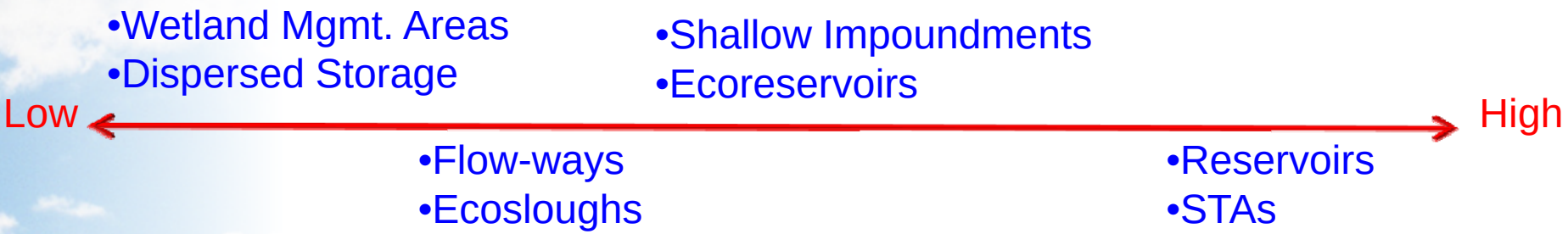


Phase I Findings
Relative Feature Performance

Water Quality- Phosphorus Treatment Performance

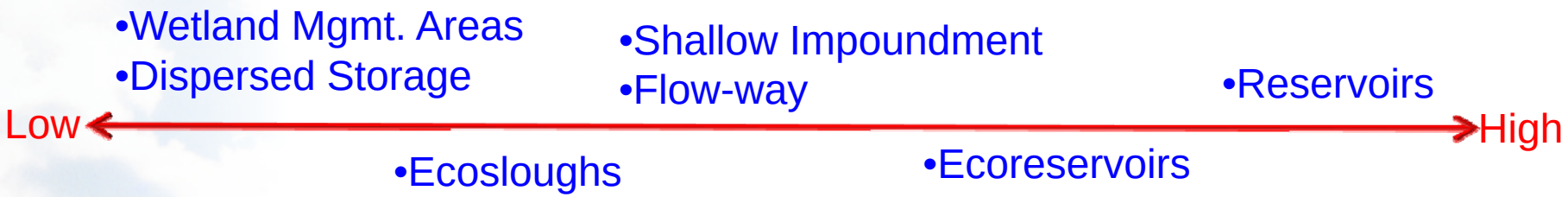


Management Intensity

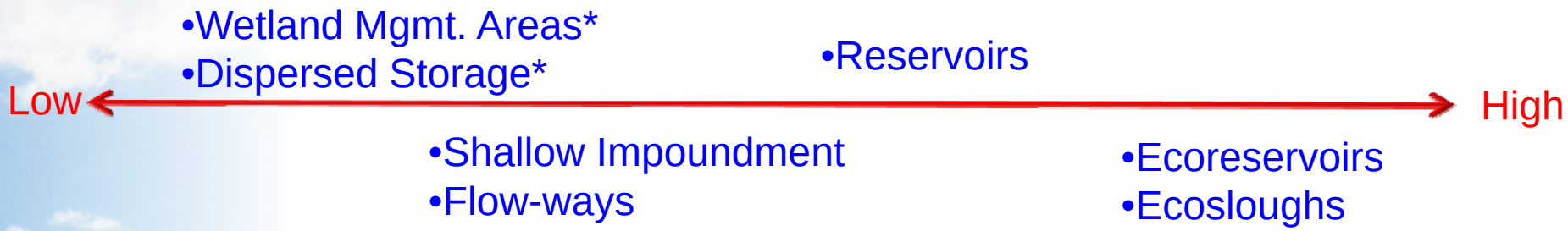


Phase I Findings
Relative Feature Performance

Storage per Acre



Cost per Acre-ft of Storage



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

Phase I Findings
Planning Level Cost Estimates

- Storage cost estimates per acre-ft
  - Deep - $10,300 per acre-ft
  - Shallow - $8,200 per acre-ft
- Total storage cost estimates for -
  - 500,000 ac-ft= $4.1B-$5.2B
  - 1,000,000 ac-ft= $8.2B-$10.3B
  - 1,500,000 ac-ft= $12.3B-15.5B
- Ecoreservoir/Ecoslough - 2-3.5x conventional storage costs

Combined Project Feature Types

Phase I Comparative Evaluation Summary of Combined Project Features

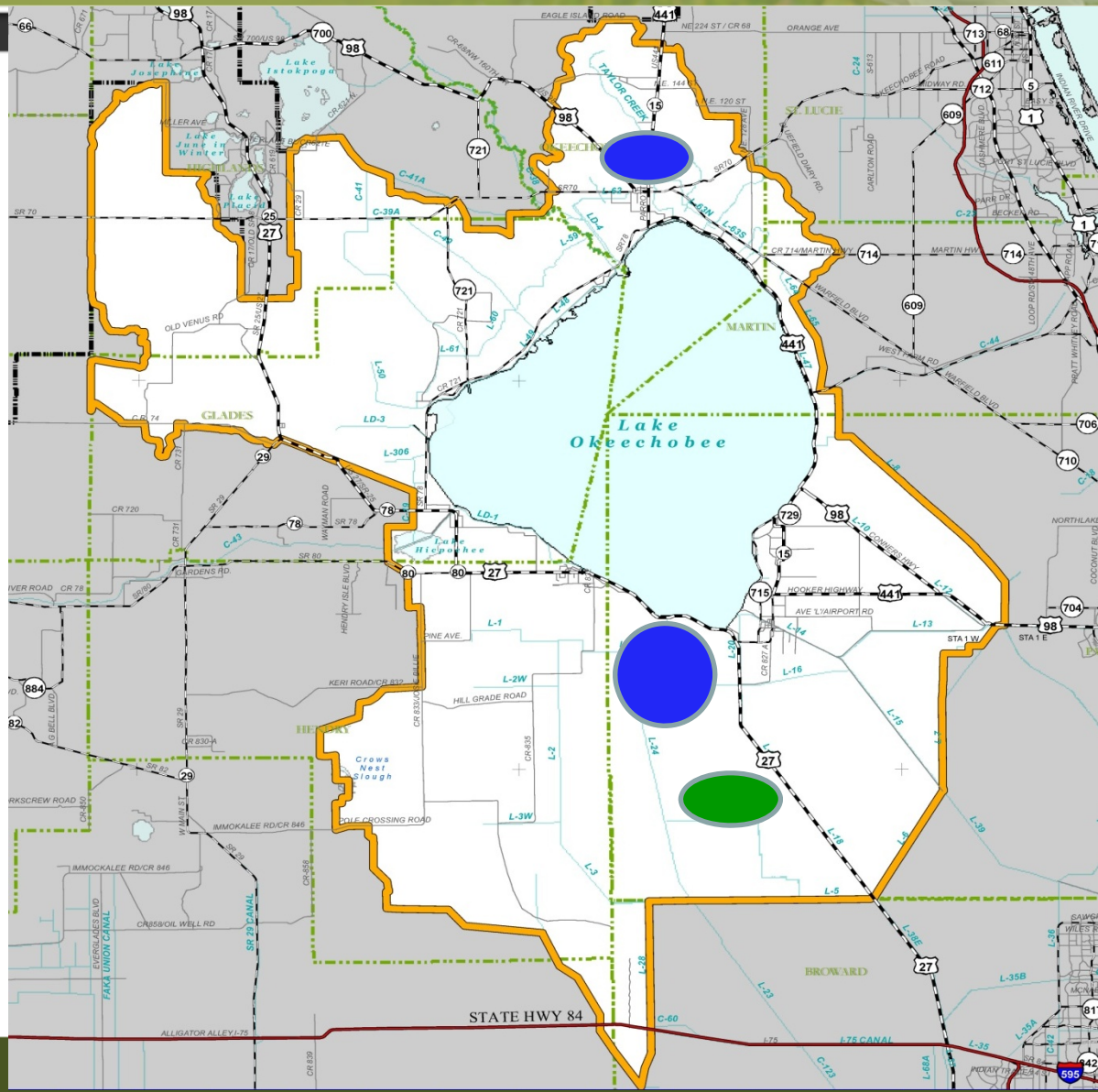
Deep Storage Reservoir With STAs

Everglades Restoration
High

EAA Wetlands
Low

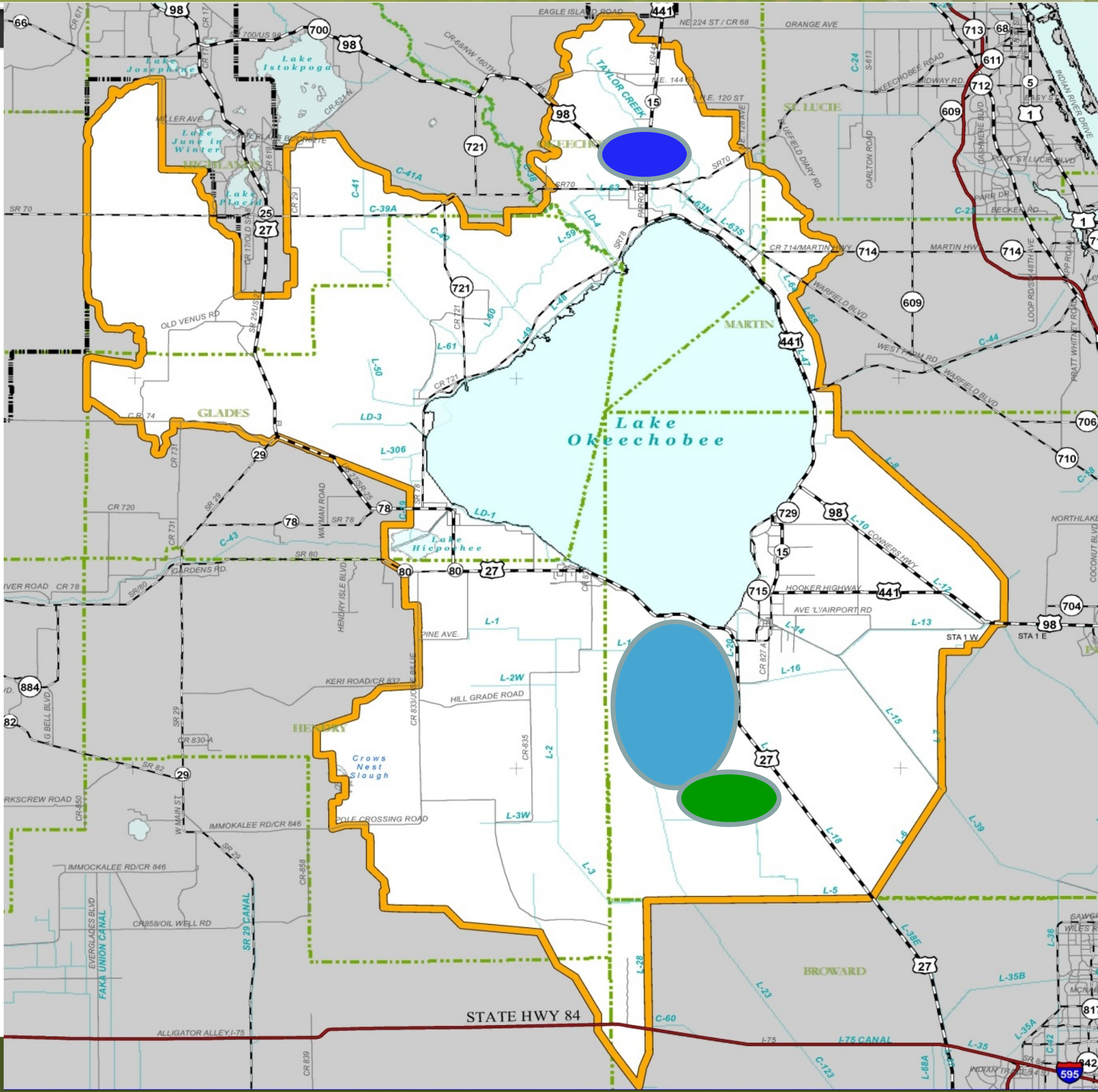
Cost Estimate
Medium

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

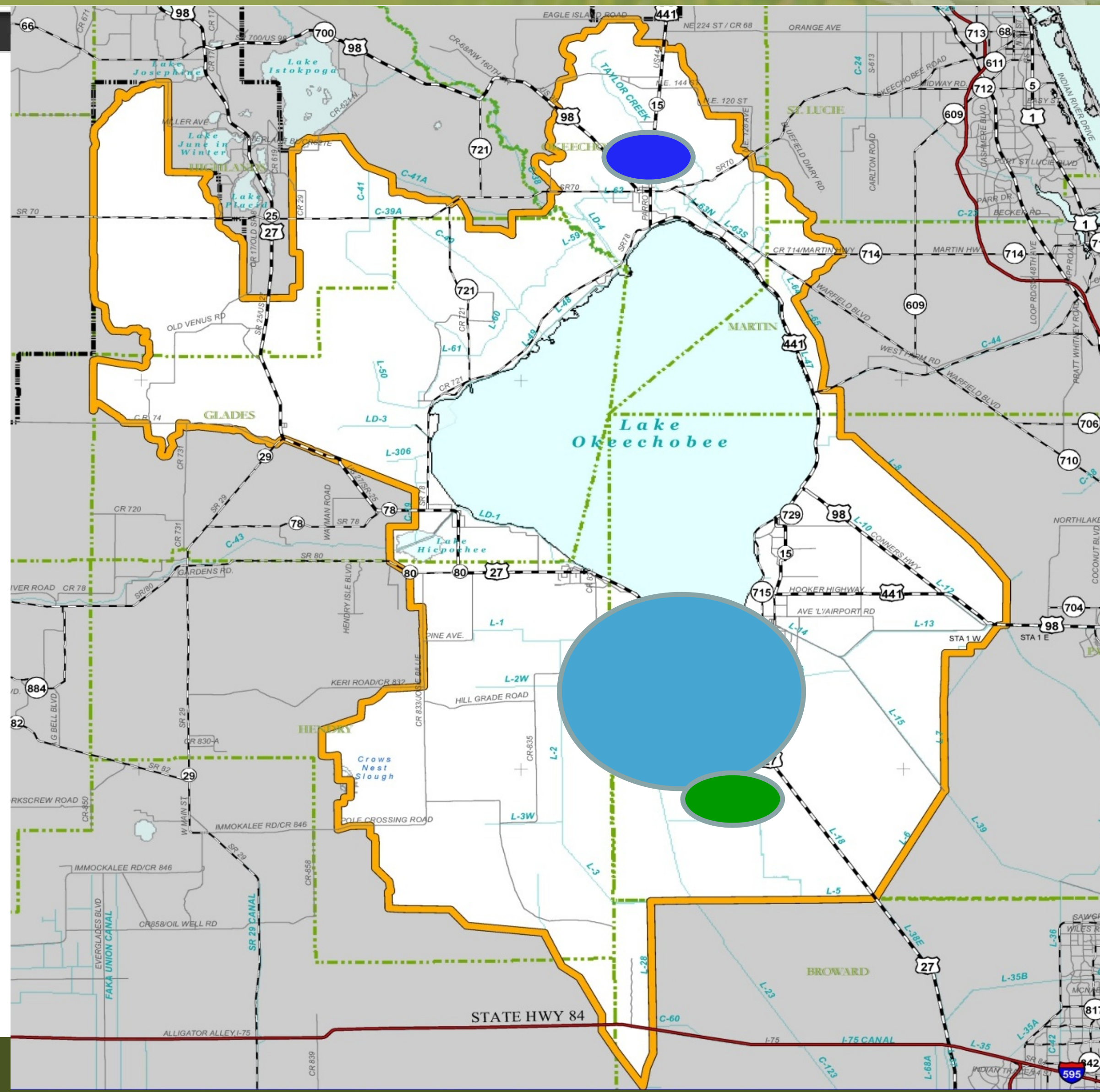
Shallow Wet Storage With STAs

Everglades Restoration
Low to Medium

EAA Wetlands
High

Cost Estimate
High

Land/Economics
High



Phase I Comparative Evaluation Summary of Combined Project Features

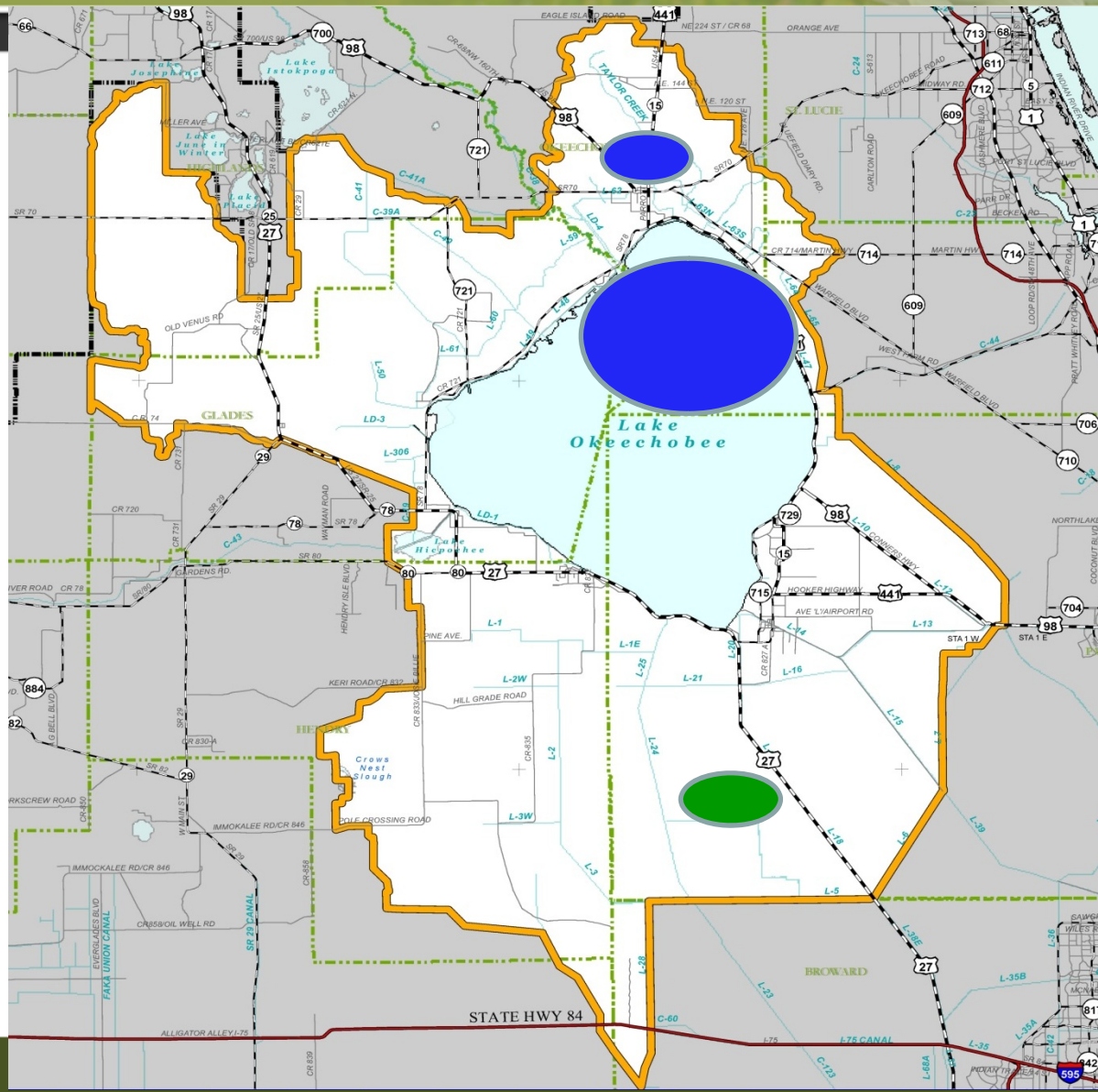
Deep Storage Within Lake Okeechobee With STAs

Everglades Restoration
Low

EAA Wetlands
Low

Cost Estimate
Medium

Land/Economics
Low



Phase I Comparative Evaluation Summary of Combined Project Features

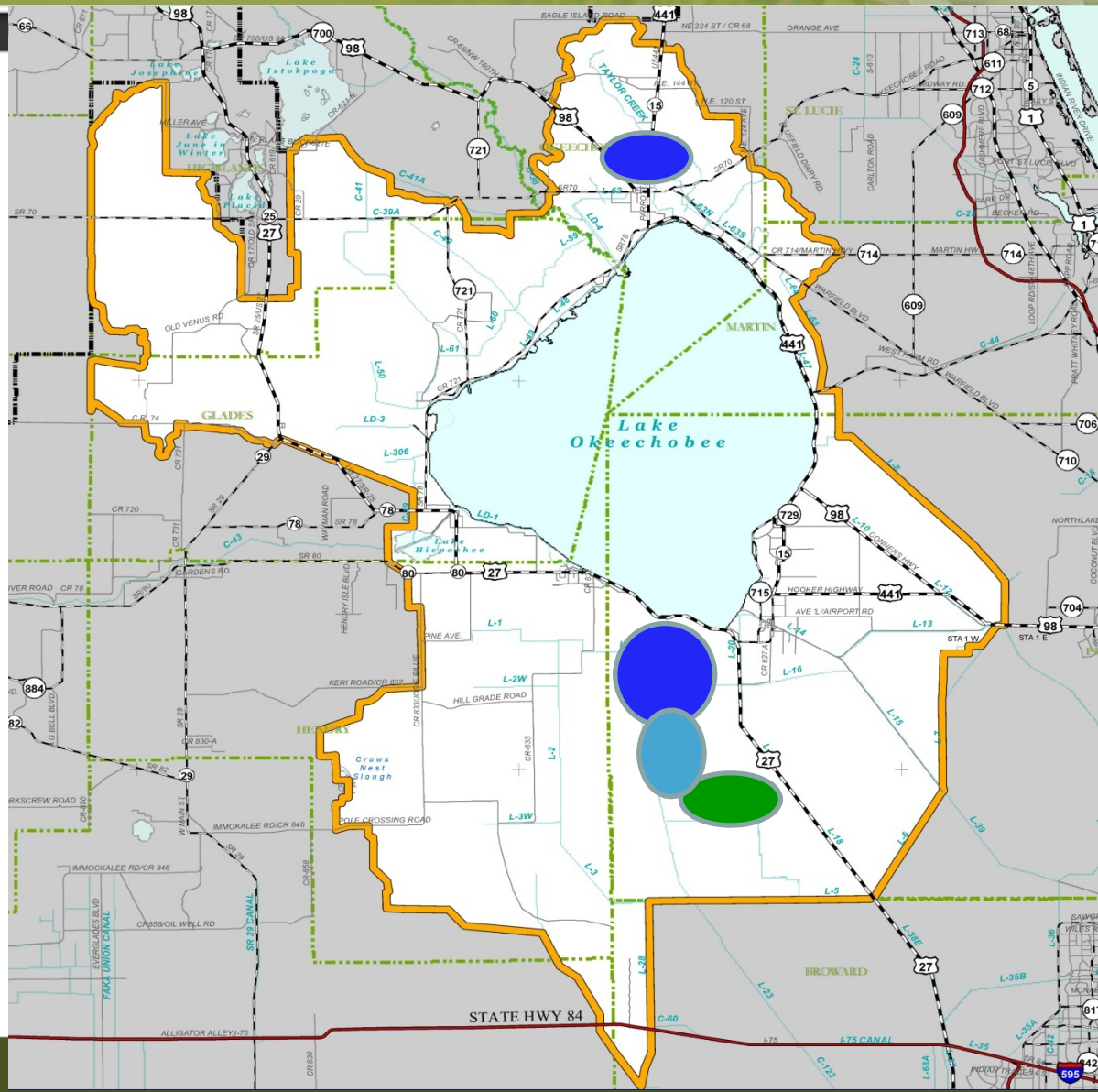
Deep Storage Reservoir and Shallow Storage With STAs

Everglades Restoration
Medium to High

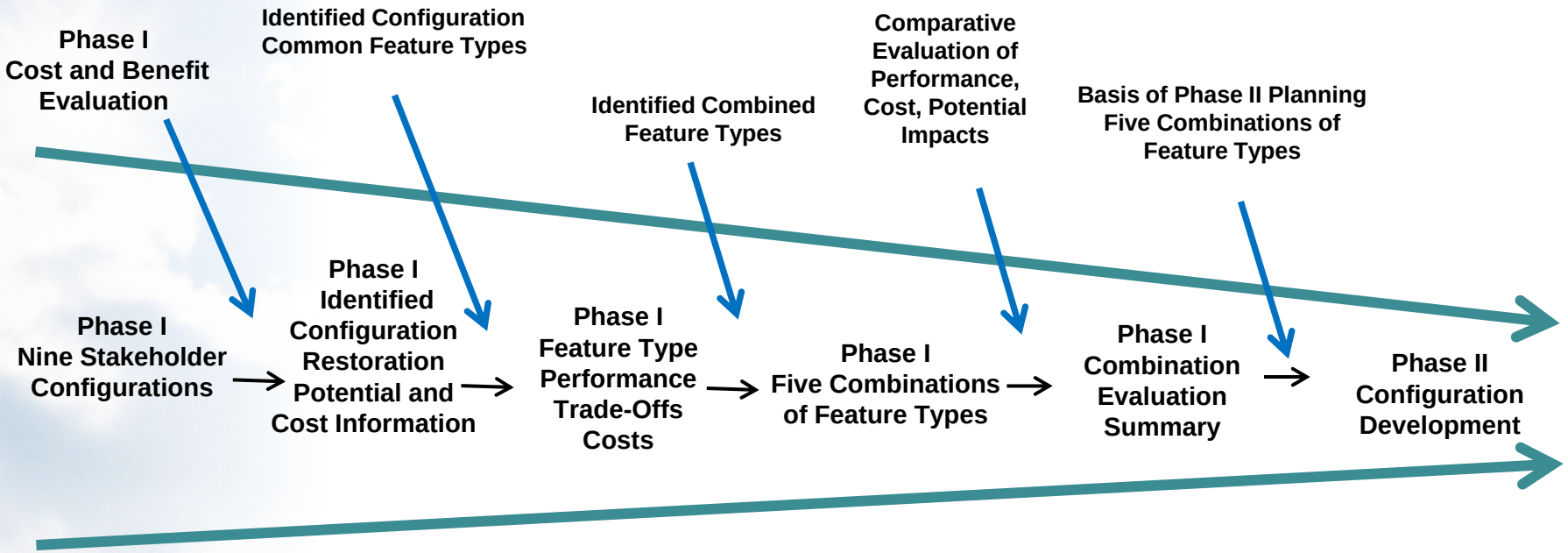
EAA Wetlands
Low to Medium

Cost Estimate
Medium to High

Land/Economics
Medium to High



Basis of Phase II Configuration Development



Maximum of 5 Phase II Configuration Development Teams Based on Combined Feature Types

Deep and Shallow Storage with STA

Deep Storage Reservoir with STA

Shallow Dry Storage with STA

Shallow Wet Storage with STA

Deep Storage in LO with STA

Does not preclude the use of ASR in Phase II Planning

Questions?

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