

# Chapter 7B: Update on RECOVER Implementation and Monitoring for the Comprehensive Everglades Restoration Plan

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## SUMMARY

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This chapter provides an update on Restoration Coordination and Verification (RECOVER) activities documented in Chapter 7B of the *2006 South Florida Environmental Report – Volume I* (2006 SFER). This update is presented in four categories: RECOVER-wide, Assessment, Evaluation, and Planning and Integration. The activities listed under the RECOVER-wide section fall under two or more mission areas as follows:

### RECOVER-wide Activities

- Defining Success
- Comprehensive Everglades Restoration Plan (CERP) Systemwide Performance Measures
- Adaptive Management Program
- Projects-RECOVER Interaction Strategy

### Assessment Activities

- Implementation of the CERP Monitoring and Assessment Plan
- 2006 Assessment Strategy for the Monitoring and Assessment Plan
- System Status Report

### Evaluation Activities

- Performance measure consistency reviews and evaluations of alternative project plans
- Benefits Evaluation and Analysis Methodology

### Planning and Integration Activities

- CERP A Refinement

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Additional information on RECOVER is available on the CERP web site at [www.evergladesplan.org/pm/recover/recover.cfm](http://www.evergladesplan.org/pm/recover/recover.cfm).

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## RECOVER-WIDE

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### DEFINING SUCCESS

The goals of the Comprehensive Everglades Restoration Plan (CERP) are to restore the greater Everglades ecosystem and to maintain or improve water supply and flood protection for human systems. While these general goals are clear at a broad scale, they are not particularly helpful as project implementation begins. Additionally, there may be a range of opinion about how these goals should be achieved (strategies) and a range of views about the qualities and/or characteristics of both the natural and human systems (outcomes) that must be achieved if the implementation of CERP is to be deemed a success.

To this end, a set of regional conceptual ecological models has been developed. This was published in the December 2005 issue of *Wetlands* (Barnes, 2005; Browder et al., 2005; Crigger et al., 2005; Davis et al., 2005a and 2005b; Duever, 2005; Havens and Gawlik, 2005; Ogden, 2005; Ogden et al., 2005a and 2005b; Rudnick et al., 2005; Sime, 2005; VanArman et al., 2005). The models have been and continue to be utilized in the development of performance measures and restoration targets. RECOVER has begun a process to better integrate the set of systemwide performance measures, reconcile any inconsistencies/trade-offs/conflicts among them, refine and reaffirm the overall vision and definition of success, and incorporate a stronger contribution from the social sciences in this process that has been undertaken previously.

### CERP SYSTEMWIDE PERFORMANCE MEASURES

#### Documentation

The CERP systemwide performance measures are developed with the best available science and tools; however, the development and application of performance measures is a dynamic process that incorporates new scientific understandings and technical improvements. As our understanding of the ecosystem and the hypotheses that define ecologic relationships grows and new predictive tools are developed, performance measures will be refined, additional performance measures will likely be proposed, and some may be dropped. Refinement of performance measures is part of CERP's Adaptive Management Strategy (RECOVER, 2006a). As such, this document will be updated as changes to the performance measures and their documentation sheets are approved by RECOVER's Evaluation and Assessment Teams. Sections discussing efforts related to the application of performance measures will also be updated periodically to reflect their current status. The latest version, dated March 16, 2006, of the CERP Systemwide Performance Measures document (RECOVER, 2006b) is available at [http://www.evergladesplan.org/pm/recover/eval\\_team\\_perf\\_measures.cfm](http://www.evergladesplan.org/pm/recover/eval_team_perf_measures.cfm).

#### Application

Much work still needs to be done before the systemwide set of performance measures mentioned above can be adequately applied for prediction and assessment. For measures to be useful in comparing alternative plans during systemwide and regional evaluations, predictive

tools must be available to measure performance at a useful scale. These predictive tools can be computer simulation models, regression models, etc. Currently, few predictive tools that show differences in systemwide responses at the project-level scale are available. The sensitivity of performance measures when using these methods and the uncertainties inherent in these predictive methods must be determined if the alternative plans are to be accurately compared. Tools must also be developed to assist with assessing the effects of CERP implementation on the natural and human systems; monitoring data alone does not provide an adequate assessment. The predictive and assessment tools used for a performance measure must be consistent in their metrics, targets, and temporal and spatial scales for CERP to be adaptively managed. In addition, the tools applied to interim goals and targets (RECOVER, 2005) must be consistent with the performance measures and their respective tools. RECOVER is in the process of prioritizing performance measures on which efforts will be focused to fully develop applications. This will include determining the feasibility of developing predictive tools that can see differences at the project-level scale.

The development and refinement of predictive tools includes the migration from using the South Florida Water Management Model (SFWMM) as the main hydrologic simulation model to the Regional System Model (RSM). The RSM is expected to be fully functional by February 2008.

## **ADAPTIVE MANAGEMENT PROGRAM**

RECOVER has the responsibility to coordinate the development and implementation of a systemwide Adaptive Management Program in support of CERP. RECOVER activities over the past year have focused on the completion of an Adaptive Management Strategy and the application of adaptive management for two restoration projects: Decompartmentalization and Ten Mile Creek.

### **Adaptive Management Strategy**

The CERP Adaptive Management Strategy was completed in April 2006 (RECOVER, 2006a) and can be found in Appendix 7B-1. The main elements of the strategy were laid out in the 2006 SFER – Volume I, Chapter 7B. The strategy document explains the importance and benefits of adaptive management to the CERP Program along with technical flow diagrams and their descriptions. RECOVER is currently developing a process to inform and train those who work within the CERP Program on how to utilize the CERP Adaptive Management Strategy. RECOVER also intends on developing an outreach program to inform the general public and those working in other programs of the CERP Adaptive Management Strategy.

### **Decompartmentalization Adaptive Management Plan**

The Decompartmentalization (Decomp) Project involves reconnecting significant portions of the now-compartmentalized Everglades and restoring sheetflow, essential for restoring the ecological functioning of the Everglades ecosystem. Adaptive management is an essential strategy for implementing projects where there are comparatively large uncertainties and ranges of opinion regarding system responses and desired endpoints, respectively, as is the case with Decomp (Ogden, personal communication). For the past year, members of the Project Delivery Team and RECOVER have been developing an adaptive management initiative for Decomp, which consists of physical field-scale models, monitoring, and data-mining. This initiative is a prime example of active adaptive management.

## Ten Mile Creek

Ten Mile Creek is the first of several reservoir/stormwater treatment facilities to be constructed as part of CERP. The project is designed to maximize environmental benefits to the North Fork of the St. Lucie River, its downstream water body. The adaptive management approach for this project is to optimize environmental operational protocols through testing and monitoring the ecological response of managed water deliveries to the downstream receiving waters. It is anticipated that lessons learned from Ten Mile Creek can be applied to future operational plan development, especially those with coastal receiving water bodies. This effort is considered to be an example of passive adaptive management.

## PROJECTS/RECOVER INTERACTION STRATEGY

The Programmatic Regulations [Department of Defense (DOD), 2003] require RECOVER to assist project teams in ensuring that project design is linked to the goals and purposes of CERP. More specifically, RECOVER strives to provide the following assistance to project teams:

- Assist project teams in understanding how project goals and objectives relate to overall CERP goals and objectives
- Assist project teams in implementing adaptive management strategies in project planning
- Provide information on the latest modeling assumptions for project planning
- Provide the scientific basis for project activities such as performance measure development, monitoring plan development, and determining project benefits
- Work with the project teams to determine which project alternative plan represents the best systemwide performance

RECOVER has developed a strategy for interacting with the project teams to ensure that adequate assistance is provided to the projects. A diagram of this strategy along with explanatory text is provided in Appendix 7B-2.

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## ASSESSMENT

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### CERP MONITORING AND ASSESSMENT PLAN

The status of monitoring components laid out in the CERP Monitoring and Assessment Plan (MAP): Part 1 Monitoring and Supporting Research (RECOVER, 2004) is provided in **Table 7B-1**. **Table 7B-2** provides a similar list for key uncertainties and supporting research projects described in the MAP.

### 2006 Assessment Strategy for the Monitoring and Assessment Plan

In April 2006, the Assessment Team released a final draft of the 2006 Assessment Strategy for the Monitoring and Assessment Plan for review (RECOVER, 2006c). This is an update of the 2005 Assessment Strategy for the Monitoring and Assessment Plan (RECOVER, 2005b) described in the previous SFER report (McLean et al., 2006).

### System Status Report

The Assessment Team is currently compiling the first annual system status report. This a technical report on CERP's progress based upon comparisons between the measured performance of CERP and the restoration targets of the performance measures. This report will be consulted and referenced by the U.S. Army Corps of Engineers and the South Florida Water Management District when preparing assessment reports as required by the Programmatic Regulations (DOD, 2003).

**Table 7B-1.** A List of Monitoring and Assessment Plan (MAP) components including MAP section and status.

MAP Component	MAP Section	Status
<b>GREATER EVERGLADES WETLANDS</b>		
Interior Gradients of Flow	3.1.3.1	Planning underway
Regional Distribution of Soil Nutrients	3.1.3.2	Underway: South Florida Water Management District (SFWMD) lead
Coastal Gradients: Salinity, Flow, and Nutrients	3.1.3.3	Underway: U.S. Geological Survey (USGS) lead
Systemwide Vegetation Mapping	3.1.3.4	Underway: SFWMD lead
Landscape Pattern: Marl Prairie/Slough Gradients	3.1.3.5	Underway: U.S. Army Corps of Engineers (USACE)
Landscape Pattern: Ridge, Slough, Tree Islands	3.1.3.6	Underway: SFWMD
Landscape Pattern: Tidal Creek Delineation	3.1.3.7	Complete: SFWMD
Periphyton Mat Cover and Composition	3.1.3.8	Underway: SFWMD
Mangrove Forest Soil Accretion	3.1.3.9	To be implemented in FY2007: USACE
Fish Sampling Methods Testing in Forested Wetlands	3.1.3.10	Underway: SFWMD
Aquatic Fauna Regional Populations	3.1.3.10	Underway: SFWMD
Amphibian Communities as Restoration Indicators	3.1.3.10	To be implemented in FY2007: USACE
Dry Season Aquatic Fauna Concentrations	3.1.3.11	Underway: SFWMD
Wading Bird Foraging, Distribution, and Abundance	3.1.3.12	Underway (MOD Waters project)
Wading Bird Nesting Colony Location, Size, and Timing	3.1.3.12	Underway: USACE
Successful Snail Kite Nesting in Greater Everglades	3.1.3.13	To be implemented in FY2007: USACE
Wood Stork and Roseate Spoonbill Nesting	3.1.3.14	Underway: USACE
American Alligator Distribution, Size, and Nesting	3.1.3.15	Underway: USACE
American Crocodile Juvenile Growth and Survival	3.1.3.16	Underway: USACE
<b>SOUTHERN ESTUARIES</b>		
Water Quality and Phytoplankton Monitoring Network	3.2.3.1	Underway: SFWMD (Non-RECOVER)
Salinity Monitoring Network	3.2.3.2	Underway: National Park Service, SFWMD, Miami-Dade Department of Environmental Resource Management (DERM)
South Florida Fish Habitat Assessment Network	3.2.3.4	Underway: SFWMD
Large-Scale Submerged Aquatic Vegetation Remote Sensing	3.2.3.4	Underway: SFWMD
Seagrass Fish and Invertebrate Assessment Network	3.2.3.5	Underway: National Oceanic and Atmospheric Administration (NOAA)/USACE
Shoreline Fish Community Visual Assessment	3.2.3.6	Underway: NOAA/USACE/SFWMD
Juvenile Spotted Seatrout Monitoring in Florida Bay	3.2.3.7	Underway: NOAA/USACE

Table 7B-1. Continued.

MAP Component	MAP Section	Status
<b>NORTHERN ESTUARIES</b>		
Salinity Monitoring Network	3.3.3.1	Underway
Water Quality and Phytoplankton Monitoring Network	3.3.3.2	Partially implemented; currently no phytoplankton monitoring
Submerged Aquatic Vegetation (SAV) Mapping from Aerial Photography	3.3.3.3	Underway in all but Lake Worth Lagoon
SAV Monitoring for Caloosahatchee and St. Lucie Estuary	3.3.3.4	Underway: SFWMD
SAV Transects/Visual Surveys for St. Lucie Estuary/Indian River Lagoon, Lake Worth Lagoon, and Loxahatchee River Estuary	3.3.3.5	Underway in all estuaries except Lake Worth Lagoon
Oyster Monitoring Network	3.3.3.6	Underway
Juvenile Fish Community Monitoring Network (Caloosahatchee Estuary, St. Lucie Estuary and Indian River Lagoon)	3.3.3.7	Underway in Caloosahatchee Estuary; pilot project for St. Lucie Estuary/Indian River Lagoon with proposed FY2007 start
Benthic Macroinvertebrate Monitoring (St. Lucie Estuary, Loxahatchee River Estuary)	3.3.3.8	Underway in St. Lucie Estuary/Indian River Lagoon, planned FY2007 start in Loxahatchee Estuary

**Table 7B-2.** A List of key uncertainties and supporting research projects from the MAP including MAP section and status.

<b>Key Uncertainties and Supporting Research</b>	<b>MAP Section</b>	<b>Status</b>
<b>GREATER EVERGLADES WETLANDS</b>		
Coastal Wetland and Bern Systems: Sea Level and CERP Influences	3.1.4.1	No funding proposed in FY2007
Tidal and Freshwater Creek Dynamics: Sea Level and CERP Influences	3.1.4.2	No funding proposed in FY2007
Productivity in Coastal Ecotones: Sea Level and CERP Influences	3.1.4.3	No funding proposed in FY2007
Ridge and Slough Landscape Pattern Sustainability	3.1.4.4	Underway: SFWMD
Technology Development: National Aeronautics and Space Administration (NASA) Vegetation Mapping	3.1.4.5	No funding proposed in FY2007
Crayfish Population Dynamics	3.1.4.6	Underway: SFWMD
Aquatic Refugia: Coastal Ecotone, Alligator Holes and Solution Holes	3.1.4.7	To be implemented in FY2007: USACE
Ecological Effects of Canals and other Artificial Deep Water Habitats	3.1.4.8	To be implemented in FY2007: USACE
Synthesis of Wading Bird Surveys 1985–2001	3.1.4.9	Underway: SFWMD
Sub-lethal Effects of Contaminants of Wading Bird Reproductions	3.1.4.10	Underway: Florida Department of Environmental Protection (FDEP), USACE
<b>SOUTHERN ESTUARIES</b>		
Florida Bay Sediment Dynamics: Sea Level and CERP Influence	3.2.4.1	No proposed start date as of June 2005
Measurement of Submarine Groundwater Discharge to Biscayne Bay	3.2.4.2	No proposed start date as of June 2005



Table 7B-2. Continued.

Key Uncertainties and Supporting Research	MAP Section	Status
Biological Availability of Organic Nitrogen in Florida Bay	3.2.4.3	Underway: SFWMD
Present and Past Distribution of Oysters in South Florida Coastal Complex	3.2.4.4	Underway: SFWMD
Factors Controlling Epibenthic Communities of Near-Shore Biscayne Bay	3.2.4.5	No proposed start date as of June 2005
Salinity Relationships of Epifaunal Species of Near-Shore Biscayne Bay	3.2.4.6	No proposed start date
Empirical Research of Epifaunal Species of Near-Shore Biscayne Bay	3.2.4.7	No proposed start date
Causal Factors of Fish Abnormalities in Biscayne Bay	3.2.4.8	No proposed start date
Bottlenose Dolphin Health Assessment in Biscayne Bay	3.2.4.9	No proposed start date
Manatee Abundance and Distribution Relative to Freshwater Inputs	3.2.4.10	No proposed start date
<b>NORTHERN ESTUARIES</b>		
Reconnaissance Study of Caloosahatchee	3.3.4.1	Complete
Fish Health and Pathology in the St. Lucie Estuary	3.3.4.2	Underway; funded by state grants
Bottlenose Dolphin Health Assessment in St. Lucie Estuary	3.3.4.3	No proposed start date
Manatee Abundance and Distribution Relative to Changes in Freshwater Flows and Seagrass Distribution as a Result of Implementation of CERP Projects	3.3.4.4	No proposed start date

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## EVALUATION

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### PERFORMANCE MEASURE CONSISTENCY REVIEWS AND EVALUATIONS OF ALTERNATIVE PLANS

Since the publication of the 2006 SFER, the Evaluation Team has conducted evaluations of alternative plans for the following CERP projects: Biscayne Bay Coastal Wetlands and Lake Okeechobee Watershed. The team also conducted an evaluation for an addendum to the Everglades Agricultural Area Reservoir Project. No performance measure consistency reviews have been conducted since publication of the 2006 SFER. The team is currently conducting evaluations to assist in the CERP A Refinement effort discussed below. Evaluation Team reviews and evaluation reports are available on the CERP web site at [www.evergladesplan.org](http://www.evergladesplan.org) ([http://www.evergladesplan.org/pm/recover/eval\\_team\\_reports.cfm](http://www.evergladesplan.org/pm/recover/eval_team_reports.cfm)).

### BENEFITS EVALUATION AND ANALYSIS METHODOLOGY

RECOVER is developing a Benefits Evaluation and Analysis Methodology (BEAM) to standardize the quantification and evaluation of ecosystem benefits associated with CERP projects. It will enable project teams to quantify ecosystem benefits for the purpose of evaluating and comparing alternatives and to justify a selected alternative on a next added increment basis. The draft report is provided in Appendix 7B-3.

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## PLANNING AND INTEGRATION

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### CERP A REFINEMENT

Evaluation of the hydrologic model results from the Initial CERP Update (October 2005) indicated that the performance of the Initial CERP Update model (termed CERP A) differed from the performance of the CERP model (termed D13R). These results were not surprising, given that a newer model version was used in this exercise with different inputs (e.g., topography, climate data) and different computing capabilities. Additionally, during the development of the CERP, more than 20 model simulations were performed and evaluated, each with the objective of iteratively maximizing the performance of the plan. This type of optimization was not performed with the Initial CERP Update.

RECOVER recommended to CERP managers that a follow-on effort to the Initial CERP Update be undertaken to improve the modeled performance of CERP A through operational optimization and some project modifications (for those projects far enough along in the planning process to have “tentatively selected plans”). The initiative for the CERP A Refinement was approved and began in January 2006.

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