

SECTION 4

IDENTIFICATION OF PROBLEMS AND OPPORTUNITIES

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4.0 PROBLEMS AND OPPORTUNITIES

Water resources projects are planned and implemented to solve problems, meet challenges, and seize opportunities. A problem can be thought of as an undesirable condition, while an opportunity offers a chance for progress or improvement. The identification of problems and opportunities focuses the planning effort and aids in the development of objectives. Problems and opportunities can also be viewed as local and regional resource conditions that can be modified in response to expressed public concerns. This section identifies the problems and opportunities associated with benefiting the natural and human environment and how a project in the BCWPA may address them.

4.1 SCOPING THE PROBLEMS AND OPPORTUNITIES

Overall, construction and operation of the C&SF Project and its subsequent modification of the natural system have:

- Contributed to a substantial reduction in function and spatial extent of natural areas and system resiliency;
- Provided a network of canals and levees which has accelerated the spread of exotic species, increased sedimentation rates, and also increased the amount of pollutants entering the natural system;
- Greatly reduced the water storage capacity within the remaining natural system;
- Created an unnatural mosaic of impounded, fragmented, and severely flooded and drained wetlands throughout the natural system.

Public concerns that were raised during the Restudy, regarding ecosystem health, uncontrolled urban growth and water quality, remain prevalent. There were several methods employed to gather input as to the problems and opportunities for the BCWPA Project. Meetings were held with stakeholders, the general public, Federal, tribal, State, and local government agencies, and the study team to develop a list of concerns that could be used to identify problems and opportunities.

The benefits to be realized by the implementation of a project are driven by the reduction in extreme flows through the S-9 pump station into the Water Conservation Area 3 (WCA 3) along with the seepage of natural system water into the urban areas during rain events and the seepage of water from the WCA 3 into the urban area during dry events. First, in order to minimize flows through the S-9 pump into the WCA 3 during rain events and maintain flood damage reduction levels to the urban areas, a storage component is required. In addition to minimizing flows through the S-9 pump a seepage management feature is also needed to maintain the natural system water in the natural

system. During dry events it is critical to maintain natural system water in the natural system through a seepage management component. In addition to controlling seepage, any remaining water that is in the storage component can be used to assist the seepage management component and to help with well field recharge and saltwater intrusion. The formulation and evaluation of alternatives will demonstrate that the storage and seepage management are interdependent and they do compliment each other for this project to fully realize benefits.

4.2 PROBLEM AND OPPORTUNITY STATEMENTS

Input was solicited through various public meetings and workshops. For the purposes of project planning, the project team identified the following problem statements:

Problem Statement 1: There is a loss of habitat function and species diversity and abundance in WCA 3 due to severe flooding and drought.

Problem Statement 2: Discharges of excessive runoff from the Western C-11 Basin through the S-9 pump station adversely affect WCA 3 by increasing nutrient loadings to the area, especially total phosphorus. The nutrient loading results in an undesirable shift from communities dominated by sawgrass to those dominated by cattails.

Problem Statement 3: Water that is essential for wildlife habitat is being lost from the WCAs via seepage.

Problem Statement 4: There is insufficient water available in the regional system to meet urban and environmental demands during the extended dry periods.

4.3 PLANNING OBJECTIVES AND CONSTRAINTS

Project-specific objectives were then developed by integrating the problem statements with the 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. 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 project team also took into consideration resource, legal, and policy constraints in developing objectives and constraints for this project.

Project Objectives

- Objective 1: Restore habitat function in WCA 3.
 Objective 2: Increase the spatial extent of wetland function.
 Objective 3: Improve hydroperiods and hydropatterns in WCA 3.
 Objective 4: Reduce the loading of excess nutrients into WCA 3.
 Objective 5: Reduce seepage out of WCA 3.
 Objective 6: Maximize the amount of water retained in the natural system.

Project Constraints

- Maintain existing (Savings Clause [Section 601 (h)(5) of WRDA 2000]) levels of flood protection to agricultural and urban lands.
- Maintain levels of service for existing (Savings Clause) legal users.
- Minimize impacts to cultural, historical and archaeological resources.
- Minimize adverse socioeconomic impacts on the local and regional economies.
- Avoid, minimize, or provide compensatory mitigation for any impacts to pre-existing compensatory mitigation sites within the project area under Section 404 of the Clean Water Act.

It should be noted that for the alternatives that will impact existing mitigation sites, efforts will be made to provide compensatory mitigation through evaluating opportunities to operate the features in a way to offset those impacts while also providing benefits to the overall plan.

Table 4-1 illustrates how the project goals and objectives relate to the goals and objectives of CERP.

**TABLE 4-1: RELATIONSHIP OF GOALS AND OBJECTIVES
CERP AND BCWPA**

CERP Goals and Objectives	Project Goals and Objectives
Enhance Ecological Values	
<ul style="list-style-type: none"> • Increase the total spatial extent of natural areas 	<ul style="list-style-type: none"> • Increase the spatial extent of wetland function. • Improve hydropatterns in WCA 3. • Reduce loading of excess nutrients into WCA 3. • Retain water for the natural system.
<ul style="list-style-type: none"> • Improve habitat and functional quality 	<ul style="list-style-type: none"> • Restore habitat function in WCA 3. • Increase the spatial extent of wetland function. • Improve hydropatterns in WCA 3. • Reduce loading of excess nutrients into WCA3. • Reduce seepage from WCA 3. • Retain water for the natural system.
<ul style="list-style-type: none"> • Improve native plant and 	<ul style="list-style-type: none"> • Reduce loading of excess nutrients

animal species abundance and diversity	into WCA 3. <ul style="list-style-type: none"> • Retain water for the natural system.
Enhance Economic Values and Social Well Being	
<ul style="list-style-type: none"> • Increase availability of fresh water (agricultural/municipal and industrial) 	<ul style="list-style-type: none"> • Reduce seepage from WCA 3. • Retain water for the natural system.
<ul style="list-style-type: none"> • Reduce flood damages (agricultural/urban) 	<ul style="list-style-type: none"> • Reduce seepage from WCA 3.
<ul style="list-style-type: none"> • Provide recreational and navigation opportunities 	<ul style="list-style-type: none"> • Maximize recreation and navigation opportunities of the selected plan while maintaining project benefits.
<ul style="list-style-type: none"> • Protect cultural and archeological resources and values 	<ul style="list-style-type: none"> • Minimize impacts to cultural and archaeological resources and values.

4.4 EVALUATION CRITERIA AND EVALUATION METHODS

4.4.1 Evaluation Criteria

To evaluate the beneficial environmental effects of the project, project-specific performance measures and evaluation criteria were developed. In general, evaluation criteria focused on the effects of the alternative plans on key Everglades ecosystem attributes, based on the conceptual ecological models (CEMs). Additional evaluation criteria were also developed focusing on the fish and wildlife habitat within project features. The process to develop the performance measures and targets was developed by the project delivery team and coordinated with Restoration Coordination and Verification (RECOVER). This involved starting with the CERP goals and objectives and applying the problems and opportunities to develop project objectives.

Hydrologic, ecologic, and water quality performance measures were developed to gauge achievement of 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, reducing excess nutrients and making the maximum amount of water available to the Greater Everglades ecosystem. Hydrologic performance measures were utilized to examine any improvement in hydroperiods and hydropatterns in WCA 3A and 3B. Ecologic performance measures were developed to examine how the proposed project would increase the spatial extent and quality of natural areas in the WCA 3A and 3B. The ecologic performance measures were mainly based on hydrologic parameters that were known to affect certain species or specific types of habitat. Water quality performance measures were developed to examine how the proposed project would reduce excess nutrients currently being discharged to the WCAs

and ultimately result in an increase in ecological benefits. Although the proposed project cannot violate State water quality standards, the water quality performance measures were not specifically developed for this constraint.

4.4.1.1 CERP System-wide Performance Measures

The RECOVER performance measures are based primarily on the CEMs developed to guide south Florida ecosystem restoration efforts as part of the South Florida Ecosystem Restoration Working Group Science Coordination Team's "Applied Science Strategy." The CEMs 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 wading bird populations) of the type of ecosystem under consideration. Evaluation performance measures are established to evaluate the response of the ecosystem attributes to the expected changes resulting from project implementation.

The planning objectives and constraints served as the basis for the project-specific evaluation performance measures and other evaluation criteria selected by the project team. Project performance measures include a consideration of the types of effects the project is likely to create, the area and ecological community types likely to be affected by the project, and hydrological or ecological performance targets. To ensure consistency with the system-wide evaluation performance measures utilized by RECOVER, a sub-set of those performance measures applicable to the BCWPA project study area was selected and utilized by the project team to evaluate and compare alternative plans. The RECOVER Evaluation Team completed an initial review of the project purpose, planning objectives, and performance measures (see *Annex E*).

4.4.1.2 Conceptual Ecological Models

For the BCWPA Project, the "Everglades Ridge and Slough Conceptual Ecological Model" (a copy of this report is located in *Appendix C*) was the basis for the performance measures selected by the project team. The project performance measures selected by the project delivery team are focused primarily on water levels and inundation patterns in WCA 3A and 3B. 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.

4.4.1.3 Hydrologic Modeling

Alternative plans and their major components were modeled as recharge areas, wetlands, stormwater treatment areas and impoundments during the various planning efforts mentioned above. The components were simulated using different hydrologic models at both regional and sub-regional scales and with different versions of those models.

The appropriate tools identified to formulate and evaluate alternatives were the South Florida Water Management Model (SFWMM) Version 3.5 and the Broward County Sub-Regional Model. For the Savings Clause analysis, the SFWMM Version 5.4.3 was used. The regional and sub-regional models have been peer reviewed and the results are documented and included in **Appendix A**.

An 8-year (1988-1995) period of record was selected for the Broward County Sub-Regional Modflow Models because this period includes a severe drought (1988-1990), an average condition (1992-1993), and an extreme wet condition (1994-1995). The primary objective for this history matching was to compare measured and computed water levels at monitoring sites and adjust model parameters as appropriate to reduce errors to an acceptable level. The sub-regional model uses a shorter period of record than the regional model (31-year) because of the computing time required to run the more detailed groundwater-surface water model and the data storage requirements of such a detailed model.

4.4.2 Evaluation Methods and Models

Table 4-2 displays the correlation of the evaluation criteria to the CERP goals that were listed in **Table 4-1**, project objectives, the metric used, biological response and the region to which it is applied. For additional information on the performance measures refer to **Appendix C** (Environmental Information).

TABLE 4-2: PERFORMANCE MEASURES AND EVALUATION CRITERIA

PM#	CERP Goal or Requirement	BCWPA Objectives addressed	BCWPA Project Performance Measure	Metric	Target	Biological Response	Region / Spatial Extent	Models
1.0 Seepage Retained by WCA 3A/3B SMA	Enhance Ecologic Values	1, 2, 3, 5, 6	Seepage water retained in the natural system	Difference in seepage quantities across GW transect along the L-37 and L-33 Levees	0 seepage through the L33/L37 levees	Improve fish and wildlife habitat	WCA 3	SFWMM v3.5 Sub regional model for Broward Co.
2.0 Extreme High and Low Water Levels in WCA 3A/3B	Enhance Ecologic Values	1, 2, 3	High and low water levels in WCA 3A And WCA 3B	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) Duration in weeks of events (weeks/even t); 3) Average annual duration (% of year)	Thresholds predicted by 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 periphyton. Decreased low water events will provide less risk of muck fires, less loss of organic soils, and better conditions for aquatic	IR (from 2x2 ver. 3.5) 15 & 16 for WCA 3B and 14, 17, 18, 19, 20, 21, 22 for WCA 3A	SFWMM v3.5 NSM 3.5

PM#	CERP Goal or Requirement	BCWPA Objectives addressed	BCWPA Project Performance Measure	Metric	Target	Biological Response	Region / Spatial Extent	Models
3.0 Average Annual Total Phosphorus Load Reduction	Enhance Ecologic Values	1, 2, 4	Average annual TP load reduction into WCA 3A	Structural Phosphorus Load (31-year annual average hydraulic load @ 10 ppb); inflows from S-9	Zero for flow (i.e., no inflows through the S-9 pump) and zero for TP load	vegetation and periphyton. Restore and maintain natural populations of flora and fauna	WCA 3A and 3B	NA
4.0 Inundation Pattern	Enhance Ecologic Values	1, 2, 3	Snail Kite - foraging habitat vegetation structure	Average duration of inundation events (weeks /event)	156 to 260 weeks inundation duration	Improve Wildlife Habitat	IR (from 2x2 ver. 3.5) 15 & 16 for WCA 3B and 14, 17, 18, 19, 20, 21, 22 for WCA 3A	SFWMM v3.5 NSM 3.5
5.0 Restoration of Stage Variability	Enhance Ecologic Values	1, 2, 3, 5, 6	Inundation Duration	1) Number of inundation events; 2) Avg. flood duration (weeks/event); 3) Avg. annual hydroperiod (% of year)	Thresholds predicted by NSM	Inundation pattern affects tree islands, aquatic vegetation communities and, populations of vertebrates and invertebrates (including apple snails, wading birds, and alligators).	IR (from 2x2 ver. 3.5) 15 & 16 for WCA 3B and 14, 17, 18, 19, 20, 21, 22 for WCA 3A	SFWMM v3.5 NSM

PM#	CERP Goal or Requirement	BCWPA Objectives addressed	BCWPA Project Performance Measure	Metric	Target	Biological Response	Region / Spatial Extent	Models
6.0 Snail Kite Foraging Habitat Vegetation Structure	Enhance Ecologic Values	1, 2, 3	Apple snail reproduction	Number of years that water levels on Apr 30 fall below ground level	Reduced number of years that water levels fall below ground surface prior to May 1 to match NSM	Improve Wildlife Habitat	IR (from 2x2 ver. 3.5) 15 & 16 for WCA 3B and 14, 17, 18, 19, 20, 21, 22 for WCA 3A	SFWMM v3.5 NSM 3.5
7.0 Apple Snail Reproduction	Enhance Ecologic Values	1, 2, 3, 5, 6	Stage variability	1) Average weekly depth; 2) Avg. max weekly depth; 3) Avg. min weekly depth; 4) Annual amplitude change (7-day max depth minus 7-day min depth in calendar year)	Thresholds predicted by NSM	Stage variability affects vegetative community structure.	IR (from 2x2 ver. 3.5) 15 & 16 for WCA 3B and 14, 17, 18, 19, 20, 21, 22 for WCA 3A	SFWMM v3.5 NSM 3.5

PM#	CERP Goal or Requirement	BCWPA Objectives addressed	BCWPA Project Performance Measure	Metric	Target	Biological Response	Region / Spatial Extent	Models
8.0 Restore Number and Acres of Functional Tree Islands	Enhance Ecologic Values	1, 2, 3	Restore number & acres of functional tree islands in WCA 3A and 3B	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	Improve spatial extent of natural habitat.	WCA3A and 3B	SFWMM v3.5 ELVM NSM 3.5
9.0 Cattail Expansion Rate Reduction	Enhance Ecologic Values	1, 2	Cattail expansion rate reduction	Rate of cattail expansion in WCA 3A and 3B	Reduce rate of cattail expansion to 0	Improve spatial extent of natural habitat.	WCA 3A and 3B	ELVM (SAWCA T module)