Everglades Agricultural Area Storage Reservoirs Phase 1
Evaluation Criteria Fact Sheet

Comprehensive Everglades Restoration Plan		EC 1.1.1.1
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.1 Water Quality**	
Level 4:	**1.1.1 Reservoirs/Impoundments**	
Level 5:	**1.1.1.1 Phosphorus**	

Description: (*What is being measured and why*)

The major forms of P that are found in surface waters can be categorized as dissolved and particulate P. Each of these fractions can be further divided into organic and inorganic forms. The combined total of all forms of P is called total P (TP). In reservoirs and aquatic environments the primary processes that remove P from the water column are chemical precipitation and biological fixation in particulate forms and subsequent sedimentation. Phosphorus undergoes biogeochemical cycles in reservoirs and aquatic environments. Some of the P that is removed from the water column to the sediments is recycled back to the water column due to natural processes such as seasonal changes in dissolved oxygen concentrations overlying the sediments. Some is recycled by fish and other aquatic organisms. Some P enters the reservoir water column via precipitation, dryfall from atmospheric dust and ash, and biological activities such as excreta from migrating waterfowl. Some P leaves reservoirs in exported biological forms. However, the primary long-term sink for P in reservoirs and lakes is permanent storage in the sediments.

The amount of reduction is dependent upon the actual hydrodynamics of the water body, the forms of P in the inflows, the regional and local climatic conditions, and the biological conditions actually present in the reservoir. The single most important factors for predicting P removal in reservoirs are typically the hydraulic residence time (reservoir volume divided by inflow rate), the P inflow concentration and mass loading rate (inflow rate times concentration), and the fractionation of the P into organic and inorganic dissolved and particulate forms.

Rationale: (*Technical basis for why the performance measure is being utilized*)

An important secondary objective of the proposed water storage reservoirs is to provide benefits for long-term P removal. Under no circumstances should the long-term downstream average P load be increased as a result of storage reservoirs. Maximizing P removal in reservoirs should be a goal whenever that function is not in conflict with other primary water storage goals. Reservoir outflow concentrations will be evaluated for use in estimating STA inflows and for use in determining compliance with State water quality standards in conveyance canals.

Target: (*Specific description of how success or failure will be measured*)

1. The proposed EAASRs should maximize the reduction of phosphorus load and concentration to the extent possible without significantly compromising the primary project goal of water storage.

2. Alternative reservoir design criteria/methods should be considered that increase P removal capacity.

3. The proposed EAASRs should not cause or contribute to violation of State water quality standards for phosphorus in downstream conveyance canals or other regulated waters of the State.

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Evaluation Method: (*Description of what model or analytical method will be utilized*)

Phosphorus removal in the proposed EAASRs will be assessed using the best available model. The best available model will be the most accurate analytical procedure, regression, spreadsheet, dynamic model, etc. for estimating P concentration and load reduction in the proposed EAASRs that is supported by existing data. Existing data on reservoir and lake P removal dynamics for Florida systems will be summarized by the District. These data will be used to calibrate the appropriate EAASR water quality model. For each reservoir alternative it will be necessary to estimate inflow rates and P concentrations as well as other inputs to the selected reservoir P removal performance model. These simulated input data sets will be used in concert with the selected model to estimate a time-series of outflow P concentrations and loads for each reservoir alternative considered. These estimated data will be compared to ambient water quality criteria for downstream water bodies to demonstrate compliance with state water quality standards. These data will also be used in concert with any available algorithms predicting P removal in the canals to serve as the input to the STA performance models.

Comments:

Reference - Scheit, D., Stober J, Jones, R., and Thornton, K. 2000. South Florida ecosystem assessment: Everglades Watershed Management, Soil loss, eutrophication and habitat. USEPA 904-R-00-003

Comprehensive Everglades Restoration Plan		EC 1.1.1.2
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.1 Water Quality**	
Level 4:	**1.1.1 Reservoirs/Impoundments**	
Level 5:	**1.1.1.2 Mercury/Sulfur Species in water, fish, and soils**	

Description: (*What is being measured and why*)

Concentration of total and methylmercury and sulfate in surface water; total mercury, methylmercury, total sulfur, and acid volatile sulfide in soils; and total mercury in mosquito fish, sunfish, and largemouth bass. Widespread elevated mercury concentrations were first discovered in freshwater fish from the Everglades in 1989, which resulted in the issuance of fish consumption advisories for selected species and locations. Mercury is a persistent, bioaccumulative toxicant (PBT), which can build up in the food chain to levels that are harmful to human and ecosystem health. Elevated mercury levels had subsequently been found in predators like raccoons, alligators, wading birds, and Florida panthers. Methylmercury is the most toxic and bioaccumulative form of mercury.

Methylmercury is produced from inorganic mercury in runoff, atmospheric deposition, and sediment by natural processes occurring in all aquatic ecosystems. Methylation of a fraction of the newly deposited and soil-bound inorganic mercury occurs primarily in surficial sediments and primarily as a byproduct of the life processes of sulfate-reducing bacteria. This occurs in the absence of oxygen (anoxic or anaerobic conditions) but in the presence of organic carbon and sulfate. Sulfide is an end product of bacterial sulfate reduction. The addition of sulfate stimulates the metabolic activity of sulfate-reducing bacteria and the inadvertent methylation of inorganic mercury up to the point that something else becomes limiting, but sulfide may stimulate or inhibit methylmercury production, depending on its concentration and the surrounding sediment biogeochemistry. The surface water sulfate concentrations causing stimulation or inhibition of mercury methylation vary across the Everglades. Methylmercury in soil and mosquitofish are strongly inversely correlated with pore water sulfide, but acid volatile sulfide in soil is an acceptable surrogate.

Evidence suggests that sulfur species originating in the EAA have contaminated surface water and soils of the EPA (Bates et.al. 2002). Sulfate concentrations in EAA runoff and Lake Okeechobee releases average more than 50 times background concentrations in the pristine Everglades, which is less than 1 mg/L. Minimally impacted areas targeted for hydropattern restoration may be especially vulnerable to stimulation of methylation if sulfate-laden water is used for this purpose. Moreover, sulfide is a toxic to aquatic invertebrates and fish and rooted plants. USEPA recommends that surface water contain no more than 2 ug/L sulfide on average to protect aquatic animals (USEPA Gold Book, 1987). A criterion to protect rooted plants has not been developed for sawgrass, but the 2 ug/L value protective of aquatic animals should be protective of rooted aquatic plants, as well.

Further, drying and rewetting of Everglades sediments greatly increases methylmercury production rates for short periods of time, but in some systems, such as STA-2 Cell 1, “first-flush” excess methylmercury production can persist for many months. This first-flush pulse of excess methylmercury then builds up in the aquatic food chain to levels that could place some fish-eating species or their predators at an unacceptable risk of toxic effects from methylmercury exposure. Moreover, in systems where the first-

flush methylmercury pulse is efficiently recycled, the contamination of the food web can persist for decades, giving rise to the "reservoir effect."

Rationale: (*Technical basis for why the performance measure is being utilized*)

The EAA SR are expected to alter the timing, extent, magnitude and duration of flow and hydroperiods to the EPA, Holey Land WMA, and Rotenberger WMA. EAA storage reservoirs may either directly or indirectly influence the sedimentary release, downstream loading, net methylation, or bioaccumulation of mercury, thus inadvertently contributing to the existing mercury contamination in south Florida.

EAA SR should not cause or contribute to sulfate contamination in the EPA. Waters discharged from the EAA SR to the STAs should be protective of the downstream areas targeted for restoration.

Target: (*Specific description of how success or failure will be measured*)

The proposed EAASRs should not cause or contribute to violations of the Class III water quality standards for total mercury in downstream surface waters. To the greatest extent practicable the EAASRs should not result in measurable increases in downstream levels of methylmercury in surface water and biota. The EAASRs also should not cause an increase in the average downstream surface water concentrations of sulfate.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Total mercury removal, methylmercury generation, and fish bioconcentration in the proposed EAASRs will be assessed using the best available models. The best available models will be the most accurate analytical procedure, regression, spreadsheet, dynamic model, etc. that is supported by existing data.

For each reservoir alternative it will be necessary to estimate inflow rates and total mercury concentrations as well as other inputs to the selected reservoir total mercury removal performance model such as total sulfate. These simulated input data sets will be used in concert with the selected mercury dynamics model to estimate a time-series of outflow total mercury concentrations and loads for each reservoir alternative considered. These estimated data will be compared to ambient water quality criteria for downstream water bodies to demonstrate compliance with state water quality standards. These data will also be used in concert with any available algorithms predicting mercury methylation, bioaccumulation, and total mercury removal in the canals to serve as the input to STA mercury dynamics models.

Comments:

Adapted from RECOVER performance measure TS-3 developed by Larry Fink-SFWMD.

Targets may be adjusted to be consistent with RECOVER Water Quality Team generic monitoring plan.

References: (1997) Mercury study report to Congress – Vol. VI: an ecological assessment for anthropogenic mercury emissions in the United States. EPA-452/R-97-008

Scheit, D., Stober J, Jones, R., and Thornton, K. 2000. South Florida ecosystem assessment: Everglades Watershed Management, Soil loss, eutrophication and habitat. USEPA 904-R-00-003

Bates, A.L., Orem W.H., Harvey, J.W., and Spiker E.C. 2002. Tracing Sulfur in the Florida Everglades. Jour. Envir. Qual. 31(1): 287-299.

Comprehensive Everglades Restoration Plan		EC 1.1.1.3
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.1 Water Quality**	
Level 4:	**1.1.1 Reservoirs/Impoundments**	
Level 5:	**1.1.1.3 Other Water Quality Parameters**	

Description: (*What is being measured and why*)

This criterion addresses the fate of other water quality parameters in the reservoirs, i.e., the reservoirs should not cause or contribute to violation of state water quality standards (Rule 62-302).

Draft CERP Guidance Memorandum (CGM) dated March 25, 2003 identifies the EAA Storage Reservoirs project as category "B" project. Category B projects are described in the CGM as those for which water quality improvement is not a project purpose, but is to be addressed during design. The water quality parameters of interest in this evaluation criterion are those that are regulated by the Florida Department of Environmental protection (FDEP) and are considered to be the most likely to show degradation in surface waters downstream from the proposed EAASRs.

The following list of parameters, compiled using Class III water quality criteria (as specified in Section 62-302.530, Florida Administrative Code), is the recommended list of water quality parameters by FDEP for baseline water quality characterization.

1. Dissolved Oxygen (DO)
2. Conductivity
3. PH
4. Turbidity
5. Total nitrogen
6. Alkalinity
7. Iron
8. Total Phosphorus (will be a separate Evaluation Criteria see 1.1.1.1)
9. Calcium
10. Sulfate (will be a separate Evaluation Criteria see 1.1.1.2)
11. Sodium
12. Chloride
13. Mercury (will be a separate Evaluation Criteria see 1.1.1.2)
14. Pesticide/Herbicide
15. Total Suspended Solids (TSS)

Rationale: (*Technical basis for why the performance measure is being utilized*)

The fate of the water quality parameters in the reservoirs needs to be evaluated to provide assurances that the project will not cause or contribute to violation of state water quality standards in downstream regulated surface waters. Storage of water in the proposed EAASRs is likely to have variable effects on the parameters of interest listed above. If the reservoir outlet is designed near the water surface, concentrations of DO may be increased due to primary production by filamentous or planktonic algae or by submerged aquatic vegetation that colonize the reservoirs. If the reservoir outlet pulls water off the

bottom of the reservoir, then DO concentrations in the discharge may be seasonally low due to anaerobic conditions near the sediment/water interface. Conductivity and chloride concentrations may be slightly raised or lowered in water stored within the proposed reservoirs due to the effects of evaporation or precipitation. Hydrogen ion concentration (pH) may also be influenced by algal and SAV productivity. Turbidity and total suspended solids concentrations may be increased by internal production of suspended solids or may be decreased by sedimentation of suspended matter and reduction in color. Total nitrogen concentrations will generally decline in reservoirs. Alkalinity may increase or decrease based on the source of the surface water and interactions with groundwater and soils. Iron, calcium, and sodium concentrations may increase or decrease due to the same factors. Concentrations of pesticides and herbicides will generally decrease in reservoirs unless there are internal sources due to mosquito or aquatic weed control.

Target: (*Specific description of how success or failure will be measured*)

The basic measure of success for any reservoir alternative that is considered is that the option will not cause or contribute to water quality degradation in downstream surface waters. More specifically, each parameter or group of parameters in the FDEP list has a different indicator of success or failure as indicated below:

Conservative parameters such as conductivity and chloride – no statistically significant change outside of normal increases or decreases due to natural climatic conditions such as precipitation and evaporation

Biologically active parameters such as DO, pH, nitrogen, turbidity, and total suspended solids – no violation of Class III water quality standards at the reservoir outfall

Salts, metals, cations, and anions such as iron, calcium, sodium, and anthropogenic trace organic pesticides and herbicides that may be released from antecedent soils within the footprint of the reservoirs or by operation of the reservoirs - no violation of Class III water quality standards at the reservoir outfall.

Evaluation Method: (*Description of what model or analytical method will be utilized)*

Water quality in the proposed EAASRs will be assessed using the best available model for each parameter of interest. The best available model will be the most accurate analytical procedure, regression, spreadsheet, dynamic model, etc. for estimating the water quality constituent concentration and load reduction in the proposed EAASRs that is supported by existing data. For each reservoir alternative it will be necessary to estimate inflow rates and water quality constituent concentrations as well as other inputs needed for the selected reservoir water quality model. These simulated input data sets will be used in concert with the selected model to estimate a time-series of outflow water quality constituent concentrations and loads for each reservoir alternative considered. These estimated data will be compared to ambient water quality criteria for downstream water bodies to demonstrate compliance with State water quality standards. These data will also be used in concert with any available algorithms predicting water quality changes in the canals to serve as the input to the STA performance models

Comments:

Comprehensive Everglades Restoration Plan	PM 1.1.1.4
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.1 Reservoirs/Impoundments**
Level 5:	**1.1.1.4 Minimize Frequency of Dry-out**

Description: (What is being measured and why)

The frequency of reservoir dry out events should be minimized through reservoir design and operation. Reservoir dryout may, in some cases, deteriorate water quality for some parameters in the reservoir outflow. For example, dryout followed by reflooding may result in the release of minimally sequestered compounds such as organic P, soluble reactive P (SRP), organic and ammonium nitrogen, cations and anions such as calcium, iron, sodium, and sulfate, methylated mercury compounds, and trace organics such as pesticides and herbicides into the reflooded water column. Upon discharge, some of these resuspended and dissolved constituents may be released to downstream waters.

Rationale: *(Technical basis for why the performance measure is being utilized)*

The frequency of reservoir dryout can be altered through reservoir siting and design. For some water quality parameters it is currently suspected that dryout will potentially result in degradation of water quality and the possible release of degraded water compared to the inflow water quality. The extent and actual importance of this potential water quality degradation is not well understood at this time but can be suspected to be highly dependent upon the actual circumstances of the dryout, including its duration and frequency, the season when it occurs, the pre-existing ecological status of the reservoir prior to the dryout (plant community, water depth, populations of fish or other wildlife, etc.), management of the reservoir during the dryout by fire, tilling, or other plant control activities, and by stochastic variation. When a reservoir dries out, the P-enriched soil in the reservoir may potentially releases phosphorus. When the reservoir is re-wetted, there is a potential flush of phosphorus into the water column that can cause increased phosphorus levels in discharge water. In addition, the production of methylmercury is increased with frequent drying and re-wetting events. Drydowns of the reservoir may produce pulses of methylmercury production; stimulate corresponding bioaccumulation in wildlife, increase exposure, and risks of toxic effects. EAA reservoirs may either directly or indirectly influence the sedimentary release, downstream loading, net methylation, or bioaccumulation of mercury, thus inadvertently contributing to the existing mercury contamination in South Florida.

For some water quality constituents and reservoir management goals, dryout may be beneficial. For example, it has been hypothesized that periodic dryouts help sequester P in shallow algal-dominated waters through co-precipitation with calcium. Dryout is also intentionally used in many lakes and man-made reservoirs for sediment consolidation (increasing water storage volume) and for control of aquatic weeds.

The effects of dryout, if any, may also be mitigated by reservoir design and by operation. For example, inclusion of perennially wet "deep zones" within the footprint of the reservoir that extend below the lowest surface elevation of the local water table may mitigate some water quality changes in drier areas. Holding water after reservoir dryout before eventual release downstream may allow re-adsorption of

some dissolved contaminants such as phosphorus, nitrogen, and methylated mercury.

For the reasons described above, it is important to assess both the potential negative and positive effects of dryout when considering a range of alternative design options and locations for the proposed EAASRs.

Target: *(Specific description of how success or failure will be measured)*

The target is to minimize the frequency of dry-out events in reservoirs, with the target of zero dry-out events. A dry-out event is defined as an event where water level within a reservoir is equal to or less than the average ground surface elevation. for one day (50% of the ground surface is not covered by water but may be saturated while 50% is covered by surface water).

Evaluation Method: *(Description of what model or analytical method will be utilized)*

Estimate the frequency of dry-out events in reservoirs using estimated inflow hydraulic loads based on watershed models and preparation of a daily water balance for each reservoir option using subregional and/or 2x2 model output. Prepare a semi-quantitative matrix of anticipated dryout effects ranging from positive (+5 to +1), no effects (0), to increasingly negative (-1 to -5) for each of the following target criteria:

1. Downstream P loads
2. Mercury methylation and bioaccumulation
3. Effects on other water quality parameters at the reservoir outflow
4. Sediment consolidation
5. Plant communities
6. Fish and wildlife habitat

Comments:

Comprehensive Everglades Restoration Plan		PM 1.1.1.5
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.1 Water Quality**	
Level 4:	**1.1.1 Reservoirs/Impoundments**	
Level 5:	**1.1.1.5 Minimize Duration of Dry-out**	

Description: *(What is being measured and why)*

The duration of reservoir dry out events should be minimized through reservoir design and operation. Reservoir dryout may, in some cases, deteriorate water quality for some parameters in the reservoir outflow. For example, dryout followed by reflooding may result in the release of minimally sequestered compounds such as organic P, soluble reactive P (SRP), organic and ammonium nitrogen, cations and anions such as calcium, iron, sodium, and sulfate, methylated mercury compounds, and trace organics such as pesticides and herbicides into the reflooded water column. Upon discharge, some of these resuspended and dissolved constituents may be released to downstream waters.

Rationale: *(Technical basis for why the performance measure is being utilized)*

The duration and spatial extent of reservoir dryout can be altered through reservoir siting and design. For some water quality parameters it is currently suspected that dryout will potentially result in degradation of water quality and the possible release of degraded water compared to the inflow water quality. The extent and actual importance of this potential water quality degradation is not well understood at this time but can be suspected to be highly dependent upon the actual circumstances of the dryout, including its duration and frequency, the season when it occurs, the pre-existing ecological status of the reservoir prior to the dryout (plant community, water depth, populations of fish or other wildlife, etc.), management of the reservoir during the dryout by fire, tilling, or other plant control activities, and by stochastic variation.

When a reservoir dries out, P-enriched soil in the reservoir potentially releases phosphorus. When the reservoir is re-wetted, there is a potential flush of phosphorus into the water column that can cause increased phosphorus levels in discharge water. In addition, the production of methylmercury is increased with frequent drying and re-wetting events. Drydowns of the reservoir may produce pulses of methylmercury production; stimulate corresponding bioaccumulation in wildlife, increase exposure, and risks of toxic effects. EAA reservoirs may either directly or indirectly influence the sedimentary release, downstream loading, net methylation, or bioaccumulation of mercury, thus inadvertently contributing to the existing mercury contamination in South Florida.

For some water quality constituents and reservoir management goals, dryout may be beneficial. For example, it has been hypothesized that periodic dryouts help sequester P in shallow algal-dominated waters through co-precipitation with calcium. Dryout is also intentionally used in many lakes and man-made reservoirs for sediment consolidation (increasing water storage volume) and for control of aquatic weeds.

The effects of dryout, if any, may also be mitigated by reservoir design and by operation. For example, inclusion of perennially wet “deep zones” within the footprint of the reservoir that extend below the lowest surface elevation of the local water table may mitigate some water quality changes in drier areas.

Holding water after reservoir dryout before eventual release downstream may allow re-adsorption of some dissolved contaminants such as phosphorus, nitrogen, and methylated mercury.

For the reasons described above, it is important to assess both the potential negative and positive effects of dryout when considering a range of alternative design options and locations for the proposed EAASRs

Target: *(Specific description of how success or failure will be measured)*

Minimize the duration of undesirable or unplanned dry-out events in reservoirs, with the target of minimizing the number of consecutive days of unplanned dry-out events. A dry-out event is defined as an event where water level within a reservoir is equal to or less than the average ground surface elevation for one day (50% of the ground surface is not covered by water but may be saturated while 50% is covered by surface water). Consecutive day events could be defined as "greater than 2 consecutive days."

Evaluation Method: *(Description of what model or analytical method will be utilized)*

Estimate the duration of dry-out events in reservoirs using estimated inflow hydraulic loads based on watershed models and preparation of a daily water balance for each reservoir option using subregional and/or 2x2 model output. Prepare a semi-quantitative matrix of anticipated dryout effects ranging from positive (+5 to +1), no effects (0), to increasingly negative (-1 to -5) for each of the following target criteria:

- Downstream P loads
- Mercury methylation and bioaccumulation
- Effects on other water quality parameters at the reservoir outflow
- Sediment consolidation
- Plant communities
- Fish and wildlife habitat

Comments:

Comprehensive Everglades Restoration Plan	PM 1.1.2.1
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.2 STAs**
Level 5:	**1.1.2.1 Minimize Frequency of Dry-out**

Performance Measure

Description: (*What is being measured and why*)

The frequency of STA dry-out for the STAs that will receive water from the EAA reservoirs. Currently the STAs receive supplemental water from Lake Okeechobee to avoid dry-out. Once on line, the reservoirs should be able to provide the supplemental water to the STAs to avoid dry-out.

Rationale: (*Technical basis for why the performance measure is being utilized*)

For some water quality parameters in STAs it is currently suspected that dryout will potentially result in degradation of water quality and the possible release of degraded water compared to the inflow water quality. The extent and actual importance of this potential water quality degradation is not well understood at this time but can be suspected to be highly dependent upon the actual circumstances of the dryout, including its duration and frequency, the season when it occurs, the pre-existing ecological status of the reservoir prior to the dryout (plant community, water depth, populations of fish or other wildlife, etc.), management of the reservoir during the dryout by fire, tilling, or other plant control activities, and by stochastic variation.

When an STA dries out, the phosphorus-enriched soil in the STA may potentially release phosphorus. When the STA is re-wetted, there is potentially a flush of phosphorus into the water column that could cause increased phosphorus levels in discharge water. In addition, the production of methylmercury is potentially increased with frequent drying and re-wetting events. Drydowns of STAs may produce pulses of methylmercury production, stimulate corresponding bioaccumulation in wildlife, increase exposure, and risks of toxic effects. EAA reservoirs may either directly or indirectly influence the sedimentary release, downstream loading, net methylation, or bioaccumulation of mercury, thus inadvertently contributing to the existing mercury contamination in South Florida. The receiving areas of STA discharge water (i.e., EPA) are negatively affected by increased phosphorus and methylmercury levels in inflow water.

For some water quality constituents and STA management goals, dryout may be beneficial. For example, it has been hypothesized that periodic dryouts help sequester P in shallow algal dominated waters through co-precipitation with calcium.

Dry-out is a major concern for the STA treatment cells dominated by Submerged Aquatic Vegetation (SAV). Plant morbidity during prolonged periods of dry-out can result in a delay in treatment capability following re-wetting.

The effects of dryout, if any, may also be partially mitigated by STA design and operation. For example, inclusion of perennially wet "deep zones" within the footprint of the STA that extend below the lowest surface elevation of the local water table may mitigate some water quality changes in drier areas. Holding water after STA dryout and reflooding before eventual release downstream may allow re-

adsorption of some dissolved contaminants such as phosphorus, nitrogen, and methylated mercury. For the reasons described above, it is important to assess both the potential negative and positive effects of dryout when considering a range of alternative design options and locations for the proposed EAASRs.

Target: (Specific description of how success or failure will be measured)

Minimize the frequency of unplanned dry-out events in STAs, with the ultimate target of zero dry-out events. A dry-out event is defined as an event where water level within an STA is below 6"above the average ground surface elevation for one day.

Evaluation Method: (Description of what model or analytical method will be utilized)

Estimate the frequency of dry-out events in STAs that will receive water from the reservoirs using estimated inflow hydraulic loads based on reservoir models and preparation of a daily STA waster balance. The 2x2 simulates sending supplemental water to the STAs on a daily as-needed basis (if source water is available). The number of days that supplemental water is provided to the STAs would be totaled over the 36-year period of simulation to define the frequency of dry-out for each alternative. Prepare a semi-quantitative matrix of anticipated STA dryout effects ranging from positive (+5 to +1), no effects (0), to increasingly negative (-1 to -5) for each of the following target criteria:

Downstream P loads
Mercury methylation and bioaccumulation
Effects on other water quality parameters at the STA outflow
Plant communities
Fish and wildlife habitat

Comments:

Comprehensive Everglades Restoration Plan	PM 1.1.2.2
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.2 STAs**
Level 5:	**1.1.2.2 Minimize Duration of Dry-out**

Performance Measure

Description: (*What is being measured and why*)

The duration of dry-out for the STAs that will receive water from the EAA reservoirs. Currently the STAs receive supplemental water from Lake Okeechobee to avoid dry-out. Once on line, the reservoirs should be able to provide the supplemental water to the STA(s) to avoid dry-out.

Rationale: (*Technical basis for why the performance measure is being utilized*)

When an STA dries out, the phosphorus-enriched soil in the STA may potentially release phosphorus. When the STA is re-wetted, there is potentially a flush of phosphorus into the water column that could cause increased phosphorus levels in discharge water. In addition, the production of methylmercury is potentially increased with frequent drying and re-wetting events. Drydowns of STAs may produce pulses of methylmercury production, stimulate corresponding bioaccumulation in wildlife, increase exposure, and risks of toxic effects. EAA reservoirs may either directly or indirectly influence the sedimentary release, downstream loading, net methylation, or bioaccumulation of mercury, thus inadvertently contributing to the existing mercury contamination in South Florida. The receiving areas of STA discharge water (i.e., EPA) are negatively affected by increased phosphorus and methylmercury levels in inflow water.

For some water quality constituents and STA management goals, dryout may be beneficial. For example, it has been hypothesized that periodic dryouts help sequester P in shallow algal dominated waters through co-precipitation with calcium.

Dry-out is a major concern for the STA treatment cells dominated by submerged aquatic vegetation (SAV). Plant morbidity during prolonged periods of dry-out can result in a delay in treatment capability following re-wetting. The effects of dryout, if any, may also be partially mitigated by STA design and operation. For example, inclusion of perennially wet "deep zones" within the footprint of the STA that extend below the lowest surface elevation of the local water table may mitigate some water quality changes in drier areas. Holding water after STA dryout and reflooding before eventual release downstream may allow re-adsorption of some dissolved contaminants such as phosphorus, nitrogen, and methylated mercury.

For the reasons described above, it is important to assess both the potential negative and positive effects of dryout when considering a range of alternative design options and locations for the proposed EAASRs.

Target: (*Specific description of how success or failure will be measured*)

Minimize the duration of unplanned dry-out events in STAs, with the ultimate target of minimizing the number of consecutive days of dry-out events. A dry-out event is defined as an event where water level

within an STA is below 6" above the average ground surface elevation for one day. Consecutive day events are defined as "greater than 2 consecutive days."

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Estimate the duration of dry-out events in STAs that will receive water from the reservoirs using estimated inflow hydraulic loads based on reservoir models and preparation of a daily STA water balance for each upstream reservoir option. The 2x2 simulates sending supplemental water to the STAs on a daily as-needed basis (if source water is available). The number of consecutive day events that supplemental water is provided to the STA(s) would be totaled over the 36-year period of simulation to define the frequency of dry-out for each alternative. Prepare a semi-quantitative matrix of anticipated STA dryout effects ranging from positive (+5 to +1), no effects (0), to increasingly negative (-1 to -5) for each of the following target criteria:

- Downstream P loads
- Mercury methylation and bioaccumulation
- Effects on other water quality parameters at the STA outflow
- Plant communities
- Fish and wildlife habitat

Comments:

Comprehensive Everglades Restoration Plan	PM 1.1.2.3
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.2 STAs**
Level 5:	**1.1.2.3 Minimize Bypass Frequency and Volume**

Performance Measure

Description: (*What is being measured and why*)

The frequency and volume of events where water is released to the EPA without first passing through and STA for treatment. The reservoirs should have the capacity to store enough water so that large storm events can be captured and released to the STAs such that the hydraulic and water treatment capacity of the STAs are not exceeded.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Water that does not pass through an STA has a higher phosphorus load than water that has passed through an STA. Phosphorus enriched water that bypasses the STAs has the potential to negatively impact downstream the natural system.

Water quality in the Everglades has experienced substantial degradation over the last century. Anthropogenic inputs associated with the EAA have resulted in the nutrient enrichment of the EPA. One of the principal goals of the EFA is to reverse the historic trend of water quality degradation and nutrient enrichment and to: 1) improve ecological health by increasing native wildlife diversity and abundance; 2) decrease occurrences of cattail stands 3) decrease nutrient tolerant organisms; 4) reverse impairments in designated uses; and 5) promote the growth of native periphyton communities. Reduction in phosphorus load is an important goal for ecological restoration of the Everglades.

Target: (*Specific description of how success or failure will be measured*)

Minimize the frequency of STA bypass events by adding upstream flow equalization in the proposed reservoirs, with an ultimate target of zero events, and to minimize the total volume of bypasses that occur.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The 2x2 simulates STA bypass water on a daily as-needed basis (if STA hydraulic capacity/maximum depth is exceeded).

Frequency: The number of STA bypass events (in days) would be summarized over the 36-year period of simulation to evaluate the frequency of bypass for each alternative.

Volume: For each alternative, the total volume of bypass (in acre-feet) over the 36-year period of simulation would be calculated.

Comments:

Comprehensive Everglades Restoration Plan	PM 1.1.2.4
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.2 STAs**
Level 5:	**1.1.2.4 Optimize Retention Time**

Performance Measure

Description: *(What is being measured and why)*

Hydraulic retention times in the STAs. Phosphorus removal in STAs is directly related to hydraulic retention time. Longer retention times in the STAs are expected to result in improved efficiency of water quality treatment. Flow-equalization capacity in the proposed reservoirs should store enough water so that large storm events can be captured and released at lower, more constant flow rates to better optimize the hydraulic retention time in the STAs.

Rationale: *(Technical basis for why the performance measure is being utilized)*

Constant flows and stable hydrologic retention times are anticipated to result in increased phosphorus removal in the STAs.

Target: *(Specific description of how success or failure will be measured)*

Optimize the hydraulic retention time for the STAs.

Evaluation Method: *(Description of what model or analytical method will be utilized)*

The 2x2 model will be used in concert with the DMSTA model to estimate the effects of flow equalization in the proposed EAASRs on STA performance. Various reservoir alternatives will be evaluated based on their contribution to maximizing P removal in the downstream STAs based on the model predictions.

Comments:

Comprehensive Everglades Restoration Plan		PM 1.1.3
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.1 Water Quality**	
Level 4:	**1.1.3 Minimize Phosphorus Loads to Lake Okeechobee**	

Performance Measure

Description: (*What is being measured and why*)

Phosphorus loads to Lake Okeechobee. Current phosphorus loads from the EAA contribute to exceedances of the Lake Okeechobee TMDL. One of the goals of the proposed reservoirs is to reduce the loads of phosphorus that enter the lake from the EAA.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The proposed EAASRs will serve multiple purposes, including water storage during rainy periods for subsequent uses in the EAA during dry periods. The reservoir volume set aside for agriculture should receive the majority, if not all, of the excess water from the EAA. Reductions in the quantity of backpumped water to the lake will be likely to reduce the pollutant loads of phosphorus, other nutrients, trace metals, and pesticides. These reductions in pollutant loads to the lake as a result of the proposed EAASR project will help with the overall restoration of Lake Okeechobee.

Target: (*Specific description of how success or failure will be measured*)

Minimize the phosphorus load into Lake Okeechobee from the EAA and 298 Districts, through S-2 and S-3, with the ultimate target of zero back pumping events.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Estimate the frequency and volume of pumping events and phosphorus load into Lake Okeechobee through S-2 and S-3. The regional or sub-regional models can be used to provide these estimates of flow and phosphorus loads for the various reservoir alternatives considered.

Comments:

Reference - Total Maximum Daily Loads for Total Phosphorus, Lake Okeechobee – FDEP, August 2001

Comprehensive Everglades Restoration Plan	EC 1.1.4
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.1 Water Quality**
Level 4:	**1.1.4 Soil Contaminants/Site Selection**

Description: (*What is being measured and why*)

Contaminants within the soils of the proposed footprint of the reservoir impoundments and canal improvements prior to flooding. Within the EAA, past agricultural practices have in some areas, created contamination of near surface soils, including but not limited to, petroleum products, herbicides and pesticides, DDT, PCBs, heavy metals and nutrients. If contaminants are found, remediate where necessary. These contaminants pose a threat to restoration by being re-released and re-mobilized into the environment from the soils.

Rationale: (*Technical basis for why the performance measure is being utilized*)

To assure that if contaminants are found, they will be remediated before flooding. This is to avoid their re-release and re-mobilization into the waters of the reservoirs. Once mobile, these contaminants may be harmful to the greater system and may bioaccumulate up the food chain. Assure that the storage reservoirs and widened canals, when built, meet WQ standards.

Target: (*Specific description of how success or failure will be measured*)

To the extent practicable, avoid sitting or constructing on contaminated lands.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Base evaluation on HTRW study and recommendations.

Comments:

Comprehensive Everglades Restoration Plan	EC 1.2.1
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**1.0 Enhance Ecologic Values**
Level 3:	**1.2 Habitat Availability**
Level 4:	**1.2.1 Terrestrial Habitat**

Description: (*What is being measured and why*)

The increase in functional value of upland habitat, relative to future without project conditions in the project area will be measured.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Native and natural upland habitat functional gains include: 1) increased wildlife diversity and abundance; 2) improved water quality; 3) increased groundwater recharge; 4) improved human interests.

Target: (*Specific description of how success or failure will be measured*)

The target is to maximize functional value including connectivity of native and natural uplands for wildlife habitat. The degree to which the target is achieved would be measured based on an increase in functional value of upland habitat below the targeted increase.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Estimate the area of terrestrial habitat associated with each alternative.

Comments:

Comprehensive Everglades Restoration Plan		EC 1.2.2
Level 1:	**EAA Storage Reservoirs Project-Level**	
Level 2:	**1.0 Enhance Ecologic Values**	
Level 3:	**1.2 Habitat Availability**	
Level 4:	**1.2.2 Aquatic Deep Water Refugia**	

Description: (*What is being measured and why*)

For the purposes of this evaluation criteria, deep water refugia are defined as areas below the surrounding reservoir floor elevation that are capable of retaining a minimum of 4 feet of water during dry conditions. The total extent of deep-water refugia habitat will be measured in total surface acres present in each reservoir.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Deep-water refugia provide important habitat for aquatic wildlife (e.g. fishes, herpetofauna, and aquatic invertebrates) during periods when the surrounding area is dry. Providing deep-water refugia will result in decreased mortality of aquatic wildlife and act as a "seed source" of aquatic organisms upon subsequent reflooding of the reservoirs. Deep-water refugia may also provide temporary feeding grounds for avian species such as wading birds and enhance nutrient removal from the water column by allowing uninterrupted submerged aquatic vegetation (SAV) growth.

Target: (*Specific description of how success or failure will be measured*)

The minimum target for deep-water refugia habitat is to maintain a depth of 4 feet of water below reservoir floor elevation in 10% of the total reservoir area. The degree to which the target is achieved would be measured based on meeting or exceeding the depth and spatial extent target.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The extent of deep-water refugia available will be measured by modeling predicted total acres of deep-water refugia present in each reservoir to compare among the different alternative plans.

Comments:

Existing agricultural canals within the reservoir footprint and possible internal perimeter canals due to excavation activities could be evaluated as deep-water refugia.

Comprehensive Everglades Restoration Plan	EC 1.2.3
Level 1: **EAA Storage Reservoirs Project-Level**	
Level 2: **1.0 Enhance Ecologic Values**	
Level 3: **1.2 Habitat Availability**	
Level 4: **1.2.3 Effects to Wetlands**	

Description: (*What is being measured and why*)

The change in wetland functional value of wetlands, a component of spatial extent and functional quality, within the project area as defined by state and/or federal criteria, relative to the future without project conditions will be measured.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Wetlands associated with the reservoirs could not only serve as habitat, but could function to capture seepage and buffer flood impacts to adjacent agriculture. The wetland habitat could also improve water quality by intercepting sediments, removing nutrients, and reducing near-shore water temperature. It would contribute to the food web through detritus input and provide habitat for reptiles, small birds and other wildlife.

The importance of wetlands in south Florida has been documented and it is known that undesirable changes and substantial losses have occurred over the last century. Wetland gains are linked to: 1) increased wildlife diversity and abundance; 2) improved water quality; 3) increased storage capacity; 4) enhanced downstream functions of the natural environment; and 5) improved human interests. Thus, reversing the historic trend of wetland losses (by additional gains) would be a significant achievement. Effects to wetland functional values (gains and losses) will be estimated for each alternative to determine overall project performance as it applies to the restoration of wetland habitat.

Target: (*Specific description of how success or failure will be measured*)

The target is to minimize the net loss of wetlands functional values within the project area, with the ultimate goal of increasing wetland functional value, to the extent practicable.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

To evaluate the change in wetland functional values, the spatial extent of existing wetlands will be delineated using combined state and federal criteria (i.e., the greater extent of the two delineation methodologies) and a future without project condition will be predicted. The change in wetland spatial extent will be calculated using GIS applications that incorporate predicted wetlands to compare different plan alternatives. STAs will not be considered for the purpose of this evaluation criterion.

To evaluate the increase/decrease in functional value, wetland evaluation methodologies (e.g., WRAP, FUWAM, or its replacement under state regulations) will be used to compare forecasted conditions in functional value with predicted project plan alternatives.

To demonstrate the effects of each alternative and to comply with Executive Order 11990, Protection of Wetlands, the change in the special extent of existing wetland will also be evaluated for each alternative.

Other evaluation methods for wetland function may also be available or developed to consider the quantitative or qualitative measures of vegetation, wildlife, water quality, hydrology, soils, and habitat suitability for threatened and endangered species.
Comments:

Comprehensive Everglades Restoration Plan			PM 2.1.
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.1**	**Reduce Agricultural Flood Damages**	
Level 4:			

Performance Measure

Description: (*What is being measured and why*)

Agricultural flood damages (in dollars) will be estimated for each alternative plan and compared to the future without project condition.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Reduction of agricultural flood damages is an authorized project purpose.

Target: (*Specific description of how success or failure will be measured*)

Reduce flood damage potential.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The hydrologic model shall be used to predict flood depths and duration for a limited seasonality partial duration series (i.e. Quarterly) as appropriate for computation of flood damages based on the seasonality of crops typically found in representative sub-basins. This hydrologic information will then be used to estimate average annual flood damages for each sub-basin, as well as for the EAA in total.

NED Requirements – Evaluation of durations of flooding in root zones for different crops using sub-regional model.

Comments:

WRDA 2000 Savings Clause compliance is necessary. It is a design target not to decrease December 11, 2000 flood protection condition in the project area.

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Comprehensive Everglades Restoration Plan			EC 2.2.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.2**	**Social Impacts**	
Level 4:	**2.2.1**	**Acceptability**	

Description: (*What is being measured and why*)

Project acceptability is a subjective measure that will identify the extent to which the alternative plans are workable and viable with respect to acceptance by State and local entities and the public.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Acceptability is one of the four primary evaluation criteria as described in the Corps' Principles and Guidelines. The other criteria include completeness, efficiency, and effectiveness.

Target: (*Specific description of how success or failure will be measured*)

Maximize acceptability of the project. Each alternative will be ranked as low, moderate, or high in terms of public acceptability.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The acceptability of alternatives by state and local entities will be assessed with respect to applicable laws, regulations, public policies, and visual aesthetics. Methodology needs to identify how the opinions will be gathered (mail out, phone survey, email, in person, other…). A composite of public opinion will provide input for this criterion.

Comments:

Everglades Agricultural Area Storage Reservoirs Phase 1
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Comprehensive Everglades Restoration Plan	EC 2.2.2.1
Level 1:	**EAA Storage Reservoirs Project-Level**
Level 2:	**2.0 Enhance Economic Values and Social Well Being**
Level 3:	**2.2 Social Impacts**
Level 4:	**2.2.2 Environmental & Economic Equity**
Level 5:	**2.2.2.1 Impact on Jobs by Group Population**

Description: (*What is being measured and why*)

The number of workers by Group Population displaced from their jobs as a direct result of this project. This evaluation will quantify impacts on low income and minority populations.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Executive Order 12898 and WRDA 2000 require the evaluation of the Restudy (p.8-13, Vol. 1) which states that "The most potentially significant 'other social effects' consideration for the alternative plans concerns the development of new storage reservoirs in the rural areas surrounding Lake Okeechobee (including the EAA) and the consequences for urban and community impacts and displacement of people. …the resilience of local economies and the cohesion of local communities to agricultural land conversion depend on a variety of factors, including the age, ethnic, and racial composition of the community and income, unemployment, and poverty levels."

The Environmental Justice goal is to identify high, adverse, and disproportionate impacts on low income or minority populations as a result of the project and then to adjust the plan if possible to avoid or reduce the impacts.

Target: (*Specific description of how success or failure will be measured*)

Minimize number of jobholders from low income and minority populations displaced from their jobs.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The evaluation will include direct impacts only. Following completion of field surveys or public outreach to determine locations of places of employment of minorities and determination of which minorities are working at those locations; this information can be combined and applied as a percentage to the information collected in evaluation criteria 2.5.1 and 2.5.2.

Comments:

Recognize that some new jobs will be created that may partially offset the lost (i.e. construction, O&M, etc.)

Comprehensive Everglades Restoration Plan			EC 2.2.2.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.2**	**Social Impacts**	
Level 4:	**2.2.2**	**Environmental & Economic Equity**	
Level 5:	**2.2.2.2**	**Displaced Housing by Group Population**	

Description: (*What is being measured and why*)

The number of households by Group Population forced to relocate as a direct result of this project. This evaluation will quantify impacts on low income and minority populations.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Executive Order 12898 and WRDA 2000 require the evaluation of the Restudy (p8-13, Vol. 1) which states that "The most potentially significant 'other social effects' consideration for the alternative plans concerns the development of new storage reservoirs in the rural areas surrounding Lake Okeechobee (including the EAA) and the consequences for urban and community impacts and displacement of people. …the resilience of local economies and the cohesion of local communities to agricultural land conversion depend on a variety of factors, including the age, ethnic, and racial composition of the community and income, unemployment, and poverty levels."

The Environmental Justice goal is to identify high, adverse, and disproportionate impacts on low income or minority populations as a result of the project and then to adjust the plan if possible to avoid or reduce the impacts.

Target: (*Specific description of how success or failure will be measured*)

Minimize the number of households from low income and minority populations forced to relocate and avoid disproportionate negative impacts on these groups.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Alternative project sites can be overlaid on a GIS database that has the most current information to determine the number of residences impacted. This information is currently available in Palm Beach County by primary sub-basins. Maps of the other counties are available but are not digitized. Data on minorities, by group, at the sub-basin level is available or being developed in the watershed. Method of evaluation could include coordination with outreach and identifying (through local knowledge) the location of homogeneous poor neighborhoods, calculating average densities, and proportioning number of structures within the affected area. If the neighborhoods or areas are not homogeneous, perhaps use a rating system (less severe, equal, more severe). Information on residential relocations for each alternative will be developed as part of the Real Estate evaluation. This information along with specific information collected through direct inquiries, will be used to determine the number of residences occupied by minorities.

Comments:

Comprehensive Everglades Restoration Plan			EC 2.3.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.3**	**Recreational Opportunities**	
Level 4:	**2.3.1**	**Access and Suitability for Boating Activities**	

Description: (*What is being measured and why*)

Evaluation of the suitability of boating activities in the reservoirs. The suitability of the reservoirs for boating activities is dependent upon water depths, the potential for water quality impacts, and the occurrence of dry-outs. For any kind of recreational activity, accessibility is directly correlated to public use accesses. For example, the levee roads may need to be rated for public use and boat ramp(s) would need to be provided for public use. In any event, the boating activities cannot cause any conflicts with the project goals and objectives.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The EAA Storage Reservoirs project has the potential to serve as a recreational resource for the citizens and taxpayers of South Florida, however, any recreational uses cannot conflict with the project goals and objectives. Passive recreational activities, such as bird watching and sightseeing are preferred over more invasive activities such as boating, fishing, and hunting. Facilities such as boardwalks, kiosks, gazebos, pavilions, and educational displays, provide excellent recreational opportunities for the public.

Boating is expected to enhance the local economy through selling of licenses, supplies and equipment needed for this activity.

Target: (*Specific description of how success or failure will be measured*)

This criterion addresses opportunities. The target is to determine the suitability of boating activities in each of the alternatives under consideration.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Evaluation criteria should be developed to address the above issues such as additional costs, O&M, liability, protection, for each of the alternatives that propose public use/recreational facilities.

Comments:

Reservoir water depths should not be managed for recreational suitability.

Accessibility for boating would depend upon the suitability of allowing public use of levee access roads (and boat ramps that might be provided for project specific uses) or the need to provide these facilities designed for public use.

The evaluation of recreational opportunities should be developed consistent with the CERP Master Recreational Plan (MRP), and the CERP Guidance Memorandum (CGM) that the Recreation Planning Team (RPT) is developing.

Operations and Maintenance (O&M) issues must be considered when evaluating the suitability of allowing recreational activities in the project components.

Public use facilities require parking facilities, restrooms, sewage disposal/treatment, trash receptacles, trash collection, and would require standard facilities maintenance (building maintenance, fencing, landscaping, mowing, etc.) Possible other considerations would be providing potable water (water fountains), picnic tables, and ADA compliant ramps, buildings, etc. In addition, public parks usually require staff (such as a wildlife officer) to patrol the facilities.

Liability and safety issues must be factored into the evaluation of the suitability of the project for any public uses/recreational facilities.

Protection of SFWMD structures and facilities is another major concern. Vandalism and/or shotgun damage to pump station buildings, water quality stations and flow monitoring facilities has occurred historically in areas where hunting is allowed (Holey Land and Rotenberger Wildlife Management Areas).

The Everglades Forever Act encouraged the incorporation recreational facilities into the design of the STAs, as long as they did not conflict with the project goals. Currently, boating and fishing are not allowed in the STAs. A trial duck hunt was allowed in STA-5 in the fall of 2002 to assess the suitability of duck hunting in the STAs. The decision as to whether or not the duck hunt will be repeated in STA-5 or in other STAs rests with the SFWMD's Governing Board.

Comprehensive Everglades Restoration Plan			EC 2.3.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.3**	**Recreational Opportunities**	
Level 4:	**2.3.2**	**Access and Suitability for Hunting**	

Description: (*What is being measured and why*)

Evaluation of the suitability of hunting activities in the reservoirs. The suitability of the reservoirs for hunting activities is dependent upon water depths, the potential for water quality impacts, and the occurrence of dry-outs. For any kind of recreational activity, accessibility is directly correlated to public use accesses. For example, the levee roads would need to be rated for public use and parking facilities would need to be provided for public use. In any event, the hunting activities cannot cause any conflicts with the project goals and objectives.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The EAA Storage Reservoirs project has the potential to serve as a recreational resource for the citizens and taxpayers of South Florida, however, any recreational uses cannot conflict with the project goals and objectives. Passive recreational activities, such as bird watching and sightseeing are preferred over more invasive activities such as boating, fishing, and hunting. Facilities such as boardwalks, kiosks, gazebos, pavilions, and educational displays, provide excellent recreational opportunities for the public.

The EAA SR compartments will provide good habitats for waterfowl and migratory shorebirds, especially if water depths fluctuate with the seasons but maintain a minimum depth of six inches through the dry season until the end of March. Hunting is expected to enhance the local economy through selling of licenses, supplies and equipment needed for this activity.

Target: (*Specific description of how success or failure will be measured*)

This criterion addresses opportunities. The target is to determine the suitability of hunting activities in each of the alternatives under consideration.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Evaluation criteria should be developed to address the above issues such as additional costs, O&M, liability, protection, hunt management agreement with FWC, for each of the alternatives that propose public use/recreational facilities.

Comments:

Reservoir water depths should not be managed for recreational suitability.

Accessibility for hunting would depend upon the suitability of allowing public use of levee access roads or the need to provide these facilities designed for public use.

The evaluation of recreational opportunities should be developed consistent with the CERP Master Recreational Plan (MRP), and the CERP Guidance Memorandum (CGM) that the Recreation Planning Team (RPT) is developing.

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Operations and Maintenance (O&M) issues must be considered when evaluating the suitability of allowing recreational activities in the project components.

Public use facilities require parking facilities, restrooms, sewage disposal/treatment, trash receptacles, trash collection, and would require standard facilities maintenance (building maintenance, fencing, landscaping, mowing, etc.) Possible other considerations would be providing potable water (water fountains), picnic tables, and ADA compliant ramps, buildings, etc. In addition, public parks usually require staff (such as a wildlife officer) to patrol the facilities.

Liability and safety issues must be factored into the evaluation of the suitability of the project for any public uses/recreational facilities.

Protection of SFWMD structures and facilities is another major concern. Vandalism and/or shotgun damage to pump station buildings, water quality stations and flow monitoring facilities has occurred historically in areas where hunting is allowed (Holey Land and Rotenberger Wildlife Management Areas).

The Everglades Forever Act encouraged the incorporation recreational facilities into the design of the STAs, as long as they did not conflict with the project goals. Currently, boating and fishing are not allowed in the STAs. A trial duck hunt was allowed in STA-5 in the fall of 2002 to assess the suitability of duck hunting in the STAs. The decision as to whether or not the duck hunt will be repeated in STA-5 or in other STAs rests with the SFWMD's Governing Board.

Comprehensive Everglades Restoration Plan			EC 2.3.3
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.3**	**Recreational Opportunities**	
Level 4:	**2.3.3**	**Access and Suitability for Fishing**	

Description: (What is being measured and why)

Evaluation of the suitability of fishing activities in the reservoirs. The suitability of the reservoirs for fishing activities is dependent upon water depths, the potential for water quality impacts, and the occurrence of dry-outs. For any kind of recreational activity, accessibility is directly correlated to public use accesses. For example, the levee roads would need to be rated for public use and parking facilities would need to be provided for public use. In any event, the fishing activities cannot cause any conflicts with the project goals and objectives.

Rationale: (Technical basis for why the performance measure is being utilized)

The EAA Storage Reservoirs project has the potential to serve as a recreational resource for the citizens and taxpayers of South Florida, however, any recreational uses cannot conflict with the project goals and objectives. Passive recreational activities, such as bird watching and sightseeing are preferred over more invasive activities such as boating, fishing, and hunting. Facilities such as boardwalks, kiosks, gazebos, pavilions, and educational displays, provide excellent recreational opportunities for the public.

Target: (Specific description of how success or failure will be measured)

This criterion addresses opportunities. The target is to determine the suitability of fishing activities in each of the alternatives under consideration.

Evaluation Method: (Description of what model or analytical method will be utilized)

Evaluation criteria should be developed to address the above issues such as additional costs, O&M, liability, protection, for each of the alternatives that propose public use/recreational facilities.

Comments:

Reservoir water depths should not be managed for recreational suitability.

Accessibility for fishing would depend upon the suitability of allowing public use of levee access roads or the need to provide these facilities designed for public use.

The evaluation of recreational opportunities should be developed consistent with the CERP Master Recreational Plan (MRP), and the CERP Guidance Memorandum (CGM) that the Recreation Planning Team (RPT) is developing.

Operations and Maintenance (O&M) issues must be considered when evaluating the suitability of allowing recreational activities in the project components.

Public use facilities require parking facilities, restrooms, sewage disposal/treatment, trash receptacles, trash collection, and would require standard facilities maintenance (building maintenance, fencing, landscaping, mowing, etc.) Possible other considerations would be providing potable water (water

fountains), picnic tables, and ADA compliant ramps, buildings, etc. In addition, public parks usually require staff (such as a wildlife officer) to patrol the facilities.

Liability and safety issues must be factored into the evaluation of the suitability of the project for any public uses/recreational facilities.

Protection of SFWMD structures and facilities is another major concern. Vandalism and/or shotgun damage to pump station buildings, water quality stations and flow monitoring facilities has occurred historically in areas where hunting is allowed (Holey Land and Rotenberger Wildlife Management Areas).

The Everglades Forever Act encouraged the incorporation recreational facilities into the design of the STAs, as long as they did not conflict with the project goals. Currently, boating and fishing are not allowed in the STAs. A trial duck hunt was allowed in STA-5 in the fall of 2002 to assess the suitability of duck hunting in the STAs. The decision as to whether or not the duck hunt will be repeated in STA-5 or in other STAs rests with the SFWMD's Governing Board.

Comprehensive Everglades Restoration Plan			EC 2.3.4
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.3**	**Recreational Opportunities**	
Level 4:	**2.3.4**	**Access and Suitability for Wildlife Viewing**	

Description: (*What is being measured and why*)

Evaluation of the suitability of wildlife viewing activities in the reservoirs. For any kind of recreational activity, accessibility is directly correlated to public use accesses. For example, the levee roads would need to be rated for public use and parking facilities would need to be provided for public use. In any event, the recreational activities cannot cause any conflicts with the project goals and objectives.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The EAA Storage Reservoirs project has the potential to serve as a recreational resource for the citizens and taxpayers of South Florida, however, any recreational uses cannot conflict with the project goals and objectives. Passive recreational activities, such as bird watching and sightseeing are preferred over more invasive activities such as boating, fishing, and hunting. Facilities such as boardwalks, kiosks, gazebos, pavilions, and educational displays, provide excellent recreational opportunities for the public.

Target: (*Specific description of how success or failure will be measured*)

This criterion addresses opportunities. The target is to determine the suitability of wildlife viewing activities in each of the alternatives under consideration.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Evaluation criteria should be developed to address the above issues such as additional costs, O&M, liability, protection, for each of the alternatives that propose public use/recreational facilities.

Comments:

Accessibility for wildlife viewing would depend upon the suitability of allowing public use of levee access roads or the need to provide these facilities designed for public use.

The evaluation of recreational opportunities should be developed consistent with the CERP Master Recreational Plan (MRP), and the CERP Guidance Memorandum (CGM) that the Recreation Planning Team (RPT) is developing.

Operations and Maintenance (O&M) issues must be considered when evaluating the suitability of allowing recreational activities in the project components.

Public use facilities require parking facilities, restrooms, sewage disposal/treatment, trash receptacles, trash collection, and would require standard facilities maintenance (building maintenance, fencing, landscaping, mowing, etc.) Possible other considerations would be providing potable water (water fountains), picnic tables, and ADA compliant ramps, buildings, etc. In addition, public parks usually require staff (such as a wildlife officer) to patrol the facilities.

Liability and safety issues must be factored into the evaluation of the suitability of the project for any

public uses/recreational facilities.

Protection of SFWMD structures and facilities is another major concern. Vandalism and/or shotgun damage to pump station buildings, water quality stations and flow monitoring facilities has occurred historically in areas where hunting is allowed (Holey Land and Rotenberger Wildlife Management Areas).

Comprehensive Everglades Restoration Plan			EC 2.3.5
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.3**	**Recreational Opportunities**	
Level 4:	**2.3.5**	**Access to Natural Areas**	

Description: (*What is being measured and why*)

Access to EPA, Holey Land Wildlife Management Area and Rotenberger Wildlife Management Area. This criterion addresses evaluation of the potential impact of the EAA SR project on the public's ability to access the EPA, Holey Land Wildlife Management Area, and Rotenberger Wildlife Management Area.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The Everglades Protection Area, the Holey Land Wildlife Management Area and the Rotenberger Wildlife Management Area currently serve as recreational resources for the citizens and taxpayers of South Florida. The EAA SR project should not adversely impact the public's ability to continue to use these resources.

Target: (*Specific description of how success or failure will be measured*)

The target will be to maintain recreational access to natural areas, including the Everglades WMA, Holey Land and Rotenberger WMA's, and Loxahatchee NWR.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Alternatives will be evaluated by examination of plan design; those designs that will result in a net loss of recreational access will be scored lower than those designs that maintain or increase access.

Comments:

New access points such as boat ramps or levee roads will be incorporated into the plan design where appropriate, subsequent to alternative evaluation. All new recreational access should be coordinated with the Master Recreational Plan.

Comprehensive Everglades Restoration Plan			EC 2.4.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.4**	**Cultural and Archaeological Resources**	
Level 4:	**2.4.1**	**Avoid or Minimize Number of Resources Impacted**	

Description: (*What is being measured and why*)

Number of significant cultural resources disturbed, encroached or impacted. "Significant cultural resources" includes archeological sites and districts; historical structures, properties, and districts; and traditional cultural properties that are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP), or are otherwise of local or regional importance. In addition, all cemeteries, family gravesites, and Native American burial sites on state-owned lands are protected under state law (Ch. 872, F.S.) regardless of their NRHP eligibility. Native American burial sites on federal and tribal lands are protected by the Native American Graves Protection and Repatriation Act of 1991.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended along with 36 CFR Part 800 through 2000, requires all federal agencies to take account of the effect of any federal undertaking on archeological sites, historic properties, and traditional cultural properties eligible or potentially eligible for listing on the NRHP. Section 101(d)(6) of the NHPA requires federal agencies in caring out their Section 106 responsibilities; to consult with any Indian Tribe or Native American organization that attaches religious and cultural significance to resources within the project's area of potential effect. Similar requirements are mandated by state law (Ch. 267.061{2}, F.S.).

Target: (*Specific description of how success or failure will be measured*)

Avoid or minimize adverse effects to all cultural resources to the greatest extent feasible, particularly those resources eligible or potentially eligible for listing by the NRHP.

For known or documented resources, the ratio of adversely affected cultural resources versus known resources should approach 0. Ratio values will range between 0 (no sites affected) and 1 (all sites affected). Target goal will be to minimize the ratio, e.g. keep the ratio as close to 0 as possible.

Adverse effects to significant resources may be minimized through various mitigation measures that may include archeological data recovery for sites and/or architectural relocation for structures. Proposing such mitigation measures will further the target goal of minimizing adverse effects.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Sensitivity analysis will be utilized to augment existing Florida Master Site Files data to determine a predicative model for the probability of cultural resources, as a 100% survey of the project area for cultural resources has not been accomplished. GIS technology and satellite imagery will be used to evaluate environmental variables: distance to potable water, wetland resources, topographic elevation, vegetation, and soil type. A review of historical documentary records (site files, aerial photos, topographical and historical maps, and interviews for oral histories), site visits and consultation with Native American groups, pursuant to Section 101(d)(6) of NHPA, will be used to evaluate the historical

context. When the site alternatives have been selected, consultation with the State Historical Preservation Officer and possible field investigations will be necessary to determine the effect of the project on cultural resources. Evaluation of cultural recourses identified within the project area for NRHP eligibility will use the National Register Criteria as specified in 36 CFR 60.4.
Comments:

Comprehensive Everglades Restoration Plan			EC 2.4.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.4**	**Cultural and Archaeological Resources**	
Level 4:	**2.4.2**	**Avoid or Minimize Spatial Extent Impacted**	

Description: (*What is being measured and why*)

Amount of spatial extent of significant cultural resources that will be adversely impacted. "Significant cultural resources" includes archeological sites and districts; historical structures, properties, and districts: and traditional cultural properties that are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP) or are otherwise of local or regional importance. In addition, all cemeteries, family gravesites, and Native American burial sites on state-owned lands are protected under state law (Ch. 872, F.S.) regardless of their NRHP eligibility. Native American burial sites on federal and tribal lands are protected by the Native American Graves Protection and Repatriation Act of 1991.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended along with rule 36 CFR Part 800, requires all federal agencies to take account of the effect of any federal undertaking on archeological sites, historic properties, and traditional cultural properties eligible or potentially eligible for listing on the NRHP. Section 101(d)(6) of the NHPA requires federal agencies in caring out their Section 106 responsibilities; to consult with any Indian Tribe or Native American organization that attaches religious and cultural significance to resources within the project's area of potential effect. Similar requirements are mandated by state law (Ch. 267.061{2}, F.S.).

Target: (*Specific description of how success or failure will be measured*)

Avoid or minimize adverse effects to all cultural resources to the greatest extent feasible, particularly those resources eligible or potentially eligible for listing by the NRHP.

The measure of success will be the ratio of acreage impacted within affected areas identified through predictive modeling to have a high potential for significant cultural resources versus the total acreage within areas of high cultural resource sensitivity. The target goal will be to minimize the ratio (i.e., keep the ratio as close to 0 as possible).

Adverse effects to significant resources may be minimized through various mitigation measures that may include archeological data recovery for sites and/or architectural relocation for structures. Proposing such mitigation measures will further the target goal of minimizing adverse effects.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Sensitivity analysis will be utilized to augment existing Florida Master Site Files data to determine a predicative model for the probability of cultural resources, as a 100% survey of the project area for cultural resources has not been accomplished. GIS technology and satellite imagery will be used to evaluate environmental variables: distance to potable water, wetland resources, topographic elevation, vegetation, and soil type. A review of historical documentary records (site files, aerial photos,

topographical and historical maps, and interviews for oral histories), site visits and consultation with Native American groups, pursuant to Section 101(d)(6) of NHPA, will be used to evaluate the historical context.

When the site alternatives have been selected, consultation with the State Historical Preservation Officer and possible field investigations will be necessary to determine the effect of the project on cultural resources. Evaluation of cultural recourses identified within the project area for NRHP eligibility will use the National Register Criteria as specified in 36 CFR 60.4.

Comments:

Everglades Agricultural Area Storage Reservoirs Phase 1
Evaluation Criteria Fact Sheet

Comprehensive Everglades Restoration Plan			EC 2.5.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.5**	**EAA Economic Impacts**	
Level 4:	**2.5.1**	**Local Government Tax Revenues**	

Description: (*What is being measured and why*)

The direct effect of purchase of lands for project facilities on property tax revenues. It is anticipated that a significant amount of agricultural land will be taken out of production as a result of this project.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Provision of urban and community services in the study area depends on tax collections. In particular, revenues from ad valorem assessments (property taxes) are likely to be affected by the land use changes caused by the EAA reservoir project.

Target: (*Specific description of how success or failure will be measured*)

Minimize reduction in local property tax revenues generated, measured in dollars.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

During the plan formulation phase of the project, the number of acres of land taken off the property tax rolls will be quantified. This can be converted to dollars using property tax rates for the appropriate county and, if applicable, the city in which the property lies.

Comments:

Comprehensive Everglades Restoration Plan			EC 2.5.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**2.0**	**Enhance Economic Values and Social Well Being**	
Level 3:	**2.5**	**EAA Economic Impacts**	
Level 4:	**2.5.2**	**Sales and Earnings**	

Description: (*What is being measured and why*)

The change in sales and earnings in the watershed (study area) as a result of the EAA project facilities.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Projects undertaken in the EAA will have an effect on the regional distribution of economic activity, and especially activities within the study area. The effect of the EAA SR project on sales and earnings, focusing on effects in the study area, is a summary measure of the effects on economic vitality of the region.

Target: (*Specific description of how success or failure will be measured*)

Maximize increases or minimize reductions on sales and earnings in the region, measured in dollars.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Changes is sales and earnings will be estimated by considering the direct effects of CERP expenditures and the changes in sales from farms and businesses directly affected by the project. Regional multipliers will be used to determine the total impacts on sales and earnings (direct, indirect and induced).

Comments:

Comprehensive Everglades Restoration Plan			EC 3.1.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.1**	**Total Cost**	
Level 4:	**3.1.1**	**Life Cycle Cost**	

Description: (*What is being measured and why*)

This criterion reflects the full economic costs of the resources utilized to construct, operate and maintain each EAA reservoir alternative through its planned life (50 years). It will include all real estate costs (land, easements, right-of-way, relocations and disposal), engineering, construction, operations and maintenance (including repair, replacement, and rehabilitation). The final cost estimates will be presented as the annual cost for the planned life of the project amortized over the 50 years project life.

Rationale: (*Technical basis for why the performance measure is being utilized*)

The cost estimates account for the use of the resources utilized to produce project benefits. Costs measure what is given up to obtain the project benefits and is integral to the process of formulating and evaluating alternatives.

Target: (*Specific description of how success or failure will be measured*)

Alternatives with lower costs that meet project goals and objectives are preferred.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Cost estimates will be prepared in conformance with USACE policy 1105-201, guidance and procedures.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.1.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.1**	**Total Cost**	
Level 4:	**3.1.2**	**Section 902**	

Description: (*What is being measured and why*)

This Total Project Cost will be compared to the Authorized Project Cost, the estimated project cost contained in the 1999 Restudy, or the programmatic costs defined in WRDA 2000 as appropriate for each of the EAA SR project components.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Section 902 of WRDA 1986 requires that the USACE obtain Congressional approval prior to exceeding the authorized project cost by more than 20%. If this limit is exceeded, the required congressional approval would result in a significant delay to the project implementation.

Target: (*Specific description of how success or failure will be measured*)

The total project cost should be maintained at no more than 120% of the authorized project cost.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Cost estimates will be prepared in conformance with USACE policy, guidance and procedures for each component of the EAA SR project. It will include all planning, engineering and design, LERRD (Lands, Easements, Rights-of-way, Relocations, and Disposal areas) and construction costs.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.2.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.2**	**Risk and Uncertainty**	
Level 4:	**3.2.1**	**Technological**	

Description: (*What is being measured and why*)

This criterion will evaluate the level of confidence of the proposed technological methodologies to achieve project goals by assessing the risk and uncertainty regarding the performance of alternatives that arise from issues regarding the capability of the technologies employed to perform as planned. The assessment procedure will be qualitative and will rely on expert judgment. A scoring of performance regarding the technological risk and uncertainty will be provided.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Risk and uncertainty are intrinsic in water resources planning and design. They arise from measurement errors and the inherent variability of complex physical, social, and economic situations. The evaluation of technological risk and uncertainty will enable the assessment of the potential variability in the performance of the proposed technologies to be incorporated into the evaluation process. The objective is to identify the alternative(s) that employ technologies that can achieve the project goals with the least amount of risk and uncertainty.

Target: (*Specific description of how success or failure will be measured*)

Alternatives with lower risk of not performing as planned will be preferred.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Alternatives will be assigned a high, moderate or low level of confidence rating. The confidence ratings will be based on a professional judgment assessment by a team knowledgeable of the technologies and the role they will play in the projected overall performance of the alternatives. Written documentation of the assessment will be provided.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.2.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.2**	**Risk and Uncertainty**	
Level 4:	**3.2.2**	**Reliability**	

Description: (*What is being measured and why*)

This criterion will assess the risk and uncertainty regarding the performance of alternatives that arise from issues regarding the reliability of the alternatives in performing as planned, especially during periods of stress such as tropical weather events, floods and droughts. The assessment procedure will be qualitative and will rely on expert judgment. A scoring of performance regarding the risk and uncertainty regarding reliability will be provided.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Risk and uncertainty are intrinsic in water resources planning and design. They arise from measurement errors and the inherent variability of complex physical, social, and economic situations. The evaluation of risk and uncertainty due to reliability issues will enable the potential variability in the performance of the alternatives due to potential failure to perform during stress periods to be incorporated into the evaluation process.

Target: (*Specific description of how success or failure will be measured*)

Alternatives with lower risk of under performing during periods of stress will be preferred.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

The evaluation ratings will be based on a professional judgment assessment by a team knowledgeable of the capabilities of the proposed design features to perform under periods of stress. Written documentation of the assessment will be provided.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.2.3
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.2**	**Risk and Uncertainty**	
Level 4:	**3.2.3**	**Environmental**	

Description: (*What is being measured and why*)

This criterion will evaluate/assess the level of confidence to achieve project benefits by assessing the risk and uncertainty regarding the performance of alternatives that arise from issues regarding the capability of the technologies employed to meet environmental requirements and regulations that will govern their operation. The assessment procedure will be qualitative and will rely on expert judgment. A scoring of performance regarding the ability to meet environmental requirements and regulations will be provided.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Risk and uncertainty are intrinsic in water resources planning and design. They arise from measurement errors and the inherent variability of complex physical, social, and economic situations. The evaluation of environmental risk and uncertainty regarding the ability of the alternatives to meet the environmental requirements and regulations that will govern their operations will be incorporated into the evaluation process.

Target: (*Specific description of how success or failure will be measured*)

Preferred alternatives will minimize risk and/or uncertainty related to the ability of the proposed plan to provide the environmental benefits with the lowest risk that the alternatives will not be able to comply with environmental requirements and regulations. This would be equivalent to a high level of confidence rating.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Alternatives will be assigned a high, moderate or low level of confidence rating based. The confidence ratings will be based on a professional judgment assessment by a team knowledgeable of the features included in the alternatives and their ability to comply with environmental requirements and regulations. Written documentation of the assessment will be provided.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.2.4
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.2**	**Risk and Uncertainty**	
Level 4:	**3.2.4**	**Cost**	

Description: (*What is being measured and why*)

This criterion will assess the risk and uncertainty regarding the cost of alternatives. This measure will focus on non-standard sources of uncertainty, which are not included in cost contingency factors included in cost estimates. (An example would be uncertainty associated with the cost of advance seepage control methods). The assessment procedure will include cost sensitivity analyses and will rely on expert judgment. A scoring of performance regarding cost risk and uncertainty will be provided.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Risk and uncertainty are intrinsic in water resources planning and design. They arise from measurement errors and the inherent variability of complex physical, social, and economic situations. The evaluation of cost risk and uncertainty will enable the risk and uncertainty due to costs to be incorporated into the evaluation process.

Target: (*Specific description of how success or failure will be measured*)

Alternatives with lower risk that costs will be significantly higher than estimated or the possibility that costs will be significantly reduced will be preferred.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Professional judgment assessment by a team knowledgeable of the factors which may significantly change estimated costs and the effect that these changes will have on the overall cost of the alternatives will be utilized. Cost sensitivity analyses will be used to prepare the assessments. Written documentation of the assessment will be provided.

Comments:

Comprehensive Everglades Restoration Plan			EC 3.3.1
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.3**	**Provide a cost effective project.**	
Level 4:	**3.3.1**	**Cost per acre-feet of storage**	

Description: (*What is being measured and why*)

Calculate costs per acre-feet of storage provided for all levels of storage considered.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration. This provides information about good financial investments given dollar costs and non-dollar outputs for the various alternatives. Efficiency (the extent to which an alternative plan is the most cost effective means of achieving the objectives) is one of the four primary evaluation criteria as described in the Water Resources Council's Principles & Guidelines. The other criteria include completeness, effectiveness, and acceptability.

Target: (*Specific description of how success or failure will be measured*)

Determine alternative plans that are cost effective with respect to storage. No specific "target" in terms of dollar cost per acre-foot is established. However, for any given level of storage, cost effectiveness is determined through the following three criteria:

1. Can the same output level be produced by another plan at less cost
2. Can a larger output level be produced at the same cost
3. Can a larger output level could be produced at less cost

Evaluation Method: (*Description of what model or analytical method will be utilized*)

For all sites, designs, and scales of project features considered, the cost per acre-foot of storage will be calculated using appropriate cost estimating techniques. Level of detail of cost estimation will be commensurate with the stage of planning for which screening/evaluation is being performed (e.g., brainstorming alternatives, preliminary screening of alternatives, final array of alternatives, etc.).

Comments:

Cost effectiveness is one of many factors used for evaluating, comparing and selecting a plan. Measuring acre-feet of storage is a surrogate for the ecological outputs/benefits that accrue from storage. Translating storage into ecological outputs/benefits will be required for the final evaluation and comparison of alternatives. How those ecological outputs/ benefits resulting from storage will be characterized is currently undetermined.

Comprehensive Everglades Restoration Plan			EC 3.3.2
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.3**	**Achieve reasonable incremental benefits.**	
Level 4:	**3.3.2**	**Incremental cost per additional acre-feet of storage**	

Description: (What is being measured and why)

Calculate incremental costs per incremental acre-feet of storage gained as successively larger (in terms of storage) cost effective alternative plans are considered.

Rationale: (*Technical basis for why the performance measure is being utilized*)

Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration. This provides information about good financial investments given dollar costs and non-dollar outputs for the various alternatives. Efficiency (the extent to which an alternative plan is the most cost effective means of achieving the objectives) is one of the four primary evaluation criteria as described in the Corps' Principles & Guidelines. The other criteria include completeness, effectiveness, and acceptability.

Target: (*Specific description of how success or failure will be measured*)

Determine which cost effective plans are "best buy" plans. "Best buys" are the cost effective plans that are most efficient in production, yielding the greatest increases in acre-feet of storage for the least increases in cost, and possessing the lowest incremental costs per acre-foot of storage as successively larger levels of storage are considered. No specific target in terms of incremental costs per acre-foot of storage is established. Rather, the incremental cost analysis provides a basis for addressing the decision question "is it worth it?" Such choices require that decision makers base subjective judgments on the value of the output being produced from additional information generated outside the framework of the cost effectiveness and incremental cost analyses.

Evaluation Method: (*Description of what model or analytical method will be utilized*)

Starting from the "No Action" alternative, the additional costs ("incremental costs") for the additional amounts of storage ("incremental output") produced by successively larger alternative plans are calculated. The incremental cost per acre-feet of storage is calculated by dividing the additional cost by the additional acre-feet of storage (as compared to the last alternative under consideration). As levels of storage increase, those plans with the lowest incremental costs per unit of output are identified as the "Best Buy" plans.

Comments:

Because it is likely that a series of Best Buy plans may be identified, the project delivery team will need to consider such factors as how well each Best Buy plan achieves or addresses planning objectives, resource significance, completeness, effectiveness, acceptability, and risk and uncertainty in answering the "Is it worth it?" question.

Measuring acre-feet of storage is a surrogate for the ecological outputs/ benefits that accrue from

storage. Translating storage into ecological outputs/benefits will be required for the final evaluation and comparison of alternatives. How those ecological outputs/benefits resulting from storage will be characterized is currently undetermined.

Comprehensive Everglades Restoration Plan			EC 3.3.3
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.3**	**Achieve reasonable incremental benefits.**	
Level 4:	**3.3.3**	**Cost effectiveness of increased treatment performance of STAs**	

Description: (*What is being measured and why*)

Calculate costs per additional ton of phosphorus removed by the STAs as a result of the project features (reservoirs and additional conveyance) for all alternatives considered.

Rationale: (*Technical basis for why the performance measure is being utilized*)

One of the project goals is to provide flow equalization and optimization of treatment performance of STA-2, STA-3/4, STA-5, and STA-6 by capturing peak storm event discharges within the reservoirs for slow release to the STAs.

Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration. This provides information about good financial investments given dollar costs and non-dollar outputs for the various alternatives. Efficiency (the extent to which an alternative plan is the most cost effective means of achieving the objectives) is one of the four primary evaluation criteria as described in the Water Resources Council's Principles & Guidelines. The other criteria include completeness, effectiveness, and acceptability.

Target: (*Specific description of how success or failure will be measured*)

Determine alternative plans that are cost effective with respect to additional tons of phosphorus removed. No specific "target" in terms of dollar cost per additional tons of phosphorus removed is established. However, for any given level of additional tons of phosphorus removed, cost effectiveness is determined through the following three criteria:

1. Can the same output level be produced by another plan at less cost
2. Can a larger output level be produced at the same cost
3. Can a larger output level could be produced at less cost

Evaluation Method: (*Description of what model or analytical method will be utilized*)

For all sites, designs, and scales of project features considered, the cost per additional ton of phosphorus removed will be calculated using appropriate cost estimating techniques. Level of detail of cost estimation will be commensurate with the stage of planning for which screening is being performed (e.g., brainstorming alternatives, preliminary screening of alternatives, final array of alternatives, etc.).

Comments:

Cost effectiveness is one of many factors used for evaluating, comparing and selecting a plan. Measuring phosphorus load reduction is a surrogate for the ecological outputs/benefits that accrue from load reduction. Translating load reduction into ecological outputs/benefits will be required for the final evaluation and comparison of alternatives. How those ecological outputs/benefits resulting from additional phosphorus load reduction will be characterized is currently undetermined.

Comprehensive Everglades Restoration Plan			EC 3.3.4
Level 1:	**EAA Storage Reservoirs Project-Level**		
Level 2:	**3.0**	**Cost, Risk and Uncertainty**	
Level 3:	**3.3**	**Achieve reasonable incremental benefits.**	
Level 4:	**3.3.4**	**Incremental cost per increased treatment performance of STAs**	

Description: (*What is being measured and why*)

Calculate incremental costs per incremental additional tons of phosphorus removed as successively larger (in terms of additional tons of phosphorus removed by the STAs) cost effective alternative plans are considered.

Rationale: (*Technical basis for why the performance measure is being utilized*)

One of the project goals is to provide flow equalization and optimization of treatment performance of STA-2, STA-3/4, STA-5, and STA-6 by capturing peak storm event discharges within the reservoirs for slow release to the STAs.

Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration. This provides information about good financial investments given dollar costs and non-dollar outputs for the various alternatives. Efficiency (the extent to which an alternative plan is the most cost effective means of achieving the objectives) is one of the four primary evaluation criteria as described in the Corps' Principles & Guidelines. The other criteria include completeness, effectiveness, and acceptability.

Target: (*Specific description of how success or failure will be measured*)

Determine which cost effective plans are "best buy" plans. "Best buys" are the cost effective plans that are most efficient in production, yielding the greatest increases in additional phosphorus reduction for the least increases in cost, and possessing the lowest incremental costs per additional tons of phosphorus removed as successively larger levels of storage are considered. No specific target in terms of incremental costs per additional tons of phosphorus removed is established. Rather, the incremental cost analysis provides a basis for addressing the decision question "is it worth it?" Such choices require that decision makers base subjective judgments on the value of the output being produced from additional information generated outside the framework of the cost effectiveness and incremental cost analyses.

Evaluation Method: (*Description of what model or analytical method will be utilized)*

Starting from the "No Action" alternative, the additional costs ("incremental costs") for the additional tons of phosphorus removed ("incremental output") produced by successively larger alternative plans are calculated. The incremental cost of additional tons of phosphorus removed is calculated by dividing the additional cost by the additional tons of phosphorus removed (as compared to the last alternative under consideration). As levels of phosphorus removed increase, those plans with the lowest incremental costs per unit of output are identified as the "Best Buy" plans.

Comments:

Because it is likely that a series of Best Buy plans may be identified, the project delivery team will need to consider such factors as how well each Best Buy plan achieves or addresses planning objectives, resource significance, completeness, effectiveness, acceptability, and risk and uncertainty in answering the "Is it worth it?" question.

Comprehensive Everglades Restoration Plan	**PM**
Level 1: **EAA Storage Reservoirs System-Wide**	
Level 2:	
Level 3:	
Level 4:	
Level 5:	

System-Wide Performance Measures

Description: (What is being measured and why)

The following System-Wide performance measures will be evaluated (the latest version can be found at http://www.evergladesplan.org/pm/recover/ret_perf_measures.cfm):

Lake Okeechobee
LO-E1 Lake Okeechobee Extreme Low Lake Stage
LO-E2 Lake Okeechobee Prolonged Moderate Low Lake Stage
LO-E3 Lake Okeechobee Extreme High Lake Stage
Everglades Protection Area
GE-E1 Number and Duration of Dry Events for Shark River Slough
GE-E2 Inundation Pattern in the Greater Everglades
GE-E3 Extreme High and Low Events in the Greater Everglades
GE-E4 Seasonal Amplitude and Interannual Variability of Water Levels in the Greater Everglades
GE-E5 Seasonal and Annual Flow Volume in the Greater Everglades
GE-E7 Greater Everglades Wetlands TP Concentrations in Surface Water
Water Availability Within the EAA
WS-E1 Frequency of Water Restrictions for the Lake Okeechobee Service Area
Estuary Salinity Envelopes
NE-E1 St. Lucie Salinity Envelope
NE-E2 Lake Worth Salinity Envelope
NE-E3 Caloosahatchee Estuary Salinity Envelope