

SECTION 2
PROBLEMS, OPPORTUNITIES, OBJECTIVES, CONSTRAINTS
AND PERFORMANCE MEASURES

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SECTION 2

PROBLEMS, OPPORTUNITIES, OBJECTIVES, CONSTRAINTS, AND PERFORMANCE MEASURES

2.1 PROCESS FOR EXPLORING THE ECOSYSTEM CONCERNS AND RESTORATION OPPORTUNITIES

2.1.1 Project Delivery Team (PDT) Organization

The PDT is an interagency, interdisciplinary team led by USACE and SFWMD Project Managers that provides input in the development of technical products necessary to implement the project.

A letter was sent on August 13, 2003 to specific agency supervisors inviting them to designate a representative of their agency to participate as a member of the Site 1 Impoundment PDT. The first PDT meeting for Site 1 Impoundment was held October 28, 2003 and consisted of the following agencies:

- Environmental Protection Agency (EPA);
- Florida Department of Environmental Protection (FDEP);
- Florida Fish and Wildlife Conservation Commission (FFWCC);
- Florida Department of Transportation (FDOT);
- Lake Worth Drainage District (LWDD);
- Palm Beach County (PBC);
- South Florida Water Management District (SFWMD);
- U.S. Army Corps of Engineers (USACE);
- U.S. Fish and Wildlife Service (USFWS);
- U.S. Geological Survey (USGS); and
- Broward County Department of Planning and Environmental Protection (DPEP).

Subsequent to the initial PDT meeting, the following sub-teams were assembled:

- Engineering – Hydrology and Hydraulics;
- NEPA;
- Water Quality; and
- Environmental.

2.1.2 Agency Coordination

PDT members were notified of PDT meetings via electronic mail. Results of technical decisions and meetings as well as other communications between USACE and SFWMD Project Managers were reported to the PDT members at each subsequent PDT meeting. PDT members were given the opportunity to provide input and comments on all deliverables for the implementation of the project. Both PDT and sub-team meetings were held regularly.

2.1.3 Stakeholder Notification / Involvement

Stakeholders such as non-governmental groups and the public are not PDT members. However, they were given the opportunity to attend PDT meetings and most recently Regional PDT (RPDT) meetings that have been posted on the CERP website (<http://www.evergladesplan.org>). They have also been provided the opportunity to voice their comments, concerns, and issues during the public comment periods at previous PDT and all RPDT meetings. Their comments are incorporated in the meeting minutes.

2.2 DEVELOPMENT OF PROBLEMS AND OPPORTUNITIES

2.2.1 Pertinent Background / Existing Information

The proposed Site 1 Impoundment has been the subject of study since the early 1990's. In 1993, the Everglades Coalition included the Site 1 Impoundment as part of the Water Supply Preserves in its Greater Everglades Ecosystem Restoration Plan. The plan called for the creation of "a series of water supply preserves sufficient to supply urban southeast Florida with a stable water supply, not dependent on Everglades supplies". These preserves would also be used to capture water previously sent to tide to meet local water supply needs and reduce the demands from the natural system. In addition, these areas were envisioned to provide groundwater recharge and recreational values.

In 1994, the SFWMD conducted an analysis of the Water Supply Preserves, which resulted in the adoption of the East Coast Buffer. The Buffer area encompasses approximately 66,400 acres of land located east of the protective levees in Palm Beach, Broward and Miami-Dade Counties. Land acquisition efforts began immediately since these lands were beginning to be purchased for future urban development.

In 1996, the SFWMD conducted a study of the Hillsboro Canal Basin, "Analysis of Water Supply Potential for Area B, the Everglades Buffer Strip, and the Hillsboro Basin: Phase 3b." This study determined that the area referred to as Site 1 (located north of the Hillsboro Canal, south of WCA 1 and northeast of S-39) was the most suitable location for a reservoir in the Hillsboro Basin. A significant amount of water was determined to be available in the Hillsboro Canal for backpumping into the Site 1 Impoundment. The proposed Site 1 Impoundment area was purchased by the SFWMD in December of 1996.

The recommended Site 1 Impoundment Project, authorized under WRDA 2000, is the result of analyses and studies dating back over ten years. Following the contingent authorization for the initial CERP projects, which included several WPA projects, work on the WPAFS continued. A draft FS report was published for comments in October 2001. The WPAFS further optimized the WPAs projects including the Site 1 Impoundment based upon additional modeling at a more sensitive scale. However, because the WPAFS did not include water reservations and allocations (requirements for a PIR), many stakeholders were not comfortable with proceeding with the FS. Therefore, in June 2002, a revised strategy was implemented whereby nine individual PIRs, containing 14 of the WPAFS components, would be developed for approval. The reports would be based upon the modeling and

analyses presented in the WPAFS with the inclusion of all of the required information addressed by WRDA 2000 including water reservations and allocation and an operating plan.

As a result of the 2001 WPAFS, it was recommended that the Site 1 Impoundment PIR be prepared to assess alternative designs that could provide similar benefits to the natural system as those initially identified in the CERP. The Site 1 Impoundment PIR provides a reassessment of alternative designs that can meet the project purpose while providing comparable benefits to the natural system as those identified in the CERP in a cost effective manner.

2.2.2 Additional Information Collected

The PDT also collected existing information and data on other key projects related to the Site 1 Impoundment study objectives and/or study area. The other key projects include the ASR Pilot Projects, Strazzulla Wetlands, ACME Basin B, C-11 Impoundment, C-9 Impoundment and WCA 3A/3B Levee Seepage Management.

2.2.3 Integration of CERP Information

The purpose of the Site 1 Impoundment Project as originally conceived during the Restudy is to supplement water deliveries to the Hillsboro Canal during dry periods thereby reducing demands on Lake Okeechobee and the LNWR. This purpose had been essential in the development of the regional as well as the project-specific problems and opportunities statements as mentioned in Section 2.2.5. Implementation of this project would make more water available in Lake Okeechobee and in the WCAs to meet natural system needs, which have resulted in various project specific opportunities.

2.2.4 Scoping the Problems and Opportunities

To initiate public and agency involvement in this project, a public notice dated August 13, 2003, was issued by the USACE, Jacksonville District, stating that a NEPA document will be prepared for this project. The notice provided a description of the study area, project purpose, and project features. The notice was sent to over 150 recipients, including Federal, state, and local agencies, Native American Tribes, and private organizations and interested persons. The purpose of the project as stated in the public notice is to “store excess storm water runoff that could be used for ecological, urban, and agricultural water supply.” This purpose is consistent with the goals that have provided the foundation for all Everglades restoration planning efforts. The goals of enhancing ecological values and enhancing economic values and social well-being were specifically stated in the Restudy.

The scoping letter solicited the recipient’s views, comments, and knowledge about resources and important features in the study area, study objectives, and alternative plans. The record was held open for a 60-day comment period. Nine written responses were received within the comment period, exclusively from Federal, state, and local agencies. The issues raised were compiled and will be considered in the Site 1 Impoundment plan formulation process. The following is a summary of responses resulting from the NEPA scoping process:

- Hazardous, Toxic and Radioactive Waste (HTRW) Phase II and cultural resources assessments are considered necessary on the project site;
- Essential Fish Habitat impacts in Florida Bay and the AIWW need to be assessed;
- Impacts to State and Federally-listed species potentially influenced by the project need to be assessed;
- Opportunities to improve wildlife habitat in WCA-1 and other natural areas were raised;
- Opportunities to increase fish and wildlife habitat on the project site were raised (e.g. incorporate deep water refugia, native plantings on littoral shelves, habitat islands, vertical structure);
- The potential to increase recreational uses/aesthetics of the reservoir was identified; and
- The potential to improve water quality was identified.

Additional opportunities for public and agency comment on the project purpose and planning objectives occurred at the PDT meeting held on October 28, 2003, in West Palm Beach, Florida and subsequent RPDT meetings. Project information and points of contact were also provided at the project web page:

http://www.evergladesplan.org/pm/projects/proj_40_site_1_impoundment.cfm.

The PDT used the available background information, previous studies, and responses to the scoping notice to identify problems and opportunities within the local, regional and system levels. The need to balance water supply demands and flood damage reduction with the protection of fish and wildlife habitat had been a central tenet of restoration planning efforts in the study area dating to the early 1990s. To accomplish this general objective, a water storage feature at the Site 1 location has been consistently included as a component of Everglades restoration plans since 1993. Multiple formal scoping initiatives had been taken for prior Federal water resources studies in the study area (CERP, C&SF Project, WPAFS). In addition, several other related planning initiatives have been undertaken by non-Federal entities to identify general planning objectives and constraints for environmental restoration and water resources development projects in the study area (National Audubon Society, Water Supply Preserves [1993], SFWMD, East Coast Buffer Project [1996], Governor's Commission for a Sustainable South Florida, Conceptual Plan [1996], SFWMD, LEC Regional Water Supply Plan [2000]). Cumulatively, these prior planning efforts have produced substantial background information while at the same time providing multiple opportunities for public, Federal, and non-Federal agency involvement in the development of objectives and constraints associated with implementing a water storage project at this location.

2.2.5 Problem and Opportunity Statements

For the purposes of project planning, the PDT utilized the existing information and responses resulting from the NEPA scoping process to identify the following problems and project opportunities associated with the regional and the planning/study area.

2.2.5.1 Ecological Problems and Opportunities

2.2.5.1.1 Regional Ecological Problems

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and richness that defined the pre-drainage system, and that these measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that even the current, degraded ecological conditions can be sustained into the future. For example, wading birds, key indicators of broad, regional patterns of aquatic production, continue to show declines in the total number of birds initiating breeding in south Florida colonies.

High water levels in recent years in Lake Okeechobee have resulted in widespread losses of the emergent and submerged plant communities that provide habitat for economically important fish. If this trend continues, there may be substantial declines in the lake's fisheries. Other examples are the declines in population levels of commercially and recreationally important fish species in the St. Lucie and Caloosahatchee Estuaries, and Biscayne and Florida Bays. Regulatory releases to the Caloosahatchee and St. Lucie Estuaries can have damaging effects on the plants and animals inhabiting these areas. Lake Okeechobee discharges contribute to dramatic salinity changes within these downstream estuaries, and combined with storm runoff from the watersheds, create extreme variables of inflow and degraded water quality (IRL 2002).

Nearly half of the original Everglades ecosystem has been converted to agricultural and urban uses. Additionally, the hydrology of the remaining Everglades has become altered by the operation of the C&SF Project. The ecological effects of these human-induced changes have generally resulted in:

- A substantial reduction in habitat quality and availability for fish and wildlife;
- A reduction in the system-wide levels of primary and secondary production and changes in the proportions of community types within the remaining system;
- An increase in the concentrations of pollutants in remaining natural system surface waters and sediment;
- A reduction in average annual flows and negative changes in the timing, duration, and magnitude of surface water stages;
- The lowering of regional ground water tables;
- Reductions in the extent of long hydroperiod refugia; and
- Alterations of salinity levels in estuaries.

2.2.5.1.2 Regional Ecological Opportunities

During the Restudy and the draft WPAFS, the combined effects of the proposed WPAs were modeled and analyzed. These WPA components would serve to both divert and store water to offset the impacts to the natural system caused by local stormwater drainage and water supply issues. Also, the WPA components would serve to assist in the management of

seepage losses from the natural areas; thereby saving water for the natural area without need for treatment. Although each of the WPAs would produce project specific opportunities within the vicinity of the project, these projects are also necessary to “jump start” the ecological effects of CERP projects. It is also important to note that the WPAs would also serve as habitat buffers between the remaining natural system and development.

2.2.5.1.3 Project-Specific Ecological Opportunities

The purpose of the Site 1 Impoundment Project as originally conceived during the Restudy is to supplement water deliveries to the Hillsboro Canal during dry periods thereby reducing demands on Lake Okeechobee and the LNWR. This would make more water available in Lake Okeechobee and in the WCAs to meet natural system needs. As a result of project implementation, there are opportunities to:

- Improve hydroperiods and hydropatterns in the LNWR and WCA-2A by reducing the amount of water withdrawn from the regional water management system necessary to supply water for municipal and industrial (M&I) users;
- Retain additional water in the natural system to improve habitat and species abundance and diversity;
- Store water discharged to tide via the Hillsboro Canal during times of excess water to augment regional water supply in the study area, thereby reducing demands on the natural system; and
- Reduce the frequency and duration of damaging freshwater flows to the Hillsboro Canal and Intracoastal Waterway.

2.2.5.2 Economic and Social Well-Being

The Site 1 Impoundment Project provides potential economic benefits through increases in regional water supply, recreational opportunities, and potential flood attenuation. The C&SF Project, by providing flood damage reduction and water supply, will enable the population of the LEC to grow from approximately 5.25 million in 2000 to over 9.25 million in 2050. Increases in population growth intensify the competition for and stress upon regional water resources (USACE, 1999). In PBC there were 1.3 million residents in 2000. This is projected to increase by almost one million residents by 2050 (SFWMD, 1998).

Without implementation of CERP projects, the growing demand for inexpensive, high quality water for agriculture, industry and an increasing population will surpass the limits of readily available sources. Predictions of water shortages in the future indicate serious and probably unacceptable levels of water supply cutbacks. Modeling for the LEC of Florida predicts water supply cutbacks to occur in a range from 15 years in northern PBC and Miami-Dade County to 29 years in Broward County. When factoring in the needs of the natural system, upon which a good part of the region’s economy depends, conflicts among water users will become even more severe. In addition, the human community is fundamentally dependent on the project for public health, safety and welfare (USACE, 1999).

In the south Florida region in general and the LEC area in particular, per capita income levels are higher than in the rest of the state. There is a strong per capita income difference between the urbanized LEC and the agricultural areas surrounding Lake Okeechobee. Employment and income opportunities in the important industries of agriculture and tourism are heavily reliant on the benefits provided by the C&SF Project.

The Governor's Commission for a Sustainable South Florida identified agriculture and tourism as "critical industries." Agriculture depends upon the system for vital water supply and flood protection. The tourism industry is dependent upon the project in a myriad of ways. The ability to sustain the region's economy and quality of life depend, to a great extent, on the success of the efforts to protect and better manage the region's water resources.

One of the best indicators of how the Site 1 Impoundment Project may affect the health of the local economy is through an evaluation of the tourism and recreational industries. The numbers of businesses in the area often reflects the degree of tourism and recreational use. Businesses in the study area include:

- Hotels and restaurants;
- Boating and water-related businesses;
- Marinas, tackle shops, boat retailers and suppliers;
- Fishing guides, charter boats; and
- Outdoor recreation supply businesses.

South Florida attracts people, both tourists and residents alike, with its pleasant weather and abundant water resources. A stable healthy area ecology will directly benefit the local economy through increases in tourism and dollars generated by the residents who enjoy outdoor activities.

2.2.5.3 Recreation and Public Access

Public use has been an important consideration of the C&SF Project since it was first developed. The C&SF Project provides opportunities for a wide range of activities that include fresh water and estuarine fishing, boating, hunting, camping, picnicking, nature watching, and photography. The opportunity to pursue these activities is very important to the economy of south Florida and to the Native American Tribes.

The 2000 Florida Statewide Comprehensive Outdoor Recreation Plan (SCORP) has identified the proposed project area as part of Region X. It also identifies a recreation deficit to include: bicycle riding, freshwater fishing, and hiking.

Within the study area, recreation includes limited access to canals and access through various locations adjacent to the WCAs. The Site 1 Impoundment Project presents various opportunities to incorporate access to recreation into the design. It will also serve to enhance ecological values, thereby improving the value of the existing recreational opportunities.

2.3 DEVELOPMENT OF OBJECTIVES AND CONSTRAINTS

It is necessary to first define goals, objectives, and constraints in order to have a better understanding as to how these project-specific, planning parameters were developed by the PDT. Webster's New Universal Unabridged Dictionary defines goal as the end or final purpose. An objective is defined as something aimed or striven for. Goals are set first and objectives are established that will help us obtain the goals. Objectives are more specific and are statements of what plans should try to achieve. Constraints are essentially restrictions that limit the planning process.

2.3.1 Project Goal

The project goal is to supplement water deliveries to the Hillsboro Canal during dry periods thereby reducing demands on Lake Okeechobee and the LNWR.

2.3.2 Development of Objectives and Constraints

Project-specific objectives were developed based on overall CERP ecologic goals that include increasing the spatial extent of natural areas, improving habitat function and quality, and improving native plant and animal abundance and diversity. In addition to the objectives, project constraints were developed to ensure that the proposed project would not reduce levels of service for flood protection and quantities of water available for municipal, industrial, and agricultural water supplies. The PDT also took into consideration resource and legal and policy constraints in developing objectives and constraints for this project.

2.3.3 Objectives and Constraints

2.3.3.1 Primary Objectives

Generally stated, the project objectives are to make additional water available for the natural system, thereby restoring natural flows and habitat that have been impacted by regional water management practices. Additionally, another objective would be to reduce the frequency and duration of damaging freshwater flows to the estuaries. More specifically stated the objectives for this project are to:

- Maximize the amount of water available to the greater Everglades system;
- Reduce damaging fresh water discharges to the estuarine system;
- Increase the spatial extent and quality of fish and wildlife habitat in the LNWR;
- Increase the spatial extent and quality of fish and wildlife habitat in WCA-2A;
- Improve hydroperiods and hydropatterns in the LNWR;
- Improve hydroperiods and hydropatterns in WCA-2A;
- Increase spatial extent of functional estuarine habitat; and
- Improve recreation at the project site.

2.3.3.2 Incidental Beneficial Effects

As a result of capturing and storing excess flows presently discharged to tide, additional beneficial effects are expected. These benefits include the following:

- Reducing the frequency and duration of water shortage restrictions in the LEC Service Area 1 by providing a supplemental source of regional water during dry periods;
- Reducing flood damages in the project area as a result of providing increased storage volume and the beneficial conversion of land that would normally contribute to runoff within the watershed; and
- Improvement of water quality in the Hillsboro Canal.

While not a project objective, the project's affects on increasing the amount of water available for regional water supply purposes have been evaluated. The incidental improvement in the flood damage reduction in the basin is intuitively expected, but has not been formally quantified. Seepage management features will be included in the impoundment design to avoid exacerbating any localized flooding problems and to ensure the satisfying of the Saving's Clause requirements included in WRDA 2000. Water quality improvement is also not a project objective, but may be incidentally improved as a result of project implementation. According to CERP Guidance Memorandum 23.01 ("Water Quality Considerations for the PIR Phase"), the Site 1 Impoundment Project is a Category C project (water quality improvement features are not included and water quality improvement is not a criterion to be addressed in project design). **Table 2.3-1** displays the correlation between the Site 1 Impoundment Objectives to the CERP objectives for the CERP goal of Enhancing Ecologic Values. **Table 2.3-2** displays the correlation between the Site 1 Impoundment Objectives to the CERP objectives for the CERP goal of Enhancing Economic Values and Social Well Being.

TABLE 2.3-1: PRIMARY OBJECTIVES FOR ENHANCING ECOLOGIC VALUES

| CERP Goal: Enhance Ecologic Values | |
|---|---|
| CERP Objectives | Site 1 Impoundment Project Objectives |
| Increase spatial extent of natural areas | <ul style="list-style-type: none"> • Reduce damaging fresh water discharges to the estuarine system. |
| Improve habitat function and quality | <ul style="list-style-type: none"> • Improve hydroperiods and hydropatterns in the LNWR. • Improve hydroperiods and hydropatterns in WCA 2A. • Increase spatial extent of functional estuarine habitat • Maximize the amount of water available to the greater Everglades system. |
| Improve native plant and animal abundance and diversity | <ul style="list-style-type: none"> • Increase the spatial extent and quality of fish and wildlife habitat in the LNWR. • Increase the spatial extent and quality of fish and wildlife habitat in WCA 2A. |

TABLE 2.3-2: PRIMARY OBJECTIVES FOR ENHANCING ECONOMIC VALUES AND SOCIAL WELL BEING

| CERP Goal: Enhance Economic Values and Social Well Being | |
|---|--|
| CERP Objectives | Site 1 Project Evaluation Considerations (Constraints) |
| Increase availability of fresh water (agricultural/ M&I) | <ul style="list-style-type: none"> • Provide an alternative source to meet M&I demands for water supply by capturing and storing fresh water discharged designated to tide in lieu of withdrawals from natural system areas. |
| Reduce flood damages (agricultural/urban) | <ul style="list-style-type: none"> • No reduction in level of service for flood protection. |
| Provide recreational and navigation opportunities | <ul style="list-style-type: none"> • Recreational opportunities (hunting, fishing, wildlife viewing, etc.) in LNWR and WCA-2A should be enhanced as a result of improving fish and wildlife habitat in those areas as a result of project implementation. Recreational opportunities will be provided on project lands. Navigation is not expected to be affected by the project. |
| Protect cultural and archaeological resources | <ul style="list-style-type: none"> • A cultural resources survey will be conducted. Cultural resources on the project site, if any, will be protected or appropriately mitigated. |

2.3.3.3 Constraints

The PDT took into consideration resource and legal and policy constraints in developing objectives and constraints for this project. The constraints that the PDT identified are listed below:

- Project must maintain existing levels of service for flood damage reduction (Legal and Policy Constraint): Pursuant to the “Savings Clause” provision in WRDA 2000 and the Programmatic Regulations (November 12, 2003).
- Project cannot cause or contribute to violations of water quality standards.
- Adjacent land use

Elimination or transfer of existing legal sources of water for agricultural or urban supplies, the Seminole and Miccosukee Tribes, Everglades National Park, and fish and wildlife is also a programmatic constraint established by WRDA 2000 to be considered for all projects; however, “elimination or transfer” of legal sources of water is not to be avoided as a planning constraint per se, since there is an expectation that many CERP projects will transfer sources of water to achieve ecosystem restoration objectives. When an elimination or transfer of a legal source of water would occur as a result of project implementation, Section 385.36 of the CERP Programmatic Regulations requires that an implementation plan be developed and included as part of the recommended project to ensure that sources of water are not lost until comparable sources are available.

The adjacent land use was a problem since the project site is located between the WCAs to the west and the established urban population to the east.

2.3.3.3.1 Water Quality

Runoff discharged into the major canal network within the WPAs must meet the criteria (both numerical and narrative) established under the State Water Quality Standards for a Class III water body or the Everglades Forever Act standards if the canal discharges to the Everglades. As a consequence, in areas other than the Everglades Protected Area, concentration and flow must, at a minimum, combine so as not to contribute to the degradation of the receiving water body. The major canal that serves as a receiving water body for discharges from the proposed impoundment is the Hillsboro Canal. The Hillsboro Canal averages from 50 to 120 parts per billion (ppb) of phosphorus (P) depending upon that the location analyzed. Knight (2002), using the modified Dynamic Model for Stormwater Treatment Areas (DMSTA), predicted for a similar impoundment (Reservoir Area=526 acres; Residence Time=104 days; Average Maximum Depth=12 ft) with an average P inflow concentration of 245 ppb that, on average, over 60 percent total phosphorus (TP) removal would occur (with 91 ppb of TP in outflow). The predicted reduction in P loading showed a similar tendency with a somewhat more appreciable quantitative difference (Inflow = 11257 kg; Outflow = 10543 kg). Knight also found that reservoir/impoundment implementation could result in a total nitrogen (TN) reduction of over 18 percent (Inflow = 1.60 parts per million [ppm]; Outflow = 1.30 ppm). Potential impoundment discharge receiving points in the AIWW would benefit, however marginally, from these occasional nutrient reductions.

According to the FDEP administered Impaired Waters Rule Criteria, the Hillsboro Canal is potentially impaired based on water quality data for chlorophyll a, dissolved oxygen (DO), lead and a fish consumption advisory. As indicated in the preceding paragraph, such an impoundment may yield a modest reduction in nutrient loading at key receiving points. Such a reduction, particularly in TN, could possibly result in reduced chlorophyll a. It is likely that some lead would be reduced from flows routed through the impoundment, as it tends to attach to the suspended solids that settle in such impoundments given adequate retention time. To the extent that the fish consumption advisory refers to high mercury levels in fish tissue, no improvement can be assumed as a result of impoundment operations. The CERP regional team is currently in the process of determining if certain operational procedures can be implemented that will contribute to the reduction of methyl mercury formation (I.e., depth control, SO₄ monitoring/management). With regards to DO, it is anticipated that some DO concentration increase may be achieved at the outflow of the impoundment as a result of the incorporation of passive aeration design and apparatus. The area of the zone of DO increase within the canal has yet to be determined. However, it is anticipated that the extent of downstream DO improvement in the water column will be limited given the volume-to-volume ratio of impoundment discharge to canal flow.

2.3.3.4 Impacts to Wetlands

Section 9.6 of the Restudy states: “During subsequent phases of this project, the construction features of the Comprehensive Plan will be designed to first avoid and then minimize

unavoidable impacts to wetlands or other aquatic sites and natural upland habitats. Unavoidable impacts to these habitats are expected to be offset by the ecological improvement throughout the south Florida ecosystem that results from the overall restoration achieved by the Comprehensive Plan. Accordingly, separate compensatory mitigation features are not included in the Selected Alternative Plan for these impacts.” The philosophy of CERP is that the individual components, or projects, of CERP to restore Everglades’ wetland function and habitat are self-mitigating. On-site, project specific impacts to wetlands are acceptable in order to restore the larger system, the Greater Everglades. However, compensation for any permitted mitigation required under Section 404 of the Clean Water Act located within a project site may be necessary. There are no permitted mitigation areas within the Site 1 Impoundment project footprint. In addition, for siting and designing purposes, the Site 1 Impoundment took into account wetland habitat and methods of avoidance. An interagency team evaluated the project site for wetland function and quality using the Wetland Rapid Assessment Procedure (WRAP). The team concluded that a majority of the project site is of low quality wetlands. As such, total avoidance of the wetlands at the site is not practicable. Designing of the impoundment will not reduce impacts to on-site wetlands without compromising the total storage capacity, and thus, reduce the efficiency to obtain the project goals. The fresh water wetlands within project lands are degraded and provide minimal functional habitat for fish and wildlife. The loss of function resulting from constructing an impoundment at this location should be offset by improvements to fish and wildlife habitat in the LNWR and WCA-2A.

2.3.3.5 Environmental Justice

The Executive Order on Environmental Justice requires that project implementation should not disproportionately affect minority and low-income communities. Additionally, in accordance with CERP Guidance Memorandum Number 24.00 (“Environmental Justice in Everglades Restoration Planning”), minority and low-income communities in the project area will be identified and contacted. The project lands have already been acquired and there will be no displacement of minority and low-income communities or residents.

2.4 DEVELOPMENT OF PROJECT EVALUATION CRITERIA

The purpose of this section is to describe the process for developing the performance measures and targets, including the tools used to calculate the results.

2.4.1 Description of Evaluation Criteria Selection Process

An aboveground impoundment at the Site 1 location has been included in several prior planning efforts (see Sections 2.2 “Development of Problems and Opportunities” and 4.1 “Management Measures”) focusing on restoring the Everglades ecosystem. In general, the impoundment contributes to Everglades ecosystem restoration by capturing and storing excess water and controlling seepage, thereby making additional water available in the natural system and for other water related needs in the project area.

In the prior planning efforts, several different management measures were considered to achieve restoration objectives (see Section 4.1). The management measures were screened and plan components were developed as part of overall Everglades ecosystem restoration plans. Extensive regional-scale hydrologic modeling was completed in these prior planning efforts to evaluate the effects of those plans. Since all of the prior Everglades restoration planning efforts validated the need to include water storage at the locations identified for this project, plan formulation and evaluation used the work performed in the prior studies for this PIR. Additional regional-scale modeling was not undertaken for this PIR.

To evaluate the beneficial environmental effects of the project, project-specific performance measures and evaluation criteria were developed using existing modeling work. The evaluation criteria focused on the effects of the alternative plans on key everglade ecosystem attributes (based on the conceptual ecological models [CEM]) and on the fish and wildlife habitat within the project area.

The process to develop the performance measures and targets was completed by the PDT. It involved using the CERP goals and objectives and applying the project specific problems and opportunities. From this, project specific objectives were developed by the PDT to define the direction of the project. Using the CERP CEM, all of the alternatives demonstrated a modification to the hydrology to some degree. It was felt that this hydrologic change could be measured and a difference in alternative plans could be quantified both hydrologically and ecologically.

2.4.2 Relationship to Project Objectives and Constraints

Hydrologic, ecological, and water quality performance measures were developed to coincide with the proposed project's goals and objectives. The majority of the hydrologic performance measures were developed to ensure that the proposed project would attain the objectives of retaining the maximum amount of water in the natural system and make the maximum amount of water available to the Greater Everglades system. Additionally, hydrologic performance measures were utilized to examine any improvement in hydroperiods and hydroperiods in the LNWR and WCA-2A. The ecologic performance measures were mainly based on hydrologic parameters that were known to affect certain species or specific types of habitat. Additionally, water quality performance measures were developed to examine how the proposed project would reduce damaging fresh water discharges to the estuarine system. Although the proposed project cannot violate State water quality standards, the water quality performance measures were not developed for this constraint, but to measure levels as which benefits expected to accrue.

2.4.3 Relationship to CERP System-Wide Performance Measures

Restoration Coordination and Verification (RECOVER) consists of a number of multi-agency teams that develop, coordinate, and verify system-wide information concerning the overall CERP program. One of RECOVER's responsibilities is to develop performance measures and CEM for the CERP. The RECOVER performance measures are actually based on the CEM, which illustrate conceptual relationships between environmental drivers (such as

agricultural or water management practices), stressors (such as reduced storage volume and degraded water quality), the ecological effects of stressors, and key attributes (such as tree island habitat and periphyton) of the type of ecosystem under consideration. Performance measures are established to evaluate the response of the ecosystem attributes to the expected changes resulting from project implementation.

To ensure that the project design and performance is fully linked to the goals and purposes of the CERP, evaluations of the project were conducted by the RECOVER Regional Evaluation and Water Quality teams. The RECOVER Water Quality Team completed an initial review of the project purpose and objectives and the project area on December 11, 2003. The Water Quality team recommended that the PDT develop evaluation performance measures that included an analysis of P loading and the retention of natural system water (i.e., rainfall) in the natural system. The project team adopted these performance measures.

The Regional Evaluation and Water Quality teams completed an evaluation of the project purpose and objectives, performance measures and evaluation criteria, and alternative plans on September 1, 2004 (see Annex E). In general, RECOVER found that the project team's evaluation criteria and analytical tools and methods were consistent with the system-wide objectives for CERP and noted that "improved (system-wide) performance is best observed through examination of the reservoir's ability to capture and store water."

RECOVER also prepared a Regional Evaluation Report on January 13, 2005 for the final three proposed project alternatives. RECOVER's conclusion was that the Tentatively Selected Plan achieves its intended functions and will contribute towards achieving CERP's goals and objectives. The full report is in Annex E.

2.4.4 Relationship to Conceptual Ecological Methods

For the Site 1 Impoundment Project, the "Everglades Ridge and Slough Conceptual Ecological Model", available at the following link:

http://www.evergladesplan.org/pm/recover/recover_docs/map/01_EverR&Sbk.pdf and the "Lake Worth Lagoon Conceptual Ecological Model" (a copy of this report is located in Appendix C) were the basis for the performance measures selected by the PDT. The project performance measures are focused primarily on water levels and inundation patterns in LNWR and WCA-2A; however, one performance measure is focused on estuarine habitat within the Hillsboro Canal and Intracoastal Waterway. Water quality and habitat response performance measures were also established to better understand the relationship of fish and wildlife and specific habitat types to hydrologic changes. The habitat response performance measures were utilized to identify certain key ecological attributes. Data was then post-processed through the CEMs to determine the project's performance as related to the key ecological attributes. As a result, habitat units were developed to justify the selected alternative plan on a Next Added Increment (NAI) and system formulation basis. The Habitat Units were also utilized to justify the Trade-Off analysis that was conducted for the selected alternative plan.

2.5 CHOOSING EVALUATION METHODS AND MODELS

2.5.1 Alignment with Objectives and Performance Measures

Utilizing the goals and objectives of both CERP and the Site 1 Impoundment Project as shown in Tables 2.3-2 and 2.3-3, the team utilized the methods and models described in the following paragraphs to identify adequate metrics to measure the performance of the project alternatives. Table 2.5-1 displays the correlation of the evaluation criteria to the CERP goals, project objectives, the metric used, target, biological response and the region to which it is applied.

2.5.2 Investigation and Overview of Evaluation Methods and Models

Using the results of the existing hydrologic modeling, hydrologic metrics were developed for cost effectiveness and incremental cost analysis. These metrics also were used as the basis for the system-wide analysis of project effects and next-added incremental justification required by the CERP Programmatic Regulations (33 Code of Federal Regulations [CFR] Part 385). Additionally, the CEM's were utilized to post-process data from the South Florida Water Management Model (SFWMM) in order to develop habitat units for the selected alternative plan. The HUs were also utilized to perform a cost effectiveness and incremental cost analysis. Additionally, the HUs were developed to demonstrate project effects of a next-added increment and last-added increment basis. The HUs were prepared by the ecological sub-team. Both the hydrologic and ecologic metrics were utilized for the National Ecosystem Restoration (NER) benefit analysis.

2.5.2.1 Project Performance Measures and CEM

To evaluate the effect of project alternatives on these natural system areas, an environmental evaluation sub-team was created consisting of representatives from the USACE, SFWMD, USFWS, FFWCC, and FDEP. Through an iterative brainstorming process, the sub-team established and refined a list of performance measures (**Table 2.5-1**) focused on desirable hydrologic and water quality conditions in the areas the project is expected to affect. In general, the project performance measures are the same as or similar to the system-wide performance measures developed by RECOVER to evaluate system-wide effects.

The primary objectives for the Site 1 Impoundment Project are based on creating beneficial system-wide effects, particularly in the LNWR and WCA-2A. The project may also beneficially affect water levels in Lake Okeechobee, although the magnitude of that effect would be relatively small. The project is also expected to beneficially affect estuarine habitat in the Hillsboro Canal and the AIWW.

2.5.2.2 Use of Performance Measures for Project Evaluations

The project's effects on water levels and inundations patterns were simulated using the SFWMD Model (version 3.5), a system-wide hydrologic model that simulates hydrologic conditions throughout most of the greater Everglades ecosystem. Water quality and habitat

response performance measures were also established to better understand the relationship of fish and wildlife and specific habitat types to hydrologic changes.

To evaluate the selected alternative's beneficial, hydrological effects on specific habitat types or wildlife (tree islands; cattail), the Everglades Ridge and Slough model and the Lake Worth Lagoon Model were utilized. The evaluation protocol for effects on habitat type involves a comparison of post-processed modeling results that were ranked to produce Habitat Suitability Indices (HSIs). The indices were then multiplied by the spatial extent of each ecological attribute to develop Habitat Units. Detailed methodology is contained in Appendix C.

Performance measures and evaluation criteria were not explicitly tiered or weighted in evaluating alternative plans. The PDT's evaluation approach was based on a holistic consideration of all of the performance measures. Data and modeling results were not available for all of the alternative plans considered such as the bracketed smaller and larger impoundment.

TABLE 2.5-1: CORRELATION OF EVALUATION CRITERIA

| CERP Goal or Requirement | Site 1 Project Objective or Constraint | Site 1 Project Evaluation Criteria | Metric | Target | Biological Response | Region / Spatial Extent | Models | POC |
|---------------------------------|---|--|--|---|--|--------------------------------|----------------------|--------------|
| Enhance Ecologic Values | Maximize the amount of water available in the greater Everglades system | Volume of water retained in the natural system | Combined discharges: S-39, S-6, S-5As, G-94A, B, and D | Increase from existing and future conditions. | Improve fish and wildlife habitat | LNWR | SFWMM v3.5 | Susan Teel |
| | Improves hydroperiods and drop patterns in the LNWR and WCA-2A | High and low water levels in LNWR | 1) Number of events above zone A2 or below zone B in period of record(POR); 2) Magnitude (in ft) of events above A2 or below B; 3) Duration (in days) of events | Using the regulation schedule, minimize the # of events that are above or below identified thresholds | Improve fish and wildlife habitat | IR 27 & 26 | SFWMM v3.5 | Susan Teel |
| | Improves hydroperiods and drop patterns in the LNWR and WCA-2A | High and Low Water Levels in WCA-2A | 1) Number of events water levels greater than 2.5 ft above ground level or less than -1 ft. below ground level in POR; 2) magnitude in feet of events above 2.5 ft or below -1 ft.; | Minimize the # of events that are above or below thresholds predicted by Natural Systems Model (NSM) | Reductions in high water events/duration will lessen tree island flooding, help prevent conversion from sawgrass to cattail, reduce alligator nest flooding, improve wading bird foraging conditions, and provide better hydrology for | IR 25 & 24 | SFWMM v3.5 / NSM 3.5 | Yvette Alger |

| | | | | | | | | | | |
|---|----------------------------------|--|--|--|--|--|---|----------------------|--------------|--|
| | | | | 3) duration in days of events (days/event); total duration in POR (% of POR) | | | periphyton. Decreased low water events will provide less risk of muck fires, less loss of organic soils, and better conditions for aquatic veg and periphyton,. | | | |
| Improves hydroperiods and hydroperiods in the LNWR and WCA-2A | Inundation Pattern | | 1) Number of inundation events; 2) mean duration in weeks of each event; 3) mean annual hydroperiod (average of each years hydroperiod) | Minimize the # of events that are outside of ranges predicted by NSM | | Inundation pattern affects tree islands, aquatic vegetation communities and populations of vertebrates and invertebrates (including apple snails, wading birds, and alligators). | LNWR- (IR 26 & 27); WCA2 - (IR 24 & 25) | SFWMM v3.5 / NSM 3.5 | Yvette Alger | |
| Improves hydroperiods and hydroperiods in the LNWR and WCA-2A | Restoration of Stage Variability | | Average weekly depth; Average max weekly depth; Average min weekly depth; Annual amplitude change (7-day max depth minus 7-day | Zero % difference from NSM | | Stage variability affects vegetative community structure. | LNWR- (IR100-102) WCA2 - (IR 110-111) | SFWMM v3.5 / NSM 3.5 | Yvette Alger | |

| | | | | | | | |
|--|---|---|--|--|--|--|-----------------------------|
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Average Annual TP Load Reduction into LNWR and WCA-2A | Structural P Load (31-year annual average hydraulic load @ 10 ppb); inflows from S-36, S-6, S-5AS, and G-94A, B, and D | Reduction from existing and/or future conditions. | Restore and maintain natural populations of flora and fauna | LNWR | Jennifer Leeds / Susan Teel |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Natural Water Recession & Reversal Rates | Suitability Index $[SI_{WB} = \min(Si_{depth}, Si_{recession})]$ for wood storks, white ibises and small herons | Improvement over 2050 base | Natural recession patterns during the dry season are necessary for wading bird nesting, fledging, and foraging | WCA-2A | Yvette Alger |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Snail Kite - Foraging habit vegetation structure | Average duration of inundation events (weeks/event) | Increase spatial extent of suitable snail kite foraging habitat as predicted by NSM | Improve Wildlife Habitat | LNWR- (IR 27 & 26) WCA2 - (IR 25 & 24) | Yvette Alger |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Apple Snail reproduction | Number of yrs that water levels on April 30 fall below ground | Reduction in # of yrs that water levels fall below ground prior to May1 to match NSM | Improve Wildlife Habitat | LNWR- (IR 27 & 26) WCA2 - (IR 25 & 24) | Yvette Alger |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Cattail Expansion Rate Reduction | Rate of Cattail Expansion in WCA-2A and LNWR | Reduce rate of Cattail Expansion | Restoration of spatial extent of pre-anthropogenic habitat | LNWR / WCA-2A | Jennifer Leeds |
| | | | | | | Everglades Landscape Vegetation Model (ELVM) | |

| | | | | | | | | | | |
|--|---|--|---|---|--|---|--|----------------|----------------------|--|
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Periphyton HSI | Periphyton HSI | | Periphyton HSI | Increase aerial coverage if habitats suitable for periphyton and reflect NSM predictions. | Restoration of spatial extent of pre-anthropogenic habitat | LNWR / WCA-2A | SFWMM v3.5 / NSM 3.5 | |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Restore number & acres of functional tree islands in LNWR and WCA-2A | 1) Acres of trees islands 2) Number of tree islands | Restore the acres and number of tree islands within the envelope of expected results from NSM | Restoration of spatial extent of pre-anthropogenic habitat | LNWR / WCA-2A | SFWMM v3.5 / ELM / NSM 3.5 | Jennifer Leeds | | |
| | Increase spatial extent of functional estuarine habitat | Live Bottom Habitat in Hillsboro Canal and Boca Raton Inlet areas | Discharges at G-56 | Increase in live bottom habitat | Spatial extent of functional marine habitat (need community/species level description) | | | Diane Crigger | | |
| | Increase the spatial extent and quality of fish and wildlife habitat in the LNWR and WCA-2A | Impoundment Habitat | 1) Number of events where water depth is less than 6"; 2) Duration (in days or weeks) of dry-down events | Minimize the number and duration of reservoir dry-downs | Dry-out and re-wetting may result in release of sediment-borne pollutants; also fish and wildlife habitat functions of emergent wetland and deepwater zones in impoundment would be adversely affected by dry-downs. | Reservoir (1660 ac) | | | | |

| | | | | | | | | |
|--|---|----------------------------|---|--------------------------------|---|---------------------------------------|--|--|
| | Maximize the amount of water available in the greater Everglades system | Impoundment Efficiency | 1) Average annual volume of water stored; 2) Average annual volume of water discharged to tide | Maximize efficiency of storage | Efficient use of impoundment for storage minimizes adverse effects of fish and wildlife habitat in the natural system associated with withdrawals of water for water supply and salinity protection | Reservoir (1660 ac) & Hillsboro Canal | | |
| | Reduce damaging freshwater discharges to the estuarine system | Hillsboro Canal (TN) loads | [N]/load @ G-56 | | Appropriate nutrient loads will prevent an imbalance in native populations of aquatic flora and fauna (e.g., algal blooms) | | | |
| | Reduce damaging freshwater discharges to the estuarine system | Hillsboro Canal TP loads | [P]/load @ G-56 | | Appropriate nutrient loads will prevent an imbalance in native populations of aquatic flora and fauna (e.g., algal blooms) | | | |

2.5.2.3 Performance Measures and Benefits

To perform the justification analysis for the project, a subset of the hydrologic performance measures was selected. As shown in **Table 2.5-2**, volume of water retained in the natural system and volume of water stored in the impoundment and the associated reduction in the volume of water released to tide were determined to be commensurate metrics that are illustrative of project benefits.

TABLE 2.5-2: SITE 1 IMPOUNDMENT PROJECT BENEFITS PERFORMANCE MEASURES

| Site 1 Impoundment Project Benefits Performance Measures | |
|---|--|
| Performance Measure | Measurement |
| Volume of water retained in LNWR. | Combined structural discharges from LNWR for water supply. |
| Volume of impoundment water storage. | Proportion of average annual volume stored to average annual volume discharged to tide (via S-39). |

2.5.3 Relationship to Objectives and Constraints

A display demonstrating the relationship between the performance measures, objectives, and constraints is presented in Table 2.5-1.

2.5.4 Relationship to CERP System-wide Performance Measures

CERP system-wide performance measures selected by RECOVER are located in the Ridge and Slough CEM. The performance measure for hydroperiods includes hydroperiods, water depth and depth duration, and sheet flow. The project-specific performance measures selected by the Site 1 Ecological sub-team utilized hydroperiods, water depth, and depth duration for evaluating the hydrologic performance of both the proposed impoundment and also for the natural system. Ecological performance measures from RECOVER include peat soils, periphyton, marsh plant communities, tree islands, marsh fishes and invertebrates and herps, alligators, and wading birds. The project-specific ecological performance measures for the proposed Site 1 Impoundment utilized cattail expansion rates, tree islands, wading birds, snail kites and apple snail habitat, and periphyton. Estuarine habitat was not involved in the Ridge and Slough model as this is not within the same habitat.

The achievement of Interim Goals and Interim Targets (IG/IT) is required by the Programmatic Regulations, Section 385.26(a)(3)(xiv). Because a final set of IG/IT has not been completed and approved by the appropriate agencies as of December 01, 2004, it is not currently possible to evaluate the contribution of this project towards meeting the goals and targets. It should be noted however, that the RECOVER Evaluation Team has suggested that the determination of individual project contributions to meeting the IG/IT may not be possible for all projects. Because the IG/IT are being developed at large regional and system-wide scales, and are designed to reflect progress towards achieving the overall

purposes of the CERP in response to the cumulative contributions of multiple projects, the responses of individual projects may not be detectable at the scale that the IG/IT are to be predicted and monitored. The ability to predict individual project contributions is especially problematic for those projects that may serve as essential precursors to overall CERP goals, but of themselves are not designed to bring about responses at large spatial scales.