ANNEX A

FISH AND WILDLIFE COORDINATION ACT AND ENDANGERED SPECIES ACT COMPLIANCE

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A FISH AND WILDLIFE COORDINATION ACT AND ENDANGERED SPECIES ACT COMPLIANCE

A.1 Planning Aid Letters

Planning Aid Letters (PAL) were received from U.S. Fish and Wildlife Service (FWS) on January 20, 2012, March 27, 2012 and December 12, 2012.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

January 20, 2012

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Pantano:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including but not limited to the project goals and objectives, management actions that should be considered (*e.g.*, project components), ecological performance measures, and to provide a list of Threatened and Endangered species that may be encountered within the Study Area.

BACKGROUND

Project Purpose

While CERP has made considerable progress on projects on the periphery of the remaining Everglades, less has been achieved in the most critical areas of the central Everglades. Construction has begun on the first generation of CERP project modifications already authorized by Congress. These include the Picayune Strand, Indian River Lagoon South and Site 1 projects. Project Implementation Reports have been completed, or are nearing completion, for the second generation of CERP projects for Congressional authorization. These include the Biscayne Bay Coastal Wetlands, Broward County Water Preserve Area, Caloosahatchee River (C-43) West Basin Storage Reservoir, and C-111 Spreader Canal Western projects.

TAKE PRIDE® IN AMERICA

The next step for implementation of the Plan, and the main focus of CEPP, is to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south. This will allow for restoration of natural habitat conditions and water flow in the central Everglades and re-connect the central Everglades ecosystem with Everglades National Park (ENP) and Florida Bay. The Corps, who is leading the planning effort in partnership with the South Florida Water Management District (SFWMD), has recommended that the Everglades Agricultural Area Storage and Treatment (EAA), Decompartmentalization of Water Conservation Area 3 (Decomp PIR 1), and Everglades Seepage Management (ESM) projects form the core of CEPP. These are highly interdependent features of the Plan that must be formulated and optimized in a comprehensive and integrated manner.

Planning Process

The CEPP will be one of five nationwide pilot projects to utilize a streamlined planning process with the goal of significantly reducing the amount of time it takes to plan projects. Over the last decade it has become apparent that the current Corps planning process is perceived by sponsors, State and Federal partners, Congress and the public as taking too long, being too cumbersome, too detailed, too expensive and does not lead to a better product or decision commensurate with the added years of effort to an already long process. The Corps and senior leadership at the Office of the Assistant Secretary of the Army (Civil Works) have initiated a pilot program for candidate planning studies designed to assess the effectiveness of transforming the Civil Works Planning Program to better meet the needs of the nation's water resources challenges.

Based on the above, the proposed approach for the CEPP is to incorporate the new science and understanding of the hydrology of the ecosystem and build upon the information and tools developed by SFWMD in support of a more streamlined planning process that utilizes the concepts for transformation of the Corps planning process. A general outline of the proposed process for CEPP is shown in Figure 1.

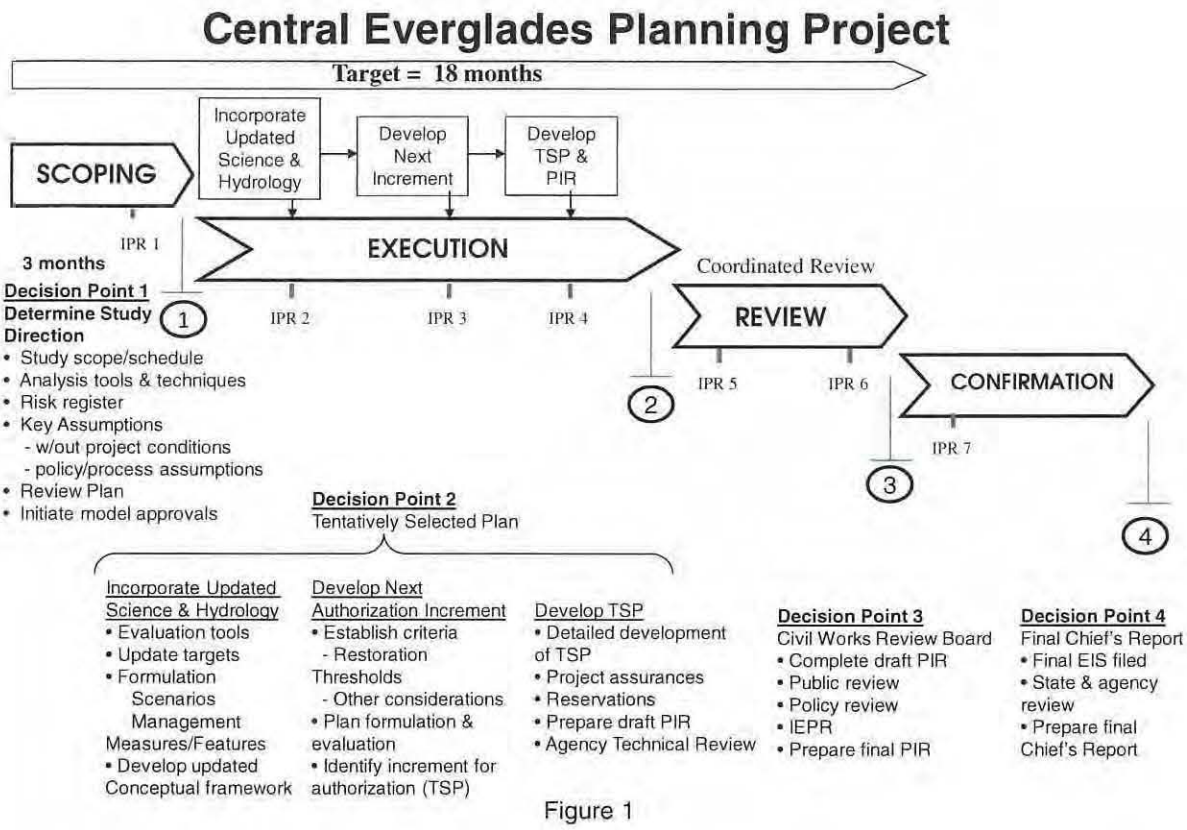

Figure 1: General outline of the proposed process for CEPP.

Project Objectives

The major goal of the project, as stated by project managers, is to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south, allowing for restoration of natural habitat conditions and water flow in the central Everglades. This will re-connect the central Everglades ecosystem with ENP and Florida Bay. This portion of the Plan will include those components that provide for storage, treatment and conveyance south of Lake Okeechobee, removal of canals and levees within central Everglades and seepage management features to protect the urban and agricultural areas to the east from the increased flow of water through the central portion of the system. An integrated study effort on these components is needed to set the direction for the next decade of implementation of the Plan. The goal of the study effort would be to develop an integrated, comprehensive technical plan for delivering the right quantity, quality, timing and distribution of water needed to restore and reconnect the central Everglades ecosystem. The study area for the CEPP has been defined to include Lake Okeechobee, Caloosahatchee and St. Lucie Estuaries, EAA, Greater Everglades, ENP, and Biscayne and Florida Bays (Figure 2).

To achieve the goals stated above, the Corps and SFWMD have drafted preliminary project objectives as follows:

- Restore seasonal hydroperiods and freshwater distribution that support a natural mosaic of wetland and upland habitat in the Everglades System.
- Improve sheet flow patterns and surface water depths and durations in order to reduce soil subsidence, frequency of damaging fires, and decline of tree islands.
- Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization.
- Restore more natural water level responses to rainfall predicted by project modeling that will promote plant and animal diversity and habitat function.
- Increase oyster habitat and sea grass populations in the Northern Estuaries by reducing salinity fluctuations from freshwater regulatory pulse discharges.

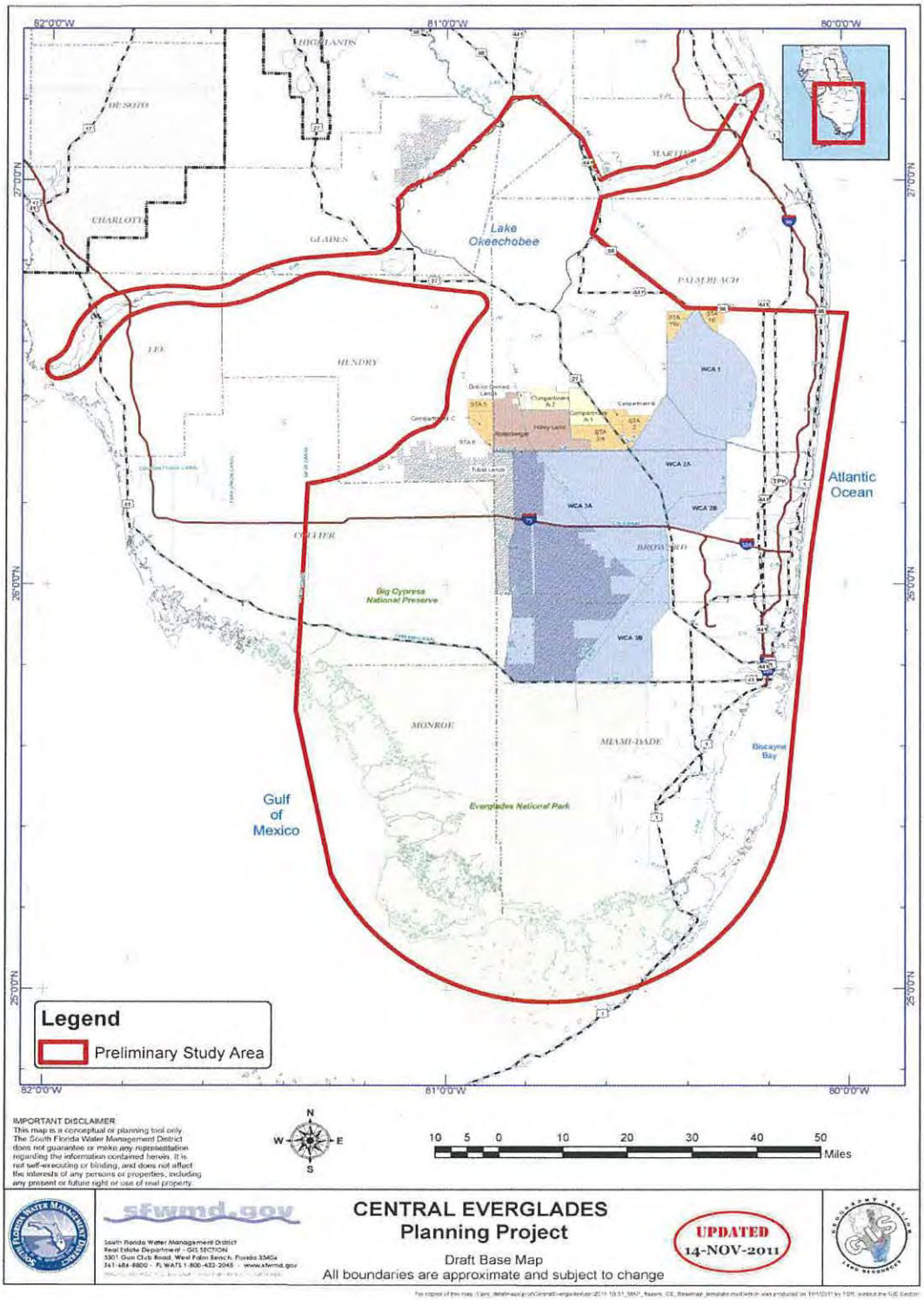

Figure 2. Central Everglades Planning Project Study Area.

Performance Measures

An interagency environmental sub-team of the Project Delivery Team (PDT), composed of scientists, engineers and planners, have drafted a list of hydrology based Performance Measures (PM) listed below. The group concentrated on Restoration Coordination and Verification (RECOVER)-approved PMs to avoid delays associated with having controversial PMs vetted. While these PMs are familiar to most and have been used in the past they will need to be adapted, in most cases, to work with the primary hydrologic model being utilized in CEPP, the Regional Simulation Model (RSM). Additionally, they are hydrologic PMs and reflect hydrologic benefits and not necessarily the desired ecological and other environmental benefits expected to result from the project. To remedy this, an interagency team led by Department of Interior scientists has drafted a list of additional environmental tools and PMs to be run separately and interjected into the planning process. A list of these tools appears below the Primary PMs. Some ecological tools that the team agreed, were not ready for use at this time, have not been included in the list (see meeting minutes available from Corps for additional information).

Preliminary List of Performance Measures

1. Lake Okeechobee Performance Measure - Lake Stage.
2. Northern Estuaries Performance Measure - Salinity Envelopes.
3. Greater Everglades Performance Measure - Inundation Duration in the Ridge and Slough Landscape.
4. Greater Everglades Performance Measure - Sheet flow in the Everglades Ridge and Slough Landscape.
5. Greater Everglades Performance Measure - Number and Duration of Dry Events in Shark River Slough.
6. Greater Everglades Performance Measure - Slough Vegetation Suitability.
7. Greater Everglades Performance Measure - Hydrologic Surrogate for Soil Oxidation.
8. Greater Everglades Aquatic Trophic Levels Small-Sized Freshwater Fish Density (RECOVER Greater Everglades #1).*
9. Everview Viewing Windows (refer to Section 2.2 of River of Grass document, page 23)*.

* Denotes Performance Measures that will be used as planning tools.

Additional Ecological

1. Everglades Landscape Vegetation Succession Model (ELVeS.)
2. Wood Stork Foraging Probability.
3. Cape Sable Seaside Sparrow Hydrologic Indicator.
4. Apple Snail Population Model.
5. Oyster Habitat Suitability Index for Northern Estuaries.

The ecological sub-team is advising the PDT to use all available ecological tools that will provide additional useful information. Two models that may be completed in time for use on this project are the amphibian community index, alligator production index and alligator population model. These indices may appear on the list above in the future.

The PMs and tools listed above are for evaluating alternative performance as it relates to environmental restoration, however there are PMs for other concerns that the Corps should include in its planning process. Examples of these would be agriculture and water supply metrics.

Models

The primary application of models in the CEPP will be in the assessment of regional-level hydrologic planning. More detailed models will also be brought to bear on specific questions related to hydraulic and water quality constraints. At this time, the modeling strategy does not consider the application of detailed flood event modeling (or hydrodynamic levee assessment) or water quality fate/succession modeling within the Everglades Protection Area given the schedule of the CEPP. Depending on the outcomes of the CEPP scoping phase and risk registry development, it is possible that key elements of this strategy may need to be revisited.

Several models will be used during the execution phase of project planning and can be categorized as screening, planning and detailed models. The Reservoir Sizing and Operations Screening (RESOPS) model is a spreadsheet application which will test alternative storage configurations that consider the interconnectivity of Lake Okeechobee, the Lake Okeechobee Service Area, the northern estuary watershed systems, and the Everglades. Models which will be used for planning include the RSM Basin, RSM Glades-LECSA, and South Florida Water Management Model (SFWMM). Detailed models include the Dynamic Model for Stormwater Treatment Areas (DMSTA) and the HEC-RAS. For more detailed information on CEPP modeling please refer to the Corps' Central Everglades Study DRAFT Modeling Strategy.

Risk Register

The risk register workshop was a good exercise for the inter-disciplinary, multi-agency PDT team. It brought the larger group into a sub-team setting to begin focusing on the risks associated with the expedited Corps planning process. Risk registers were developed by four sub-teams consisting of (1) Cultural Resources/Real Estate; (2) Environmental; (3) Engineering, Hydrology, Hydraulics, Geotech and Operations; and (4) Planning. Risks were identified and valued in a qualitative nature based on best professional judgment and agreement within each group. It is expected that a "living" document will be created by the Corps and updated on a regular basis.

SERVICE RECOMMENDATIONS

Project Purpose

While the Service fully supports this effort and approach, it is necessary to point out that there are many restoration opportunities within the Central Everglades that would not be captured by simply undertaking the three specific projects suggested: EAA storage component; Decomp PIR 1 Project; and ESM Project. Primarily, the reconnection of WCA-3B as a flow-through system connecting WCA-3A to ENP is the most critical part of Everglades restoration remaining to be planned. This component of the Modified Water Deliveries (MWD) to ENP Project was called Conveyance and Seepage and has undergone initial planning during the Combined Structural and Operational Plan. Since then, funding for MWD has been exhausted, and the Conveyance and Seepage Project set aside. The Service suggests, and will provide alternative scenarios, that this critical element be made a core component of CEPP. The initial phase of this component could be as simple as continued use of the L-67A culvert approved for the Decompartmentalization Physical Model and a new weir on the L-29 levee. The optimal approach, however, would be implementation of the original plan (1994 GDM) which consisted of 3 gates (S-349 A,B and C) in the L-67A canal, 3 weirs or culverts in the L-67 A levee, degradation of the L-67 C levee and canal, and 3 weirs on the L-29 levee to allow flow across the Tamiami Trail.

Additional opportunities that should be included in CEPP are the relaxation of the G-3273 constraint, integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and expansion of the S-333 structure to allow greater flow out of the ponded areas of WCA-3A into Northeast Shark River Slough (NESRS). Also, if the Combined Operational Plan is going to be delayed or absorbed into CEPP then an operational plan that utilizes the newly constructed 1-mile bridge should be incorporated. Other opportunities include defining environmental water regulation schedules for WCAs 2 and 3B and refining the schedule for 3A.

It is also important that the Corps and SFWMD, as quickly as possible, determine the size and type of available storage and treatment areas in the EAA to help guide the team in formulating downstream project features. There is considerable speculation as to the amount of water that the project will deliver south which is entirely predicated on the amount of storage and treatment available in the EAA. Team members and the public are initially being asked to provide comments and lay out issues for an as yet undefined project. This will hinder stakeholder and public buy-in and support. Even if tentative plans are numerous, they need to be discussed early in the process.

It may be the case that some proposed components of the project become less important (*e.g.,* seepage management) as more is learned about the quality of water delivered south. The Service does not feel that a completed seepage management project, without the delivery of additional water for the environment, constitutes a valid restoration project. The Corps should notify the Service regarding the best time to provide important information regarding the design and detailed operations of stormwater treatment areas and storage reservoirs and their effects on listed species, migratory birds, and other wildlife resources.

A project feature that should not be considered during the CEPP is further modification of the S-12 structures closure regime for protection of the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Once the Everglades Restoration Transition Plan (ERTP) is authorized (Record of Decision scheduled late February 2012) the S-12 closure regime will be relaxed due to the addition of year-round operational capability at S-12 C. With the additional "untested" risk to the Cape Sable seaside sparrow subpopulation A and its habitat from ERTP operations, the Service strongly recommends that restoration become more focused on shifting flow eastward towards the original flow path of WCA 3B to NESRS. No further management changes to the S-12s should be considered until more flow has been restored into northeastern ENP.

Planning Process

The Service fully supports the use of an expedited planning process for the CEPP. The process used to plan CERP projects over the past decade is cumbersome and has not always resulted in a better plan. The proposed expedited process will identify issues early and elevate these issues through the vertical management team for timely decisions, reducing delay at the PDT level. The complexity previously required of project implementation reports will be reduced, thus allowing preparation of these documents in much shorter time periods. In an effort to identify and process the added risk of completing a rapid and possibly less detailed study, the Corps has implemented a risk registry procedure where team members and other public stakeholders were asked to identify major risks and suggest ways in which to mitigate the risk.

An area of concern regarding the expedited process is how PDT meetings are being conducted. As we approach the 3-month mark there have only been two PDT meetings. These were conducted as short (~3 hour) meetings prior to public workshops. Dialogue among PDT members and between the team and project management regarding critical project planning elements was restricted. Draft language, such as project objectives, on which the PDT members were asked to comment, was not shared prior to the meeting. The Service suggests that the Corps and SFWMD convene a PDT meeting in the style previously used during CERP to discuss critical project elements as soon as possible.

As noted above, the primary performance measures listed to date are hydrologic. There are a number of ecological planning tools that have been developed and are being linked to RSM output that could be used in the planning process. The Service encourages the Corps and SFWMD to seek out and use available ecological planning tools to help to ensure that evaluations include both hydrologic and ecologic information. Consideration should be given to ecological planning tools in Florida Bay and Biscayne Bay as well as Greater Everglades.

Adaptive management and the monitoring associated with it is a key part of the science strategy for CERP and should be for CEPP as well, yet there has been no discussion on development of an adaptive management plan for CEPP. The Service recommends that development of an adaptive management plan occur in conjunction with the CEPP planning process.

Project Objectives

The Service appreciates the challenging work completed by the Corps and SFWMD staff on the initial draft project objectives. This task is difficult because of the scope and enormity of the project study area. The Corps and SFWMD project managers should refine the scope and study area to more precisely fit the first increment of the CEPP as soon as possible. This will allow the team to refine the objectives and identify PMs and model applications that will be useful in determining project benefits.

Specific comments on the draft project objectives are as follows:

- "Reduce water loss out of the natural system…" We assume that this is referring to seepage loss since the Seepage Management project was identified as a core component of CEPP but it is not clear. It may refer to the loss of freshwater to tide. The seepage component is not primarily for wildlife benefit but for flood protection and the objective should reflect this. Please clarify this objective.

- "Restore more natural water level responses to rainfall predicted by project modeling…" This needs to be reworded or better explained. Does this imply that the model predicts rainfall? We assume the desire is to have the system respond more naturally to rainfall patterns.

- "Increase oyster habitat and sea-grass populations in the Northern Estuaries by reducing salinity fluctuations from freshwater regulatory pulse discharges." There is a misconception contained within this objective that by reducing salinity fluctuations you increase oyster and seagrass habitats. This is not the case as additional management actions are needed for this to occur. The Service also suggests this objective be reworded to include the restoration of the overall ecological function of the estuaries as measured by oyster and sea-grass populations. Detailed questions regarding this objective are as follow:

    - What is meant by seagrass population, species composition, density, acreage increase, etc?
    - Is *Vallisneria* included under seagrass since it is an important component of the Caloosahatchee River restoration?
    - Which Northern Estuaries will the CEPP improve (St. Lucie, Caloosahatchee, etc.)?
    - Will muck removal in estuaries or addition of artificial substrates (oyster cultch) be included in the Management Measures as part of the CEPP to claim maximum ecological benefits for Northern Estuaries oyster and seagrass health and abundance?

Performance Measures

The process used by the Ecological sub-team to select the project PMs is working well and the draft suite of PMs listed above is suitable to detect hydrologic benefits. Concerns we have at this point are whether the RECOVER approved and vetted PMs previously used in CERP can be modified to use RSM output. Additionally, the estuarine performance measures proposed utilize an array of models including the SFWMM; or 2x2. Will the SFWMM be used to evaluate project alternatives (perhaps solely in the estuaries)?

Also of concern is how output from the additional ecological tools will be used to formulate alternatives to optimize benefits for natural resources throughout the system. The Service recommends that conclusions and recommendations drawn from these specialized tools be considered between alternative runs to make the next iteration more beneficial for natural resources. Additionally, the information will be used to better relate hydrologic change to environmental lift predicted by the preferred alternative.

Examples of the resource-specific ecological tools currently under consideration are listed previously in this document and minutes from a recent Ecological sub-team meeting indicate that most of the models are ready for use. One issue that arose is whether the models can accept RSM hydrologic model output. Most of the ecological models were set up to work on a fixed grid so the RSM output needs to be manipulated to get it into a fixed-grid format. Modelers from the Corps, Joint Ecological Modeling group and other agencies are working on ways to eliminate this problem.

Models

Since the River of Grass modeling tools and PMs have been moderately peer-reviewed, their use during CEPP will be appropriate as long as the Corps' certification process is either completed or these PMs exempted from certification.

There are some concerns with using the RESOPS model in conjunction with the Regional Simulation Model – Glades Lower Ease Coast Service Area (RSM-Glades LECSA) model. RSM-Glades LECSA is a daily time-step model that will be using output from RESOPS which utilizes a monthly time-step. This will automatically create inherent errors in the model results.

The RSM Basin model covers the Kissimmee Basin, Lake Okeechobee, St. Lucie River, and Caloosahatchee River. Unfortunately, this model does not provide individual gauge data, which the Service has used previously to assess impacts and implement terms and conditions within its biological opinions. Rather than simulating gauge data, this model represents stage as an average water level condition across an entire water body. Also, model documentation for RSM Basin does not discuss ground water. The spatial extent of the RSM Basin model includes an intensive surface water / ground water interaction. This interaction in the Everglades headwaters needs to be defined and verified for accuracy. It is unclear whether the surficial aquifer is simulated in this model.

A similar concern exists for the RSM Glades-LECSA model which simulates hydrology within 1-square mile grid cells without providing individual gauge data. Since the Corps and SFWMD water management sections base their management actions on individual gauge data as the Service bases its nondiscretionary terms and conditions on gauge data, a cross-walk between simulated hydrology across a large area to that at specific gauges will be needed. The hydrologic effects of the proposed action at key gauge sites identified by the Service during this and previous consultations should be provided.

The modeling strategy for CEPP does not consider any detailed flood event modeling or levee assessments. L-29 levee concerns have presented a human health and safety constraint in WCA-3A, thus a levee assessment with flood event modeling will likely become necessary especially since more water is predicted to move south through the system into WCA-3A.

Recent water quality legal and scientific issues throughout the Everglades necessitate the need for water quality assessments and modeling. It has been noted that the DMSTA model does not allow for extreme events, such as droughts and hurricanes. Thus, DMSTA is expected to predict +/-23 percent of the mean phosphorus concentrations. DMSTA may be useful in the planning process, but it will likely need more refinement for project level simulations.

Climate Change Scenarios

Given the range of uncertainties in dealing with climate change and urbanization it is important that these be incorporated into the planning process in the best way feasible. The planning team should evaluate available tools and information that can be used to assess future impacts of climate change including sea level rise and changes in urbanization (which may affect water supply). One possible tool has resulted from work conducted by an MIT research team (Service, U.S. Geological Survey, and MIT) that developed a series of scenarios in collaboration with a wide range of stakeholders, including representatives from Federal, State, and local government. These scenarios have four top-level dimensions selected by the stakeholders: climate change, population, financial resources, and planning assumptions. Within these dimensions, stakeholders developed a bounded range of possible values from the best available science, including sea level rise, land use, agriculture, conservation lands, and transportation corridors. This climate change model covers the CEPP area and it is recommended that the team determine how best to incorporate this information into the planning process and/or identify other climate change information that can be used during planning.

Project Schedule

The following table (Table 1) highlights some issues identified with the current draft schedule as it pertains to Service activities.

Table 1. Comments on the draft schedule as it pertains to Service activities.

Activity ID	Activity Name	Start	End	Notes
1060	Prepare Draft PIR and EIS	1 May 2012	2 Oct 2012	What will be evaluated in this draft PIR/EIS? The TSP will be selected 4 months later (1110). Will the Corps be assessing all the potential TSPs that are under consideration (1400)?
1410	Complete Draft PIR/EIS Report	4 Feb 2013	7 Feb 2013	This occurs a week after the TSP Approval (1110). How does the Corps propose to evaluate the TSP for the EIS in less than 4 days?
1570	FWS Prepares Coordination Act Report	4 Feb 2013 *14 Dec 2012*	20 Mar 2013 *8 Feb 2013*	Is this the draft or final CAR? The draft CAR is usually completed about 45 days after the TSP (1120) and a couple weeks prior to the draft EIS (1420). If we are given the TSP when the EIS begins evaluating it we can start this activity earlier (see the italics dates for example).
1540	USACE Starts Biological Assessment	1 Feb 2013	22 Mar 2013	This activity lists 1550 as a successor. What is 1550? The FWS BO is activity 1560.
1560	FWS Prepares Biological Opinion	25 Mar 2013	2 Oct 2013 *12 Aug 2013*	The Service has 135 calendar days to prepare the BO under the Act. It appears that the current schedule has 135 work days. I think this makes the end date 12 Aug 2013 which lines up with 1240. The predecessor to the BO is listed as 1550. What is 1550?
	Final FWS Coordination Act Report	*9 Apr 2012*	*27 May 2013*	This activity is not included in the schedule. The end date for this is usually prior to the final EIS going to public review (see the italics dates for example).

Threatened and Endangered Species List

The Service has received a request from the Corps (email dated January 20, 2012) for a preliminary list of Threatened and Endangered Species that may be encountered within the project area. The following table (Table 2) is a preliminary list that will be finalized later when an official request from the Corps has been received.

Table 2: Threatened and Endangered species that may be present in the CEPP project area.

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	CRITICAL HABITAT
Mammals			
Florida bonneted bat	*Eumops floridanus*	Candidate	No
Florida panther	*Puma (=Felis) concolor coryi*	Endangered	No
West Indian manatee	*Trichechus manatus*	Endangered	Yes
Birds			
Northern Crested caracara	*Caracara cheriway*	Threatened	No
Bald eagle*	*Haliaeetus leucocephalus*	Delisted	No
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	Endangered	Yes
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	Endangered	Yes
Piping plover	*Charadrius melodus*	Threatened	No
Red-cockaded woodpecker	*Picoides borealis*	Endangered	No
Roseate tern	*Sterna dougallii dougallii*	Threatened	No
Wood stork	*Mycteria Americana*	Endangered	No
Reptiles			
American alligator	*Alligator mississippiensis*	Threatened	No
American crocodile	*Crocodylus acutus*	Endangered	Yes
Eastern indigo snake	*Drymarchon corais couperi*	Threatened	No
Green sea turtle**	*Chelonia mydas*	Endangered	Yes
Hawksbill sea turtle**	*Eretmochelys imbricata*	Endangered	Yes
Kemp's ridley sea turtle**	*Lepidochelys kempii*	Endangered	No
Leatherback sea turtle**	*Dermochelys coriacea*	Endangered	Yes
Loggerhead sea turtle**	*Caretta caretta*	Threatened	No
Plants			
Big Pine partridge pea	*Chamaecrista lineata* var. *keyensis*	Candidate	No
Blodgett's silverbush	*Argythamnia blodgettii*	Candidate	No
Cape Sable thoroughwort	*Chromolaena frustrata*	Candidate	No
Crenulate lead-plant	*Amorpha crenulata*	Endangered	No
Deltoid spurge	*Chamaesyce deltoidea* ssp. *deltoidea*	Endangered	No
Florida brickell-bush	*Brickellia mosieri*	Candidate	No

Florida pineland crabgrass	*Digitaria pauciflora*	Candidate	No
Florida prairie-clover	*Dalea carthagenensis* var. *floridana*	Candidate	No
Florida semaphore cactus	*Consolea corallicola*	Candidate	No
Johnson's seagrass	*Halophila johnsonii*	Threatened	No
Garber's spurge	*Chamaesyce garberi*	Threatened	No
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeensis*	Endangered	No
Pineland sandmat	*Chamaesyce deltoidea* ssp. *pinetorum*	Candidate	No
Tiny polygala	*Polygala smallii*	Endangered	No
Invertebrates			
Bartram's hairstreak butterfly	*Strymon acis bartrami*	Candidate	No
Florida leafwing butterfly	*Anaea troglodyta floridalis*	Candidate	No
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	Endangered	No
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	Endangered	No
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	Threatened	No
Fish			
Smalltooth sawfish**	*Pristis pectinata*	Endangered	No

* The bald eagle has been delisted under the Act but continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

** Species under the purview of the NMFS-NOAA Fisheries for consultation under the Act.

CONCLUSION

The guidance and recommendations that we provide in this PAL aim to assist us in our obligations to consider the effects of the project on all of the trust resources that we must address to fulfill our responsibilities under the FWCA and Act. We applaud the progress made so far by the CEPP PDT as well as the team's common vision for restoration and commitment to the expedited planning process. We look forward to continuing our working relationship with the Corps staff and other partners and stakeholders throughout the remainder of the CEPP planning process. If you have any questions regarding the contents of this PAL, please contact Kevin Palmer or Lori Miller at 772-562-3909.

Sincerely yours,

Larry Williams
Field Supervisor
South Florida Ecological Services

cc: electronic copy only
Corps, Jacksonville, Florida (Eric Bush, Eric Summa, Kimberly Vitec, Gina Ralph)
Corps, West Palm Beach, Florida (Kim Taplin, Lt Col. Michael Kinard)
DEP, Tallahassee, Florida (Greg Knecht)
District, West Palm Beach (Lisa Cannon, Matt Morrison)
ENP, Homestead, Florida (Bob Johnson, Carol Mitchell)
FWC, Tallahassee, Florida (Mary Ann Poole)
FWC, West Palm Beach, Florida (Chuck Collins)
Service, Atlanta, Georgia (David Flemming, Dave Horning)
Service, Jacksonville, Florida (Miles Meyer)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 27, 2012

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Pantano:

The U.S. Fish and Wildlife Service (Service) has prepared this second in a series of Planning Aid Letters (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including, but not limited to, management measure screening, alternative formulation, modeling strategy, and natural resource considerations.

Review of major points from previous PAL

- Reconnection of Water Conservation Area (WCA) 3B as a flow-through system connecting WCA-3A to Everglades National Park (ENP) is the most critical part of restoration remaining to be planned. All options should be analyzed regarding how and to what extent this critical reconnection should be made.
- Relaxation of the G-3273 constraint, the integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and the expansion of S-333 structure to allow greater flow out of the ponded areas of WCA-3A into Northeast Shark River Slough (NESRS) should be included in CEPP.
- Regulation schedules for WCAs 2 and 3B should be defined and the regulation schedule for WCA-3A should be refined.
- Further modification of the S-12s should not be considered as it was screened out in the recent Everglades Restoration Transition Plan (ERTP) for protection of the Cape Sable Seaside Sparrow (CSSS) (*Ammodramus maritimus mirabilis*). Once ERTP is authorized, the S-12C closure regime will be relaxed allowing for year-round operations.

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Project Status

Since the last PAL was submitted on January 24, 2012, the Corps and South Florida Water Management District (SFWMD) project managers briefed their vertical management teams on the progress of the project at a Decision Point One meeting held on January 27, 2012. The purpose of this meeting was to determine study direction and receive feedback on the study scope and schedule. The team was directed to proceed to the next phase of the project, the Execution phase. This phase will last roughly 12 months and result in development of a Tentatively Selected Plan (TSP) and Project Implementation Report for the first increment of the CEPP Project. Detail regarding the team's progress during the first 2 months of the Execution phase will follow in this letter. The next milestone will be an In-Progress Review to the Corps' vertical management team on March 29, 2012. This letter will help inform that briefing.

Management Measures and Screening

Background

A draft list of coarse or general management measures was presented to the Project Delivery Team (PDT) at a meeting on January 31, 2012 (Table 1). These measures were compiled from work other teams had completed on previous CERP projects, and grouped by geographic location (*i.e.*, above and below the red line (an imaginary line used in modeling) designating the bottom of the Everglades Agricultural Area [EAA]). The team agreed to employ a first-cut screening of these measures using information generated from the other teams that considered them (*e.g.*, partitioning Lake Okeechobee was screened out during previous project deliberations and so it would be screened out of CEPP on this basis).

Table 1. List of general management measures grouped by geographic location. Quantity and quality are located above the red line in the EAA; Conveyance and distribution measures are located in the Greater Everglades downstream of the EAA; and Seepage management measures are located between the Greater Everglades and populated areas of the Miami Rock Ridge along the protective levee.

Quantity and Quality	Conveyance and Distribution	Seepage Management
Higher lake levels	Plug or backfill canal to marsh grade	Detention area
Partition Lake Okeechobee	Shallowing of canal	New pump stations
Above-ground storage reservoir	Gated structure in canal	Groundwater wells
Ecoreservoir	Pipeline	Line/pipe canals
Operational changes	Spreader canal	Recharge area
Stormwater Treatment Area	Levee removal/degradation	Flood attenuation reservoir
Flow equalization basin	Increase flow resistance in canals	Relocate existing canals
Dry/wet flow way	Culverts within existing levees	New canals
Aquifer Storage and Recovery	Spoil mound removal	Relocate existing pump stations
	Operational changes	Operational changes
	Bridging	Raise canal stages
	Cap canals	Step-down levees
	Pumping stations	In-ground seepage barriers
	Levee/berm construction	

The management measures remaining after the first round of screening (Table 2) have been added to a spreadsheet currently being called the *CEPP Component and Alternative Development and Screening Tool (CEPP Roadmap)*. This spreadsheet is a central depository of all information the team will generate and use to screen and combine management measures into components, and combine components into a final array of alternatives. The next step will be to define the process the team will use to analyze available information (model output and other data) using hydrologic and ecological targets, and screen out certain measures while combining others into functional components and alternatives. As seen in Table 2, the names and numbers of management measures in each category have changed somewhat from the original list. The Service recommends that a brief write-up be included with the matrix to show the evolution of how some of the measures were screened and others were fleshed out in detail.

Table 2. Management measures as listed in the latest version (March 7, 2012) of the CEPP Component and Alternative Development and Screening Tool (The Roadmap). These are the remaining measures after the first screening iteration.

Quantity and Quality	Conveyance and Distribution	Seepage Management
Operational Flexibility	Degrade Levees	Detention area
Shallow Reservoir (FEB)	Gap Levee	New pump stations
Deep Reservoir	Remove Levee	Raise Canal Stages
Strategic Aquifer Storage and Recovery	Spreader Canal	Flood attenuation reservoir
Stormwater Treatment Area	Pumping Stations	Relocate existing canals
	Canal Conveyance	New canals
	Focused Flows	Relocate existing pump stations
	Canal Backfill	Operational changes
	Spoil mound removal	In-ground seepage barriers
	Canal Plugging	
	Gated Control Structures	
	Culverts	
	Weirs	
	Operational Flexibility	
	DOI Bridging	
	Structural Improvements	
	Swales	
	Culvert/Canal Maintenance	
	Collector Canals	

Issues and Concerns

There is uncertainty as to how the next screening phase will be implemented. The team has been briefed by the modeling group, which indicated that some "upfront" modeling products will be used to screen and optimize management measures for compilation into components and subsequently into alternatives. The Service recommends that the Corps quickly define the methodology that will be used during this step and make sure that the modeling sensitivity, and hydrologic and ecological targets are robust enough to potentially remove or retain management measures. The Service would like to be included in discussions regarding the ecological targets that will be used during this process.

At a February 29, 2012, Core Planning Team meeting, the S-12 operational regime for protection of the CSSS was added to the *CEPP Roadmap* (second level of screening) with little discussion. The Service would like to reiterate comments from the first PAL that changes to the S-12 operations should be considered as part of the first-cut screening methodology because changes to all of the S-12 structures were considered during ERTP. In fact, the primary focus of ERTP was determining operational flexibility and optimizing the S-12 closure regime for improving WCA-3A water management while maintaining protection for the CSSS. During the recent ERTP multi-agency PDT meetings all options for change to the S-12 structures were screened out with the exception of S-12C, which became operational year round in the final plan. It is our understanding that there is no project objective in CEPP for the modification of these structures since the goal of the project is to restore flow to NESRS. It is unclear, at present, how the preliminary modeling will provide necessary information on S-12 operations to screen them out. The modeling group has indicated that the preliminary modeling will not consider impediments to flow along the Tamiami Trail or operations. The CEPP team has agreed to eliminate measures and components from other CERP projects, such as Decompartmentalization, due to the extensive study and project work done in those projects. The Service recommends the same screening process be incorporated for exclusion of the S-12 A/B, S-344, and S-343 structure operations for maintaining protection of the CSSS. We believe the team should focus on the primary goal of the project which is to restore flow from WCA-3A to WCA-3B and into NESRS.

The Service is also concerned about the process by which alternatives will be developed and evaluated. The general alternative formulation and evaluation process has been described by the Corps as a series of screening iterations using "upfront" modeling output whereby management measures are screened or combined into components which will then be screened out or combined to form the final array of alternatives. Relying on modeling products to choose alternative features for the final array of alternatives without regards to operations, adaptive management, and past experience could result in a plan with adverse impacts to the landscape and threatened and endangered species. The Service requests that we receive model output pertaining to threatened and endangered species, throughout the planning process from screening through alternative formulation, so that we may help the team identify all possible means to reduce or eliminate impacts and ensure the TSP will help restore these imperiled species [Act section 7(a)(1)].

Use of New Science in Planning

It is critical for the PDT to begin discussing the "transition strategy" for how we will slowly introduce larger volumes of water into a system which has had its spatial extent reduced by 50 percent and its biological systems acclimated to reduced water flow. For the purposes of comparing modeled alternative runs it may be appropriate to use Natural System Model-based hydrologic targets; however, it should be understood that the first increment of CEPP will probably not meet these, and they may be inappropriate for use in some areas of the system. It is likely that both species and their habitat will be impacted during the transition to full restoration and careful planning will be needed to ensure these natural resources remain on the landscape. Excessive increases in flow volumes could overwhelm the system and disrupt timing,

which could be harmful to tree islands, wetland dependent bird nesting and foraging, apple snail survival and reproduction, among others. Both the landscape and species response will need time to adjust to new conditions.

In addition to the new science learned during the 2 day Science Workshop for CEPP, the team should also use information learned from other CERP projects. A good example of this is the Multi-species Transition Strategy (MSTS) used during ERTP-1. A group of interagency scientists, in coordination with species experts, compiled the latest information regarding a number of species and defined a WCA-3A water management strategy. This science-based strategy was designed for snail kites, apple snails, wading birds, and vegetation found within WCA-3A and was based on the current hydrologic system. For CEPP, this strategy can be refined and other species and locations within the project area can be added. One of the key benefits from the MSTS and ERTP-1 was opening a communication channel between regional water operators and interagency scientists responsible for managing the system for natural resources. The Periodic Scientist Calls and seasonal scientist meetings are simple and effective forms of adaptive management and should be utilized in CEPP.

The Service recommends that threatened and endangered species be considered regularly throughout the CEPP planning process, from screening through alternative formulation, to ensure species protection while restoring the ecosystem. The Service understands that the PDT would like to have definitive answers as to how threatened or endangered species will be affected by certain aspects of the project, and the Service will work with PDT to provide those answers as soon as feasible within the process. Most importantly, in the end, the CEPP water control and operational plan will have to be analyzed (by the Service) to determine any effects to threatened and endangered species.

CSSS Nesting and Habitat Criteria

CSSS inhabit the relatively short hydroperiod marl marsh which flanks the Taylor and Shark River Sloughs in the ENP. Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water level or stage is above ground surface) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat ([Kushlan et al. 1982]; Olmsted 1984; Kushlan 1990a; Wetzel 2001; Ross et al. 2006). Recent observed average annual hydroperiods in subpopulation A (CSSS-A), as measured at NP-205 near the sparrow's core breeding habitat in western Shark Slough, have been in the range of 240 days or more. The effect of these longer hydroperiods in consecutive years has been the conversion of short hydroperiod marsh suitable for sparrow nesting to a sawgrass-dominated, wetter, marsh-type habitat unsuitable for sparrows. While the habitat occupied by sparrows can tolerate occasional average annual hydroperiods to 240 or more days this condition should not occur in concurrent years. Hydroperiods of 60 to 180 days should be experienced at the highest frequencies (*e.g.*, 7 out of 10 years) with occasional years ranging from 210 to 240 days. The opposite is true in the eastern subpopulations where hydroperiods are shorter resulting in higher threats of catastrophic fires and woody plant encroachment. CEPP is expected to alleviate these conditions by shifting more water into NESRS.

Targets for CEPP alternative performance, with regards to sparrow nesting, in the vicinity of the six sparrow subpopulations (A-F) will remain the same as during Interim Operational Plan and ERTP-1. For all CSSS subpopulations the target is at least 60 consecutive days and preferably 80 or more consecutive days in most years during the nesting season from March 1 through July 15 with water levels at or below ground surface. For CSSS-A this equates to 60 days at or below 6.0 feet National Geodetic Vertical Datum (NGVD) at NP-205. In understanding this target, it is important to note that, due to topographic variation within the sparrow's habitat, available habitat at a higher elevation than the NP-205 reference point will remain dry for longer than habitat at the reference point elevation. Therefore this requirement, with current protective operations of S-12A/B, S-343, and S-344, should provide the 80 dry days required for completion of two successive broods over a larger percentage of habitat above 6.0 feet NGVD. At a stage elevation of 6.0 feet NGVD at NP-205, roughly 40 percent of the habitat is available for nesting by CSSS.

This requirement is less critical, though still important, in the eastern subpopulations (B, C, E, and F) because the habitat in these areas has been too dry in recent years and has become more susceptible to damaging human-induced and naturally occurring wildfires. It is anticipated that CEPP will greatly improve the habitat in these eastern populations due to the fact that a large proportion of current and new water from the project will be distributed to NESRS east of the L-67 extension. Subpopulation D, located to the east of Taylor Slough, has been maintained too wet in recent years due to its proximity to the C-111 Canal. The CERP Project, C-111 Spreader Canal, has implemented protective measures and habitat restoration actions for the benefit of this subpopulation.

Modeling

The Service recommends that the PDT not rely solely on modeling for CEPP. Values produced from modeling are not intended to be taken literally, but rather for observing trends and for making comparisons. All of the models being used in CEPP have a +/- 0.50 foot error along with inherent errors in data and topography. Best available science, best professional judgment, ecosystem observations from monitoring, and adaptive management should be the primary tools used to design and select the TSP as discussed in the PDT kick-off meeting.

It is the Service's understanding that early model runs, using preliminary performance measures and ecological targets, will be performed as a way to pre-screen alternatives. During this modeling process, the Service recommends making the model output of any screened-out scenarios available to the PDT members for their agency analyses to avoid any pre-decisional determinations. Current Everglades' performance measures and ecological targets, including those developed in the ERTP-1, should also be included as screening tools and in alternative model runs.

The Service also wants to point out that using NSM-4.6.2 targets for the entire Everglades may not be desirable. Models tend to work well in some areas of the project area and less in other areas. Some of these differences are due to current topographic information and mapping as well as resolution of the models. The CEPP planning and modeling cannot ignore micro-topography as it is extremely important to the species and their habitats.

Climate

The Service recommends that the CEPP PDT discuss and consider the current and predicted climate regimes that influence the rainfall patterns of the Florida Peninsula. Local, regional, and global regimes have important consequences for ecosystems, species, and habitats and should be a part of the planning process. Examples of regimes to be discussed are effects to land and sea breezes and tropical weather due to, but not limited to, the Atlantic Multi-Decadal Oscillation and the El Nino Southern Oscillation.

Climate Change

Climate change should also be a part of the active dialog in planning for Everglades restoration in determining the viability of recommended restoration targets and solutions with emphasis around the perimeter of the Greater Everglades. The Service recommends the use of "Addressing the Challenge of Climate Change in the Greater Everglades Landscape" research imitative that was recently completed by a group of researchers at the Department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT) in coordination with the Service and U.S. Geological Survey. The study investigates possible trajectories of future landscape changes in and around the Greater Everglades landscape relative to four main drivers: climate change, shifts in planning approaches and regulations, population change, and variations in financial resources. This research identifies some of the major challenges to future conservation efforts and illustrates a planning method which can generate conservation strategies resilient to a variety of climatic and socioeconomic conditions (Vargas-Moreno and Flaxman 2011). CEPP needs to ensure that the theory and practice of restoration fits with the forecast of a changing environment (Harris et al. 2006). Sea level rise, especially, should be considered and planned for as it will likely affect structural operations, water management plans, ecology, and landscapes. We feel it is important to include the MIT scenarios in discussions and planning to insure we investigate the best methods to restore our resources.

In summary, the Service continues to support the strategy and vision for accomplishing this challenging but critical restoration project. We commend the Corps' sustained efforts to complete CEPP within the expedited schedule. We pledge our continuing support in planning of restoration projects to maximize opportunities and minimize potential adverse effects to the natural system. For assistance or if you have questions regarding the contents of this PAL, please contact Lori Miller or Kevin Palmer at 772-562-3909.

Sincerely yours,

Larry Williams

Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
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FISH AND WILDLIFE SERVICE
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December 12, 2012

Eric Bush
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Dear Colonel Dodd:

The U.S. Fish and Wildlife Service (Service) has prepared this third in a series of Planning Aid Letters (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including, but not limited to, management measure screening, alternative formulation, modeling strategy, and natural resource considerations.

Project Status

Since the last PAL was submitted on March 27, 2012, the interagency CEPP team has achieved several milestones including the completion of the 'screening phase' of alternative evaluation, brief introduction of the draft final array consisting of 5 alternatives, and several Internal Progress Review briefings of the vertical management teams of the Corps and South Florida Water Management District (District). The final step of the roughly 12-month long Execution phase, which started in late January 2012, will be an analysis of the final array of alternatives using the Regional Simulation Model (RSM) and RECOVER performance measures which will aid the team in selecting the Tentatively Selected Plan (TSP). The Project Implementation Report (PIR) will follow after the selection of the TSP. The focus of this letter will be on comments and recommendations regarding the conceptual design and modeling of the final array of alternatives. The Service understands that a 'hybird' alternative, or one in which contains the best components from several of the final alternatives, could be defined and selected as the TSP. It is unclear at this time if this alternative would then need a separate model run to satisfy the CERP Programmatic Regulations.

Draft Final Array of Alternatives

Background

For the past several months, the core planning team members, in conjunction with the project planning team (PDT) and participants of the Working Group-sponsored public workshops, have been analyzing screening level model output to determine which of the previously identified management measures should be retained and grouped into alternative scenarios (more detail regarding this process will be included in the Corps' PIR and Environmental Impact Statement). The latest of two tiers of screening level analyses allowed the group to reduce the number of draft alternative scenarios from 10 to 5 (Figures 1 – 5). All of these alternatives retain the same configuration above the redline but differ to varying degrees from the Hydropattern Restoration Feature (HRF) south through the green and blue lines and along the yellow line which represents the seepage management barrier along the urban boundary of the Everglades. The approach taken was to have a set of alternatives, composed of a wide array of management measures with three likely scenarios bound by "bookends" representing a minimum and maximum scenario. These alternatives will be simulated by the Regional Simulation Model (RSM) and evaluated using a set of REstoration COordination and VERification (RECOVER) performance measures. Scores from these metrics will be combined with estimated costs and entered into the Corps cost-benefit analysis to determine which of the alternatives are cost effective.

General Comments about the Alternatives

- All of the alternatives state that the A-2 Flow Equalization Basin (FEB) will be integrated with the FEB on A-1, which is now in the Future Without Project condition for CEPP; however, the operation of these basins is unclear at this time. Will the A-1 be used to collect up to 60,000 acre/feet of runoff from the Everglades Agricultural Area while the A-2 handles the 200,000 acre/feet of "new water" produced by CEPP?
- There are certain aspects about the project that have been shelved for decisions to be made at a later date. These include: conveyance capacity from Lake Okeechobee to the FEBs, operational plan for the entire project, L-6 diversion, eastern Hydropattern Restoration Feature (HRF), Miami Canal backfill method, planted spoil mound retention, L-28 cuts, C-11 Extension cuts, etc. It is unclear whether the RSM modeling of the final array will help us make these decisions.
- The Service suggests that an assumptions category be included for each alternative that would contain separable elements of the project such as retention of the Decompartmentalization Physical Model (DPM) Project and any modifications to the Tamiami Trail which the Department of Interior (DOI) would make under the Tamiami Trail Next Steps Project.
- There is no discussion of plugs in the L-67A Canal associated with the gated structures to help channel the flow into the pocket. Additionally, there is no discussion of cutoff walls to prevent short-circuiting of water down the pocket. The Service assumes that enough length of L-67 C canal and levee will be degraded to allow the water to flow into Water Conservation Area (WCA)-3B.

- The Service suggests that climate change scenarios be run on all of the alternatives instead of just the TSP.
- The Service is concerned about flow effects to Biscayne Bay under CEPP. Blue Line model sensitivity runs conducted in August 2012 indicated significant reduction in flows to the bay for several scenarios that are likely due to CEPP seepage management features. Total freshwater flow volumes currently entering Biscayne Bay are required for the protection of fish and wildlife resources in the bay, including threatened and endangered species. The Service believes that any CEPP alternative that causes reduction in flows to Biscayne Bay should be re-evaluated and potentially revised to maintain current or greater flows to the bay.
- The preliminary RECOVER analysis, of CEPPs effects on Lake Okeechobee, indicate that there is little difference between the FEB scenario and the existing condition base and future without project condition. However, the analysis does note that there may be times when higher stages impact the vegetation communities present in the lake. An adaptive management plan should be used to identify areas where CEPP can improve lake health in the future.

Specific Comments about the Alternatives

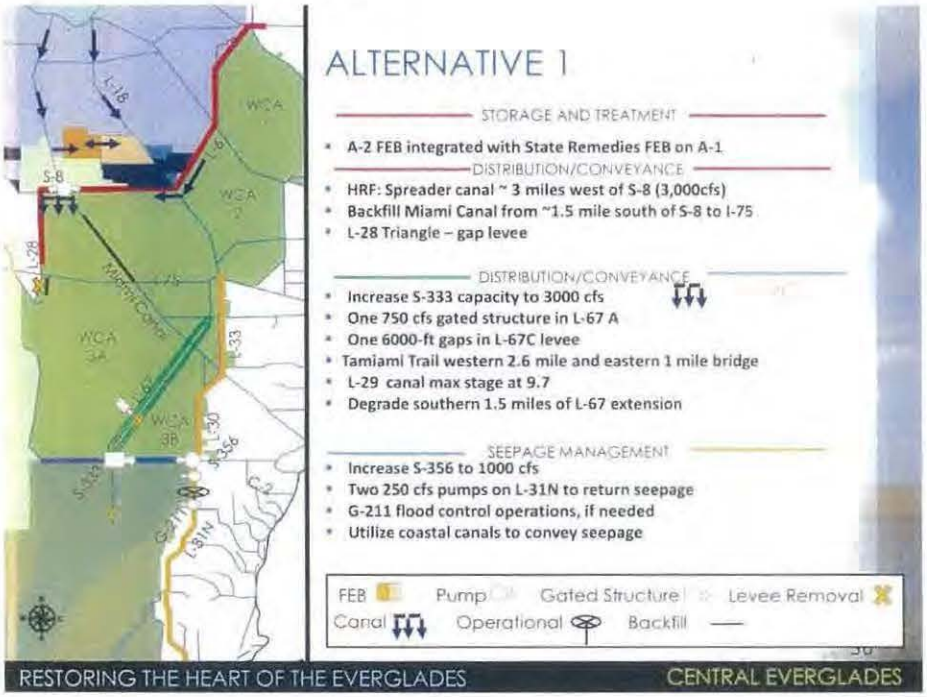

Figure 1. Alternative 1 of the Draft Final Array of alternatives for CEPP.

Alternative 1 was originally intended to be the minimal action plan or "bookend" and avoided any flow of water into WCA-3B. There is now a structure present on the L-67A and it is unclear if this is the retained DPM culvert or an additional culvert set. If we are planning to retain the

DPM structure, then this would be a cost savings for CEPP and it could possibly mean additional funding for monitoring of the DPM Project. The Service suggests that it should be listed as separate from the CEPP Project.

Additionally, it is not likely that one structure in the L-67A can provide enough flow into WCA-3B to alleviate concerns about the amount of time the WCA-3A regulation schedule would remain in Zone A. Although this alternative includes expansion of the S-333 structure capacity to 3,000 cubic feet per second (cfs), it is unclear at this time how this would be done and whether the hydraulic head in southern WCA-3A (under the lowered schedule implemented by the Everglades Restoration Transition Plan [ERTP]) would be sufficient to sustain 3,000-cfs flows.

The two 250-cfs pumps on the L-31N are not desirable as planned in this alternative. All other structures on the L-31 discharge into detention basins separate from the Everglades National Park (ENP) to reduce the likelihood of exotic fish transfer and to prevent impacts from poor quality water entering directly into the Park. Also, the location of the southern pump, which is currently sited directly north of and adjacent to the 8.5 Square Mile Area, would likely impact that projects ability to collect and remove seepage coming from Northeast Shark Slough (NESRS).

Finally, it is unclear how the benefit of degrading the lower 1.5-miles of the L-67 Extension will be evaluated. The Service does not recall data being generated by the iModel during the screening phase regarding partial degradation of the L-67 Extension. The Service recommends that this feature either be fully removed or left in place until future iterations of CEPP.

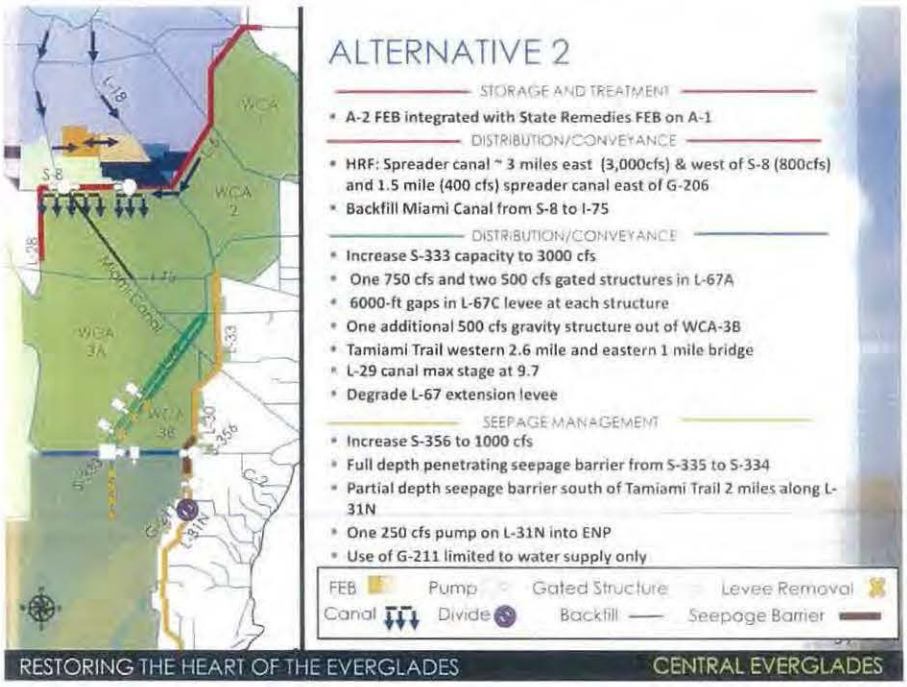

Figure 2. Alternative 2 of the Draft Final Array of alternatives for CEPP.

Alternative 2 is preferable to the Service at this point because it allows for a wider distribution of flows throughout the system while doing it in a passive manner. This alternative would allow rehydration of a majority of WCA-3B up to the newly defined stage at Site 71. Once this level is reached the structures on L-67A could be cycled off while discharge is increased at the S-333 with improved capacity. There is some uncertainty whether the one additional structure on the L-29, in conjunction with the existing S-355s, will match the inflows into WCA-3B. The RSM model output should be able to resolve this issue. An additional weir(s) may be necessary along the L-29 to ensure that new water added to WCA-3B can be discharged into the NESRS.

Degradation of the remaining portion of the L-67 Extension should benefit the spread of water at the downstream end of the S-12 structures. This would allow more water to move through the S-12 C and D and S-333 and help reduce the long hydroperiods currently observed in the western marl prairies.

Again, we believe direct discharge into ENP from L-31N is undesirable at this time, especially given that there is capacity in the South Dade Conveyance System and new Frog Pond detention areas associated with the C-111 Spreader Canal Project.

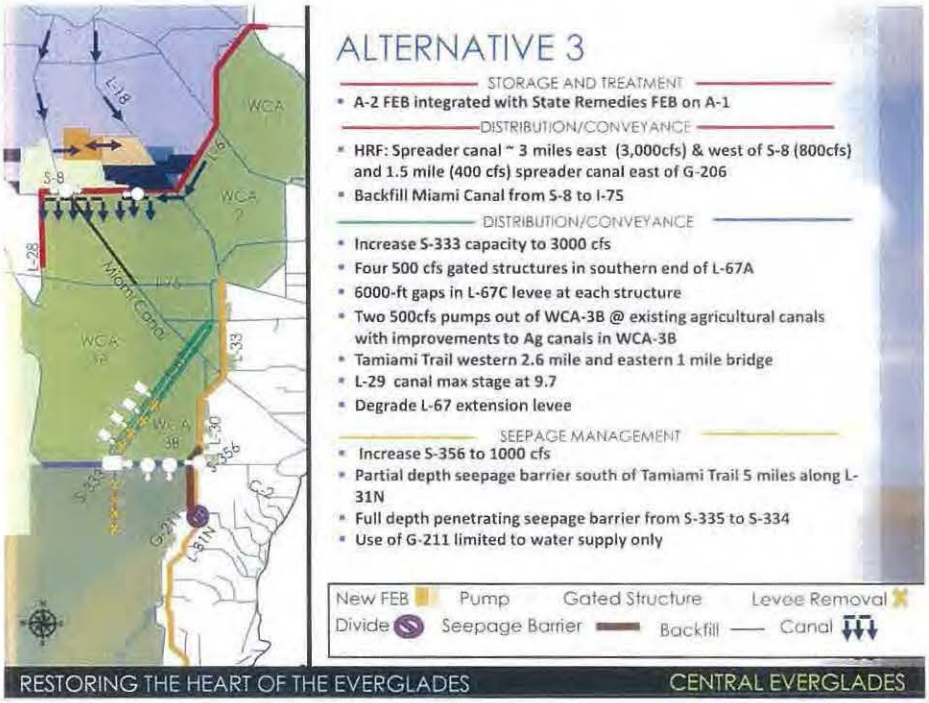

Figure 3. Alternative 3 of the Draft Final Array of alternatives for CEPP.

Should Alternative 2 not be able to move a sufficient amount of water from WCA-3A through WCA-3B passively (since this project is not providing additional storage of water in the North), then it may be necessary to utilize a temporary pump on the L-29 to facilitate the flow through

WCA-3B. Alternative 3 includes temporary pumps to move more water through WCA-3B, however, it seems to be slightly overbuilt for this increment of CEPP. The Service suggests removing one of the four structures on the L-67A and one of the temporary pumps on L-29. With the removal of those two features, this alternative would still move more water through WCA-3B than Alternative 2 but at less cost than currently conceptualized.

The Service would like to reiterate its desire to have the first increment of CEPP restore flow to as much of WCA-3B as possible and distribute flows east along a wide expanse of Tamiami Trail. We have recently been made aware by project managers that inclusion of pumps in this project is controversial. If a temporary pump on the L-29 means the difference between starting the restoration of WCA-3B at this time or delaying its restoration conceivably to a much later date, then a temporary pump seems desirable. A temporary pump on the L-29 would move clean water from WCA-3B into the NESRS of ENP.

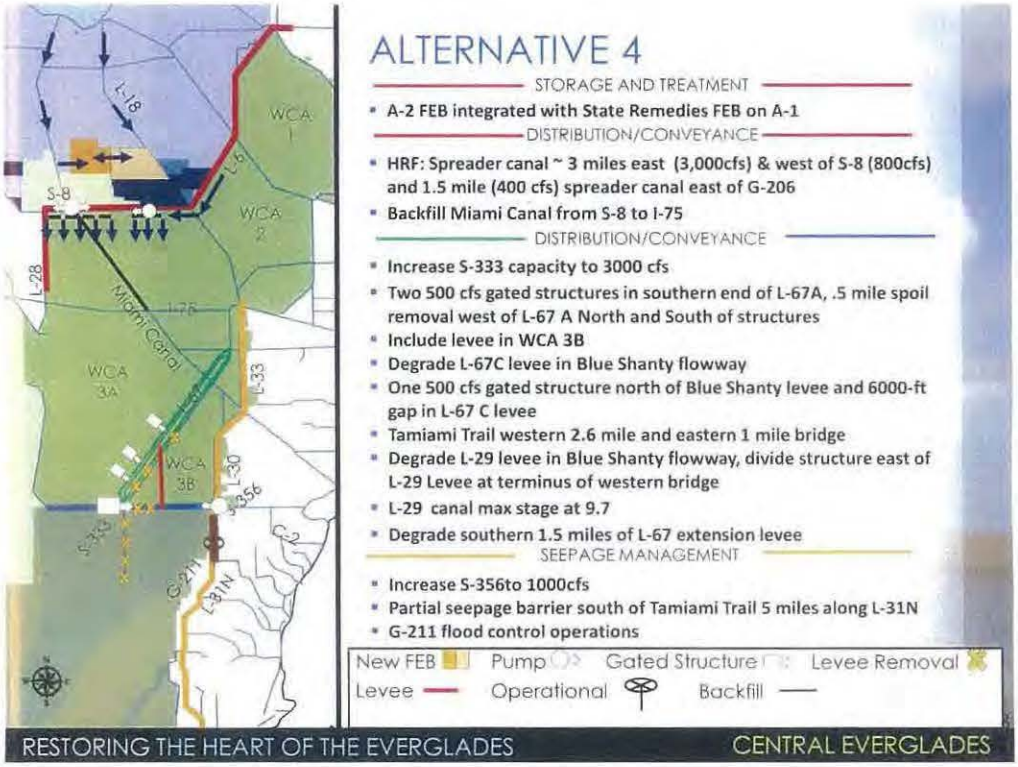

Figure 4. Alternative 4 of the Draft Final Array of alternatives for CEPP.

Alternative 4 is the "Blue Shanty Plan" and was originally designed to prevent high water from reaching the eastern portions of Tamiami Trail, in the event that DOI would not be able to modify the entire length of Tamiami Trail to accommodate higher water levels. This alternative originally included a temporary berm extending from L-67 A south to approximately 2 miles into ENP and a divide structure in the L-29 borrow canal. As the project progressed, we learned that DOI will, in fact, elevate the entire length of the Trail and that we should not consider it a

constraint in CEPP. We also learned that the temporary berm would actually need to be a full-sized levee and that the National Park Service could not accept building a levee in a wilderness area.

The current conceptualization of this alternative retains the levee in WCA-3B and the divide structure in the L-29 in an effort to reduce the need for seepage management on the eastern side of WCA-3B. The Service does not feel that construction of a levee (roughly 20 acres of filled wetland) through WCA-3B and the resulting delay in shifting flows eastward through WCA-3B fits a first increment project like CEPP. If seepage management is needed in WCA-3B, in addition to the existing L-30/S-356 conveyance system and/or the Pensucco Wetlands, the Service feels that a seepage barrier along the already existing levee system would be the prudent choice.

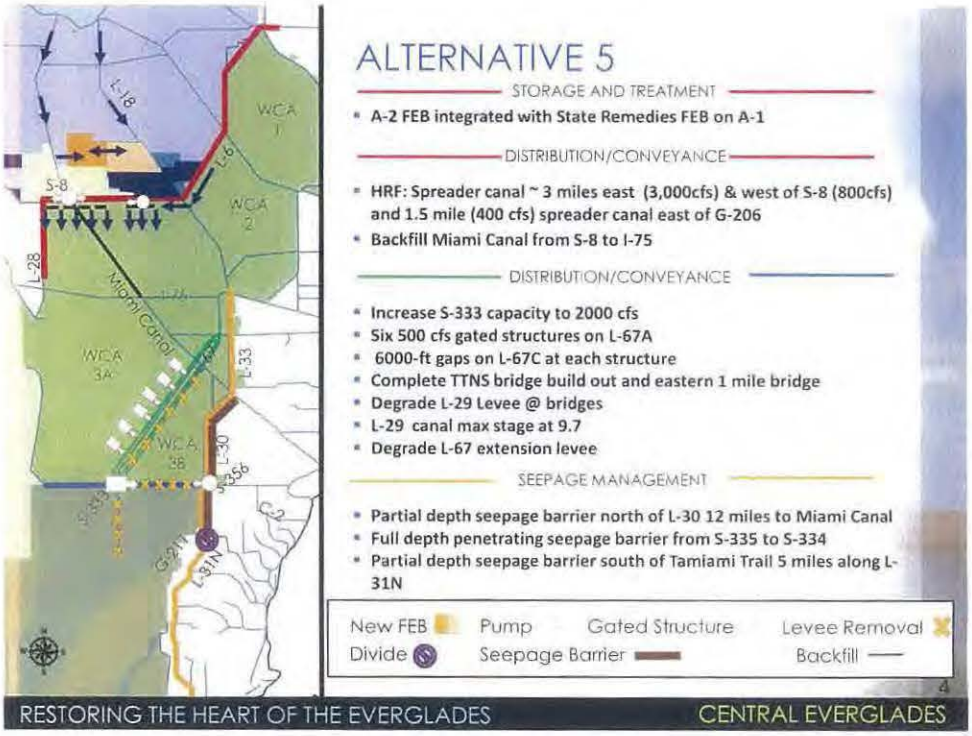

Figure 5. Alternative 5 of the Draft Final Array of alternatives for CEPP.

Although Alternative 5 contains some management measures that have the potential to move us closer to CERP-level restoration, it does not seem consistent with the scale of the other parts of the project. It is unlikely that enough flow could be provided in the dry season, without additional storage, to prevent WCA-3B from drying out in dry to average years if the entire L-29 is removed.

The Service believes this alternative should be removed at this time or modified to come more in line with the other alternatives. This would allow a potential hybrid plan to be included in the final array of alternatives.

Final Comments on CEPP Alternatives

The Service supports the Corps and District endeavors to model and analyze the proposed final array of alternatives. The Service is prepared to evaluate any and all data made available related to effects to threatened and endangered species, and all natural resources within the project area. We have a good idea of how these alternatives will perform from previous iModel results, and we believe Alternative 2 provides the most benefit to all areas of the system while still meeting the intent of an incremental project. We are concerned; however, that enough water will not be able to move through WCA-3B in this scenario which is why Alternative 3 with its temporary pump to facilitate the movement of water should be closely analyzed. We advocate, as we always have, a passive restoration system but understand the difficulty in flowing water across a degraded landscape that has lost much of its slough patterning and contains a high percentage of dense sawgrass. If, it is found through further modeling, a temporary pump could be utilized to effectively facilitate greater flow through WCA-3B into NESRS then the Service would support its temporary use. During the screening phase, plans that distributed water throughout WCA-3B, both with and without pumps, performed the best in the western marl prairies and WCA-3B while also providing substantial hydrologic lift in downstream areas of NESRS in ENP (Table 1). We look forward to receiving the first batch of RSM model output.

Table 1. The table below shows iModel screening output for the WCA-3B flow-through plans (Opt_3A1 – Opt_3B3) along with the target and base conditions. A1 and A2 scenarios do not include pumps while B2 and B3 do contain pumps which facilitate the movement of water from WCA-3B into NESRS (via L-29). Note that all plans make significant improvements above existing condition in NESRS (locations NE2 and P33). Plans with pumps improve hydroperiods in the western marl prairie (NP 205) over the existing conditions (ECB).

Hydroperiod							
Location	Target	ECB	FWO	Opt_3A1	Opt_3A2	Opt_3B2	Opt_3B3
				without pumps		with pumps	
NP205	58.14	73.53	74.04	79.37	78.95	67.54	66.00
Site71	99.53	93.36	91.16	97.01	97.10	99.02	96.73
NE2	99.53	87.75	87.28	99.67	99.86	99.77	100.00
P33	98.78	89.34	89.10	99.86	99.91	100.00	100.00
Average Water Depth							
NP205	-0.10	0.15	0.15	0.26	0.25	0.10	0.08
Site71	1.82	0.84	0.80	1.24	1.31	1.21	0.76
NE2	2.07	0.94	0.93	1.98	2.02	2.10	2.15
P33	2.05	0.96	0.96	1.57	1.62	1.65	1.65

Review of major points from previous PALs

- Reconnection of WCA-3B as a flow-through system connecting WCA-3A to ENP is the most critical part of restoration remaining to be planned. All options should be analyzed regarding how and to what extent this critical reconnection can be made.
- Relaxation of the G-3273 constraint, the integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and the expansion of S-333 structure to allow greater flow out of the ponded areas of WCA-3A into NESRS should be included in CEPP.
- Regulation schedules for WCAs 2 and 3B should be defined and the regulation schedule for WCA-3A should be refined.
- Further modification of the S-12s should not be considered as it was screened out in the recent ERTP for protection of the Cape Sable Seaside Sparrow (CSSS) (*Ammodramus maritimus mirabilis*). Once ERTP is authorized, the S-12C closure regime will be relaxed allowing for year-round operations.
- The general alternative formulation and evaluation process uses "upfront" modeling output whereby management measures are screened or combined into components which will then be screened out or combined to form the final array of alternatives. Relying on modeling products to choose alternative features for the final array of alternatives without regards to operations, adaptive management, and past experience could result in a plan with adverse impacts to the landscape and threatened and endangered species. The Service requests that we receive model output pertaining to threatened and endangered species throughout the planning process (including alternative screening, alternative formulation, operational plans, and adaptive management) so that we may help the team identify all possible means to reduce or eliminate impacts and ensure the TSP will help restore these imperiled species.
- It is critical for the PDT to begin discussing the "transition strategy" for how we will slowly introduce larger volumes of water into a system which has had its spatial extent reduced by 50 percent and its biological systems acclimated to reduced water flow.
- For the purposes of comparing modeled alternative runs it may be appropriate to use Natural System Model-based hydrologic targets; however, it should be understood that the first increment of CEPP will probably not meet these, and they may be inappropriate for use in some areas of the system.
- Use of the 2010 Multi-species Transition Strategy refined during ERTP-1 is highly recommended. A group of interagency scientists, in coordination with species experts, compiled the latest information regarding a number of species and defined a WCA-3A water management strategy. This science-based strategy was designed for Everglade snail kites (*Rostrhamus sociabilis plumbeus*), apple snails (*Pomacea paludosa*), wading birds, and vegetation found within WCA-3A and was based on the current hydrologic system. For CEPP, this strategy can be refined and other species and locations within the project area can be added.

- The Periodic Scientist Calls and seasonal scientist meetings should be utilized in CEPP. These meetings maintain a communication channel between regional water operators and interagency scientists responsible for managing the system for natural resources.
- The Service recommends that threatened and endangered species be considered regularly throughout the CEPP planning process, from screening, alternative formulation, water management plans, through adaptive management to ensure species protection while restoring the ecosystem.
- CSSS inhabit the relatively short hydroperiod marl marsh that flanks the Taylor and Shark River Sloughs in the ENP. Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water level or stage is above ground surface) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat. Recent observed average annual hydroperiods (since 2002 and implementation of Interim Operations Plan [IOP]) in subpopulation A (CSSS-A) as measured at NP-205 near the sparrow's core breeding habitat in western Shark Slough, have been in the range of 240 days or more. While the habitat occupied by sparrows can tolerate occasional average annual hydroperiods of 240 or more days this condition should not occur in concurrent years. Hydroperiods of 60 to 180 days should be experienced at the highest frequencies (*e.g.*, 7 out of 10 years) with occasional years ranging from 210 to 240 days. The opposite is true in the eastern subpopulations where hydroperiods are shorter resulting in higher threats of catastrophic fires and woody plant encroachment.
- Targets for CEPP alternative performance, with regards to sparrow nesting, in the vicinity of the six sparrow subpopulations (A-F) will remain the same as during IOP and ERTP-1. For all CSSS subpopulations the target is at least 60 consecutive days and preferably 80 or more consecutive days in most years during the nesting season from March 1 through July 15 with water levels at or below ground surface. For CSSS-A this equates to 60 days at or below 6.0 feet National Geodetic Vertical Datum (NGVD) at NP-205. In understanding this target, it is important to note that, due to topographic variation within the sparrow's habitat, available habitat at a higher elevation than the NP-205 reference point will remain dry for longer than habitat at the reference point elevation. Therefore this requirement, with current protective operations of S-12A/B, S-343, and S-344, should provide the 80 dry days required for completion of two successive broods over a larger percentage of habitat above 6.0 feet NGVD. At a stage elevation of 6.0 feet NGVD at NP-205, roughly 40 percent of the habitat is available for nesting by CSSS.
- The Service recommends that the PDT not rely solely on modeling for CEPP. Best available science, best professional judgment, ecosystem observations from monitoring, and adaptive management should be the primary tools used to design and select the TSP as discussed in the PDT kick-off meeting.
- The Service recommends making the model output of any screened-out scenarios available to the PDT members for their agency analyses to avoid any pre-decisional determinations. Current Everglades' performance measures and ecological targets, including those developed in the ERTP-1, should also be included as screening tools and in alternative model runs.

- The Service also wants to point out that using NSM-4.6.2 targets for the entire Everglades may not be desirable. The CEPP planning and modeling cannot ignore micro-topography as it is extremely important to the species and their habitats.
- The Service recommends that the CEPP PDT discuss and consider the current and predicted climate regimes that influence the rainfall patterns of the Florida Peninsula.
- Climate change should also be a part of the active dialog in planning for Everglades restoration in determining the viability of recommended restoration targets and solutions with emphasis around the perimeter of the Greater Everglades. Along with the Corps' climate change scenarios, the Service recommends the use of "Addressing the Challenge of Climate Change in the Greater Everglades Landscape" research initiative that was recently completed by a group of researchers at the Department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT) in coordination with the Service and U.S. Geological Survey. Sea level rise, especially, should be considered and planned for as it will likely affect structural operations, water management plans, ecology, and landscapes. We feel it is important to include the MIT scenarios in discussions and planning to insure we investigate the best methods to restore our resources.

In summary, the Service continues to support the strategy and vision for accomplishing this challenging but critical restoration project. We commend the Corps' sustained efforts to complete CEPP within the expedited schedule. We pledge our continuing support in planning of restoration projects to maximize opportunities and minimize potential adverse effects to the natural system. For assistance or if you have questions regarding the contents of this PAL, please contact Lori Miller or Kevin Palmer at 772-562-3909.

Sincerely yours,

Daniel R Ringelstein

for Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
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A.2 Coordination Act Reports

The Final Fish and Wildlife Coordination Act (FWCAR) was received from U.S. Fish and Wildlife Service (FWS) on December 17, 2013.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

December 17, 2013

Colonel Alan M. Dodd
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Conservation Planning Activity Code: 04EF2000-2012-CPA-0270
Service Consultation Code: 04EF2000-2012-F-0290
Project: Central Everglades Planning Project

Dear Colonel Dodd:

Enclosed for your review is the Final Fish and Wildlife Coordination Act Report (FWCAR) on the Central Everglades Planning Project (CEPP). The Final FWCAR is based on the proposed action as described and analyzed in the U.S. Army Corps of Engineers' (Corps) Draft Integrated Project Implementation Report and Environmental Impact Statement and on model evaluations conducted by the U.S. Fish and Wildlife Service (Service) and other entities. This Final FWCAR provides the Service's evaluation of the Tentatively Selected Plan (TSP; Alternative 4R2) which was not complete at the time the draft FWCAR was submitted. This document reiterates guidance and recommendations for the benefit of fish and wildlife resources in the CEPP study area. This report is provided by the Service in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The attached report includes an evaluation of Alternative 4R and 4R2 model runs which were released after the Draft FWCAR was prepared. The Corps has selected Alternative 4R2 as the TSP, and described it as an optimization of the previously selected Alternative 4. The attached analysis of effects for Alt 4R2 show that it functions similarly to previous alternatives while making some improvements to water supply and damaging freshwater discharge to northern estuaries. Alternative 4R2 will also create an additional 10,000 to 15,000 acre/feet of flow to the Greater Everglades and slightly shift the distribution of habitat units in certain parts of the system.

The Service continues to support this project and the Corps' selected TSP, which demonstrates a significant step forward in Everglade's restoration and conservation. Although significant strides will be made with the implementation of this project, there remains much to be done. In conjunction with the subsequent phases of the CEPP and other Comprehensive Everglades

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Restoration Plan (CERP) projects, the currently proposed project will provide the additional water and improved distribution necessary to restore northern Water Conservation Area-3A, Water Conservation Area-3B, eastern Everglades National Park and Florida Bay. We request the Corps continue careful consideration of how to effectively sequence and implement the components of the CEPP to expedite and maximize the benefits to natural resources.

If you, or your staff, have any questions regarding the findings and recommendations contained in this draft report, please contact Kevin Palmer at 772-469-4280. The cooperation of your staff and the staff of the South Florida Water Management District in furthering Everglades Restoration is greatly appreciated.

Sincerely yours,

for Larry Williams
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure (electronic copy only)
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Service, Jacksonville, Florida (Miles Meyer)

Final

Final Fish and Wildlife Coordination Act Report

Central Everglades Planning Project

Submitted to:

Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida

Prepared by:

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

December 2013

EXECUTIVE SUMMARY

The Final Fish and Wildlife Coordination Act Report (FWCAR) for the Central Everglades Planning Project (CEPP) should be regarded as a supplement to the Draft FWCAR which was submitted to the U.S. Army Corps of Engineers (Corps) in May 2013, and herein incorporated by reference in its entirety. Many of the analyses, conclusions and recommendations regarding the original Final Array of alternatives (Alternatives [Alt] 1 through 4) can be found in the Draft FWCAR and are not entirely repeated within this document. For more detailed information regarding the planning process and comparison of previous alternatives, please see the Corps' Project Implementation Report (PIR) (2013) and U.S. Fish and Wildlife Service's (Service) Draft FWCAR (2013).

In May 2013, the Service supported the Corps' Tentatively Selected Plan (TSP), Alt 4, in its Draft FWCAR. During preparation of the Draft FWCAR, however, the Corps had work underway to optimize the TSP. This FWCAR analyzes the modified CEPP Alt 4R and the new TSP Alt 4R2. The Service supports the Corps' selection of Alt 4R2 as the TSP for CEPP.

While the optimized Alts, 4R and 4R2, make slight adjustments to CEPP performance in certain areas of the system, the main focus remains to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south. This will allow for restoration of natural habitat conditions and water flow in the central Everglades and re-connect the central Everglades ecosystem with Everglades National Park (ENP) and Florida Bay. A brief description of the most recent alternatives can be found in this report along with a general analysis of alternative effects to geographic regions within the study area.

In varying degrees, the alternatives provided for improvements to the current distribution of water into Water Conservation Area (WCA) 3A and throughout the Greater Everglades into Northeast Shark River Slough (SRS). Improved distribution of water deliveries through SRS is anticipated to increase foraging opportunities for wading birds and snail kites as well as improve conditions for alligators and other wetland species inhabiting the partially-restored landscapes of northern WCA-3A, WCA-3B, and Northeast SRS. We also expect improved conditions in southern WCA-3A, by reducing the frequency and duration of high water events which erode the ridge and slough landscape and result in tree island flooding. Vegetation shifts are expected in marshes and on tree islands throughout northern WCA-3A, WCA-3B, and SRS.

Benefits to ENP and Florida Bay are likely by re-establishing sheetflow and hydropattern resulting in restored ridge and slough habitat beneficial to all natural resources within ENP. The Service also finds that the project would provide significant benefits south of Lake Okeechobee with an acceptable balance of risks to the ecology of Lake Okeechobee; however, until additional storage proposed for areas around Lake Okeechobee is available, the threat of damaging high and low lake stages will continue. For the estuaries, both Alts 4R and 4R2 increase the number of months in the preferred salinity range when compared to the Future Without Conditions (FWO). This difference could prove to be beneficial to seagrass and oyster abundance if suitable substrate was available for colonization and spat recruitment. In Florida Bay, CEPP will lower salinities resulting in measureable improvements in habitat for juvenile American crocodiles (*Crocodylus acutus*), juvenile spotted sea trout, pink shrimp, and seagrasses.

Despite the potential benefits described above and to reiterate from our Draft FWCAR (2013), the Service remains concerned about potential effects to Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) subpopulations A and E and designated critical habitat for this species located on the eastern side of SRS. We are also concerned about the project's lack of improvement in habitat conditions for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) in WCA-3. Furthermore, there were other issues identified during previous restoration actions that were to be addressed by this project. One example is the significant ponding of water in eastern and southern WCA-3A; however, there may be an opportunity to address this with operational flexibility. Another example is the inability to significantly reduce damaging flows to the northern estuaries. We believe that more storage combined with less consumption represents a balanced approach to restoring the downstream environment. The use of reservoirs is one component in this approach. Also, by implementing the TSP, WCA-3B will not be fully reconnected to re-establish the historic flow path and begin the process of ridge and slough regeneration in this area. This will result in continuing current operations which put too much flow into the western reaches of SRS. Lastly, while the CEPP model results for the TSP predict benefits to Florida Bay, we remain concerned that these same model results may indicate reduced flows to central and southern Biscayne Bay compared to the FWO project conditions. These reductions could impact fish and wildlife resources in Biscayne National Park and impact the effectiveness of the Comprehensive Everglades Restoration Plan's (CERP) Biscayne Bay Coastal Wetlands Project.

Incremental in nature, implementation of the Corps' PIR (2013) is the first part of a multi-step restoration effort intended on fulfilling the recommendations made by the National Academy of Science's National Research Council which stated that Incremental Adaptive Restoration is necessary to achieve the timely and meaningful benefits of CERP. It is expected that subsequent planning processes will utilize and implement additional CERP components previously envisioned to achieve the level of restoration envisioned for CERP.

While the Service believes that the CEPP has the operational flexibility necessary to maximize favorable ecological conditions, this operational flexibility needs to be translated into clear triggers and well-defined management actions through the CEPP Adaptive Management Plan. The AM plan should have continuous and secure funding throughout the life of the project until the targets are realized. The Service is committed to continue working with the Corps and South Florida Water Management District (District) to identify the operational flexibility necessary to improve conditions and enhance restoration in these areas. Additionally, the Corps should include aspects from previous CERP projects, such as Periodic Scientist Calls, in a well-designed adaptive assessment process to aid in identifying and alleviating these concerns. We look forward to assisting the Corps and District in optimizing and refining these restoration efforts.

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

ac-ft	Acre-feet
Act	Endangered Species Act
AFB	Alternatives Formulation Briefing
Alt	Alternative
AM	Adaptive Management
C-111SC	C-111 Spreader Canal
C&SF	Central and Southern Florida
cm	Centimeters
CEPP	Central Everglades Planning Project
CERP	Comprehensive Everglades Restoration Plan
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRE	Caloosahatchee River and Estuary
CSSS	Cape Sable seaside sparrow
Decomp	Decompartmentalization of Water Conservation Area 3
District	South Florida Water Management District
EAA	Everglades Agricultural Area
ECB	Existing Conditions Baseline
ENP	Everglades National Park
EIS	Environmental Impact Statement
ERTP	Everglades Restoration Transition Plan
ELVeS	Everglades Landscape Vegetation Succession Model
FEB	Flow Equalization Basin
FWCAR	Fish and Wildlife Coordination Act Report
FWC	Florida Fish and Wildlife Conservation Commission
FWO	Future Without Project
HSI	Habitat Suitability Indices
HU	Habitat Unit
IRL	Indian River Lagoon
km	kilometer
LEC	Lower East Coast
LECSA	Lower East Coast Service Area
LORS	Lake Okeechobee Regulation Schedule
LOSA	Lake Okeechobee Service Area
MBTA	Migratory Bird Treaty Act
MMN	Marine Monitoring Network
NESRS	Northeast Shark River Slough
NGVD	National Geodetic Vertical Datum
NSM	Natural System Model
NWR	National Wildlife Refuge
PDT	Project Delivery Team
PM	Performance Measure
PIR	Project Implementation Report
PWS	Public Water Supply

RECOVER	Restoration Coordination and Verification
RSM	Regional Simulation Model
RSMGL	Regional Simulation Model Glades Lower
SCS	Southern Coastal Systems
Service	U.S. Fish and Wildlife Service
SFWMM	South Florida Water Management Model
STA	Stormwater Treatment Area
SLE	St. Lucie River and Estuary
SRS	Shark River Slough
SAV	Submerged Aquatic Vegetation
TSP	Tentatively Selected Plan
USGS	U.S. Geological Survey
WADEM	Wader Distribution Evaluation Modeling
WCA	Water Conservation Area
WRDA 2000	Water Resources Development Act of 2000

I. PURPOSE SCOPE AND AUTHORITY

A. Introduction

The Final Fish and Wildlife Coordination Act Report (FWCAR) for the Central Everglades Planning Project (CEPP) should be regarded as a supplement to the Draft FWCAR which was submitted to the U.S. Army Corps of Engineers (Corps) in May 2013, and herein incorporated by reference in its entirety. Many of the analyses, conclusions and recommendations regarding the original Final Array of alternatives (Alternatives [Alt] 1 through 4) can be found in the Draft document and are not entirely repeated within this document. The Draft report supported the Corps' Tentatively Selected Plan (TSP), Alt 4, but at that time work was underway to optimize the TSP. This FWCAR analyzes the modified CEPP Alt 4R and the new TSP Alt 4R2 as they perform relative to the base conditions. The U.S. Fish and Wildlife Service (Service) supports the Corps selection of Alt 4R2 as the TSP for CEPP.

The evaluation of Alts 1 through 4 identified the need to revise the operations of Alt 4 to ensure the project savings clause constraints are met, to minimize localized adverse ecological effects, and to identify additional opportunities to provide for other water related needs. Alternative 4 was initially refined with operational changes to avoid potential impacts to water supply levels of service in the Lake Okeechobee Service Area (LOSA) and Lower East Coast (LEC), resulting in Alt 4R. Alt 4R was then refined further to determine if water supply cutbacks to the LOSA could be further reduced and to determine the quantity of additional Lower East Coast Service Area (LECSA) 2 and LECSA 3 public water supply (PWS) able to be provided while maintaining the natural system performance realized for Alt 4R. Alternatives 4R and 4R2 were compared to and evaluated against the FWO and Existing Conditions Baseline (ECB) to describe changes to existing conditions with implementation of each CEPP alternative.

While the optimized Alts, 4R and 4R2, make slight adjustments to CEPP performance in certain areas of the system, the main focus remains to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south. This will allow for restoration of natural habitat conditions and water flow in the central Everglades and re-connect the central Everglades ecosystem with Everglades National Park (ENP) and Florida Bay. The Corps, who is leading the planning effort in partnership with the South Florida Water Management District (District), has recommended that the Everglades Agricultural Area Storage (EAA) and Storage and Treatment, Decompartmentalization of Water Conservation Area 3 (Decomp), and Everglades Seepage Management projects form the core of CEPP. These are highly interdependent features of the plan that must be formulated and optimized in a comprehensive and integrated manner.

A brief description of the modifications to Alt 4 (Alts 4R and 4R2) can be found in this report along with a general analysis of alternative effects to geographic regions within the study area. For more detailed information regarding the planning process and comparison of previous alternatives please see the Corps Project Implementation Report (PIR) (2013) and Service's Draft FWCAR (2013). Areas of this document that have been considerably changed from the Draft version include the Executive Summary, Description of the TSP, Regional Evaluations of the Project, and Summary of Position.

B. Purpose and Scope of Project

The purpose of the CEPP is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades (Water Conservation Area [WCA] 3 and ENP). The CEPP will be composed of increments of project components that were identified in the CERP, reducing the risks and uncertainties associated with project planning and implementation. The term "increment" is used to underscore that this study will formulate an initial portion of individual CERP components. It is envisioned that later studies will further expand upon this "increment" by developing subsequent CERP components to achieve the level of restoration envisioned for the CERP. This study approach is consistent with the recommendations from the National Research Council to utilize Incremental Adaptive Restoration to both achieve timely, meaningful benefits of the CERP and to lessen the continuing decline of the Everglades ecosystem.

Prior planning efforts and the development of scientific goals and targets for CERP have led to a determination that some components are interdependent features that necessitate formulation from a systems approach. Recently authorized CERP projects are "perimeter" projects that generally do not greatly depend upon or influence other CERP projects. However, the components in the central part of the Everglades (interior CERP projects) are hydraulically connected from Lake Okeechobee to Florida Bay, and are reliant on one another for both inflows and outflows. These interdependencies require system plan formulation and analysis in order to optimize structural and operational components, rather than formulating separable components that may not be compatible when looking at the cumulative impacts.

The scope of CEPP included several components that were originally parts of the Yellow Book Plan (denoted with asterisk in list below). Other pieces that were within the scope of CEPP but not retained in CEPP's TSP are also listed:

- EAA Storage Reservoirs*
- Flow to Northwest and Central WCA-3A*
- WCA- 3 Decompartmentalization and Sheetflow Enhancement*
- Dade-Broward Levee/Pennsuco Wetlands
- Bird Drive Recharge Area
- L-31N Improvements for Seepage Management and S-356 Structures*
- Everglades Rain-Driven Operations

1. Study Area Location

The CEPP study area (Figure 1) encompasses a large portion of the south Florida Peninsula. For purposes of this document, the project area has been sub-divided into five regions: Northern Estuaries, Lake Okeechobee, a portion of the EAA, Greater Everglades, and Southern Coastal Systems (SCS) (especially Florida Bay). A brief description of each region is described below with more detail provided in the regional chapters of this report.

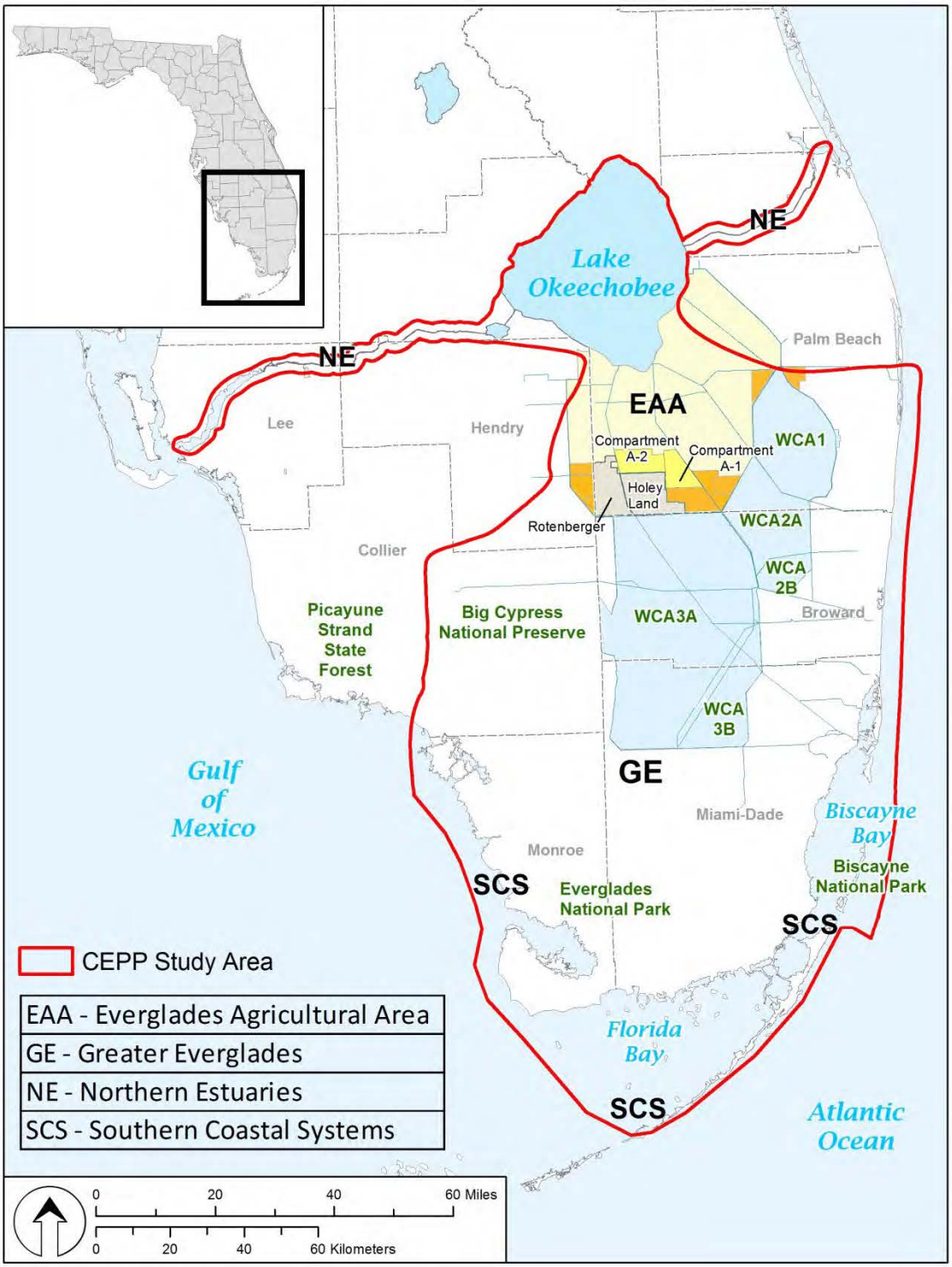

Figure 1. Map showing the CEPP study area.

a. Northern Estuaries

The Northern Estuaries are composed of two different discharge systems from Lake Okeechobee. The St. Lucie Canal feeds into the St. Lucie Estuary, part of a larger system known as the Indian River Lagoon (IRL). The lagoon is designated an Estuary of National Significance under U.S. Environmental Protection Agency's National Estuary Program. The Caloosahatchee Canal and River feeds into the Caloosahatchee Estuary to the west.

b. Lake Okeechobee

Lake Okeechobee is a large, roughly circular lake with a surface area of approximately 730 square-miles. It is a broad, shallow lake that lies 30 miles west from the Atlantic coast and 60 miles east of the Gulf of Mexico in the central peninsula of Florida. It serves as the principal water supply reservoir for southern Florida, and is also used for navigation, flood control, and recreation. The lake is impounded by a system of levees, and has six outlets: The St. Lucie Canal eastward to the Atlantic Ocean and the Caloosahatchee Canal and River westward to the Gulf of Mexico, and four agricultural canals – the West Palm Beach, Hillsboro, North New River, and Miami.

c. Everglades Agricultural Area

The EAA is approximately 700,000 acres in size and is located immediately south of Lake Okeechobee. Much of this rich, fertile land is devoted to sugarcane production, and is crossed by a network of canals that are strictly maintained to manage water supply and flood protection. The CEPP will include a southern component of the EAA.

d. Greater Everglades

The Greater Everglades encompasses the WCAs and the northern half of ENP. The WCAs are situated south and east of the EAA and comprise an area of approximately 1,350 square-miles; about 40 miles wide and 100 miles long from Lake Okeechobee to ENP. These provide for floodwater retention, PWS, and also serve as the headwaters of ENP. They are divided into three major sections: WCA-1 (Loxahatchee National Wildlife Refuge [NWR]), WCA-2, and, WCA-3 (the largest of the three). The ENP is located to the south of the WCAs, and is the third largest national park in the continental United States, established in 1947. The ENP covers approximately 2,353 square-miles and has total elevation changes of only 6 feet from its northern boundary of Tamiami Trail south to Florida Bay. The landscape is comprised of sawgrass (*Cladium* spp.*)* sloughs, tropical hardwood hammocks, offshore coral reefs, mangrove forest, lakes, pond, and bays.

e. Southern Coastal Systems

This region is comprised of Biscayne Bay, Florida Bay, the southwest Florida coast up to and including the Ten Thousand Islands Area. Biscayne Bay is a shallow coastal lagoon located along the southeastern coast of Florida. The bay is bordered to the west by the mainland of Florida and to the east by a series of barrier islands and the northern Florida Keys. Florida Bay

is a mosaic of banks, basins and small islands located at the southern end of the Florida Peninsula. Basins within the bay are shallow (10 foot maximum), and are separated by a network of shallow, flat-topped banks. Over 85 percent of Florida Bay's 849 square-mile area lies within ENP. For purposes of this report, the southwest coastal environment includes Whitewater Bay and the estuarine areas associated with outflows from Shark River Slough (SRS). Virtually all of the area is within ENP.

2. Project Objectives

The major goal of the project, as stated by project managers, is to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south, allowing for restoration of natural habitat conditions and water flow in the central Everglades. This will re-connect the central Everglades ecosystem with ENP and Florida Bay. This portion of the CEPP will include those components that provide for storage, treatment and conveyance south of Lake Okeechobee, removal of canals and levees within the central Everglades and seepage management features to protect the urban and agricultural areas to the east from the increased flow of water through the central portion of the system. An integrated study effort on these components is needed to set the direction for the next decade of implementation of the CEPP. The goal of the study effort would be to develop an integrated, comprehensive technical plan for delivering the right quantity, quality, timing and distribution of water needed to restore and reconnect the central Everglades ecosystem. To achieve the goals stated above, the Corps and District have drafted preliminary project objectives as follows:

- Restore seasonal hydroperiods and freshwater distribution that support a natural mosaic of wetland and upland habitat in the Everglades System.
- Improve sheet flow patterns and surface water depths and durations in order to reduce soil subsidence, frequency of damaging fires, and decline of tree islands.
- Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization.
- Restore more natural water level responses to rainfall predicted by project modeling that will promote plant and animal diversity and habitat function.
- Increase oyster habitat and sea grass populations in the Northern Estuaries by reducing salinity fluctuations from freshwater regulatory pulse discharges.

C. Authorities

The WRDA of 2000 provided authority for the CERP in Section 601(b)(1)(A).
The authorization states:

(b) Comprehensive Everglades Restoration Plan. –

(1) Approval. –

(A) IN GENERAL. — Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the

improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.

Specific authorization for the CEPP will be sought under Section 601(d) as a future CERP project:

(d) AUTHORIZATION OF FUTURE PROJECTS.—
(1) IN GENERAL.—Except for a project authorized by subsection (b) or (c), any project included in the Plan shall require a specific authorization by Congress.
(2) SUBMISSION OF REPORT.—Before seeking congressional authorization for a project under paragraph (1), the Secretary shall submit to Congress —
(A) a description of the project; and
(B) a project implementation report for the project prepared in accordance with subsections (f) and (h).

Sections 601(f) and (h) provide a provision to submit a PIR for the CEPP:

(f) EVALUATION OF PROJECTS.—
(1) IN GENERAL.—Before implementation of a project authorized by subsection (c) or (d) or any of clauses (i) through (x) of subsection (b)(2)(C), the Secretary, in cooperation with the non-Federal sponsor, shall complete, after notice and opportunity for public comment and in accordance with subsection (h), a project implementation report for the project.
(2) PROJECT JUSTIFICATION.—
(A) IN GENERAL.—Notwithstanding section 209 of the Flood Control Act of 1970 (42 U.S.C. 1962–2) or any other provision of law, in carrying out any activity authorized under this section or any other provision of law to restore, preserve, or protect the South Florida ecosystem, the Secretary may determine that—
(i) the activity is justified by the environmental benefits derived by the South Florida ecosystem; and
(ii) no further economic justification for the activity is required, if the Secretary determines that the activity is cost-effective.

(B) APPLICABILITY.— Subparagraph (A) shall not apply to any separable element intended to produce benefits that are predominantly unrelated to the restoration, preservation, and protection of the natural system.

(h) ASSURANCE OF PROJECT BENEFITS.—
(In summary, this section contains provisions for the protection of the South Florida Ecosystem and other water-related needs of the region, including water supply and flood protection.)

Sections 601(e) provides guidance on cost sharing for the CEPP:

(e) COST SHARING.—
(1) FEDERAL SHARE.—The Federal share of the cost of carrying out a project authorized by subsection (b), (c), or (d) shall be 50 percent.
in accordance with subsections (f) and (h).

II. SERVICE INVOLVEMENT IN CENTRAL EVERGLADES PLANNING PROJECT

For details regarding Service involvement with previous relevant projects leading up to CEPP and our involvement during CEPP, including early planning assistance recommendations, please refer to the Draft FWCAR (Service 2013). Since the draft was submitted, the Service has remained committed to meeting the Corps' requirements for deliverables including this Final FWCAR and a Preliminary Biological Opinion. The Service has attended multiple meetings, reviewed and analyzed model output for the optimized runs, drafted reports and coordinated critical Cape Sable seaside sparrow (CSSS) projects to ensure a smooth implementation of CEPP in the future.

III. DESCRIPTION OF THE TENTATIVELY SELECTED PLAN

A. Modeling

CEPP Operational Changes to Alternative 4

At the conclusion of the alternative evaluation and selection process, Alt 4 was chosen by the CEPP's project delivery team (PDT) as the TSP. Model refinements were then begun on Alt 4 primarily using variations of the coarse operations contained in the regional hydrologic model. During this process, stakeholders requested that the refined model runs be compared to Alts 1 through 4 to insure that the team has adequately chosen the best performing alternative. The Corps and District modelers maintained that the new refinements beginning with Alt 4R were not directly comparable to Alts 1 through 4 due to:

- Modifications to address project constraints such as WCA-2B, WCA-3B, and water supply for the LOSA and the LECSA.
- Modifications to address low flows to the St. Lucie Estuary.
- Modifications to minimize action of reductions in the flows to Biscayne Bay.

The final set of alternatives (Alt 4R, Alt 4R1, and Alt 4R2) used the same modeling assumptions as Alts 1 through 4. However, operational changes were made in the final model runs. (Wilcox 2013). The following table indicates the release dates of the final model runs.

Table 1. Release dates of the final optimization runs of Alt 4.

Model Run	Release Date
Alt 4R	February 28, 2013
Alt 4R1	June 6, 2013
Alt 4R2	June 26, 2013

Key Modeling Assumptions and Inclusions:

Existing Condition Baselines (ECB and 2012EC):

The original ECB is based on conditions and operations in years 2010 and 2011 and includes the Interim Operation Plan. 2012EC is based on conditions and operations on December 13, 2012, and includes the Everglades Restoration Transition Plan (ERTP) (Wilcox 2013A). This baseline was developed primarily for the water supply and flood protection subteam to analyze the savings clause. The savings clause Water Resources Development Act of 2000 (WRDA 2000) requires that existing levels of flood protection be maintained. The only changes in the 2012EC were modeling refinements for localized conditions (*i.e.*, S-9, S-9A, L-28 weir, Site-1). The major change is the lowering of WCA-3A Zone A of the regulation schedule during ERTP for dam safety concerns. These concerns were to be addressed by a flood risk analysis. This flood analysis no longer has Corps authorization or funding so it will not be completed. The following are key modeling assumptions and inclusions for ECB and 2012EC:

- Conditions and demands at the time the TSP is identified.
- Existing operations of the Central and Southern Florida (C&SF) Project at the time TSP is identified.
- Non-CERP projects with approved operating manuals at the time the TSP is identified.
- Authorized CERP projects with approved operating manuals at the time the TSP is identified.
- Refinements to the model representation of the S9/S9A, L28 Weir and Site 1.

Future Without Project:

The FWO did not change throughout all of the modeling iterations.

Initial Operating Regime:

The IOR was developed primarily for the water supply and flood protection subteam to analyze the project assurances. Project specific assurances (WRDA 2000) required water for the natural systems and for other water related needs be identified. In CEPP, the IOR is the same as the TSP Alt 4R and includes:

- 2012 conditions and demands or estimated permitted demands at the time that the TSP is identified, whichever is greater.
- Existing operations of C&SF Project at the time the TSP is identified.
- Non-CERP activities with approved operating manuals at the time the TSP is identified.
- Authorized CERP projects with approved operating manuals at the time the TSP is identified.
- The TSP is included.

Initial Operating Regime Baseline (IORBL):

The IORBL is the same as the IOR without the TSP (Wilcox 2013B) and includes and is based on:

- The FWO as of December 13, 2012.
- Updated A-1 Flow Equalization Basin (FEB) operations from the project Environmental Impact Statement (EIS) work.
- Includes “western” 2.6-mile Tamiami Trail Bridge.

- Refinements to model representation of S9/S9A, L28 weir, Site-1, etc.
- Other operations at the time of the selected TSP.
- Captures water reservations and water anticipated from future projects.
- Estimated permitted demands.
- Includes projects such as the C-43, C-44, IRL, Broward County Site-1, Biscayne Bay, C-111 Spreader Canal (C-11SC), restoration strategies for EAA, 1-mile Bridge, and 2.6-mile Bridge along the Tamiami Trail.

Alternative 4R:

How Alt 4R model run differs from the FWO (Wilcox 2013C):

Lake Okeechobee:

- Optimized release guidance in order to improve selected performance within the Lake Okeechobee, Northern Estuaries, and LOSA while meeting environmental targets in the Everglades.
- Lake Okeechobee sends flood releases south through the Miami Canal and North New River Canal to the FEB when the Lake Okeechobee stage is above the bottom of Zone D and the FEB depth is below 2 feet.
- Lake Okeechobee sends flood releases south to help meet water quality based flow targets at stormwater treatment area (STA) 3/4, STA-2N, and STA-2S when Lake Okeechobee stage is above the bottom of the baseflow zone.

St. Lucie Canal Basin:

- C-44 reservoir releases water back to Lake Okeechobee when stages are below the bottom of the baseflow zone.

Storm Water Treatment Areas:

- FEB includes both A-1 and A-2.
- No supplemental water supply is provided to the FEB.
- STA-3/4 will NOT receive 60,000 acre-feet (ac-ft) annually from Lake Okeechobee regulations.
- STA-3/4 will discharge into lower Miami and lower NNR canals.

How ECB differs from FWO:

Northern Lake Okeechobee Watershed Inflows:

- Kissimmee River inflows are based on interim schedules for Kissimmee Chain of Lakes using the IKISS model.
- Restored reaches and pools of the Kissimmee River as of 2010.
- Fisheating Creek, Istokpoga, Taylor Creek, and Nubbin Slough basin inflows are calculated from historical runoff estimates.

Lake Okeechobee and the Northern Estuaries:

- A regional hydrologic surrogate for the 2010 Adaptive Protocol operations is utilized. This attempts to mimic desired timing of releases without estimating salinity criteria for the estuaries.

Everglades Agricultural Area:

- EAA runoff and irrigation demand is compared to South Florida Water Management Model (SFWMM) (ECB) simulated runoff and demand from 1965 to 2005 for reasonability.
- Compartment C land in the Miami Canal basin between STA-5 and STA-6 is not considered to be in production (shrub land use); therefore, no irrigation demands are required in this area.
- Compartment B (excluding cell 4) land in the NNR / Hillsboro is not considered to be in production (shrub land use); therefore no irrigation demands are required in this area.

Stormwater Treatment Areas:

- STA-2: Includes first four cells: 9,910 acres.
- STA-5: Includes first 3 cells at 7,619 acres.
- STA-6: 2,486 acres.

How FWO differs from ECB:

Lake Okeechobee:

- Releases via S-77 can be diverted into C-43 Reservoir.
- No Lake Okeechobee environmental releases.

Northern Lake Okeechobee Watershed Inflows:

- Headwaters Revitalization schedule for Kissimmee Chain of Lakes uses the UKISS model.
- Kissimmee River Restoration is complete.

Caloosahatchee River Basin:

- Maximum reservoir height of 41.7 feet National Geodetic Vertical Datum (NGVD) with a 9,379 acre footprint in western C-43 basin with a 175,800 ac-ft. effective storage.
- Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.

St. Lucie Canal Basin:

- Excess C-44 basin runoff is allowed to backflow into Lake Okeechobee if lake stage is 0.25 ft. below the Zone D pulse release line before being pumped into the C-44 reservoir.
- Indian River Lagoon South (IRL-S) Project features that include Ten-mile Creek Reservoir and STA, C-44 Reservoir, and C-23/C-24 Reservoir and STA.
- All proposed reservoirs meet estuary demands.

Everglades Agricultural Area:

- Regional Simulation Model (RSMBN) ECB runoff and irrigation demand is compared to SFWMM (ECB) simulated runoff and demand from 1965 to 2005 for reasonability.

Stormwater Treatment Areas:

- STA-2N, STA-2S, STA-5N, STA-5S, and STA-6 are expanded.
- Inflows for STA-3/4, STA-2N, and STA-2S are based on the Dynamic Model for Stormwater Treatment Areas and meet local basin runoff, Lake Okeechobee regulatory discharge, and available A1 FEB storage.

Flow Equalization Basin (A-1):

- FEB inflows are from excess EAA basin runoff.
- FEB outflows are used to meet established inflow targets at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and Lake Okeechobee regulatory discharges are not sufficient.

Alternative 4R1:

Alternative 4R1 model run was developed for the Savings Clause Analysis and includes comparisons within the table below (Wilcox 2013D). If no significant and adverse reductions result, then requirements of savings clause have been met. Significant is determined on a case-by-case basis according to the modelers.

Table 2. Iterations of model runs for Alt 4R1.

Modeling Steps	Base Model Run	With Project Model Run
1	2012EC	IOR Alt 4R
2	Pre-CERP Baseline (previous SFWMM 36-year period of record (POR) run and RSM-2000 ECB)	IOR Alt 4R
3	IOR w/o project IORBL	IOR Alt 4R

The purpose of the above mentioned iterations was to:

- Revise Lake Okeechobee operations in Alt 4R to meet similar water supply cutback performance of ECB2012 (now referred to as 2012EC) and IORBL. Improved performance is important for more severe drought events like 1981, 1982, 1989, and 1990.
- Keep natural system benefits (Habitat Units [HU]) the same as Alt 4R while utilizing a portion of the additional water in the regional system to meet other water related needs, specifically PWS located in the LEC 2 and 3 areas.
- Utilize the optimized Alt 4R, now called Alt 4R1 to complete savings clause and project assurances analyses.

Alternative 4R2:

The last round of refinements was completed in model run Alt 4R2, which is considered the final TSP (Wilcox 2013E). Again, key modeling assumptions did not change, but there were some changes to operations (Wilcox 2013) that included:

- An updated Lake Okeechobee Regulation Schedule (LORS)08 CEPP release from Lake Okeechobee to the estuaries.

- Allow C44 Reservoir water to be sent to Lake Okeechobee when the lake stage is below the baseflow zone (C44 reservoir discharges to C44 canal and then backflows through S308).
- No changes in operations of the STA/FEB compared to Alt 4R.
- After L-6 diversions and the S-8 Rain Driven Operations (RDO) are completed, 40 percent of the L-6 diverted water previously targeted for the S-8 is returned to the S-7 pump station.
- WCA-2A floor is defined in the modeling as being crossed when either of the following two criteria are met:
  - Stages at 2A-U1 marsh gage falls below 10.5 feet.
  - Stages in L38 canal fall below 10.0 feet.
- WCA-3A floor is defined as being crossed when either of the following two criteria are met:
  - Stages at 3-69W marsh gage falls below 7.5 feet.
  - Stages in CA3 canal fall below 7.0 feet.
- Environmental target deliveries through the new L-67 S-345 structures are determined through the iModel produced Rainfall Driven Operations (RDO). Target flows are:
  - S345D = 40 percent
  - S345F = 35 percent
  - S345G = 25 percent
- Tamiami Trail releases (S-333 @2500 cubic feet per second [cfs] capacity and S-12s at existing ERTP capacities). CEPP replaces the rainfall plan with the RDO. CEPP attempts to deliver 100 percent of both the environmental and regulatory calculation through S-333 subject to capacity and hydraulic constraints. After final calculations have been completed, a final check is made to quantify any flood control water to be delivered through the S-12s. If hydraulic capacity exists at the S-345s, then this discharge occurs into WCA-3B instead of the S-12s. This adds a flood control component to the S-345s in addition to the existing RDO environmental target.
- L-29 canal can receive inflow up to 9.7 feet, from S-333 and S-356.
- G-3273 constraint = 9.5 feet using the L29 divide structure criteria.
- Same discharges and design capacity for S-334.
  - L-30 Canal – CEPP delivers water supply from the regional system from WCA-3A through the S-151 / S-337 to maintain L-30 at:
  - 01 Jan = 6.45 feet
  - 01 Jun = 5.40 feet
  - 01 Nov = 6.45 feet
  - 31 Dec = 6.45 feet
- Water supply reserve level applies when WCA-3A is below the floor and no in-kind Lake Okeechobee releases are occurring (when regional water availability does not meet water supply requirements).
  - 01 Jan = 6.25 feet
  - 01 Jun = 5.20 feet
  - 01 Nov = 6.25 feet
  - 31 Dec = 6.25 feet
- Operate to send water from L-29W to L-29E to equilibrate canals when L-29E falls below 7 feet.

B. Description of Final Optimization Alternatives

1. Alternative Formulation Process

Two main alternatives were created during the operational refinement of Alt 4 which became Alts 4R and 4R2. These two alternatives do not differ structurally from one another and only slightly from Alt 4 in that the eastern portion of the spreader canal along the L-5 Levee was deemed unnecessary through modeling and was therefore removed from the Alts 4R and 4R2 evaluations. The main differences in Alt 4R and Alt 4R2 are minor modifications to the coarse operational regime employed in the Regional Simulation Model (RSM). Staff on the District's modeling team implemented the modifications and provided a limited set of output for the various subteams to evaluate. Alternative 4 was initially refined with operational changes to avoid potential impacts to water supply levels of service in the LOSA and LEC, resulting in Alt 4R (for detail see section above; Corps 2013). Alternative 4R was then refined further to determine if water supply cutbacks to the LOSA could be further reduced and to determine the quantity of additional LECSA 2 and LECSA 3 PWS made available while maintaining the natural system performance realized for Alt 4R (Corps 2013). It was unclear at the time what the targets were for supply cutbacks to the LOSA or what an acceptable level of reduction of environmental benefits would be but after reviewing the data the Corps decided that Alt 4R2 was an acceptable TSP.

2. The Tentatively Selected Plan (Alternative 4R2)

Alternative 4R2 differs little from Alt 4 structurally (Corps 2013). The major operational refinements included an updated LORS08, C-44 Reservoir flow to Lake Okeechobee, L-29 canal stages up to 9.7 feet and G-3273 constraint raised to 9.5 feet. The general result of the operational refinements in Alt 4R2 included moderate hydrologic change in Lake Okeechobee, characterized by a stage increase of 0.25 to 0.50 feet for the upper 70 percent of the stage duration curve and a 60 percent increase in the number of days, stage is above 16 feet National Geodetic Vertical Datum (NGVD) (an increase from 696 to 1162 days). A moderate improvement to discharges to the St. Lucie Estuary with a mean monthly reduction in flows above 2,000 cfs and 3,000 cfs reduced by 29 months and 7 months respectively. The alternative also provided an additional 10,000 – 15,000 ac-ft of water to the Greater Everglades on average annually. Alternative 4R2 provides significant benefits in the form of increased flow to northern and central WCA-3A, WCA-3B, and northeast SRS in ENP. Conditions in southern WCA-3A and northwest SRS remain a concern. Biscayne Bay and Florida Bay are slightly improved by the project.

3. The Service's Preferred Alternative

The Service has been steadfast throughout CEPP planning that it prefers an alternative that makes the most of any new water by spreading it throughout the project area. This would provide the most consistent and even transition into restoration preserving the trust resources and their habitat currently found throughout the Everglades system. While the Service fully supports the Corps in implementing the alternative they deem most appropriate, a more balanced and less invasive approach like Alt 2 is preferred by the Service. Alternative 2 costs slightly more

(roughly $30 million) than Alt 4R2 and provides less HUs; however, the hydrologic lift downstream is nearly identical and cost savings measures were not applied to this alternative. The Service understands that flowing water though the currently degraded WCA-3B is challenging and may not be possible in this increment of CEPP, but the Service recommends that at least the hydrologic performance in WCA-3B should approach that of Alt 2. The Service also suggests, as the Corps' stated during the January 23, 2013, PDT meeting, that the Blue Shanty Levee be constructed last and only if necessary. It may be the case that the project can operate satisfactorily and without negative impacts to WCA-3B without the levee and its associated negative impact.

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IV. REGIONAL EVALUATIONS OF THE PROJECT

In this section we present the highlights of the evaluation. For more detailed information, see Annex E of the CEPP PIR and EIS entitled, *RECOVER System-wide Evaluation of the Central Everglades Planning Project.*

A. Northern Estuaries

1. Performance Measure Results and Evaluation

a. Caloosahatchee River and Estuary

The evaluation of the Caloosahatchee River and Estuary (CRE) is based on the number of mean monthly flows that fell into specified flow classes during the 41-year (1965 to 2005) period of record. The Performance Measures (PM) target flow is a mean monthly inflow at the S-79 (Figure 2) structure between 450 and 2,800 cubic feet per second (cfs) during all months. Flows at the S-79 that are less than 450 cfs are considered harmful to tape grass (*Vallisneria americana*) in the upper estuary, flows greater than 2,800 cfs cause mortality of the marine shoal grass (*Halodule wrightii*) and oysters (*Crassostrea virginica*) in the lower estuary, and flows greater than 4,500 cfs cause seagrasses to decline downstream in San Carlos Bay (Table 3).

Figure 2. Caloosahatchee River and Estuary.

For this analysis, high-flow events were combined into one flow category (greater than 2,800 cfs). A reduction in the number of damaging high flow events represents improvement. A reduction in the number of times that flow is below 450 cfs also represents an improvement.

Table 3. Mean monthly flow classes for the CRE and the anticipated ecological effects.

Mean Monthly Inflow at S-79	Ecological Response	Ranking Criteria
< 450 cfs	Damage to upper estuary tape grass	Fewer is better
450-2800 cfs	Tolerable range	More is Better
2800-4500 cfs	Damage to estuary	Fewer is Better
> 4500 cfs	Damage to estuary and bay	Fewer is Better

The predicted number of times that the salinity envelope criteria were not met in the CRE is shown in Figure 3. Analysis of the data showed there was no substantial difference between the FWO and Alts 4R or 4R2 when predicting high and low flow events. The data did reveal a significant difference when comparing the ECB to the FWO and Alts. This difference may be explained by comparing the number of times the low-flow criteria (less than 450 cfs) are not met. Because the C-43 West Basin Storage Reservoir CERP project provides base flows to the CRE

during the dry season, its inclusion in the FWO and CEPP alternative's account for the observed reduction and subsequent system improvements. Despite the lack of a substantial difference, it should be noted that when compared to the FWO, both Alt 4R and Alt 4R2 have 11 fewer high-flow months which would increase the number of months in the preferred salinity range. This difference could prove to be beneficial to seagrass and oyster abundance if suitable substrate was available for colonization and spat recruitment. If the system were degraded to a condition where existing shell and shell/sand habitat was buried, oyster recovery times would be protracted.

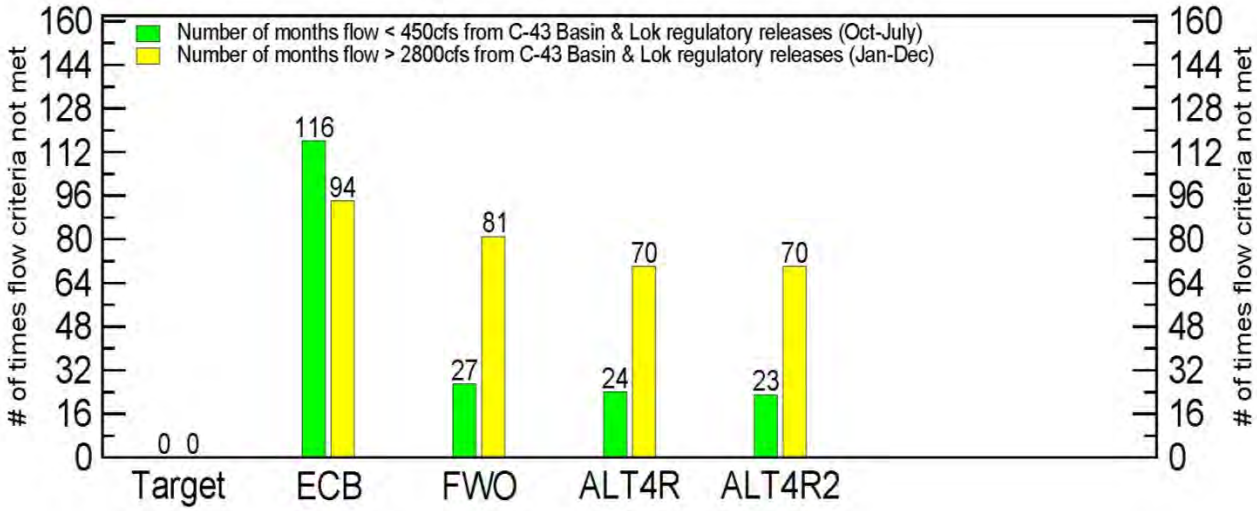

Figure 3. Number of times the salinity envelope criteria are not met in the CRE over the 41-year period of record.

b. St. Lucie River and Estuary

The evaluation of the St. Lucie River and Estuary (SLE) focuses on the total combined freshwater inflow. This includes flows at the S-80 structure, which integrates the discharges from Lake Okeechobee at the S-308 structure plus the C-44 basin, as well as an estimate of inflows from other basins in the watershed. An objective of CEPP is to reduce damaging high volume discharges from Lake Okeechobee to maintain a salinity range favorable to fish, oysters and Submerged Aquatic Vegetation (SAV). The targeted area for oyster population restoration in this estuary is between the Roosevelt/US-1 (Figure 4) and A1A bridges.

Figure 4. St. Lucie River and Estuary.

The CERP system-wide PM for Northern Estuaries salinity envelopes proposes a full restoration target of a mean monthly inflow into the SLE from all sources including groundwater and all surface water tributaries below 350 cfs for 31 months in a 36-year period, no more than 28 high flow events greater than 2,000 cfs based on a 14-day moving average and no regulatory discharge events of flows greater than 2,000 cfs from Lake Okeechobee based on a 14-day moving average (RECOVER 2007).

Based on the salinity tolerances of oysters, flows less than 350 cfs result in higher salinities at which oysters are susceptible to increased predation and disease. Flows in the 350–2,000 cfs range produce tolerable salinities while flows greater than 2,000 cfs result in low, intolerable salinities within the estuary. Seagrasses in the IRL-S are damaged when flows exceed 3,000 cfs (Table 4). For this analysis, high flow events were combined into one category (greater than 2,000 cfs).

Table 4. Combined flow* classes for the SLE and the anticipated ecological effects.

Flow Categories	Ecological Response	Ranking Criteria
< 350 cfs	Salinity too high for optimal oyster health	Fewer is Better
350-2,000 cfs	Tolerable range	More is Better
2,000-3,000 cfs	Damage to estuary	Fewer is Better
> 3,000 cfs	Damage to SLE and IRL	Fewer is Better

* S-80, S-97, and S-49 structures

The predicted number of times the salinity envelope criteria are not met for the ECB, FWO and CEPP alternatives is shown in Figure 5. Analysis of these flows showed a substantial difference between the CEPP alternative's and both ECB and FWO. Alternatives 4R2 and 4R had a lower number of combined high flow events (greater than 2000 cfs) than either FWO or ECB (86, 100, 151 and 177 respectively). Alternative 4R2 also had a decrease in the number of times the low flow criteria (less than 350 cfs) were not met which increased the number of months

the estuary was in the preferred salinity range. This difference would prove to be beneficial to seagrass and oyster abundance if suitable substrate was available for colonization and spat recruitment. Therefore, the removal of muck and addition of artificial substrate associated with the IRL-S CERP project are essential components for estuarine restoration.

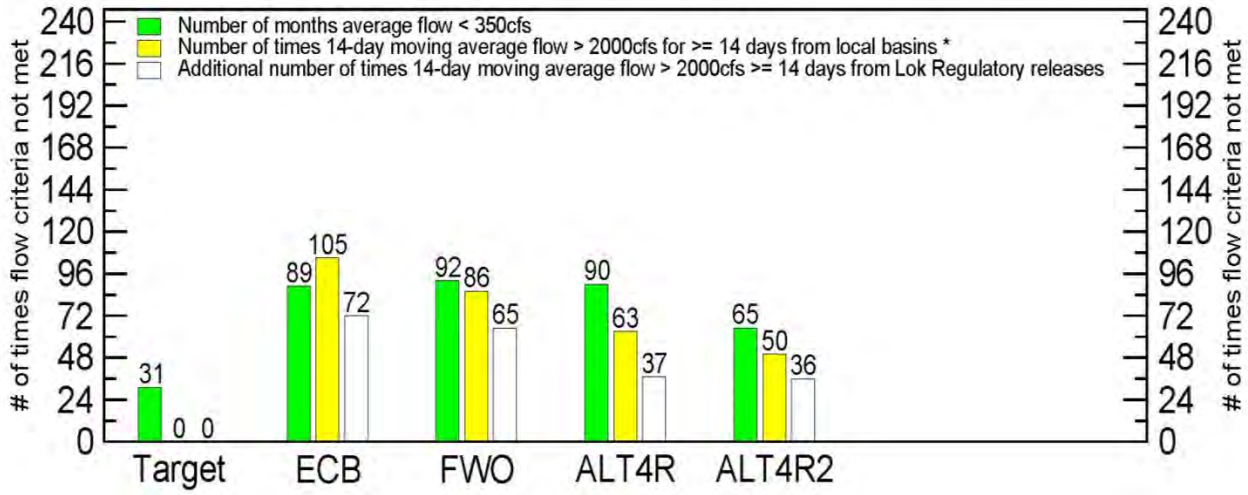

Figure 5. Number of times the salinity envelope criteria are not met in the SLE over the 41-year period of record.

2. Other Ecological Tools Results

Additional evaluations of Alt 4R2 were performed based on salinity performance and selected estuarine resources including oyster and seagrass. The oyster simulation models for both estuaries were simplified versions of a framework derived to evaluate potential effects of increased area of oyster habitat on SLE water quality (Buzzelli et al. 2012a). This model uses an idealized oyster-salinity relationship, variable temperature, and a constant suspended solid concentration to predict oyster density. Similarly, the shoal and manatee grass simulations for both estuaries were simplified models derived to quantify effects of variable freshwater discharge and salinity on seagrass shoot density at Boy Scout Island located in IRL-S (Buzzelli et al. 2012b). Water column chlorophyll a and turbidity were assumed constant although depth and the amount of colored dissolved organic matter and, therefore, submarine light varied dynamically throughout the 41-year simulations. A description of these tools and results can be found in the RECOVER's Systemwide Evaluation of the CEPP Northern Estuaries section (Corps 2013).

3. Potential Adverse and Beneficial Effects of the Project

One objective of CEPP is to reduce the number and duration of damaging high volume discharges from Lake Okeechobee in an effort to improve the quality of oyster and SAV habitat in the northern estuaries. In the CRE, the number of low flow events (less than 450 cfs) and high flow events (greater than 2,800 cfs) predicted by the modeling indicated that the TSP did not perform different than the FWO although it was better than the ECB.

In the SLE, the modeling indicated that the TSP would reduce the number of combined high-flow events from 151 in the FWO to 86 (approximately 43 percent). There is also a reduction in the number of times the low-flow criteria were not met from 92 in the FWO to 65 (approximately 29 percent) with the implementation of the TSP. Both of these improvements increase the amount of time that the SLE will be in the appropriate salinity range for oyster and SAV production, the key estuarine indicator species. It is important to note that the predicted TSP benefits are dependent on the construction of the authorized IRL-S CERP project. The difference between Alts 4R and 4R2 pertain to changes in operations of the C-44 Reservoir and STA and its connection to the C-23 which are components of IRL-S. The sequence of CEPP component construction and implementation is critically linked to the sequence of other CERP and non-CERP projects. Refining this interdependent project component sequencing is the key to achieving predicted restoration with the aide of adaptive management.

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B. Lake Okeechobee

In this section we present the highlights of the evaluation of the effects CEPP on Lake Okeechobee. For more detailed information, see Annex E of the CEPP PIR and EIS entitled, *RECOVER System-wide Evaluation of the Central Everglades Planning Project.*

1. Performance Measures Results

All PMs were scored between 0 and 100 with the minimum value of 0 representing a fully degraded ecosystem and a maximum value of 100 representing the restoration target. The lake

stage envelope PM evaluates both the magnitude and duration that alternative plans exceed the optimal stage envelope (12.0 to 15.5 feet NGVD). For the period of simulation, the standardized scores ranged from 82.50 for FWO to 71.76 for Alt 4R2. Based on this measure, Alt 4R and Alt 4R2 performed worse than the FWO.

To better understand the standardized scores, we evaluated years where the greatest differences between hydrographs occurred (Figure 6). For the simulated year 2003, the Alt 4R2 lake stage was 6.0 to 19.5 inches higher than it was for the FWO for 306 days. Although this PM may indicate a difference in lake stage, it did not always translate to a difference in hydrograph score. For example, in simulated January and December 2003, although the modeling indicated the lake was deeper under Alt 4R2 than the FWO or the baseline, the alternatives for both months were within optimal conditions. Contrast that to the simulated June, July, and August 2003, where neither alternative performed optimally, but the FWO was 9.9 to 18.9 inches lower than Alt 4R2 and therefore, received a better overall score.

Stage	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03
19.0	3.5	4.0	4.5	5.0	6.0	6.5	6.5	6.0	5.0	4.0	3.5	3.5
18.5	3.0	3.5	4.0	4.5	5.5	6.0	6.0	5.5	4.5	3.5	3.0	3.0
18.0	2.5	3.0	3.5	4.0	5.0	5.5	5.5	5.0	4.0	3.0	2.5	2.5
17.5	2.0	2.5	3.0	3.5	4.5	5.0	5.0	4.5	3.5	2.5	2.0	2.0
17.0	1.5	2.0	2.5	3.0	4.0	4.5	4.5	4.0	3.0	2.0	1.5	1.5
16.5	1.0	1.5	2.0	2.5	3.5	4.0	4.0	3.5	2.5	1.5	1.0	1.0
16.0	0.5	1.0	1.5	2.0	3.0	3.5	3.5	3.0	2.0	1.0	0.5	0.5
15.5	0.0	0.5	1.0	1.5	2.5	3.0	3.0	2.5	1.5	0.5	0.0	0.0
15.0	0.0	0.0	0.5	1.0	2.0	2.5	2.5	2.0	1.0	0.0	0.0	0.0
14.5	0.0	0.0	0.0	0.5	1.5	2.0	2.0	1.5	0.5	0.0	0.0	0.0
14.0	0.5	0.0	0.0	0.0	1.0	1.5	1.5	1.0	0.0	0.0	0.5	0.5
13.5	1.0	0.5	0.0	0.0	0.5	1.0	1.0	0.5	0.0	0.0	1.0	1.0
13.0	1.5	1.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	0.5	1.5	1.5
12.5	2.0	1.5	1.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0
12.0	2.5	2.0	1.5	1.0	0.0	0.0	0.0	0.0	0.5	1.5	2.5	2.5
11.5	3.0	2.5	2.0	1.5	0.5	0.5	0.5	0.5	1.0	2.0	3.0	3.0
11.0	3.5	3.0	2.5	2.0	1.0	1.0	1.0	1.0	1.5	2.5	3.5	3.5
10.5	4.0	3.5	3.0	2.5	1.5	1.5	1.5	1.5	2.0	3.0	4.0	4.0
10.0	4.5	4.0	3.5	3.0	2.0	2.0	2.0	2.0	2.5	3.5	4.5	4.5
9.5	5.0	4.5	4.0	3.5	2.5	2.5	2.5	2.5	3.0	4.0	5.0	5.0
9.0	5.5	5.0	4.5	4.0	3.0	3.0	3.0	3.0	3.5	4.5	5.5	5.5
8.5	6.0	5.5	5.0	4.5	3.5	3.5	3.5	3.5	4.0	5.0	6.0	6.0
8.0	6.5	6.0	5.5	5.0	4.0	4.0	4.0	4.0	4.5	5.5	6.5	6.5
7.5	7.0	6.5	6.0	5.5	4.5	4.5	4.5	4.5	5.0	6.0	7.0	7.0

Figure 6. Simulated Lake Okeechobee stages for 2003 for baseline, FWO, and Alt 4R2. Optimal conditions are represented by the blue band between 12.0 and 15.5 feet NGVD.

2. Below Lake Stage Envelope

The below lake stage envelope PM evaluates how many times the alternative plans result in a stage envelope below the optimal level. The standardized score was derived from a combination of the magnitude and duration of exceedances. A perfect score would be 100. The results ranged from 47.95 (Alt 4R2) to 34.29 (FWO) indicating that Alt 4R2 performed better than the FWO and Alt 4R (44.50). We expected that Alt 4R2 would perform better than the FWO for this PM because one of the goals of the CEPP was to store more water in the lake for later release to the Greater Everglades.

3. Above Extreme High Lake Stage

The above extreme high lake stage PM evaluates the amount of time lake stage is in excess of 17.0 feet NGVD. The scores were similar (99.11 for FWO and 97.78 for both Alt 4R and Alt 4R2) indicating little ecological difference between alternatives.

4. Below Extreme Low Lake Stage

The below extreme low lake stage PM evaluates the amount of time the lake stage is below 10.0 feet NGVD. The scores were 88.62 (Alt 4R2), 86.50 (Alt 4R), and 86.02 (FWO). Because of uncertainty in the model simulations, it is difficult to define if these are significantly different outcomes statistically or environmentally.

5. Stage Duration Curve

Figure LO2 shows the stage duration curves for the FWO, Alt 4R, Alt 4R2, and ECB. The ideal curve would be very flat between lake stages 12.0 to 15.5 feet and steep outside this range. The curve showed a similar pattern for all alternatives, and ECB when the lake was below 12.6 feet. This might be expected given the proposed operation of the CEPP to stop additional lake water releases to the FEBs (under Alt 4R or Alt 4R2) if lake levels drop to 12.6 feet (in effect from January 1 to August 31). Lake water releases for water supply could continue.

For the remainder of the curve, Alt 4R2 holds the lake higher (deeper) than FWO or Alt 4R. This was also expected because modelers added up to approximately 15,000 ac-ft of water from the future C-44 Reservoir to the lake and generally held the lake higher to offset the additional water demand of the CEPP, which calls for sending an annual average 215,000 ac-ft south to the Everglades. For the critical time where the preferred lake stage is between 12.5 and 15.5 feet, the FWO performed better than Alt 4R2 by holding the lake in that range for slightly more time. At damaging high stages (15.5 to 17.0 feet), Alt 4R2 performs slightly worse numerically than the FWO by holding lake stage higher for a longer amount of time.

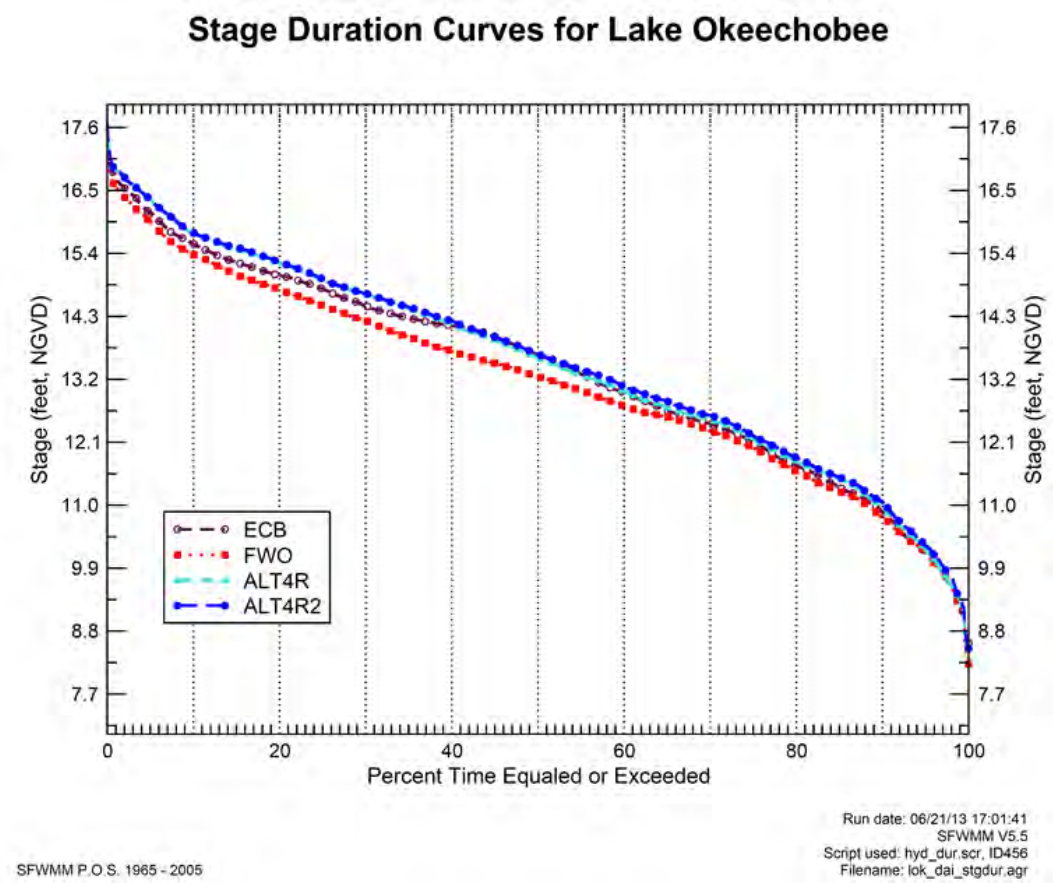

Figure 7. Lake Okeechobee stage duration curve.

6. Flood Protection Criteria

The flood protection criteria evaluate the number of days the lake stage is above 16.5 feet NGVD from August 1 to September 15 as well as the maximum water levels in the 41-year period of simulation. While both alternatives exceeded the 16.5 feet stage at various times of the year, only Alt 4R2 exceeded it (for 9 days in September 1995; maximum stage = 16.56 feet) during the appropriate time of year. During this period, the FWO maximum simulated stage was 16.14 feet. We do not believe this to be a substantial difference for this short duration.

The maximum water levels during the entire period of simulation for the ECB and both alternatives (achieved on April 1, 1970) were as follows: 17.54 feet (ECB), 17.66 feet (Alt 4R2), and 17.50 feet (FWO). For these criteria, the simulated FWO performed better than Alt 4R2 numerically, although it is not apparent that this 0.16 foot difference is meaningful.

7. Minimum Water Level and Duration Measure

The minimum water level and duration measure compares the number of times that the simulated water level was below 11.0 feet NGVD for more than 80 consecutive days in the 41-year

simulation. Note that this is different from the revised MFL (minimum flows and levels) PM as it is purely hydrologic and does not take into account the legal definition of how MFL exceedances and violations are counted. The ECB, FWO, and Alt 4R2 exceeded this measure six times. For the simulated 1974, 1977, and 1981 events, the numbers of days between the ECB and two alternatives were similar. However, in 1989, the ECB and Alt 4R2 simulations were comparable (151 and 139 days, respectively), but outperformed the FWO (which was below 11.0 feet for 191 days). In 1990, Alt 4R2 (160 days) performed better than both the ECB (188 days) and the FWO (189 days). In 2001, the ECB (229 days) and Alt 4R2 (231 days) outperformed the FWO (271 days). We expected that the Alt 4R2 would perform better under this metric because the lake operations were changed under the Alt 4R2 simulation to hold lake stages higher when possible to make water more available to the CEPP. As recent data have indicated (actual conditions 2005 to 2012), a lower lake stage is not as harmful to the Lake's ecology as high water stages (RECOVER 2009, 2012). Therefore, this PM could be refined to enable an actual determination of minimum water level violations, which would include an x times in y years component. As it stands now, the ECB, FWO, and Alt 4R2 had the same number of exceedance events, but the Alt 4R2 had fewer days than FWO below the threshold within three of the six events (*i.e.*, Alt 4R2 performed slightly better than FWO).

8. Daily Time Series Analysis

Greater Than 15 Feet Events

We identified seven events where the simulated Alt 4R2 hydrograph performed worse (*i.e.*, potentially more ecologically damaging because the stage was greater for a substantial amount of time) than the simulated FWO. It is difficult to say whether substantial ecological damage would occur if these simulations reflected "real world" conditions because we do not have evaluation tools that are precise enough to parse out the differences. We can infer from on-going vegetation studies in Lake Okeechobee that the following events have, at least, the potential to negatively affect submerged aquatic vegetation; however, because it may take 6 months to 3 or 4 years for vegetation shifts to result from differing conditions, and because of other compounding factors (turbidity, nutrients, and storms) we cannot offer better conclusions. The seven events are as follows.

From July 21, 1968 to December 30, 1968 (163 days), Alt 4R2 was above the 15.0 feet threshold (maximum = 15.94 feet), but the FWO exceeded 15.0 feet (maximum = 15.01 feet) for only 4 days. During this period, there were 72 days when Alt 4R2 was 6.0 inches to 10.0 inches higher than the FWO and 58 days of difference greater than 10.0 inches (Figure 8). This represents a slight improvement in the performance of Alt 4R2 over the simulated performance of Alt 4R.

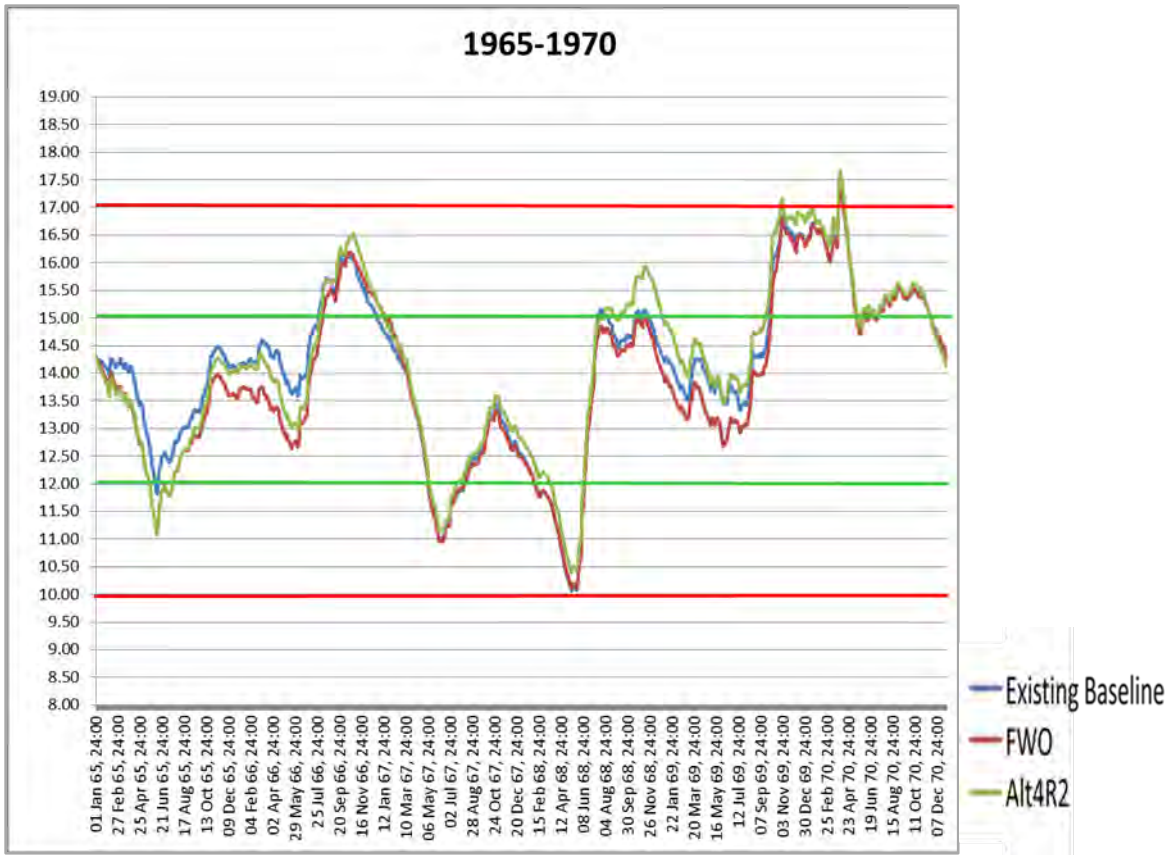

Figure 8. Daily Time Series Stage Hydrographs for Lake Okeechobee as simulated for the ECB, Alt 4R2, and FWO from 1965 to 1970.

The Alt 4R2 simulation was also greater than 15.0 feet for 224 days (August 24, 1978 to April 4, 1979; 16.39 feet maximum stage), while the FWO simulation exceeded this stage for only 99 days during this period (maximum = 15.66 feet). Furthermore, Alt 4R2 exhibited a 6.0-inch to 9.1-inch difference for 131 days over the FWO. Alternative 4R2 performed worse than Alt 4R for this event.

The Alt 4R2 simulation was greater than 15.0 feet for 125 days (September 29, 1983 to January 28, 1984; maximum = 15.53 feet), while the FWO simulation did not exceed 15.0 feet (range = 14.33 to 14.87 feet). Additionally, the Alt 4R2 simulation was 6.0 inches to 9.2 inches higher than the FWO. For this event, Alt 4R2 was slightly worse than Alt 4R.

From August 27, 1991 to December 18, 1991 (114 days), the Alt 4R2 simulation was again greater than 15.0 feet (maximum = 15.70 feet). Over this same period, the FWO simulation was greater than 15.0 feet for 50 days (maximum = 15.20 feet). Alternative 4R2 was 6.0 inches to 8.4 inches higher than the FWO for 46 days (Figure 9). For this event, Alt 4R2 was slightly worse than Alt 4R.

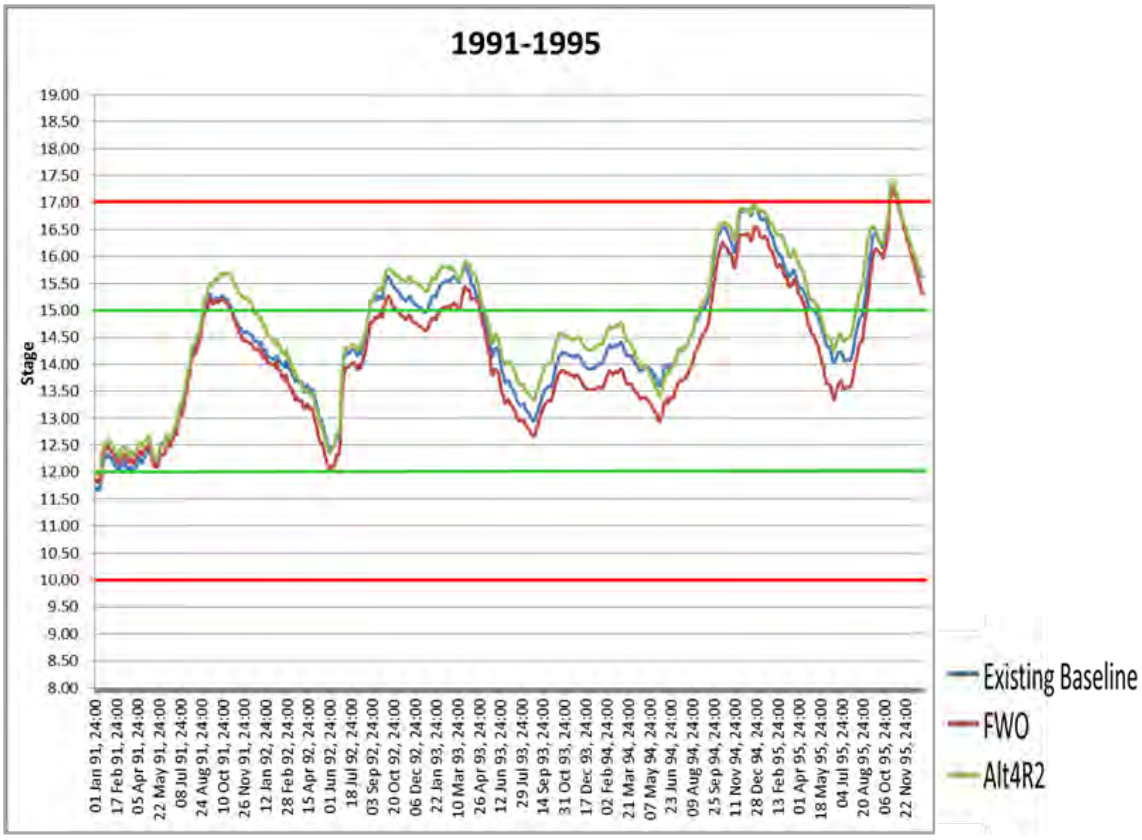

Figure 9. Daily Time Series Stage Hydrographs for Lake Okeechobee as simulated for the ECB, Alt 4R2, and FWO from 1991 to 1995.

Alternative 4R2 exceeded 15.0 feet from August 28, 1992 to May 9, 1993 (255 days; maximum 15.92 feet), while the FWO exceeded 15.0 feet for only 85 days (maximum = 15.39 feet). Additionally, Alt 4R2 was 6.0 inches to 10.0 inches higher than the FWO for 218 days during that period (Figure 10). For this event, Alt 4R2 was slightly worse than Alt 4R.

From December 14, 2002 to April 15, 2003 (123 days), the Alt 4R2 simulation was again greater than 15.0 feet (maximum 15.92 feet). Over this same period, the FWO simulation was greater than 15.0 feet for only 10 days (maximum = 15.05 feet). Alternative 4R2 was 6.0 inches to 10.0 inches higher than the FWO for 30 days and 10.0 inches to 17.5 inches higher for 91 days. For this event, Alt 4R2 was substantially worse than Alt 4R due to an additional 44 days over 15.0 feet and deeper water (Alt 4R was up to 11.6 inches deeper than FWO; Alt 4R2 was up to 17.5 inches deeper than FWO).

From June 22, 2003 to January 13, 2004 (206 days), the Alt 4R2 simulation was greater than 15.0 feet and achieved a maximum elevation of 16.48 feet. Over this same period, the FWO simulation was greater than 15.0 feet for 101 days (maximum = 16.22 feet). Alternative 4R2 was 6.0 inches to 10.0 inches higher than the FWO for 86 days and 10.0 inches to 18.7 inches higher than the FWO for an additional 71 days. Similar to the previous event, Alt 4R2 was substantially worse than Alt 4R.

Greater Than 17 Feet Events

We also identified times when the 17.0 feet threshold was exceeded by both Alt 4R2 and the FWO (although for less time for the FWO). For example, from March 27, 1970 to April 12, 1970, the Alt 4R2 simulation exceeded the 17.0 feet threshold for 17 days (maximum stage = 17.66 feet). The FWO exceeded 17.0 feet during this same period for 15 days (maximum stage = 17.50 feet). A similar event happened from October 18, 1995 to November 7, 1995 (21 days; Figure LO4). Conversely, from October 29, 2005 to November 17, 2005 (20 days), Alt 4R2 exceeded 17.0 feet (maximum = 17.29 feet), while the FWO only reached a maximum elevation of 16.69 feet. None of these events, even though they exceeded 17.0 feet, indicated a measurable ecological difference between Alt 4R2 and FWO simulations. In essence, both alternatives performed poorly and no additional substantial ecological damage would likely have occurred under simulated Alt 4R2 conditions (when compared to FWO conditions) during these periods. For these high lake stage events, the performance of Alt 4R2 was similar to Alt 4R.

Ecologically Beneficial Event

While the previous discussion identified events where Alt 4R2 may have performed worse than the FWO, there was at least one event where Alt 4R2 may have performed better. On May 25, 1987, the simulated FWO dropped below 12.0 feet (the low side of the preferred stage envelope), and stayed below 12.0 feet until October 22, 1987 (150 days; minimum stage = 10.97 feet). The simulated Alt 4R2 dropped below 12 feet for 48 days (minimum stage = 11.74 feet) (Figure 10). Under these conditions, more of the littoral zone would have been flooded under Alt 4R2. For example, at 12.0 feet, approximately 26,000 acres of littoral zone are flooded but at 11.5 and 11.0 feet approximately 17,000 and 6,000 acres, respectively, are flooded. Periodic drying of the littoral zone may be beneficial to lake ecology through oxidation of undesirable organic soils (*i.e.*, muck), but prolonged desiccation can negatively affect apple snail survival and cause unwanted shifts from aquatic plant to upland plant species. The duration of this simulated event could have negatively affected native apple snails, but more so under the FWO condition. According to Darby (2006), adult native apple snails show the following desiccation tolerances: a 3-month dry-out will kill 21 percent of the population; a 4-month dry-out will kill 50 percent of the population; and a 4.5-month dry-out will kill 63 percent of the population. Juvenile snails have even less tolerance to desiccation -- for example, a 3-month dry-out will kill 40 percent a population of six-week old apple snails (10-15 millimeters in size). The simulated FWO was between 11.0 and 11.5 feet for 4 months. For this event, Alt 4R2 performed better than Alt 4R (Alt 4R was drier longer; *i.e.*, had 91 days below 12 feet NGVD).

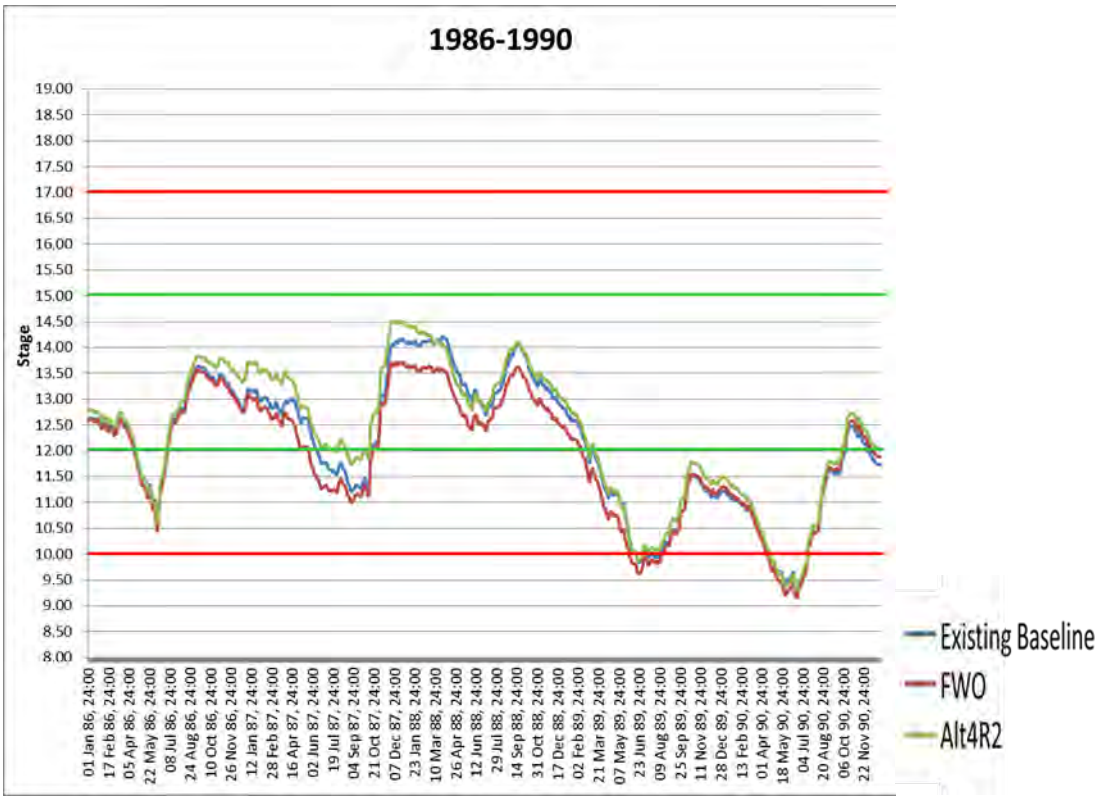

Figure 10. Daily Time Series Stage Hydrographs for Lake Okeechobee as simulated for the ECB, Alt 4R2, and FWO from 1986 to 1990.

9. Potential Adverse and Beneficial Effects of the Project

a. Effects on the Lake Okeechobee Littoral Zone

As modeled, the CEPP is likely to have few long-term effects on the littoral zone of Lake Okeechobee. Most of the time there was no difference between Alt 4R2 and FWO. For approximately 5 percent of the time (and usually during the rainy season), Alt 4R2 was 6.0 to 18.7 inches higher than the FWO. This occurred at 15.0 feet NGVD and so water essentially "stacked" under Alt 4R2. This would eliminate most foraging habitat for short-legged wading birds and potentially adversely affect emergent vegetation through uprooting. This, in turn, could adversely affect the macroinvertebrates and fish that rely on those habitats. Conversely, during the 1987 event, approximately 10,000 more acres of littoral zone remained hydrated under the simulated Alt 4R2, than for FWO. This may indicate a benefit to apple snails during droughts, but it only occurred once in the 41-year period of simulation. There were other times when both the FWO and Alt 4R2 approached 10.0 feet NGVD, yet there were no differences in performance between alternatives. It is likely that preceding precipitation patterns and lake operating rules could affect the frequency of dry season benefits of CEPP to the lake.

Any project that does not keep the annual hydrograph between 12.0 and 15.0 feet can be only marginally successful at restoring the lake's littoral zone close to the more favorable vegetation patterns in the Pesnell and Brown (1977) littoral zone survey. However, this cannot be achieved

with the current infrastructure surrounding the lake; much more dynamic storage will need to be connected to the lake. It may also increase the risk of having to send more freshwater into the estuaries to provide flood control in preparation of a large storm. High water levels are also destructive to snail habitat. Once the water depth in a particular area exceeds approximately 40 centimeters (cm), the area is considered to be too deep to allow snails to breed. Higher lake stages also allow wind storms to tear out emergent vegetation, particularly along the outer edge of the littoral zone. Because the snails must breathe air, they need stems to climb to survive; they also need portions of the stems to remain above water level for their eggs to hatch.

b. Lake Okeechobee Minimum Flows and Levels

Both the simulated FWO and Alt 4R2 violated the MFL three times. The MFL represents the point at which further withdrawals would cause significant harm to the water resources or ecology of the area. It is the District's intent to correct or prevent the violation of these MFLs through management of the water resources and implementation of a recovery strategy.

c. Lake Okeechobee Regulation Schedule

The current project dependencies for CEPP include the implementation of a new Lake Okeechobee Regulation Schedule prior to the completion of the A-2 FEB. While we know today the lake levels that are beneficial or detrimental for the ecology of the lake, it would be premature to predict if those levels would still be appropriate in the 15 to 20 years when CEPP is scheduled to be implemented under a new lake regulation schedule. Therefore, we recommend a robust monitoring and adaptive management protocols.

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C. Everglades Agricultural Area

1. Regional Area Location and Existing Condition

The EAA extends south from Lake Okeechobee to the northern levee of WCA-3A, from its eastern boundary at the L-8 canal to WCA-1 and WCA-2 and along the western boundary to the L-1, L-2 and L-3 levees.

Under the CEPP project concept, water flowing south from Lake Okeechobee can be separated into three flow-paths: the Western flow-path that extends beyond the EAA to the west, the Central flow-path, which is the bulk of the EAA, and the Eastern flow-path. The FEB project site is in the southern portion of the Central EAA flowpath.

a. Ecological Description

The A-1 FEB footprint contains 16,152 acres of land, of which 14,705 acres are waters of the United States and 1,447 acres are uplands. The waters of the United States consists of 10,158 acres of mixed scrub shrub wetlands, 234 acres of exotic scrub shrub wetlands, 3,877 acres of herbaceous freshwater marsh wetlands, 109 acres of lateral farm ditches, and 327 acres of channelized waterway. The uplands consist of existing levees and areas that have been previously filled to store rock material and muck soils (Corps 2013).

The A-2 FEB footprint contains 13,900 acres of land of which 13,778 acres were devoted to the cultivation of sugarcane, 45 acres of canals, 7 acres of upland scrub, and 13 acres of wetland (Florida Land Use and Cover Classification System 2009).

b. Fish and Wildlife Resource Concerns

The draft Fish and Wildlife Coordination Report (Service 2013) evaluated potential effects of CEPP Alts 1, 2, 3, and 4 on a variety of species that occur, or may potentially occur, within the EAA and the A-1 and A-2 FEB footprints. The report also included the following threatened and endangered species: Florida panther, West Indian manatee, Everglade snail kite, wood stork, bald eagle, eastern indigo snake, Audubon's crested caracara and Okeechobee gourd.

Based on subsequent analysis, the Corps determined that Alt 4 was the most cost effective alternative and has further optimized the performance by developing two new Alts (4R and 4R2) since the draft Coordination Act Report was written. The optimized components of Alts 4R and 4R2 occur south of the red line (*i.e.*, south of the EAA) and therefore are not expected to result in significant changes to the anticipated effects within the EAA and A-1 and A-2 FEB footprints compared to the previous alternatives.

Direct Impacts

Direct impacts are defined as impacts that occur within the footprints of the proposed project site during or as a direct result of construction and operation activities. The following discusses

potential direct impacts to federally-listed threatened and endangered species, species of special concern (SSC), and designated critical habitat. The impact analysis also includes listed species that have the potential to occur within the A-1 and A-2 FEB project footprints. Construction of these projects would lead to unavoidable adverse wetland and surface water impacts due to placement of fill and excavation activities. Wetland conditions would occur within the FEBs after construction is complete and the facilities become operational. The FEBs would be operated at an average depth of 1.5 feet and a maximum depth of 4 feet. Emergent and submerged aquatic wetland vegetation is expected to be maintained or grown within the FEBs. Existing wetlands not converted to agriculture and within the FEB footprint will be inundated with water up to 4 feet.

Agricultural Lands

Although natural wetland habitat has been mostly replaced by agriculture in the FEB project areas, the creation of ditches, canals, rice paddies, and the flooding of fallow agricultural fields during the rainy season provides some habitat for terrestrial and aquatic wildlife. These habitats provide attractive foraging habitat for birds, particularly during the rainy season with the highest diversity and total number of individuals found in rice fields, followed closely by flooded fallow fields. Therefore, temporarily flooded areas may serve as important habitat for bird species within the EAA.

Wetlands

Many fish and wildlife species may be affected by the replacement of wetland habitat in the A-1 and A-2 FEB projects during construction. Species that rely on shallow water areas will be displaced, while deeper water aquatic species and those species that rely on them for survival may benefit positively. The construction of the FEBs would result in the replacement of all existing on site wetlands.

Increase in Aquatic Habitat

Although the construction of the FEBs will result in a reduction of wetlands in addition to a loss of terrestrial agricultural habitat, there will be an increase in available open-water aquatic habitat in the project footprints. Fish and macroinvertebrate species common to the surrounding canals are likely to enter the FEBs via inflows, and populations may survive unless and/or until the majority of an FEB dries out completely. Emergent, submerged or floating aquatic vegetation may provide vegetative habitat. Fish and other aquatic wildlife within the FEBs may provide foraging opportunities for avian species such as the osprey (*Pandion haliaetus*), double-crested cormorant (*Phalacrocorax auritus*), least tern (*Sterna antillarum*), and bald eagle. Wading birds, including the endangered wood stork, may forage within the FEBs along the bottom surface when stages are low. The FEBs may provide important foraging opportunities for nesting wading birds during extreme regional dry events as waters recede. Ducks and other waterfowl may also inhabit and/or use the FEBs although depending upon the density of vegetation, primarily in the form of emergent vegetation such as cattail, may lessen potential benefit. Amphibians and aquatic reptiles are likely to inhabit and/or forage within the FEBs, and within

the footprint, the aquatic area may provide foraging opportunities for mammals such as the river otter (*Lutra canadensis*), raccoon (*Procyon lotor*), and rodent species.

Deep Water Refugia

Deep water refugia are areas of lower elevation within the FEBs that provide habitat for macroinvertebrates, fish, and amphibians during dry events. Deep water refugia will consist of the existing agricultural canals and ditches, as well as borrow pits excavated within the project footprints to provide fill for the FEB embankments. In addition, the refugia may provide foraging areas for wading birds during extreme regional dry events. Of particular significance may be the presence of refugia for foraging habitat during the nesting seasons of the federally endangered wood stork and State-listed wading birds. However, the refugia could also act as sinks for contaminants that may be ingested by fish and wildlife during regional dry events.

Wildlife-related Recreation

Recreation features proposed for any CEPP project should be compatible with the authorized project purposes, should be affordable within project limits, and easily operated and maintained. The Corps and the District should keep regional recreation development in mind throughout the planning process in conjunction with their other project goals and objectives. The intent is to incorporate regional recreation development to the extent practical, justified, and in accordance with primary objectives of Ecosystem Restoration policies throughout the CEPP region.

Opportunities for recreation within the FEB project areas should be evaluated and include biking, hiking, equestrian activities, nature study, wildlife viewing, bank fishing, canoeing, and boating (Corps and District 2006). Boat ramps, benches, parking areas, trail shelters, and informational kiosks have been proposed. Providing recreational opportunities is one of the original C&SF purposes. The Corps indicates that one of the FEB project objectives will be to not adversely impact the ability of the public to enjoy existing natural areas such as Holey Land and Rotenberger Wildlife Management Areas (Corps 2005). The CERP Master Recreation Plan may further identify and evaluate potential new recreation, public use, and educational opportunities within the FEBs (District 2004).

A more detailed discussion of the project area, species effects, and operations of the FEBs can be found in the draft Fish and Wildlife Coordination Report and the Corps PIR/EIS.

D. Greater Everglades

1. Evaluation of the Project

a. Performance Measure Results

RECOVER Performance Measures and Habitat Units

The PM scores were generated for the Greater Everglades region using the RMS Glades LECSA (RSMGL) which provides daily, detailed estimates of hydrology across the 41-year period of

record (January 1965 to December 2005). The PM scores are displayed as a function of restoration potential or achievement of the target with the minimum value of zero representing a fully degraded ecosystem and a maximum value of 100 representing the restoration target. The habitat suitability indices (HSI) associated with each PM are then summed and applied to the total spatial extent of each zone (in acres) to produce HUs. The Greater Everglades were divided into nine zones based on differences in existing conditions. Zones evaluated include northeast WCA-3A (3A-NE), northwest WCA-3A (3A-NW), WCA-3A Miami Canal (3A-MC), central WCA-3A (3A-C), southern WCA-3A (3A-S), WCA-3B (3B), northern ENP (ENP-N), southern ENP (ENP-S), and southeast ENP (ENP-SE; Figure 11).

Habitat unit results for Alts 4R and 4R2, which represent modifications to the TSP, ECB and FWO are displayed in Table 5. These alternatives were not evaluated in the Draft FWCAR (Service 2013) because they were not yet complete at the time that report was drafted. The Corps instructed PDT participants to evaluate these modifications with regards to the FWO and ECB runs but instructed that they were not to be evaluated against the original final array of alternatives 1 through 4 because of changes to model parameters. Habitat unit results for the FWO were subtracted from each alternative to produce a HU lift (Table 5). The results in Tables 5 and 6 indicate that Alt 4R and Alt 4R2 perform similarly to Alt 4 which provided the greatest lift for the Greater Everglades and Florida Bay relative to the FWO condition. Out of the final array of alternatives, Alt 3 provided the second best lift followed by Alts 1 and 2 (Corps 2013, Service 2013). Within the Greater Everglades and Florida Bay, the FWO generally provides less HUs than the ECB, resulting in a positive lift for the ECB.

It should be noted that all of the alternatives provide substantial lift above the FWO and ECB base conditions within the Greater Everglades. Additionally, there are many other factors to be considered in choosing the TSP. The Corps has instituted a process by which other factors can be utilized in choosing the TSP. This is especially important given the similar hydrologic performance between the alternatives. For more detailed information on the raw hydrologic model output for each PM and zone and for detail on how the Corps factors in other considerations besides modeling, please refer to the Draft PIR (Corps 2013).

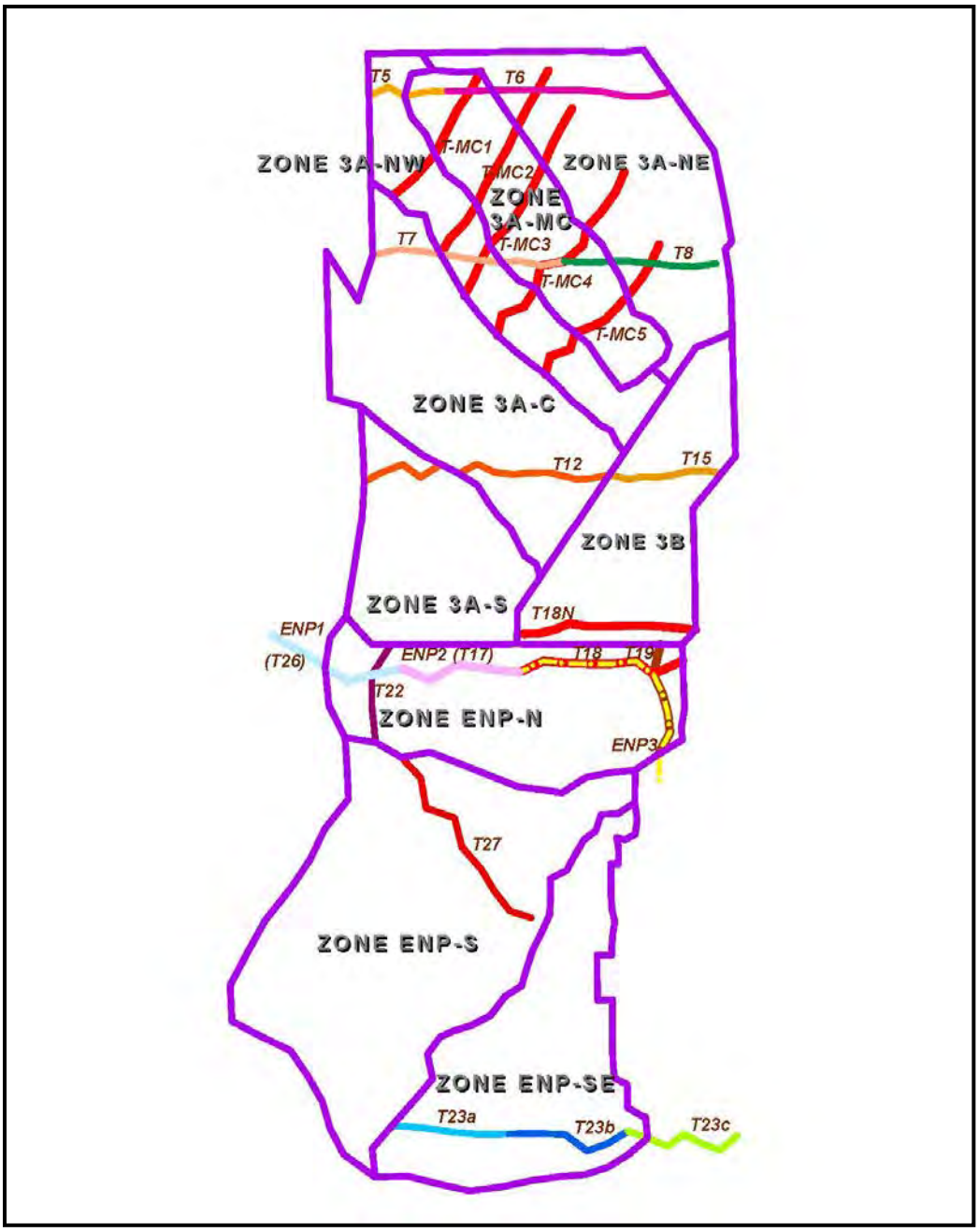

Figure 11 Graphic showing the performance measure zones and flow transect lines.

Table 5. Habitat unit results for zones located within the Greater Everglades Region.

Zone	ECB	FWO	Alt 4R	Alt 4R2	Target
3A-NE	44,451	29,634	92,606	91,372	123,475
3A-MC	32,847	27,373	54,746	54,746	78,208
3A-NW	30,970	30,266	54,198	54,198	70,387
3A-C	108,414	105,669	109,786	111,159	137,233
3A-S	69,247	68,423	68,423	68,423	82,437
3B	55,697	48,842	58,268	59,125	85,688
ENP-N	57,557	55,054	98,847	98,847	125,123
ENP-S	124,068	126,454	169,400	169,400	238,592
ENP-SE	79,711	81,062	85,116	83,764	135,104
All Zones	**602,962**	**572,777**	**791,390**	**791,034**	**1,076,247**

Table 6. Difference in habitat units comparing CEPP alternatives to ECB.

Zone	ECB	Alt 4	Alt 4R	Alt 4R2
3A-NE	14,817	66,677	62,972	61,738
3A-MC	5,474	29,719	27,373	27,373
3A-NW	704	23,228	23,932	23,932
3A-C	2,745	4,117	4,117	5,490
3A-S	824	0	0	0
3B	6,855	5,998	9,426	10,283
ENP-N	2,503	47,547	43,793	43,793
ENP-S	-2,386	62,034	42,946	42,946
ENP-SE	-1,351	2,702	4,054	2,702
All Zones	**30,185**	**242,022**	**218,613**	**218,257**

b. Everglades Restoration Transition Plan Performance Measures

Cape Sable seaside sparrow

The two CSSS PMs were not "new" to CEPP and have been used by the Service to evaluate the effects of hydrologic restoration projects on the sparrow since the mid 1990's. These metrics include a nesting component which measures the number of days during the nesting season (March 1-July 15) that water levels are below ground surface. CSSS construct their nests close

to the ground and will only initiate breeding when water levels have dropped to at or below ground surface. The second metric is a habitat component and targets the annual discontinuous hydroperiod at between 90-210 days. This range provides the optimal conditions for the clumped graminoid grasses that the sparrow prefers to nest in (*e.g.*, *Muhlenbergia*, *Schoenus*, *Shizacrium* and sparse *Cladium*).

Tables 7 and 8 coarsely summarize the results of the two CSSS PMs. More detailed analyses using additional data will be conducted during preparation of the Corps' Biological Assessment and the Service's Preliminary Biological Opinion. The CSSS nesting condition results are summarized by the number of years that the target was met over the 40 year period of record produced by the RSMGL. Various gauge locations and indicator regions within the model mesh were used to assess spatial aspects of alternative hydrology can be seen in Figure 12.

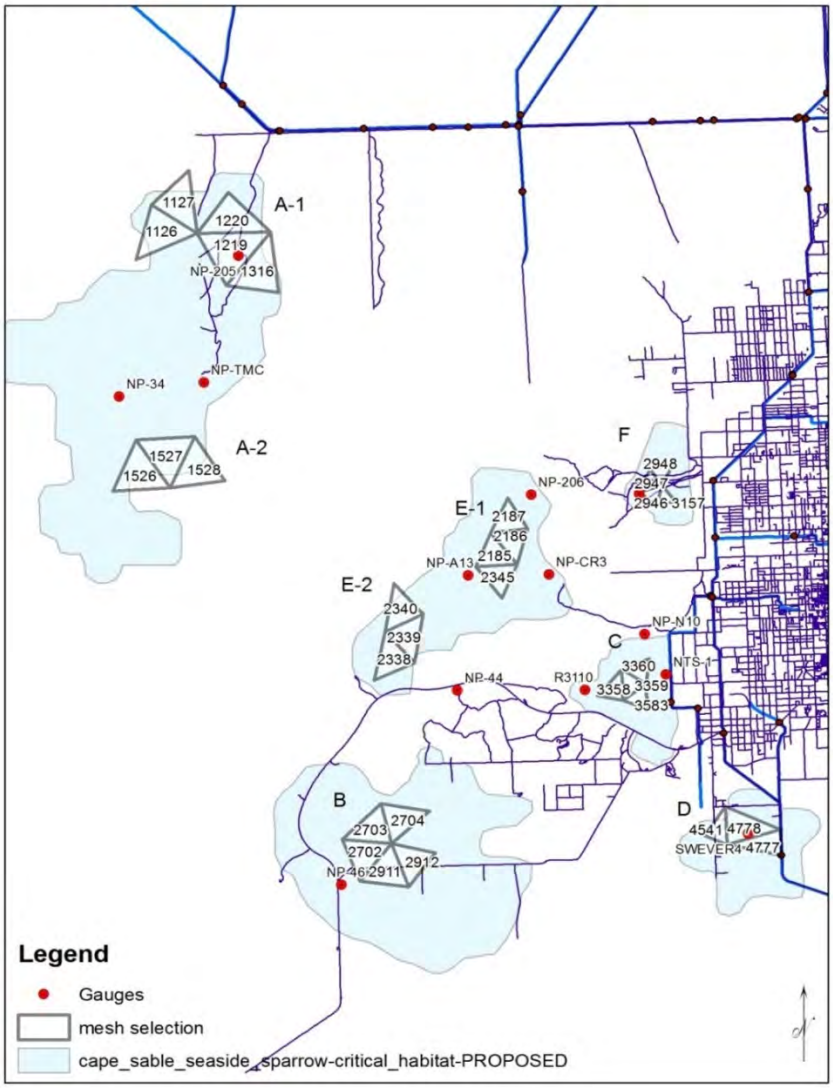

Figure 12. Regional Simulation Model cells and gauges used for CSSS indicator regions in CEPP modeling.

Of note is the reduction in years when the target is met in CSSS-A-2 and in the second most productive subpopulation, CSSS-E. This was somewhat expected as the project was designed to shift dry season water flow from western SRS to eastern SRS; however, as stated earlier, CSSS-E is a productive breeding area for the sparrow and consecutive years of reduced nesting potential should be avoided at all costs. On the beneficial side, CSSS-A-1 shows a slight improvement in the number of years the target is met.

The greatest concern is the increase in annual hydroperiod of CSSS-E as seen in Table 8 and the reduction of years the target is met. Successive years with hydroperiods greater than 210 days will cause the sparrow's preferred nesting habitat to shift to a wetter marsh type that will preclude successful nesting. This impact will need to be mitigated through intensive monitoring and real-time operational adaptive management.

Table 7. Cape Sable Seaside Sparrow nesting. Number of years in period of record that target is met. Target is more than 60 continuous dry days during the nesting season March 1 – July 15.

Subpopulation		ECB	FWO	Alt 4R	Alt 4R2
		# of years	# of years	# of years	# of years
A	Indicator Region A1	18	20	22	22
	Indicator Region A2	33	33	26	25
	Gauge P34	31	29	29	29
	Gauge TMC	34	32	29	29
B	Gauge CY3	40	40	40	40
C	Gauge R3110	39	39	39	39
	Gauge E112	38	38	38	38
D	Gauge EVER4	20	22	20	20
E	Gauge NE of NPA13	37	36	33	33
F	Gauge NE of RG2	32	33	33	33

Table 8. Cape Sable Seaside Sparrow Habitat. Number of years in period of record that target is met. Target is 90-210 days annual discontinuous hydroperiod.

Subpopulation		ECB	FWO	Alt 4R	Alt 4R2
		# of years	# of years	# of years	# of years
A	Indicator Region A-1	4	6	10	10
	Indicator Region A-2	10	9	8	8
B	Indicator Region B	25	25	24	24
C	Indicator Region C	17	19	16	15
D	Indicator Region D	11	16	12	13
E	Indicator Region E-1	25	24	17	18
	Indicator Region E-2	13	12	10	10
F	Indicator Region F	19	18	15	14

Everglade Snail Kite

The Everglade snail kite PM, defined in the MSTS through collaboration with researchers responsible for monitoring the kite population, provides optimal hydrologic ranges for two important time periods within the year. The first is the pre-breeding season which is most effectively measured on January 1. Water levels between 9.76 and 10.26 feet NGVD on January 1, coupled with the recommended recession rate (0.05 feet per week), are recommended to provide favorable conditions in southwest WCA-3A for optimal snail kite nest success during the peak breeding season (March-June). As discussed earlier, higher water levels up through this time period are associated with decreased snail kite nest success; thus, reduced water levels (from the wet season high) should benefit nesting kites. Attaining the recommended water levels on or around January 1 (followed by the recommended recession rate) should allow individual snail kites to choose nesting locations more appropriately based on water depths that can be expected to be present throughout nest building, incubation, and nestling stages.

The second metric provides an optimal hydrologic range at the end of the dry season from May 1–June 1. Minimum water levels between 8.8 and 9.3 feet NGVD are recommended to provide favorable conditions in southwest WCA-3A for increased snail kite nest success and juvenile survival. For more detailed information on how these metrics were defined please refer to the Service's MSTS white paper (Service 2010). Although the snail kite metrics were applied to locations throughout WCA-3A and 3B, most of the snail kite nesting in recent years has been concentrated in central to southwestern WCA-3A. Therefore, gauges 3A-4, 3A-28 and 3A-SW may be the most important to focus on. However, improving conditions in areas that have been absent kite nesting may allow them to utilize these areas for the first time or return to old nesting grounds.

The Corps did not evaluate Alts 4R and 4R2 with the snail kite-specific PMs described above, as they had for the previous final array of alternatives. They determined that only using these metrics in southern WCA-3A where they were designed to be used in ERTP is too restrictive for use in CEPP. Instead they opted to use an apple snail based hydrologic metric and apple snail model as a surrogate for their snail kite analysis. While the Service agrees that using the ERTP metrics in southern WCA-3A does not adequately cover the geographic scope of CEPP, we do not feel that it is appropriate to solely use the apple snail metrics to evaluate the performance of CEPP regarding snail kites. The Service will provide a more robust and thorough snail kite analysis in future ESA consultations when more information is learned about when certain aspects of the project will be constructed.

As indicated in our draft report (Service 2013), all of the alternatives keep conditions the same or slightly better with the exception of the gage in 3A-SW which shows slight reductions in the number of years the target is achieved. Alternatives 4R and 4R2 are no different in this regard. This result is somewhat disappointing as one of the goals of CEPP was to improve conditions in southern WCA-3A for wildlife and other resources in the vicinity. Of note are the base condition scores which are very low. This indicates that conditions were poor to start with at this location and the alternatives do not improve upon it. Additional analyses should be conducted on this output to ensure its accuracy. Areas of improvement over the base conditions are northern WCA-3A which has been historically too dry for snail kites. The alternatives make these areas

significantly better which could become suitable kite foraging habitat if other conditions are met (note snail kite critical habitat is not defined in northern 3A; however, it has been designated in WCA-1 and WCA-2A and 2B).

Florida Apple Snail

Optimal hydrologic ranges for successful apple snail reproduction are also provided during two time periods within the year, similarly to the snail kite (Table 9). Water depths between 9.65 and 10.31 feet NGVD (40-60 cm) on January 1, coupled with a slow, gradual recession rate (approximately 0.05 feet per week), are recommended to provide favorable conditions (*i.e.*, water depths ≤ 40 cm, as discussed under dry season recommendations below) for apple snail egg production beginning in March, and prevent delayed or reduced apple snail egg production. Additionally, apple snail egg production is maximized when dry season minimum water levels are < 9.65 feet but > 8.67 feet NGVD (water depths < 40 cm but > 10 cm). Maximizing egg cluster production contributes to increased snail density the following year.

As expected for this project, all of the alternatives, including Alts4R and 4R2, make the May 1-June 1 conditions better for apple snails in most areas because the project is designed to deliver water during the dry season. As with the snail kite PM the apple snail metric performs worse than the base conditions at the 3A-SW gauge location. This gauge is located just north of the terminus of the L-28 Tieback in the mouth of Mullet Slough. This area usually gets a lot of flow funneling out of Big Cypress National Preserve into WCA-3A and may explain why the targets are not met in most years.

Table 9. Numbers of years in the period of record (41 years) that target water levels between 9.7 and 10.3 feet NGVD by December 31 and between 8.7 and 9.7 feet between May 1 and June 1 for the apple snails in WCA-3A. Numbers in parenthesis in the Total line represent the percentage of total years possible 328.

	May 1 - June 1			**December 31c**		
		ALTERNATIVE			**ALTERNATIVE**	
	FWO	**4R**	**4R2**	**FWO**	**4R**	**4R2**
3A-NE	2	21	20	0	0	0
3A-NW	4	17	19	0	17	16
3A-3	7	21	20	11	10	10
3A-4	18	23	23	22	24	22
3A-28	19	17	15	5	4	4
3A-SW	37	31	31	2	0	0
3B-71	5	28	28	5	6	6
3BS1W1	13	17	17	18	24	21
Total	**105** (32%)	**175** (53)	**173** (53)	**63** (19%)	**85** (26)	**79** (24)

Dry Season Recession Rate

A recession rate of 0.05 feet per week is recommended from January 1 to June 1 (or the onset of the wet season) to maximize kite nest success. This equates to a stage difference of approximately 1.0 feet between January and the dry season low. This recession rate guideline is most important to follow during the peak snail kite breeding season (March-June). Recession rates < 0.05 feet per week, or > 0.05 feet but < 0.10 feet per week may also be considered acceptable under certain environmental conditions (*e.g.*, unseasonably heavy rainfall). These recession guidelines may also be applied in the fall (October-December), although faster recession rates during this time may be considered acceptable under exceptionally high water conditions (> 11.0-11.5 feet NGVD) to reach desirable pre-breeding (January 1) water levels.

The Corps did not provide information on this metric in its updated PIR, however, it is assumed here that Alts 4R and 4R2 perform similarly to the other alternatives reported in our previous document (Service 2013). All of the alternatives perform similarly to the base conditions for the optimal range of 0.05 – 0.07 feet per week; however, the number of weeks is low indicating that the target is not currently met very often. The benefit comes from the alternatives ability to shift recession rates from outside all acceptable ranges into the mid-range rates (> -0.05 but < 0.06 and >0.07 but <0.17). This seems to be a benefit over the base conditions. The Corps has committed to continuance of the Periodic Scientist Calls where recession rates are evaluated periodically throughout the year and adjustment made where necessary.

Wet Season Rate of Rise (Ascension Rate)

A maximum ascension rate (rate of rise) of ≤ 0.25 feet per week is recommended from June 1 to October 1 to avoid drowning of apple snail egg clusters. The importance of this guideline depends on what happens in the dry season (*i.e.*, whether snails need additional time for egg production due to poor hydrological conditions earlier in year). Darby et al. (2005) and Darby et al. (2009) observed a shift in peak egg cluster production (to later in the year) associated with higher water depths in 2003 and at relatively deeper southern sites in the relatively wet year of 2005.

The Corps did not provide information regarding this metric for Alts 4R and 4R2 in their updated PIR Appendix C.2.2. It is assumed here that the operational refinements of Alt 4 (4R and 4R2) perform similarly to alternatives previously analyzed, which would be similar to or slightly better than base conditions.

Wood Stork Foraging Conditions

Several methods were used to evaluate wood storks and other wading birds with regards to the CEPP Project. Originally, Beerens and Cook (2010; Appendix B) reviewed wood stork survey data and hydrological data and found that, at the minimum 3-AVG stage during 2000-2005 (8.02 feet on May 21, 2001), wood storks were still feeding in southeastern WCA-3A. Flock size appeared to increase correspondingly with a decrease in stage during the breeding seasons in these years. Their analysis also indicated that wood storks used a mean depth of 0.48 feet

(14.63 cm), with the optimal range including the 95 percent confidence intervals equal to 0.46-0.50 feet (13.93-15.33 cm).

This information was used to create a PM for the MSTS during ERTP which was analyzed in our original draft report (Service 2013). Model output was categorized by percentage of time wood stork foraging depth target of 5 – 25 cm within the core foraging area (18.6 mile radius) of any active wood stork colony. Conclusions from the previous draft were that for areas in northern WCA-3A all of the alternatives perform similarly and slightly worse than the base conditions. One might expect this as the project was designed to move water into this area during the dry season. The result for 3ASW is confusing as it is not located in the southwestern portion of WCA-3A rather it is located at the north end of the L-28 tieback in Mullet Slough. How the project is changing hydrology in this area should be more closely investigated. Additionally, a more suitable gauge in southwestern WCA-3A should be included in the analysis (*e.g.*, 3AS3W1 or W2). Southern WCA-3A remains largely unchanged by the alternatives and has low base condition scores. This is due to the fact that southern WCA-3A is impounded behind the Tamiami Trail and usually stays too wet for foraging wading birds during the dry season. Performance in WCA-3B is maintained by Alt 4 while other alternatives tend to make it slightly worse.

Since the last report was drafted, Beerens and Noonburg (2013) completed work on their model WADEM (Wader Distribution Evaluation Modeling), and have provided a report summarizing Alts 4R and 4R2 as compared to the FWO for CEPP. The WADEM essentially uses Systematic Reconnaissance Flight data collected between 2002 and 2009 and pairs it with EDEN hydrologic parameters such as recession rates, days since drydown, reversals and hydroperiods for each cell within the model domain. The main relationships that the authors discovered are that a geographical location is used more frequently by wading birds when it has a higher number of days since last drydown, which produces more forage, and shallow foraging depths which concentrates prey making it easier to obtain.

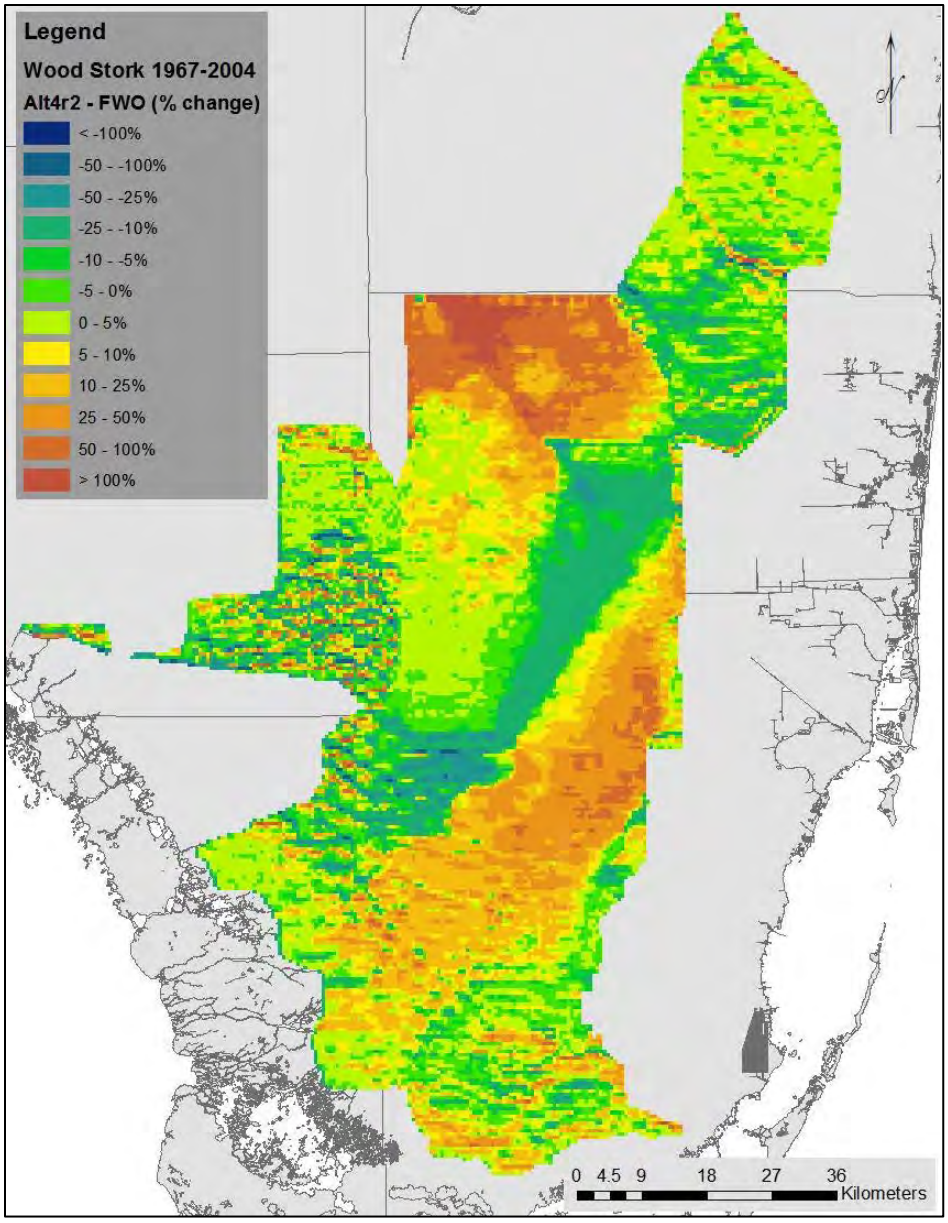

Figure 13. Mean percent change in wading bird cell use (Jan–May, 1967-2004) for Alt 4R2 relative to FWO.

Figure 13 shows a difference map with varying coloration demonstrating percent change between the tentatively selected plan Alt 4R and the FWO condition. An increase in wading bird usage can be seen in northern WCA-3A, WCA-3B and northeast SRS which is anticipated based on project features. These areas have been consistently drier than other parts of the system and will benefit greatly by increased dry season flow provided by CEPP. What is not as clear is what effect, if any, this increased dry season flow will have on wet season high water stage and timing of dry downs.

Additional wood stork analysis was provided by ENP as modeled and analyzed by their Wood Stork Foraging Probability Index (ENP 2013). The Wood Stork Foraging Probability Index

(Lo Galbo et al. 2012) is a spatially explicit modeling tool that simulates wood stork foraging habitat suitability throughout the Greater Everglades based on the foraging and water depth relationships of Herring and Gawlik (2011). The model also includes a penalization for water depth recessions to estimate the impact of water reversals on wood stork foraging.

Summary output for ALTs 4R and 4R2 as compared to the FWO can be seen in Figure 14. As with the previous analyses, wood stork foraging conditions improve the most in northern WCA-3A and in southern ENP.

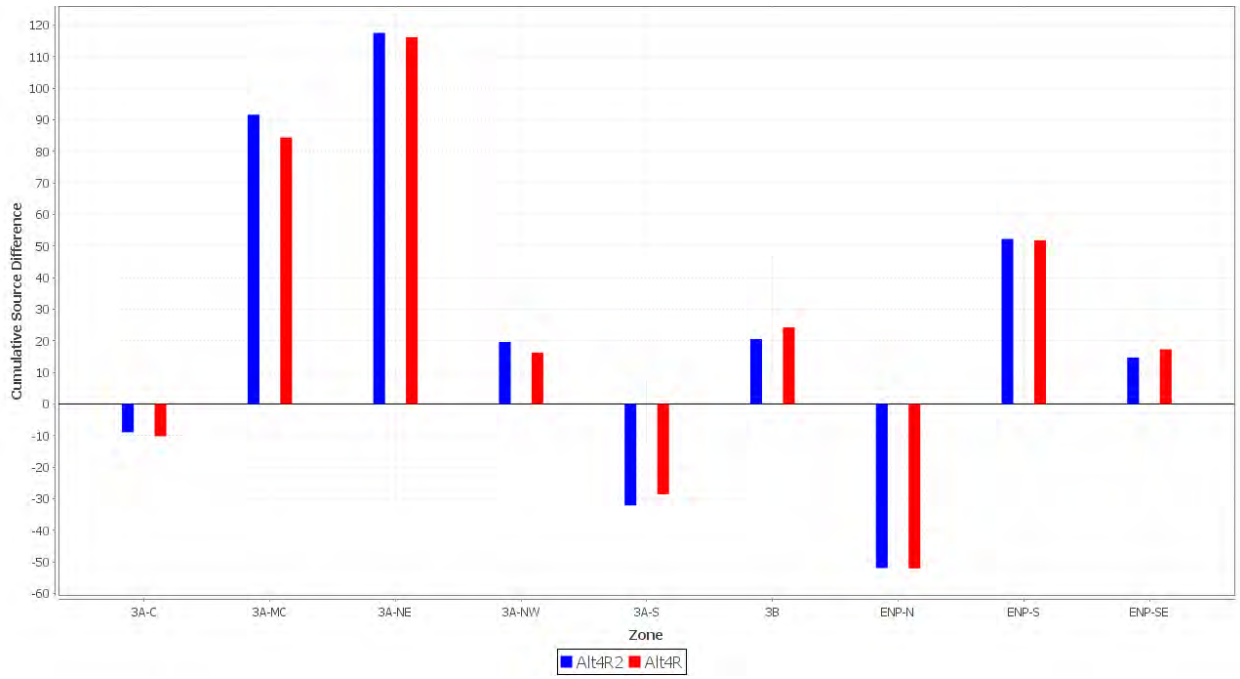

Figure 14. Cumulative wood stork foraging suitability (1965-2005) lift from CEPP FWO for CEPP TSP (Alt 4R2) and CEPP alternative (Alt 4R) within each CEPP zone. A maximum score of 1327 is possible if FWO has a suitability score of 0.0 every week and the alternative has a suitability score of 1.0 every week of the 41 year hydrologic model runs.

c. Other Ecological Tool Results

Everglades Landscape Vegetation Succession Model

The Everglades Landscape Vegetation Succession model (ELVes) is a spatially explicit simulation of vegetation community dynamics over time in response to changes in environmental conditions. The model uses empirically based probability functions to define the realized niche space of vegetation communities. Temporal lags in response to changing environmental conditions are accounted for in the model. The Everglades Landscape Vegetation Succession Model (ELVeS) Version 1.1 simulates Everglades freshwater marsh and prairie community response to hydrologic and soil properties. The ELVeS has been developed to provide scientists, planners, and decision makers a simulation tool for CERP landscape-scale analysis, planning, and decision making.

In examining the dominant vegetation communities selected by ELVeS at the end of the 41-year period of hydrologic record, little difference is discernible among the alternatives and FWO or ECB. Open water is eliminated in all the alternatives (Alt 4R, Alt 4R1, and Alt 4R2) in southern WCA-2B and increased wetting in Alt 4R1 is being expressed along the western edge of northern WCA-3A with pockets of spikerush (*Eleocharis* spp.). Northern WCA-3A in the ECB and FWO is drier than it is expected to be in the alternatives and is characterized by willow and shrubs. In the alternatives, water deliveries to northern WCA-3A result in ELVeS probabilities for sawgrass becoming quite high and following the pathways of water flow. One notable transition occurs in northern WCA-3A (CEPP Zone 3A-NE) where increased water deliveries from CEPP result in a decreased spatial extent of wet scrubland community and subsequent increased spatial extent of sawgrass community. Another significant shift occurs within the Blue Shanty Flow-way in WCA-3B (southwestern portion of CEPP Zone 3B) and northeast SRS (CEPP Zone ENP-N) with Alt 4R2. Sawgrass communities are replaced by cattail, floating emergent marsh, and open marsh as a result of the substantial increased flow deliveries that occur to the Blue Shanty Flow-way with CEPP implementation.

Marl Prairie Indicator

The Marl Prairie Indicator is a temporally and spatially explicit modeling tool that ENP uses to simulate hydrologic suitability of marl prairies based on CSSS survey presence data threshold ranges (Pearlstine et al. 2013). The marl prairie indicator evaluates marl prairie habitat suitability with four metrics: (1) average wet season water depths (June – October); (2) dry season water depths (November – May); (3) discontinuous annual hydroperiod (May – April of the next year); and (4) maximum continuous dry days during the nesting season (March 1 – July 15).

Similarly to the more detailed analysis of sparrow conditions currently being completed by the Service, the Marl Prairie Indicator predicts substantial negative effects to the western portions of CSSS-E, extreme western edge of CSSS-B, and CSSS-D (Figure 15). Modest gains in habitat suitability can be seen in the very northern edges of CSSS-A and CSSS-C. A more detailed analysis of CEPP effects on the sparrow will be in the Service's ESA consultation document which will be provided in the future during detailed planning and design of CEPP components expected to impact sparrows.

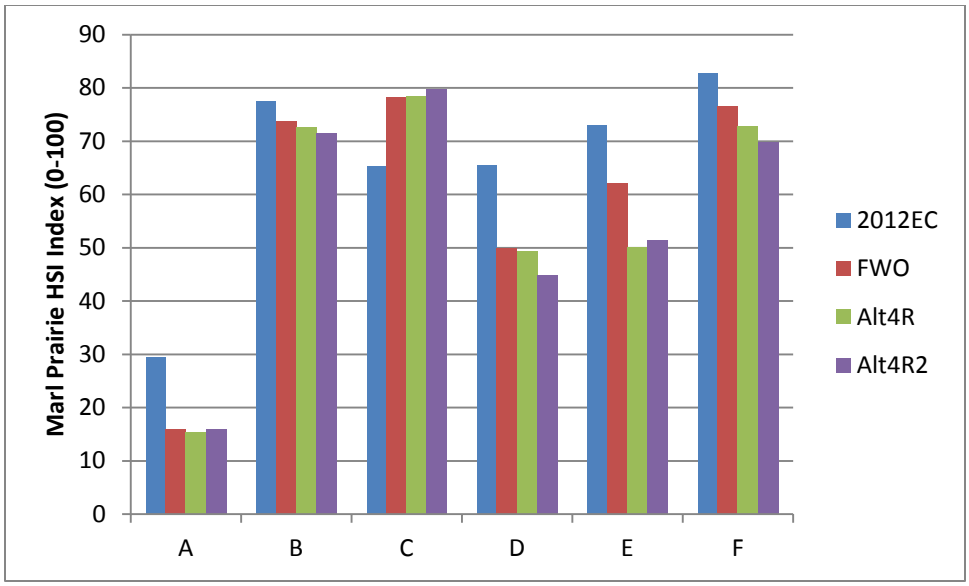

Figure 15. This bar graph shows the relative performance of Alts 4R and 4R2 compared to the FWO and EBC in each of the 6 sparrow subpopulations.

The Service remains concerned that the impact of CEPP as modeled, if it were to be implemented tomorrow, to the relatively strong but vulnerable CSSS-E would result in an intolerable decrease in the overall sparrow population. Fortunately, it will be many years before the implementation of CEPP components that will affect the CSSS and the Service and Corps are working together to implement projects and study initiatives to reassess baseline conditions and help bolster sparrow populations so that they may better weather the transition into full CEPP and CERP.

American Alligator Production

The American alligator is a keystone species within the Everglades marsh systems, acting as predator and prey and structuring plant communities (Brandt and Mazzotti 2000). Alligators are dependent on spatial and temporal patterns of water fluctuations that affect courtship and mating, nesting, and habitat use. Water management practices and other anthropogenic changes to the Everglades region have affected alligators, which historically were abundant in peripheral marshes of the Everglades (Craighead 1968) and are now most abundant in central sloughs (Kushlan 1990). The alligator ecological planning tool models habitat suitability annually for five components of alligator production: (1) land cover suitability; (2) breeding potential (female growth and survival from April 16 of the previous year - April 15 of the current year); (3) courtship and mating (April 16-May 31); and (4) nest building (June 15-July 15), and egg incubation (nest flooding from July 01-September 15).

All of the alternative plans, including Alt 4R and Alt 4R2, improve alligator habitat in northern WCA-3A and the Miami Canal zone by as much as 20 percent because of new water deliveries to northern WCA-3A. Gains are smaller in central WCA-3A, WCA-3B and ENP north and south zones with modest variation regarding which alternative best improves scores. Changes to WCA-3A south and ENP southeast are negligible. When scores are aggregated by water

conservation area, the trends are similar, but lifts are compressed by aggregation over a larger area. In addition, WCA-2 has a five percent loss of habitat suitability resulting from water being redirected from WCA-2 to WCA-3A.

Apple Snail Population

This model was developed by Phil Darby (University of West Florida), Don DeAngelis U.S. Geological Survey (USGS), and Stephanie Romañach (USGS) and is being used in CEPP as an Ecological Planning Tool. The purpose of the model is to describe the dynamics of the apple snail population as a function of hydrology and air temperature. The estimated number and size distribution of the snails are simulated on a daily basis and can be calculated for any day of a year with user input. Standard output is produced as difference maps which show the simulated alternative minus the base condition.

Conditions will be provided for dry years for each alternative, which is the period when CEPP is likely to have the biggest impact, given that the system is largely rainfall driven in the wet season. Results will also be provided for adult snails (> 20 mm) during the spring of a dry year, before that years' reproductive period. Adult snails during a given year are a product of egg production, and thus environmental conditions, from the previous year.

Inputs

- Water depth from the District's RMS
- Air temperatures from DBHYDRO interpolated across hydro input domain

Outputs

- Apple snail population numbers per 500 x 500 meter cell on a daily time step (500 meters cell interpolation from the District's RSMGL hydrologic output)
- Snail egg numbers on a daily time step

As with the four previous alternatives, Alts 4R and 4R2 provide better conditions for apple snail populations compared to the FWO. All of the alternative plans should lead to increased apple snail populations in northern WCA-3A, WCA-3B and Northeast Shark River Slough (NESRS).

2. Potential Adverse and Beneficial Effects of the Project

Overall, the alternatives perform quite similarly; however, all show marked improvement over the existing and FWO conditions. This is expected as most of the project components were designed using existing information produced from prior project planning efforts. As was expected from a first increment while making significant gains in the Greater Everglades and other project areas the TSP does not fully complete restoration. The Corps and the District should, as soon as is feasible, continue planning the next phase of restoration. Following is a brief description, by geographical region within the Greater Everglades, of potential adverse and beneficial effects of the TSP.

a. Loxahatchee National Wildlife Refuge

Hydrologic impacts from the implementation of any of the final array alternatives are not expected in Loxahatchee NWR because no changes to the regulation schedule or current water management infrastructure are contemplated.

b. Water Conservation Areas 2A/2B

Although the team tried to identify ways to improve the hydrologic conditions in WCA-2, it was never an objective of CEPP to change the regulation schedule for this area. Future phases of Everglades restoration should study the problems in WCA-2 and implement changes.

CEPP does include a component, called L-6 diversions, which would move water discharged from STA-2, normally discharged into WCA-2A, west into northern WCA-3A. The hydrologic effect of this component generally made conditions during dry times worse in WCA-2A. The TSP will require adaptive management of operations to avoid performance issues in this area.

The Service provided draft WCA-2A regulation schedule changes early in the planning process to help guide the modeling team in their efforts to define operations. These proposed draft changes can be seen in Figure 16 and were contemplated in conjunction with the FWC. Future work on WCA-2 regulation schedules should include various wildlife agencies and start with modifying the regulation schedule to be more environmentally based.

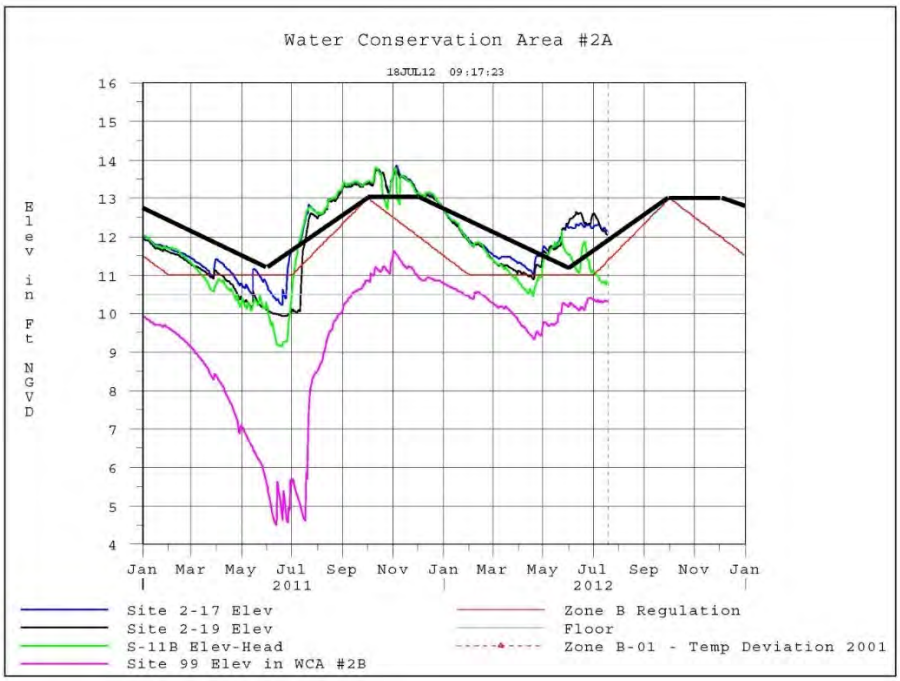

Figure 16. Proposed draft regulation schedule changes for WCA-2A shown as black line on existing regulation schedule hydrograph.

The CEPP is not making changes to either operations or infrastructure to WCA-2B thus no changes are expected in this area. However, conditions in WCA-2B are generally poor with sustained high water levels and little inter-annual variability. This area should be included in future discussions regarding the restoration of WCA-2.

c. Water Conservation Area 3A

All alternatives showed improved ecological performance for fish, wading birds, and apple snails in northern and central WCA-3A and SRS. Improved hydroperiods and sheetflow in WCA-3A, WCA-3B, and ENP result in less soil oxidation, which promotes peat accretion necessary to rebuild the complex mosaic of habitats across the landscape.

The project does not appear to alleviate the long-standing concern of ponded water at the Miami Canal/L67 A junction and in southern WCA-3A. Adaptive management should be used when possible to continue movement of water east into WCA-3B, NESRS and the South Dade Conveyance System when upstream and downstream areas will not be impacted. Additionally, the guidelines outlined in the MSTS and other aspects of the ERTP should continue to be followed throughout CEPP.

d. Water Conservation Area 3B

WCA-3B will see a substantial increase in beneficial flow through which should begin the re-establishment of ridge and slough patterning in this area. There is a concern that too much water may pool in the southeastern corner of WCA-3B during the wettest years. To alleviate these concerns the Corps should include this area in its monitoring and adaptive management plan and be prepared to make real-time operational changes to alleviate these concerns. An additional outflow structure may be necessary in the southeastern corner of WCA-3B just north of the existing Tamiami Trail 1-mile bridge. This structure, in conjunction with the use of the proposed L-29 divide structure which lowers stages in eastern Tamiami Trail will create the necessary hydrologic head to move water out of WCA-3B into NESRS.

e. Shark River Slough

Since the construction of the L-67 A and C levees and installation of the S-12 structures on the western side of Tamiami Trail, too much water has entered western SRS negatively impacting marl prairies in this location. Consequentially, too little water has been delivered to northeastern SRS causing the eastern marl prairies and Rocky Glades to become too dry. This has resulted in this area seeing increased woody vegetation encroachment and has made it susceptible to catastrophic wild fires. The TSP of CEPP will make significant positive gains in routing flows to the east, improving sheet flow and hydroperiod in NESRS which will benefit snail kites, wading birds, tree islands and other wildlife resources in this area.

f. Marl Prairies

The Service's greatest concern with the TSP at this time is the rapid change in hydrology predicted in areas of marl prairie on the eastern flank of SRS. The second most productive subpopulation CSSS-E is located in this area, roughly 10 miles south of the L-67 Extension, and contained an estimated 736 sparrows in 2012. Modeling has shown that we may expect a roughly 35 percent decline in the number of years in which hydroperiod falls within the 90 to 210 day window. Consecutive years of hydroperiods above 210 days will significantly alter currently suitable sparrow nesting habitat to a more marsh-like *Cladium*-domintated habitat which is unacceptable for sparrow nesting. Although other areas in and around currently suitable sparrow habitat may be enhanced by the project, rapid reduction of currently productive habitat will have a greater negative effect on overall sparrow population numbers than relatively slow gain in habitat in other areas.

The key to overcoming this impact is a slower transition into full hydrologic restoration. A stringent monitoring plan including helicopter surveys, intensive ground surveys and vegetation surveys in conjunction with adaptive management and real-time operational control will help alleviate the risk to sparrows resulting from this project. The Service is committed to working closely with the Corps and its local sponsor during formal consultation in the coming months to ensure that full CEPP benefits can be achieved throughout the system while restoring and maintaining trust resources like the sparrow.

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E. Southern Coastal System

1. Model Results

a. Florida Bay

Figure 17 shows flows across Transect 27 in SRS. Alternatives 4R and 4R2 show substantially greater flow across the transect toward the coast compared to FWO and ECB. This flow can directly benefit the southwest coastal wetlands and estuaries (*e.g.*, Whitewater Bay and riverine estuaries). It can less directly benefit Florida Bay via surface water and shallow groundwater flow and by plumes of low salinity water across the bay's western boundary (around Cape Sable). Note that Florida Bay salinity for CEPP is estimated from wetland stage and not flow.

Simulations show greater mean annual flow, mean dry season flow, and wet season flow for Alt 4R and Alt 4R2 compared to FWO and ECB. Alts 4R and 4R2 provide nearly identical flows across Transect 27; however, Alt 4R2 provides slightly more flow during the dry season than Alt 4R. Annual flow increases above FWO are 164,000 ac-ft per year for Alt 4R and

166,000 ac-ft per year for Alt 4R2. Compared to FWO, Alt 4R2 provides 34 per cent more flow across the transect during the wet season and 21 per cent more flow during the dry season. Both CEPP alternatives provide significantly more flow compared to ECB.

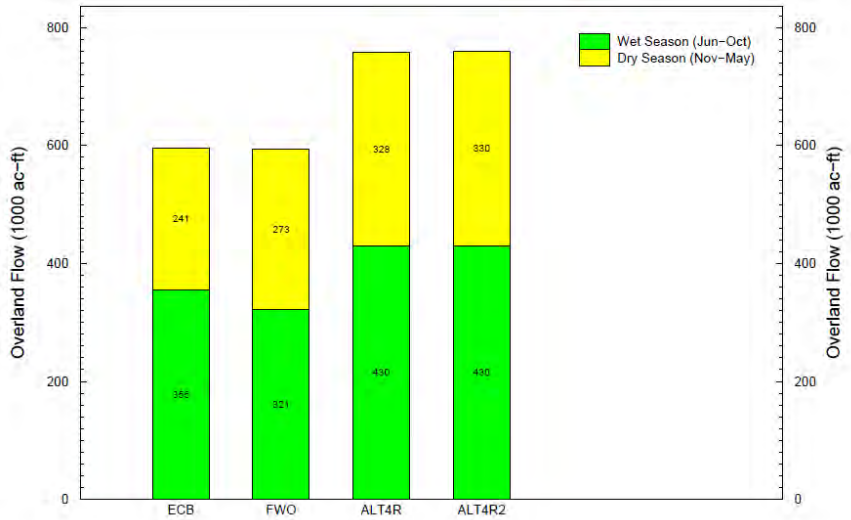

Figure 17. Average annual overland flow across Transect 27 (southwestward flow in central Shark River Slough).

Average annual overland flow across Transect 23B (one of the three flow transects across western Taylor Slough) also shows increases for Alt 4R and Alt 4R2 compared to FWO and ECB (Figure 18). For this location Alt 4R provides slightly more flows than Alt 4R2. Annual flow increases above FWO are 10,000 ac-ft per year for Alt 4R and 8,000 ac-ft per year for Alt 4R2. Combining the flows across the three Transect 23 sites yields a similar result as the Transect 23B site. Alternative 4R provides 27,000 ac-ft per year (10 percent) more flow than FWO; whereas, Alt 4R2 provides 23,000 ac-ft per year (9 percent) more flow than FWO. Both CEPP alternatives provide more flow to Taylor Slough compared to ECB.

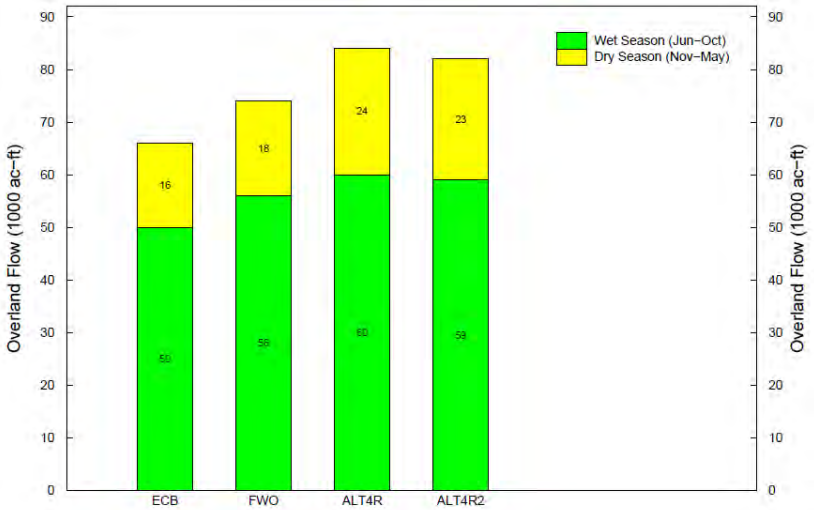

Figure 18. Average annual overland flow across Transect 23B (southwestward flow in central Shark River Slough).

c. Biscayne Bay

Flow at coastal structures

Evaluation of the coastal structure flow is displayed in Table 10. The purpose of this evaluation is to ensure that CEPP does not affect Biscayne Bay in any manner that would worsen it from existing conditions. Unfortunately, improving conditions in Biscayne Bay was not a CEPP objective, but CEPP should induce no harm to the bay. Also, the comparison of FWO and the alternatives against ECB is necessary to understand the effects of the different model assumptions made in the ECB and future conditions.

Results indicate that total flows to Biscayne Bay past all coastal structures combined under FWO, Alt 4R, and Alt 4R2 are greater than ECB. Alt 4R2 provides 3 percent more flow than ECB; whereas, Alt 4R provides 7 percent more water than ECB. Alternative 4R2 provide 2 percent less total flow to the bay compared to FWO.

Table 10. Mean annual flows for all Biscayne Bay coastal structures. Differences between annual means of FWO, Alt 4R, and Alt 4R2 compared to ECB (expressed in percent). Color codes depict North Bay (yellow), Central Bay (blue), South-central Bay (orange), and South Bay (green).

	ECB	**FWO**		**Alt 4R**		**Alt 4R2**	
Structure	Mean Flow	Mean	% Diff ECB	Mean Flow	% Diff ECB	Mean Flow	% Diff ECB
S29	282.8	372.3	32%	374.5	32%	310.8	10%
S28	90.9	93.2	3%	93	2%	90.8	0
S27	115.2	114.5	-1%	115.1	0	115.1	0
S26	124.6	116.4	-7%	124.5	0	124.9	0
S25B	109.3	102.4	-6%	103.3	-5%	105.6	-3%
S25	9.7	9.6	-2%	9.6	-1%	9.7	0
G93	28.4	26.7	-6%	26.8	-6%	27.8	-2%
S22	121.2	113.9	-6%	115.3	-5%	117.7	-3%
S123	17.5	17.3	-1%	17.5	0	17.7	1%
S21	101.3	101.9	1%	106.3	5%	115.3	14%
S21A	58.2	60.6	4%	60.8	5%	62.8	8%
S20G	0.4	0.3	-1%	0.3	0	0.4	0
S20F	145.7	154.7	6%	152.7	5%	154.9	6%
S20	6.6	6.6	0	6.6	0	6.6	0
S197	22.8	9.2	-60%	11.2	-51%	11.3	-50%
Total	**1234.5**	**1299.2**	**5%**	**1317.7**	**7%**	**1271.2**	**3%**

As requested by the CEPP project managers, the Biscayne Bay coastal structure evaluation was performed for four separate bay regions—North, Central, South-central, and South Bay areas (Manatee Bay/Barnes Sound). Modeled flow output indicates an increase in annual flow to North Bay under both Alt 4R and Alt 4R2 compared to ECB (see yellow cells in Table 10). Alternative 4R2 flow at the S29 indicates a 10 percent increase in annual flow compared to ECB. Further analyses indicate the increase occurs during both wet and dry seasons. Alternative 4R2 shows significantly less flow at the S29 compared to FWO. Flow at the S28 and S27 structures indicate no change in annual flow compared to ECB. However, further analysis indicates an approximate 1 to 2 percent reduction in flow past the S28 and S27 during the dry season (not shown). Alternative 4R2 exhibits very similar flow to FWO at the S28 and S27 structures.

In the Central Bay region, simulations indicate a relatively small decrease (1 to 3 percent) in annual flows at three of the five coastal structures under Alt 4R2 compared to ECB (see blue cells in Table 10). However, all five coastal structures in this bay region show a decrease in dry season flows of 3 to 20 percent under Alt 4R2 compared to ECB. Flow at the S26 exhibits the largest decrease (almost 20 percent) in dry season flows under Alt 4R2 relative to ECB (Figure 19). Further, two structures (S25B and G93) indicate a decrease in flow during both seasons compared to ECB. Figure 20 shows that flow under Alt 4R2 is reduced 10 percent during the dry season and almost 2 percent during the wet season at the S25B structure compared to ECB. All five coastal structures in this bay region show an increase in total annual flow and seasonal flow under Alt 4R2 compared to FWO. The only exception is the S26 structure, which shows slightly greater decreases in flow during the dry season under Alt 4R2 compared to FWO. Alternative 4R performed worse than Alt 4R2 at all coastal structures in the Central Bay region (Table 10).

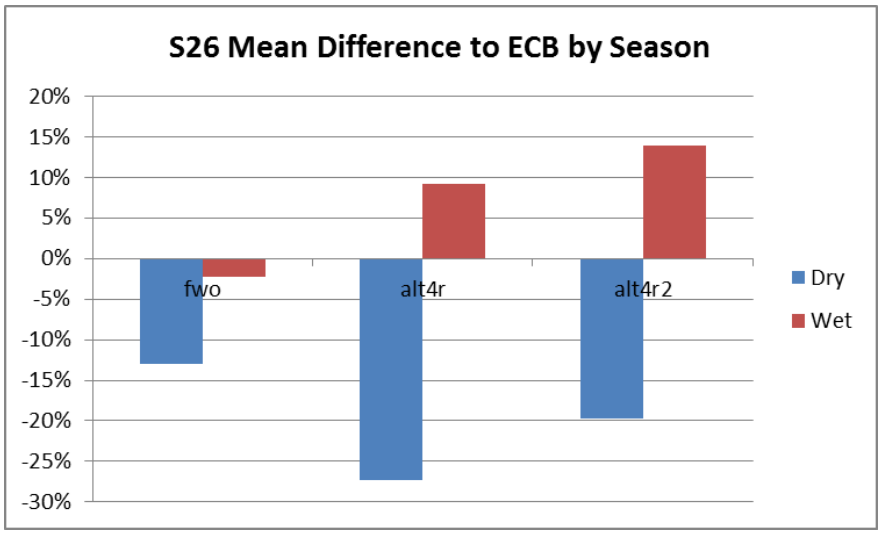

Figure 19. Histogram showing the mean difference (percent) in flow at the S26 structure (Miami Canal) for FWO, Alt 4R, and Alt 4R2 compared to ECB.

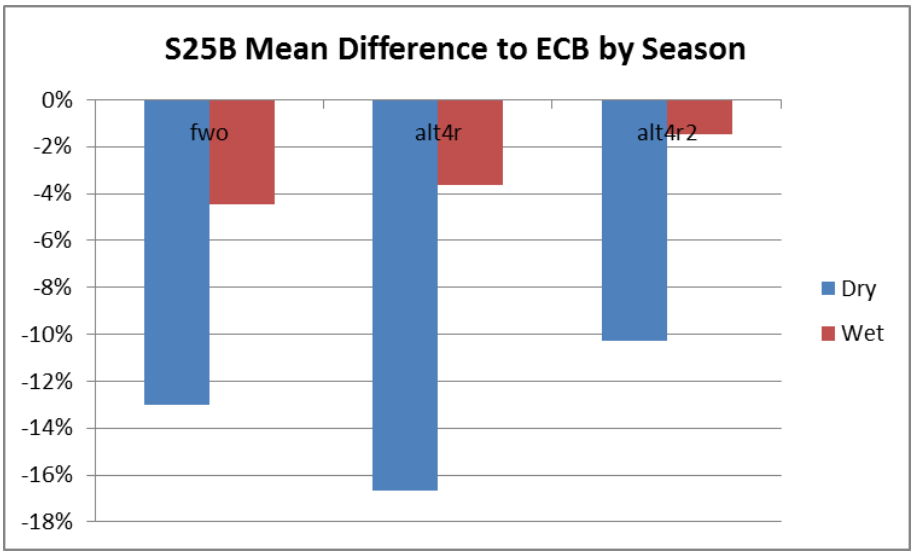

Figure 20 Histogram showing the mean difference (percent) in flow at the S25B structure for FWO, Alt 4R, and Alt 4R2 compared to ECB.

In South-central Bay, simulations indicate an increase in annual mean flows at four of the five structures under Alt 4R2 compared to ECB. The fifth structure (S123) shows no change in annual mean flows between Alt 4R2 and ECB. The maximum increase is at the S21 (C-1 Canal) where Alt 42 flow is 14 percent greater than ECB. All structures show increases in flows during both seasons, except S123, which shows a very small reduction in flow during the dry season for Alt 4R2 compared to ECB (not shown). Alternative 4R also shows increases in annual mean flows compared to ECB for S21, S21A, and S20F compared to ECB with no change at the S123 and S20G structures. Alternative 4R2 also shows increases (2 to 13 percent) in annual mean flows above FWO for all South-central Bay coastal structures. Results from S-20G (Military Canal) are not applicable as the sole function of this canal is to provide stormwater drainage from Homestead Air Reserve Base and is not affected by the overall operation of the South Dade Conveyance System (*i.e.*, CEPP would have no effect on this canal).

For South Bay (Manatee Bay and Barnes Sound), results show no change in flows at S-20, but significant decreases in annual flow for FWO, Alt 4R, and Alt 4R2 compared to ECB. Those reductions range from 50 percent (Alt 4R2) to 60 percent (FWO). Flows at this structure are relatively small compared to most other coastal structures, but this flow is important for establishing and maintaining brackish salinities in Manatee Bay and Barnes Sound. While the desired restoration scenario for Manatee Bay includes the reduction of large, pulsed discharges through the S-197 structure, it is important to emphasize that the volume of water lost to the reduction in flows in FWO and the alternatives is not captured by another feature and redistributed to the region. This results in a net loss of freshwater flows to this particular region. It is speculated that the CERP C-111SC Project is responsible for the simulated reduction in flows at the S197. Alternative 4R2 provides slightly more flows at the S197 compared to FWO.

Flow at Divide Structures

Flows at select divide structures were evaluated partly because these structures provide flow east across the Atlantic Ridge to Biscayne Bay and partly because of model uncertainty associated with output at the coastal structures. Coastal structures are along the edge of the model domain which increases uncertainty. Only flows at the S-338 (C-1 Canal), S-194 (C-102 Canal), and S-196 (C-103 Canal) were included in the analysis. Results show that Alt 4R2 provides 24 to 51 percent more flow to Biscayne Bay compared to ECB (Table 11). Alternative 4R2 provides 28 percent and 4 percent more flows than FWO at the S338 and S194 structures, respectively. However, Alt 4R2 provides slightly less flow (-1 percent) at the S196 compared to FWO. Alternative 4R provides slightly less flow at each of the three structures compared to ECB and significantly less flow than FWO at S194 and S196. It should be noted that the value of including analyses of divide structure flows is diminished because the latest CEPP runs includes withdrawals from wells east of those structures for water supply, which will affect groundwater levels east of the ridge, thereby affecting groundwater flow into the conveyance canals.

Table 11. Mean annual flows at the three divide structures that provide freshwater flows across the Atlantic Ridge to south-central Biscayne Bay for ECB, FWO, Alt 4R, and Alt 4R2 simulations.

	ECB		**FWO**		**Alt 4R**			**Alt 4R2**		
Structure	Mean Flow	% Diff from FWO	Mean	% Diff ECB	Mean Flow	% Diff ECB	% Diff FWO	Mean Flow	% Diff ECB	% Diff FWO
S338	58.9	3	57.1	-3	58.0	-2	2	72.9	24	28
S194	21.0	-19	25.8	23	20.8	-1	-19	26.8	28	4
S196	9.0	-34	13.7	52	8.8	-2	-36	13.6	51	-1

2. Performance Measure Results

a. Florida Bay

The first of the Florida Bay salinity PM results (regime overlap metric) is shown in Figure 21. Alternatives are compared to FWO and ECB, and wet season and dry season results are shown. The plots show lift in both seasons for all regions (except the east region during the dry season) for Alt 4R and Alt 4R2 compared to FWO and ECB. Lift during the wet season is higher than during the dry season for most regions. Alternative 4R2 performs slightly better than Alt 4R in most regions, but the differences are very small. Note that conditions in Florida Bay are always better (relatively closer to the Natural System Model [NSM] target) in the wet season than dry season – dry season conditions are typically very poor.

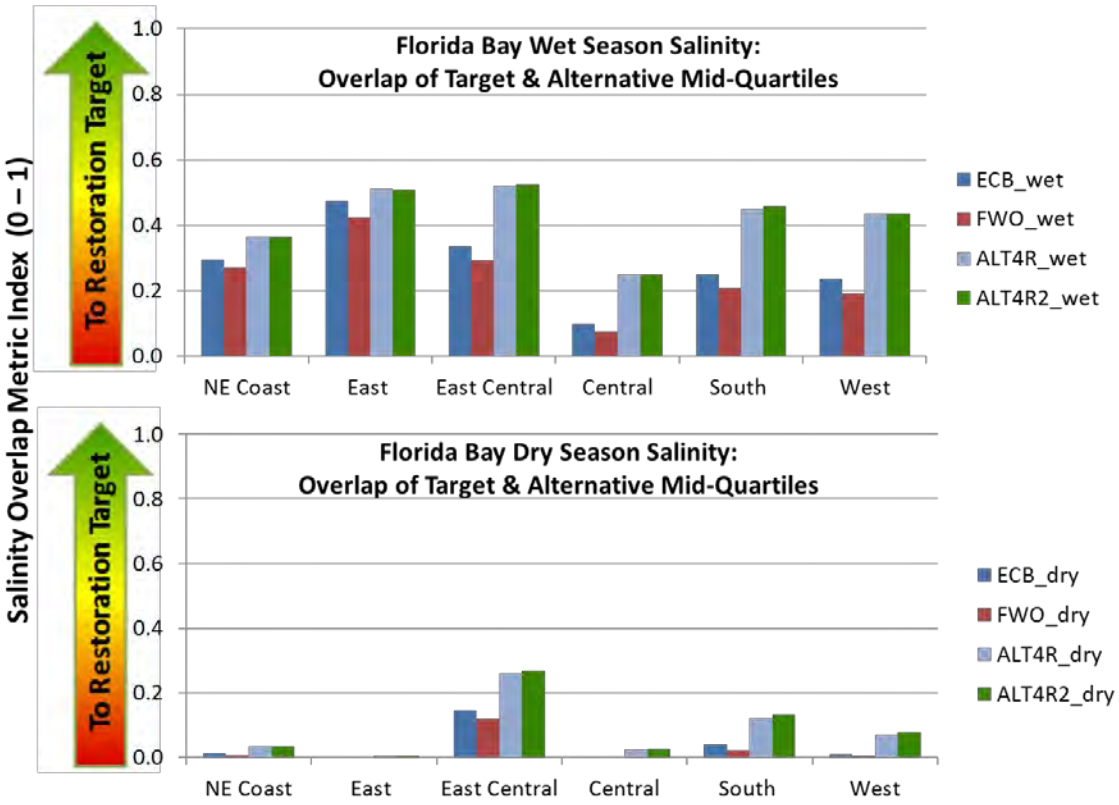

Figure 21. Histogram plot of salinity regime metric comparing CEPP alternatives, Alt 4R and Alt 4R2 to FWO (wet season shown in top plot and dry season in bottom plot). Dry season values from alternatives in the East zone are zero.

The high-salinity metric scores for Alt 4R and Alt 4R2 compared to FWO and ECB are shown in Figure 22. This metric indicates the frequency of unnatural and harmful high salinity conditions. It shows a similar lift pattern to that of the regime metric, with generally more lift occurring in the wet season except for the East-Central Region. In the South and West regions there is about a 65 percent increase in the metric index value during the wet season for both CEPP alternatives compared to FWO. During the dry season, both alternatives show about an 85 percent increase in the index score compared to FWO. Again, differences between Alt 4R and Alt 4R2 are slight compared to differences of alternatives relative to FWO. In several sub-regions, Alt 4R and Alt 4R2 appear to be equal. Also, the East Region shows almost no lift from Alt 4R or Alt 4R2 in either season over FWO. Note that both CEPP alternatives fall well short of the target during both wet and dry seasons.

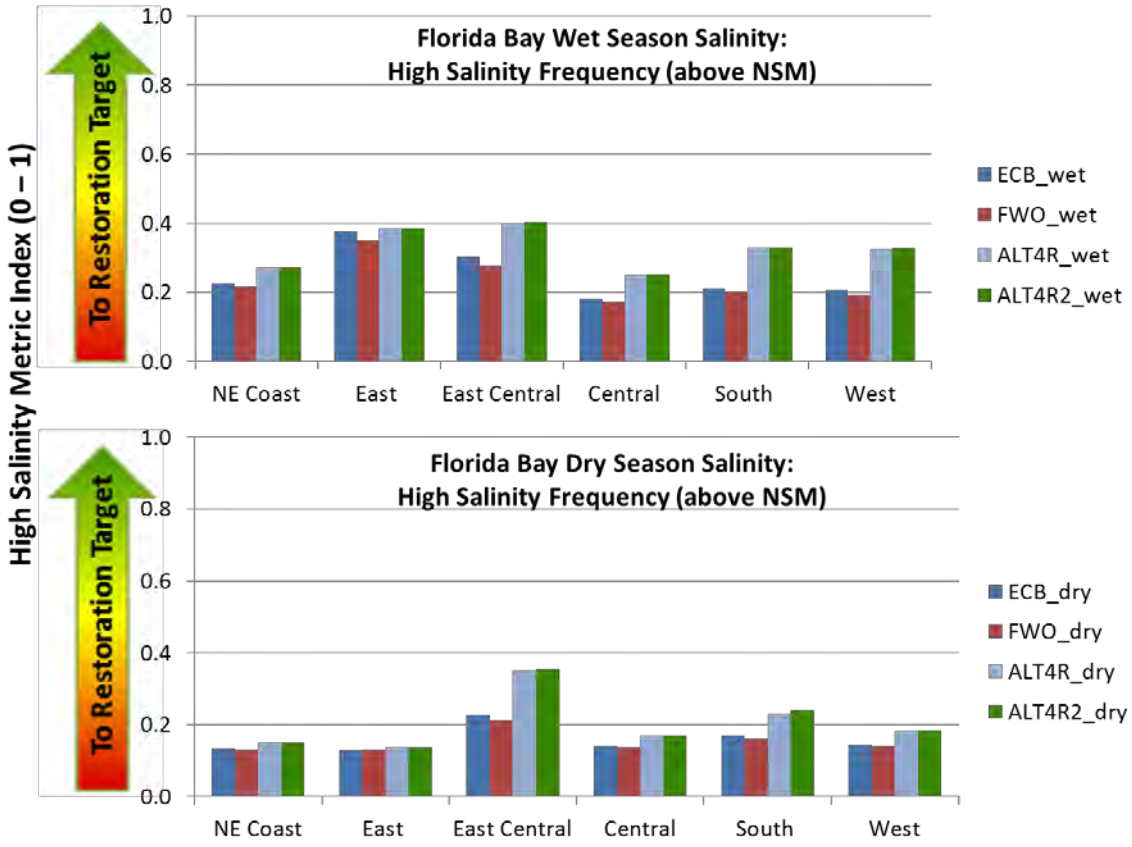

Figure 22. Histogram plot of high-salinity metric index comparing Alt 4R and Alt 4R2 to FWO and ECB (wet season shown in top plot and dry season in bottom plot).

The third of the three Florida Bay salinity PM metrics—the salinity offset—is shown in Figure 23. This metric is the difference between an alternative's (FWO, ECB, Alt 4R, or Alt 4R2) mean salinity and the NSM target's mean salinity. The values are absolute salinity units ("psu" is practical salinity units, which are nearly equivalent to parts per thousand). Lower values mean the alternative is closer to the NSM target (*i.e.*, more desirable). The results show that Alt 4R and Alt 4R2 perform almost equally and generally decrease mean salinities about 1.5 to 2 psu closer to the NSM target compared to FWO, except in the East Zone, which is more hydrologically isolated from the Everglades than other zones. In the East Zone the two CEPP alternatives decrease mean salinities by only about 0.5 psu compared to FWO. Note that this salinity offset metric was not included in habitat unit calculations of the CEPP benefits analysis because it is not a zero-to-one scale index that can be multiplied by acres.

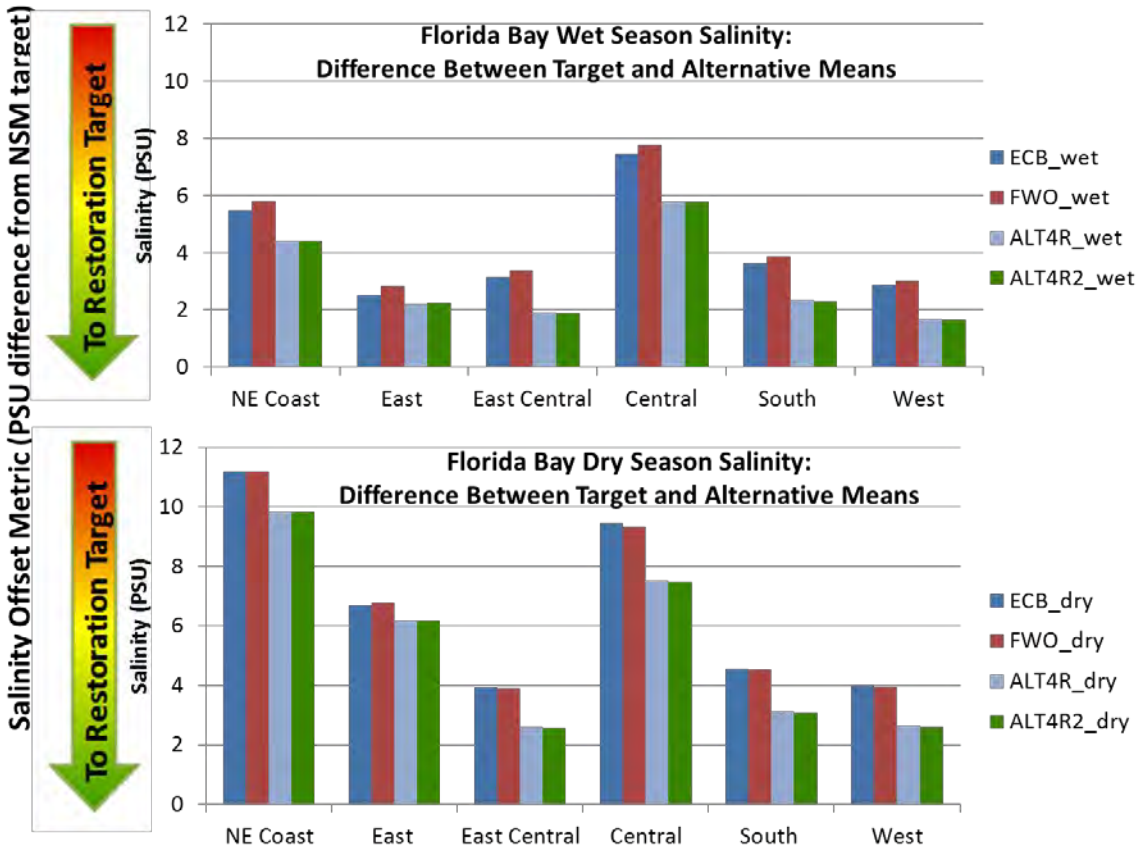

Figure 23. Histogram plot of salinity offset metric index comparing CEPP alternatives, Alt 4R and Alt 4R2 to FWO and ECB (wet season shown in top plot and dry season in bottom plot.

b. Biscayne Bay

Results of the RECOVER salinity PMs for Biscayne Bay are shown in Table 12. These PMs utilize daily, monthly, or seasonal flow envelope targets at select coastal structures as a proxy for desired salinity conditions in the bay. For each PM, the percentage of time, the daily flows are within the flow target envelope are compared. The primary focus of this evaluation is to compare the Alt 4R2 against ECB to ensure that the TSP does not impair existing conditions in the bay. In North Bay, there is a PM only for the S29 coastal structure. Results indicate Alt 4R2 daily flows fall within the target envelope 5 percent more of the time than ECB, but 6 percent less time than FWO.

In Central Biscayne Bay, salinity PMs have been developed only for the S26/S25/S25B and S22 structures. For the S-22 PM, Alt 4R2 indicates no change in performance compared to ECB. However, Alt 4R2 shows a 3 percent reduction in mean flows past this structure compared to ECB. For the S26/S25/S25B PM, Alt 4R2 shows a slight reduction in performance compared ECB, which is supported by a slight reduction in flows under Alt 4R2. The TSP shows improved performance compared to FWO for both PMs.

In South Bay, salinity PMs have been developed for all structures except the S20G. Results show slight improved performance at the S123 for Alt 4R2 compared to ECB. Results for the S21, S21A, and S20F show slightly reduced performance for Alt 4R2 compared to ECB. However, mean flows at each of these structures under Alt 4R2 is slightly greater than ECB. It is unclear why there is this discrepancy between mean flows and PM performance, but it may be due to differences in timing of flows and magnitude of releases.

In the Manatee Bay/Barnes Sound region, there is one PM available for use at the S197 structure. Results show a reduction in percent time the flows are within the PM of 1 percent for the TSP. Also, the flows at S197 are 50 percent less for Alt 4R2 compared to ECB. This reduction is supposedly attributed to the C-111SC Project, but it should be noted that these reductions may exacerbate harmful hypersaline events that occur in the receiving bodies of Manatee Bay and Barnes Sound.

Table 12. Mean flow and performance measure results for Biscayne Bay coastal structures.

	ECB	**ECB**	**FWO**	**FWO**	**FWO**	**Alt 4R2**	**Alt 4R2**	**Alt 4R2**
Structure	Mean Flow	% within PM	Mean	% Diff ECB	% within PM	Mean	% Diff ECB	% within PM
S29	282.2	68%	372.3	32%	79%	310.8	10%	73%
S26/S25/S25B	243.6	35%	228.4	-6%	32%	240.2	-1%	34%
S22	121.2	12%	113.9	-6%	11%	117.7	-3%	12%
S123	17.5	21%	17.3	-1%	21%	17.7	1%	22%
S21	101.3	67%	101.9	1%	66%	115.3	14%	65%
S21A	58.2	46%	60.6	4%	46%	62.8	8%	44%
S20F	145.7	43%	154.7	6%	43%	154.9	6%	42%
S197	22.8	3%	9.2	-60%	1%	11.3	-50%	2%

3. Habitat Units

Total HUs generated in Florida Bay by ECB, FWO, Alt 4R, and Alt 4R2 simulations are provided in Table 13.

These results indicate that the FWO provides less HUs than the ECB, even though the FWO condition includes the implementation of several CERP and non-CERP projects with the capability of improving the timing, quantity, and quality of flow to Florida Bay (*e.g.*, C-111 Spreader Canal Western Project). The overall negative ecological trends, continued loss of resources through landscape alterations and degradation of habitat, are expected to continue into the future without better restoration efforts. More natural hydroperiods produced

by the implementation of these restoration projects would assist in slowing the continued degradation of existing habitat function within the WCAs, ENP and Florida Bay; however, until the completion of CERP, current problems plaguing the areas are expected to continue and worsen in some areas.

Table 13. Total habitat units for ECB, FWO, and Alts 4R and 4R2.

Florida Bay Zone	Habitat Units			
	Existing Condition Baseline	FWO Condition	Alt 4R	Alt 4R2
West	23,693	20,534	39,488	41,068
Central	9,025	8,205	13,948	14,769
South	16,614	14,659	27,364	28,341
East Central	21,984	20,225	33,416	34,295
North	2,154	2,028	2,534	2,661
East	9,440	8,685	9,818	9,818
Total Florida Bay	**82,910**	**74,336**	**126,568**	**130,952**

Habitat unit results for the FWO were subtracted from Alt 4R and Alt 4R2 to produce HU lift (Table 14). Results indicate that Alt 4R2 provides greater lift in Florida Bay relative to the FWO condition compared to Alt 4R. Surprisingly, the total HU increase in Florida Bay for Alt 4R2 compared to FWO is 76 percent and the Alt 4R2 lift in the West Zone is 100 percent. These are very high lift values.

Table 14. Habitat unit lift of Alt 4R and Alt 4R2 over FWO.

Florida Bay Zone	Habitat Units	
	Alt 4R	Alt 4R2
West	18,954	20,534
Central	5,743	6,564
South	12,705	13,682
East Central	13,191	14,070
North	506	633
East	1,133	1,133
Total Florida Bay	**52,232**	**56,616**

The relatively small improvement in salinity in the bay brings into question the seemingly large HU lift, especially in the west and south zones. This large proportional increase is perhaps a consequence of three factors. First, the base condition of Florida Bay salinity, estimated in both ECB and FWO model runs, is poor, especially in the north and central zones. With low scores, a small increase in a PM score can yield a large relative improvement. If the base condition was closer to the restoration target, it would take much more flow to yield the predicted improvement. This aspect of proportional gains is a consequence of the scaling of all PMs used in the benefits analysis; it is not unique to Florida Bay metrics. Second, the absolute amount of additional freshwater flows (increase above ECB and FWO flows) delivered to

Florida Bay with all CEPP alternatives is not small. Comparison of flows down SRS (Transect 27) shows Alt 4R and Alt 4R2 increase mean annual flows to Florida Bay over FWO flows by 164,000 ac-ft and 166,000 ac-ft, respectively. This corresponds to a 28 percent increase in flow compared to FWO. Additionally, Alt 4R and Alt 4R2 increase mean annual flows to Florida Bay over FWO flows by 10,000 ac-ft and 8,000 ac-ft, respectively, in Taylor Slough. Finally, the increase in the PM indices is multiplied by thousands of acres for each zone, which translates into large HU values.

Another point to make about the HUs analysis is essentially a repeat of the point made above regarding the salinity analysis; that is, the calculation of HUs does not include information on the statistical significance of differences between alternatives. It is likely that the difference between either Alt 4R and Alt 4R2 and FWO is significant, but it is unclear if the relatively subtle difference between Alt 4R and Alt 4R2 is statistically significant.

There is one obvious inconsistency regarding Alt 4R and Alt 4R2 performance. As noted above, Alt 4R provides slightly more water to Taylor Slough compared to Alt 4R2, yet salinity performance and HUs are greater for Alt 4R2 compared to Alt 4R in the Florida Bay zones that are fed by Taylor Slough (North, East-central, and Central). Also, it should be noted that all the original CEPP alternatives (Alt 1, Alt 2, Alt 3, and Alt 4) provided noticeably more benefits to Florida Bay than either Alt 4R or Alt 4R2.

4. Other Eco Tools Results

This section provide results from the four habitat suitability indices applicable to Florida Bay—juvenile crocodiles, juvenile spotted seatrout, pink shrimp, and submerged aquatic vegetation. Additional results from these four HSIs can be found in Annex E of the CEPP draft PIR and EIS.

a. Juvenile crocodiles

Results from applying the salinity data into the juvenile crocodile HSI is shown in Figure 24. The plot shows the difference between Alt 4R2 and FWO, ECB, and Alt 4R using an index of juvenile crocodile growth and survival at sites along the northern Florida Bay shoreline for all years of the model runs. Sites in the orange box historically have had the most crocodile nesting. Results indicate that there is no difference between Alt 4R and Alt 4R2 at any of the sites. Alternative 4R2 performs better than FWO at all sites except Joe Bay with the crocodile index increasing a maximum of about 0.1 at the Terrapin Bay site. Alternative 4R2 performs better than ECB at all sites except Garfield, where the HSI value is 0.11 less under Alt 4R2 conditions than ECB. Alternative 4R2 shows no improvement over FWO or ECB at the Joe Bay site. It is worth noting that determination of any statistical significance between alternatives is not possible.

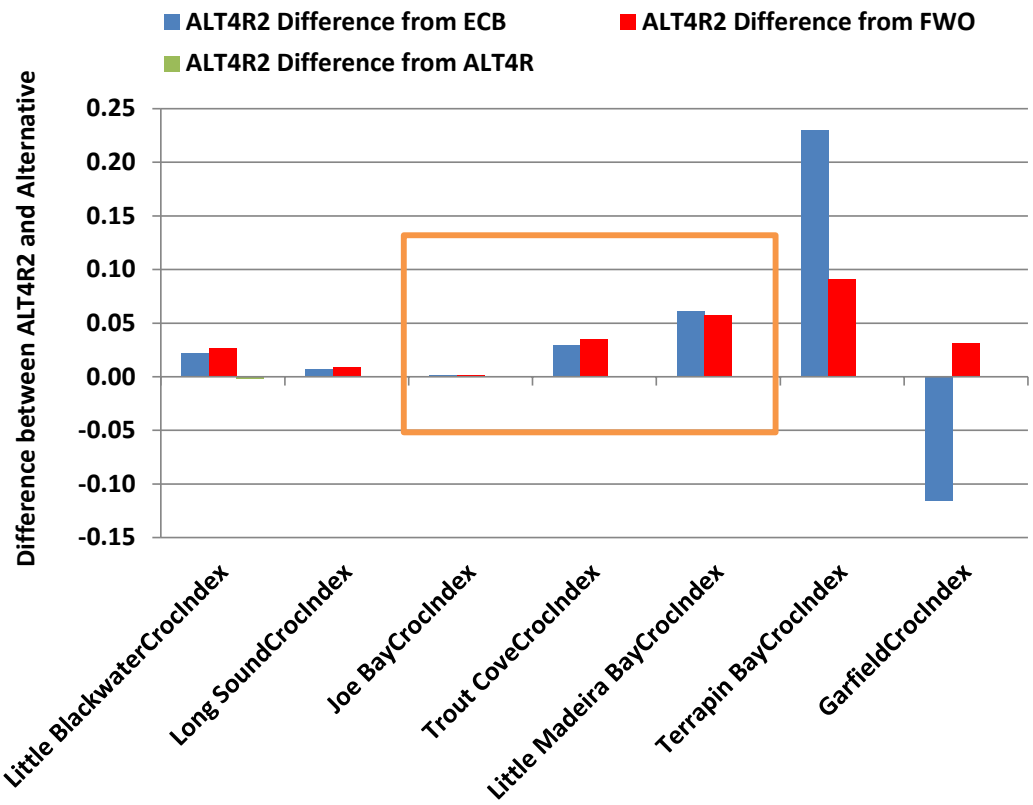

Figure 24. Histogram showing the comparison of the juvenile crocodile HSI results for seven locations of known crocodile nesting areas. Index values show lift provided by Alt 4R2 compared to ECB, FWO and Alt 4R. Sites in the orange box historically have had the most crocodile nesting.

Results of the juvenile crocodile HSI performance for an extremely dry year (1989) are shown in Figure 25. Again, there is no difference in performance between Alt 4R and Alt 4R2. Alternative 4R2 shows almost no lift over FWO at the Joe Bay, Trout Cove and Garfield Bay sites. Also, Alt 4R2 shows very small lift at the other sites, with lift ranging between 0.02 and 0.05 index units. Overall, Alt 4R and Alt 4R2 provides very little crocodile habitat improvement compared to ECB and FWO during the simulated dry year.

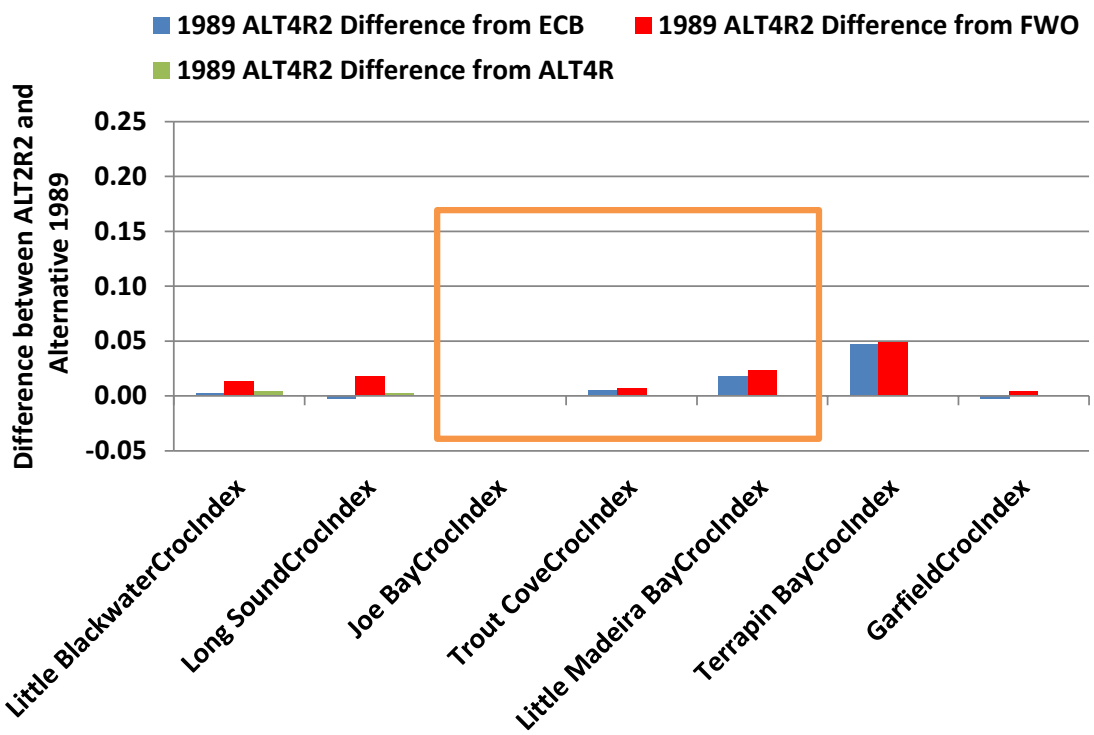

Figure 25 Histogram comparing the results of the juvenile crocodile HSI for seven locations of known crocodile nesting areas during 1989 (a very dry year). Index values show lift provided by Alt 4R compared to ECB, FWO and Alt 4R. Sites in the orange box historically have had the most crocodile nesting.

b. Juvenile spotted seatrout

The juvenile spotted seatrout HSI model was run on the monthly average salinities from May through November to coincide with spotted seatrout juvenile recruitment for all CEPP scenarios. The HSI model output from the salinity monitoring stations in Florida Bay was gridded to produce spatial distributions of HSI scores for each month. This allowed for the calculation of area of optimal juvenile spotted seatrout habitat in square kilometers. The mean area of optimal juvenile spotted seatrout for the entire period of record for NSM, ECB, FWO, Alt 4R, and Alt 4R2 is shown in Figure 26. The error bars reflect the standard error for the data set. The NSM serves as the target for this analysis since it had the largest mean area of optimal juvenile spotted seatrout habitat at 368 km^2. The FWO had the lowest optimal habitat followed by ECB. Alt 4R and Alt 4R2 show improvements over FWO and ECB. Alternative 4R2 provides 28 km^2 additional optimal habitat compared to FWO, which is about a 10 percent increase. Results from a Mann-Whitney U-test indicate that Alt 4R2 had statistically significantly higher areal extent of optimal habitat for juvenile spotted seatrout (α=0.1) compared to FWO. However, there was no significant differences between Alt 4R and Alt 4R2 (α=0.1). An alternative way to examine these data is to calculate the percent increase towards the target. This calculation reveals that Alt 4R2 provides a 33 percent increase toward the target compared to FWO ([Alt 4R2 – FWO] ÷ [NSM – FWO]).

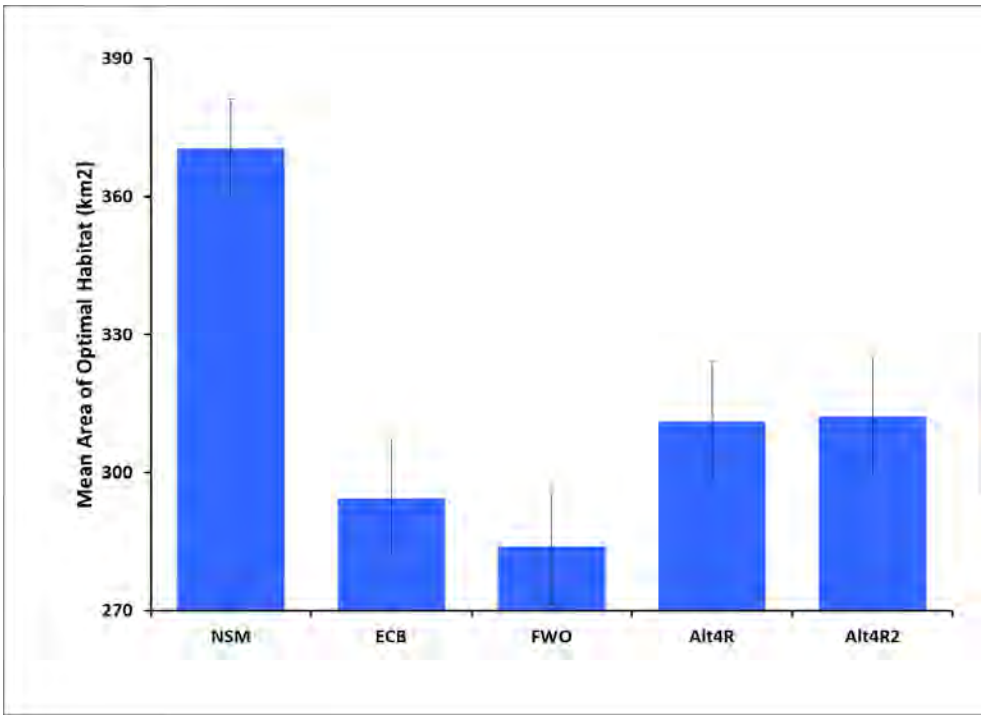

Figure 26. Histogram showing the mean optimal habitat area of the juvenile spotted seatrout HSI for NSM (target), ECB, FWO, Alt 4R, and Alt 4R2.

d. Pink shrimp

Results of the 41-year simulations of potential harvests from Whipray Basin in north central Florida Bay and Johnson Key Basin in western Florida Bay are shown in Figure 27. Results show the lift above FWO and ECB (as percent) in potential harvests for Alt 4R2 only. The equation for calculating lift as percent of FWO was as follows: 100 x (Alt_x – FWO) / FWO, where Alt_x is simulated potential harvest from a given alternative and FWO is simulated potential harvest from FWO salinity conditions. The equation for ECB substitutes ECB for FWO. Alternative 4R2 provides minimal lift in potential harvest over FWO and ECB (generally less than 0.7 percent). The lift from Alt 4R2 is greater in Whipray Basin than in Johnson Key Basin, but only by a very small amount. Also, Alt 4R2 offers greater improvement over FWO than over ECB in both basins.

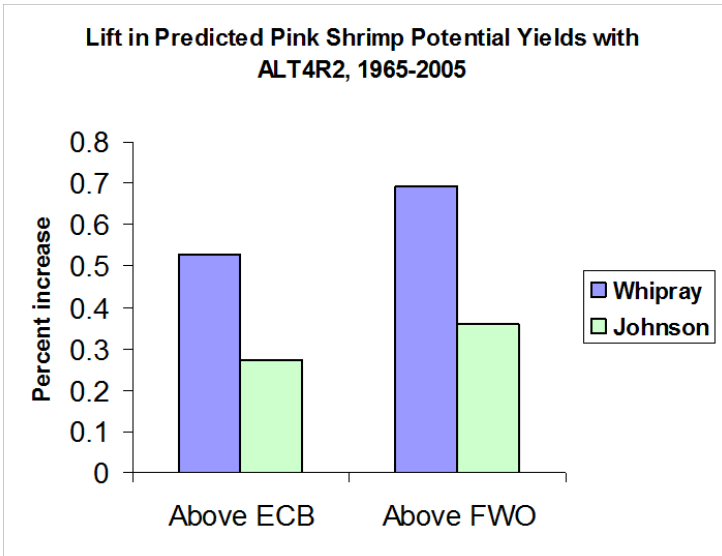

Figure 27. Histogram showing the results of the potential pink shrimp harvest in Whipray Basin for the 1965-2005 period of record based on model output. Bars show percent increase over ECB and FWO.

5. Potential Adverse and Beneficial Effects of the Project

a. General Fish and Wildlife Effects and Benefits

The effects on fish and wildlife resources in the SCS as a result of CEPP are anticipated to be mostly beneficial to Florida Bay and the southwest Florida coast through the restoration of estuarine, tidal wetland and freshwater wetland habitat types. The project should provide relatively small benefits to these nearshore estuarine areas by maintaining a lower salinity than current conditions or the FWO conditions resulting in a slightly healthier coastal estuarine community. Increased stage and flow in tidal and freshwater wetlands is anticipated to begin the restoration and enhancement of these wetland community types. Although the beneficial effects in Florida Bay and the southwest Florida coast are relatively small, they are moving in the right direction and will likely be increased as other CERP projects are constructed and implemented. However, negative impacts to fish and wildlife resources may be possible due to the quality of water that will be diverted to the wetlands and estuaries. Past activities in and around ENP have resulted in a legacy nutrient pool that remains sequestered in the soil and plant tissues. Increased water deliveries may result in the mobilization and redistribution of soil and plant tissue nutrients downstream, which could increase the frequency, spatial extent, duration and/or magnitude of algal blooms in Florida Bay and the lower southwest Florida coast.

The analysis described earlier indicates that flows to Biscayne Bay may be reduced in some areas, which could increase salinity in the bay. Such increases in salinity would have the opposite effect of what is predicted in Florida Bay and the southwest Florida coast. That is, a raised salinity regime would result in further degradation of nearshore estuarine and coastal wetland communities, which would negatively affect fish and wildlife resources.

Construction-related Effects

There are no CEPP construction features in the footprint of the SCS region; therefore, there are no construction-related effects to this area from CEPP.

Operational Effects

Upstream operations could have profound and significant effects to the SCS. CEPP modeling indicates that pump stations, some of which are part of the seepage management features, will be operated to provide additional freshwater flow to Florida Bay and the southwest Florida coast via SRS and Taylor Slough. Given appropriate water quality, these additional flows will certainly be beneficial to fish and wildlife resources in those areas. However, modeling results indicate that the pumps and seepage features reduce flows to Biscayne Bay in the central and southern regions, during both wet and dry seasons. The magnitude of these reductions could significantly impact fish and wildlife resources in these areas. The Service believes it will be critical to monitor flows at the Biscayne Bay coastal water management structures to ensure that operations associated with CEPP seepage management in the urban areas to the east of the CEPP study area will not negatively impact Biscayne Bay.

Although not in the SCS region, it should be reiterated that the operation of high-volume pumps to move water in the CEPP project area represents a potential threat to fish and other aquatic resources. Pumps can cause direct loss of fish, amphibians, invertebrates, and other aquatic life through impingement and entrainment. Also, operation of pumps associated with the project will divert water south to transitional wetlands in the SCS, which may alter this habitat over time. The significance of this impacted area on fish and wildlife, including listed species, is unclear, although it is anticipated to increase habitat value for fish and wildlife.

Water diversion operations also can cause the undesirable spread of non-native fish, such as the Asian swamp eel (*Monopterus albus*), butterfly peacock (*Cichla ocellaris*), and various cichlid species. However, many of these non-native species require relatively deep-water habitat, little of which is found in the wetlands of the project area. Due to the sensitivity of the habitat in the project study area, care should be taken in final project feature design and operation to protect against undesired spreading of non-native fish.

V. RECOMMENDATIONS/CONSERVATION MEASURES

A. Northern Estuaries

- It is imperative that all of the IRL-S components (not just C-44 reservoir/STA) and C-43 reservoir are operating when CEPP is implemented to ensure that dry season water is delivered to the CRE and SLE as obligated prior to routing the water south. The Service recommends that the Master Implementation Sequencing Plan and Integrated Delivery Schedule be updated to ensure that interdependent projects and/or project components are linked in an effort to provide restoration optimization and avoid unanticipated adverse effects.

- The Service believes that in future increments of CEPP, the Corps should explore opportunities to provide additional storage to protect the CRE, SLE, and IRL estuaries from damaging Lake Okeechobee regulatory releases. The Service recommends that the Corps start the planning process for the next increment of CEPP as soon as this Final PIR/EIS is completed. The next CEPP increment should include adequate storage of high volume lake regulatory releases that could be held and redirected south when needed.
- The Service recommends that a re-evaluation of base flow criteria for the CRE and SLE, especially in the dry season, be conducted during the development of the CEPP Operations Manual. This effort must include, but is not limited to, "lessons learned" from the Corps' Periodic Scientists conference calls for Lake Okeechobee and the Northern Estuaries as well as data from the RECOVER oyster mesocosm studies currently underway.
- The Service recommends that the Corps or the District pursue funding for oyster reef restoration in the CRE and SLE by placement of hard substrate to increase the likelihood of oyster reef expansion. The restoration target for the CRE is 400 acres of suitable oyster habitat with at least 100 acres of living oyster reefs. The restoration target for the SLE is to provide approximately 900 acres of suitable oyster habitat. Although the CEPP TSP may improve salinity conditions for oysters and associated flora and fauna, oyster expansion is directly tied to the availability of hard substrate for recruitment and colonization.

B. Lake Okeechobee

- The water regulation schedules that agencies use to decide when, where, and how much water to release from the lake is a critical component in maintaining a proper water balance throughout south Florida. The CEPP is an added feature in south Florida that will increase the amount of lake level management needed for both the existing regulation schedule and the yet to be proposed regulation schedule that is to be implemented prior to the A-2 FEB. Prudent water management under the LORS is served when agencies can coordinate with stake holders in a timely manner so that management decisions can be made quickly (within days) across the full range of water conditions affecting Lake Okeechobee and surrounding areas.
- We recommend that Lake Okeechobee stage not be kept higher than what would be expected under the existing LORS until the FEB has been in operation for at least 6 months to allow testing of the integrity and flow capacity of the water management infrastructure for the FEBs. This would help to preclude the FEB going off-line for an unknown structural reason and then having to potentially release additional "stored" water from the lake to the estuaries where it may be ecologically damaging.
- There was at least one event in the modeling which indicated a potentially significant beneficial effect of CEPP on the littoral zone of Lake Okeechobee (1987 event). We recommend that the Corps evaluate and discuss in the PIR why that year indicated a benefit when other low-stage events in the simulation did not respond similarly to Alt 4R2 (or Alt 4R). It is possible that project benefits to alleviating environmental impacts from droughts were not fully recognized. We also recommend that the Corps evaluate severe drought water years outside of the Period of Record (*e.g.*, 1954-56, 2007) to assess whether or not CEPP provides environmental benefits during those occurrences.

- The existing PM for evaluating project effects on snail kites is difficult to apply to Lake Okeechobee. The Service is committed to assist in developing reliable and sufficiently sensitive PMs to specifically analyze the effects of water levels on snail kite feeding and nesting and in the lake.

C. Everglades Agricultural Area

- The initial operating plan should specifically address when water would be discharged from Lake Okeechobee and the EAA to the FEBs. The final operating plan should also specifically address when water would be discharged from the FEBs to the STAs.
- The operating manual(s) should be consistent with project assurances.
- The Service supports the inclusion of existing agricultural canals in the FEB to serve as deep water refugia for aquatic organisms during extreme dry periods or when it is emptied for operations or maintenance.
- The Service recommends optimization of FEB design, construction, and operations in a manner that considers potential impacts to fish and wildlife and continues through the detailed design and construction phases. For example, the Corps should consider a multiple-cell design for the FEB to increase operational and management flexibility.
- Prior to final design and the formulation and implementation of a final operating plan for the FEB, the Corps should consult with the Service to determine whether initiation of consultation for listed species, is needed. As more information becomes available in the detailed design documentation and operations manual, the Service will continue its review of the potential effects of FEB components on listed species (and fish and wildlife in general).
- Although drydowns within the FEBs may concentrate and improve prey availability, the Service recommends optimizing operations to prevent or minimize drydown to land surfaces in order to minimize the potential for remobilization of nutrients and/or contaminants that could be directly ingested by, or ingested by prey of, the bald eagle or the endangered wood stork (Service 2005). If the ecological risks from nutrients and/or contaminants to listed species become evident through sampling plans and monitoring, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.
- The Service recommends that the Corps notifies the Service and FWC in the event colonial or solitary wading bird nests are observed within the FEB construction footprint.
- The Service recommends that the Corps and District cooperate with research-based efforts to provide for long-term ecological monitoring of indigo snake densities and habitats in the project area.
- The Service recommends the Corps and the District consult with the FWC regarding habitat needs and additional conservation recommendations for state-listed species.
- The Florida burrowing owl is a State-listed species of special concern and protected under the Federal Migratory Bird Treaty Act (MBTA). During a site visit in 2003, burrowing owls were observed within Compartment A of the EAA Project footprint (Service 2003) which is adjacent to FEB A-2. In accordance with MBTA, the Corps and the District must perform a

burrowing owl nest survey within the FEB footprint prior to construction. The Service further recommends the survey take place immediately prior to construction in order to ensure owls have not nested in the area between the time of the survey and construction. If the project is to be phased, surveys should be performed immediately prior to construction of the various phases. Burrowing owls could also potentially be present along canal banks and embankments.

D. Greater Everglades

- The Service believes that there was a missed opportunity for this project to help resolve the long-standing problem of restoring the historic flow path from WCA-3A through WCA-3B into NESRS. During this project the Department of Interior and National Park Service indicated their intent to render the Tamiami Trail hydrologically invisible, the most critical feature on the road to restoring the historic flow path. Additionally, throughout the planning process, we were told that WCA-3B seepage management would be a part of the project. We recommend the Corps start the planning process for the next phase of CEPP as soon as this Final PIR/EIS is approved. The next CEPP phase should include adequate WCA-3B seepage management and increased WCA-3B outflow capacity such that the historic flow path can be re-established.
- The Service recommends that the Blue Shanty Levee be constructed last and only if necessary. An adequate monitoring plan for WCA-3B resources should be implemented and the full project, minus the Blue Shanty levee, should be allowed to function for several years to assess the need for the levee.
- If the Blue Shanty Levee is constructed in WCA-3B, it should be placed on the same footprint as the existing agricultural canal as much as possible, to minimize impacts to relatively pristine wetlands. North of the existing agricultural canal the levee should jog east or west to avoid bisecting three healthy tree islands. The leading tree island researchers in the Everglades should be consulted to determine whether the tree islands should be contained within the flow way or outside of it.
- The Service recommends the Corps implement a robust endangered species monitoring plan and assesses the data in coordination with the Service and other wildlife agencies to timely modify operations for the protection of those species. This is most critical for the imperiled CSSS which stands to receive the most impact from this project. It will be imperative, as will be stated in the Service's forthcoming Preliminary Biological Opinion, that consecutive years, with either a reduction in dry nesting days or longer than recommended hydroperiods in CSSS-E, will need to be avoided. Likewise, all S-12, S-343 and S-344 seasonal closures for protection
of CSSS should be followed consistent with ERTP. Service sparrow biologists have recommended that closure dates for S-12B be modified to coincide with those for S-12A to ensure appropriate nesting conditions are consistently met in CSSS-A.
- The initial operating plan has not been thoroughly defined for this project. We have compared alternatives and selected a plan based solely on the model's general interpretation of operations. The Service recommends that the Corps define an operational plan to the extent possible and assess any changes to performance it may have.

- The Corps should immediately begin a new study to modify the WCA-2A regulation schedule. As the system is decompartmentalized and WCA-2A is no longer needed to hold large amounts of water, more attention should be paid to its ecological restoration.

E. Southern Coastal System

- Given the possible flow reduction that may occur in central and southern Biscayne Bay as a result of CEPP, the Service recommends frequent evaluation of flow data collected at the coastal water management structures in Miami-Dade County to ensure that any reductions in flow can be detected early and alleviated through operational modifications. Flow reductions, if they occur, would increase salinity in this region of Biscayne Bay which may negatively impact flora and fauna in nearshore areas, including juvenile crocodiles. This monitoring should be included in the CEPP Adaptive Management (AM) Plan.
- A robust water quality monitoring network should be established at primary discharge areas along the southwest Florida coast and Florida Bay that would be poised to detect changes in nutrient concentrations in these areas.
- The ENP Marine Monitoring Network (MMN) should be maintained at its current level of operation. This network is critical to determining if CEPP implementation will, in fact, result in ecologically-beneficial salinity changes in Florida Bay. If salinity was to increase as a result of CEPP, this could cause impacts to Federally-threatened crocodiles and other flora and fauna. ENP's MMN is our primary tool to evaluate salinity in Florida Bay.
- Current funding provided by the CERP Monitoring and Assessment Plan for juvenile spotted seatrout and SAV should be continued and expanded, if possible, to determine if predicted ecological benefits to seatrout and SAV result from salinity improvements provided under CEPP.
- Monitoring of juvenile crocodiles and pink shrimp in Florida Bay should be reinitiated to determine if predicted ecological benefits to these species are realized.
- Upstream storage components (reservoirs, STAs, private land incentive programs) should be considered in any future CERP increments to provide increased water to Florida Bay and Biscayne Bay.

VI. SUMMARY OF POSITION

A. Northern Estuaries

The Service finds that the modeling simulations of hydrology, salinity, and associated ecology of the CRE showed some reductions in high-flow discharges from Lake Okeechobee when comparing the TSP to the FWO. Although the difference was not substantial, the change is "in the right direction" for reducing high peak flow events which is a project objective. Modeling predictions of the TSP indicated a substantial decrease in high-flow events in the SLE as well as a decrease in the number of times low-flow criteria were not met. These combined flow differences should increase the amount of time that the estuary is in the preferred salinity range

and may prove to be beneficial to seagrass and oyster abundance when suitable substrate is available. Since this project is only the first increment of a larger CEPP we believe that future increments should include increased storage to provide operational flexibility to further reduce high flows and increase base flows needed to achieve optimal estuarine habitat restoration. Future operations of the IRL-South and C-43 Reservoir CERP projects should also be optimized to assist in estuary restoration.

B. Lake Okeechobee

The Service also finds that the project would provide benefits south of Lake Okeechobee with an acceptable balance of risks to the ecology of Lake Okeechobee. Until all of the additional storage proposed in the CERP for the areas around Lake Okeechobee is available, the threat of damaging high and low lake stages will continue. The CEPP takes advantage of flexibility of the LORS08 by hedging slightly towards retaining water in the lake to provide flows to the south through the FEBs. The net result is a slight benefit of reducing the likelihood of lower lake stages (that could cause either minor ecological harm or more serious MFL violations). The risk is that management of Lake Okeechobee under the CEPP increases the possibility that severe storms could cause a greater magnitude of ecological damage both in the lake and from larger discharges to the estuaries. If storms like Tropical Storm Fay (August 2008, where lake levels rose about 4 feet in 30 days) will occur at even moderate lake stages instead of the low lake stage prior to the storm, the adverse effects of high water in Lake Okeechobee and regulatory releases to the estuaries would be exacerbated. However, the Service believes that, on balance, the proposed regulation of Lake Okeechobee is necessary to provide benefits to the plan, and the study has recognized the limitations of increased average water storage in the lake until additional storage, beyond that modeled in the FWO assumptions, becomes available.

C. Everglades Agricultural Area

While the Service is pleased that nearly 29,000 acres of fallow agricultural land will be converted to shallow FEB, as this will slightly enhance its value to natural resources and yield considerable water quality benefits, it is highly recommended that more land within the EAA is converted to deeper storage reservoirs which will be needed to fully restore the Everglades. Prior to final design and the formulation and implementation of a final operating plan for the FEB, the Corps should consult with the Service to determine whether initiation of consultation for listed species, is needed. As more information becomes available in the detailed design documentation and operations manual, the Service will continue its review of the potential effects of FEB components on listed species (and fish and wildlife in general).

D. Greater Everglades

CEPP modeling predicts that all of the alternatives are capable of providing the targeted 200,000 ac-ft average annual flow to the Everglades during the dry season. In fact, the operational refinement runs Alts 4R and 4R2 provided an additional 10,000 – 15,000 ac-ft. It is less clear at what frequency this target will be met, given that the project will only construct shallow storage (up to 4 feet) in the EAA and make only minor changes to the LORS. Regardless of the frequency, the project will provide additional water during the dry season

and improve downstream conditions. This new water, in combination with the proposed hydropattern restoration feature and backfilling of the Miami Canal, will vastly improve the degraded ecological conditions in the northern part of WCA-3A north of Interstate 75. Less benefit will be seen in southern WCA-3A where depth and durations will be maintained at their current levels which have been identified by the Service and others as being too wet.

It should be noted here that while the operational refinement runs (Alts 4R and 4R2) performed better than the FWO overall, as did all of the other final array Alts 1 through 4, they did result in a reduction of HUs for most areas within the system. Examples of HU reductions include 7.4 percent in WCA-3A northeast, 7.8 percent in WCA-3A Miami Canal, 7.8 percent in ENP north and 30 percent in ENP south. There were slight increases in some areas, most notably WCA-3B. The Service expects that any operational flexibility employed on behalf of endangered species protection could infrequently affect the distribution of HUs as described above and we hope that the Corps and other partnering agencies would accept these changes as acceptable.

WCA-3B, NESRS and Florida Bay were disconnected from the rest of the system for decades by canals, levees and roads. The CEPP will take a critical first step in restoring this flow path and provide environmental lift. However, the Service finds that the project will not achieve the full restoration targets. CEPP is the first increment of restoration allowing for the establishment of essential monitoring for evaluation of full restoration in future phases.

E. Southern Coastal System

The Service finds the CEPP TSP provides overall hydrologic and ecologic benefits in the SCS compared to ECB and FWO. CEPP modeling simulations for the TSP predicts flow increases in major sloughs providing freshwater to Florida Bay and the southwest Florida coast. These flow increases are reflected in the salinity improvements which show noticeable lift from the TSP over FWO. Model-predicted salinity improvements from the TSP translated to a subtle lift in juvenile spotted seatrout, pink shrimp, and juvenile crocodile HSIs. Based on the hydrologic connections between SRS and the southwest coastal areas of Florida (*e.g.*, Whitewater Bay), there is high likelihood that the southwest coastal areas will experience significant ecological benefits from the TSP, probably more benefits than those predicted for Florida Bay.

CEPP model results indicate increased annual flows to the north and south-central areas of Biscayne Bay by the TSP compared to ECB. However, when evaluated on a seasonal basis, dry season flows are reduced and wet season flows are increased at the S28 and S27 coastal structures in the north region; whereas, seasonal flows are increased during both seasons in the south-central region at all structures except for S123. In the central region, simulations indicate dry season flow reductions of 2 to 10 percent from the TSP compared to ECB, with little change in wet season flows. Results also show significant reductions in flow to Manatee Bay (via the C-111) under the TSP compared to ECB. These reductions in Biscayne Bay flows, if realized by an implemented CEPP, could impact fish and wildlife resources in Biscayne National Park, the Biscayne Bay Aquatic Preserve, and reduce the effectiveness of CERP's Biscayne Bay Coastal Wetlands Project. Even though the TSP model output appears to alleviate more serious flow reductions to Biscayne Bay observed in previous CEPP alternative simulations, given the

uncertainties inherent in hydrologic models, the Service believes it would be prudent to incorporate periodic evaluation of flow data at the Biscayne Bay coastal water management structures into the CEPP Adaptive Management Plan. Doing so would allow managers to modify operations, if needed, to avoid harmful reductions in flow to Biscayne Bay.

A.3 Recommendations and responses under the Fish and Wildlife Coordination Act Report

RECOMMENDATIONS/CONSERVATION MEASURES

Objectives identified by the Service in providing recommendations on this project are to protect and conserve fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to the CEPP Project area consistent with the basic project purpose. This includes developing recommendations to make this project more environmentally compatible and to further conserve and enhance the diversity and abundance of fish and wildlife resources in the study area.

A. Northern Estuaries

1. It is imperative that all of the IRL-S components (not just C-44 reservoir/STA) and C-43 reservoir are operating when CEPP is implemented to ensure that dry season water is delivered to the CRE and SLE as obligated prior to routing the water south. The Service recommends that the Master Implementation Sequencing Plan and Integrated Delivery Schedule be updated to ensure that interdependent projects and/or project components are linked in an effort to provide restoration optimization and avoid unanticipated adverse effects.

Response: Concur. The Corps and the SFWMD will undertake integration of the CEPP plan and the other CERP projects awaiting authorization into the CERP Programs' integrated delivery schedule through a robust public process.

2. The Service believes that in future increments of CEPP, the Corps should explore opportunities to provide additional storage to protect the CRE, SLE, and IRL estuaries from damaging Lake Okeechobee regulatory releases. The Service recommends that the Corps start the planning process for the next increment of CEPP as soon as this Final PIR/EIS is completed. The next CEPP increment should include adequate storage of high volume lake regulatory releases that could be held and redirected south when needed.

Response: Concur. This is just the first increment of CEPP. Based on public and agency feedback, there is a strong desire to have the next increment of CEPP look at additional storage.

3. The Service recommends that a re-evaluation of base flow criteria for the CRE and SLE, especially in the dry season, be conducted during the development of the CEPP Operations Manual. This effort must include, but is not limited to, "lessons learned" from the Corps' Periodic Scientists conference calls for Lake Okeechobee and the Northern Estuaries as well as data from the RECOVER oyster mesocosm studies currently underway.

Response: Noted. Up to date scientific input will be used to the extent possible when the CEPP Operations Manual is being developed and the Manual will be updated in conjunction with knowledge gained from monitoring and CEPP adaptive management.

4. The Service recommends that the Corps or the District pursue funding for oyster reef restoration in the CRE and SLE by placement of hard substrate to increase the likelihood of oyster reef expansion. The restoration target for the CRE is 400 acres of suitable oyster habitat with at least 100 acres of living oyster reefs. The restoration target for the SLE is to provide approximately 900 acres of

suitable oyster habitat. Although the CEPP TSP may improve salinity conditions for oysters and associated flora and fauna, oyster expansion is directly tied to the availability of hard substrate for recruitment and colonization.

Response: Noted. The availability of hard substrate is tied to oyster reef restoration and the opportunity to secure funding for that effort will be pursued when possible.

B. Lake Okeechobee

1. The water regulation schedules that agencies use to decide when, where, and how much water to release from the lake is a critical component in maintaining a proper water balance throughout south Florida. The CEPP is an added feature in south Florida that will increase the amount of lake level management needed for both the existing regulation schedule and the yet to be proposed regulation schedule that is to be implemented prior to the A-2 FEB. Prudent water management under the LORS is served when agencies can coordinate with stake holders in a timely manner so that management decisions can be made quickly (within days) across the full range of water conditions affecting Lake Okeechobee and surrounding areas.

Response: Noted.

2. We recommend that Lake Okeechobee stage not be kept higher than what would be expected under the existing LORS until the FEB has been in operation for at least 6 months to allow testing of the integrity and flow capacity of the water management infrastructure for the FEBs. This would help to preclude the FEB going off-line for an unknown structural reason and then having to potentially release additional "stored" water from the lake to the estuaries where it may be ecologically damaging.

Response: Noted. Independent of CEPP implementation, there is an expectation that revisions to the 2008 LORS will be needed following the implementation of other CERP projects and Herbert Hoover Dike infrastructure remediation. The USACE expects to operate under the 2008 LORS until there is a need for revisions due to the earlier of either of the following actions: (1) system-wide operating plan updates to accommodate CERP "Band 1" projects, as described in ***Section 6.1.3.2****, or (2) completion of sufficient HHD remediation for reaches 1, 2 and 3 and associated culvert improvements, as described in* ***Section 2.5.1.*** *When HHD remediation is completed and the HHD DSAC Level 1 rating is lowered, higher maximum lake stages and increased frequency and duration of high lake stages may be possible to provide the additional storage capacity assumed with the CEPP TSP . The future Lake Okeechobee Regulation Schedule which may be developed in response to actions (1) and/or (2) is unknown at this time. It is anticipated that the need for modifications to the 2008 LORS will be initially triggered by non-CEPP actions and that these actions will occur earlier than implementation of CEPP. Therefore, the CEPP PIR will not be the mechanism to propose or conduct the required NEPA evaluation of modifications to the Lake Okeechobee Regulation Schedule. However, depending on the ultimate outcome of these future Lake Okeechobee Regulation Schedule revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further Lake Okeechobee Regulation Schedule revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.*

3. There was at least one event in the modeling which indicated a potentially significant beneficial effect of CEPP on the littoral zone of Lake Okeechobee (1987 event). We recommend that the Corps evaluate and discuss in the PIR why that year indicated a benefit when other low-stage events in the

simulation did not respond similarly to Alt 4R2 (or Alt 4R). It is possible that project benefits to alleviating environmental impacts from droughts were not fully recognized. We also recommend that the Corps evaluate severe drought water years outside of the Period of Record (*e.g.*, 1954-56, 2007) to assess whether or not CEPP provides environmental benefits during those occurrences.

Response: The CEPP ecological benefit evaluation did not calculate habitat units for Lake Okeechobee, since the performance of this area was considered a constraint during formulation. The Final CEPP PIR/EIS, including the POM, will not be the mechanism to propose or conduct the required National Environmental Policy Act (NEPA) evaluation of modifications to the Lake Okeechobee Regulation Schedule. Revisions to the 2008 LORS would be conducted through a separate effort, and it is anticipated that the need for modifications to the 2008 LORS will be initially triggered by non-CEPP actions and that these actions will occur earlier than implementation of CEPP. However, depending on the ultimate outcome of these future Lake Okeechobee Regulation Schedule revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further Lake Okeechobee Regulation Schedule revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements. The CEPP TSP includes a placeholder set of Lake Okeechobee Regulation Schedule modifications that represent reasonable and likely implementable future operating conditions under CEPP. The CEPP PIR does not claim ecological benefits within Lake Okeechobee, given the uncertainty of these future actions outside of CEPP.

During CEPP screening above the red line, Lake Okeechobee model output from the LOOPS model was evaluated using four RECOVER performance measures and assigned weighting factors: standard score above 17 feet NGVD (50%), standard score below 10 feet NGVD (25%), standard score above stage envelope (15%), and standard score below stage envelope (10%). It was decided to assign relative weights to each of the four performance measures, which themselves are all normalized to a scale of 0 to 100%, and then to combine the weighted scores to obtain a Lake Okeechobee total value for each screening alternative. The CEPP assignment of weighting factors was based on nearly 20 years of Lake Okeechobee data which generally indicate that the most significant factor affecting Lake ecological health are stages above 17 feet NGVD which tend to have devastating and cascading effects on lake vegetation and their associated faunal communities. Following stages over 17 feet NGVD, the most important ecological factors in descending order are then considered to be stages under10 feet NGVD which dry out the entire littoral zone, and deviations above and below the stage envelope which, though ecologically sub-optimal do not necessarily mediate against a viable vegetation community although the relative ratio and distribution of terrestrial, emergent wetland, and submerged vegetation may vary over a wide geographic range.

Future USACE efforts to revise the Lake Okeechobee Regulation Schedule may establish different weighting methods for the Lake Okeechobee ecological performance measures, different criteria for evaluating discharges to the Northern Estuaries, and/or may need to consider new or modified constraints. The resulting formulation outcome may not mirror the speculated revisions of the CEPP TSP. Recommendations for Lake Okeechobee drought benefits evaluations may be considered by the USACE during these efforts, outside of CEPP.

4. The existing PM for evaluating project effects on snail kites is difficult to apply to Lake Okeechobee. The Service is committed to assist in developing reliable and sufficiently sensitive PMs to specifically analyze the effects of water levels on snail kite feeding and nesting and in the lake.

Response: The USACE has determined that the project may affect the Everglades snail kite and its critical habitat. The USACE encourages the incorporation of updated science, new information, and improved hydrologic modeling tools to further develop performance measures to evaluate potential effects to federally listed species.

C. Everglades Agricultural Area

1. The initial operating plan should specifically address when water would be discharged from Lake Okeechobee and the EAA to the FEBs. The final operating plan should also specifically address when water would be discharged from the FEBs to the STAs.

Response: Noted. Based on the hydrologic modeling conducted for the CEPP TSP, preliminary operational guidance included in the DPOM (Annex C) provides a template for the operational information that will be included in Final Operating Plan, including the Lake Okeechobee stage ranges in which a basic decision was made as to when to deliver water from the lake to either the STAs and/or the combined CEPP FEB and FEB operational constraints. Further Water Management operational guidance for Lake Okeechobee and the FEB will be developed during the PED phase for PPA New Water components. It is anticipated that changes to 2008 LORS would be needed in order to achieve the complete ecological benefits envisioned through implementation of CEPP and to address the minor to moderate adverse effects indicated with the CEPP future without project condition. These changes are part of the final operational assumptions within the CEPP modeling. The CEPP PIR, including the POM, will not be the mechanism to propose or conduct the required National Environmental Policy Act (NEPA) evaluation of modifications to the Lake Okeechobee Regulation Schedule. Revisions to the 2008 LORS would be conducted through a separate effort, and it is anticipated that the need for modifications to the 2008 LORS will be initially triggered by non-CEPP actions and that these actions will occur earlier than implementation of CEPP. However, depending on the ultimate outcome of these future Lake Okeechobee Regulation Schedule revisions, including the level of inherent operational flexibility provided with these revisions, CEPP implementation may still require further Lake Okeechobee Regulation Schedule revisions to optimize system-wide performance and ensure compliance with Savings Clause requirements.

2. The operating manual(s) should be consistent with project assurances.

Response: Concur. The Programmatic Regulations [Section 385.28(a)(6)(vi)] for CERP require that the operating manual be consistent with the reservation or allocation of water for the natural system made by the State (in accordance with section 601 of WRDA 2000). The operating criteria within the CEPP DPOM (Annex C) are consistent with the operating criteria used to identify the water available for the natural system during wet, average, and dry periods as described in the Project Assurances section of the PIR. The operating criteria contained in this DPOM will be in accordance with section 601 of WRDA 2000. The operating criteria may be further refined during detailed design and captured in the Preliminary POM phase. These refinements would also need to be consistent with any reservation or allocation of water for the natural system.

3. The Service supports the inclusion of existing agricultural canals in the FEB to serve as deep water refugia for aquatic organisms during extreme dry periods or when it is emptied for operations or maintenance.

Response: Noted. Specific details regarding the backfilling of existing agricultural canals within the footprint of the A-2 FEB will be determined during the PED phase of the project.

4. The Service recommends optimization of FEB design, construction, and operations in a manner that considers potential impacts to fish and wildlife and continues through the detailed design and construction phases. For example, the Corps should consider a multiple- cell design for the FEB to increase operational and management flexibility.

Response: Noted. A multiple-cell design is not currently planned within the footprint of the A-2 FEB. Specific details regarding the design of the A-2 FEB will be determined during the PED phase of the project. During the CEPP screening discussions, the FEB was deemed more flexible and adaptable than STAs due in part to the lack of internal cells and structures. This was part of the "adaptability" screening of management measures discussed in Section 3.

5. Prior to final design and the formulation and implementation of a final operating plan for the FEB, the Corps should consult with the Service to determine whether initiation of consultation for listed species, is needed. As more information becomes available in the detailed design documentation and operations manual, the Service will continue its review of the potential effects of FEB components on listed species (and fish and wildlife in general).

Response: Concur. The USACE recognizes the need for re-initiation of consultation if modifications to the project are made and/or additional information involving potential effects to listed species becomes available. NEPA documentation and Section 7 ESA consultation will be updated if applicable, as revisions are made to Water Control Plans and/or Project Operating Manuals associated with the project. The USACE commits to maintaining ongoing communications with the FWS in the event of project modifications.

6. Although drydowns within the FEBs may concentrate and improve prey availability, the Service recommends optimizing operations to prevent or minimize drydown to land surfaces in order to minimize the potential for remobilization of nutrients and/or contaminants that could be directly ingested by, or ingested by prey of, the bald eagle or the endangered wood stork (Service 2005). If the ecological risks from nutrients and/or contaminants to listed species become evident through sampling plans and monitoring, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.

*Response: The A-2 FEB will be operated in conjunction with the A-1 FEB and STAs. As additional design details are developed during the PED phase, the operational criteria for the A-2 FEB, including the integrated relationship with the A-1 FEB operations, will become more refined. Refinements will also include lessons learned from the A-1 FEB, as described in the CEPP Adaptive Management Plan (**Annex D Part 1**). Based on the results of the initial optimization for the CEPP hydrologic modeling, no supplemental water supply will be provided to the FEB to prevent dryout. See **Annex C** (**Draft Project Operating Manual**) **Section 7.1.2** (**FEB Operations**). The USACE recognizes the need for re-initiation of consultation if modifications to the project are made and/or additional information involving potential effects to listed species becomes available.*

7. The Service recommends that the Corps notifies the Service and FWC in the event colonial or solitary wading bird nests are observed within the FEB construction footprint.

Response: Noted. Standard construction conservation measures will be included in the plans and specifications to minimize impacts to migratory bird species. Monitoring for migratory birds and the creation of a buffer zone around active nests or nestling activity will be required by the construction contractor during the nesting season.

8. The Service recommends that the Corps and District cooperate with research-based efforts to provide for long-term ecological monitoring of indigo snake densities and habitats in the project area.

Response: Noted.

9. The Service recommends the Corps and the District consult with the FWC regarding habitat needs and additional conservation recommendations for state-listed species.

Response: Coordination with resource agencies, including the FWC, has been ongoing throughout the planning process of this project. Additionally, the FWC provided formal comments on the draft PIR/EIS during the public and agency review period.

10. The Florida burrowing owl is a State-listed species of special concern and protected under the Federal Migratory Bird Treaty Act (MBTA). During a site visit in 2003, burrowing owls were observed within Compartment A of the EAA Project footprint (Service 2003) which is adjacent to FEB A-2. In accordance with MBTA, the Corps and the District must perform a burrowing owl nest survey within the FEB footprint prior to construction. The Service further recommends the survey take place immediately prior to construction in order to ensure owls have not nested in the area between the time of the survey and construction. If the project is to be phased, surveys should be performed immediately prior to construction of the various phases. Burrowing owls could also potentially be present along canal banks and embankments.

Response: Concur. A pre-construction survey and nest inventory will be included in the construction contract. If either are present, the Corps will coordinate with the FWS on implementing a protection plan prior to construction.

D. Greater Everglades

1. The Service believes that there was a missed opportunity for this project to help resolve the long-standing problem of restoring the historic flow path from WCA-3A through WCA-3B into NESRS. During this project the Department of Interior and National Park Service indicated their intent to render the Tamiami Trail hydrologically invisible, the most critical feature on the road to restoring the historic flow path. Additionally, throughout the planning process, we were told that WCA-3B seepage management would be a part of the project. We recommend the Corps start the planning process for the next phase of CEPP as soon as this Final PIR/EIS is approved. The next CEPP phase should include adequate WCA-3B seepage management and increased WCA-3B outflow capacity such that the historic flow path can be re-established.

Response: Concur. The CEPP is composed of increments of project components that were identified in CERP. The term "increment" is used to underscore that the study formulated portions (scales) of individual CERP components. The USACE acknowledges that additional actions are needed to achieve the restoration envisioned in CERP.

2. The Service recommends that the Blue Shanty Levee be constructed last and only if necessary. An adequate monitoring plan for WCA-3B resources should be implemented and the full project, minus the Blue Shanty levee, should be allowed to function for several years to assess the need for the levee.

*Response: Noted. WRDA 2000 requires (Savings Clause) that CERP does not reduce the level of service for flood protection as of 2000 and in accordance with applicable law. The function and integrity of the C&SF flood protection system provided by the L-67 A and L-67 C levee system must be maintained following CEPP implementation, and CEPP degradation of portions of the L-67 C and L-29 levees must be offset with additional infrastructure and operational constraints that maintain the pre-project level of flood protection and account for any potential increased design risk. The details of additional infrastructure, and how it would interface with operations and existing infrastructure, will be determined in the future as adaptive management, PED, and as other information becomes available for this area. Consideration of a new L-67 D levee (currently included as a component of the CEPP recommended plan), including its footprint (width/height), costs, and permanency, will be cautiously considered and subject to applicable policies and permitting. Please see the CEPP Adaptive Management Plan (**Annex A Part 1 Section 1.4.2.8 WCA 3B Structures and Blue Shanty Flowway**) for a description of information that will be gathered to inform future decisions about implementation of this component of CEPP.*

3. If the Blue Shanty Levee is constructed in WCA-3B, it should be placed on the same footprint as the existing agricultural canal as much as possible, to minimize impacts to relatively pristine wetlands. North of the existing agricultural canal the levee should jog east or west to avoid bisecting three healthy tree islands. The leading tree island researchers in the Everglades should be consulted to determine whether the tree islands should be contained within the flow way or outside of it.

Response: The initial location for the new L-67D was aligned along the existing Blue Shanty canal since that area is an existing alteration in the landscape. The northern end of the proposed levee was angled slightly westward to avoid impacting several large tree islands that exist north of the terminus of the Blue Shanty Canal. Although the initial location of the new levee generally along the Blue Shanty canal minimized impacts to unexcavated wetlands, it created other concerns: 1) it was directly in the center of the western 2.6 mile Tamiami Trail Next Steps bridge and would fail to fully take advantage of the new bridge span opening, and 2) excluding the tree islands would result in a levee alignment that intercepts the desired southerly flow path dictated by landscape patterning in the area. The proposed alignment of the new L-67D is identified in Section 6.10.2.2 (Blue Shanty Levee) of the Final PIR/EIS. Consideration of a new L-67 D levee (currently included as a component of the CEPP recommended plan), including its footprint (width/height), costs, and permanency, will be cautiously considered.

4. The Service recommends the Corps implement a robust endangered species monitoring plan and assesses the data in coordination with the Service and other wildlife agencies to timely modify operations for the protection of those species. This is most critical for the imperiled CSSS which stands to receive the most impact from this project. It will be imperative, as will be stated in the Service's forthcoming Programmatic Biological Opinion, that consecutive years, with either a reduction in dry nesting days or longer than recommended hydroperiods in CSSS-E, will need to be avoided. Likewise, all S-12, S-343 and S-344 seasonal closures for protection of CSSS should be followed consistent with ERTP. Service sparrow biologists have recommended that closure dates for S-12B be modified to coincide with those for S-12A to ensure appropriate nesting conditions are consistently met in CSSS-A.

Response: Noted. The Programmatic BO does not provide incidental take of potentially affected species, but does provide preliminary terms and conditions to support species management and recovery in

anticipation of incidental take associated with future project implementation and subsequent consultations under the Endangered Species Act. FWS provided preliminary terms and conditions including monitoring and restoration projects to support species recovery. Terms and conditions within a Programmatic BO are considered to be preliminary and are not mandated until a Final BO is issued. Once more details regarding project scope, implementation schedule, interdependent projects, and operational plans are provided, FWS will coordinate with the Corps to determine the proper path for completion of consultation. Completion of consultation will involve finalization of terms and conditions in conjunction with authorization of incidental take as appropriate.

5. The initial operating plan has not been thoroughly defined for this project. We have compared alternatives and selected a plan based solely on the model's general interpretation of operations. The Service recommends that the Corps define an operational plan to the extent possible and assess any changes to performance it may have.

Response: Noted. Further Water Management operational guidance will be developed during the PED phase.

6. The Corps should immediately begin a new study to modify the WCA-2A regulation schedule. As the system is decompartmentalized and WCA-2A is no longer needed to hold large amounts of water, more attention should be paid to its ecological restoration.

Response: The Corps of Engineers can start a process towards revision of a regulation schedule if requested or if the Corps of Engineers deems it appropriate at any time. If a change to a regulation schedule is requested, the requesting agency should provide the Corps of Engineers with appropriate justification containing any new information ascertained which would deem the current regulation schedule no longer the most preferred option, the goals and objectives which would be strived for, and any constraints which were considered necessary by the requesting agency. Having such information the Corps of Engineers could then choose to move forward with a change to the regulation schedule and as a result the corresponding Water Control Plan.

Absent any specific planning study, this effort would need to be funded from the Corps of Engineers' Operations and Maintenance budget. The revision to the regulation schedule and Water Control Plan a scope and schedule would need to be determined in order to ensure there was appropriate funding for the effort. In regards to the WCA-2A Interim Regulation Schedule, appropriate means of funding would have to be budgeted into the Operations and Maintenance budget for the appropriate fiscal years to come. This specific effort is envisioned to be a somewhat complex one due to the already existing expectation that there will likely need to be cultural resource surveys in WCA-2A eventually likely leading to a Programmatic Agreement.

In addition, it is premature to suggest that the system is decompartmentalized as a result of CEPP and that WCA-2A is no longer needed to hold large amounts of water.

E. Southern Coastal System

1. Given the possible flow reduction that may occur in central and southern Biscayne Bay as a result of CEPP, the Service recommends frequent evaluation of flow data collected at the coastal water management structures in Miami-Dade County to ensure that any reductions in flow can be detected early and alleviated through operational modifications. Flow reductions, if they occur, would increase

salinity in this region of Biscayne Bay which may negatively impact flora and fauna in nearshore areas, including juvenile crocodiles. This monitoring should be included in the CEPP Adaptive Management (AM) Plan.

*Response: Noted. The CEPP Adaptive Management Plan (**Annex D Part 1 Section 1.4.3 Southern Coastal Systems Strategies and Management Options**) describes monitoring that will take place to assure that CEPP will remain within its legal constraints regarding water deliveries to Biscayne Bay. As with all of the monitoring described in the AM Plan, monitoring in this area will require networking with local monitoring efforts and other CERP monitoring programs.*

2. A robust water quality monitoring network should be established at primary discharge areas along the southwest Florida coast and Florida Bay that would be poised to detect changes in nutrient concentrations in these areas.

*Response: Noted. While the CEPP water quality monitoring plan focuses mostly on permit-required monitoring at outflow structures, the CEPP Adaptive Management Plan contains a section on potential nutrient changes within the Everglades (**Annex D Part 1 Section 1.4.3.1 Avoiding Legacy Nutrients in Everglades Soils**). Incorporating the suggestion into this part of the monitoring program would only be undertaken if the results could be used directly to adjust and improve CEPP and CERP. The Adaptive Management Plan will be refined once CEPP is authorized and closer to implementation, at which time this suggestion will be discussed in light of the criteria in Section 1.2 of the Adaptive Management Plan.*

3. The ENP Marine Monitoring Network (MMN) should be maintained at its current level of operation. This network is critical to determining if CEPP implementation will, in fact, result in ecologically-beneficial salinity changes in Florida Bay. If salinity was to increase as a result of CEPP, this could cause impacts to Federally-threatened crocodiles and other flora and fauna. ENP's MMN is our primary tool to evaluate salinity in Florida Bay.

*Response: Noted. The CEPP Adaptive Management Plan (**Annex D Part 1 Section 1.4.3 Southern Coastal Systems Strategies and Management Options**) describes monitoring that will take place in the Southern Coastal Systems. As with all of the monitoring described in the AM Plan, monitoring in this area will require networking with local monitoring efforts and other agency monitoring programs. The networks that will be relied upon should highlight whenever possible their role of informing CEPP; likewise many of these programs have been named in the AM Plan. The ENP MMN has been named in the AM Plan.*

4. Current funding provided by the CERP Monitoring and Assessment Plan for juvenile spotted seatrout and SAV should be continued and expanded, if possible, to determine if predicted ecological benefits to seatrout and SAV result from salinity improvements provided under CEPP.

Response: The CEPP Adaptive Management Plan (Annex D) identifies estuarine submerged aquatic vegetation, and juvenile seatrout as attributes to be monitored to address uncertainties (CEPP Uncertainty #62 and #65) related to the ecological effects of CEPP hydrology within the Southern Coastal Systems. See Section 1.4.3 (Southern Coastal Systems Strategies and Management Options) of Annex D.

5. Monitoring of juvenile crocodiles and pink shrimp in Florida Bay should be reinitiated to determine if predicted ecological benefits to these species are realized.

Response: The CEPP Adaptive Management Plan (Annex D) identifies juvenile crocodiles, juvenile pink shrimp, and associated estuarine epifauna as attributes to be monitored to address uncertainties (CEPP Uncertainty #62 and #65) related to the ecological effects of CEPP hydrology within the Southern Coastal Systems. Please see Section 1.4.3 (Southern Coastal Systems Strategies and Management Options) of Annex D.

6. Upstream storage components (reservoirs, STAs, private land incentive programs) should be considered in any future CERP increments to provide increased water to Florida Bay and Biscayne Bay.

Response: Concur. The CEPP is composed of increments of project components that were identified in CERP. The term "increment" is used to underscore that the study formulated portions (scales) of individual CERP components. The USACE acknowledges that additional actions are needed to achieve the restoration envisioned in CERP.

A.4 Listing of Threatened and Endangered Species

The list of federally threatened and endangered species within the CEPP study area was received from U.S. Fish and Wildlife Service (FWS) on May 10, 2013. The list of federally threatened and endangered species is shown below.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 10, 2013

Eric Summa
Chief, Environmental Branch
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232

Service Consultation Number: 2012-F-0290
Applicant: U.S. Army Corps of Engineers
Date Received: January 21, 2012
Project: Central Everglades Planning Project
Counties: Multiple

Dear Mr. Summa:

The U.S. Fish and Wildlife Service (Service) has reviewed your letter dated January 21, 2012, requesting confirmation of federally-listed species or their designated critical habitat and candidate species for listing that may be present within the study area for the Central Everglades Planning Project (CEPP). The species list is a National Environmental Policy Act (42 U.S. Code (USC) § 4321) requirement for the environmental analysis. This species list is also provided in accordance with the Endangered Species Act of 1973, as amended (Act) (87 stat. 884; 16 U.S.C. 1531 *et seq*. The project area includes portions of Broward, Collier, Glades, Hendry, Highlands, Lee, Martin, Miami-Dade, Monroe, Okeechobee, and Palm Beach Counties, Florida.

The Service has reviewed our Geographic Information System (GIS) database and other information for recorded locations of federally listed threatened and endangered species and critical habitats on or adjacent to the project site. The GIS database is a compilation of data received from several sources. CEPP occurs mainly in wetland habitats in the planning area, however, effects of the proposed project could reach into adjacent habitats as well. State-listed species and those proposed for Federal listing are included due to the projected life of the proposed project. The following table is a list of species with both Federal and State status that should be considered in the planning process for CEPP.

Table 1. List of federally Threatened and Endangered Species within the CEPP study area (E: Endangered, T: Threatened, C: Candidate, SC: Species of Special Concern, Pr E: Proposed Endangered, SA: Similarity of Appearance, CH: Critical Habitat).

Common Name	Scientific Name	Status	Agency	Location[1]
Mammals				
Big Cypress fox squirrel	*Sciurus niger avicennia*	T	State	4
Everglades mink	*Mustela vison evergladensis*	T	State	4,5
Florida bonneted bat	*Eumops floridanus*	Pr E	Federal	1,2,3,5
Florida manatee	*Trichechus manatus latirostris*	E, CH	Federal	6
Florida mastiff bat	*Eumops glaucinus floridanus*	E	State	5
Florida mouse	*Podomys floridanus*	SC	State	1,2,3
Florida panther	*Puma concolor coryi*	E	Federal	6
Shermans fox squirrel	*Sciurus niger shermani*	SC	State	1,2
Birds				
American oystercatcher	*Haematopus palliatus*	SC	State	1,5
Black skimmer	*Rynchops niger*	SC	State	1,2,5
Brown pelican	*Pelecanus occidentalis*	SC	State	6
Burrowing owl	*Athene cunicularia*	SC	State	1,2,3
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH	Federal	4,5
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH	Federal	6
Florida sandhill crane	*Grus canadensis pratensis*	T	State	6
Least tern	*Sterna antillarum*	T	State	1,2,5
Limpkin	*Aramus guarauna*	SC	State	6
Little blue heron	*Egretta caerulea*	SC	State	6
Northern crested caracara	*Caracara cheriway*	T	Federal	1,2,3
Piping plover	*Charadrius melodus*	T	Federal	1,5
Red-cockaded woodpecker	*Picoides borealis*	E	Federal	1
Reddish egret	*Egretta rufescens*	SC	State	2,6
Roseate spoonbill	*Platalea ajaja*	SC	State	6
Roseate tern	*Sterna dougallii dougallii*	T	Federal	1,5
Snowy egret	*Egretta thula*	SC	State	6
Snowy plover	*Charadrius alexandrinus*	T	State	1,2,5
Tricolored heron	*Egretta tricolor*	SC	State	6
White ibis	*Eudocimus albus*	SC	State	6
White-crowned pigeon	*Columba leucocephalus*	T	State	4,5
Wood stork	*Mycteria americana*	E	Federal	6
Reptiles				
American alligator	*Alligator mississippiensis*	T/SA	Federal	6
American crocodile	*Crocodylus acutus*	T, CH	Federal	4,5
Eastern indigo snake	*Drymarchon corais couperi*	T	Federal	6

[1] Numbers indicate the locations within the project area where a species in the table is found. 1 represents the Northern Estuaries, 2 represents Lake Okeechobee, 3 represents the Everglades Agricultural Area, 4 represents the Greater Everglades, 5 represents the Southern Coastal Systems, and 6 is used to represent all locations considered in CEPP.

Florida pine snake	*Pituophis melanoleucus mugitus*	SC	State	2
Gopher tortoise	*Gopherus polyphemus*	SC	State	1,2,3,5
Green sea turtle[2]	*Chelonia mydas*	E, CH[2]	Federal	1,5
Hawksbill sea turtle[2]	*Eretmochelys imbricata*	E, CH[3]	Federal	1,5
Kemp's Ridley sea turtle[2]	*Lepidochelys kempii*	E	Federal	1,5
Leatherback sea turtle[2]	*Dermochelys coriacea*	E, CH[3]	Federal	1,5
Loggerhead sea turtle[2]	*Caretta caretta*	T	Federal	1,5
Miami black-headed snake	*Tantilla oolitica*	T	State	5
Fish				
Mangrove gambusia	*Gambusia rhizophorae*	SC	State	5
Mangrove rivulus	*Rivulus marmoratus*	SC	State	1,5
Opossum pipefish[2]	*Microphis brachyurus lineatus*	SC	Federal	1
Smalltooth sawfish[2]	*Pristis pectinata*	E, CH	Federal	1,5
Invertebrates				
Bartram's hairstreak butterfly	*Strymon acis bartrami*	C	Federal	5
Elkhorn coral[2]	*Acropora palmata*	T, CH	Federal	5
Florida leafwing butterfly	*Anaea troglodyta floridalis*	C	Federal	5
Florida tree snail	*Liguus fasciatus*	SC	State	1,5
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E	Federal	5
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	Federal	5
Staghorn coral[2]	*Acropora cervicornis*	T, CH	Federal	5
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	T	Federal	4,5
Plants				
Beach jacquemontia	*Jacquemontia reclinata*	E	Fed	5
Cape Sable thoroughwort	*Chromolaena frustrata*	Pr E, Pr CH		5
Crenulate lead plant	*Amorpha crenulata*	E	Federal	5
Deltoid spurge	*Chamaesyce deltoidea* spp. *deltoidea*	E	Federal	5
Eatons spikemoss	*Selaginella eatonii*	E	State	5
Garber's spurge	*Chamaesyce garberi*	T	Federal	5
Johnson's seagrass[2]	*Halophila johnsonii*	E, CH	Federal	1,5
Lattace vein fern	*Thelypteris reticulate*	E	State	1,4
Mexican vanilla	*Vanilla mexicana*	E	State	1,5
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeenis*	E	Federal	2
Pine-pink orchid	*Bletia purpurea*	T	State	6
Small's milkpea	*Galactia smallii*	E	Federal	5
Tiny polygala	*Polygala smallii*	E	Federal	5
Tropical fern	*Schizaea pennula*	E	State	1,4,3,5
Wright's flowering fern	*Anemia wrightii*	E	State	4,5

[2] Indicates Critical Habitat for the designated species is not within the action study area (in status column).

The complete species list provided in the table above and the accompanying designated critical habitat maps (Figures 1-4) concludes the statutory requirements set forth in 50 CFR §402.12(d) of the Act. Please be aware that verification of current accuracy of the species list is for a time period not to exceed 90 days as stated in 50 CFR §402.12(e) of the Act. If the Corps does not begin preparation of the biological assessment within 90 days of receipt of (or concurrence with) the species list, then they must verify (formally or informally) with the Service the current accuracy of the species list at the time the preparation of the biological assessment is begun. Further, the Corps shall complete the biological assessment within 180 days after its initiation (receipt of or concurrence with the species list) consistent with 50 CFR §402.12(i) of the Act.

For your convenience, we are also providing updated maps for known wood stork (*Mycteria americana*) and Everglades snail kite (*Rostrhamus sociabilis*) nests, Florida panther (*Puma concolor coryi*) telemetry locations, and bald eagle (*Haliaeetus leucocephalus*) and Audubon's crested caracara (*Polyborus plancus audubonii*) nests in the CEPP study area.

Thank you for your cooperation in the effort to conserve fish and wildlife resources. If you have additional questions concerning the incidental take permit process and the options available to you, please contact Kevin Palmer at 772-469-4280.

Sincerely yours,

Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Stacie Auvenshine, Gina Ralph)
ENP, Homestead, Florida (Dan Kimball)
DEP, West Palm Beach, Florida (Inger Hansen)
District, West Palm Beach, Florida (Tom Teets)
FWC, West Palm Beach, Florida (Barron Moody)
Miccosukee Tribe, Miami, Florida (James Erskine)
Miami-Dade County DERM, Miami, Florida (Marcia Levinson)
NOAA Fisheries, Miami, Florida (Joan Browder)
Service, Atlanta, Georgia (David Horning)
Service, Jacksonville, Florida (Miles Meyer)

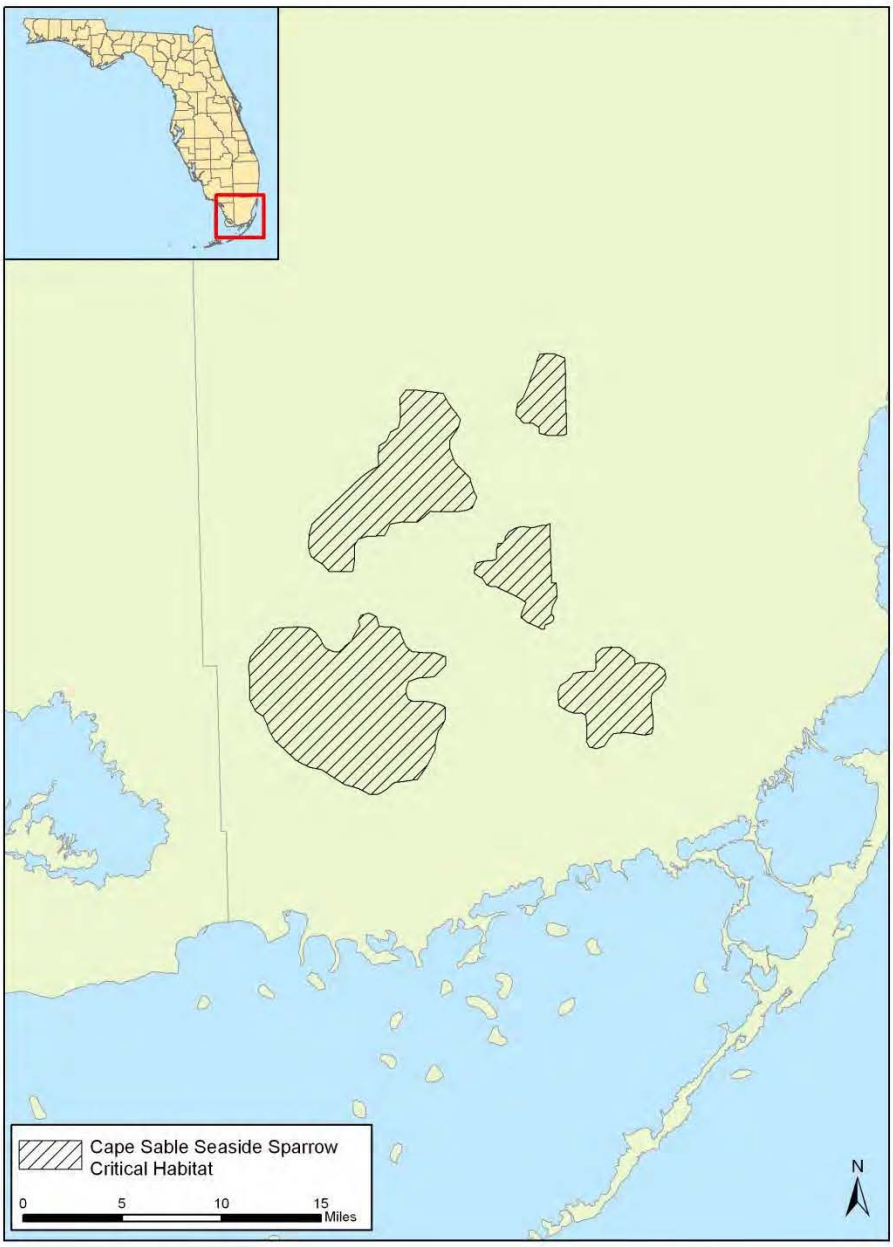

Figure 1: Cape Sable Seaside Sparrow *(Ammodramus maritimus mirabilis*) Designated Critical Habitat.

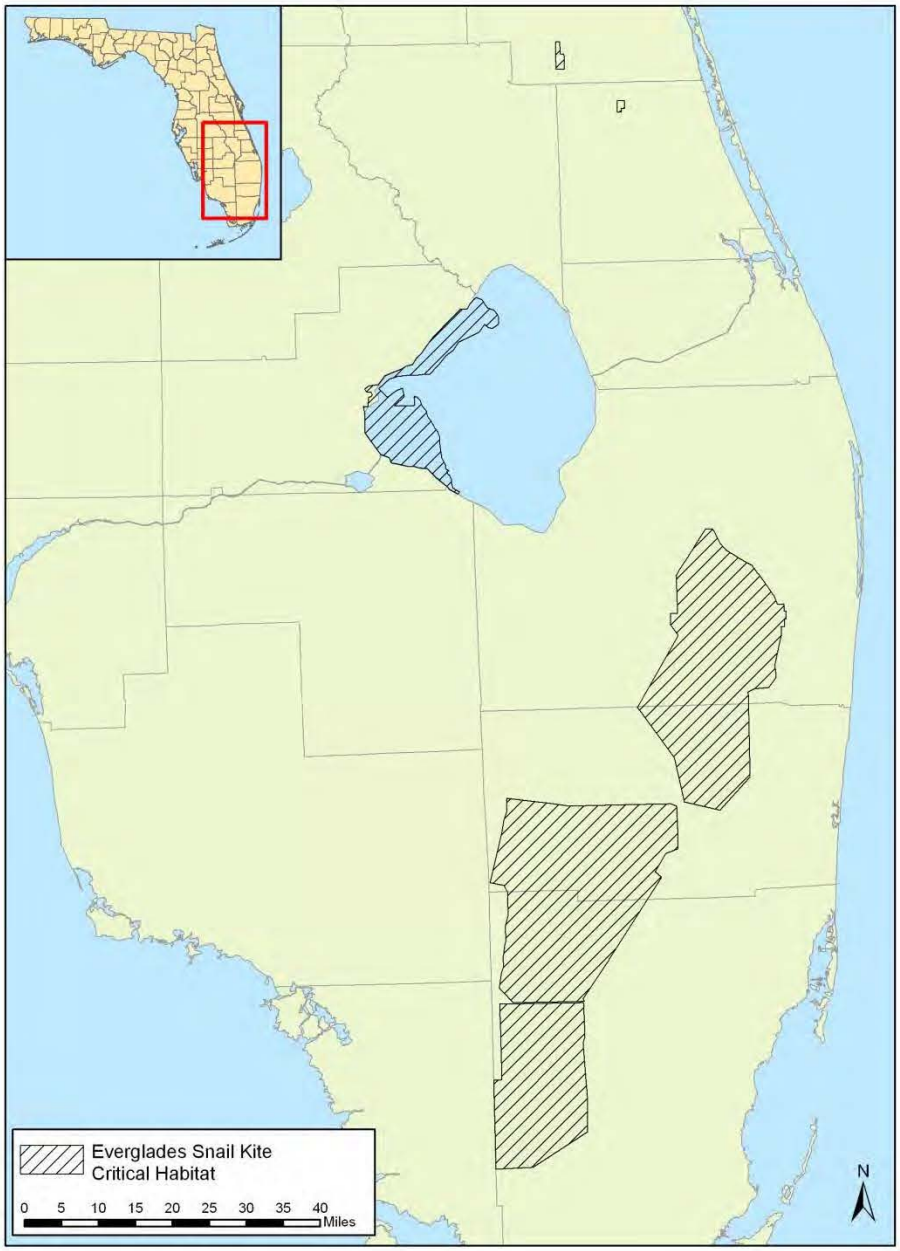

Figure 2: Everglade Snail Kite Designated Critical Habitat.

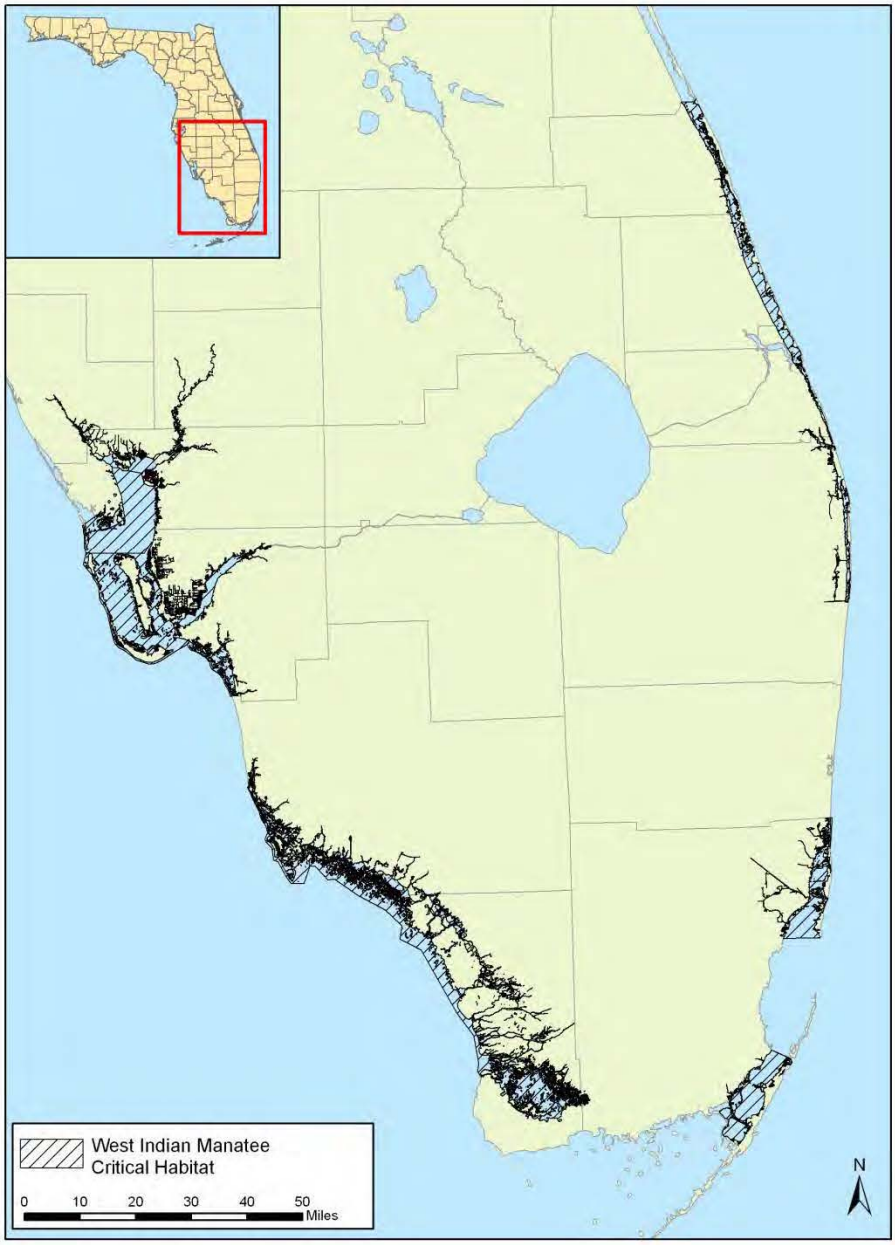

Figure 3: West Indian Manatee (*Trichechus manatus*) Designated Critical Habitat.

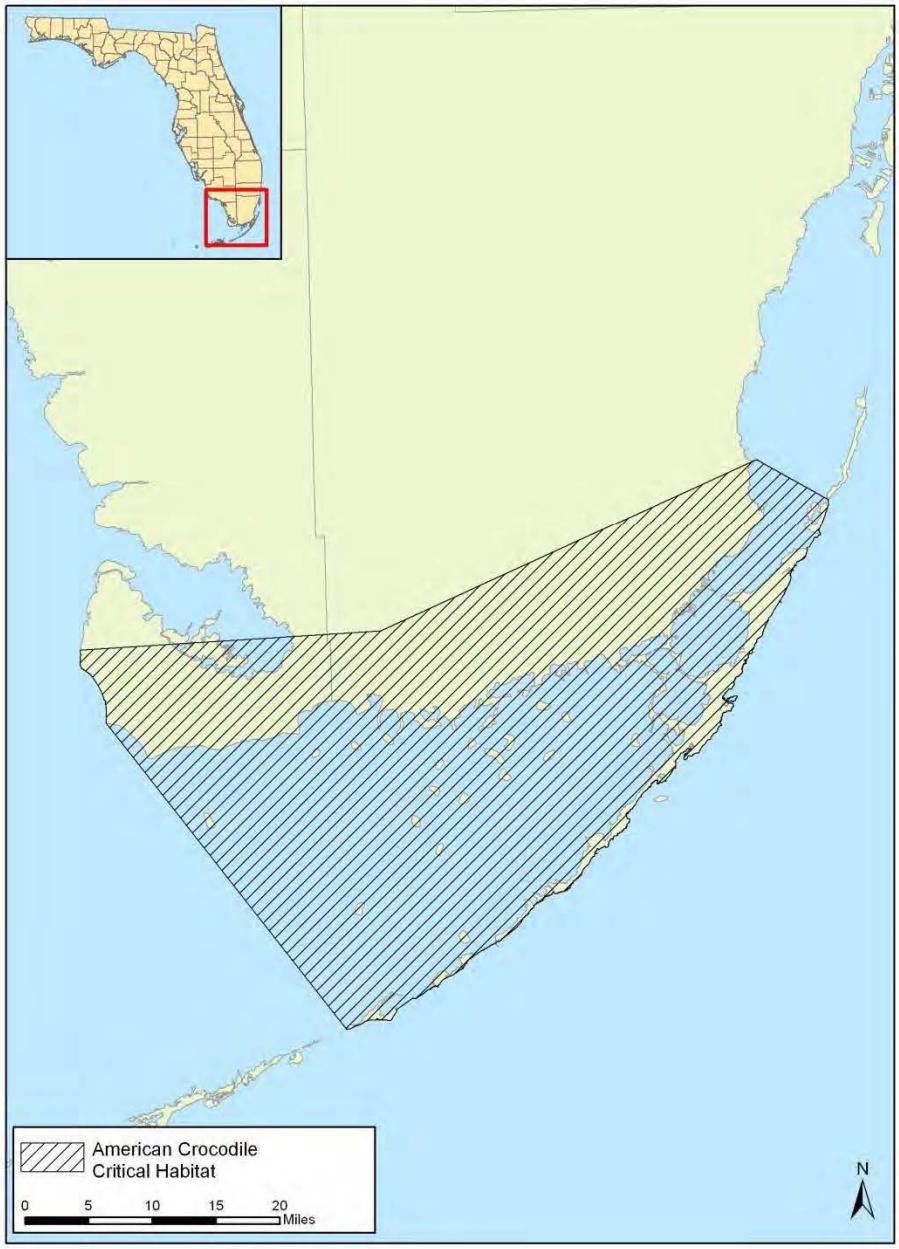

Figure 4: American Crocodile (*Crocodylus acutus*) Designated Critical Habitat.

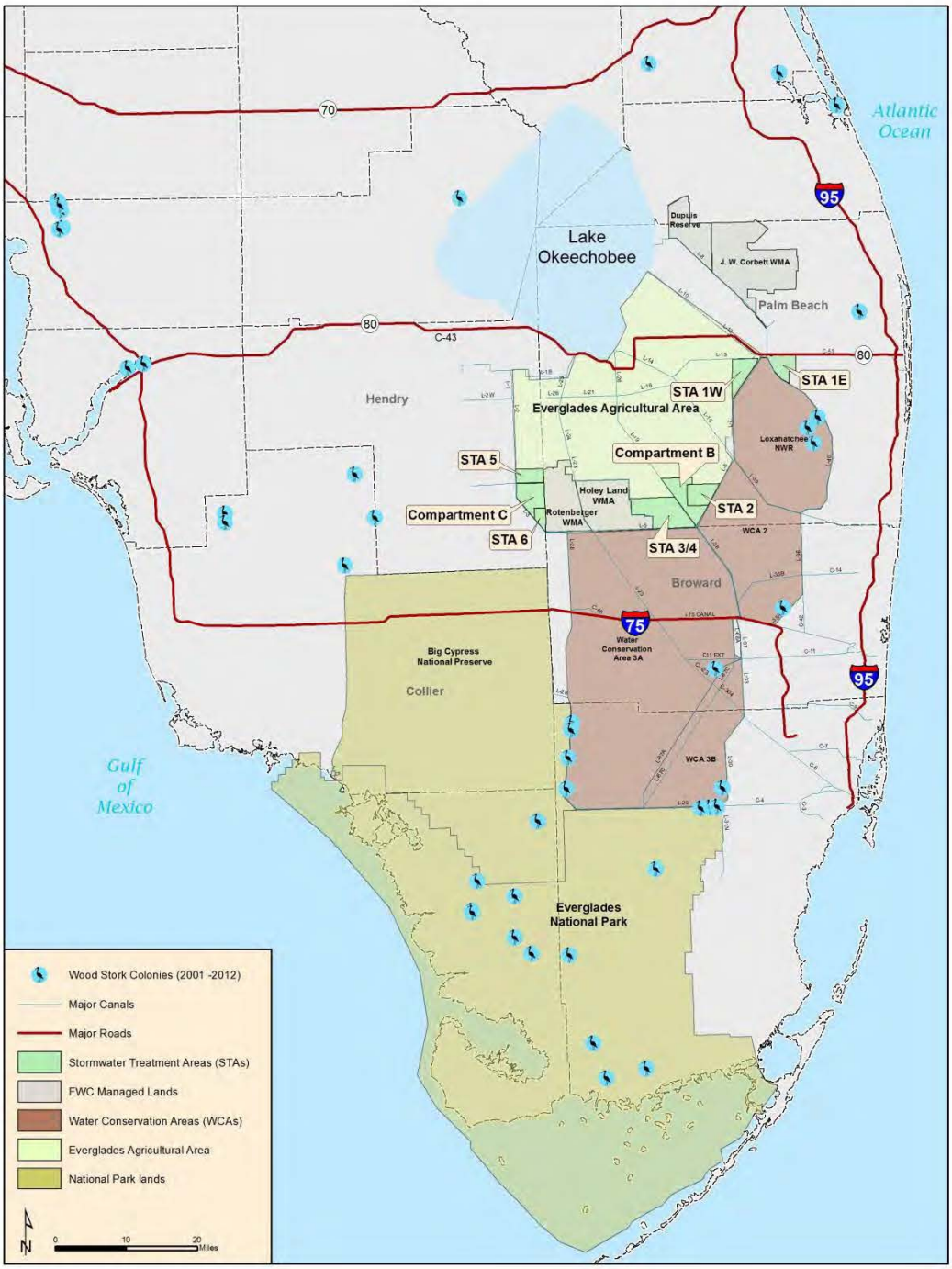

Figure 5. Known wood stork colony locations from 2001 to 2012.

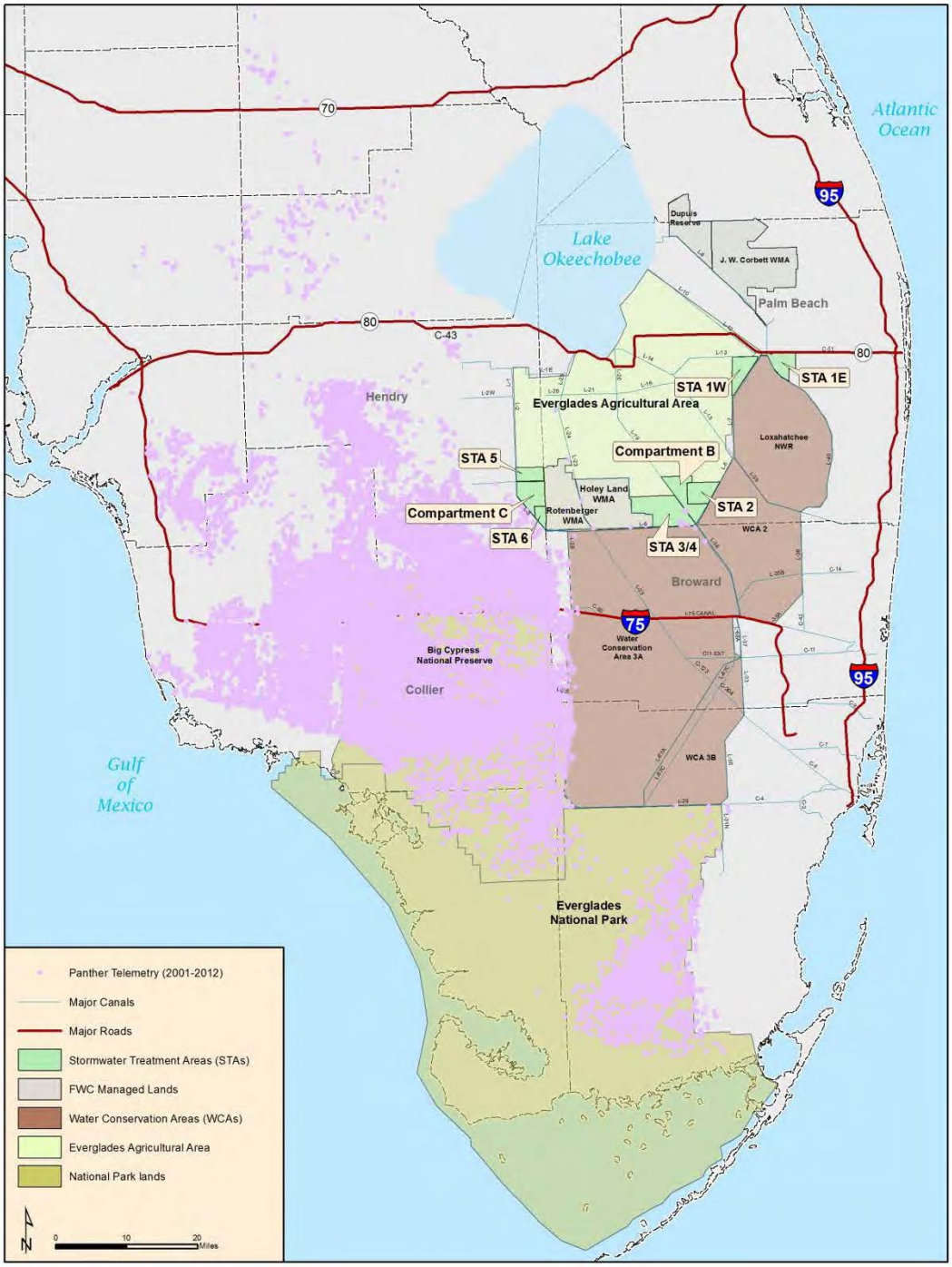

Figure 6. Florida panther telemetry locations between 2001 and 2012.

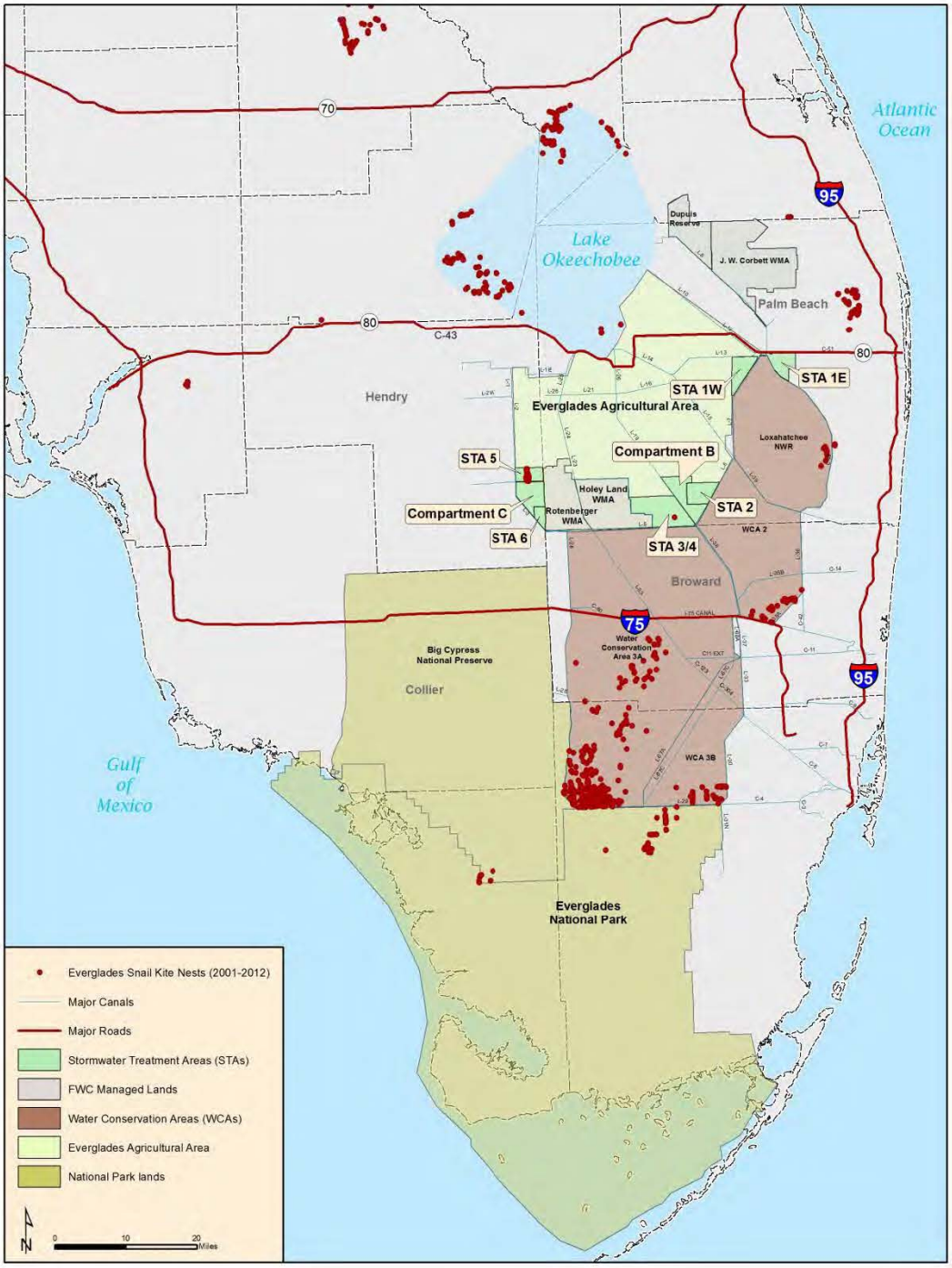

Figure 7. Known Everglade snail kite nest locations between 2001 and 2012.

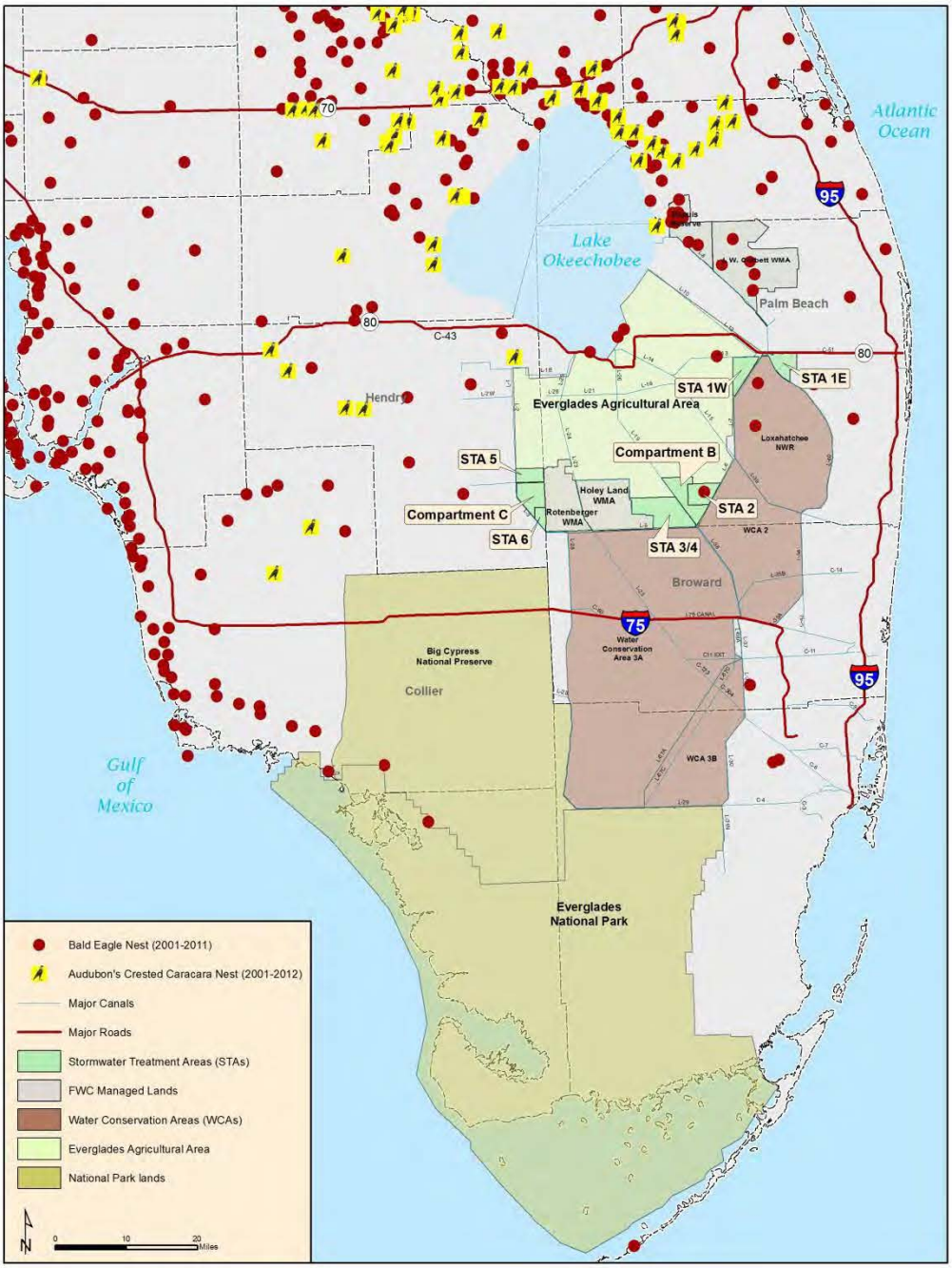

Figure 8. Known bald eagle and Audubon's crested caracara nest sites from 2001 to 2011 and 2012, respectively.

A.5 Endangered Species Act Biological Assessment

The USACE provided NMFS with the Endangered Species Act Programmatic Biological Assessment for the Comprehensive Everglades Restoration Plan (CERP) in July 2013 that included CEPP.

The USACE provided USFWS with the Central Everglades Planning Project Endangered Species Act Biological Assessment on August 5, 2013. On September 4, 2013, the USFWS provided comments and a request for additional information. On October 24, 2013 the USACE provided the USFWS with a Supplemental Technical Analysis in Response to Fish and Wildlife Service Request for Information and a comment response matrix to address the Request for Additional Information.

A.5.1 Comprehensive Everglades Restoration Plan (CERP) Programmatic Biological Assessment submitted to the National Marine Fisheries Service

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning Division
Environmental Branch

Roy E. Crabtree, PhD
Regional Administrator
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

Re: Request for Consultation under Section 7 of the Endangered Species Act

Dear Dr. Crabtree:

Through extensive coordination in October and November 2011 between the U.S. Army Corps of Engineers (Corps) and the National Marine Fisheries Service (NMFS), a need for a programmatic Endangered Species Act Section 7 consultation was recognized in order to adequately evaluate the potential effects of the Comprehensive Everglades Restoration Plan (CERP) program on listed species and designated critical habitat under NMFS' purview. The CERP projects described in the enclosed document include Biscayne Bay Coastal Wetlands; C-111 Spreader Canal Western Project; Site 1 Impoundment; Indian River Lagoon South Feasibility Study; Caloosahatchee River (C-43) West Basin Storage Reservoir; Picayune Strand Restoration Project; Everglades National Park (ENP) Seepage Management Project; and the Central Everglades Planning Project.

As a result, this consultation effort entails the submittal of a Programmatic Biological Assessment (BA) addressing all CERP projects. The intent of this BA, therefore, is to reference the Central and Southern Florida Project Comprehensive Review Study (C&SF); update the status of each CERP project; and evaluate the potential effects to any threatened or endangered species under NMFS purview that was not addressed in previous consultations. This Programmatic BA also includes the most recent CERP project referred to as the Central Everglades Planning project (CEPP) and provides specific evaluations of potential effects to threatened and endangered species within the purview of NMFS.

The primary restoration purpose of CERP is to restore the biological integrity of the remaining natural areas within the project boundaries through modifications to the existing C&SF Project while also providing for the water supply and flood control needs in this area. The project area includes Lake Okeechobee, the Everglades Agricultural Area, the Water Conservation Areas, the majority of Everglades National Park, Coastal Estuaries, Florida Bay, the majority of Big Cypress National Preserve and urban and agricultural areas along Florida's east coast south of the St. Lucie Canal.

Species and critical habitat identified during informal consultation as potentially affected by the proposed CERP projects include fifteen federally listed threatened or endangered species; along with designated critical habitat for Johnson's seagrass, elkhorn coral, staghorn coral, and the smalltooth sawfish.

Enclosed is a Programmatic BA to initiate informal consultation under Section 7(a)(2) of the Endangered Species Act (ESA). Based on the information contained in this BA, the Corps has determined that implementation of CERP "may affect, but is not likely to adversely affect" Johnson's seagrass, smalltooth sawfish, green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle. We request your concurrence with the Corps' determination, and hereby request informal consultation under Section 7 of the ESA.

Please contact Mr. Brad Tarr at 904-232-3582 or by email at bradley.a.tarr@usace.army.mil of my staff regarding this consultation request.

Sincerely,

Eric Summa
Chief, Environmental Branch

ENDANGERED SPECIES ACT
PROGRAMMATIC BIOLOGICAL ASSESSMENT

Comprehensive Everglades Restoration Plan (CERP)

Prepared for
NOAA National Marine Fisheries Service

Prepared by
Department of the Army
Jacksonville District Corps of Engineers

July 2013

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

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Dear Dr. Crabtree:

Through extensive coordination in October and November 2011 between the U.S. Army Corps of Engineers (Corps) and the National Marine Fisheries Service (NMFS), a need for a programmatic Endangered Species Act Section 7 consultation was recognized in order to adequately evaluate the potential effects of the Comprehensive Everglades Restoration Plan (CERP) program on listed species and designated critical habitat under NMFS' purview. The CERP projects described in the enclosed document include Biscayne Bay Coastal Wetlands; C-111 Spreader Canal Western Project; Site 1 Impoundment; Indian River Lagoon South Feasibility Study; Caloosahatchee River (C-43) West Basin Storage Reservoir; Picayune Strand Restoration Project; Everglades National Park (ENP) Seepage Management Project; and the Central Everglades Planning Project.

As a result, this consultation effort entails the submittal of a Programmatic Biological Assessment (BA) addressing all CERP projects. The intent of this BA, therefore, is to reference the Central and Southern Florida Project Comprehensive Review Study (C&SF); update the status of each CERP project; and evaluate the potential effects to any threatened or endangered species under NMFS purview that was not addressed in previous consultations. This Programmatic BA also includes the most recent CERP project referred to as the Central Everglades Planning project (CEPP) and provides specific evaluations of potential effects to threatened and endangered species within the purview of NMFS.

The primary restoration purpose of CERP is to restore the biological integrity of the remaining natural areas within the project boundaries through modifications to the existing C&SF Project while also providing for the water supply and flood control needs in this area. The project area includes Lake Okeechobee, the Everglades Agricultural Area, the Water Conservation Areas, the majority of Everglades National Park, Coastal Estuaries, Florida Bay, the majority of Big Cypress National Preserve and urban and agricultural areas along Florida's east coast south of the St. Lucie Canal.

Species and critical habitat identified during informal consultation as potentially affected by the proposed CERP projects include fifteen federally listed threatened or endangered species; along with designated critical habitat for Johnson's seagrass, elkhorn coral, staghorn coral, and the smalltooth sawfish.

Enclosed is a Programmatic BA to initiate informal consultation under Section 7(a)(2) of the Endangered Species Act (ESA). Based on the information contained in this BA, the Corps has determined that implementation of CERP "may affect, but is not likely to adversely affect" Johnson's seagrass, smalltooth sawfish, green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle. We request your concurrence with the Corps' determination, and hereby request informal consultation under Section 7 of the ESA.

Please contact Mr. Brad Tarr at 904-232-3582 or by email at bradley.a.tarr@usace.army.mil of my staff regarding this consultation request.

Sincerely,

Eric Summa
Chief, Environmental Branch

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1.0 EXECUTIVE SUMMARY

Through extensive coordination in October and November 2011 between the U.S. Army Corps of Engineers (Corps) and the National Marine Fisheries Service (NMFS), a need for a programmatic Endangered Species Act Section 7 consultation was recognized in order to adequately evaluate the potential effects of the Comprehensive Everglades Restoration Plan (CERP) program on listed species and designated critical habitat under NMFS' purview. The CERP projects described in this document include Biscayne Bay Coastal Wetlands; C-111 Spreader Canal Western Project; Site 1 Impoundment; Indian River Lagoon South Feasibility Study; Caloosahatchee River (C-43) West Basin Storage Reservoir; Picayune Strand Restoration Project; Everglades National Park (ENP) Seepage Management Project; and the Central Everglades Planning Project.

As a result, this consultation effort entails the submittal of a Programmatic Biological Assessment (BA) addressing all CERP projects. The intent of this document, therefore, is to reference the Central and Southern Florida Project Comprehensive Review Study (C&SF - also referred to as the Restudy or Yellow Book); update the status of each CERP project; and evaluate the potential effects to any threatened or endangered species under NMFS purview that was not addressed in previous consultations. This Programmatic BA also includes the most recent CERP project referred to as the Central Everglades Planning project (CEPP) and provides specific evaluations of potential effects to threatened and endangered species within the purview of NMFS.

The primary restoration purpose of CERP is to restore the biological integrity of the remaining natural areas within the project boundaries through modifications to the existing C&SF Project while also providing for the water supply and flood control needs in this area. The project area includes Lake Okeechobee, the Everglades Agricultural Area, the Water Conservation Areas, the majority of Everglades National Park, Coastal Estuaries, Florida Bay, the majority of Big Cypress National Preserve and urban and agricultural areas along Florida's east coast south of the St. Lucie Canal.

Species and critical habitat identified during informal consultation as potentially affected by the proposed CERP projects include fifteen federally listed threatened or endangered species; along with designated critical habitat for Johnson's seagrass, elkhorn coral, staghorn coral, and the smalltooth sawfish.

Based on the information contained in this BA, the Jacksonville District of the Corps has determined that implementation of the Comprehensive Plan "may affect, but is not likely to adversely affect" Johnson's seagrass, smalltooth sawfish, green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle. Potential effects are minimized through the overall project restoration opportunities; the expectation of improved water quality and deliveries to coastal and nearshore habitats; and the inclusion of project commitments and conservation measures described herein.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which will not likely be of concern in this study due to the lack of suitable habitat include blue whale, finback whale, humpback whale, sei whale, sperm whale, elkhorn coral, and staghorn coral.

Recognizing the possibility of re-initiating consultation, the Corps will continue discussions with NMFS in the event of project design or operational modifications.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the Corps is requesting written concurrence from the NMFS with the determination of this Biological Assessment.

2.0 INTRODUCTION

The purpose of a Biological Assessment (BA) is to evaluate the potential effects of a federal action (project) on listed and proposed species, including designated and proposed critical habitat, and determine whether the continued existence of any such species or habitat are likely to be adversely affected by the federal action. The BA is also used in determining whether formal consultation or a conference is necessary [Federal Register 51 (106): Section 402.1 (f), pg. 19960, 3 June 1986]. This is achieved through the following:

- The results of an on-site inspection of the area affected by the federal action to determine if listed or proposed species are present or occur seasonally.
- The views of recognized experts on the species at issue.
- A review of the literature and other information.
- An analysis of the effects of the federal action on species and habitat including consideration of cumulative effects, and the results of any related studies.
- An analysis of alternative actions considered by the federal agency for the proposed action.

The federal action evaluated in this Programmatic BA is CERP, which contains over sixty project features. Principal features of the plan are the creation of approximately 217,000 acres of new reservoirs and wetlands based water treatment areas. These features vastly increase storage and water supply for the natural system, as well as for urban and agricultural needs, while maintaining current Central and Southern Florida Project (C&SF) purposes. The recommended CERP achieves the restoration of more natural flows of water, including sheetflow, improved water quality, and more natural hydroperiods in the south Florida ecosystem. Improvements to native flora and fauna, including threatened and endangered species, will occur as a result of the restoration of hydrologic conditions.

On 3 November 2011, the U.S. Army Corps of Engineers (Corps) and the National Marine Fisheries Service (NMFS) agreed to a consultation effort entailing the submittal of a Programmatic BA evaluating each of the CERP projects potentially affecting threatened and endangered species within the purview of NMFS. Those projects include Biscayne Bay Coastal Wetlands; C-111 Spreader Canal Western Project; Site 1 Impoundment; Indian River Lagoon South Feasibility Study; Caloosahatchee River (C-43) West Basin Storage Reservoir; Picayune Strand Restoration Project; Everglades National Park (ENP) Seepage Management Project; and the Central Everglades Planning Project (CEPP).

The intent of this Programmatic BA is to reference the Central and Southern Florida Project Comprehensive Review Study (AKA the Restudy or Yellow Book); update the status of each CERP project; and evaluate potential effects to any threatened or endangered species under NMFS purview that was not addressed in previous consultations. As stated, this Programmatic BA also includes the most recent CERP project referred to as the Central Everglades Planning Project (CEPP) and provides specific evaluations of potential impacts to threatened and endangered species, along with designated critical habitat, within the purview of NMFS.

3.0 CONSULTATION SUMMARY

Annex B of the Restudy includes a preliminary programmatic biological opinion assessing potential impacts to threatened and endangered species with the understanding that a more intense evaluation would occur through separate biological assessments contained in each project's National Environmental Protection Act (NEPA) documentation.

Federally listed species potentially occurring in the Comprehensive Plan project area that are under the purview of NMFS include the smalltooth sawfish (*Pristis pectinata*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), Johnson's seagrass (*Halophila johnsonii*), elkhorn coral (*Acropora palmata*), and staghorn coral (*Acropora cervicornis*). In addition, the project study area contains designated critical habitat for Johnson's seagrass, elkhorn coral, staghorn coral, smalltooth sawfish, and Gulf sturgeon.

On 3 October 2011, NMFS sought additional information on the CERP program and individual projects to better evaluate potential effects on listed species and critical habitat under NMFS purview. As a result, 14 CERP projects are in various stages of planning and/or construction. Of these, NMFS determined that eight of the projects may affect listed species and/or designated critical habitat under their purview; while the other six projects have either been constructed or would have no effect on listed species or designated critical habitat.

The status of these projects and chronology of previous Endangered Species Act (ESA) consultation with NMFS is summarized below:

1. Biscayne Bay Coastal Wetlands (BBCW): By letter dated August 30, 2007, NMFS concurred with the Corps' determination that implementation of the BBCW Acceler8 (initial phase of the project) may affect, but is not likely to adversely affect, smalltooth sawfish. By letter dated 3 November 2011, the NMFS concurred with the Corps' determination that the BBCW project is not likely to adversely affect any listed species under NMFS's purview and subsequently concurred with the Corps' determination that proceeding with the project will not violate sections 7(a)(2) and 7(d) pending completion of a recommended programmatic consultation for any remaining individual CERP projects.

2. C-111 Spreader Canal Western Project: On 7 May 2009, the Corps requested concurrence with NMFS on its determination of may affect, but is not likely to adversely affect smalltooth sawfish and sea turtles. In addition, the Corps determined that the project would not modify critical habitat for elkhorn or staghorn coral. Critical habitat for the smalltooth sawfish had not been designated until after publication of the final

PIR/EIS. After further discussion with NMFS, the Corps changed their determinations to no effect for each species and their designated critical habitat, and NMFS concurred by email on 6 August 2009. Construction is complete for this project; therefore, re-initiation is not required.

3. Site 1 Impoundment: On 16 February 2005, the Corps requested concurrence with NMFS on its determination of no effect on the smalltooth sawfish and opossum pipefish downstream of the project area. By letter dated 18 February 2005, NMFS concurred with the Corps' no effect determination. Construction has been initiated for this project; therefore, re-initiation is not required.

Of the remaining CERP projects pending construction, five are required to re-initiate ESA consultation with NMFS to evaluate potential effects on the smalltooth sawfish and/or its designated critical habitat. Those projects and their consultation histories are summarized below:

1. Indian River Lagoon South Feasibility Study: On 18 March 2002, NMFS concurred with the Corps' determination that the project may affect, but is not likely to adversely affect sea turtles, Johnson's seagrass, and Johnson's seagrass designated critical habitat. On 1 April 2003, the smalltooth sawfish (*Pristis pectinata*) was listed as endangered under the Endangered Species Act (ESA). Construction is not complete and re-initiation of ESA Section 7 consultation with NMFS is required to evaluate any potential effects on the smalltooth sawfish. Consultation will focus exclusively on the species since the project is not located within designated critical habitat for smalltooth sawfish. An assessment of potential effects is included in this document.

2. Caloosahatchee River (C-43) West Basin Storage Reservoir: By letter dated 18 March 2002, NMFS stated that only the Gulf sturgeon could potentially be affected by the proposed action, but concluded that the project would not adversely affect the species. On 10 January 2007, the Corps submitted a revised BA to NMFS. By letter dated 20 July 2007, NMFS concurred with the Corps' determination that the project may affect, but is not likely to adversely affect sea turtles and smalltooth sawfish. On 2 September 2009, NMFS designated critical habitat for smalltooth sawfish. Although the project site is not located within designated critical habitat, it is located upstream from smalltooth sawfish critical habitat. Since construction has not been completed for this project, the Corps requests reinitiation of Section 7 consultation to evaluate potential effects to designated critical habitat for smalltooth sawfish. An assessment of potential effects is included in this document.

3. Picayune Strand Restoration Project: On 20 October 2004, the Corps requested concurrence from NMFS on its no effect determination on smalltooth sawfish, green sea turtle, Kemp's ridley sea turtle and loggerhead sea turtle. As stated in the BA published in the Final Project Implementation Report/Environmental Impact Statement (PIR/EIS), NMFS concurred with the Corps' effect determination for those species. This project is

intended to re-establish sheetflow to the Ten Thousand Islands National Wildlife Refuge, which on 27 August 2009, was designated as critical habitat for the smalltooth sawfish; therefore, re-initiation of consultation with NMFS to evaluate potential effects is required, and an evaluation of potential effects are discussed in this document.

4. Everglades National Park (ENP) Seepage Management Project: As envisioned, this project is comprised of three components: L-31N Improvements for Seepage Management, S-356 Structures, and the Bird Drive Recharge Area. These three components would work to improve freshwater deliveries to Northeast Shark River Slough and restore wetland hydroperiods and hydropatterns in ENP via seepage management. Planning efforts proceeded up to the formulation of an initial array of alternatives; however, the project is presently on hold until related projects can develop the best possible solutions for seepage management out of ENP. This CERP project has been incorporated into CEPP. Potential effects to threatened and endangered species under NMFS purview are examined in section 7.2.8

5. Central Everglades Planning Project (CEPP): The purpose of CEPP is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades (Water Conservation Area [WCA] 3 and ENP). The CEPP will be composed of increments of project components that were identified in CERP, reducing the risks and uncertainties associated with project planning and implementation. The goal of CEPP is to improve the quantity, quality, timing and distribution of water in the Northern Estuaries, WCA 3, and ENP in order to restore the hydrology, habitat and functions of the natural system.

Consultation for four of these CERP projects was previously conducted; however, re-initiation is required for the evaluation of potential effects on smalltooth sawfish and/or its designated critical habitat that wasn't included in previous consultations. Therefore, the Corps is seeking concurrence on the determination of potential effects on smalltooth sawfish and/or designated critical habitat for each of these projects to satisfy the remaining ESA Section 7 requirements.

Presently, the Corps and its non-federal partner, the South Florida Water Management District (SFWMD) are preparing National Environmental Policy Act (NEPA) documentation for the next tier of CERP restoration via CEPP. Although the proposed project has separate components and timelines still under development, a detailed evaluation of potential effects of this project on federally listed species within NMFS purview is included in this Programmatic BA.

4.0 PROJECT DESCRIPTION

4.1 Project Authority

The C&SF Project Comprehensive Review Study, also known as the Restudy or Yellow Book, was authorized by Section 309(l) of the Water Resources Development Act of 1992 (P.L.102-580). This study was also authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated September 24, 1992. Section 528 of

the Water Resources Development Act of 1996 provides specific direction and guidance for the Restudy.

4.2 Description of Proposed Action

In general, the CERP Comprehensive Plan seeks to restore the biological integrity of the remaining natural areas within the project boundaries through modifications to the existing C&SF Project while also providing for the water supply and flood control needs in this area. A description of some of the major features of the proposed action is provided below:

Water Storage Areas: New water storage reservoirs are proposed in the following general areas: 20,000 acres in the Kissimmee River Basin near Lake Okeechobee; 10,000 acres in the St. Lucie River Basin near Lake Okeechobee; 20,000 acres in the Caloosahatchee River Basin near Lake Okeechobee and 60,000 acres in the Everglades Agricultural Area. These reservoirs will store excess water when it is not needed in the natural system or for water supply, so that it may be used later. Currently, much of this excess water is discharged to the Atlantic Ocean and Gulf of Mexico where it often causes adverse impacts to estuarine environments. Other new water storage areas, called Stormwater Treatment Areas and Water Preserve Areas, would help to improve water quality and improve water supply and flood control.

Additional Water Control Structures: Several new water control structures are proposed in the Initial Draft Plan. These structures provide additional flexibility in the control of timing, direction and volume of water flow necessary to improve and maintain natural habitats and water supply and flood control. For example, new structures proposed for the southern border of WCA 2B and eastern border of ENP will allow the movement of excess water from WCA 2B to the Taylor Slough area in ENP where it is needed to restore natural conditions.

Removal of Existing Structures: The proposed action would remove several existing water control structures, including large portions of the L-28 and Tamiami Trail canals and levees. This would provide more natural free flow of water between large areas that are currently separated and would allow many fish and wildlife species to move more freely between habitats.

Operational Changes: Numerous changes are proposed for the way new and existing water control structures are operated. Examples include different rules for opening and closing gates and different rules for turning pumps on and off. Each of the proposed changes would help to make the timing, distribution and volume of water flow more like natural conditions and/or would help provide for water supply and flood control.

The focus of CERP has been on recovering the defining ecological features of the original Everglades and other south Florida ecosystems. The construction of the many levees and dikes designed to compartmentalize the Everglades and separate Lake Okeechobee from its natural overflow, and the canals that drained water to the coast, disrupted natural hydrological

patterns, and destroyed the ability of many animals to find the dependable habitat needed for survival.

The CERP, by removing over 240 miles of internal levees in the Everglades, and approaching recovery of the natural volume of water in the remaining wetlands, will restore these essential defining features of the pre-drainage wetlands over large portions of the remaining system. The plan also includes water storage and water quality treatment areas that will improve water quality conditions in the south Florida ecosystem.

The CERP provides major benefits to the Caloosahatchee and St. Lucie estuaries, and Lake Worth Lagoon. The plan eliminates almost all the damaging fresh water releases to the Caloosahatchee and most detrimental releases to the St. Lucie. The plan makes substantial improvements to Lake Worth Lagoon. As a result, seagrass beds and other submerged aquatic vegetation will benefit and thus provide abundant favorable habitat for the many aquatic species that depend on these areas for food, shelter, and breeding grounds, thereby enhancing the productivity and economic viability of estuarine fisheries. The CERP also includes several water storage and treatment areas to improve water quality conditions in the Indian River Lagoon and the St. Lucie and Caloosahatchee estuarine systems.

The CERP makes improvements in fresh water deliveries to Florida and Biscayne bays. These bays will benefit from more natural water deliveries. Appropriate freshwater regimes will result in substantial improvements in aquatic and semi-aquatic habitats; fish and wildlife will respond favorably to these beneficial changes. Mangroves, coastal marshes, and seagrass beds interacting together to produce food, shelter, and breeding and nursery grounds will support more balanced, productive fish, shellfish, and wildlife communities.

The CERP expands the storage capability of the C&SF Project, enabling the system to better meet ecosystem and urban water supply needs in the future. Frequency of water restrictions expected with CERP is greatly reduced compared to the Without Plan Condition. This will be accomplished by more effectively providing adequate flows from the regional system to recharge the surficial aquifer. This will help offset withdrawals from public water supply wellfields and other users in the urbanized Lower East Coast Region. Such recharge also protects the surficial aquifer from saltwater intrusion, allowing it to remain a productive source of fresh water in the future.

The CERP will significantly increase the capability to supply water from the regional system to agricultural users. This will provide better protection from economically harmful water supply cutbacks and allow agriculture to remain productive. Storage facilities associated with Lake Okeechobee such as those north of the lake, and Lake Okeechobee aquifer storage and recovery will enable the lake to remain an important source of water supply while keeping lake stages at more ecologically desirable levels. Additional storage facilities built throughout the system will diversify sources of water for many users and enable recycling of water within a basin to meet dry season demands, significantly improving the reliability of agricultural water supply in the future.

The CERP also assures that the quality of south Florida's water bodies will be restored to achieve overall ecosystem restoration. The recommended Comprehensive Plan includes many features to assure that water quality standards will be met and water quality conditions are improved or not degraded. The Comprehensive Plan includes the development of a comprehensive integrated water quality plan, which will lead to recommendations for water quality remediation programs and the integration of water quality restoration targets into future design, construction, and operation activities as features of the recommended Comprehensive Plan are implemented.

4.3 Project Objectives

The purpose of the Restudy was to reexamine the C&SF Project to determine the feasibility of modifying the project to restore the south Florida ecosystem and to provide for other water-related needs of the region. Specifically, as required by the authorizing legislation, the Restudy investigated making structural or operational modifications to the C&SF Project for improving the quality of the environment; protecting water quality in the south Florida ecosystem; improving protection of the aquifer; improving the integrity, capability, and conservation of urban and agricultural water supplies; and improving other water-related purposes.

The following principles guided the development of CERP:

- The overarching objective of CERP is the restoration, preservation and protection of the south Florida ecosystem while providing for other water related needs of the region;
- The CERP will be based on the best available science, and independent scientific review will be an integral part of its development and implementation;
- The CERP will be developed through an inclusive and open process that engages all stakeholders;
- All applicable Federal, tribal, state, and local agencies will be full partners and their views will be considered fully; and
- The CERP must be a flexible plan that is based on the concept of adaptive assessment – recognizing that modifications will be made in the future based on new information.

4.4 Project Location

The project area includes Lake Okeechobee, the Everglades Agricultural Area, the Water Conservation Areas, the majority of Everglades National Park, Coastal Estuaries, Florida Bay, the majority of Big Cypress National Preserve and urban and agricultural areas along Florida's east coast south of the St. Lucie Canal.

The CERP area encompasses approximately 18,000 square miles from Orlando to the Florida Reef Tract with at least 11 major physiographic provinces: Everglades, Big Cypress, Lake Okeechobee, Florida Bay, Biscayne Bay, Florida Reef Tract, nearshore coastal waters, Atlantic Coastal Ridge, Florida Keys, Immokalee Rise, and the Kissimmee River Valley. The Kissimmee

River, Lake Okeechobee and the Everglades are the dominant watersheds that connect a mosaic of wetlands, uplands, coastal areas, and marine areas. The study area includes all or part of the following 16 counties: Monroe, Miami-Dade, Broward, Collier, Palm Beach, Hendry, Martin, St. Lucie, Glades, Lee, Charlotte, Highlands, Okeechobee, Osceola, Orange, and Polk.

The C&SF Project, which was first authorized by Congress in 1948, is a multi-purpose project that provides flood control; water supply for municipal, industrial, and agricultural uses; prevention of saltwater intrusion; water supply for Everglades National Park; and protection of fish and wildlife resources throughout the study area. The primary system includes about 1,000 miles each of levees and canals, 150 water control structures, and 16 major pump stations. The Central and Southern Florida Project is shown on **Figure 4-1**.

The following section summarizes each of the regions that comprise this large study area. The study regions are the Kissimmee River Basin, Lake Okeechobee, Upper East Coast, Everglades Agricultural Area, Water Conservation Areas, Lower East Coast, Biscayne Bay, Everglades National Park, Florida Bay, Whitewater Bay and the Ten Thousand Islands, Florida Keys, Big Cypress Basin, and Lower West Coast. A map of the study regions is shown on **Figure 4-2.**

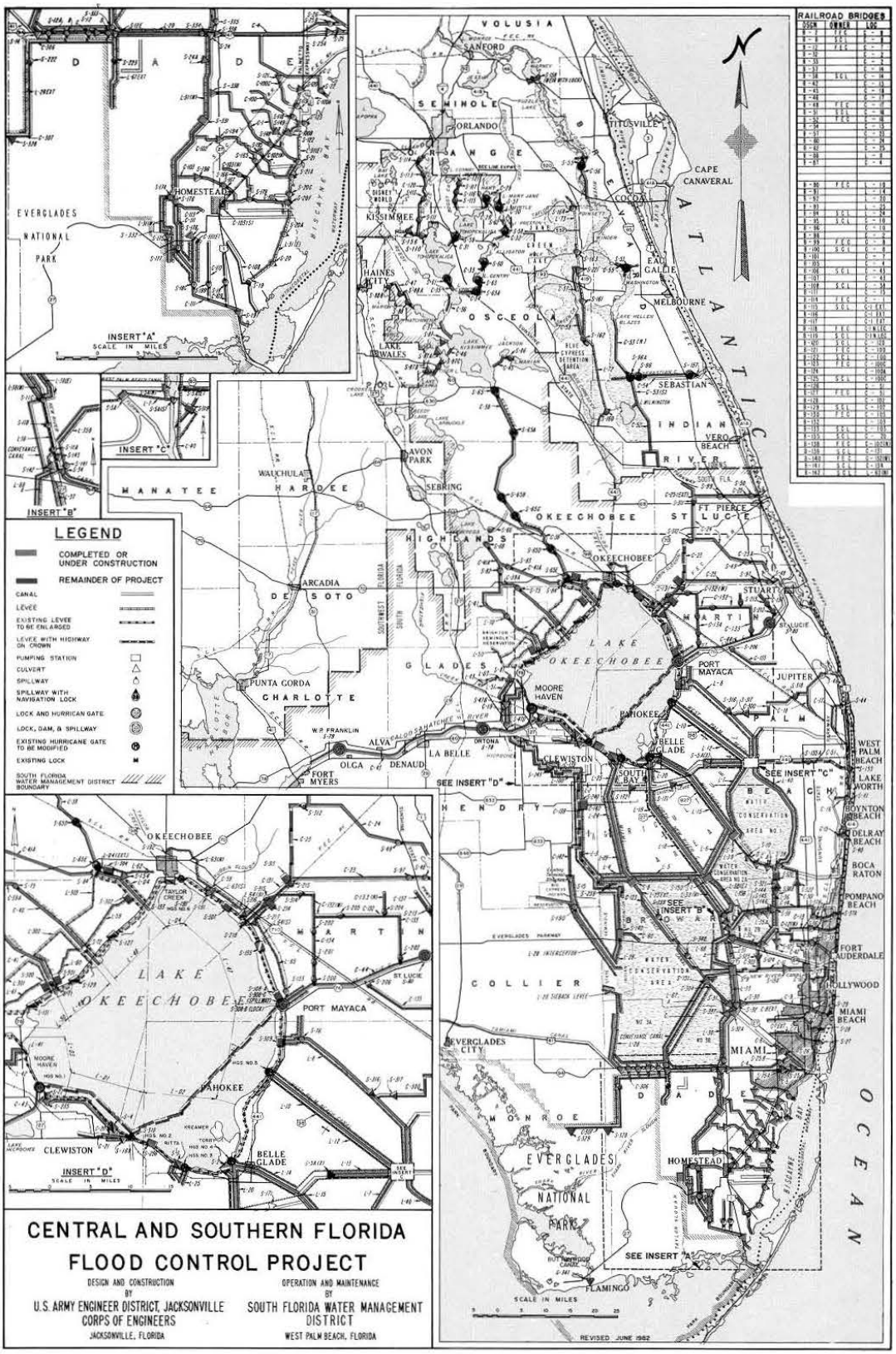

Figure 4-1. C&SF Study Map

Figure 4-2. Study Regions

4.4.1 Kissimmee River Basin

The Kissimmee River Basin is comprised of 3,013 square miles, and extends from Orlando southward to Lake Okeechobee. The watershed, which is the largest source of surface water to the lake, is about 105 miles long and has a maximum width of 35 miles. Project works in the basin for flood control and navigation were constructed by the Corps as part of the C&SF Project. Upper Basin works consist of channels and structures that control water flows through 18 natural lakes into Lake Kissimmee. The Lower Basin includes the channelized Kissimmee River (C-38) as a 56-mile earthen canal extending from Lake Kissimmee to Lake Okeechobee. The northern portion of the basin is comprised of many lakes, some of which have been interconnected by canals. This large sub-basin, often termed the "Upper Basin" or "Chain of Lakes", is bounded on the southern end by State Road 60, where the largest of the lakes, Lake Kissimmee, empties into the Kissimmee River. The Upper Basin is 1,633 square miles and includes Lake Kissimmee and the east and west Chain of Lakes area in Orange and Osceola Counties. A 758-square-mile Lower Basin includes the tributary watersheds of the Kissimmee River between the outlet in Lake Kissimmee and Lake Okeechobee. The 622-square-mile Lake Istokpoga area provides tributary inflow to the Lower Basin.

4.4.2 Lake Okeechobee

Lake Okeechobee lies 30 miles west from the Atlantic coast and 60 miles east from the Gulf of Mexico in the central part of the peninsula. Lake Okeechobee is a broad shallow lake occurring as a bedrock depression. The large, roughly circular lake, with a surface area of approximately 730 square miles, is the principal natural reservoir in southern Florida. The lake's largest outlets include the St. Lucie Canal eastward to the Atlantic Ocean and the Caloosahatchee Canal and River to the Gulf of Mexico. The four major agricultural canals – the West Palm Beach, Hillsboro, North New River, and Miami Canals - have a smaller capacity, but are used whenever possible to release excess water to the Water Conservation Areas, south of the lake, when storage and discharge capacity are available. When regulatory releases from the lake are required, excess water can be passed to the three Water Conservation Areas up to the capacity of the pumping stations and agricultural canals, with the remainder going to the Atlantic Ocean and Gulf of Mexico. The waters of the lake are impounded by a system of encircling levees, which form a multi-purpose reservoir for navigation, water supply, flood control, and recreation. Pumping stations and control structures in the levee along Lake Okeechobee are designed to move water either into or out of the lake as needed. Other surface water bodies include the Kissimmee River, Fisheating Creek, and Taylor Creek that flow into the lake from the north; the Caloosahatchee River that flows out of the lake to the west; the St. Lucie and West Palm Beach Canals that flow out of the lake to the east; and the Hillsboro, North New River, and Miami Canals that flow out of the lake to the south. The hydroperiod of the lake is partially controlled, permitting water levels to fluctuate with flood and drought conditions and the demand for water supply.

4.4.3 Upper East Coast

The Upper East Coast area encompasses approximately 1,139 square miles and includes most of Martin and St. Lucie Counties as well as a portion of eastern Okeechobee County. Martin and St. Lucie Counties are bounded to the east by the Atlantic Ocean, and a substantial portion of Martin County's western landmass borders Lake Okeechobee. Urban development is primarily located along the coastal areas while the central and western portions are used primarily for agriculture where the main products are citrus, truck crops, sugarcane, and beef and dairy products. The land is generally flat, ranging in elevation from 15 to 60 feet NGVD in the western portion with an average elevation of 28 feet. The coastal area ranges from sea level to 25 feet. The coastal sand hills adjacent to the Atlantic Intracoastal Waterway are higher than most parts of the county and reach a maximum elevation of 60 feet. This feature is known as the Atlantic Coastal Ridge. The natural drainage has been significantly altered by the construction of canals, drainage ditches and numerous water control structures which predominately direct stormwater discharge to the east coast. The area contains the C&SF Project Canals C-23, C-24, and C-25 drainage basins and the drainage area served by C-44 (St. Lucie Canal). The St. Lucie Canal is Lake Okeechobee's eastern outlet, extending 25.5 miles from Port Mayaca to the city of Stuart, where it terminates at the south fork of the St. Lucie River. The St. Lucie River Basin is part of a much larger southeastern Florida basin that drains over 8,000 square miles. The St. Lucie River, composed of the North and South forks, lies in Martin and St. Lucie Counties in the northeastern portion of the basin. The South Fork is a relatively short stretch of river. The North Fork, designated as an aquatic preserve by the State of Florida, begins south of Fort Pierce and flows past the city of Port St. Lucie to the St. Lucie River Estuary. The St. Lucie Estuary is part of a larger estuarine system known as the Indian River Lagoon. The Indian River Lagoon has been designated an estuary of national significance and is a component of the U. S. Environmental Protection Agency sponsored National Estuary program. The Indian River Lagoon is also designated as a state priority water body for protection and restoration under the state's Surface Water Improvement and Management (SWIM) Act. The Surface Water Improvement and Management Act Plan identifies excessive freshwater runoff from the St. Lucie Estuary watershed as a problem within the St. Lucie Estuary. Much of the St. Lucie River has been channelized and many drainage canals empty into the river, particularly the St. Lucie Canal, C-23 and C-24. The St. Lucie Canal, the largest overflow canal for Lake Okeechobee, is a navigation channel 8 feet deep and 100 feet wide connecting the Atlantic Intracoastal Waterway in Stuart with Lake Okeechobee at Port Mayaca.

4.4.4 Everglades Agricultural Area

The lands located immediately south and southeast of the lake are known as the Everglades Agricultural Area. This area of about 700,000 acres is rich, fertile agricultural land. A large portion of the Everglades Agricultural Area is devoted to the production of sugarcane. The average ground elevation is about 12 feet. The occurrence of surface water in the area is now a direct result of the construction of the numerous conveyance and drainage canals. The primary canals consist of the Miami, the North New River, the Hillsboro, and the West Palm Beach Canals, which traverse the area north south, and

the Bolles and Cross Canal, which extends east-west. Water levels and flows are stringently manipulated in the canals to achieve optimum crop growth. Major surface impoundments in the area are non-existent.

4.4.5 Water Conservation Areas

The WCAs are an integral component of the Everglades and freshwater supplies for south Florida. The WCAs, located south and east of the Everglades Agricultural Area (EAA), comprise an area of about 1,350 square miles, including 1,337 square miles of the original Everglades, which averaged some 40 miles in width and extended approximately 100 miles southward from Lake Okeechobee to the sea. The WCAs provide a detention reservoir for excess water from the agricultural area and parts of the Lower East Coast region, and for flood discharge from Lake Okeechobee. The WCAs also provide levees needed to prevent Everglades floodwaters from inundating the Lower East Coast, while providing water supply for Lower East Coast agricultural lands and ENP; improving water supply for east coast communities by recharging the Biscayne Aquifer (the sole source of drinking water for southern Palm Beach, Broward, Miami-Dade, and Monroe Counties); retarding salt water intrusion in coastal well fields; and benefiting fish and wildlife in the Everglades.

4.4.5.1 Water Conservation Area 1

WCA 1 (Loxahatchee National Wildlife Refuge) is about 21 miles long from north to south and comprises an area of 221 square miles. The West Palm Beach Canal lies at the extreme northern boundary, and on the south the Hillsboro Canal separates WCA 1 from WCA 2. Ground elevations slope about five feet in 10 miles, both to the north and to the south from the west center of the area, varying from over 16 feet in the northwest to less than 12 feet in the south. The area, which is enclosed by about 58 miles of levee (approximately 13 miles of which are common to WCA 2), provides storage for excess rainfall, excess runoff from agricultural drainage areas of the West Palm Beach Canal (230 square miles) and the Hillsboro Canal (146 square miles), and excess water from Lake Okeechobee. Inflow comes from rainfall and runoff from the EAA through canals at the northern end. Release of water for dry-season use is controlled by structures in the West Palm Beach Canal, the Hillsboro Canal, and in the north-south levee which forms the eastern boundary of the area. When stages exceed the regulation schedule, excess water in WCA 1 is discharged to WCA 2.

4.4.5.2 Water Conservation Area 2

WCA 2 is comprised of two areas, 2A and 2B, measures about 25 miles from north to south, and covers an area of 210 square miles. It is separated from the other Water Conservation Areas by the Hillsboro Canal on the north and the North New River Canal on the south. Ground elevations slope southward about two to three feet in 10 miles, ranging from over 13 feet NGVD in the northwest to less than seven feet NGVD in the south. The area is enclosed by about 61 miles of levee, of which approximately 13 miles are common to WCA 1 and 15 miles to WCA 3. An interior levee across the southern portion of the area reduces water losses due to seepage into an extremely pervious

aquifer at the southern end of the pool and prevents overtopping of the southern exterior levee by hurricane waves. The upper pool, WCA 2A, provides a 173-square-mile reservoir for storage of excess water from WCA 1 and a 125-square-mile agricultural drainage area of the North New River Canal. Storage in WCA 2A provides water supply to the east coast urban areas of Broward County. Water enters the area from Water Conservation Area 1 and the Hillsboro Canal on the northeast side and from the North New River Canal on the northwest side. Water in excess of that required for efficient operation of WCA 2A is discharged to WCA 3 via structures into C-14, the North New River Canal, and Water Conservation Area 2B. WCA 2B has ground elevations ranging from 9.5 feet NGVD in the northern portions down to 7.0 feet NGVD in the southern portions of the area. The area experiences a high seepage rate, which does not allow for long term storage of water, and as a result, water is not normally released from the area.

4.4.5.3 Water Conservation Area 3

WCA 3 is also divided into two parts, 3A and 3B. It is about 40 miles long from north to south and comprises about 915 square miles, making it the largest of the conservation areas. Ground elevations, which slope southeasterly 1 to 3 feet in 10 miles, range from over 13 feet NGVD in the northwest to 6 feet NGVD in the southeast. The Miami Canal traverses the area from northwest to southeast, and the North New River Canal separates it from WCA 2. The area is enclosed by about 111 miles of levee, of which 15 miles are common to WCA 2. An interior levee system across the southeastern corner of the area reduces seepage into an extremely pervious aquifer. The upper pool, WCA 3A, provides a 752-square-mile area for storage of excess water from WCA 2A; rainfall excess from approximately 750 square miles in Collier and Hendry Counties and from 71 square miles of the former Davie agricultural area lying east of Pumping Station S-9 in Broward County; and excess water from a 208-square-mile agricultural drainage area of the Miami Canal and other adjacent areas to the north. Water enters WCA 3A from various sources on the northern and eastern sides. The storage is used to meet the principal water supply needs of adjacent areas, including urban water supply and salinity control requirements for Miami-Dade and Monroe County, irrigation requirements, and water supply for ENP.

4.4.6 <u>Lower East Coast Area</u>

The Lower East Coast area, which consists of the coastal ridge section in Palm Beach, Broward, and Miami-Dade Counties, is a strip of sandy land which lies east of part of the Water Conservation Areas. The ground surface of the flatlands in the west ranges from about 25 feet NGVD in the upper part of the region to about five feet NGVD in lower Miami-Dade County. The Atlantic Coastal Ridge is comprised of broad, low dunes and ridges with elevations ranging from 10 to 25 feet NGVD. This ridge area ranges from two to four miles in width at its northern edge to its southern edge in Miami. South of Miami the ridge becomes less pronounced but significantly wider. The Lower East Coast area is the most densely populated part of the state. The largest population centers are near the coast and include the cities of Miami, West Palm Beach, Fort Lauderdale, and

Hollywood. Water levels in coastal canals are controlled near the coastal shoreline to prevent over-drainage and to resist salt water intrusion. Low water levels in these canals may enable salt water to migrate into the ground water, well fields, and natural freshwater systems upon which the urban areas depend for a potable water supply.

This area is characterized by sandy flatlands to the west, the sandy coastal ridge, and the coastal marsh and mangrove swamp areas along the Atlantic seaboard. The northern portion, generally that part north of Miami-Dade County, marks the shore of a higher Pleistocene Sea and occurs as one or more relict beach ridges. The southern portion appears to be marine deposited sands or marine limestone. Extensive development has resulted in nearly complete urbanization of the coastal region from West Palm Beach southward through Miami, and these physiographical characteristics of the region have been greatly overshadowed. South of Miami, in Miami-Dade County, this coastal area widens as the Everglades bends to the west to include urban areas and agricultural areas that extend almost to the southern coast. Miami-Dade County's agricultural industry covers more than 83,000 acres in the southwest of the coastal metropolitan area. Vegetables, tropical fruits, and nursery plants are grown in this area.

4.4.7 Biscayne Bay

Biscayne Bay is a shallow, tidal sound located near the extreme southeastern part of Florida. Biscayne Bay, its tributaries and Card Sound are designated by the state of Florida as aquatic preserves, while Card and Barnes sounds are part of the Florida Keys National Marine Sanctuary. A significant portion of the central and southern portions of Biscayne Bay comprise Biscayne National Park. The original areal extent of Biscayne Bay approximated 300 square miles, but it has since undergone major areal modifications, particularly in its northern portions, as a result of development. The bay extends about 55 miles in a south-southwesterly direction from Dumfoundling Bay on the north to Barnes Sound on the south. It varies in width from less than 1 mile in the vicinity of the Atlantic Intracoastal Waterway passage to Dumfoundling Bay, to about 10 miles between the mainland and the Safety Valve Shoals to the east. While there has been extensive dredging and filling within northern Biscayne Bay, the area still supports a productive and healthy seagrass bed and a few tracts of natural shoreline remain. Northern Biscayne Bay's headwaters are now considered to include dredged areas known as Maule Lake and Dumfoundling Bay, near the northern boundary of Miami-Dade County. Central and, in particular, southern Biscayne Bay have been impacted less by development than northern Bay. For instance, mangrove-lined coastal wetlands extend from Matheson Hammock Park south along the entire shoreline of Biscayne National Park, Card and Barnes Sounds, a distance of approximately 30 miles. These coastal wetlands are the largest tract of undeveloped wetlands remaining in south Florida outside of Everglades National Park, the Big Cypress Preserve, and the Water Conservation Areas.

Biscayne National Park, in southern Biscayne Bay was established in 1980 to protect and preserve this nationally significant marine ecosystem consisting of mangrove shorelines,

a shallow bay, undeveloped islands, and living coral reefs. The park is 180,000 acres in size and 95 percent water. The shoreline of southern Biscayne Bay is lined with a forest of mangroves and the bay bottom is covered with dense seagrass beds. The park has been designated a sanctuary for the Florida spiny lobster. Biscayne Bay and Biscayne National Park support a multitude of marine wildlife such as lobster, shrimp, fish, sea turtles, and manatees. The coral reefs within the Biscayne National Park support a diverse community of marine plant and wildlife. Depending upon the flood stages reached, all C&SF Project canals in adjacent Miami-Dade County can carry floodwaters to Biscayne Bay. However, much of the time, discharges from project canals represent primarily runoff or seepage from within the flood protected area of the county. These flows originate in the extensive networks of secondary drainage canals and storm sewers that discharge into the project canals. Supplementing the complex system of project canals and secondary drainage systems are many hundreds of other stormwater drainage canals and storm sewer outfalls within Miami-Dade County that discharge freshwater directly into Biscayne Bay.

4.4.8 Everglades National Park

ENP encompasses 2,353 square miles of wetlands, uplands, and submerged lands at the southern end of the Florida peninsula. The topography is extremely low and flat, with most of the area below four feet NGVD. The highest elevations are found in the northeastern section of the park and are from six to seven feet NGVD. The saline wetlands, including mangrove and buttonwood forests, salt marshes, and coastal prairie that fringe the coastline are subject to the influence of salinity from tidal action.

ENP, authorized by Congress in 1934 and established in 1947, was established to protect the unique tropical biological resources of the southern Everglades ecosystem. It was the first national park to be established to preserve purely biological (vs. geological) resources. The park's authorizing legislation mandated that it be managed as "…wilderness, [where] no development… or plan for the entertainment of visitors shall be undertaken which will interfere with the preservation intact of the unique flora and fauna and the essential primitive natural condition now prevailing in this area." This mandate to preserve wilderness is one of the strongest in the legislative history of the National Park System. ENP has been recognized for its importance, both as a natural and cultural resource as well as for its recreational value, by the international community and the national and state government. At the international level, the park is a World Heritage Site, an International Biosphere Reserve, and a Wetland of International Significance. In 1978, Congress designated much of the park, (86%) as Wilderness under the Wilderness Act of 1964. In 1997, this area was re-designated the Marjory Stoneman Douglas Wilderness. Hell's Bay Canoe Trail and the Wilderness waterway are designated National Trails. The State of Florida has designated the Park an Outstanding Florida Water.

The ENP preserves a unique landscape where the temperate zone meets the subtropics, blending the wildlife and vegetation of both. The landscape includes sawgrass sloughs,

tropical hardwood hammocks, offshore coral reefs, mangrove forests, lakes, ponds, and bays, providing habitat for dozens of threatened and endangered species of plants and animals. It is the largest designated wilderness, at 1,296,500 acres, east of the Rocky Mountains. It protects the largest continuous stand of sawgrass prairie in North America, the most significant breeding grounds for tropical wading birds in North America, over 230,100 acres of mangrove forest (the largest in the western hemisphere), a nationally significant estuarine complex in Florida Bay and significant ethnographic resources, revealing 2,000 years of human occupation.

4.4.9 Florida Bay, Whitewater Bay, and the Ten Thousand Islands

Florida Bay and the Ten Thousand Islands comprise 1,500 square miles of ENP. The bay is shallow, with an average depth of less than three feet. To the north is the Florida mainland and to the south lie the Florida Keys. Sheet flow across marl prairies of the southern Everglades and 20 creek systems fed by Taylor Slough and the C-111 Canal provide direct inflow of fresh surface water and groundwater recharge. Surface water from Shark River Slough, the sub-region's largest drainage feature, flows into Whitewater Bay and also may provide essential groundwater recharge for central and western Florida Bay. Exchange with Florida Bay occurs as the lower salinity water mass flows around Cape Sable into the western sub-region of the bay.

4.4.10 Florida Keys

The Florida Keys are a limestone island archipelago extending southwest over 200 miles from the southern tip of the Florida mainland to the Dry Tortugas, 63 miles west of Key West. They are bounded on the north and west by the relatively shallow waters of Biscayne Bay, Barnes and Blackwater Sounds, Florida Bay - all areas of extensive mud shoals and seagrass beds – and the Gulf of Mexico. Hawk Channel lies to the south, between the mainland Keys and an extensive reef tract 5 miles offshore. The Straits of Florida lie beyond the reef, separating the Keys from Cuba and the Bahamas. The Keys are made up of over 1,700 islands encompassing approximately 103 square miles. They are broad, with little relief, have a shoreline length of 1,865 miles, and are inhabited from Soldier Key to Key West. Key Largo and Big Pine Key are the largest islands. The Keys are frequently divided into three regions: 1) the Upper Keys, north of Upper Matecumbe Key; 2) the Middle Keys, from Upper Matecumbe Key to the Seven Mile Bridge; and 3) the Lower Keys, from Little Duck Key to Key West. The Florida Keys National Marine Sanctuary encompasses approximately 3,668 square miles of submerged lands and waters between the southern tip of Key Biscayne and the Dry Tortugas Bank. North of Key Largo it includes Barnes and Card Sounds, and to the east and south the oceanic boundary is the 300-foot isobath. The Sanctuary also contains part of Florida Bay and the entire Florida Reef Tract, the largest reef system in the continental United States. The Sanctuary contains components of five distinct physiographic regions: Florida Bay, the Southwest Continental Shelf, the Florida Reef Tract, the Florida Keys, and the Straits of Florida. The regions are environmentally and lithologically unique, and together they form the framework for the Sanctuary's diverse terrestrial and aquatic habitats.

4.4.11 Florida Reef Tract

The Florida Reef Tract is an accurate band of living coral reefs paralleling the Keys. The reefs are located on a narrow shelf that drops off into the Straits of Florida. The shelf slopes seaward at a 0.06 degree angle into Hawk Channel, which is several miles wide and averages 50 feet deep. From Hawk Channel, the shelf slopes upward to a shallower area containing numerous patch reefs. The outer edge is marked by a series of bank reefs and sand banks that are subject to open tidal exchange with the Atlantic. The warm, clear, naturally low-nutrient waters in this region are conducive to reef development.

4.4.12 Big Cypress Basin

Big Cypress Swamp spans approximately 1,205 square miles (771,000 acres) from southwest of Lake Okeechobee to the Ten Thousand Islands in the Gulf of Mexico. The 570,000-acre Big Cypress National Preserve was established by *Public Law 93-440* in 1974 to protect natural and recreational values of the Big Cypress watershed and to allow for continued traditional uses such as hunting, fishing, and oil and gas production. It was also established to provide an ecological buffer zone and protect Everglades National Park's water supply. In 1988, Congress passed the *Big Cypress National Preserve Addition Act* which will add 146,000 acres to the preserve.

4.4.13 Lower West Coast

The Lower West Coast region covers approximately 4,000 square miles in Lee, Hendry, Glades, and Collier Counties and a portion of Charlotte County. This area is generally bounded by Charlotte County to the north, Lake Okeechobee and the EAA to the east, the Big Cypress National Preserve to the south, and the Gulf of Mexico to the west. The area is characterized by the sandy flatlands region of Lee County, which give way to sandy though more rolling terrain in Hendry County; and the coastal marshes and mangrove swamps of Collier County. The Caloosahatchee River sub-watershed includes an area of 550,900 acres in parts of Lee, Glades, Charlotte, and Hendry Counties. From a hurricane gate on the southwest shore of Lake Okeechobee at Moore Haven, the Caloosahatchee Canal drains westerly for about five miles through a very flat terrain into Lake Hicpochee. From there the canal joins the upper reach of the Caloosahatchee River. On its way to the Gulf of Mexico, the river is controlled by navigation locks at Ortona (15 miles downstream from Moore Haven) and at Olga near Fort Myers. Downstream from Ortona Lock, many tributaries join the river along its course to the Gulf. The Caloosahatchee River serves as a portion of the cross-state Okeechobee Waterway, which extends from Stuart on the east coast via the St. Lucie Canal, through Lake Okeechobee and the Caloosahatchee River to Fort Myers on the Gulf of Mexico. The river has been straightened by channelization through most of its 65-mile course from the Moore Haven Lock to Fort Myers. The J. N. "Ding" Darling National Wildlife Refuge Complex includes Pine Island NWR, Island Bay NWR, Matlacha Pass NWR, and Caloosahatchee NWR, all located on the lower west coast. The health of the estuarine ecosystem they embody is directly tied to the water quality, quantity and timing of

flows from the Caloosahatchee watershed and those watersheds which drain into the Caloosahatchee River (i.e. Kissimmee River and Lake Okeechobee watersheds).

5.0 CERP Elements (U.S. Army Corps of Engineers, 1999)

The Restudy Team formulated and evaluated 10 alternative comprehensive plans and more than 25 intermediate computer simulations. Alternative D-13R was selected as the Initial Draft Plan. Alternative D-13R along with the series of Other Project Elements, Critical Projects, water quality treatment facilities, and other modifications that further improve performance of the plan, comprise the recommended Comprehensive Plan. The estimated first cost of the recommended Comprehensive Plan is $7.8 billion; and the annual operation and maintenance costs, including adaptive assessment and monitoring, are $182 million. The plan includes the following structural and operational changes to the existing C&SF Project:

5.1 Surface Water Storage Reservoirs

A number of water storage facilities are planned north of Lake Okeechobee, in the Caloosahatchee and St. Lucie basins, in the EAA, and in the Water Preserve Areas of Palm Beach, Broward and Miami-Dade counties. These areas will encompass approximately 181,300 acres and will have the capacity to store 1.5 million acre-feet of water.

5.2 Water Preserve Areas

Multipurpose water management areas are planned in Palm Beach, Broward and Miami-Dade counties between the urban areas and the eastern Everglades. The WCAs will have the ability to treat urban runoff, store water, reduce seepage, and improve existing wetland areas.

5.3 Manage Lake Okeechobee as an Ecological Resource

Lake Okeechobee is currently managed for many, often conflicting, uses. The lake's regulation schedule will be modified and plan features constructed to reduce the extreme high and low levels that damage the lake and its shoreline. Management of intermediate water levels will be improved, while allowing the lake to continue to serve as an important source for water supply. Several plan components and Other Project Elements are included to improve water quality conditions in the lake. A study is recommended to evaluate in detail the dredging of nutrient-enriched lake sediments to help achieve water quality restoration targets, important not only for the lake, but also for downstream receiving bodies.

5.4 Improve Water Deliveries to Estuaries

Excess stormwater that is discharged to the ocean and the gulf through the Caloosahatchee and St. Lucie rivers is very damaging to their respective estuaries. The CERP will greatly reduce these discharges by storing excess runoff in surface and underground water storage areas. During times of low rainfall, the stored water can be used to augment flow to the estuaries. Damaging high flows will also be reduced to the Lake Worth Lagoon.

5.5 Underground Water Storage

Wells and associated infrastructure will be built to store water in the upper Floridian aquifer. As much as 1.6 billion gallons a day may be pumped down the wells into underground storage zones. The injected fresh water, which does not mix with the saline aquifer water, is stored in a "bubble" and can be pumped out during dry periods. This approach, known as aquifer storage and recovery, has been used for years on a smaller scale to augment municipal water supplies. Since water does not evaporate when stored underground and less land is required for storage, aquifer storage and recovery has some advantages over surface storage. The CERP includes aquifer storage and recovery wells around Lake Okeechobee, in the WCAs, and the Caloosahatchee Basin.

5.6 Treatment Wetlands

Approximately 35,600 acres of manmade wetlands, known as stormwater treatment areas, will be built to treat urban and agricultural runoff water before it is discharged to the natural areas throughout the system. Stormwater treatment areas are included in CERP for basins draining to Lake Okeechobee, the Caloosahatchee River Basin, the St. Lucie Estuary Basin, the Everglades, and the Lower East Coast. These are in addition to the over 44,000 acres of stormwater treatment areas already being constructed pursuant to the Everglades Forever Act to treat water discharged from the EAA.

5.7 Improve Water Deliveries to the Everglades

The volume, timing, and quality of water delivered to the south Florida ecosystem will be greatly improved. The Comprehensive Plan will deliver an average of 26 percent more water into Northeast Shark River Slough over current conditions. This translates into nearly a half million acre-feet of additional water reaching the slough, and is especially critical in the dry season. More natural refinements will be made to the rainfall-driven operational plan to enhance the timing of water sent to the WCAs, ENP, Holey Land, and Rotenberger Wildlife Management Areas.

5.8 Remove Barriers to Sheetflow

More than 240 miles of project canals and internal levees within the Everglades will be removed to reestablish the natural sheetflow of water through the Everglades. Most of

the Miami Canal in WCA 3 will be removed and 20 miles of the Tamiami Trail (U.S. Route 41) will be rebuilt with bridges and culverts, allowing water to flow more naturally into ENP, as it once did. In the Big Cypress National Preserve, a north-south levee will be removed to restore more natural overland water flow.

5.9 Store Water in Existing Quarries

Two limestone quarries in northern Miami-Dade County will be converted to water storage reservoirs to supply Florida Bay, the Everglades, Biscayne Bay, and Miami-Dade County residents with water. The 11,000-acre area will be ringed with an seepage barriers to ensure that stored water does not leak or adjacent groundwater does not seep into the area. A similar facility will be constructed in northern Palm Beach County.

5.10 Reuse Wastewater

The recommended Comprehensive Plan includes two advanced wastewater treatment plants in Miami-Dade County capable of making more than 220 million gallons a day of the county's treated wastewater clean enough to discharge into wetlands along Biscayne Bay and for recharging the Biscayne Aquifer. This reuse of water will improve water supplies to south Miami-Dade County as well as reducing seepage from the Northeast Shark River Slough area of the Everglades. Given the high cost associated with using reuse to meet the ecological goals and objectives for Biscayne Bay, other potential sources of water to provide freshwater flows to the central and southern bay will be investigated before pursuing reuse.

5.11 Pilot Projects

A number of technologies proposed in CERP have uncertainties associated with them -- either in the technology itself, its application, or in the scale of implementation. While none of the proposed technologies are untested, what is not known is whether actual performance will measure up to that anticipated in CERP. The pilot projects, which include wastewater reuse, seepage management, Lake Belt technology, and three aquifer storage and recovery projects are recommended to address uncertainties prior to full implementation of these components.

5.12 Improve Fresh Water Flows to Florida Bay

Improved water deliveries to Shark River Slough, Taylor Slough, and wetlands to the east of Everglades National Park will in turn provide improved deliveries of fresh water flows to Florida Bay. A feasibility study is also recommended to evaluate additional environmental restoration needs in Florida Bay and the Florida Keys.

5.13 Southwest Florida

There are additional water resources problems and opportunities in southwest Florida requiring studies beyond the scope of the Restudy recommended Comprehensive Plan. In this regard, a feasibility study for Southwest Florida is being recommended to investigate the region's hydrologic and ecological restoration needs.

5.14 Comprehensive Integrated Water Quality Plan

The CERP includes a follow-on feasibility study to develop a comprehensive water quality plan to ensure that CERP leads to ecosystem restoration throughout south Florida. The water quality feasibility study would include evaluating water quality standards and criteria from an ecosystem restoration perspective and recommendations for integrating existing and future water quality restoration targets for south Florida water bodies into future planning, design, and construction activities to facilitate implementation of the recommended Comprehensive Plan. Further, water quality in the Keys is critical to ecosystem restoration. The Florida Keys Water Quality Protection Plan includes measures for improving wastewater and stormwater treatment within the Keys. Implementation of the Keys Water Quality Protection Plan is critical for restoration of the south Florida ecosystem.

Overall, CERP will capture and store much of the water that is now lost to the ocean and gulf. This will provide enough water in the future for both the ecosystem, as well as urban and agricultural users. It will continue to provide the same level of flood protection as it does at present for south Florida. The CERP is a system-wide solution for ecosystem restoration, water supply, and flood damage reduction. It is a necessary step towards a sustainable south Florida.

6.0 DESCRIPTION OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

6.1 Affected Environment

Southern Florida is characterized by highly productive agricultural regions and rapidly growing urban areas. These areas contain extensive aquatic and wetland ecosystems that are in serious states of decline, largely as a result of water management activities required to support the agricultural and urban systems. An expanding urban population occupies most of the higher elevation areas of the Lower East Coast. Extensive agricultural areas cover much of the interior of the peninsula north and south of Lake Okeechobee and along the western fringes of the Lower East Coast. Both urban and agricultural land uses require increasing levels of water supply and flood control.

A channelized and degraded Kissimmee River is currently undergoing ecological restoration. A diked and highly regulated Lake Okeechobee has been reduced in area by half with the loss of extensive littoral wetlands. It now requires frequent regulatory water releases to maintain lowered water levels defined by water regulation schedules.

The regulatory releases severely damage the St. Lucie and Caloosahatchee estuarine ecosystems.

The Everglades have also been reduced in area by half due to agricultural and urban expansion. The remaining Everglades ecosystem is in a continuing state of decline largely as a result of altered water regimes and degraded water quality, as evidenced by vegetation change, declining wildlife populations and organic soil loss. In contrast, the Big Cypress region, although modified from its natural condition through major man-caused disturbances (eg. logging, oil and gas exploration, residential development, recreation uses and agriculture). is in relatively good condition as an ecosystem. At the downstream end of the system, Florida Bay, the Gulf of Mexico, and Biscayne Bay estuarine ecosystems experience altered salinity regimes due to decreased freshwater heads and inflows from the Everglades, with damaging effects on habitats, nursery grounds, and estuarine fauna.

The situation throughout the project area can be attributed largely to a diminished capacity to retain the huge volume of water that once pooled and sheet flowed across the pre-drainage landscape. These waters are now either discharged in massive volumes through canal systems to tide or are stored at unnaturally high levels in remnant diked wetlands of the Everglades. In hindsight, many of these problems are now recognized to be unanticipated effects of the existing C&SF Project.

6.2 Vegetative Communities

The location of south Florida between temperate and subtropical latitudes, its proximity to the West Indies, the expansive wetland system of the greater Everglades, and the low levels of nutrient inputs under which the Everglades evolved, all combine to create a unique flora and vegetation mosaic. Today nearly all aspects of south Florida's native vegetation have been altered or eliminated by the development, altered hydrology, nutrient inputs, and spread of exotics that have resulted directly or indirectly from a century of water management.

Riparian plant communities of the Kissimmee River and its floodplain are recovering from channelization and drainage. The macrophyte communities of the diminished littoral zone of Lake Okeechobee are now contained within the Herbert Hoover Dike. They remain essential for the ecological health of the Lake but are stressed by extreme high and low lake levels and by the spread of exotics. Below the Lake, all of the pond apple swamp forest and most of the sawgrass plain of the northern Everglades have been converted to the EAA. Also eliminated is the band of cypress forest along the eastern fringe of the Everglades that was largely converted to agriculture after the eastern levee of the WCAs cut off this community from the remaining Everglades. The mosaic of macrophyte and tree island communities of the remaining Everglades within the WCAs and ENP is altered even in seemingly remote areas by changes in hydrology, exotic plant invasion, and/or nutrient inputs.

The problems of the Everglades extend to the mangrove estuary and coastal basins of Florida Bay, where the forest mosaics and submerged aquatic vegetation show the effects of diminished freshwater heads and flows upstream. These problems are exacerbated by sea level rise. The upland pine and hardwood hammock communities of the Atlantic coastal ridge, interspersed with wet prairies and cypress domes and dissected by "finger glades" water courses that flowed from the Everglades to the coast, remain only in small and isolated patches that have been protected from urban development. In contrast, much of the vegetation mosaic in Big Cypress Swamp to the west of the Everglades remains relatively intact.

More detailed documentation of existing vegetation throughout the CERP project area is described in the Restudy (U.S. Army Corps of Engineers, 1999). Those systems include the Everglades peatland, the Everglades marl prairie and rocky glades, and the mangrove estuaries and coastal basins of Florida Bay and southern Biscayne Bay. For purposes of this BA, the following vegetative descriptions focus on the transition zones between coastal wetlands and nearshore habitats.

The primary factors influencing the distribution of vegetation in the transition zone of freshwater and saltwater wetlands are hydropattern, salinity, previous disturbance and nutrient loading and soil type. The plant community can strongly influence wildlife composition and patterns of utilization. The plant community types in these areas include sawgrass glades, spike rush and beak rush flats, muhly prairie, cypress stands, native dominated forested wetlands, tree islands, mangrove flats, hydric hammocks, and exotic-dominated forests. Natural disturbances, such as fire, play an important role in maintaining a diverse mosaic of vegetation communities. Altered hydroperiods, wildfire suppression and human caused fires have disrupted the natural frequency and pattern of fires in the region.

Invasive species present in the wetland transition zones include melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), and Brazilian pepper (*Schinus terebinthifolius*), among others. The heaviest impacts from invasive species tend to occur in disturbed areas within the project area, such as abandoned farmland and lands in the immediate vicinity of roads and berms. Such areas are frequently dominated by nearly monotypic stands of invasive plants. Elsewhere, these invasive plants are present in smaller, but no less important numbers in tree islands, marshes, and mangrove forests as a result of long distance seed dispersal.

The mangrove estuary between the freshwater Everglades and Florida Bay and southern Biscayne Bay supports a mosaic of mangrove forests, tidal creeks, salt marshes, coastal lakes, tropical hardwood hammocks, and coastal basins. Red mangrove (*Rhizophora mangle*) swamp dominates the landscape along with stands of buttonwood (*Conocarpus erectus*), black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*). Tidal creeks dissect the mangrove forests and are often bordered by salt

marsh communities of black sedge (*Schoenus nigricans*) and cord grass (*Spartina* spp.). Tropical hardwood hammocks with canopy trees such as West Indian mahogany, Jamaica dogwood (*Piscidia piscipula*), strangler fig (*Ficus aurea*) and holly grow on elevated coastal embankments.

The nearshore habitats, including coastal lakes and basins, support seasonally variable beds of submerged aquatic macrophytes that range from low-salinity communities of bladderwort and widgeon grass (*Ruppia maritima*), to marine seagrasses that include turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Additional species include star grass (*Halophila engelmannii*), paddle grass (*Halophila decipiens*), and Johnson's seagrass (*Halophila johnsonii*). Reduction in freshwater heads and flows from the Everglades, in concert with sea level rise, has caused community shifts in the submerged aquatic vegetation of the coastal lakes and basins and apparently has contributed to the filling in of tidal creeks. A salinity regime favoring an increased frequency of high salinity events and a decreased frequency of low salinity events in the coastal lakes and basins has resulted in the loss of the low-to-moderate salinity macrophyte communities that seasonal populations of migratory waterfowl once utilized.

6.3 Federally Listed Species

The Corps has coordinated the existence of federally listed species with NMFS, as appropriate. Specifically, coordination with NMFS includes listed fish, marine plants, and sea turtles at sea. Fifteen federally listed threatened and endangered species under NMFS purview are either known to exist or potentially exist within the project area and, subsequently, may be affected by the proposed action (**Table 6-1**). Many of these species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation.

Federally listed animal species that exist or potentially exist in the project area, include smalltooth sawfish (*Pristia pectinata*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and loggerhead sea turtle (*Caretta caretta*). Other federally threatened or endangered animal species that are known to exist or potentially exist in the project area, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Gulf sturgeon (*Acipenser oxyrinchus desotoi*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), elkhorn (*Acropora palmata*), and staghorn (*Acropora cervicornis*) stony corals.

A federally listed plant species that may occur in the project area includes Johnson's seagrass (*Halophila johnsonii*). Johnson's seagrass is a rare plant that has a very limited

distribution, often found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents. The species ranges from central Biscayne Bay to Sebastian Inlet.

Table 6-1. Status of Threatened & Endangered Species Under NMFS Purview Likely to be Affected by CERP Projects – and the Corps Effects Determinations

Common Name	Scientific Name	Status	Agency	May Affect, Likely to Adversely Effect	May Affect, Not Likely to Adversely Effect	No Effect
Mammals						
Blue whale	*Balaenoptera musculus*	E	Federal			X
Fin whale	*Balaenoptera physalus*	E	Federal			X
Humpback whale	*Megaptera novaeangliae*	T	Federal			X
Sei whale	*Balaenoptera borealis*	E	Federal			X
Sperm whale	*Physeter macrocephalus*	E	Federal			X
Reptiles						
Green sea turtle	*Chelonia mydas*	E	Federal		X	
Leatherback sea turtle	*Dermochelys coriacea*	E	Federal		X	
Hawksbill sea turtle	*Eretmochelys imbricata*	E	Federal		X	
Loggerhead sea turtle	*Caretta caretta*	T	Federal		X	
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	Federal		X	
Fish						
Smalltooth sawfish*	*Pristia pectinata*	E	Federal		X	
Gulf sturgeon*	*Acipenser oxyrinchus desotoi*	T	Federal			X
Invertebrates						
Elkhorn coral*	*Acropora palmata*	T	Federal			X
Staghorn	*Acropora*	T	Federal			X

coral*	*cervicornis*					
Plants						
Johnson's seagrass*	*Halophila johnsonii*	E	Federal		X	

* Critical habitat designated for this species
E: Endangered
T: Threatened

6.4 State Listed Species

In addition to federally listed species, portions of project area contain habitat potentially suitable for two state-listed threatened species and nine species of special concern that are under NMFS purview. Threatened species include key silverside (*Mendia conchorum*), and pillar coral (*Dendrogyra cylindricus*). Species of special concern include Alabama shad (*Alosa alabamae*), dusky shark (*Carcharhinus obscurus*), mangrove rivulus (*Rivulas marmoratus*), opossum pipefish (*Microphis brachyurus lineatus*), sand tiger shark (*Carcharias Taurus*), speckled hind (*Epinephelus drummondhayi*), warsaw grouper (*Epinephelus nigritus*), and ivory bush coral (*Oculina varicose*).

While habitats utilized by some of these animal species may be affected by CERP, construction impacts would be minimal and temporary, and not likely to adversely affect any protected species. The majority of protected species is outside of the projects' zone of influence and therefore, is not likely to be adversely affected by project operations. Successful implementation of restoring existing wetlands will improve the overall functional capacity of affected habitats thus benefiting the species utilizing these areas. Therefore, no adverse effects are anticipated to state listed species, or species of concern as a result of this project.

6.5 Designated Critical Habitat

In addition to threatened and endangered species, the project area also includes or is adjacent to designated critical habitats for Johnson's seagrass, Gulf sturgeon, smalltooth sawfish, elkhorn coral, and staghorn coral. Maps of critical habitat locations for these species are depicted in **Figure 6-1 through Figure 6-5**

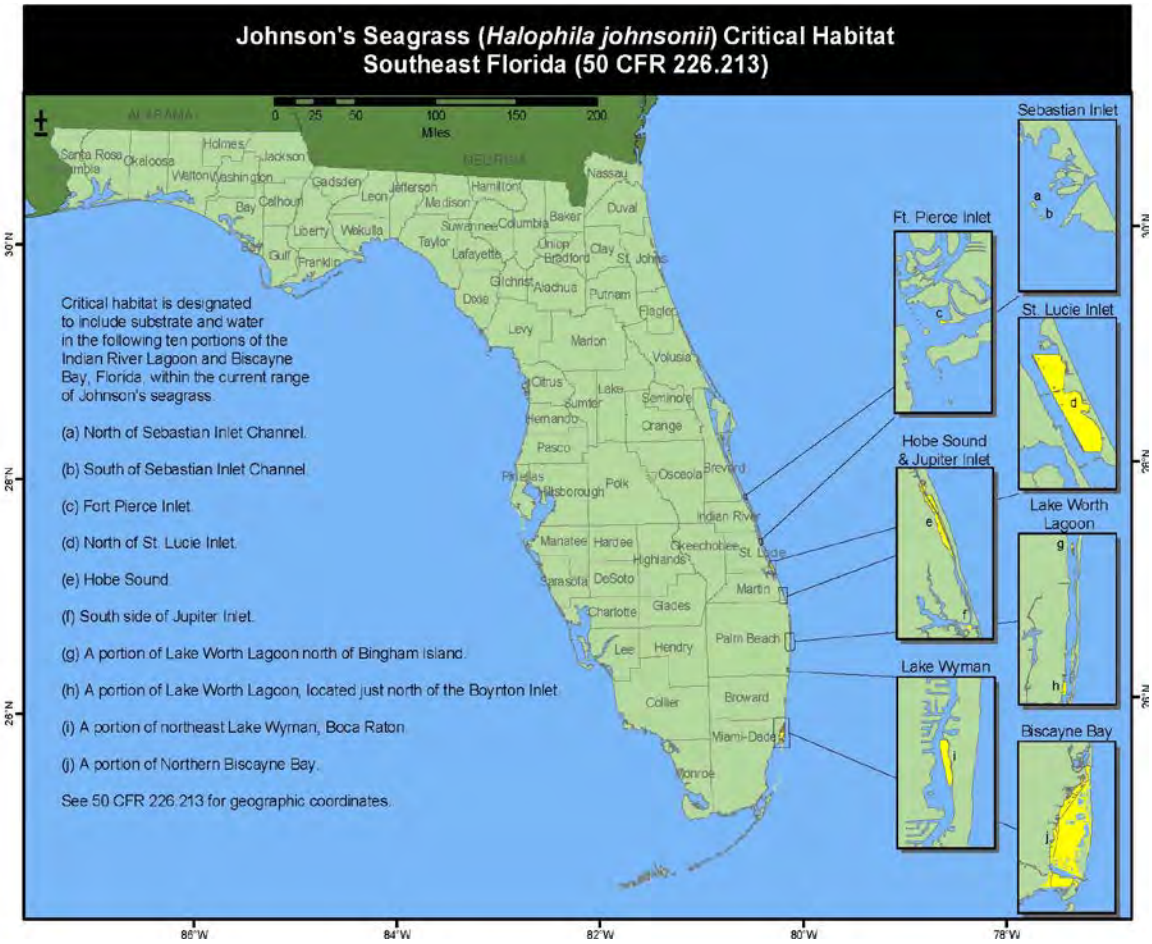

Figure 6-1. Critical Habitat for the Johnson's Seagrass

As defined in the Code of Federal Regulations (50 CFR Part 226, Section 226.213, Vol. 65, 5 April 2000), the Johnson's seagrass critical habitat includes all land and water within the following boundary: Beginning at the easternmost tip of Turkey Point, Dade County, on the coast of Biscayne Bay; then southeastward along a straight line to Christmas Point at the southernmost tip of Elliott Key; then southwestward along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Anglefish Key, Key Largo, Plantation Key, Windley Key, Upper Matecumbe Key, Lower Matecumbe Key, and Long Key; then to the westernmost tip of Middle Cape; then northward along the shore of the Gulf of Mexico to the north side of the mouth of Little Sable Creek; then eastward along a straight line to the northernmost point of Nine-Mile Pond; then northeastward along a straight line to the point of beginning.

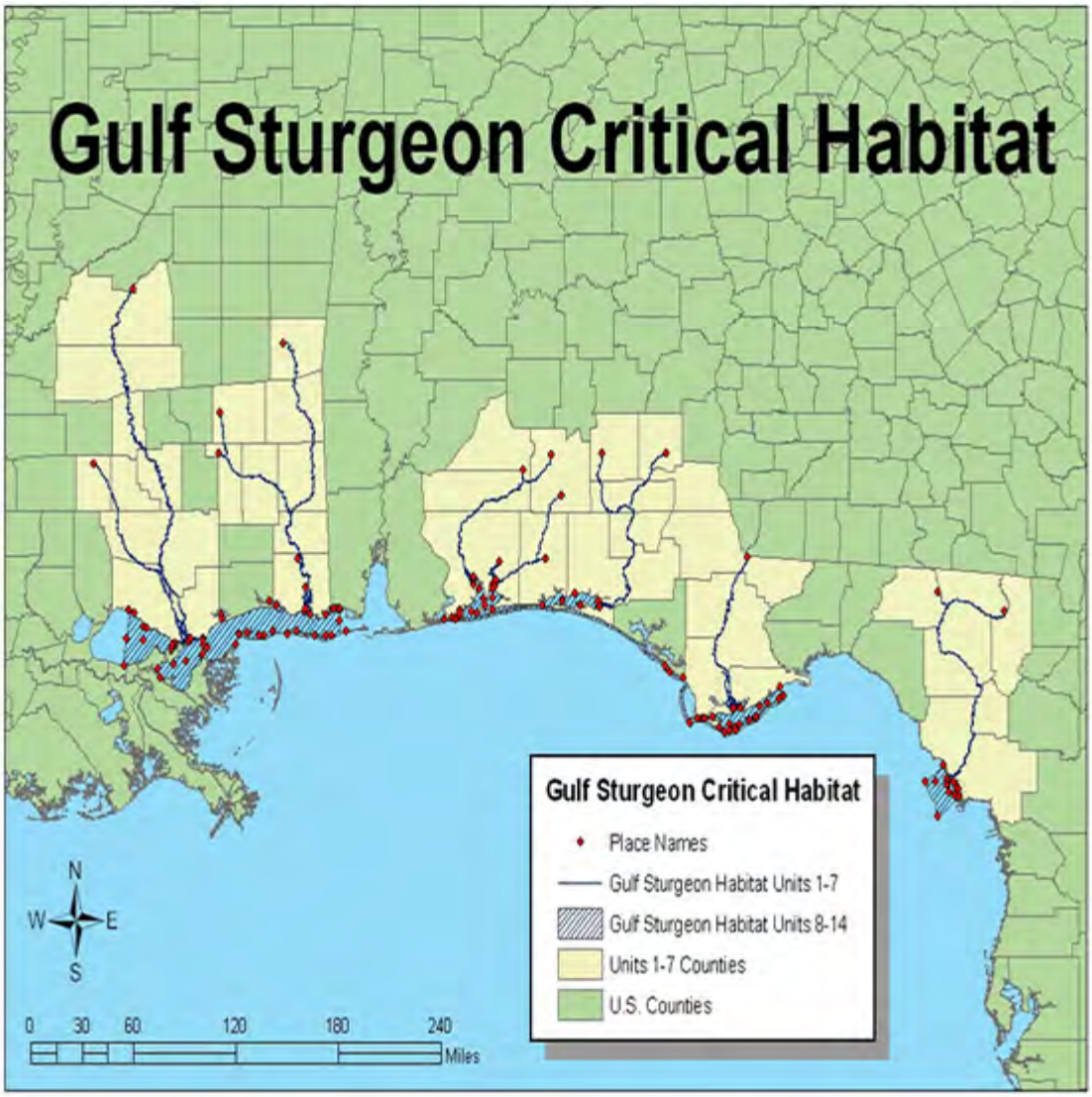

Figure 6-2. Critical Habitat for the Gulf Sturgeon

As defined in the Code of Federal Regulations (50 CFR Part 226, Vol. 68, 19 March 2003), the Gulf Sturgeon critical habitat portions in Florida includes Unit 9, Pensacola Bay System in Escambia and Santa Rosa Counties; Unit 10, Santa Rosa Sound in Escambia, Santa Rosa, and Okaloosa Counties; Unit 11, Florida Nearshore of Mexico Unit in Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf Counties: Unit 12, Chotawhatchee Bay in Okaloosa and Walton Counties; Unit 13, Apalachicola Bay in Gulf and Franklin Counties; and Unit 14, Suwannee Sound in Dixie and Levy Counties.

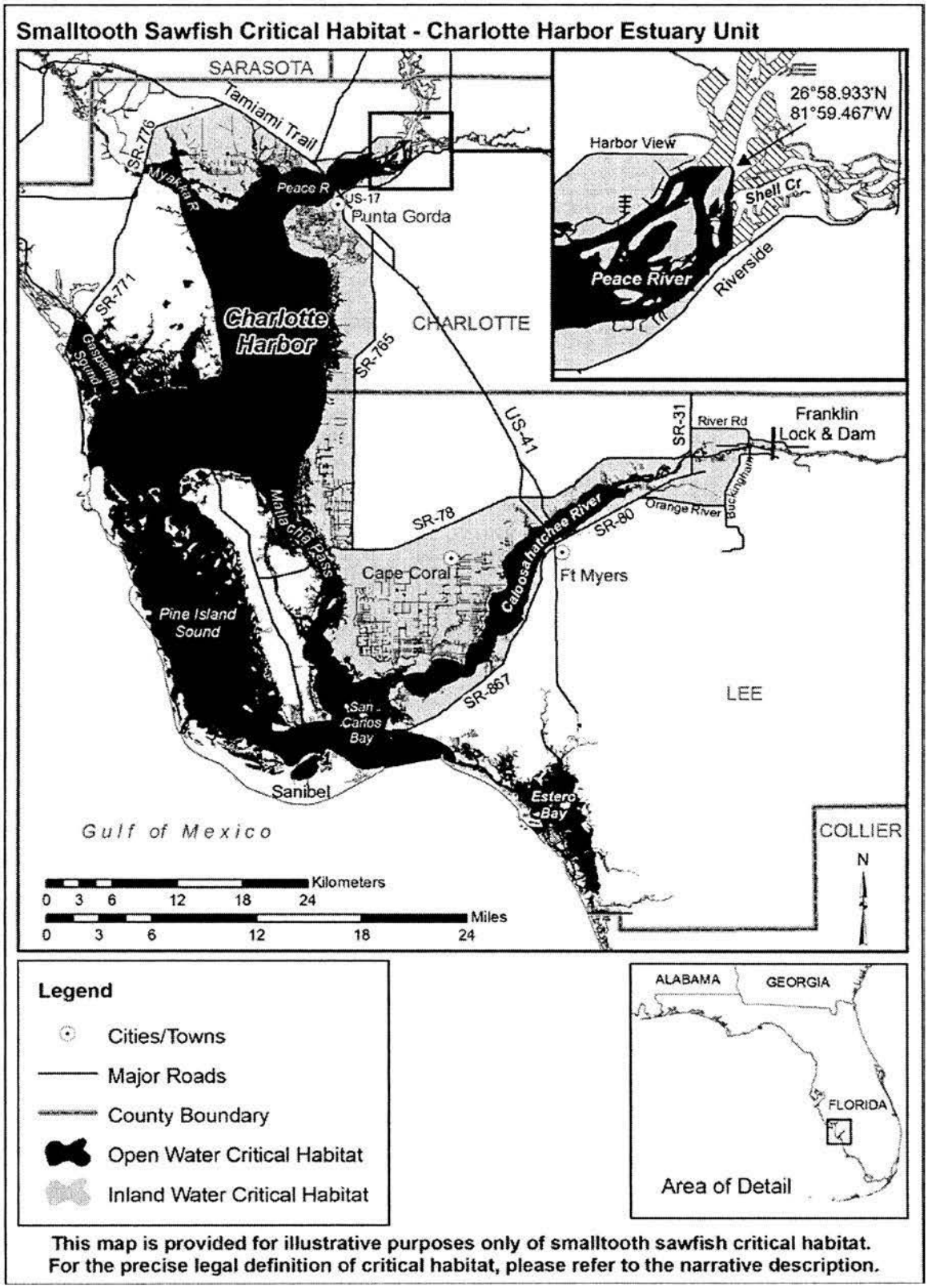

Figure 6-3. Critical Habitat for the Smalltooth Sawfish – Charlotte Harbor Everglades Unit

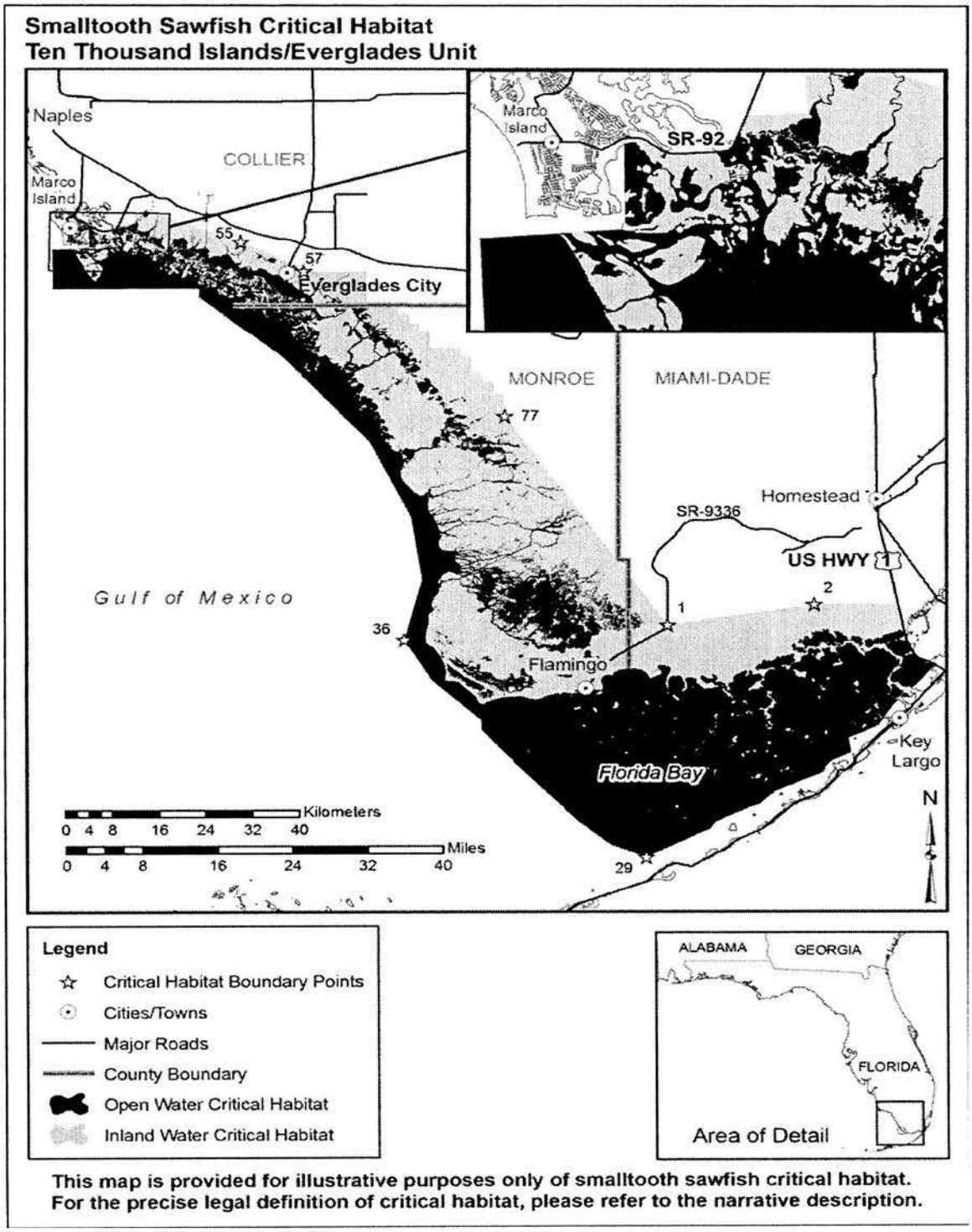

Figure 6-4. Critical Habitat for the Smalltooth Sawfish – 10,000 Islands

As stated in the final rule published in the Federal Register on 2 September 2009, critical habitat consists of two coastal habitat units: the Charlotte Harbor Estuary Unit and the Thousand Islands/Everglades Unit.

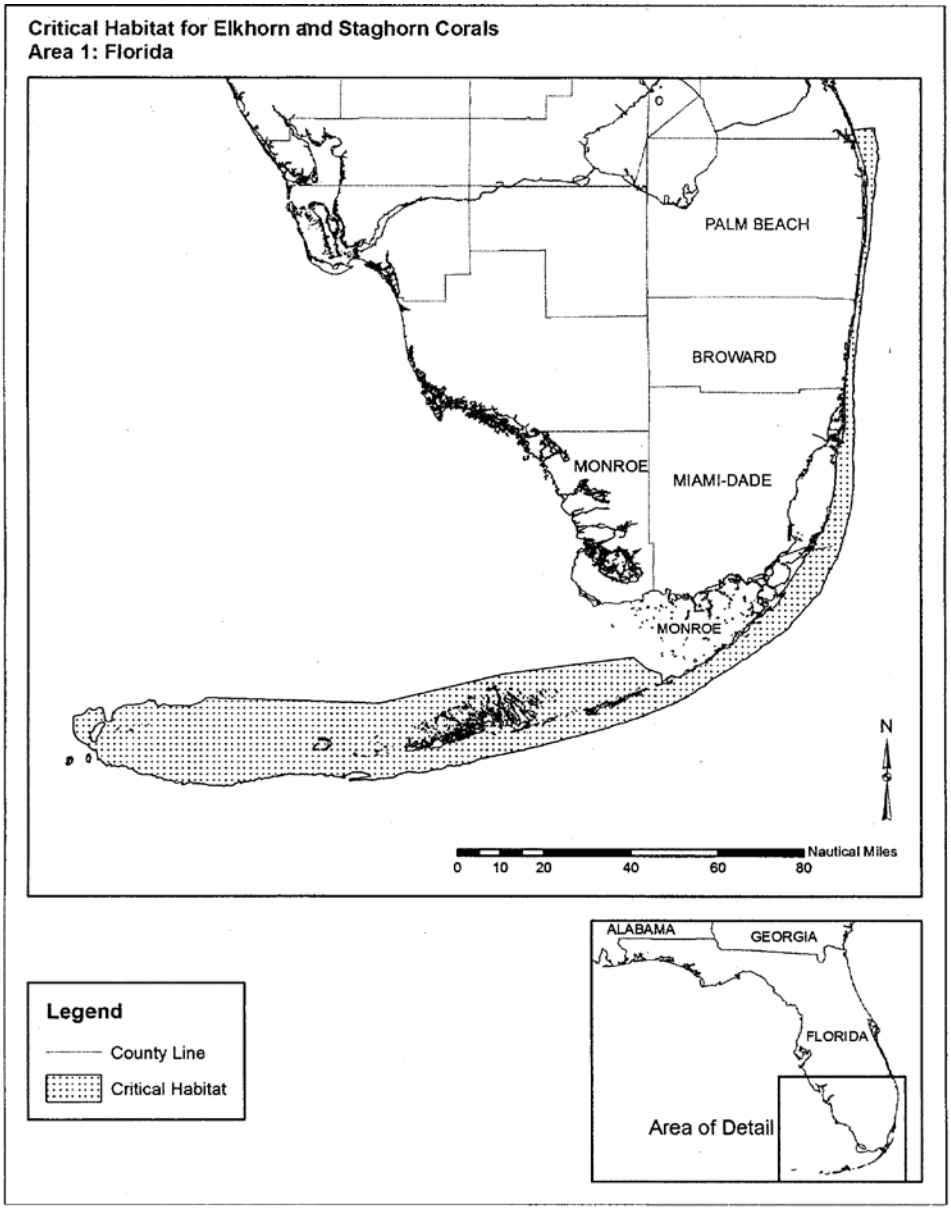

Figure 6-5. Critical Habitat for Elkhorn and Staghorn Corals

In southeast Florida, staghorn coral has been documented along the east coast as far north as Palm Beach County in deeper (16 to 30 m) water and is distributed south and west throughout the coral and hard-bottom habitats of the Florida Keys, through Tortugas Bank. Elkhorn coral has been reported as far north as Broward and Miami-Dade counties, with significant reef development and framework construction by this species beginning at Ball Buoy Reef in Biscayne National Park, extending discontinuously southward to the Dry Tortugas (CFR Vol. 73, No. 25, 02-06-08).

7.0 EFFECTS OF PROPOSED ACTION

7.1 Species Biology and Effect Determination

7.1.1 Elkhorn Coral (*Acropora palmata*)

Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches. The dominant mode of reproduction is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites). Colonies are fast growing: branches increase in length by 2-4 inches (5-10 cm) per year, with colonies reaching their maximum size in approximately 10-12 years. Elkhorn coral was formerly the dominant species in shallow water (3-16 ft (1-5 m) deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (6 m), although isolated corals may occur to 65 feet (20 m). Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean. Its northern limit is the Biscayne Bay National Park and it extends south to Venezuela; it is not found in Bermuda. Since 1980, populations have collapsed throughout their range from disease outbreaks with losses compounded locally by hurricanes, increased predation, bleaching, elevated temperatures, and other factors.

7.1.2 Staghorn Coral (*Acropora cervicornis*)

Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over 6.5 feet (2 m) in length. The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and attach to the substrate. Similar to elkhorn coral, sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 4-8 inches (10-20 cm) per year. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat. Staghorn coral occur in back reef and fore reef environments from 0-98 feet (0-30 m) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Staghorn coral is found throughout the Florida Keys, the Bahamas, and the Caribbean islands. This coral occurs in the western Gulf of Mexico, but is absent from U.S. waters in the Gulf of Mexico. It also occurs in Bermuda and the west coast of South America. The northern limit is on the east coast of Florida, near Boca Raton. The greatest source of region-wide mortality for staghorn coral has been disease outbreaks, mainly of white band disease. Other, more localized losses have been caused hurricanes, increased predation, bleaching,

algae overgrowth, human impacts, and other factors. This species is also particularly susceptible to damage from sedimentation and is sensitive to temperature and salinity variation.

7.1.3 Smalltooth Sawfish (*Pristis pectinata*)

Smalltooth sawfish have been reported in the Pacific and Atlantic Oceans, and the Gulf of Mexico; however, the United States population is found only in the Atlantic Ocean and Gulf of Mexico. Historically, the United States population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras. The current range of this species includes peninsular Florida, but is relatively common only in the Everglades region at the southern tip of the state. Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development of the coastal areas of Florida and other southeastern states. The loss of juvenile habitat likely contributed to the decline of this species.

7.1.4 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

Gulf sturgeons inhabit coastal rivers from Louisiana to Florida during the warmer months, and the Gulf of Mexico and its estuaries and bays in the cooler months. Sturgeon are primitive fish characterized by bony plates, or "scutes," and a hard, extended snout; they have a heterocercal caudal fin. Adults range from 4-8 feet (1-2.5 m) in length; females attain larger sizes than males. They are bottom feeders, and eat primarily macroinvertebrates, including brachiopods, mollusks, worms, and crustaceans. All foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries; sturgeon do not forage in riverine habitat. Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and as far east and south as Florida Bay. The sub-species' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida. The species is anadromous: feeding in the winter months in the marine waters of the Gulf of Mexico including bays and estuaries, migrating in the spring up freshwater rivers to spawn on hard substrates, and then spending summers in the lower rivers before emigrating back out into estuarine/marine waters in the fall.

7.1.5 Green Sea Turtle (*Chelonia mydas*)

The green sea turtle weighs approximately 150 kg and lives in tropical and sub-tropical waters. Areas that are known as important feeding areas for the green turtles in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. Green turtles occupy three habitat types: high energy oceanic beaches,

convergence zones in the pelagic habitat, and benthic feeding grounds in the relatively shallow, protected waters. Females deposit eggs on high energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line. Hatchlings leave the beach and move in the open ocean. Green sea turtles forage in pastures of seagrasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms.

7.1.6 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The hawksbill sea turtle is a small to medium-sized marine turtle weighing up to 15 kilograms in the United States. The hawksbill lives in tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. Areas that are known as important feeding areas for hawksbill turtles in Florida include the waters near the Florida Keys and on the reefs off Palm Beach County. Hawksbill turtles use different habitat types at different stages of their life cycle. Post hatchlings take shelter in weed lines that accumulate at convergence zones. Coral reefs are the foraging habitat of juveniles, sub-adults, and adults. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore where coral reefs are absent. Hawksbills feed predominantly on sponges and nest on low and high energy beaches, frequently sharing the high-energy beaches with green sea turtles. Nests are typically placed under vegetation.

7.1.7 Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is the largest living turtle and weighs up to 700 kg. The leatherback lives in tropical and sub-tropical waters. Habitat requirements for juvenile and post-hatchling leatherbacks are virtually unknown. Nesting females prefer high-energy beaches with deep unobstructed access. Leatherbacks feed primarily on jellyfish.

7.1.8 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's ridley sea turtle is the smallest of all sea turtles and weighs up to 45 kg. This species is a shallow water benthic feeder consuming mainly algae and crabs. Juveniles grow rapidly. Juveniles and sub-adults have been found along the eastern seaboard of the United States and in the Gulf of Mexico. However, the major nesting beach for the Kemp's ridley sea turtle is on the northeastern coast of Mexico.

This species occurs mainly in coastal areas of the Gulf of Mexico and in the northwestern Atlantic Ocean. The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths.

7.1.9 Loggerhead Sea Turtle (*Caretta caretta*)

Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Females select high energy beaches on barrier strands adjacent to continental land masses for nesting. Steeply sloped beaches with gradually sloped offshore approaches are favored. After leaving the beach, hatchlings swim directly offshore and eventually are found along drift lines. They migrate to the near-shore and estuarine waters along the continental margins and utilize those areas as the developmental habitat for the sub-adult stage. Loggerheads are predators of benthic invertebrates.

7.1.10 The Blue Whale (*Balaenoptera musculus*)

The blue whale, a species of baleen and rorqual whale, can grow to lengths in excess of 100 feet (30.48 meters) but are typically found up to 88 feet (26.8 m). Female blue whales tend to be slightly larger than their male counterparts. Sexual maturity is believed to be reached between ages 5-15 years. Blue whale's mating and birthing events usually occur during the winter. Commercial whaling has led to the declination of this species. Populations today are estimated at about 3800-5255 whales. Threats to this population include vessel strikes, fisheries interactions, natural mortality, anthropogenic noise, competition, habitat degradation, and vessel disturbance.

Three subspecies are recognized: the Northern Hemisphere blue whale (*B.m. musculus*), the Antarctic blue whale (*B.m. intermedia*), and the pygmy blue whale (*B.m. brevicauda*). Found across the globe, blue whales are separated into the North Atlantic, North Pacific, and Southern Hemisphere populations. There is also a "resident" population found in the northern Indian Ocean. In the North Atlantic population, most sightings are located off of eastern Canada. The southern border of the whales feeding range is thought to be near Massachusetts. The North Pacific population is thought to be divided into five subpopulations describing their location. These are southern Japan, northern Japan/Kurils/Kamchatka, Aleutian Islands, eastern Gulf of Alaska, and California/Mexico. The Southern Hemisphere whales are found mainly in high latitudes south of the Antarctic Convergence (*B.m. intermedia*) and also north of the Antarctic Convergence (*B.m. brevicauda*).

It is possible that these whales travel into the Gulf of Mexico and the Caribbean but these occurrences are thought to be rare.

7.1.11 Humpback Whale (*Megaptera novaeangliae*)

Humpback whales are commonly identified by distinct coloration on their flukes. They are also known for their long pectoral fins. Females tend to be larger than males reaching lengths of up to 60 feet (18m). There is an estimated 20,000 whales found in the North Pacific, over 11,000 in the North Atlantic, and an approximate 25,000 whales in the Southern Hemisphere. Threats to humpbacks whales include entanglement, vessel strikes, whale watching harassment, and habitat disturbance.

During the summer, humpbacks can be found in areas of high latitude such as the Gulf of Maine and the Gulf of Alaska. Shallow waters are preferred when humpback whales are feeding and calving. The North Atlantic stock can usually be found along the whole east coast of US, Greenland, St. Lawrence, and Newfoundland/Labrador. During the winter, the whales migrate to the West Indies for mating and calving. The North Pacific stock has three populations of humpback whales: California/Oregon/Washington, Central North Pacific, and Western North Pacific. Whales found in the Southern Hemisphere are found near 20°S for breeding purposes. For feeding, the Southern Hemisphere whales travel to around 40°S and between 102°E and 110°W.

Humpback whales have been reported in the central and eastern Gulf of Mexico in the winter when the whales migrate south.

7.1.12 Sperm Whale (*Physter macrocephalus*)

The sperm whale is an odontocete or toothed whale. Males of this species often grow larger than females reaching 52 ft (16m) while females may reach lengths of up to 36 feet (11m). Sexual maturity for females is reached around 9 years of age and males reach maturity anywhere from 10-20 years of age. Today, there are between 200,000 and 1,500,000 estimated sperm whales approximated from a few areas. Threats to this population include vessel strikes, entanglements, anthropogenic noise, and pollutants.

Found across the world, they are often located in waters deeper than 600m. Migration patterns are not well known but sperm whales follow conditions that are favorable for feeding and breeding. In the Pacific U.S. waters, they are commonly found near the equator but also occur by Alaska, California, Washington, and Oregon. In the Atlantic, they are typically found north of Delaware and Virginia. Sperm whales are typically found far off shore.

There are sperm whales present in the northern Gulf of Mexico year-round, but they are most commonly found there during the summer. This population is thought to have about 1300 individuals. Sperm whales may also be found far off the Florida coast during the winter.

7.1.13 Finback Whale (*Balaenoptera physalus*)

Fin whales, the second largest species of whale have a maximum length of 75-85 feet (22-26 m). Like other baleen whales, females tend to be larger than the males. Sexual maturity is reached from ages 6-10 for males and 7-12 for females. Distinguishing features include a unique coloration: the underside is a shade of white while the dorsal surface and sides are black or shades of brown-gray. The jaw is dark on the left side and white on the right. Commercial whaling led to the declination of this species. There is thought to be over 10,000 whales occupying U.S. waters, but global population

estimates are uncertain due to a small amount of surveys taken. Current threats to these whales worldwide include collisions with vessels, entanglement in fishing gear, reduction in prey abundance, habitat degradation, and disturbance from low-frequency noise.

Fin whales can be found throughout the world but more commonly in temperate to polar latitudes. They typically inhabit deep, offshore waters. There are two identified subspecies of the fin whale found in the North Atlantic (*B. p. physalus*) and the Southern Ocean (*B. p. quoyi*). Another, unnamed subspecies can be found in the North Pacific.

During the winter fin whales travel down to the coast of Florida and the Gulf of Mexico but they are uncommon in this area.

7.1.14 Sei Whale (*Balaenoptera borealis*)

The sei whale can grow to lengths of 40-60 feet (12-18m) and like most other baleen whales, females can be larger than the males. Sexual maturity is thought to be reached between 6-12 years of age. Similar to Bryde's whale, they can be differentiated by a single ridge on their rostrum. Their coloration pattern is noted as dark on the dorsal side and light ventrally. Commercial whaling led to the declination of this species. A current estimate of the sei whale population is about 80,000 whales worldwide. Threats to this population include vessel strikes and fishing gear.

Two subspecies are identified, *B. b. borealis* in the Northern Hemisphere and *B. b. schlegellii* in the Southern Hemisphere. Their distribution can include subtropical, temperate, and sub polar waters in the Atlantic, Pacific, and Indian oceans. During the summer they can be found areas such as the Gulf of Maine and Georges Bank in the western North Atlantic among other locations. During the winter, it is thought that the whales migrate to more tropical locations. However, their entire distribution and migration patterns are not well known.

Sei whales have been noted in the northeast and southwest Gulf of Mexico.

7.1.15 Johnson's Seagrass (*Halophila johnsonii*)

Johnson's seagrass is a rare plant that may have the most limited distribution of any seagrass in existence. It frequently occurs in small isolated patches from centimeters to a few meters in diameter. Johnson's seagrass appears to reproduce only through asexual branching. There are no known seed banks. The leaves are generally two to five centimeters in length, and the rhizome internodes rarely exceed three to five centimeters in length. Johnson's seagrass prefers to grow in coastal lagoons in the intertidal zone, or deeper than many other seagrasses. It fares worse in the intermediate areas where other seagrasses thrive. The species has been found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents.

Johnson's seagrass is more tolerant of salinity, temperature, and desiccation variation than other seagrasses in the area. It has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet. The southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay.

7.2 Projects with "No Effect" Determination (Consultation Completed)

Federally threatened or endangered species that are known to potentially exist within close proximity of CERP project areas, but which will not likely be of concern are discussed in detail below:

7.2.1 Biscayne Bay Coastal Wetlands Project

7.2.1.1 Project Summary

The primary purpose of the Biscayne Bay Coastal Wetlands project is to redistribute freshwater runoff from the watershed away from the existing canal discharges and into the coastal wetlands adjoining Biscayne Bay to provide a more natural and historic overland flow through existing coastal wetlands. The Restudy identified a need to replace lost overland flow, rehydrate coastal wetlands and reduce point source freshwater discharges to Biscayne Bay using a system of pumps, and interconnections between coastal canals and operational changes to coastal structures **(Figure 7-1)**.

7.2.1.2 Existing Conditions

Historically, freshwater runoff entered Biscayne Bay via overland flow from the Everglades through estuarine coastal wetlands and artesian up-wellings. The water quality in the late 1800s was low in nutrients, low in turbidity, and high in light transmittance; such conditions allowed an abundant coverage of seagrass beds. The Biscayne Bay water quality was still within natural conditions at the time the City of Miami was founded in 1896. As development progressed, canal networks were constructed for flood protection and prevention of aquifer saltwater intrusion. The canal network, a system of managed water, had replaced the natural sloughs. Freshwater flow into Biscayne Bay is now dominated by pulse-released direct canal discharges.

7.2.1.3 Project Effects

Construction includes building pumps, levees, canals and other structures that will displace existing natural areas. Diversion of canal discharges into coastal wetlands, as opposed to their direct discharge into the Bay, is expected to re-establish productive nursery habitat along the shoreline and reduce the abrupt freshwater discharges that

are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets.

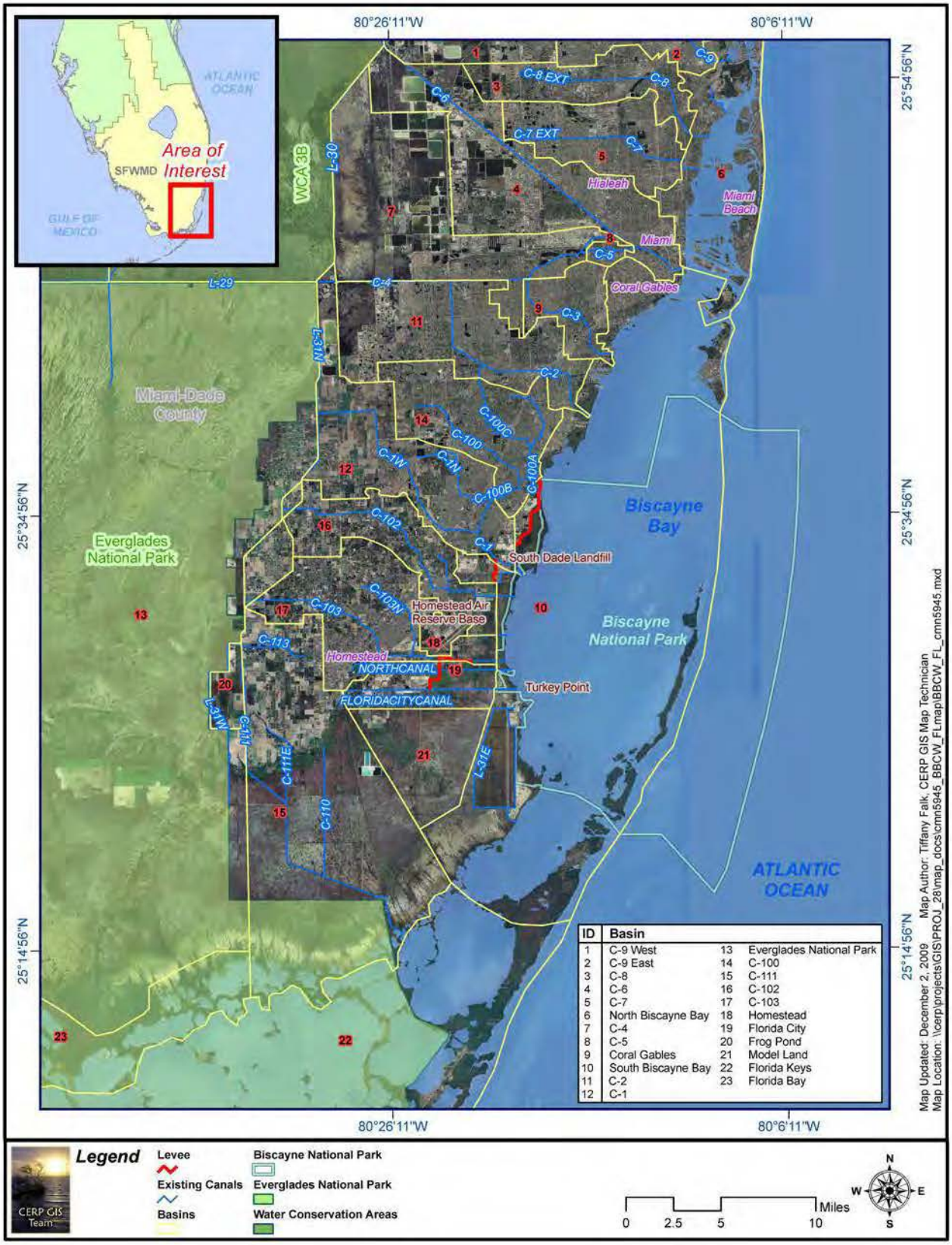

Figure 7-1. Biscayne Bay Coastal Wetlands Location Map

7.2.1.4 Status of ESA Consultation with NMFS

By letter dated August 30, 2007, NMFS concurred with the Corps' determination that implementation of the BBCW Acceler8 (initial phase of the project) may affect, but is not likely to adversely affect, smalltooth sawfish. By letter dated 3 November 2011, the NMFS concurred with the Corps' determination that the BBCW project is not likely to adversely affect any listed species under NMFS's purview and subsequently concurred with the Corps' determination that proceeding with the project will not violate sections 7(a)(2) and 7(d) pending completion of a recommended programmatic consultation for any remaining individual CERP projects.

Smalltooth Sawfish and "May Affect, But Not Likely to Adversely Affect" Determination

The smalltooth sawfish has the potential to be found within Biscayne Bay, and juveniles could potentially occur and feed in red mangrove wetlands. With the proposed project, the smalltooth sawfish may benefit as a result of the redistribution of freshwater runoff from the watershed away from the existing canal discharges into the coastal wetlands adjoining Biscayne Bay to provide a more natural and historic overland flow. With the expectation of improved wetland habitat, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the smalltooth sawfish may be affected, but is not likely to be adversely affected, by the proposed project.

Green Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Biscayne Bay, the increased freshwater flows associated with the Biscayne Bay Coastal Wetlands Phase I project may alter seagrass species composition but should not have an adverse effect on the overall biomass available for sea turtle feeding habits. Additionally, no green sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the green sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Hawksbill Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Although hawksbill sea turtles are expected to be found foraging near coral reef habitats within Biscayne Bay, the increased freshwater flows associated with Phase 1 of the Biscayne Bay Coastal Wetlands project may reduce nearshore salinity concentrations

but should not have an adverse effect on sponges or other food sources utilized by this species. Additionally, no hawksbill sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the hawksbill sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Leatherback Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Although leatherback turtles are expected to be found foraging in nearshore habitats within Biscayne Bay, the increased freshwater flows associated with the Biscayne Bay Coastal Wetlands Phase 1 project may reduce nearshore salinity concentrations but should not have an adverse effect on jellyfish or other food sources utilized by this species. Additionally, no leatherback sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the leatherback sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Kemp's Ridley Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Biscayne Bay, this species is not expected to be found within the direct area of influence associated with the Biscayne Bay Coastal Wetlands Phase 1 project. Additionally, no Kemp's ridley sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the Kemp's ridley sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Loggerhead Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Biscayne Bay, the increased freshwater flows associated with the Biscayne Bay Coastal Wetlands Phase 1 project may reduce nearshore salinity concentrations but should not have an adverse effect on crustaceans, mollusks or other invertebrate food sources utilized by this species. Additionally, no loggerhead sea turtles would attempt

to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the loggerhead sea turtle may be affected, but would not likely be adversely affected by the proposed project.

Elkhorn Coral and "No Effect" Determination

Elkhorn coral may be found outside the waters of Biscayne Bay, specifically within the offshore reef track in Biscayne National Park where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately five to eight miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1,500 meters from shore. Because the reef tract where elkhorn coral resides is several miles outside of any projected salinity changes, the Corps has determined the proposed project would have no effect on elkhorn coral.

Elkhorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat; therefore, the project would have no effect on critical habitat for elkhorn coral.

Staghorn Coral and "No Effect" Determination

Staghorn coral may be found outside the waters of Biscayne Bay, specifically within the offshore reef track in BNP where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately five to eight miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1,500 meters from shore. Because the reef tract where staghorn coral resides is several miles outside of any projected salinity changes, the Corps has determined the proposed project would have no effect on staghorn coral.

Staghorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat designated for staghorn coral; therefore, the project would have no effect on critical habitat for this species.

Johnson's Seagrass and "No Effect" Determination

Johnson's seagrass is not expected to be found within the project site since the southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay (FR Vol. 63, No.177. 1998). Since the northernmost project limits are south of Virginia

Key, the U.S. Army Corps of Engineers has determined the project would have no effect on Johnson's seagrass.

Johnson's Seagrass Critical Habitat

Since the northernmost project limits are south of the known distribution area for this species, the project would have no effect on critical habitat for Johnson's seagrass.

7.2.2 C-111 Spreader Canal Western Project

7.2.2.1 Project Summary

The purpose of the C-111 SC Western project is to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough. It is anticipated that these improvements will be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal, which will reduce seepage from Taylor Slough, and from its headwaters. The project is also anticipated to resolve critical uncertainties related to the ability to reduce seepage losses from Taylor Slough, and resulting flood control responses of the drainage system. The project is designed to eliminate ecologically damaging flows through C-111 Basin to Barnes Sound and Florida Bay while improving habitat, functional quality of existing natural areas, and increase spatial extent where practicable.

7.2.2.2 Existing Conditions

As a consequence of past and current water management practices, land development and sea level rise, freshwater wetlands in the project area have been reduced in areal extent, altered and degraded. Currently much of this area is drained. Water elevations are generally held close to or below land surface in the northern project area, or starved of water as in the Model Lands area where water is diverted by drainage structures toward other basins. The current operation of the systems has resulted in an inland migration of saline conditions in both the groundwater and surface waters such that the expansion of moderate to high salinity zones have diminished the spatial extent of freshwater wetland habitats, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangroves communities typical of the hypersaline "white zone." Some wetlands have been impacted by invasive exotic vegetation as a result of physical disturbance and/or hydrologic isolation.

7.2.2.3 Project Effects

Implementation of the C-111 SC Western project would result in short-term impacts to and displacement of the natural environment. In addition, some temporary, short-term effects would likely occur during the construction phase of the project, including fill

placement for the canal plugs. The project is expected to have long-term positive effects that will contribute to the restoration of Everglades National Park and the adjacent southeast Florida ecosystem.

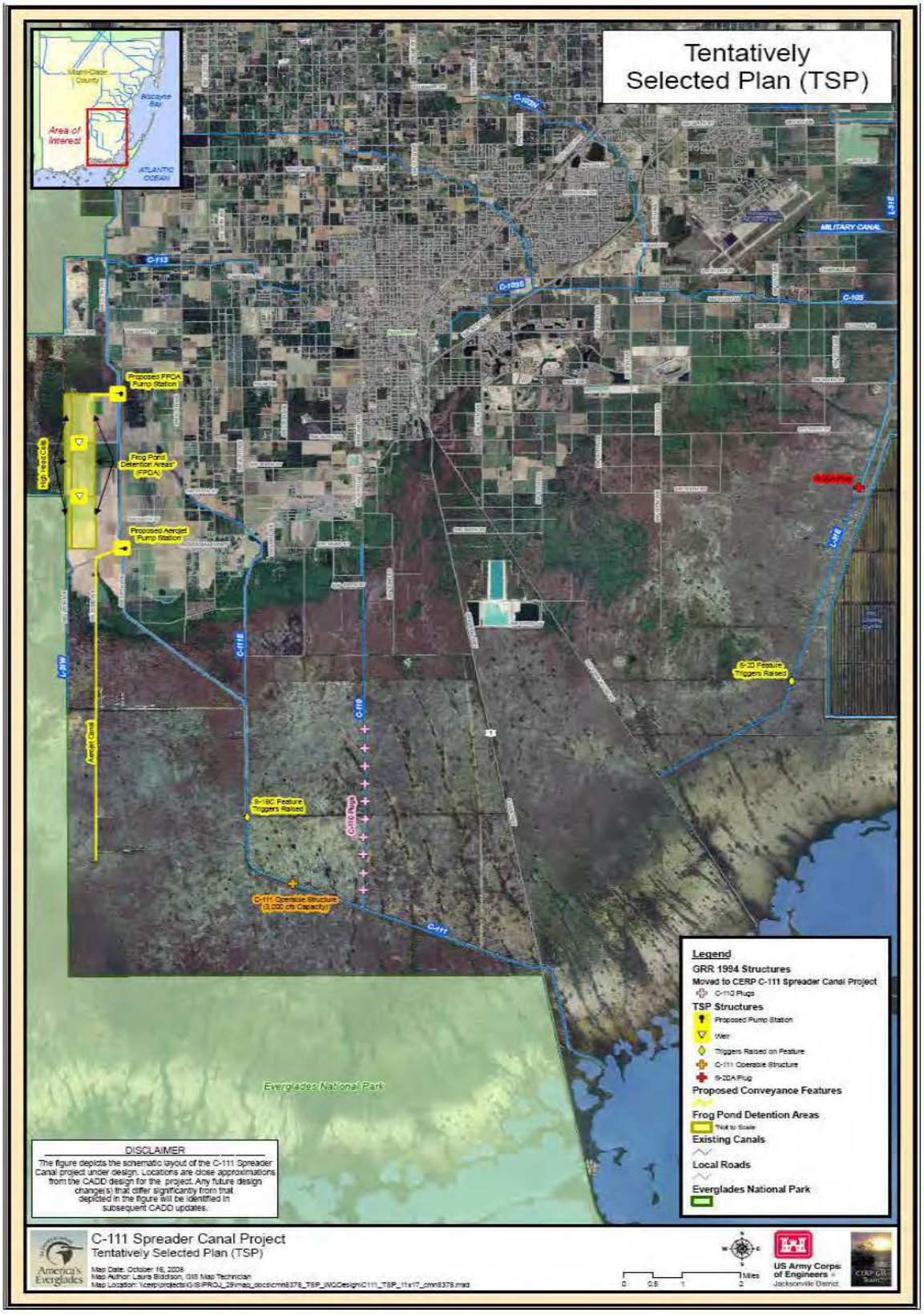

Figure 7-2. C-111 Spreader Canal Tentatively Selected Plan

7.2.2.4 Status of ESA Consultation with NMFS

On 7 May 2009, the Corps requested concurrence with NMFS on its determination of may affect, but is not likely to adversely affect smalltooth sawfish and sea turtles. In addition, the Corps determined that the project would not modify critical habitat for elkhorn or staghorn coral. Critical habitat for the smalltooth sawfish had not been designated until after publication of the final PIR/EIS. After further discussion with NMFS, the Corps changed their determinations to no effect for each species and their designated critical habitat, and NMFS concurred by email on 6 August 2009. Construction is complete for this project; therefore, re-initiation is not required.

Smalltooth Sawfish and "No Effect" Determination

The smalltooth sawfish has the potential to be found within Florida Bay, and the juveniles could potentially occur and feed in coastal wetlands. With the proposed project, the smalltooth sawfish may benefit as a result of freshwater flows from Taylor Slough into the coastal wetlands adjoining Florida Bay to provide a more natural and historic overland flow. With the expectation of improved wetland habitat, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect on the smalltooth sawfish.

Green Sea Turtle and "No Effect" Determination

Although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may alter seagrass species composition but should not have an adverse effect on the overall biomass available for sea turtle feeding habits. Additionally, no green sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect on the green sea turtle.

Hawksbill Sea Turtle and "No Effect" Determination

Although hawksbill sea turtles are expected to be found foraging near hardbottom habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may reduce nearshore salinity concentrations but should not have an adverse effect on sponges or other food sources utilized by this species. Additionally, no hawksbill sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved

nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect on the hawksbill sea turtle.

Leatherback Sea Turtle and "No Effect" Determination

Although leatherback turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may reduce nearshore salinity concentrations but should not have an adverse effect on jellyfishes or other food sources utilized by this species. Additionally, no leatherback sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect on the leatherback sea turtle.

Kemp's Ridley Sea Turtle and "No Effect" Determination

Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Florida Bay, this species is not expected to be found within the direct area of influence associated with Phase 1 of the C-111 SC project. Additionally, no Kemp's ridley sea turtles would attempt to utilize areas for nesting purposes since their main nesting location is on a single stretch of beach on the Gulf Coast of Mexico. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect on Kemp's ridley sea turtle.

Loggerhead Sea Turtle and "No Effect" Determination

Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may reduce nearshore salinity concentrations but should not have an adverse effect on crustaceans, mollusks or other invertebrate food sources utilized by this species. Additionally, no loggerhead sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project would have no effect the loggerhead sea turtle.

Elkhorn Coral and "No Effect" Determination

Elkhorn coral may be found outside the waters of Florida Bay, specifically within the offshore reef track of the Florida Keys where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately 10 to 20 miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1500 meters from shore. Because the reef tract where elkhorn coral resides is several miles outside of any projected salinity changes, the Corps has determined the proposed project would have no effect on elkhorn coral.

Elkhorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat; therefore, the project would have no effect on critical habitat for elkhorn coral.

Staghorn Coral and "No Effect" Determination

Staghorn coral may be found outside the waters of Florida Bay, specifically within the offshore reef track of the Florida Keys where salinities are stable (35 ppt) and more representative of open ocean conditions. The reef tract is approximately 10 to 20 miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1500 meters from shore. Because the reef tract where staghorn coral resides is several miles outside of any projected salinity changes, the Corps has determined the proposed project would have no effect on staghorn coral.

Staghorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat designated for staghorn coral; therefore, the project would have no effect on critical habitat for this species.

7.2.3 Site 1 Impoundment Project

7.2.3.1 Project Summary

The Site 1 Impoundment is a component of CERP, designed to capture and store local runoff during wet periods and then use that water to supplement water deliveries to the Hillsboro Canal during dry periods thus reducing demands for releases from Lake Okeechobee and the Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR) **(Figure 7-3)**. Constructing and operating the impoundment will reduce the need for releases from LNWR during the dry season to meet local water demands and will facilitate the maintenance of more natural, desirable, and consistent water levels within the LNWR. The impoundment will also reduce groundwater seepage from LNWR. The ability to achieve and maintain more natural hydroperiods and hydropatterns within LNWR by retaining more rainfall and inflows from upstream will enhance habitat

function and quality and will also improve native plant and animal species abundance and diversity. In addition, there will be benefits to the downstream estuaries as a result of reducing peak freshwater flows from local storm water runoff and pulsed releases from Lake Okeechobee.

7.2.3.2 Existing Conditions

Additional storage in the project area is needed to reverse declines in ecological function and productivity in the LNWR and WCA-2A and to provide an alternate source of water to meet water supply and water resource protection demands in the Lower East Coast Service Area 1. Regional adverse ecological conditions in the vicinity of the project area include prolonged unnatural and undesirable water levels (stages) during both wet and dry periods in LNWR and WCA-2A (natural areas). Although the primary function of these natural areas is water storage, these areas are also designated as wildlife refuges for the protection of fish and wildlife. The current managed hydrologic regime which results in too much water during wet periods and too little during dry periods is not conducive to attaining and preserving desirable fish and wildlife habitat functions. During severe dry periods, freshwater releases from the natural areas to meet municipal, industrial, and resource protection (prevention of salt water intrusion into the aquifer) demands in the project area (Lower East Coast Service Area 1) are not sufficient, resulting in the imposition of water shortage rules to curtail water use. In addition, discharges of excessive volumes of freshwater from the Hillsboro Canal into the Atlantic Intracoastal Waterway also adversely affect marine life in the estuarine area at the mouth of the Hillsboro Canal between the Hillsboro Inlet to the south and the Boca Raton Inlet to the north.

In 2009, the Miami-Dade Limestone Products Association constructed a 1,000 foot long, 18 foot deep slurry wall to reduce seepage between ENP and rock mine properties to the east of ENP. In July 2012, the Association completed construction of a 2 mile long, 35 foot deep seepage wall in this same location south of Tamiami Trail. It is unknown whether this new test will effectively reduce seepage to the east, or whether the Association will construct an additional wall if this new test is effective. The association also has an “option” to construct an additional 5 miles of seepage wall south of the 2-mile seepage wall if approved by committee and permitted.

7.2.3.3 Project Effects

The project includes construction of a 1,660-acre above-ground reservoir, an inflow pump station, gated discharge culvert, emergency overflow spillway and a seepage control canal with associated features. Construction impacts will be offset by improving habitat function and quality and restoring native plant and animal abundance and diversity in the LNWR, WCA-2A, and in the estuarine portion of the Hillsboro Canal, thereby increasing the spatial extent of functional habitats in those areas. The project will achieve these beneficial effects by reducing seepage and the amount of water

withdrawn from the natural system for water supply and aquifer protection in developed area of Palm Beach and Broward Counties. Some incidental level of flood damage reduction is also anticipated due to increased storage capacity for fresh water. Recreational opportunities are also provided, including boardwalks, viewing platforms, picnic shelters, canoe launches and information kiosks at two sites within the project footprint.

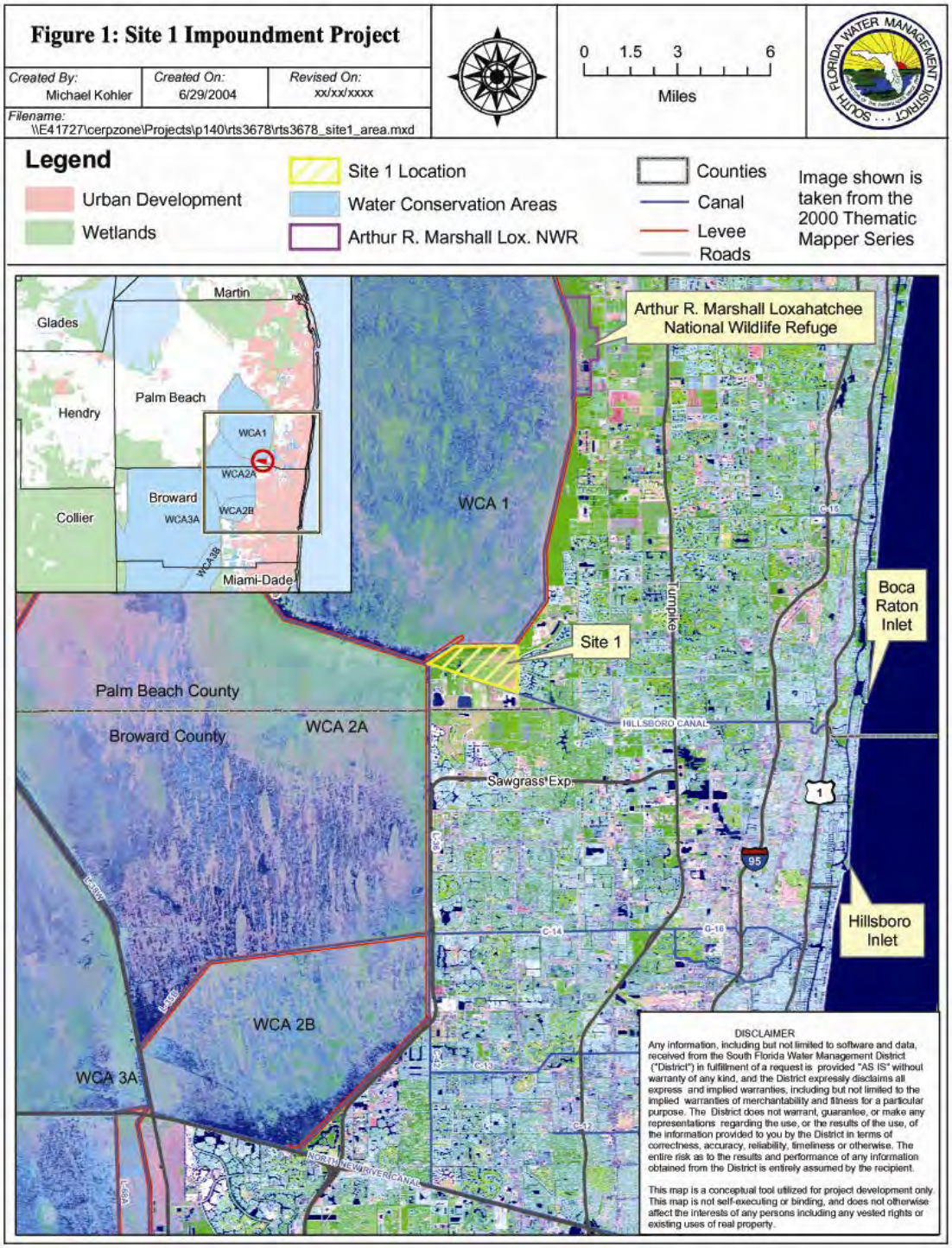

Figure 7-3. Site 1 Impoundment Project Area Map

7.2.3.4 Status of ESA Consultation with NMFS

On 16 February 2005, the Corps requested concurrence with NMFS on its determination of no effect on the smalltooth sawfish and opossum pipefish downstream of the project area. By letter dated 18 February 2005, NMFS concurred with the Corps' no effect determination. Construction is on-going for this project; therefore, re-initiation is not required.

Opossum Pipe Fish and "No Effect" Determination

Opossum pipefish are not likely to inhabit or utilize waterways of the project site due to little or no existing emergent vegetation along the adjacent canals. Effects downstream are not anticipated as the recommend plan would improve water quality and salinity levels in estuarine environment. Therefore, no effect is anticipated to the listed species from Site 1 implementation.

Smalltooth Sawfish and "No Effect" Determination

Smalltooth sawfish are typically found in the southern Everglades and south tip of Florida and are not anticipated to be affected within the proposed project area or downstream reaches of the Hillsboro Canal. However, implementation of the Site 1 project would reduce the freshwater, nutrient laden flows to the estuarine environment. Therefore, it is anticipated that no effect would be attributable to the proposed implementation of the Site 1 project and in fact, conditions for the species are expected to improve.

Projects with "May Affect, But Not Likely to Adversely Affect" Determination (Consultation Summaries and New Information)

Federally listed plant and animal species, including critical habitat, which may have the potential to be affected by CERP projects are discussed in detail below:

7.2.4 Indian Driver Lagoon South Feasibility Project

7.2.4.1 Project Summary

The Indian-River Lagoon-South Project is a CERP Project that is located within Martin and St. Lucie Counties **(Figure 7-4)**. The purpose of the project is to improve surface-water management in the C-23/C-24, C-25, and C-44 basins for habitat improvement in the St. Lucie River Estuary and southern portions of the Indian River Lagoon. Project features include the construction and operation of four above ground reservoirs to capture water from the C-44, C-23, C-24, and C-25 canals for increased storage (130,000 acre-ft), the construction and operation of four stormwater treatment areas to reduce

sediment, phosphorous, and nitrogen to the estuary and lagoon, the restoration of upland and wetland habitat, the redirection of water from the C-23/24 basin to the north fork of the St. Lucie River to attenuate freshwater flows to the estuary, muck removal from the north and south forks of the St. Lucie River and middle estuary; and the creation of oyster shell, reef balls and artificial submerged habitat near muck removal sites for added for habitat improvement. The project is expected to provide significant water-quality improvement benefits to both the St. Lucie River and Estuary and Indian River Lagoon by reducing the load of nutrients, pesticides, and suspended materials from basins runoffs.

7.2.4.2 Existing Conditions

The southern Indian River Lagoon estuary system has been degraded by heavy and rapidly occurring discharges of freshwater during the rainy season, and by an excessive accumulation of muck in estuary and lagoon bottoms. These stressors have reduced water clarity and exceeded the salinity tolerances of submerged vegetation and benthic animals.

7.2.4.3 Project Effects

Project features include building pumps, levees, canals and other structures that will displace existing natural areas. These features are required in order to operate and interconnect project features, provide a mechanism for re-directing freshwater discharges to the north fork of the St. Lucie River, and facilitate muck removal and habitat restoration actions inside the estuaries. Impacts due to construction of these features are offset by the redirection of flow and reduction of damaging high volume flows into the estuary during the wet season.

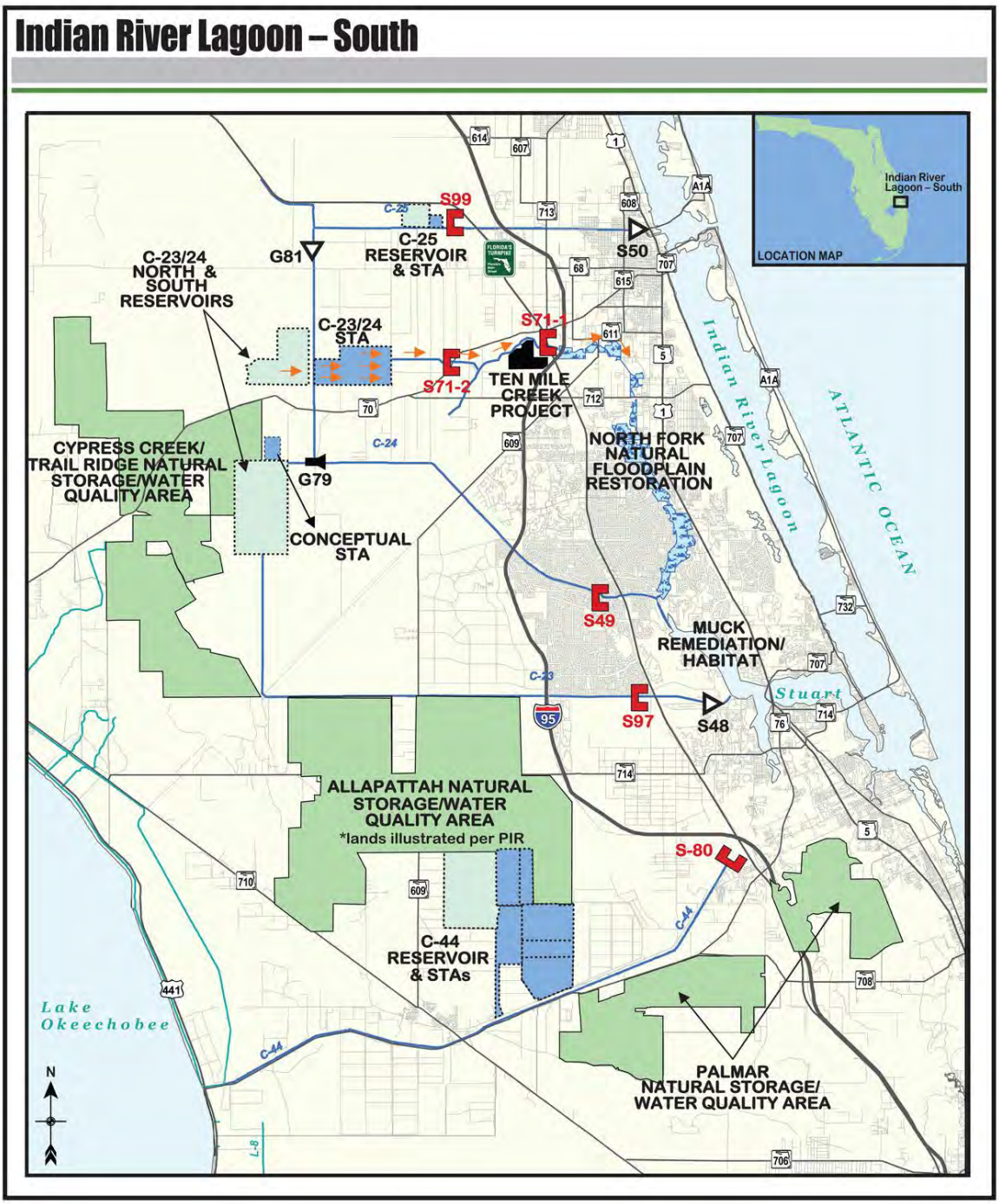

Figure 7-4. Indian River Lagoon South Project Area Map

7.2.4.4 Status of ESA Consultation with NMFS

On 18 March 2002, NMFS concurred with the Corps' determination that the project may affect, but is not likely to adversely affect, sea turtles, Johnson's seagrass, and Johnson's seagrass designated critical habitat (see note below). On 1 April 2003, the smalltooth sawfish (*Pristis pectinata*) was listed as endangered under the ESA. Construction is not complete and re-initiation of ESA Section 7 consultation with NMFS is required to evaluate any potential effects on the smalltooth sawfish due to project implementation. Consultation will focus exclusively on the species since the project is not located in designated critical habitat for smalltooth sawfish.

(NMFS) Letter dated March 18, 2002

Section 7 Coordination
"Sea turtles and Johnson's seagrass may occur within the Indian River Lagoon system. The NMFS Protected Resources Division concurs with the Corps' determination that implementation of the preferred plan will not adversely affect listed species nor designated critical habitat under the Service's purview. This concludes consultation responsibilities under Section 7 of the Endangered Species Act."

Additional Consultation and Request for Determination Concurrence

<u>Smalltooth Sawfish and "No Effect" Determination</u>

Smalltooth sawfish observations have been very rare throughout the St. Lucie estuary. By redirecting flows, removing muck, and restoring estuarine habitat, conditions are expected to benefit the habitat necessary to enhance recovery of the species. Therefore, the Corps determines that implementation of the proposed project will have no effect on smalltooth sawfish.

7.2.5 Caloosahatchee River (C-43) West Basin Storage Reservoir Project

7.2.5.1 Project Summary

The Caloosahatchee River (C-43) West Basin Storage Reservoir Project is a CERP Project that is located within Hendry County **(Figure 7-5)**. The purpose of the project is to improve the timing, quantity, and quality of freshwater flows to the Caloosahatchee River and Estuary. The project provides approximately 170,000 acre-feet of above-ground storage volume in a two-cell reservoir. Major features of the project include external and internal embankments, and environmentally responsible design features to provide fish and wildlife habitat such as littoral areas in the perimeter canal and deep water refugia within the reservoir. The project contributes toward the restoration of ecosystem function in the Caloosahatchee Estuary by reducing the number and severity

of events where harmful amounts of freshwater from basin runoff and Lake Okeechobee releases are discharged into the estuary system. The project also helps to maintain a desirable minimum flow of freshwater to the estuary during dry periods. These two primary functions help to moderate unnatural changes in salinity that are detrimental to estuarine communities.

7.2.5.2 Existing Conditions

South Florida's flood reduction system stores water in Lake Okeechobee during the annual dry season. Excess water is released when the lake rises to a level that threatens the integrity of the Herbert Hoover Dike and the health of the lake's delicate ecosystem. The resulting, unnatural surges of freshwater to the Caloosahatchee River reduce estuarine salinity levels. Alternately, during the dry season when irrigation demands are high, water managers may release little or no water to the river. This causes an increase in salinity levels. Both high and low salinity levels can trigger die-offs of sea grasses and oysters, species that are indicators of the estuary's overall health.

7.2.5.3 Project Effects

The C-43 West Basin Storage Reservoir will help ensure a more natural, consistent flow of freshwater to the estuary. To restore and maintain the estuary during the dry season, the project will capture and store basin stormwater runoff, along with a portion of water discharged from Lake Okeechobee. Managers will slowly release water into the Caloosahatchee, as needed to benefit the river and estuarine conditions.

Figure 7-5. Caloosahatchee River (C-43) West Basin Storage Reservoir Site Map

7.2.5.4 Status of ESA Consultation with NMFS

By letter dated 18 March 2002, NMFS stated that only the Gulf sturgeon could potentially be affected by the proposed action, but concluded that the project would not adversely affect the species. On 10 January 2007, the Corps submitted a revised BA to NMFS. By letter dated 20 July 2007, NMFS concurred with the Corps' determination that the project may affect, but is not likely to adversely affect sea turtles and smalltooth sawfish. On 2 September 2009, NMFS designated critical habitat for smalltooth sawfish. Although the project site is not located within critical habitat, it is located upstream from smalltooth sawfish critical habitat. Since construction has not been completed for this project, the Corps is reinitiating Section 7 consultation to evaluate potential effects to designated critical habitat for smalltooth sawfish.

Previous Consultation (10 January 2007)

The smalltooth sawfish may benefit from indirect project impacts which include salinity regime improvements to the downstream Caloosahatchee Estuary. This potential beneficial effect is supported by findings in Simpfendorfer (2006); this study suggests that the species may travel upstream in the Caloosahatchee River in the spring when flow is limited. It is anticipated that the project may affect, but is not likely to adversely affect, the smalltooth sawfish, and will likely benefit the species.

Sea turtles including loggerhead turtle, green turtle, leatherback turtle, Kemp's ridley turtle, and hawksbill turtle are listed as endangered by NMFS with the exception of the loggerhead turtle, which is listed as threatened. These are marine species with a presence in south Florida waters and are known to utilize bays and estuarine habitats, such as the Caloosahatchee Estuary, for feeding and resting. Sea turtles may benefit from indirect project effects which include salinity regime improvements to the downstream Caloosahatchee Estuary. The project may affect, but is not likely to adversely affect, sea turtles and will likely benefit these sea turtle species.

Additional Consultation and Request for Determination Concurrence

Smalltooth Sawfish Critical Habitat

With the capacity of storing excess water during the wet season, the C-43 Project will have the ability to provide supplemental freshwater flows, as needed, to regulate salinities and sustain the health and productivity of the Caloosahatchee River and Estuary. As a result of project implementation, salinities are expected to stabilize into preferred ranges for estuarine biota, including smalltooth sawfish. Since a more natural freshwater flow regime will be established through project restoration efforts with no physical changes to existing habitat, the Corps has determined that the C-43 Project will have no adverse effect on critical habitat for the smalltooth sawfish.

7.2.6 Picayune Strand Restoration Project

7.2.6.1 Project Summary

The Picayune Strand Restoration Project (PSRP) **(Figure 7-6)** involves the restoration of natural water flow across 85 square miles in western Collier County that were drained in the early 1960s in anticipation of extensive residential development. This subsequent development dramatically altered the natural landscape, changing a healthy wetland ecosystem into a distressed environment. The PSRP will restore wetlands in Picayune Strand and in adjacent public lands by reducing over-drainage, while restoring a natural and beneficial sheetflow of water to the Ten Thousand Islands National Wildlife Refuge. Project features include 83 miles of canal plugs, 227 miles of road removal, and the addition of pump stations (3) and spreader swales to aid in rehydration of the wetlands. Restoration benefits include wetland restoration and subsequent reemergence of foraging wading birds and native flora. In addition to restoring fresh water wetlands, the project will improve estuarine water quality by increasing groundwater recharge and reducing large and unnatural freshwater inflows.

7.2.6.2 Existing Conditions

Restoring the Picayune Strand entails plugging 48 miles of canals that were originally dug to provide flood protection for a sprawling residential area that was never built. Golden Gate Estates (GGE) was planned as an extensive residential subdivision by Gulf American Corporation (GAC) beginning in the 1950s. GAC constructed roads and canals in the 1960s and early 1970s, but the residential development failed before many of the planned houses were built. These roads and four large canals have over-drained the area resulting in the reduction of aquifer recharge, greatly increased freshwater point source discharges to the receiving estuaries to the south, invasion by upland vegetation, loss of ecological connectivity and associated habitat, and increased frequency of forest fires. The construction of Interstate 75, also known as Alligator Alley, split the GGE subdivision in half forming Northern Golden Gate Estates and Southern Golden Gate Estates.

7.2.6.3 Project Effects

Through PSRP, estuarine resources will be positively affected by the restoration of a more natural water flow regime. The features of PSRP Plan (Alternative 3D from 2004 PIR/FEIS) will increase freshwater flows to Faka Union Bay, Pumpkin Bay, and Blackwater Bay. Under the current baseline conditions **(Figure 7-7, 7-8, and 7-9)**, freshwater enters the estuaries through the Faka Union Canal. Faka Union Bay and Santina Bay are most affected by this point discharge. The salinities in these areas are low and in other nearby estuaries are higher. After the PSRP is implemented, the freshwater discharge will be distributed more evenly to the coastal estuaries. It was estimated in the 2004 PIR/FEIS that in Faka Union Bay the restoration is estimated to

match natural conditions by over 80 percent in the wet season and by over 60 percent in the dry season. In Pumpkin Bay, flows will meet natural conditions by less than 50 percent; however, there will still be an increase of freshwater flows over current conditions. In Blackwater Bay, during the critical wet season months flows will match natural conditions by over 60 percent (PSRP PIR/FEIS 2004). Since, salinity is important to the smalltooth sawfish and freshwater input appears to be an important element of their habitat (Simpfendorfer et al. 2011), the PSRP should be beneficial to the smalltooth sawfish and may increase available habitat in southwestern Florida.

Figure 7-6. Picayune Strand Restoration Project Site Map

7.2.6.4 Status of ESA Consultation with NMFS

On 20 October 2004, the Corps requested concurrence with NMFS on its no effect determination on the smalltooth sawfish, the green sea turtle, Kemp's ridley sea turtle and the loggerhead sea turtle. As stated in the BA published in the 2004 Final PIR/EIS, NMFS concurred with the Corps' effect determination for those species. This project is intended to re-establish sheetflow to the Ten Thousand Islands National Wildlife Refuge, which on 27 August 2009, was designated as critical habitat for the smalltooth sawfish; therefore, re-initiation of consultation with NMFS to evaluate potential effects is required, and an evaluation of potential effects are discussed below.

Sea Turtles, Smalltooth Sawfish, and "No Effect" Determination

The hydrologic restoration of SGGE under the recommended plan would redistribute freshwater flows from the Faka Union Canal system to other parts of Study Area estuaries and bays within the Ten Thousand Islands Region. Reestablishing a more natural hydrology would restore the slow year-round influx of freshwater needed to maintain the salinity in the natural range that is optimal for estuarine organisms. The only truly estuarine endangered species found in the region is the smalltooth sawfish. Improvements in estuarine salinity gradients will in turn benefit estuarine secondary productivity, which will benefit the sawfish by favoring development of forage fish and invertebrate communities. No effects are expected on marine turtles, which are not normally present in the inner estuaries, although the lower Ten Thousand Islands region is an important habitat for the endangered Kemp's ridley sea turtle. The Faka Union Canal weir #1 that is just north of US Highway 41 will remain in place as a barrier to salt water intrusion. It will act as a barrier to any upstream movement of these species thus protecting them during construction. Implementation of the recommended plan should have a favorable impact on estuarine habitats used by the smalltooth sawfish and sea turtles.

Additional Consultation and Request for Determination Concurrence

Smalltooth Sawfish Critical Habitat

By re-establishing sheetflow to the downstream estuaries, including the Ten Thousand Islands National Wildlife Refuge, salinities are expected to stabilize into a preferred range for estuarine biota, including the smalltooth sawfish. Since all construction activities are well outside of designated critical habitat, and a more natural freshwater flow regime will be established through project restoration efforts, the Corps has determined that the PSRP will have no adverse effect on designated critical habitat for the smalltooth sawfish.

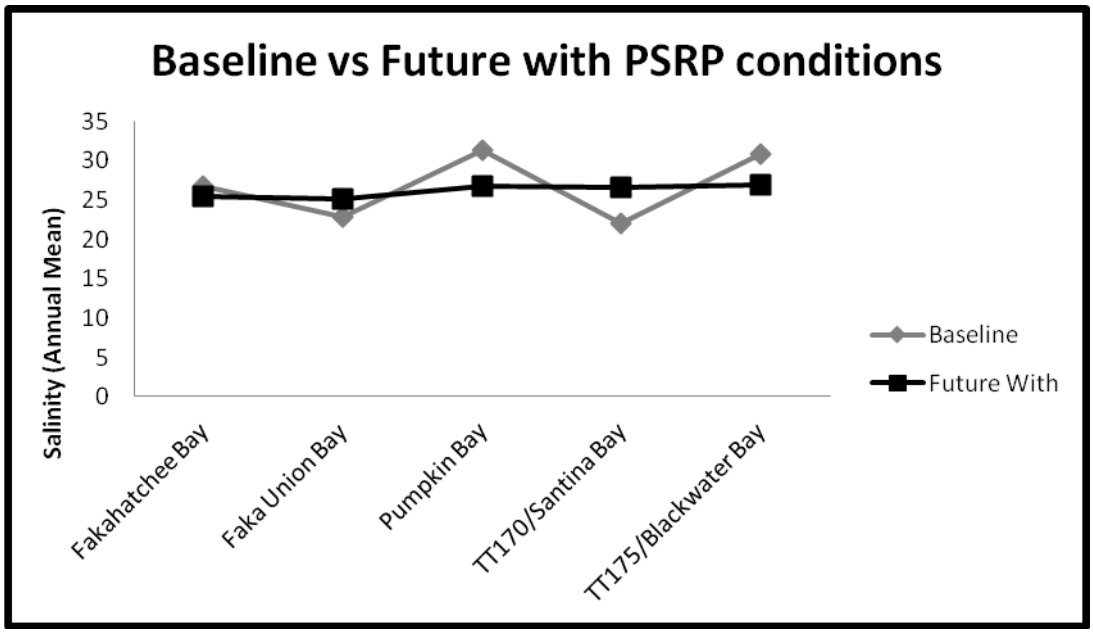

Figure 7-7. **Baseline vs. Future conditions for average annual salinity**

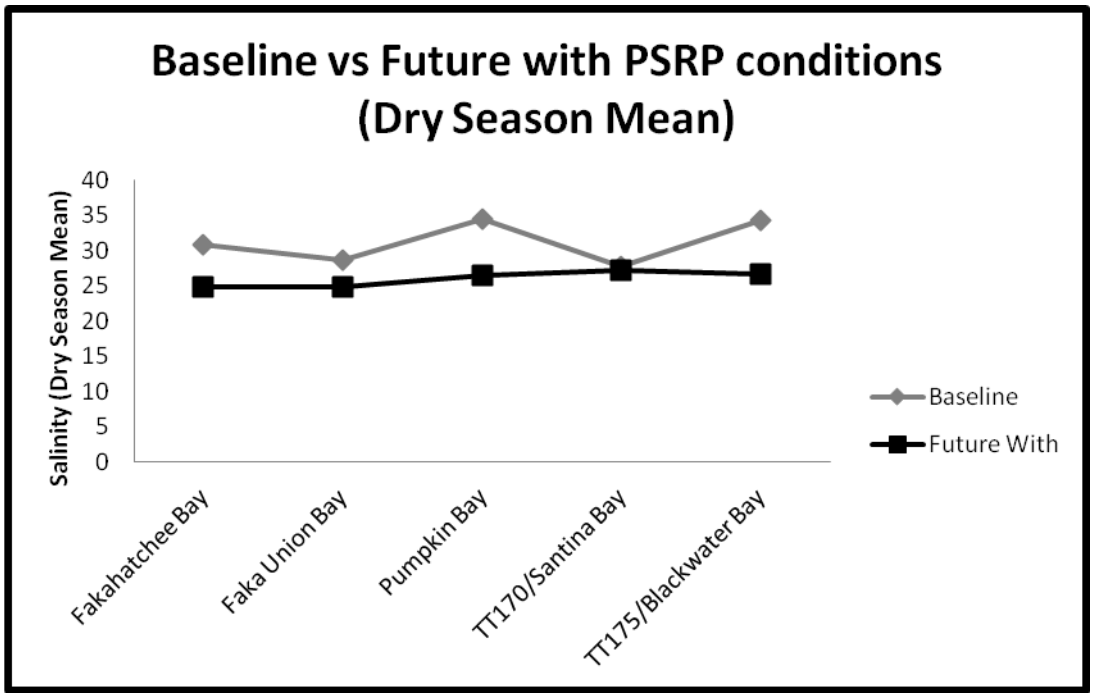

Figure 7-8. Baseline vs. Future with project conditions for dry season mean

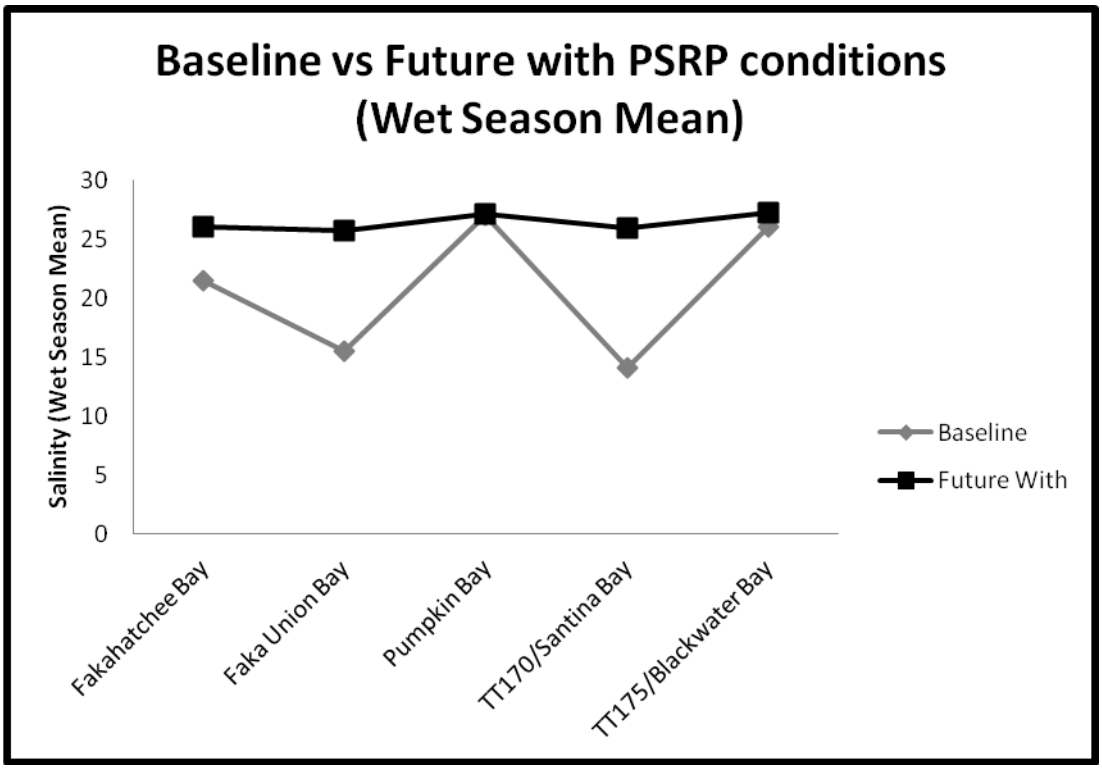

Figure 7-9. Baseline vs. Future with project conditions for wet season mean

7.2.7 Everglades National Park Seepage Management Project

7.2.7.1 Project Summary

The project as envisioned (U.S. Army Corps of Engineers. 1999) is composed of three components: L-31N Improvements for Seepage Management (Component FF), S-356 Structures (Component V), and Bird Drive Recharge Area. These three components would work to improve water deliveries to Northeast Shark River Slough (NESRS) and restore wetland hydroperiods and hydropatterns in Everglades National Park (ENP) via seepage management. The CERP L-31N Improvements for Seepage Management and S-356 Structures components included relocating and enhancing L-31N, groundwater wells, and sheetflow delivery system adjacent to ENP. More detailed planning, design, and pilot studies were to be conducted to determine the appropriate technology to control seepage from ENP. Also included was a feature to relocate the Modified Water Deliveries Structure S-357 to provide more effective water deliveries to ENP. In 2009, the Miami-Dade Limestone Products Association constructed a 1,000 foot long, 18 foot deep slurry wall to reduce seepage between ENP and rock mine properties to the east of ENP. In July 2012, the Association completed construction of a 2 mile long, 35 foot deep seepage wall in this same location south of Tamiami Trail. It is unknown whether this new test will effectively reduce seepage to the east, or whether the Association will construct an additional wall if this new test is effective. The Association also has an

"option" to construct an additional 5 miles of seepage wall south of the 2-mile seepage wall if approved by committee and permitted.

This project has recently been incorporated into CEPP. The project details and species effects determination are discussed in Section 7.2.8.

7.2.8 Central Everglades Planning Project

7.2.8.1 Executive Summary

Consistent with CERP, the goal of CEPP is to improve the quantity, quality, timing and distribution of water in the Northern Estuaries, WCA 3, and ENP in order to restore the hydrology, habitat and functions of the natural system. The project area includes Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, a portion of the Everglades Agricultural Area, the Water Conservation Areas; Everglades National Park, the Southern Estuaries (Florida Bay and Biscayne Bay), and the Lower East Coast.

Species and critical habitat identified during informal consultation as potentially affected by the proposed CEPP project includes fifteen federally listed threatened or endangered species; along with designated critical habitat for Johnson's seagrass, elkhorn coral, staghorn coral, and the smalltooth sawfish.

Based on the information contained in this section of the Programmatic BA, the Corps has determined that implementation of the CEPP Recommended Plan may affect, but is not likely to adversely affect smalltooth sawfish, green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and loggerhead sea turtle. Potential effects are minimized through the overall project restoration opportunities; the expectation of improved water quality and deliveries to coastal and nearshore habitats; and the inclusion of project commitments and conservation measures described herein.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which will not likely be of concern in this study due to the lack of suitable habitat include Johnson's seagrass, blue whale, finback whale, humpback whale, sei whale, sperm whale, elkhorn coral, and staghorn coral.

7.2.8.2 INTRODUCTION

The federal action evaluated in this section of the Programmatic BA is CEPP, which contains features designed to improve the flow of water through the system by constructing, modifying, or removing existing levees, canals, culverts, and pump stations. The goal of the Recommended Plan is to improve the quantity, quality, timing and distribution of water in the Northern Estuaries, WCA 3, and ENP in order to restore

the hydrology, habitat and functions of the natural system. Improvements to native flora and fauna, including threatened and endangered species, will occur as a result of the restoration of hydrologic conditions.

7.2.8.3 CONSULTATION SUMMARY

The Corps has coordinated with NMFS pertaining to potential action effects on listed species under their purview by letter dated 10 January 2012. In a letter dated 23 January 2012, NMFS provided concurrence with the Corps finding of listed species that may be encountered or adjacent to the action area. Federally listed species under the purview of NMFS include blue whale (*Balaenoptera* musculus), finback whale (*Balaenoptera* physalus), humback whale (*Megaptera* novaeangliae), sei whale (*Balaenoptera* borealis), sperm whale (*Physeter* macrocephalus), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), and Johnson's seagrass (*Halophila johnsonii*). In addition, the action study area contains designated critical habitat for smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson's seagrass.

7.2.8.4 PROJECT DESCRIPTION

7.2.8.4.1 Project Authority

The Water Resources Development Act (WRDA) of 2000 provided authority for the CERP in Section 601(b)(1)(A). Specific authorization for the CEPP will be sought under Section 601(d) as a future CERP project. The purpose of the CEPP is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades and downstream estuaries.

7.2.8.4.2 Description of Proposed Project

The proposed project incorporates restoration components primarily intended to benefit freshwater wetlands and estuarine resources by distributing freshwater flows through WCA 3A, WCA 3B and ENP. The project would decrease the large pulses of Lake Okeechobee water that currently are sent east to the St. Lucie and west to the Caloosahatchee estuaries and send this water southward through Everglades Agricultural Area canals to flowage equalization basins (FEB). This reduction of the existing high flows to the St. Lucie and Caloosahatchee estuaries would help restore these estuaries. The FEBs would deliver water to existing stormwater treatment areas, which would reduce phosphorus concentrations in the water. The treated water would be released at the northwestern end of WCA 3A to flow through and restore much of WCA 3A, WCA 3B, ENP, and Florida Bay. Several existing levees, canals, and culverts,

and pump stations would be constructed, modified, or removed to improve the flow of water through the system. Specific project features of the tentatively selected plan, Alternative 4R, are summarized in **Figure 7-10**.

7.2.8.4.3 Project Goals, Objectives, and Performance Measures

Consistent with WRDA 2000, CERP included goals for enhancing economic values and social well being with specific objectives towards improving other project purposes of the C&SF project, including agricultural, municipal and industrial water supply. Section 601(h) of WRDA 2000 states "*the overarching objective of the Plan is the restoration, preservation, and protection of the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection*".

These same objectives apply to CEPP study efforts. Specifically, the goal of the CEPP is to improve the quantity, quality, timing and distribution of water in the Northern Estuaries, WCA 3, and ENP in order to restore the hydrology, habitat and functions of the natural system. Identified below, are the goals and objectives of CEPP, and CERP (**Table 7-1**).

Table 7-1. Goals and Objectives of CERP and CEPP

CERP GOAL: Enhance Ecological Values	
CERP Objective	**CEPP Objective**
Increase the total spatial extent of natural areas	
Improve habitat and functional quality	Restore seasonal hydroperiods and freshwater distribution to support a natural mosaic of wetland and upland habitat in the Everglades System
	Improve sheetflow patterns and surface water depths and durations in the Everglades system in order to reduce soil subsidence, the frequency of damaging peat fires, the decline of tree islands, and salt water intrusion
	Reduce high volume discharges from Lake Okeechobee to improve the quality of oyster and SAV habitat in the northern estuaries
Improve native plant and animal species abundance and diversity	Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization
	Restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function
CERP GOAL: Enhance Economic Values and Social Well Being	
Increase availability of fresh water (agricultural/municipal &	Increase availability of water supply to the Lake Okeechobee Service Area

industrial)	
Reduce flood damages (agricultural/urban)	
Provide recreational and navigation opportunities	
Protect cultural and archeological resources and values	

7.2.8.5 Project Location

The study area for CEPP encompasses the Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, a portion of the Everglades Agricultural Area, the Water Conservation Areas; Everglades National Park, the Southern Estuaries (Florida Bay and Biscayne Bay), and the Lower East Coast. A description of each region is summarized in **Table 7-2**, and a map of the study area is presented in **Figure 7-10.**

Table 7-2: Description of CEPP Study Area Regions

CEPP Study Area Region	Description of the Study Area Region
Lake Okeechobee	Lake Okeechobee is a large, shallow lake (surface area ~73 square miles) 30 miles west of the Atlantic coast and 60 miles east of the Gulf of Mexico. It is the principal water supply reservoir for south Florida, is used for navigation, flood control, and recreation. It is impounded by a system of levees, with 6 outlets: St. Lucie Canal eastward to the Atlantic Ocean, Caloosahatchee Canal/River westward to the Gulf of Mexico, and four agricultural canals (West Palm Beach, Hillsboro, North New River and Miami).
Northern Estuaries	Lake Okeechobee discharges into the 2 Northern Estuaries. The St. Lucie Canal feeds into the St. Lucie Estuary, part of a larger system, the Indian River Lagoon (designated an Estuary of National Significance and is part of the U.S. Environmental Protection Agency (USEPA)-sponsored National Estuary program). The Caloosahatchee Canal/River feeds into the Caloosahatchee Estuary to the west.
Everglades Agricultural Area (EAA)	The EAA is ~700,000 acres in size and is immediately south of Lake Okeechobee. Much of this rich, fertile land is devoted to sugarcane production, and is crossed by a network of canals that are strictly maintained to manage water supply and flood protection.
Water Conservation Areas (WCAs)	The WCAs, WCA 1 (Loxahatchee National Wildlife Refuge), WCA 2, and, WCA 3 (the largest of the three) are situated southeast of the EAA and are ~1,350 square miles (~40 miles wide and 100 miles long) from Lake Okeechobee to Florida Bay. Provides floodwater retention, public water supply, and are the headwaters of Everglades National Park.
Everglades National Park (ENP)	ENP was, established in 1947, covering ~2,353 square miles (total elevation changes of only 6 feet from its northern boundary of Tamiami Trail south to Florida Bay). Landscape includes sawgrass sloughs, tropical hardwood hammocks, offshore coral reefs, mangrove forest, lakes, ponds, and bays.
Southern Estuaries	Florida Bay comprises a large portion of ENP, and is a shallow estuarine system (average depth less than 3 feet). Florida Bay is the main receiving water of the greater Everglades, heavily influenced by changes in timing, distribution, and quantity of freshwater flows into the southern estuaries.
Lower East Coast (LEC)	The LEC encompasses Palm Beach, Broward, and Miami-Dade Counties, the most densely populated area in Florida. Water levels in this area are highly controlled by the Central and Southern Florida (C&SF) water management system to prevent overdrainage and manage saltwater intrusion at the shoreline, provides flood control and water supply. Only portions of the LEC adjacent to the natural areas and susceptible to seepage will be considered in CEPP planning.

Figure 7-10: Central Everglades Planning Project Study Area

7.2.8.6 Model Description

The CEPP planning model was specifically developed to evaluate project alternatives within CEPP domain. The primary areas to be evaluated include the northern estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), the Water Conservation Areas (WCA 3A and 3B) and ENP. Performance measures (PM) are used to make the correlation between hydrologic output and ecosystem functions and evaluate the degree to which proposed alternative plans will meet restoration

objectives. Performance measure scores are generated from hydrologic models. Each PM has a predictive metric and a desired target representative of historical conditions or pre-drainage hydropatterns within the study area. The desired targets are based on hydrologic requirements necessary to meet empirical or theoretical ecological thresholds.

7.2.8.6.1 Hydrologic Models

The performance measures are hydrologic metrics based on output from regional hydrologic models. These models provide daily, detailed estimates of hydrology across the 41-year period of record (January 1965 – December 2005. The regional models proposed as the primary tools for the CEPP assessment include the Regional Simulation Model Basins (RSMBN) version 2.3.2 and the South Florida Regional Simulation Model Glades LECSA Implementation (RSMGL) version 2.3.2. These models were developed by the Hydrologic and Environmental Systems Modeling Department of the South Florida Water Management District (SFWMD).

The RSMBN is a link-node model designed to simulate the transfer of water from a pre-defined set of watersheds, lakes, reservoirs or any "water body" that receives or transmits water to another adjacent water body. The model domain covers Lake Okeechobee and four major watersheds related to the northern portion of the project area: Kissimmee, Lake Okeechobee, St. Lucie River, Caloosahatchee River and the Everglades Agricultural Area.

The RSMGL is a sub-regional model which includes Palm Beach, Broward, and Miami-Dade Counties, the WCAs, ENP, and Big Cypress National Preserve (BCNP). The model uses historical and modeled boundary condition data for the purpose of defining flows at water control structures, tidal stages, etc. RSMGL simulates hydrology on a daily basis using climatic data for the January 1965 – December 2005 period of record, which includes both drought and wet periods. The RSMGL simulates major components of south Florida's hydrology including evapotranspiration, infiltration, overland and groundwater flow, canal flow, canal-groundwater seepage, levee seepage and incorporates current or proposed water management control structures and operational rules.

Performance measures targets were primarily based on output from the Natural System Model (NSM) version 4.6.2, which simulates the hydrologic response of a pre-drained Everglades. The NSM has been used as a planning tool in several Everglades restoration projects.

7.2.8.7 Description of Project Performance Measures

Rehydration within the Greater Everglades would improve habitat for fish and wildlife resources within the project area. In order to evaluate potential impacts to these

resources, performance measures and ecological targets were developed for indicator species and their habitats. Ecological targets are designed to support the intention of the performance measures. Performance measures and ecological targets relative to the evaluation of impacts to threatened and endangered species in estuarine or nearshore habitats are identified below.

To make the correlation between hydrologic output and ecosystem functions, the project team utilized PMs developed from the Northern Estuaries; the Greater Everglades Ridge; and Slough Conceptual Ecological Models (CEMs) (Barnes 2005, Ogden 2005a, Sime 2005). Conceptual ecological models, as used in the Everglades restoration program, are non-quantitative planning tools that identify the major anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and the best biological attributes or indicators of these ecological responses (Ogden et al. 2005b).

7.2.8.7.1 Northern Estuaries Performance Measure - Salinity Envelopes

Caloosahatchee Estuary - PM 6.1 Low Flow Targets and PM 6.2 High Flow Targets

Overall restoration goals include; re-establishment of a salinity range favorable to juvenile marine fish, shellfish, oysters and submerged aquatic vegetation (SAV), re-establishment of seasonally appropriate freshwater flows of favorable quality that maintain low salinities in the upper estuary and re-establishment of more stable salinities and ranges in the lower estuary.

Targets are based on freshwater discharges from to C-43 canal at the S-79 structure where the mean monthly inflow should be maintained between 450 and 2,800 cubic feet per second (cfs). Targets were developed to reduce minimum discharge and mediate high flow events to the estuary to improve estuarine water quality and protect and enhance estuarine habitat and biota. Ultimately, the low flow target is no months during October to July when the mean monthly inflow from the Caloosahatchee watershed, as measured at S-79, falls below a low-flow limit of 450 cfs (C-43 basin runoff and Lake Okeechobee regulatory releases). Ultimately, the high flow target is no months with mean monthly flows greater than 2,800 cfs, as measured at the S-79, from Lake Okeechobee regulatory releases in combination with flows from the Caloosahatchee River (C-43) basin.

St. Lucie Estuary - PM 6.1 Low Flow Targets and PM 6.2 High Flow Targets

Overall restoration goals include maintaining a salinity range favorable to fish, benthic invertebrates, oysters and SAV. This requires addressing high volume, long duration discharge events from Lake Okeechobee, the C-44, C-23 and C-24 watersheds. The flow targets are designed to result in a favorable salinity envelop in the mid estuary of 8 to 25 psu salinity. For the CEPP the flow targets for the St. Lucie Estuary focus on flows from

Lake Okeechobee only. This is due to the fact that the watershed flow targets are being addressed in the Indian River Lagoon South Project which is included in the 2050 base conditions. Full restoration targets are estimated to be 31 months where mean flow is less than 350 cubic feet per second (cfs) and 0 Lake Okeechobee regulatory discharge events (14 day moving averages > 2000 cfs).

7.2.8.7.2 Spatial Extent of Performance Measures

Performance measures within the northern estuaries will be used to measure the suitability for oyster and submerged aquatic vegetation habitat based on target flows from structures S-79 and S-80. CEPP will improve conditions for estuarine and marine resources throughout the northern estuaries by restoring more natural timing, volume, and duration of freshwater flows to the Caloosahatchee and St. Lucie estuaries with the potential to provide a more appropriate range of salinity conditions by reducing extreme salinity fluctuations. Performance measure scores within the northern estuaries will be generated from the RSMBN at S-79 and S-80. Calculation of habitat benefits achieved by each of the project alternatives is restricted to portions of the estuary where changes in salinity in relation to freshwater flows at S-79 and S-80 can be reasonably predicted.

For analytical purposes, the areas within the Caloosahatchee and St. Lucie Estuary systems that have the potential to be beneficially affected by the project are assumed to encompass the entire system which is approximately 85,973 acres (70,979 acres for the Caloosahatchee Estuary (Zone CE-1) (**Figure 7-11**) and 14,994 acres for the St. Lucie Estuary (Zone SE-1) (**Figure 7-12**)).

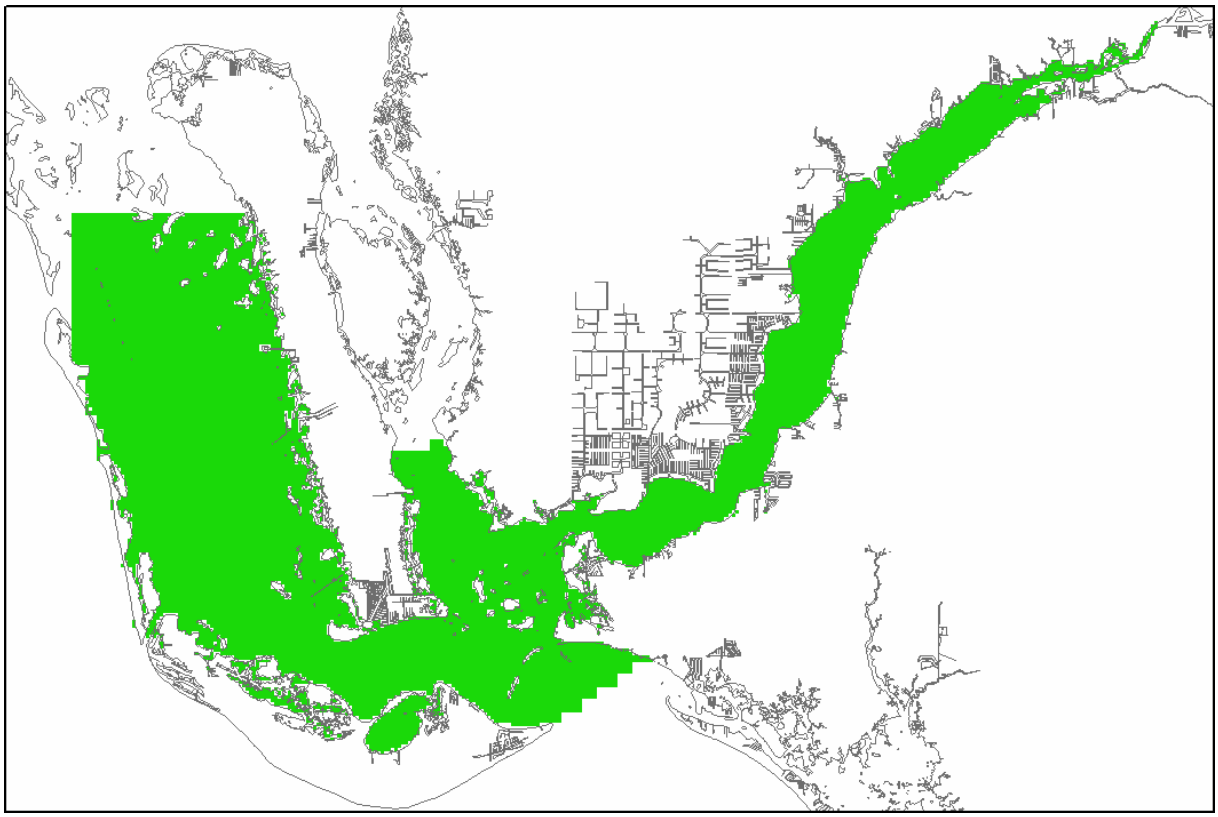

Figure 7-11: Estimate of the Maximum Area of Potential Ecological Benefit for the Caloosahatchee Estuary (Zone CE-1)

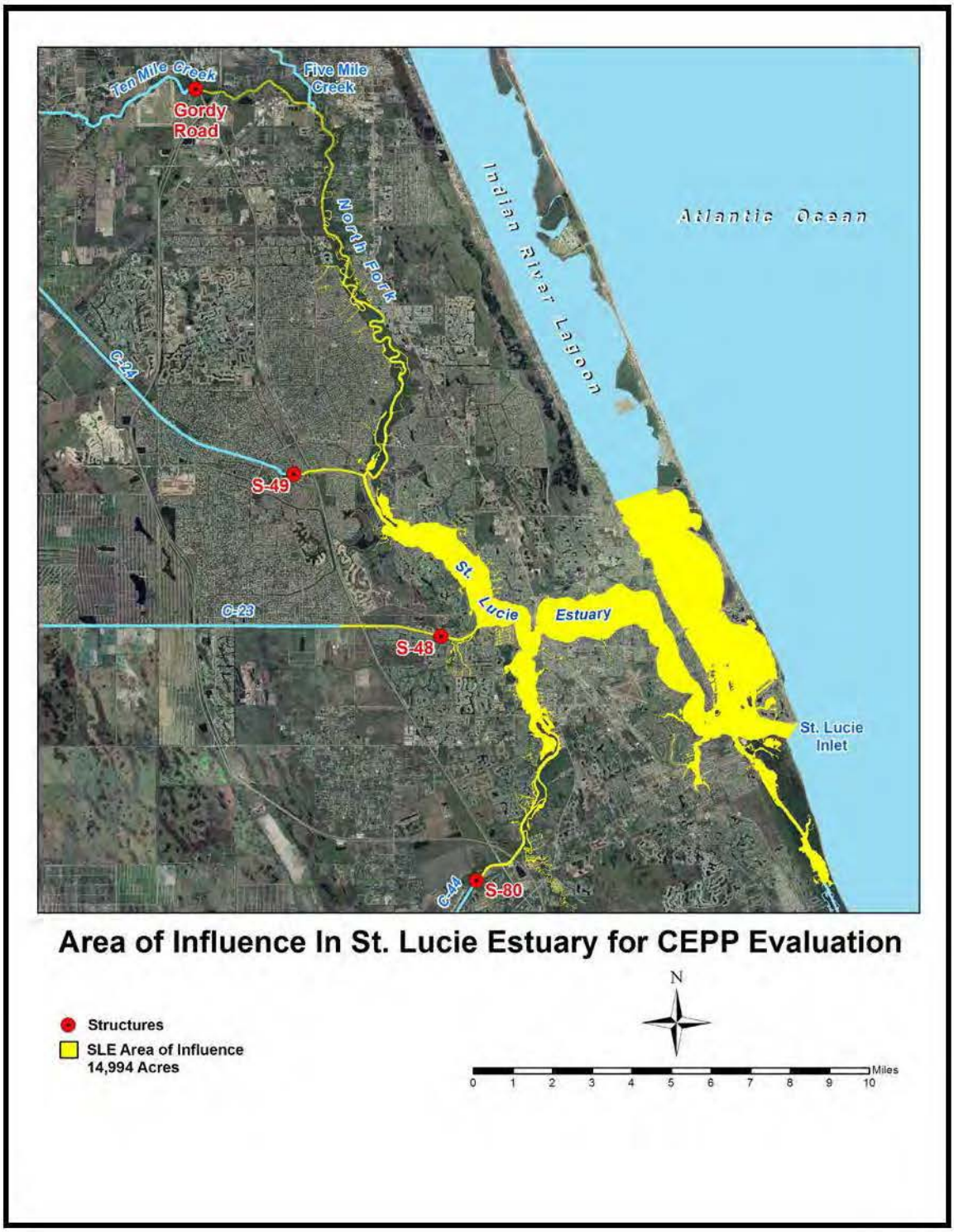

Figure 7-12. Estimate of the Maximum Area of Potential Ecological Benefit for the St. Lucie Estuary (Zone SE-1)

7.2.8.7.3 Southern Estuaries

CEPP Hydrological Model

A desired result of restored hydroperiods through CEPP is to increase densities of small fishes and macroinvertebrates throughout the Everglades, especially in the southern Everglades. Because small fishes are the most abundant vertebrates in the Everglades and are consumed by apex predators, the Trophic Hypothesis predicts that an increase in density of small fish will benefit higher trophic-level predators such as wading birds, reptiles, and larger fish that depend on them as a food source. This CEPP model (Cantano and Trexler, 2013) compares freshwater fish densities in the Water Conservation Areas (3-A and 3-B), Shark River Slough, and Taylor Slough of existing conditions against future without project conditions, and CEPP alternatives.

Results of these model comparisons (**Table 7-3**) agree that abundance of both small fishes and largemouth bass would increase under the CEPP hydrological model scenarios compared to the Existing Conditions Baseline (ECB) hydrology or the 2050 future conditions without CERP (2050FWO). The increased fish productivity under CEPP is linked to longer hydroperiods and reduced severity of drying events in regions south of the L-5 canal (WCA 3A, WCA 3B, Shark River Slough, Southern Marl Prairies, Taylor Slough). CEPP alternative scenarios 3 and 4 yielded the greatest benefits for fish production. There were relatively small differences between these two scenarios in the predicted benefits on small fish density and largemouth bass CPUE. Fishes are a system-wide indicator of the ecological functioning of the Greater Everglades because of their significance in trophic interactions among wildlife (Doren et al. 2009). Therefore, restoring hydrology under CEPP may have ecological benefits for the Everglades ecosystem.

Table 7-3. Percent change in average fish density per m² between Existing Conditions Baseline (ECB) and 2050 conditions without CERP (2050FWO).

Region	CEPP1		CEPP2		CEPP3		CEPP4	
	ECB	FWO	ECB	FWO	ECB	FWO	ECB	FWO
2A	**0.70**	-12.96	**0.70**	-12.96	**0.70**	-12.96	**0.71**	-12.95
3A	**5.46**	**9.36**	**4.75**	**8.62**	**4.46**	**8.31**	**5.20**	**9.08**
3B	-0.43	**4.87**	**2.59**	**8.04**	**1.25**	**6.64**	-1.30	**3.96**
LOX	-2.71	-0.46	-2.71	-0.46	-2.71	-0.46	-2.71	-0.46
SMP	**16.05**	**18.42**	**14.85**	**17.20**	**28.65**	**31.28**	**27.45**	**30.05**
SRS	**13.39**	**16.04**	**13.64**	**16.30**	**18.66**	**21.44**	**20.48**	**23.30**
TS	**0.04**	**0.55**	-0.11	**0.39**	**0.05**	**0.56**	-0.01	**0.49**

Pink Shrimp Model

A pink shrimp model developed for CEPP by the NMFS (Browder 2013) simulates growth, survival, and potential harvests from a specified monthly cohort, as a function of salinity and temperature. Coefficients for functional relationships were determined from laboratory trials with 2000 juvenile shrimp from Florida Bay. Treatments ranged from 2-55 ppt and18-33°C for salinity and temperature, respectively. Daily salinity was calculated for CEPP and future without project scenarios using a period of record from 1965-2005, and daily water temperature was used from the year 2007.

Although small (3.5-6.8%), results from Whipray to Johnson Key basins in Florida Bay produced a greater potential harvest of shrimp compared to a future without project scenario. This implies that conditions with CEPP implemented have the potential to improve the productivity of estuarine and nearshore biota in areas of Florida Bay (**Figure 7-13**).

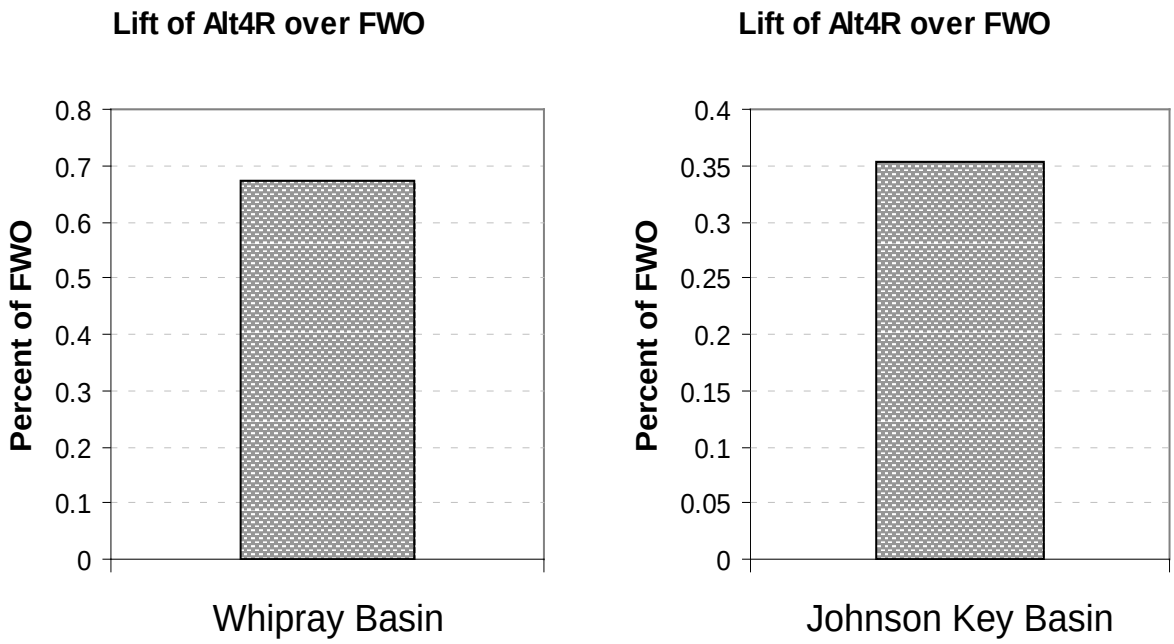

Figure 7-13. Lift of Alternative 4R over Future Without Project Conditions

7.2.8.8 Recommended Plan Elements

Features in the Everglades Agricultural Area include construction of the 14,000 acre A-2 FEB (perimeter levees, internal distribution channels, inlet structures, outlet structures, and channels connecting the FEB to the Miami Canal north of S-8. Operation of the A-2 FEB would be integrated with the operation of the A-1 FEB, a state-funded and state-constructed FEB.

Conveyance features in WCA 2A and northern WCA 3A include: a gated spillway to deliver water from the L-6 Canal to the L-5 Canal, a new gated spillway to deliver water from STA 3/4 to the L-5 Canal, enlarge ~13.6 miles of the L-5 Canal, degrade ~2.9 miles of the southern L-4 Levee, a 200 cfs pump station to move water within the L-4 Canal to maintain Tribal water supply deliveries west of the L-4 Canal, gated culverts to deliver water from the Miami Canal (south of the S-8 Pump Station) and the L-5 Canal to the L-4 Canal, and backfill ~13.5 miles of the Miami Canal and include upland mounds between a point 1.5 miles south of the S-8 Pump Station and Interstate Highway I-75.

Additional conveyance features would be located in southern WCA 3A, WCA 3B, and the northern edge of ENP: a 1,000 cfs gated spillway adjacent to S-333, a 500 cfs gated culvert in L-67A Levee and an associated 6,000 foot gap in L-67C Levee, a flowway through the western end of WCA 3B (2 gated culverts in L-67A Levee, removal of ~8 miles of L-67C Levee, removal of ~4.3 miles of L-29 Levee, construct new ~8.5 mile levee), a gated spillway in L-29 Canal to control water movement in the L-29 Canal and provide access to the L-29 Levee, remove ~5.5 miles of the L-67 Extension Levee, remove ~6 miles of Old Tamiami Trail between Tram Road and L-67 Extension Levee, and remove spoil mounds along the northwestern side of the L-67A Canal adjacent to the new structures in the L-67A Levee, and incidental remove vegetation along agricultural ditches.

Features primarily for seepage management along the eastern edge of ENP include a new 1,000 cfs pump station to replace the existing temporary S-356 pump station and a ~4 mile long, 35 feet deep tapering seepage barrier cutoff wall along the L-31N Levee just south of Tamiami Trail.

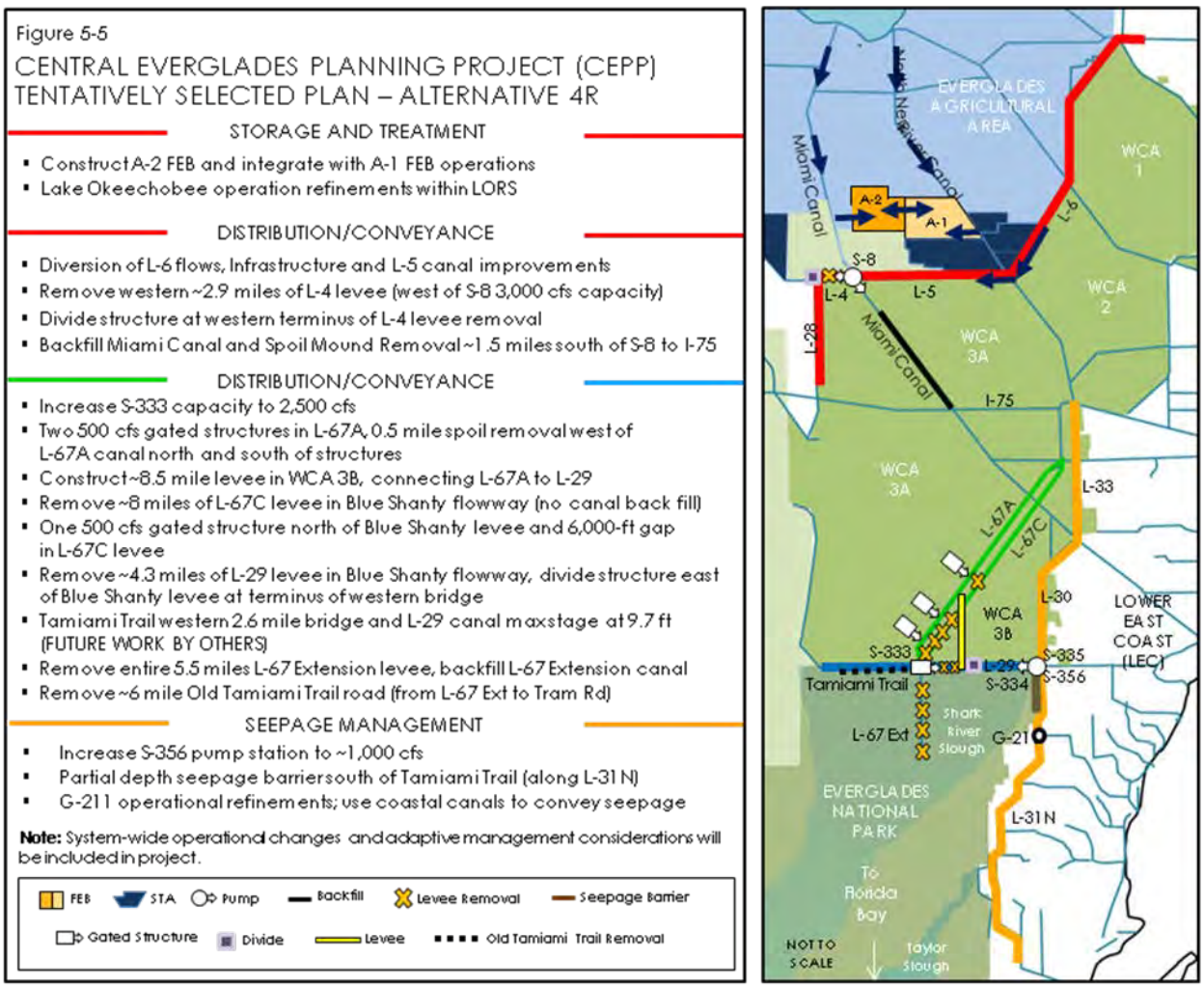

Figure 7-14. Project Features of the CEPP Recommended Plan

7.2.8.9 DESCRIPTION OF LISTED SPECIES AND DESIGNATED HABITAT

7.2.8.9.1 Affected Environment

The project area encompasses the Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, a portion of the Everglades Agricultural Area, the Water Conservation Areas, Everglades National Park, the Southern Estuaries (Florida Bay and Biscayne Bay), and the Lower East Coast. For the purpose of evaluating environmental effects related to marine and estuarine species, this section focuses on estuarine, coastal, and nearshore habitats within the project area.

Northern Estuaries

The Northern Estuaries are composed of two different systems that receive discharges from Lake Okeechobee. The eastern portion is composed of the St. Lucie Canal which feeds into the St. Lucie Estuary, part of a larger system known as the Indian River Lagoon. It has been designated an Estuary of National Significance and is part of the U.S. Environmental Protection Agency-sponsored National Estuary program. The western portion is composed of the Caloosahatchee Canal and River, and the Caloosahatchee Estuary.

Everglades National Park

Everglades National Park (ENP) is located to the south of the Water Conservation Areas, and is the third largest National Park in the continental U.S. The ENP covers approximately 2,353 square miles and is extremely low and flat, with total elevation changes of only 6 feet from Tamiami Trail south to Florida Bay. Established in 1947, ENP possesses a unique landscape comprised of sawgrass sloughs, tropical hardwood hammocks, offshore coral reefs, mangrove forest, and lakes, ponds and bays.

Southern Estuaries

Biscayne Bay, a shallow tidal sound, approaches 300 square miles in size. Although the northern and central portions have been greatly affected by development and human encroachment, the southern portion of the Bay includes Biscayne National Park with Card and Barnes Sounds having been designated part of the Florida Keys National Marine Sanctuary. Florida Bay comprises a large portion of Everglades National Park, and is a shallow estuarine system with an average depth of less than three feet. Florida Bay is the main receiving water of the greater Everglades system and is heavily influenced by changes in the timing, distribution and quantity of freshwater flows into the estuaries.

Lower East Coast

The Atlantic Coastal Ridge, generally referred to as the Lower East Coast (LEC) Area, is mostly urbanized and encompasses Palm Beach, Broward and Miami-Dade Counties. The LEC is the most densely populated area in Florida, and includes the population centers of West Palm Beach, Fort Lauderdale and Miami. Water levels in this area are tightly controlled near the shoreline to prevent over-drainage and manage saltwater intrusion, and the entire area is dependent upon operation of the C&SF system for flood control and water supply.

Vegetative Communities (Estuarine/Marine)

The Everglades landscape is dominated by a complex of freshwater wetland communities that includes open water sloughs and marshes, dense grass- and sedge-dominated marshes, forested islands, and wet marl prairies. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrological regime (FWS 1999). These communities generally occur along a hydrological gradient with the slough/open water marsh communities occupying the wettest areas (flooded more than nine months per year), followed by sawgrass marshes (flooded six to nine months per year), and wet marl prairie communities (flooded less than six months per year) (FWS 1999). The freshwater wetlands of the Everglades eventually grade into intertidal mangrove wetlands and subtidal seagrass beds in the estuarine waters of Florida Bay.

Development and drainage over the last century have dramatically reduced the overall spatial extent of freshwater wetlands within the Everglades, with approximately half of the pre-drainage 1.2 million hectares of wetlands being converted for development and agriculture (Davis and Ogden 1997). Alteration of the normal flow of freshwater through the Everglades has also contributed to conversions between community types, invasion by exotic species, and a general loss of community diversity and heterogeneity. Vegetative trends in ENP have included a substantial shift from the longer hydroperiod slough/open water marsh communities to shorter hydroperiod sawgrass marshes (Davis and Ogden 1997; Armentano et al. 2006). In addition, invasion of sawgrass marshes and wet prairies by exotic woody species has led to the conversion of some marsh communities to forested wetlands (Gunderson 1997).

The estuarine communities of Florida Bay have also been affected by upstream changes in freshwater flows through the Everglades. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (FWS 1999). For purposes of this biological assessment, descriptions will focus on vegetative types encountered in estuarine systems.

Northern Estuaries

Submerged aquatic vegetation (SAV) is one of the most important vegetation communities of the St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary. The SAV converts sunlight into food for fish, sea turtles, manatees, and a myriad of invertebrates, among other species. Seagrass meadows improve water quality by removing nutrients, dissipating the effects of waves and currents, and by stabilizing bottom habitats thereby reducing suspended solids within the water column. Seagrass beds support some of the most abundant and diverse fish populations in the Indian River Lagoon. Seagrass and macro algae (collectively referred to as SAV) are highly productive areas and are perhaps the most important habitat of the Indian River Lagoon (IRL CCM, 1996). Many commercial and recreational fisheries (i.e. clams, shrimp, lobster, fish) are associated with healthy seagrass beds (US Fish and Wildlife

Service (FWS 1999). Currently, many SAV beds are stressed and have been reduced or eliminated from their former areas by extreme salinity fluctuations, increased turbidity, sedimentation, dredging, damage from boats, and nutrient enrichment which causes algal blooms that, in turn, restrict light penetration.

Upper Caloosahatchee River and Estuary

In terms of distribution and abundance, tape grass (*Vallisneria americana)* has been the dominant species in the upper Caloosahatchee River and Estuary, colonizing littoral zones in water less than one meter in depth (Chamberlain and Doering 1998a). In the early 1990s, SAV covered approximately 1,000 acres and about 60% of the coverage occurred within an 8-kilometer (km) stretch between Beautiful Island and the Fort Myers Bridge (Hoffacker 1994). Total longitudinal cover ranged from 14 to 32 km upstream from Shell Point (Chamberlain and Doering 1998b). Tape grass can typically tolerate salinities of 3 to 5 practical salinity units (psu) with few long-term effects if light conditions are sufficient (Haller et al. 1974, French and Moore 2003, Jarvis and Moore 2008). Dramatic declines in Tape grass were observed beginning in late 2006 as a result of salinities exceeding the species' tolerance (Bourn 1932, Haller et al. 1974, Doering et al. 1999, Kraemer et al. 1999, Doering et al. 2001). During this period widgeon grass (*Ruppia maritime)* was the dominant species although it never achieved even the minimum abundance recorded for Tape grass (Burns et al. 2007).

Lower Caloosahatchee River and Estuary

Historically, two species of SAV have been routinely reported during surveys in the lower Caloosahatchee River Estuary upstream of Shell Point. These include shoal weed (*Halodule beuadettei*), shoal grass (*Halodule wrightii*) and turtle grass (*Thalassia testudinum)* (Chamberlain and Doering 1998a, Wilzbach et al. 2000, Burns et al. 2007). In more recent reports, manatee grass (*Syringodium filiforme*) has been reported in San Carlos and Tarpon Bays (Wilzbach et al. 2000, Burns et al. 2007). Shoal grass coverage, described as abundant, has been at 300 acres; about 75% of this occurred between 2 and 8 kilometers (km) upstream of Shell Point (Chamberlain and Doering 1998b).

From 2004 to 2008, the lower estuary was dominated by shoal grass. Although widgeon grass was observed occasionally (Burns et al. 2007); only very low densities were found in the lower estuary when surveys were searching specifically for it. High salinity fluctuations with tides and shading by shoal grass may limit its growth. Low salinities during higher rainfall periods and discharge events observed since 2004 likely prevented the survival of seagrass species including turtle grass (Burns et al. 2007). Water clarity was poor in 2004 and 2005 preventing SAV growth in waters greater than 0.7 meter deep. Water clarity conditions improved in 2007 and were sufficient for growth down to 1.2 meters.

Hurricane effects lowering SAV abundance in 2005 and 2006 and subsequent *shoal grass* recovery in 2007 were evident with cover in 2007 exceeding 2004 levels. Salinities of 1 psu or less occurred each year from 2004 to 2006. The large drop in cover and density in fall 2007 prior to the usual winter dieback could have been caused by grazing.

St. Lucie Estuary

The SAV communities in the St. Lucie Estuary and Southern Indian River Lagoon include seagrass and macro algae. The estuaries support six species of seagrass including shoal grass, manatee grass, turtle grass, paddle grass (*Halophila decipiens*), star grass (*Halophila engelmannii*) and the threatened Johnson's seagrass (*Halophila johnsonii*). Johnson's seagrass was listed as threatened under ESA in 1998, and critical habitat was designated in 2000. The species has a very limited distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. Major threats include propeller scarring, dredging, sedimentation and degraded water quality. Shoal grass and manatee grass are the dominant canopy species in the lagoon (Thompson 1978, Dawes et al. 1995, Morris et al. 2000). While all of these species are most successful in salinities greater than 20 psu, *shoal grass* can tolerate a wide range of salinity and salinity variations. However, manatee grass is not as tolerant of low salinities or widely varying salinities (Irlandi 2006).

SAV distribution has been mapped in the St. Lucie Estuary and the Southern Indian River Lagoon every two to three years since 1986, including annual mapping from 2005 through 2007 to help assess hurricane impacts. Historic SAV maps show SAV extending throughout the estuary. In 2007, very sparse (< 10% cover in most areas) SAV was present in the lower and middle estuary, but not in either of the forks. Three seagrass species occurred within the estuary: shoal grass, Johnson's seagrass and paddle grass. The majority of the SAV occurred in small isolated patches. The dominant SAV species in 2007 was Johnson's seagrass. It also extended farther upstream than any other SAV species.

This region was impacted by hurricanes and associated freshwater discharges in 2004 and 2005. Following the hurricanes, observed impacts to Southern Indian River Lagoon SAV communities included large coverage and density declines and smaller direct impacts due to burial by shifting bottom sediments. Lush manatee grass beds were documented through 2004, however, low salinities and associated poor water quality following the 2004 and 2005 hurricanes greatly impacted manatee grass in the area. The hurricanes also altered bathymetry on the east and west edges of the estuary, covering seagrasses. The steepest decline in percent occurrence of manatee occurred in 2005 after Hurricane Wilma. Johnson's seagrass followed by shoal grass colonized the former manatee grass habitat and recruited throughout the site. Available data indicates a clear trend toward recovery of the manatee grass beds.

Southern Estuaries

Nearly all aspects of south Florida's native vegetation have been affected by development, altered hydrology, nutrient inputs, and spread of non-native species that have resulted directly or indirectly from a century of water management. Habitat types that dominate the southern coastal regions within the project area include submerged aquatic vegetation (primarily seagrasses and algae), mangrove forests, saline emergent wetlands, freshwater wetlands, and non-native dominated wetlands (primarily wetlands dominated by Australian pine, *Casaurina* spp. or Brazilian pepper, *Schinus terebinthifolius*).

The estuarine communities of south Florida have been affected by upstream changes in freshwater flows through the Everglades. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (FWS 1999). Mangrove communities occur within a range of salinities from 0 to 40 practical salinity units (psu). Florida Bay experiences salinities in excess of 40 psu on a seasonal basis. Implementing CEPP will provide increased freshwater flows to Florida Bay and the Southwest Coast, thereby aiding to lower salinities levels within these areas to better encompass mangrove salinity tolerance range.

Mangroves

Mangrove communities are forested wetlands occurring in intertidal, low-wave-energy, estuarine and marine environments. Within the project area, extensive mangrove communities occur in the intertidal zone of Florida Bay. Mangrove forests have a dense canopy dominated by four species: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). Mangrove communities occur within a range of salinities from 0 to 40 parts per thousand (ppt). Florida Bay experiences salinities in excess of 40 ppt on a seasonal basis. Declines in freshwater flow through the Everglades have altered the salinity balance and species composition of mangrove communities within Florida Bay. Changes in freshwater flow can lead to an invasion by exotic species such as Australian pine (*Casuarina equisetifolia*) and Brazilian pepper (*Schinus terebinthifolius*).

The mangrove species found in the Biscayne Bay area are the red mangrove (*Rhizophora mangle*); the black mangrove (*Avicennia germinans*); the white mangrove (*Laguncularia racemosa*); and the buttonwood (*Conocarpus erectus*). Most of the mangrove habitat in the project area can be sub-divided into four forest types (Gaiser and Ross, 2003). Closest to the bay shoreline is the coastal mangrove forest, whose canopy is comprised mainly of red and black mangroves exceeding 30 feet in height. Landward of this zone is the interior mangrove forest that is dominated by black and white mangroves approximately 15-30 feet tall, with an understory of red mangroves. Adjacent to and landward of the interior mangrove forest is the transitional mangrove forest. This vegetative type is dominated by white mangroves, approximately 7-15 feet high, with

red and black mangroves, and buttonwood found emerging from the canopy. The most landward forest type is the dwarf mangrove forest, which is dominated by red mangroves generally less than 6 feet in stature.

Seagrass Beds

Seagrasses are submerged vascular plants that form dense rooted beds in shallow estuarine and marine environments. This community occurs in subtidal areas that experience moderate wave energy. Within the project area, extensive seagrass beds occur in Florida Bay. The most abundant seagrasses in south Florida are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Additional species include star grass (*Halophila engelmannii*), paddle grass (*Halophila decipiens*), and Johnson's seagrass (*Halophila johnsonii*). Widgeon grass may also occur in seagrass beds in areas of low salinity. Seagrasses have an optimum salinity range of 24 to 35 ppt, but can tolerate considerable short term salinity fluctuations. Large-scale seagrass die-off has occurred in Florida Bay since 1987, with over 18% of the total bay area affected. Suspected causes of seagrass mortality include high salinities and temperatures during the 1980s and long-term reductions of freshwater inflow to Florida Bay (RECOVER 2009).

Federally Listed Species (Under NMFS Purview)

Fifteen federally listed threatened and endangered species under NMFS purview are either known to exist or potentially exist within the project area and, subsequently, may be affected by the proposed action (**Table 7-4**). These marine species include the smalltooth sawfish (*Pristia pectinata*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and the loggerhead sea turtle (*Caretta caretta*). Other federally threatened or endangered species that are known to exist or potentially exist in the project area, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Johnson's seagrass (*Halophila johnsonii*), the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), and the elkhorn (*Acropora palmata*), and staghorn (*Acropora cervicornis*) stony corals.

Table 7-4: Status of Threatened & Endangered Species Under NMFS Purview Likely to be Affected by CEPP – and the Corps' Effects Determinations

Common Name	Scientific Name	Status	Agency	May Affect, Likely to Adversely Effect	May Affect, Not Likely to Adversely	No Effect

					Effect	
Mammals						
Blue whale	*Balaenoptera musculus*	E	Federal			X
Fin whale	*Balaenoptera physalus*	E	Federal			X
Humpback whale	*Megaptera novaeangliae*	T	Federal			X
Sei whale	*Balaenoptera borealis*	E	Federal			X
Sperm whale	*Physeter macrocephalus*	E	Federal			X
Reptiles						
Green sea turtle	*Chelonia mydas*	E	Federal		X	
Leatherback sea turtle	*Dermochelys coriacea*	E	Federal		X	
Hawksbill sea turtle	*Eretmochelys imbricata*	E	Federal		X	
Loggerhead sea turtle	*Caretta caretta*	T	Federal		X	
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	Federal		X	
Fish						
Smalltooth sawfish*	*Pristia pectinata*	E	Federal		X	
Gulf sturgeon*	*Acipenser oxyrinchus desotoi*	T	Federal			X
Invertebrates						
Elkhorn coral*	*Acropora palmata*	T	Federal			X
Staghorn coral*	*Acropora cervicornis*	T	Federal			X
Plants						
Johnson's seagrass*	*Halophila johnsonii*	E	Federal			X

* Critical habitat designated for this species
E: Endangered
T: Threatened

State Listed Species

Portions of project area contain habitat potentially suitable for two state-listed threatened species and nine species of special concern that are under NMFS purview (see Section 6.4). The majority of protected species is outside of the projects' zone of influence and therefore, is not likely to be adversely affected by project operations. Successful implementation of restoring existing wetlands will improve the overall functional capacity of affected habitats thus benefiting the species utilizing these areas. Therefore, no adverse impacts are anticipated to state listed species, or species of concern as a result of this project.

Designated Critical Habitat (Under NMFS Purview)

NMFS has designated critical habitat for Johnson's seagrass, the Gulf sturgeon, smalltooth sawfish, elkhorn coral, and staghorn coral (see Figures 6.1 – 6.5). Critical habitat is not contained within the study area for the Gulf sturgeon; therefore, no effect is anticipated. Critical habitat for Johnson's seagrass, along with elkhorn and staghorn corals does exist within the study action area but is unlikely to be affected by CEPP.

7.2.8.9.2 EFFECTS OF PROPOSED ACTION

Species Biology and Effect Determination

A description of the biology and distribution of threatened and endangered species potentially occurring in the project area that are under NMFS purview is contained in Section 7.0.

"No Effect" Determination

Federally threatened or endangered species that are known to potentially exist within close proximity of the project area, but which will not likely be of concern are discussed below:

<u>Gulf Sturgeon and "No Effect" Determination</u>

Although historical records indicate that the Gulf sturgeon ranged from the Mississippi River east to Tampa Bay and south to Florida Bay, the present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi, and east to the Suwannee River in Florida. Since all project effects will occur south of any known species locale, the Corps has determined the proposed project would have no effect the Gulf sturgeon nor its designated critical habitat.

<u>Blue, Finback, Humpback, Sei and Sperm Whales and "No Effect" Determination</u>

Although ocean whales have been reported migrating along the Florida coastlines of the Gulf of Mexico and Atlantic Ocean seeking warmer waters during the winter months,

they are typically found far off shore, away from any potential influences of the proposed project. Since project effects are anticipated to be limited to land-based wetlands, estuarine systems and near shore habitats, the Corps has determined the proposed project will have no effect the blue, finback, humpback, sei or sperm whales.

Elkhorn Coral, Staghorn Coral and "No Effect" Determination

Elkhorn and staghorn corals may be found offshore of bay habitats including Biscayne and Florida Bay outer reef tracts where salinities are stable (35 ppt) and representative of open ocean conditions. The reef tract is approximately 10 to 20 miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1500 meters from shore. Because the reef tract where elkhorn and staghorn coral resides is several miles outside of any projected salinity changes, the Corps has determined the proposed project would have no effect on elkhorn or staghorn corals.

Elkhorn Coral and Staghorn Coral Critical Habitat

Project restoration efforts are expected to focus on wetland and estuarine habitats and will not extend offshore into the vicinity of critical habitat; therefore, the project would have no effect on designated critical habitat for elkhorn or staghorn coral.

Johnson's Seagrass and "No Effect" Determination

Johnson's seagrass has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet including the mouth of the St. Lucie Inlet. Because Johnson's seagrass potentially benefits from the project as a result of fewer high-volume freshwater discharges from Lake Okeechobee, the Corps has determined the project would have no effect on Johnson's seagrass.

Johnson's Seagrass Critical Habitat

The project area includes designated critical habitat for Johnson's seagrass in the St. Lucie estuary. Implementation of the project would result in fewer high volume freshwater discharges from Lake Okeechobee and therefore, may benefit seagrasses in the St. Lucie estuary, including Johnson's seagrass. As a result, the Corps has determined that implementation of the project will not destroy or adversely modify designated critical habitat and will have no adverse effect on critical habitat

"May Effect" Determination

The proposed project would improve the quality, quantity, timing, and distribution of flows to the Greater Everglades, including the coastal areas of the southern estuaries

and Florida Bay. Subsequently, the project will provide significant beneficial effects to listed plant and animal species such as sea turtles, estuarine fishes, and seagrasses. Federally listed species under the purview of the NMFS which may have the potential to be affected by CEPP include the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the smalltooth sawfish, and is discussed below:

Green Sea Turtle and "May Affect" Determination

The green sea turtle weighs approximately 150 kilograms and lives in tropical and sub-tropical waters. Areas that are known as important feeding areas for the green turtles in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. Green turtles occupy three habitat types: high energy oceanic beaches, convergence zones in the pelagic habitat, and benthic feeding grounds in the relatively shallow, protected waters. Females deposit eggs on high energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line. Hatchlings leave the beach and move in the open ocean. Green sea turtles forage in pastures of seagrasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms.

Although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Florida Bay, the increased freshwater flows associated with CEPP may alter seagrass species composition but should not have an adverse effect on the overall biomass available for sea turtle feeding habits. Additionally, no green sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined green sea turtle may be affected, but is not likely to be adversely affected, by the proposed project.

Hawksbill Sea Turtle and "May Affect" Determination

The hawksbill sea turtle is a small to medium-sized marine turtle weighing up to 15 kilograms in the United States. The hawksbill lives in tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. Areas that are known as important feeding areas for hawksbill turtles in Florida include the waters near the Florida Keys and on the reefs off Palm Beach County. Hawksbill turtles use different habitat types at different stages of their life cycle. Post hatchlings take shelter in weed lines that accumulate at convergence zones. Coral reefs are the foraging habitat of juveniles, sub-adults, and adults. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore where coral reefs are absent. Hawksbills feed predominantly on sponges and nest on low and high energy beaches, frequently sharing

the high-energy beaches with green sea turtles. Nests are typically placed under vegetation.

Although hawksbill sea turtles are expected to be found foraging near hardbottom habitats within Florida Bay, the increased freshwater flows associated with CEPP may reduce nearshore salinity concentrations but should not have an adverse effect on sponges or other food sources utilized by this species. Additionally, no hawksbill sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined hawksbill sea turtle may be affected, but is not likely to be adversely affected, by the proposed project.

Leatherback Sea Turtle and "May Affect" Determination

The leatherback sea turtle is the largest living turtle and weighs up to 700 kilograms. The leatherback lives in tropical and sub-tropical waters. Habitat requirements for juvenile and post-hatchling leatherbacks are virtually unknown. Nesting females prefer high-energy beaches with deep unobstructed access. Leatherbacks feed primarily on jellyfish.

Although leatherback turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with the CEPP may reduce nearshore salinity concentrations but should not have an adverse effect on jellyfishes or other food sources utilized by this species. Additionally, no leatherback sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined leatherback sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Kemp's Ridley Sea Turtle and "May Affect" Determination

The Kemp's ridley sea turtle is the smallest of all sea turtles and weighs up to 45 kilograms. This species is a shallow water benthic feeder consuming mainly algae and crabs. Juveniles grow rapidly. Juveniles and sub-adults have been found along the eastern seaboard of the United States and in the Gulf of Mexico. However, the major nesting beach for the Kemp's ridley sea turtle is on the northeastern coast of Mexico. This species occurs mainly in coastal areas of the Gulf of Mexico and in the northwestern Atlantic Ocean. The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths.

Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Florida Bay, this species is not expected to be found within the direct area of influence associated with CEPP. Additionally, no Kemp's ridley sea turtles would attempt to utilize areas for nesting purposes since their main nesting location is on a single stretch of beach on the Gulf Coast of Mexico. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined Kemp's ridley sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Loggerhead Sea Turtle and "May Affect" Determination

Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Females select high energy beaches on barrier strands adjacent to continental land masses for nesting. Steeply sloped beaches with gradually sloped offshore approaches are favored. After leaving the beach, hatchlings swim directly offshore and eventually are found along drift lines. They migrate to the near-shore and estuarine waters along the continental margins and utilize those areas as the developmental habitat for the sub-adult stage. Loggerheads are predators of benthic invertebrates.

Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with CEPP may reduce nearshore salinity concentrations but should not have an adverse effect on crustaceans, mollusks or other invertebrate food sources utilized by this species. Additionally, no loggerhead sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined loggerhead sea turtle may be affected, but would not likely be adversely affected, by the proposed project.

Smalltooth Sawfish and "May Affect" Determination

Smalltooth sawfish (*Pristia pectinata*) have been reported in the Pacific and Atlantic Oceans, and the Gulf of Mexico; however, the United States population is found only in the Atlantic Ocean and Gulf of Mexico. Historically, the United States population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras. The current range of this species includes peninsular Florida, with some regularity only in south Florida from Charlotte Harbor to Florida Bay. Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to

development of the coastal areas of Florida and other southeastern states. The loss of juvenile habitat likely contributed to the decline of this species.

Although the main Florida population resides in the Caloosahatchee River and adjacent Charlotte Harbor estuaries, smalltooth sawfish have the potential to be found in the southern estuaries where the juveniles could potentially occur and feed in red mangrove wetlands. By implementation of the proposed project, the smalltooth sawfish may benefit from increased freshwater flows into the coastal wetlands adjoining Florida Bay, which would provide more natural and historic overland flows.

Discharging large volumes of freshwater from Lake Okeechobee to the Caloosahatchee River during the wet season significantly reduces salinities and increases nutrient loading; all of which has a profound adverse effect on estuarine flora and fauna. As a result, the smalltooth sawfish may benefit from the project's ability to reduce excessive freshwater flows by improving the salinity regime throughout the Caloosahatchee estuary. With the expectation of improved wetland habitat, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the Corps has determined the proposed project may affect, but is not likely to adversely affect, smalltooth sawfish.

Smalltooth Sawfish Critical Habitat

Critical habitat includes two areas (units) located along the southwest coast of peninsular Florida. The northern unit is the Charlotte Harbor Estuary Unit and the southern unit is the Ten Thousand Islands/Everglades (TTI/E) Unit (**Figures 6.3-6.4**). The units encompass portions of Charlotte, Lee, Collier, Monroe, and Miami-Dade Counties. By reducing the number and severity of freshwater pulses to the Caloosahatchee River and estuary, CEPP has the potential of having a beneficial effect to the Caloosahatchee's portion of designated sawfish critical habitat. Since a more natural freshwater flow regime will be established through project restoration efforts, the Corps has determined that CEPP will have no adverse effect on critical habitat for the smalltooth sawfish.

7.2.8.10 CONCLUSION (CEPP)

The Corps, Jacksonville District, acknowledges the potential existence of fifteen federally listed threatened and endangered species under NMFS purview within the boundaries of the CEPP study area. Based on available information, it is evident that green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*) and smalltooth sawfish (*Pristia pectinata*), resides, travels, and/or forages within the study area. Although project related impacts through restoration efforts will ultimately benefit estuarine and nearshore communities and associated biota, these species could be affected by the implementation of CEPP.

Other federally threatened or endangered species that are known to exist or potentially exist in the CEPP project area, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Johnson's seagrass (*Halophila johnsonii*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), elkhorn (*Acropora palmata*), and staghorn (*Acropora cervicornis*) stony corals.

8.0 CONSERVATION MEASURES (CERP)

The Corps acknowledges the potential usage and occurrence of the previously discussed threatened and endangered species and/or critical habitat within the CERP study area. In recognition of this, disturbance to listed species will be minimized or avoided by implementing the Sea Turtle and Smalltooth Sawfish Construction Conditions dated March 23, 2006.

9.0 CONCLUSION (CERP)

The Corps, Jacksonville District, acknowledges the probable existence of fifteen federally listed threatened and endangered species under NMFS purview within the boundaries of the CERP study area. Based on available information, it is evident that smalltooth sawfish (*Pristia pectinata*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and loggerhead sea turtle (*Caretta caretta*) resides, travels, and/or forages within the study area and could be affected by CERP implementation.

Other federally threatened or endangered species that are known to exist or potentially exist in the CERP project area, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Johnson's seagrass (*Halophila johnsonii*), the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), and the elkhorn (*Acropora palmata*), and staghorn (*Acropora cervicornis*) stony corals.

The Corps recognizes that until completion of the CERP there are few opportunities within the current constraints of the C&SF system to completely avoid effects to listed species. However, the purpose of CERP is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades and downstream estuaries. The Corps will continue discussions with U. S. Fish and Wildlife Service (FWS), NMFS and Fish and Wildlife Conservation Commission (FWC) in the event of CERP project modifications.

This document is being submitted for formal consultation with the NMFS pursuant to Section 7 of the Endangered Species Act.

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APPENDIX 1: STANDARD PROTECTION MEASURES

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

A.5.2 Central Everglades Planning Project Biological Assessment submitted to the US Fish and Wildlife Service

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

05 AUG 2013

Mr. Larry Williams, Field Supervisor
South Florida Ecological Services Field Office
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960-3559

Dear Mr. Williams,

In accordance with provisions of Section 7 of the Endangered Species Act, as amended, the U.S. Army Corps of Engineers (Corps) is hereby initiating consultation with the U.S. Fish and Wildlife Service (FWS) on the Central Everglades Planning Project (CEPP). The purpose of CEPP is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades including Water Conservation Area 3 (WCA 3) and Everglades National Park (ENP). CEPP includes project components identified in the 1999 Comprehensive Everglades Restoration Plan (CERP), approved by Congress as a framework for restoration of the south Florida ecosystem in Section 601 of the Water Resources Development Act of 2000.

The CEPP study was initiated in November 2011. Staff from your office have participated in the development and evaluation of alternative plans throughout the study. To facilitate progress, Mr. Kevin Palmer of your office provided a list of species on May 10, 2013 that occur or have the potential to occur within the CEPP study area. The Service advises that federally threatened, endangered, and candidate species that may occur within the study area include: Florida panther (*Puma concolor coryi*), Florida population of West Indian Manatee (Florida manatee) (*Trichechus manatus*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Everglade snail kite (*Rostrhamus sociablis plumbeus*), Northern crested caracara (*Caracara cheriway*), piping plover (*Charadrius melodus*), red-cockaded woodpecker (*Picoides borealis*), roseate tern (*Sterna dougallii dougallii*), wood stork (*Mycteria americana*), American alligator (*Alligator mississippiensis*), Florida bonneted bat (*Eumops floridanus*), American crocodile (*Crocodylus acutus*), Eastern indigo snake (*Drymarchon corais couperi*), Miami black-headed snake (*Tantilla oolitica*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), Florida leafwing butterfly (*Anaea troglodyta floridalis*), Bartram's hairstreak butterfly (*Strymon acis bartrami),* Stock Island tree snail (*Orthalicus reses* [not incl. *nesodryas*]), crenulate lead-plant (*Amorpha crenulata*), Cape Sable thoroughwort (*Chromolaena frustrata*) deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), Garber's spurge (*Chamaesyce garberii*), Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeenis*), Small's milkpea (*Galactia smallii*), and tiny polygala (*Polygala smallii*).

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the Endangered Species Act but continues to be protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. In addition, the study area contains designated critical habitat for the American crocodile, Everglade snail kite, Cape Sable seaside sparrow, and Florida manatee.

Based upon the best available scientific analysis and information along with biological information obtained from scientific publications and discussions with species researchers, the Corps has determined the following effects associated with implementation of CEPP:

- The plan will result in no effect on Florida bonneted bat, Northern crested caracara, piping plover, red-cockaded woodpecker, roseate tern, Miami black-headed snake, Bartram's hairstreak butterfly, Florida leafwing butterfly, Schaus swallowtail butterfly, Stock Island tree snail, Miami blue butterfly, Cape Sable thoroughwort, crenulate lead-plant, Okeechobee gourd, deltoid spurge, Garber's spurge, Small's milkpea, and tiny polygala.
- The plan may affect, but is not likely to adversely affect Florida manatee and its critical habitat and American crocodile and its critical habitat.

The Corps requests formal consultation on the Cape Sable seaside sparrow and its critical habitat, Everglade snail kite and its critical habitat, wood stork, Florida panther, and Eastern indigo snake. Due to the necessity of having completed consultation prior to release of the Final Environmental Impact Statement and submitting a recommendation to the Assistant Secretary of the Army for Civil Works, the Corps respectfully requests a Biological Opinion within the 135-day timeframe after receipt of the enclosed Biological Assessment.

The Corps is also coordinating with National Marine Fisheries Service (NMFS) pertaining to potential effects on listed species under their purview by letter and programmatic Biological Assessment. The NMFS is expected to provide concurrence with the Corps' findings of effects on listed species that may be encountered or adjacent to the study area.

Your concurrence on the above determinations is requested. We sincerely appreciate the effort that you and your staff have put into this tremendously important restoration project. We look forward to our continued partnership as we move forward with Everglades restoration through the implementation of CEPP. If you have any questions or need additional information, please contact Stacie Auvenshine at stacie.j.auvenshine@usace.army.mil or 904-232-3694.

Sincerely,

Mark Ralph for

Eric P. Summa
Chief, Environmental Branch

Enclosures

ENDANGERED SPECIES ACT BIOLOGICAL ASSESSMENT

Central Everglades Planning Project

Prepared by
Department of the Army
U.S. Corps of Engineers, Jacksonville District

August 2013

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LIST OF APPENDICES

Appendix A – FWS Planning Aid Letters
Appendix B – Existing Conditions and Future Without Project Assumptions

LIST OF ACRONYMS

A
B
BA Biological Assessment
BCNP Big Cypress National Preserve
BO Biological Opinion

C
C-111 Canal-111
C-111 SC C-111 Spreader Canal
C-x Canal
C&SF Central & south Florida Project
CEPP Central Everglades Planning Project
CEM Conceptual Ecological Models
CERP Comprehensive Everglades Restoration Plan
CFA Core Foraging Area
CFR Code of Federal Regulation
cfs Cubic Feet per Second
COP Combined Operational Plan
Corps U.S. Army Corps of Engineers (see also the Corps)
CM Centimeters
CSSS Cape Sable seaside sparrow (or sparrow)

D
E
EAA Everglades Agricultural Area
ECB Existing Conditions Baseline 2012
EIS Environmental Impact Statement
ENP Everglades National Park
EPA Environmental Protection Agency
ERTP Everglades Restoration Transition Plan
ESA Endangered Species Act
ET Ecological Target

F
FEB Flow Equalization Basin
FWC Florida Fish and Wildlife Conservation Commission
FWS U.S. Fish and Wildlife Service
FEIS Final Environmental Impact Statement
FWCA Fish and Wildlife Coordination Act
FWO Future Without Project Condition
FWS U.S. Fish and Wildlife Service (see also USFWS)

G
G-x Gauging Station or Culvert Structure
H
HSI Habitat Suitability Index
I
IAR Incremental Adaptive Restoration
IOP Interim Operational Plan
ISOP Interim Structural and Operational Plan

J
K
KCOL Kissimmee Chain of Lakes

L
L-x Levee
LEC Lower East Coast

M
MSTS Multi-Species Transition Strategy
MWD Modified Water Deliveries (to ENP)

N
NESRS Northeast Shark River Slough
NGVD National Geodetic Vertical Datum
NMFS National Marine Fisheries Service
NRC National Research Council

O
P
PAL Planning Aid Letter
PDT Project Delivery Team
PL Public Law
PM Performance Measure
ppt parts per thousand
psu practical salinity units

Q
R
RECOVER Restoration, Coordination, and Verification
RPA Reasonable and Prudent Alternative

S
S-x Pump Station, Spillway or Culvert
SAV Submerged Aquatic Vegetation
SDCS South Dade Conveyance System (ENP)

SFWMD South Florida Water Management District
SRS Shark River Slough
STA Stormwater Treatment Area

T
TSP Tentatively Selected Plan
U
Corps U.S. Army Corps of Engineers (see also Corps)
USFWS U.S. Fish and Wildlife Service (see also FWS)
USGS U.S. Geological Survey

V
W
WCA Water Conservation Area
WCA-3 AVG Water Conservation Area 3 Gauge Average
WQ Water Quality
WRDA Water Resources Development Act
WSRS Western Shark River Slough

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1.0 INTRODUCTION

The purpose of a Biological Assessment (BA) is to evaluate the potential effects of a Federal action on both listed species and those proposed for listing, including designated and proposed critical habitat, and determine whether the continued existence of any such species or habitat are likely to be adversely affected by the Federal action. The BA is also used in determining whether formal consultation or a conference is necessary [50 CFR Section 402.12(a)]. This is achieved by:

- Reviewing the results of an on-site inspection of the area affected by the Federal action to determine if listed or proposed species are present or occurs seasonally.
- Reviewing the views of recognized experts on the species at issue and relevant literature.
- Analyzing the effects of the Federal action on species and habitat including consideration of cumulative effects, and the results of any related studies.
- Analyzing alternative actions considered by the Federal agency for the proposed project (50 CFR Section 402.12(f)).

2.0 CONSULTATION SUMMARY FOR CEPP

Beginning in November of 2011 and throughout the Central Everglades planning process, employees of the United States Fish and Wildlife Service (FWS) have attended CEPP Project Delivery Team (PDT) and core planning team meetings, as well as South Florida Ecosystem Task Force Working Group sponsored workshops. The FWS has provided substantive comments informally at meetings and through e-mails. Formal comments have been submitted in Planning Aid Letters (PALs) in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA), 16 U.S.C. 661 *et seq.*, and section 7 of the Endangered Species Act (ESA) of 1973, as amended (Act), 16 U.S.C. 1531 *et seq*. Provided below is a brief consultation summary of the PALs received to date. The FWS PALs are located within Appendix A.

- January 20, 2012: The FWS provided comments on the project goals and objectives, management actions that should be considered (i.e., project components), as well as ecological performance measures.
- March 27, 2012: The FWS provided comments on the planning process including, but not limited to management measure screening, alternative formulation, modeling strategy, and natural resource considerations.
- December 12, 2012: The FWS provided comments on the conceptual design and modeling of the final array of alternatives.
- May 10, 2013: The FWS provided a list of potentially occurring listed species within the project area.

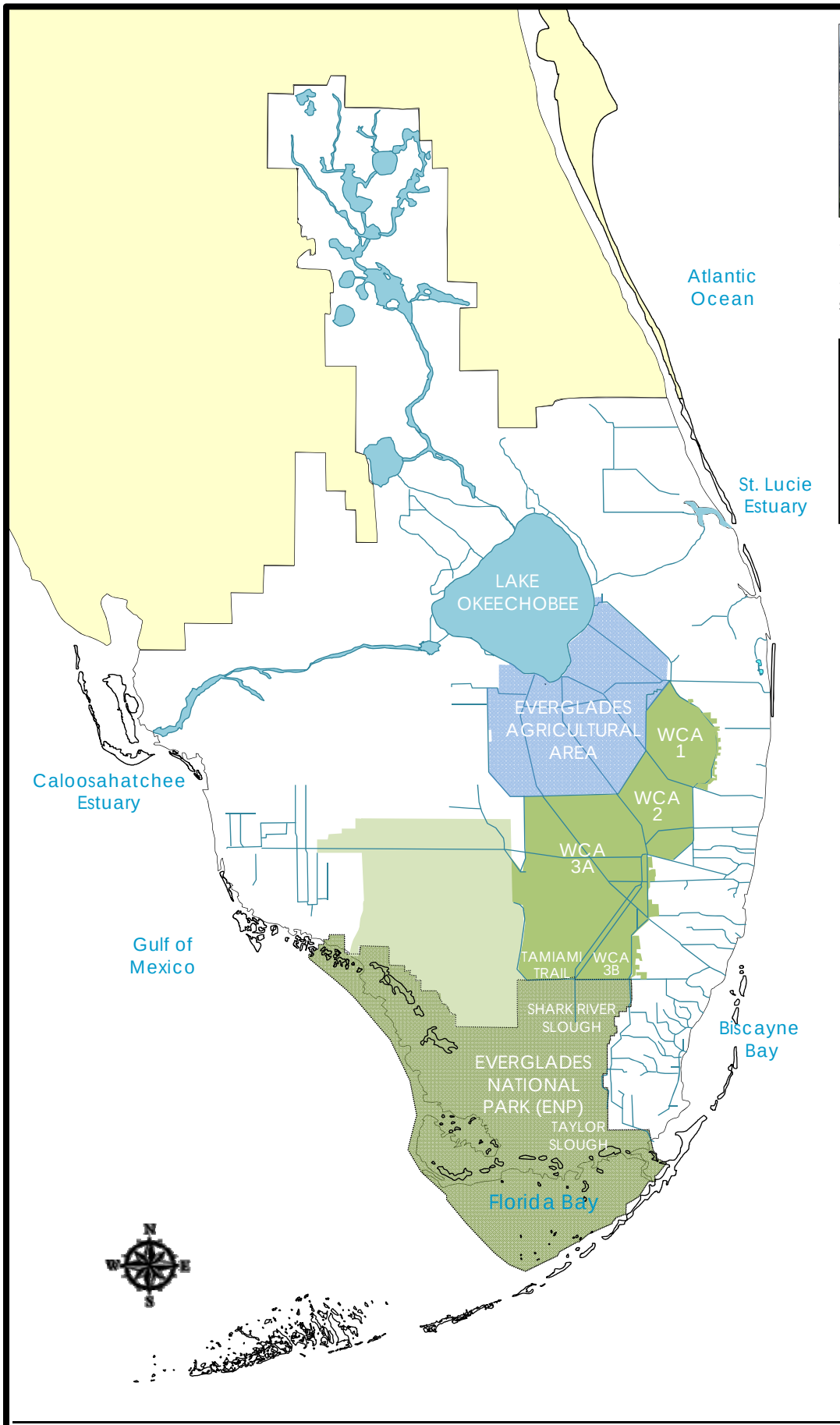
In addition, the US Army Corps of Engineers (Corps) has consulted with FWS by letter dated January 23, 2013 on federally listed threatened and endangered species that may be present in the action study area. In an email dated February 19, 2013, FWS provided concurrence with the Corps' finding of listed species that may be encountered within or adjacent to the action area. Federally threatened and endangered species that may occur within the action area include Florida panther (*Puma concolor coryi*), Florida population of West Indian Manatee (Florida manatee) (*Trichechus manatus*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Everglade snail kite (*Rostrhamus sociablis plumbeus*), Northern crested caracara (*Caracara cheriway*), piping plover (*Charadrius melodus*), red-cockaded woodpecker (*Picoides borealis*), roseate tern (*Sterna dougallii dougallii*), wood stork (*Mycteria americana*), American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), Eastern indigo snake (*Drymarchon corais couperi*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), Stock Island tree snail (*Orthalicus reses* [not incl. *nesodryas*]), crenulate lead-plant (*Amorpha crenulata*), deltoid spurge (*Chamaesyce*

deltoidea ssp. *deltoidea*), Garber's spurge (*Chamaesyce garberii*), Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeenis*), Small's milkpea (*Galactia smallii*), and tiny polygala (*Polygala smallii*). The bald eagle (*Haliaeetus leucocephalus*) has been delisted under the ESA but continues to be protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. In addition, the study area contains designated critical habitat for the American crocodile, Everglade snail kite, Cape Sable seaside sparrow, and Florida manatee.

The Corps is coordinating with National Marine Fisheries Service (NMFS) pertaining to potential effects on listed species under their purview by letter and programmatic BA. NMFS will provide a letter to the Corps based on their concurrence with the Corps' finding of listed species that may be encountered or adjacent to the study area. Federally listed species under the purview of NMFS include the blue whale (*Balaenoptera* musculus), finback whale (*Balaenoptera* physalus), humback whale (*Megaptera* novaeangliae), sei whale (*Balaenoptera* borealis), sperm whale (*Physeter* macrocephalus), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), and Johnson's seagrass (*Halophila johnsonii*). In addition, the study area contains designated critical habitat for the smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson's seagrass.

3.0 STUDY AREA

The study area for CEPP encompasses the Northern Estuaries (St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary), Lake Okeechobee, a portion of the Everglades Agricultural Area (EAA), the Water Conservation Areas (WCA), Everglades National Park (ENP), the Southern Estuaries (Florida Bay and Biscayne Bay), and the Lower East Coast (LEC) (**Figure 3-1**).



NORTHERN ESTUARIES: Too much water from Lake Okeechobee during the wet season, and too little water during the dry season impacts salinity levels, stressing estuarine ecosystems

WCA 3: Too dry in WCA 3B and Northern WCA 3A; too wet (ponding) in Southern WCA 3A

WCAs: Disrupted hydrologic conditions lead to topographic changes, with a decline in the ridge and slough system and tree islands

TAMIAMI TRAIL: Barriers reduce southerly flows into Everglades National Park resulting in ponding in southern WCA 3A and drier conditions in ENP

FLORIDA BAY: Lack of adequate freshwater flows reaching the Southern Coastal System results in higher salinity levels in southern estuaries

CENTRAL EVERGLADES PLANNING PROJECT (CEPP) STUDY AREA

Figure 3-1. CEPP Study Area

4.0 CEPP PROJECT DESCRIPTION

The purpose of the Central Everglades Planning Project (CEPP) is to improve the quantity, quality, timing, and distribution of water flows to the central Everglades (Water Conservation Area 3 [WCA 3] and ENP). The CEPP will be composed of project components that were identified in the Comprehensive Everglades Restoration Plan (CERP). This study approach is consistent with the recommendations from the National Resource Council (NRC) to utilize Incremental Adaptive Restoration (IAR) to both achieve timely, meaningful benefits of CERP and to lessen the continuing decline of the Everglades ecosystem.

Prior planning efforts and the development of scientific goals and targets for CERP have led to a determination that some components are interdependent features that necessitate formulation from a systems approach. Recently authorized CERP projects are "perimeter" projects that generally do not greatly depend upon or influence other CERP projects. However, the components in the central part of the Everglades (interior CERP projects) are hydraulically connected from Lake Okeechobee to Florida Bay, and are reliant on one another for both inflows and outflows. These interdependencies required system plan formulation and analysis in order to optimize structural and operational components, rather than formulating separable components that may not be compatible when looking at the cumulative effects.

The tentatively selected plan (TSP) will benefit the St. Lucie and Caloosahatchee Estuaries by decreasing the number and severity of high-volume regulatory flood control releases sent from Lake Okeechobee. This will be accomplished by redirecting approximately 210,000 acre feet of additional water to the historical southerly flow path south through flow equalization basins (FEBs) and existing stormwater treatment areas (STAs). The STAs reduce phosphorus concentrations in the water to meet required water quality standards. Rerouting this treated water south and redistributing it across the degraded L-4 Levee will facilitate hydropattern restoration in WCA 3A. This, in combination with Miami Canal backfilling and other CEPP components, is paramount to re-establishing a 500,000-acre flowing system through the northern most extent of the remnant Everglades. The treated water will be distributed through WCA 3A to WCA 3B and ENP via new gated control structures and creation of the Blue Shanty Flowway. The Blue Shanty Flowway will restore continuous sheet-flow and re-connection of a portion of WCA 3B to ENP (**Figure 4-1**).

CENTRAL EVERGLADES PLANNING PROJECT (CEPP) TENTATIVELY SELECTED PLAN – ALTERNATIVE 4R2

STORAGE AND TREATMENT

- Construct A-2 FEB and integrate with A-1 FEB operations
- Lake Okeechobee operation refinements within LORS

DISTRIBUTION/CONVEYANCE

- Diversion of L-6 flows, Infrastructure and L-5 canal improvements
- Remove western ~2.9 miles of L-4 levee (west of S-8 3,000 cfs capacity)
- 360 cfs pump station at western terminus of L-4 levee removal
- Backfill Miami Canal and Spoil Mound Removal ~1.5 miles south of S-8 to I-75

DISTRIBUTION/CONVEYANCE

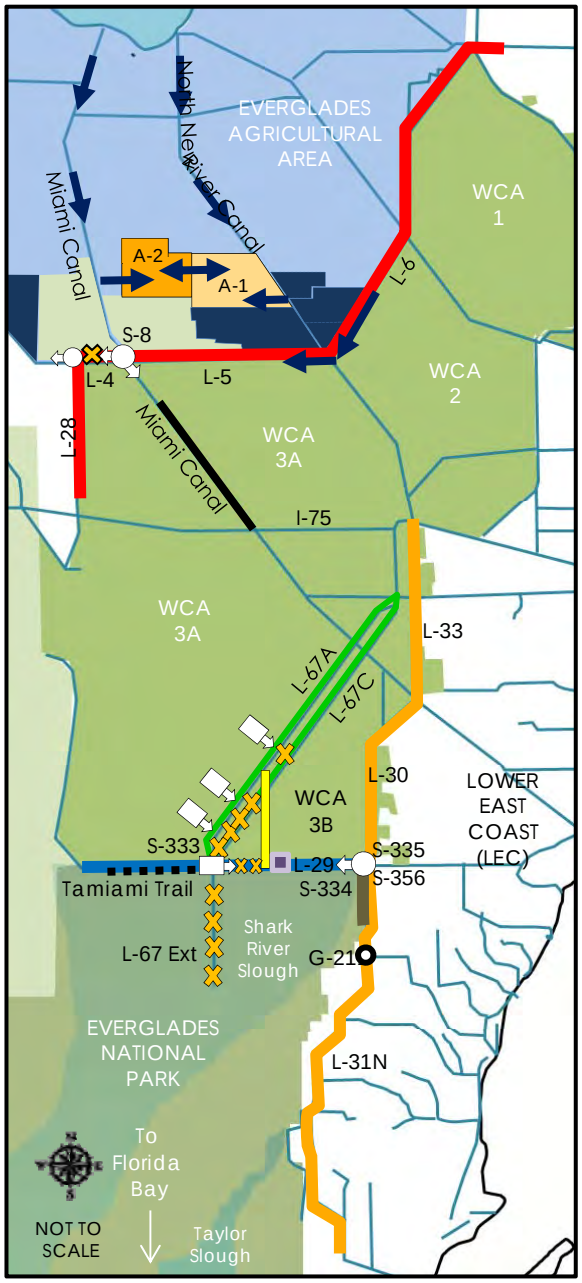
- Increase S-333 capacity to 2,500 cfs
- Two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structures
- Construct ~8.5 mile levee in WCA 3B, connecting L-67A to L-29
- Remove ~8 miles of L-67C levee in Blue Shanty flowway (no canal back fill)
- One 500 cfs gated structure north of Blue Shanty levee and 6,000-ft gap in L-67C levee
- Remove ~4.3 miles of L-29 levee in Blue Shanty flowway, divide structure east of Blue Shanty levee at terminus of western bridge
- Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft (FUTURE WORK BY OTHERS)
- Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal
- Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Rd)

SEEPAGE MANAGEMENT

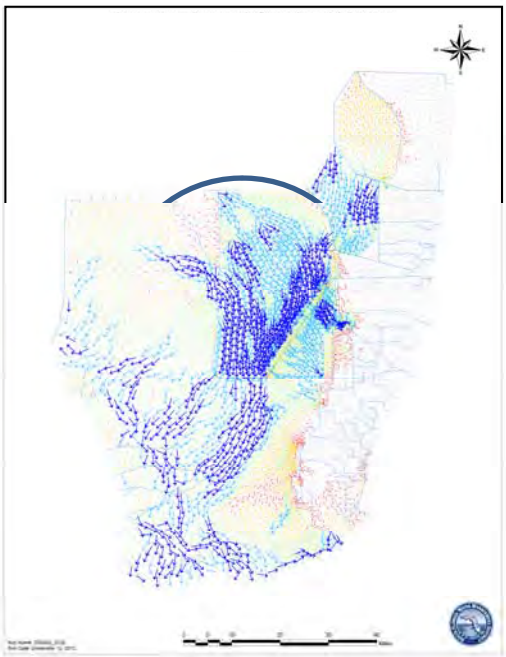
- Increase S-356 pump station to ~1,000 cfs
- Partial depth seepage barrier south of Tamiami Trail (along L-31N)
- G-211 operational refinements; use coastal canals to convey seepage

Note: System-wide operational changes and adaptive management considerations will be included in project.

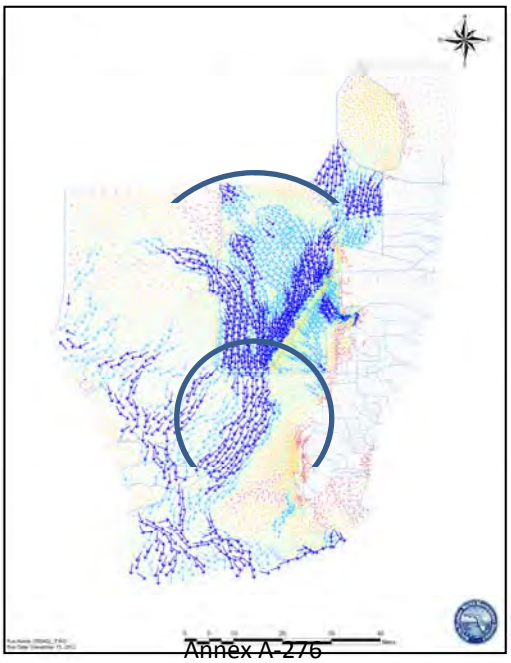
FEB | STA | Pump | Backfill | Levee Removal | Seepage Barrier | Gated Structure | Divide | Levee | Old Tamiami Trail Removal



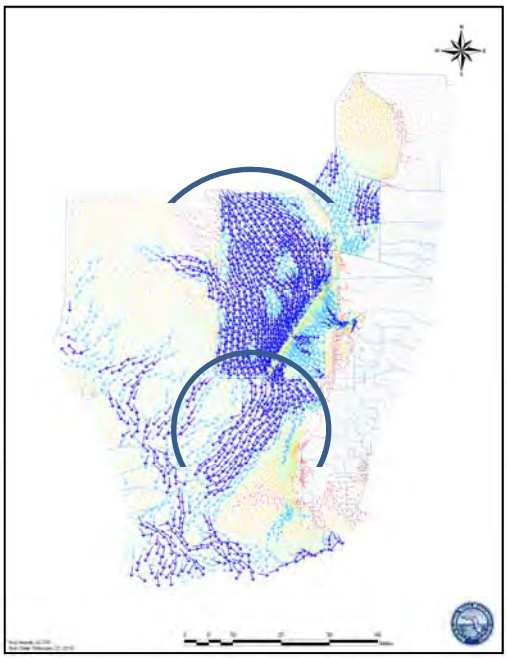
CENTRAL EVERGLADES PLANNING PROJECT EXISTING AND FUTURE FLOWS



EXISTING FLOW



FUTURE WITHOUT PROJECT FLOW



FUTURE WITH PROJECT FLOW

Figure 4-1. CEPP Project Components and Flows

4.1 Plan Features

The components of the TSP, Alternative 4R2 (Alt 4R2), are organized into four geographic areas: North of the Redline, South of the Redline, the Green/Blue lines and along the Yellowline.

4.1.1 Everglades Agricultural Area (EAA) (North of the Redline)

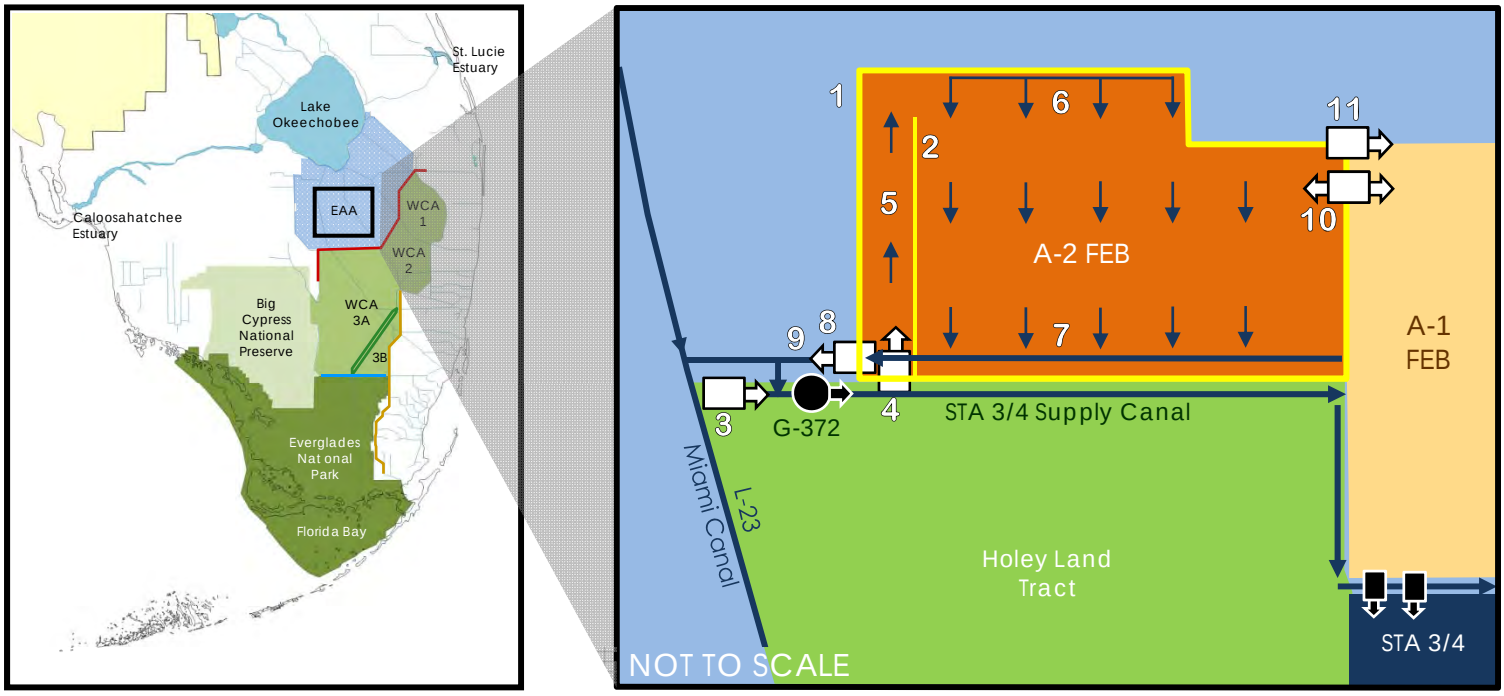
This includes construction and operations to divert, store and treat Lake Okeechobee regulatory releases **(Figure 4-2**).

Storage and treatment of new water will be possible with the construction of a 14,000 acre FEB and associated distribution features on the A-2 footprint that is operationally integrated with the state-funded and state-constructed A-1 FEB and existing STAs. The A-2 FEB will accept EAA runoff and a portion of the Lake Okeechobee water currently discharged to the estuaries. This Lake Okeechobee water is diverted to the FEB when FEB/STAs and canals have capacity. The C-44 reservoir also collects water that would go to the St. Lucie Estuary and returns some of this water back to Lake Okeechobee, from where it can be delivered to the FEB.

It is anticipated that changes to the 2008 LORS will be needed in order to achieve the complete ecological benefits envisioned through implementation of CEPP. Operational changes to the LORS were incorporated into the hydrologic modeling conducted for the CEPP alternatives, including Alternative 4R2, in efforts to optimize CEPP system-wide performance within the current Zones of the 2008 LORS. More specifically, the hydrologic modeling of the CEPP alternatives included proposed revisions to the 2008 LORS decision tree outcome maximum allowable discharges dependant on the following criteria: Lake Okeechobee inflow and climate forecasts (class limits were modified for tributary hydrologic conditions, seasonal climate outlook, and multi-seasonal climate outlook), stage level (regulation zone), and stage trends (receding or ascending). While some refinements were made within the operational flexibility available in the 2008 LORS, assumptions ultimately extended beyond this flexibility due to adjustments made to the tributary/climatological classifications. Additional information of these assumptions are found in the **Appendix B**. The CEPP PIR will not be the mechanism to propose or conduct the required NEPA evaluation or biological assessment of modifications to the Lake Okeechobee Regulation Schedule.

NORTH OF THE REDLINE

STORAGE AND TREATMENT EQUALIZATION BASIN (FEB) – A2



LEGEND: Pump | Gated Structure | Levee | Spreader Canal | Existing Structure

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	L-624	Levee		Perimeter Levee (~ 20 miles, 11.3 feet high, 14 feet wide, 3:1 side slope)
2	L-625	Levee		Interior levee (~ 4 miles, 11.3 feet high, 12 feet wide, 3:1 side slope)
3	S-623	Gated Spillway	3700	Delivers water from Miami Canal to existing G-372 pump station
4	S-624	Gated Sag Culvert (FEB inflow structure)	1550	Receives water from existing pump station G-372 via STA 3/4 Supply Canal and delivers it to C-624 FEB inflow canal
5	C-624	FEB Inflow Canal	1550	Conveys water from FEB inflow structure S-624 to FEB C-624 E spreader canal (length: ~ 4 miles)
6	C-624E	FEB Spreader Canal		Distributes FEB inflows across northern FEB; sheetflow within FEB is generally north to south (length: ~ 4 miles)
7	C-625E	FEB Collection Canal	400	Existing seepage canal for STA 3/4 Supply Canal, used to supplement FEB sheetflow during normal operating conditions
8	S-625	Gated Culverts (FEB discharge structure)	1550	Delivers water to FEB outflow canal (C-625W)
9	C-625W	FEB Outflow Canal	1550	FEB Outflow Canal is the extended seepage canal for the STA 3/4 Supply Canal; delivers water via existing G-372 pump station to STA 3/4 for water quality treatment
10	S-628	Gated Culvert (FEB intake/discharge structure)	930	Delivers water in both directions between A-2 FEB and A-1 FEB for operational flexibility
11	S-627	Emergency Overflow weir	445	Location to be determined
A-2 FEB design also includes an exterior seepage collection system (not illustrated):				
	C-626	Seepage Canal	400	~ 11 miles
	S-626	Seepage Pump Station	500	Delivers seepage back into the FEB outflow canal C-625W

Figure 4-2. TSP Treatment and Storage Features and Location

4.1.2 WCA 2A and Northern WCA 3A (South of the Redline)

This includes conveyance features to deliver and distribute existing flows and the redirected Lake Okeechobee water through WCA 3A (**Figure 4-3**).

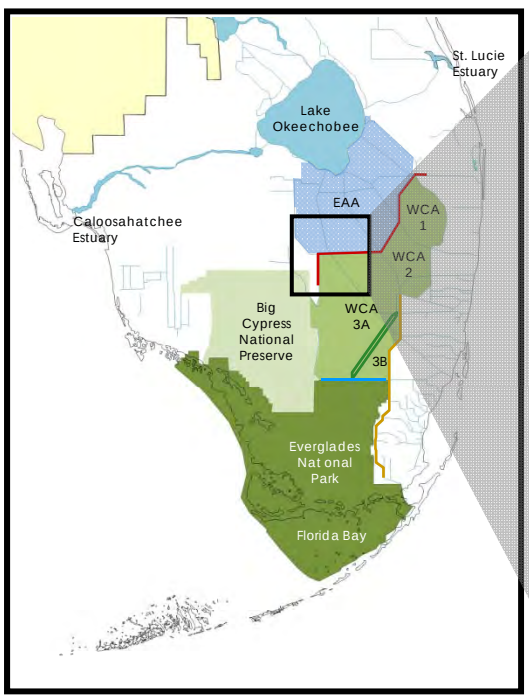
Backfilling 13.5 miles of the Miami Canal between I-75 and 1.5 miles south of the S-8 pump station, and converting the L-4 canal into a spreader canal by removing 2.9 miles of the southern L-4 levee are the key features needed to ensure spatial distribution and flow directionality of the water entering WCA 3A.

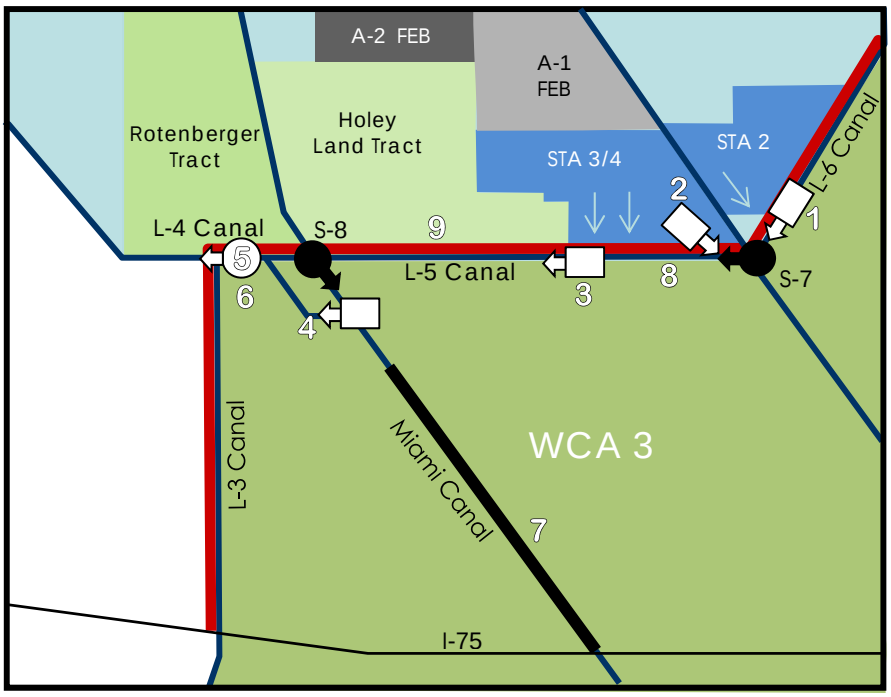
Conveyance features to move water into and through the northwest portion of WCA 3A include: a gated culvert to deliver water from the L-6 Canal to the remnant L-5 Canal, a new gated spillway to deliver water from the remnant L-5 canal to the western L-5 canal (during L-6 diversion operations); a new gated spillway to deliver water from STA 3/4 to the S-7 pump station during peak discharge events (eastern flow route is not typically used during normal operations), including L-6 diversion operations; a 360 cubic feet per second (cfs) pump station to maintain Seminole Tribe water supply deliveries west of the L-4 Canal; and new gated culverts to deliver water from the Miami Canal (downstream of S-8, which pulls water from the L-5 Canal) to the L-4 Canal.

The Miami Canal will be backfilled to approximately 1.5 feet below the peat surface of the adjacent marsh. Spoil mounds on the east and west side of the Miami Canal from S-8 to I-75 will be used as a source for Miami Canal backfill material. Refuge for fur-bearing animals and other upland species will continue to be provided by the retention of 22 of the highest priority Florida Fish and Wildlife Conservation Commission (FWC) enhanced spoil mounds between S-339 to I-75 and the creation of additional upland landscape (constructed tree islands) approximately every mile along the entire reach of the backfilled Miami canal section (S-8 to I-75) where historic ridges or tree islands once existed. The constructed tree islands will block flow down the backfilled canal due to the tree island having a profile across the landscape that varies, or undulates, in elevation. Miami Canal constructed tree island design details will be determined during CEPP preconstruction, engineering and design (PED) phase. Tree island design, construction/planting will be coordinated with appropriate science team members with expertise in these topics to accomplish the restoration vision and intent of CEPP's canal backfilling and tree island construction. A diverse array of species will be planted, including trees, shrubs, and herbaceous species that are appropriate for these tree islands.

SOUTH OF THE REDLINE

DISTRIBUTION AND CONVEYANCE





LEGEND: Pump | Gated Structure | Levee Removal | Existing Structure

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	S-620	Gated Culvert	500	Delivers water from L-6 Canal to L-5 Canal
2	S-621	Gated Spillway	2500	Closed to direct STA 3/4 discharges to western L-5 Canal during normal operations; controls water from STA 3 /4 to the existing S-7 pump station during peak events
3	S-622	Gated Spillway	500	Delivers water from east to west in L-5 Canal (replaces existing L-5 canal plug)
4	S-8A	Gated Culverts with Canal	3080 & 1020	Existing S-8 pump station delivers water from L-5 Canal to Miami Canal; S-8A delivers water from Miami Canal to L-4 Canal (3120 cfs) and remaining Miami Canal segment (1040 cfs); potential design modifications to the existing S-8/G-404 complex will be assessed during PED
5	S-630	Pump Station	360	Delivers water from L-4 Canal west to maintain existing water supply deliveries
6		L-4 Levee Removal		Removes ~2.9 miles of south L-4 Levee
7		Miami Canal Backfill with Tree Islands Mounds		Remove ~ 13.5 miles of Miami Canal , from 1.5 miles south of S-8 to I-75; tree island mounds create habitat and promote sheetflow in WCA-3A within the footprint of the former Miami Canal
8		L-5 Remnant Canal	500	Enlarging canal to expand capacity of L-5 Canal (between S-621 & S-622)
9		L-5 Canal	3000	Enlarging canal to expand capacity of L-5 Canal (between S-622 & S-8)

Figure 4-3. TSP Northern Conveyance and Distribution Features and Location

4.1.3 Southern WCA 3A, WCA 3B, and ENP (Green/Blue Lines)

This includes conveyance features to deliver and distribute water from WCA3A to WCA 3B and ENP (**Figure 4-4**).

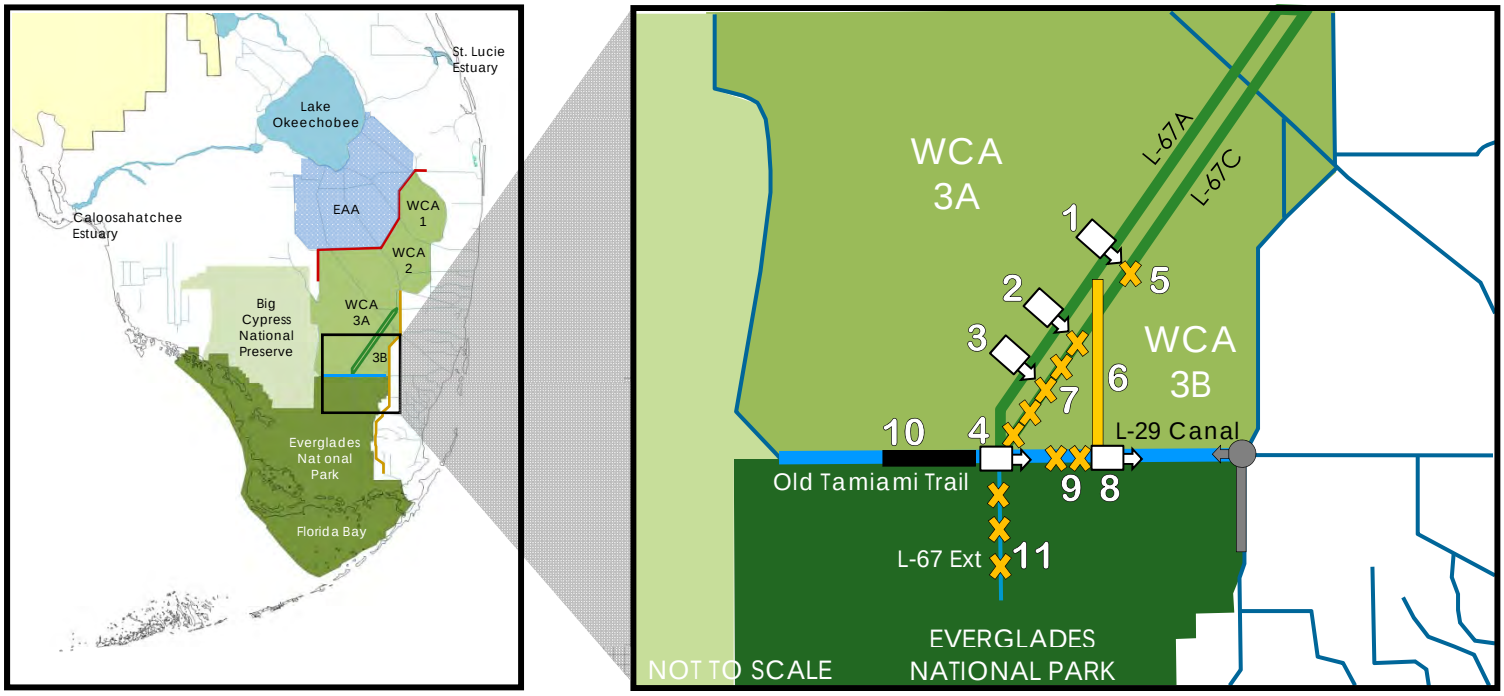
A new Blue Shanty levee extending from Tamiami Trail northward to the L-67A levee will be constructed. This Blue Shanty levee will divide WCA 3B into two subunits, a large eastern unit (3B-E) and a smaller western unit, the Blue Shanty Flowway (3B-W). A new levee is the most efficient means to restore continuous southerly sheetflow through a practicable section of WCA 3B and alleviates concerns over effects on tree islands by maintaining lower water depths and stages in WCA 3B-E. The width of the 3B-W flowway is aligned to the width of the downstream 2.6-Mile Tamiami Trail Next Steps bridge, optimizing the effectiveness of both the flowway and bridge.

In the western unit, construction of two new gated control structures on the L-67A, removal of the L-67C and L-29 Levees within the flowway, and construction of a divide structure in the L-29 Canal will enable continuous sheetflow of water to be delivered from WCA 3A through WCA 3B to ENP. A gated control structure will also be added to the L-67A, outside the flowway, to improve the hydroperiod of the eastern unit of WCA 3B.

Increased outlet capability at the S-333 structure at the terminus of the L-67A canal, removal of approximately 5.5 miles of the L-67 Extension Levee, and removal of approximately 6 miles of Old Tamiami Trail between the ENP Tram Road and the L-67 Extension Levee will facilitate additional deliveries of water from WCA 3A directly to ENP. Detailed design and construction of these features will consider improving recreation access and minimize project footprints due to the nature of these environmentally sensitive areas. Establishment of expanded maintenance easements along the old Tamiami Trail for existing and new infrastructure, to facilitate road modifications, maintenance and water delivery is recommended.

BLUE AND GREEN LINES

DISTRIBUTION AND CONVEYANCE



LEGEND: Pump | Gated Structure | Levee | Levee Removal | Road Removal | Yellow Line Features

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	S-631	Gated Culvert	500	Delivers water from WCA 3A to 3B, east of L-67D Levee
2	S-632	Gated Culvert	500	Delivers water from WCA 3A to 3B, west of L-67D Levee
3	S-633	Gated Culvert	500	Delivers water from WCA 3A to 3B, west of L-67D Levee
4	S-333 (N)	Gated Spillway w/new canal	1150	Delivers water from L-67A Canal to L-29 Canal; supplements existing S-333 gated spillway
5		L-67C Levee Removal Gap		Gap, ~ 6000 feet (corresponding to S-631)
6	L-67D	Blue Shanty Levee		Levee, ~ 8.5 miles, connecting from L-67A to L-29 (6 feet high, 14-foot crest width, 3:1 side slopes)
7		L-67C Levee Removal		Complete removal of ~ 8 miles from New Blue Shanty Levee (L-67D)south to intersection of L-67A/L-67C; L-67C canal is not backfilled
8	S-355W	Gated Spillway	1230	Maintains water deliveries to eastern L-29 Canal
9		Levee Removal (L-29)		Removal of ~ 4.3 miles between L-67A and Blue Shanty Levee intersection with L-29 Levee
10		Removal of remnants of Old Tamiami Trail roadway		Removal of ~ 6 miles of roadway west of L-67 Extension
11		L-67 Extension Levee Removal and Canal Backfill)		Complete removal of ~ 5.5 miles of remaining L-67 Extension, including S-346 culvert

Figure 4-4. TSP Southern Distribution and Conveyance Features and Location

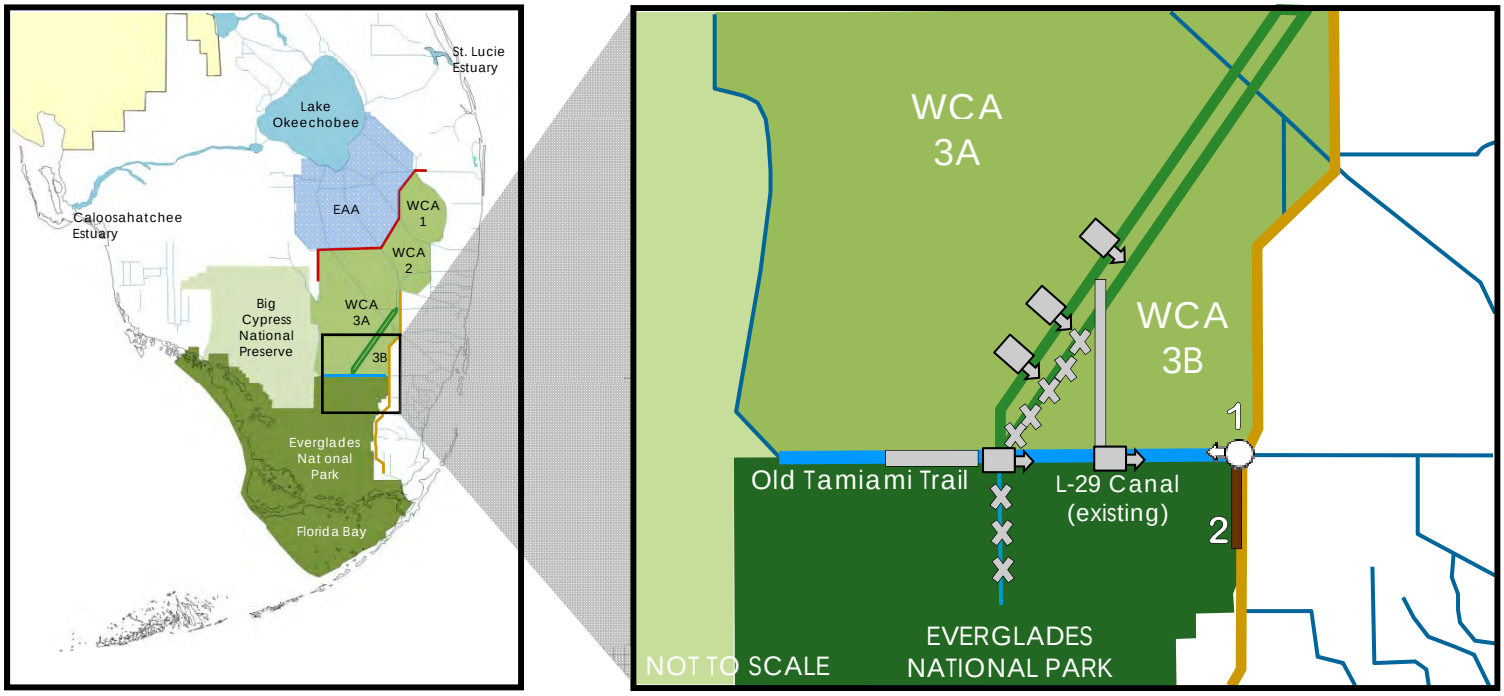
4.1.4 Lower East Coast Protective Levee (Yellowline)

The LEC protective levee Includes features primarily for seepage management, which are required to mitigate for increased seepage resulting from the additional flows into WCA 3B and ENP (**Figure 4-5**).

A newly constructed pump station with a combined capacity of 1,000 cfs will replace the existing temporary S-356 pump station, and a 4.2 mile seepage barrier cutoff wall will be built along the L-31N Levee south of Tamiami Trail.

There is an existing 2-mile seepage cut-off wall in the same vicinity that was constructed by a permittee as mitigation. There is a possibility that the same permittee may construct an additional 5 miles of seepage wall south of the 2-mile seepage wall, if permitted. Since the capability and effectiveness of the existing seepage wall to mitigate seepage losses from ENP remains under investigation, the CEPP TSP conservatively includes an approximately 4.2 mile long, 35 feet deep tapering seepage barrier cutoff wall in the event construction is necessary.

SEEPAGE MANAGEMENT



LEGEND: Pump | Gated Structure | Seepage Wall | Green Line/Blue Line Features

#	STRUCTURE	STRUCTURE/FEATURE TYPE	CFS	TECHNICAL NOTES
1	S-356	Pump Station	1000	Provides seepage management for WCA 3B and NESRS stages
2		Seepage Barrier Cutoff Wall		Soil cement bentonite (SCB) wall (~4.2 miles, 3 feet wide, 35 feet deep)

Figure 4-5. TSP Seepage Management Features and Location

4.2 PROJECT AUTHORITY

The 2000 Water Resources Development Act (WRDA) provided authority for future projects in Section 601(d)(1)(A) under the CERP project. Specific authorization for CEPP will be sought under Section 601(d) as a future CERP project:

(d) AUTHORIZATION OF FUTURE PROJECTS.—

(1) IN GENERAL.—Except for a project authorized by subsection (b) or (c), any project included in the Plan shall require a specific authorization by Congress.

(2) SUBMISSION OF REPORT.—Before seeking congressional authorization for a project under paragraph (1), the Secretary shall submit to Congress—

(A) a description of the project; and

(B) a project implementation report for the project prepared in accordance with subsections (f) and (h).

Sections 601(f) and (h) provide for evaluation of projects and assurance of project benefits. This is accomplished in Project Implementation Reports.

4.3 PROJECT GOAL, OBJECTIVES, CONSTRAINTS AND PERFORMANCE MEASURES

The goals of CEPP remain consistent with prior planning efforts of CERP (USACE 1999). Specific CEPP objectives were created to address the central part of the southern Florida ecosystem to improve the quantity, quality, timing, and distribution of water flows to the central Everglades, including WCA 3 and ENP.

4.3.1 Goal and Objectives

The six CEPP objectives were built upon the overall CERP goals and objectives (**Table 4-1**) in order to provide the needed linkages between the projects. CERP included goals for enhancing economic values and social well being with specific objectives towards improving other project purposes of the C&SF project, including agricultural, municipal, and industrial water supply. Section 601(h) of WRDA 2000 states "*the overarching objective of the Plan is the restoration, preservation, and protection of the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection*".

Table 4-1. Goals and Objectives of CEPP. Goals and objectives for CERP are also depicted to acknowledge the direct linkage between the two projects.

CERP Objective	CEPP Objective
CERP GOAL: Enhance Ecological Values	
Increase the total spatial extent of natural areas	No corresponding CEPP objective; consider this objective in future increments
Improve habitat and functional quality	Restore seasonal hydroperiods and freshwater distribution to support a natural mosaic of wetland and upland habitat in the Everglades System
	Improve sheetflow patterns and surface water depths and durations in the Everglades system in order to reduce soil subsidence, the frequency of damaging peat fires, the decline of tree islands, and salt water intrusion
	Reduce high volume discharges from Lake Okeechobee to improve the quality of oyster and SAV habitat in the northern estuaries
Improve native plant and animal species abundance and diversity	Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization
	Restore more natural water level responses to rainfall to promote plant and animal diversity and habitat function
CERP GOAL: Enhance Economic Values and Social Well Being	
Increase availability of fresh water (agricultural/municipal & industrial)	Increase availability of water supply to the Lake Okeechobee Service Area, Lower East Coast, and Broward
Reduce flood damages (agricultural/urban)	No corresponding CEPP objective; consider this objective in future increments
Provide recreational and navigation opportunities	Provide recreational opportunities
Protect cultural and archeological resources and values	Protect cultural and archeological resources and values

4.3.2 Constraints

Project constraints were recognized to ensure that the proposed project would not reduce the level of service for flood protection, protect existing legal users, and meet applicable water quality standards for the natural system. In accordance with Section 601(h)(5) of WRDA 2000 and Chapter 373.1501(4)(d), Federal Statute (F.S.), the following are constraints for CEPP implementation:

- Avoid any reduction in the existing level of service for flood protection caused by Plan implementation
- Provide replacement sources of water of comparable quantity and quality for existing legal users caused by Plan implementation
- Meet applicable Water Quality Standards

4.3.3 Performance Measures

The overall objective of CEPP is to rehydrate the Everglades through improvements in quantity, quality, timing, and distribution of flows. Rehydration within the Greater Everglades would improve habitat for some threatened and endangered species within the project area. The Corps and FWS, in conjunction with the multi-agency CEPP team, evaluated potential project effects on Everglade snail kite, wood stork, alligator, crocodile, vegetation, and Cape Sable seaside sparrow using performance measures (PMs) and ecological targets (ETs) for these species and their habitat previously developed for the Everglades Restoration Transition Plan (ERTP 2012). The ERTP PMs and ETs were adapted for use in CEPP and are defined as follows. The PMs are defined as a set of operational rules that identify optimal

WCA 3A water stages and recession rates to improve conditions in WCA 3A for Everglade snail kite, wood stork, wading birds, and tree islands. The ERTP PM-A addresses the nesting window for Cape Sable Seaside Sparrow subpopulation A (CSSS-A), as outlined in the 1999 FWS Reasonable and Prudent Alternative (RPA; FWS 1999). The ETs are designed to support the intention of PMs by providing hydroperiod guidelines to help maintain appropriate nesting and foraging habitat. For example, ET-1 outlines a NP-205 stage of less than 7.0 feet National Geodetic Vertical Datum (NGVD) by December 31. Based upon NP-205 recession rate calculations, a stage of less than 7.0 at NP-205 on December 31 will enable water levels to reach less than 6.0 feet NGVD by mid-March (PM-A). As referenced in the ERTP PMs and ETs, **Figure 4-6** shows the locations of the gages.

The FWS, along with Wiley Kitchens, Ph.D. of the University of Florida, Phil Darby, Ph.D. of the University of West Florida, and Christa Zweig, Ph.D. of the University of Florida, developed a series of water depth recommendations for WCA 3A that addresses the needs of the Everglade snail kite, apple snail, and vegetation characteristics of their habitat (**Figure 4-7**). This water management strategy is divided into three time periods representing the height of the wet season (September 15 to October 15), the pre-breeding season (January) and the breeding season (termed dry season low, May 1 to June 1) and illustrates appropriate water depths to attain within each time period. Water depth recommendations as measured at the WCA 3AVG (average of Site 63 [Gage 3A-3], Site 64 [Gage 3A-4] and Site 65 {Gage 3A-28]) proposed within the FWS Multi-Species Transition Strategy (MSTS, FWS 2010) form the basis for ERTP PMs and ETs. Please note that these water depths are not targets, but used as guidance and represent a compromise between the needs of the multiple species. Inter-annual variability is extremely important in the management of the system to promote recovery of the species.

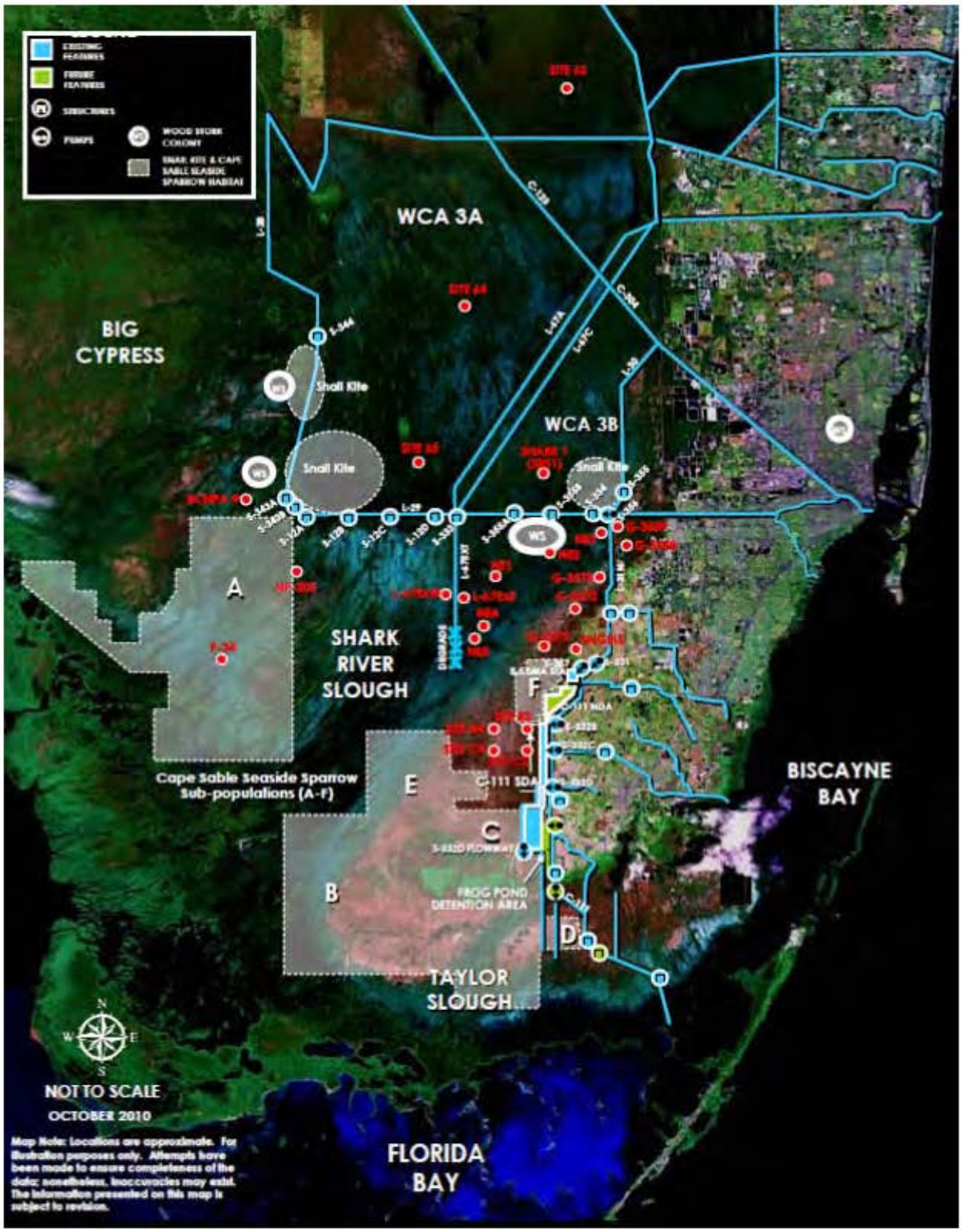


Figure 4-6. Location of gages within the CEPP action area as referenced in the Everglades Restoration Transition Plan Performance Measures and Ecological Targets

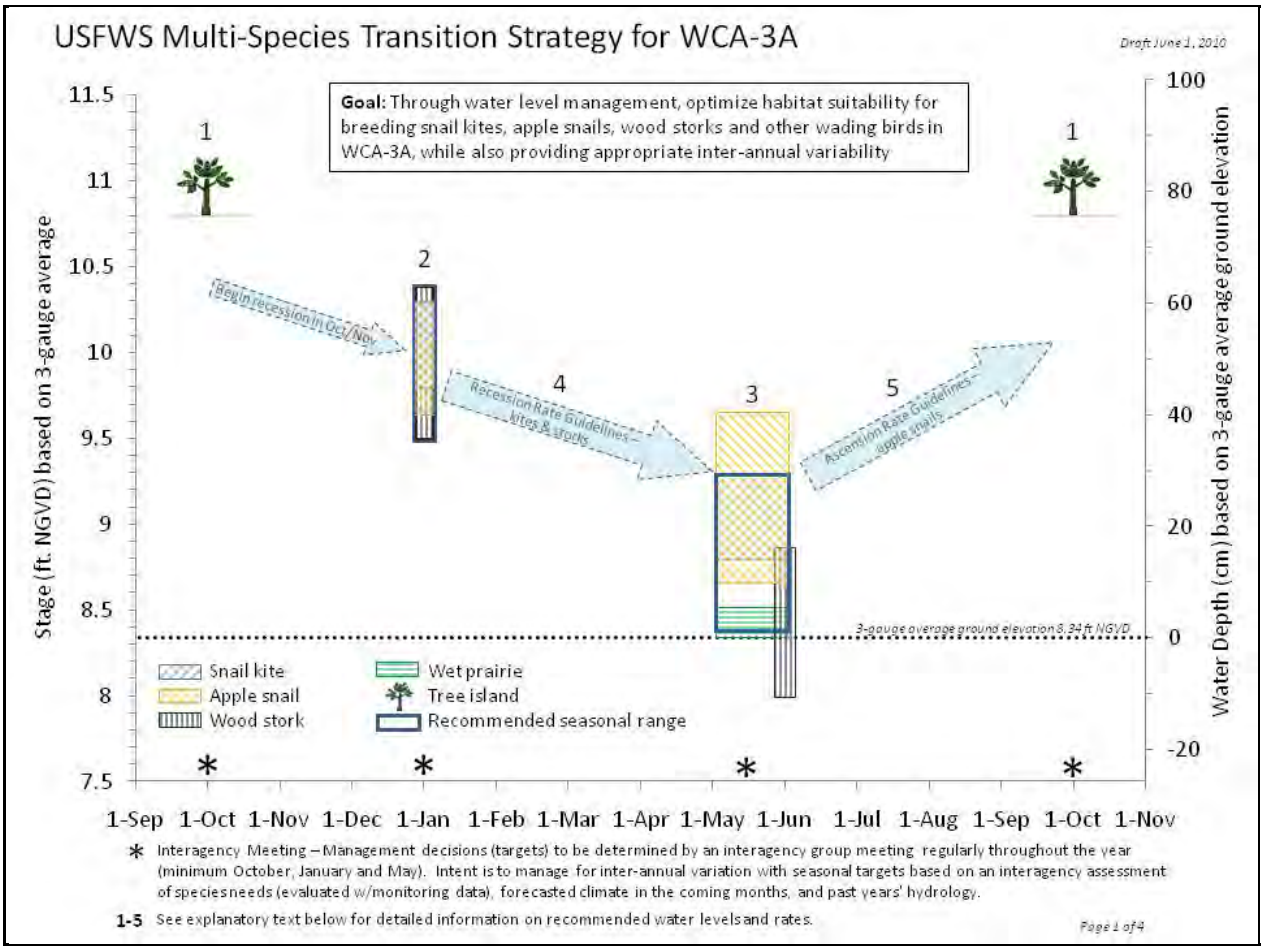


Figure 4-7. U.S. Fish and Wildlife Service Multi-Species Transition Strategy for Water Conservation Area 3A

The FWS MSTS (2010) for WCA 3A includes species-specific ranges (windows) which reflect water levels or water depths identified by species experts based on the best available science that are believed to provide optimal conditions for wading bird breeding and foraging as well as tree island considerations.

Many ERTP PMs and ETs were used to evaluate potential effects of CEPP on threatened and endangered species within the project area (**Table 4-2**). It is important to note that for the evaluation of potential effects on Everglade snail kite, PM-B and PM-C were adapted in order to evaluate depths within specific areas throughout WCA 3A and WCA 3B to give a broader spatial perspective of habitat suitability. Additional detail is located within **Section 6.2.6** of this document. In addition, Ecological Planning Tools were also used to evaluate potential project effects on listed species. Ecological Planning Tools used within this assessment include, Alligator Production Model (South Florida Natural Resources Center [SFNRC] 2013a), Juvenile Crocodile Habitat Suitability Index (Brandt 2013), Apple Snail Production Model (SFNRC 2013d), and Wood Stork Foraging Potential Model (SFNRC 2013b). Further details of these models and analyses are outlined in further detail within relevant sections of this document.

In addition to the PMs and ETs mentioned above, additional hydrologic and ecologic PMs developed by CERP's interagency science group, the Restoration, Coordination, and Verification group, (RECOVER) were used in the evaluation of alternative plans and assessment of CERP performance from a system-wide perspective. RECOVER PMs identify hydrologic and ecological indicators expected to respond to

implementation of CERP and are developed from Conceptual Ecological Models (CEMs) that identify the major anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and the best biological attributes or indicators of these ecological responses.

Table 4-2. ERTP Performance Measures Used to Evaluate Potential CEPP Effects on Threatened and Endangered Species CEPP

Species	PM	Description of PM
CSSS	A	*NP-205 (CSSS-A): Provide a minimum of 60 consecutive days at NP-205 below 6.0 feet NGVD beginning no later than March 15*
Everglade Snail kite	B	*WCA-3A: For Everglade snail kites, strive to reach waters levels between 9.8 and 10.3 feet NGVD by December 31, and between 8.8 and 9.3 feet between May 1 and June 1.*
	C	*WCA-3A: For apple snails, strive to reach water levels between 9.7 and 10.3 feet NGVD by December 31 and between 8.7 and 9.7 feet between May 1 and June 1.*
	D	*WCA-3A (Dry Season Recession Rate): Strive to maintain a recession rate of 0.05 feet per week from January 1 to June 1 (or onset of the wet season). This equates to a stage difference of approximately 1.0 feet between January and the dry season low.*
	E	*WCA-3A (Wet Season Rate of Rise): Manage for a monthly rate of rise less than or equal to 0 .25 feet per week to avoid drowning of apple snail egg clusters.*

*Note: All stages for WCA-3A are as measured at WCA 3- gage average [WCA-3AVG] [Sites 63, 64, 65])

4.3.4 Ecological Targets

Cape Sable Seaside Sparrow

1. NP-205 (CSSS-A): Strive to reach a water level of less than or equal to 7.0 feet NGVD at NP-205 by December 31 for nesting season water levels to reach 6.0 feet NGVD by mid- March.

2. CSSS: Strive to maintain a hydroperiod between 90 and 210 days (3 to 7 months) per year throughout sparrow habitat to maintain marl prairie vegetation (hydroperiod depths depend upon averages of gauges).

5.0 DESCRIPTION OF EXISTING CONDITIONS, LISTED SPECIES, AND DESIGNATED CRITICAL HABITAT

The following describes existing conditions within the action area. **Table 5-1** provides a brief description of each region of the study area.

5.1 Existing Conditions

Table 5-1. Existing Conditions of the CEPP Study Area

CEPP Study Area Region	Description of the Study Area Region
Lake Okeechobee	Lake Okeechobee is a large, shallow lake (surface area 730 square miles) 30 miles west of the Atlantic coast and 60 miles east of the Gulf of Mexico. It is impounded by a system of levees, with 6 outlets: St. Lucie Canal eastward to the Atlantic Ocean, Caloosahatchee Canal/River westward to the Gulf of Mexico, and four agricultural canals (West Palm Beach, Hillsboro, North New River and Miami). The lake is surrounded by the 143 mile long Herbert Hoover Dike. The lake has many functions, including flood risk management, urban and agricultural water supply, navigation, recreation, fisheries, and wildlife habitat. It is critical for flood control during wet seasons and water supply during dry seasons. Agriculture in the Lake Okeechobee Service Area (LOSA), including the EAA, is the predominate user of lake water.

CEPP Study Area Region	Description of the Study Area Region
	The lake is an economic driver for both the surrounding areas and south Florida's economy.
Northern Estuaries	Lake Okeechobee discharges into the 2 Northern Estuaries. The St. Lucie Canal flows eastward into the St. Lucie Estuary, which is part of the larger Indian River Lagoon Estuary. The Caloosahatchee Canal/River flows westward into the Caloosahatchee Estuary and San Carlos Bay, which are part of the larger Charlotte Harbor Estuary. The St. Lucie and Caloosahatchee estuaries are designated Estuaries of National Significance, and the larger Indian River Lagoon and Charlotte Harbor estuaries are part of the U.S. Environmental Protection Agency (USEPA)-sponsored National Estuary Program. The landscape includes pine-flatwoods, wetlands, mangrove forests, submerged aquatic vegetation, estuarine benthic areas (mud and sand) and near-shore reefs.
Everglades Agricultural Area	The EAA is approximately 630,000 acres in size and is immediately south of Lake Okeechobee. Much of this rich, fertile land is devoted to sugarcane production, and is crossed by a network of canals that are strictly maintained to manage water supply and flood protection. The landscape includes natural and man-made areas of open water such as canals, ditches, and ponds, wetlands, and lands associated with agricultural and urban use. Within the EAA there is approximately 45,000 acres of STAs and the Holey Land and Rotenberg Wildlife Management Areas.
Water Conservation Areas	WCA 1, WCA 2, and, WCA 3 (the largest of the three) are situated southeast of the EAA and are approximately 1,328 square miles. The WCAs extend from EAA to ENP. They provide floodwater retention, public water supply, and are the headwaters of ENP. The landscape includes open water sloughs, sawgrass marshes, and tree islands.
Everglades National Park	ENP was established in 1947, covering ~2,353 square miles (total elevation changes of only 6 feet from its northern boundary at Tamiami Trail south to include much of Florida Bay). The landscape includes sawgrass sloughs, tropical hardwood hammocks, mangrove forest, lakes, ponds, and bays.
Florida Bay	Florida Bay is a shallow estuarine system (average depth less than 3 feet comprising a large portion of ENP. It is the main receiving water of the greater Everglades, heavily influenced by changes in timing, distribution, and quantity of freshwater flows into the Southern Estuaries. The landscape includes saline emergent wetlands, seagrass beds, and mangrove forests.
Lower East Coast	The LEC encompasses Palm Beach, Broward, Monroe and Miami-Dade Counties. Water levels in this area are highly controlled by the Central and Southern Florida (C&SF) water management system to provide flood damage reduction and sufficient water supply to minimize the risk of detrimental saltwater intrusion. The CEPP is focused on the portions of the LEC adjacent to the natural areas and susceptible to seepage.

5.1.1 Vegetative Communities

5.1.1.1 Lake Okeechobee

The vegetation and cover types within the Lake Okeechobee region have been greatly altered during the last century. Historically the natural vegetation was a mix of freshwater marshes, hardwood swamps, cypress swamps, pond apple forests, and pine flatwoods. Freshwater marshes were the predominant cover type throughout, especially along the southern portion of Lake Okeechobee where it flowed into the Everglades. These marshes were vegetated primarily with sawgrass (*Cladium jamaicense*) and scattered clumps of Carolina willow (*Salix caroliniana*), sweetbay (*Magnolia virginiana*), and cypress (*Taxodium spp.*). Hardwood swamps dominated by red maple (*Acer rubrum*), sweetbay, and sweet gum (*Liquidambar styraciflua*) occurred in riverine areas feeding Lake Okeechobee, while cypress swamps were found in depressional areas throughout the region. Pine flatwoods composed of slash pine (*Pinus elliottii*), cabbage palm (*Sabal palmetto*), and saw palmetto (*Serenoa repens*) were prevalent in upland areas especially to the north.

The majority of the surface of Lake Okeechobee is not vegetated and provides open water (pelagic) habitat. Open water habitat within Lake Okeechobee covers about 75% of the lake's surface area. Lake Okeechobee has an extensive littoral zone that occupies approximately 150 square miles (about 25 percent) of the lake's surface (Milleson 1987). Littoral vegetation occurs along much of Lake Okeechobee's perimeter, but is most extensive along the southern and western borders (Milleson 1987). The littoral zone plant community is composed of a mosaic of emergent and submergent plant species. Emergent vegetation within the littoral zone is dominated by herbaceous species such as cattail (*Typha spp*.), spike rush (*Eleocharis cellulose*), and torpedo grass (*Panicum repens*) an invasive exotic species. Other emergent vegetation includes bulrush (*Scirpus californicus*), sawgrass, pickerelweed (*Pontedaria cordata*), duck potato (*Sagittaria spp*.), beakrush (*Rhynochospora tracyi*), wild rice (*Zizania aquatic*), arrowhead (*Sagittaria latifolia*), buttonbush (*Cephalanthus occidentalis*), sand cordgrass (*Spartina bakeri*), fuirena (*Fuirena scirpoidea*), rush (*Scirpus cubensis*), sourthern cutgrass (*Leersia hexandra*), maidencane (*Panicum hemitomon*), white vine (*Sarcostemma clausum*), dogfennel (*Eupatorium capillifolium*), and mikania (*Mikania scandens*). Woody vegetation consists of primrose willow (*Ludwigia peruviana*), Carolina willow, and melaleuca (*Melaleuca quiquenervia*), an invasive exotic species. Over the years, there has been an on-going effort to eradicate melaleuca. The eradictation effort has been extremely effective.

The submerged vegetation is composed almost entirely of hydrilla (*Hydrilla verticillata*), which is an invasive exotic species, pondweed (*Potoamogeton illinoensis*), bladderwort (*Utricularia spp*.), Chara (*Chara spp*.), and tape grass (*Vallisneria americana*). The floating component of the littoral zone consists of lotus lily (*Nelumbo lutea*), fragrant water lily (*Nymphaea odorate* and *N. Mexicana*), water hyacinth (*Eichhornia crassipes*) which is an invasive exotic species, water lettuce (*Pistia stratiotes*), duckweed (*Lemna spp*.), coinwort (*Hydrocotyle umbellate*), and ludwigia (*Ludwigia leptocarpa*).

5.1.1.2 Northern Estuaries

Submerged aquatic vegetation (SAV) is one of the most important vegetation communities of the St. Lucie River and Indian River Lagoon and the Caloosahatchee River and Estuary. The SAV converts sunlight into food for fish, sea turtles, manatees, and a myriad of invertebrates, among other species. Seagrass meadows improve water quality by removing nutrients, dissipating the effects of waves and currents, and by stabilizing bottom habitats thereby reducing suspended solids within the water column. Seagrass beds support some of the most abundant and diverse fish populations in the Indian River Lagoon. Seagrass and macro algae (collectively referred to as SAV) are highly productive areas and are perhaps the most important habitat of the Indian River Lagoon (IRL CCMP, 1996). Many commercial and recreational fisheries (i.e. clams, shrimp, lobster, fish) are associated with healthy seagrass beds (FWS 1999). Currently, many SAV beds are stressed and have been reduced or eliminated from their former areas by extreme salinity fluctuations, increased turbidity, sedimentation, dredging, damage from boats, and nutrient enrichment which causes algal blooms that, in turn, restrict light penetration.

5.1.1.2.1 Upper Caloosahatchee River and Estuary

In terms of distribution and abundance, tape grass (*Vallisneria americana)* has been the dominant species in the upper Caloosahatchee River and Estuary, colonizing littoral zones in water less than one meter in depth (Chamberlain and Doering 1998a). In the early 1990s, SAV covered approximately 1,000 acres and about 60% of the coverage occurred within an 8-kilometer (km) stretch between Beautiful Island and the Fort Myers Bridge (Hoffacker 1994). Total longitudinal cover ranged from 14 to 32 km upstream from Shell Point (Chamberlain and Doering 1998b). Tape grass can typically tolerate salinities of 3 to 5 practical salinity units (psu) with few long-term effects if light conditions are sufficient (Haller 1974, French and Moore 2003, Jarvis and Moore 2008). Dramatic declines in Tape grass were observed

beginning in late 2006 as a result of salinities exceeding the species' tolerance (Bourn 1932, Haller et al. 1974, Doering et al. 1999, Kraemer et al. 1999, Doering et al. 2001). During this period widgeon grass (*Ruppia maritime)* was the dominant species although it never achieved even the minimum abundance recorded for Tape grass (Burns et al. 2007).

The effects of hurricane water releases in 2005 resulted in decreased plant cover and density in the latter half of 2005. Compounding the high turbidity effects from freshwater releases in 2005, precipitous increases in salinities beginning in October 2006 raised salinity levels from 10 to 25 psu from November 2006 through April 2008. During the December 2005 to April 2006 period, the lower water clarity was associated with lower shoot density and cover. The loss of plants was quite rapid with a significant end-of-year dieback in 2006 followed by no regrowth in spring 2007. Salinities finally declined between April and October 2008, but recovery has been slow. This may be related to a lack of propagules as nearly all the *V. americana* was lost during the 2007 to 2008 high salinity period. It may also be related to herbivory or other impacts on the initial recolonization of recruits into the area (RECOVER 2009).

5.1.1.2.2 Lower Caloosahatchee River Estuary

Historically, two species of SAV have been routinely reported during surveys in the lower Caloosahatchee River Estuary upstream of Shell Point. These include shoal weed (*Halodule beuadettei*), shoal grass (*Halodule wrightii*), and turtle grass (*Thalassia testudinum)* (Chamberlain and Doering 1998a, Wilzbach et al. 2000, Burns et al. 2007). In more recent reports, manatee grass (*Syringodium filiforme*) has been reported in San Carlos and Tarpon Bays (Wilzbach et al. 2000, Burns et al. 2007). Shoal grass coverage, described as abundant, has been at 300 acres, about 75% of this occurred between 2 and 8 kilometers (km) upstream of Shell Point (Chamberlain and Doering 1998b).

From 2004 to 2008, the lower estuary was dominated by shoal grass. Although widgeon grass was observed occasionally (Burns et al. 2007), only very low densities were found in the lower estuary when surveys were searching specifically for it. High salinity fluctuations with tides and shading by shoal grass may limit its growth. Low salinities during higher rainfall periods and discharge events observed since 2004 likely prevented the survival of seagrass species including turtle grass (Burns et al. 2007). Water clarity was poor in 2004 and 2005 preventing SAV growth in waters greater than 0.7 meter deep. Water clarity conditions improved in 2007 and were sufficient for growth down to 1.2 meters.

Hurricane effects lowering SAV abundance in 2005 and 2006 and subsequent shoal grass recovery in 2007 were evident with cover in 2007 exceeding 2004 levels. Salinities of 1 psu or less occurred each year from 2004 to 2006. The large drop in cover and density in fall 2007 prior to the usual winter dieback could have been caused by grazing.

5.1.1.2.3 St. Lucie Estuary

The SAV communities in the St. Lucie Estuary and Southern Indian River Lagoon include seagrass and macro algae. The estuaries support six species of seagrass including shoal grass, manatee grass, turtle grass, paddle grass (*Halophila decipiens*), star grass (*Halophila engelmannii*), and the threatened Johnson's seagrass (*Halophila johnsonii*). Johnson's seagrass was listed as threatened under ESA in 1998, and critical habitat was designated in 2000. The species has a very limited distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. Major threats include propeller scarring, dredging, sedimentation, and degraded water quality. Shoal grass and manatee grass are the dominant canopy species in the lagoon (Thompson 1978, Dawes et al. 1995, Morris et al. 2000). While all of these species are most successful in salinities greater than 20 psu, shoal grass can tolerate a wide

range of salinity and salinity variations. However, manatee grass is not as tolerant of low salinities or widely varying salinities (Irlandi 2006).

SAV distribution has been mapped in the St. Lucie Estuary and the Southern Indian River Lagoon every two to three years since 1986, including annual mapping from 2005 through 2007 to help assess hurricane impacts. Historic SAV maps show SAV extending throughout the estuary. In 2007, very sparse (< 10% cover in most areas) SAV was present in the lower and middle estuary, but not in either of the forks. Three seagrass species occurred within the estuary: shoal grass, Johnson's seagrass, and paddle grass. The majority of the SAV occurred in small isolated patches. The dominant SAV species in 2007 was Johnson's seagrass. It also extended farther upstream than any other SAV species.

This region was impacted by hurricanes and associated freshwater discharges in 2004 and 2005. Following the hurricanes, observed impacts to Southern Indian River Lagoon SAV communities included large coverage and density declines and smaller direct impacts due to burial by shifting bottom sediments. Lush manatee grass beds were documented through 2004, however, low salinities and associated poor water quality following the 2004 and 2005 hurricanes greatly impacted manatee grass in the area. The hurricanes also altered bathymetry on the east and west edges of the estuary, covering seagrasses. The steepest decline in percent occurrence of manatee occurred in 2005 after Hurricane Wilma. Johnson's seagrass followed by shoal grass colonized the former manatee grass habitat and recruited throughout the site. Available data indicates a clear trend toward recovery of the manatee grass beds.

5.1.1.3 Everglades Agricultural Area

Currently, much of the native south Florida landscape has been destroyed or substantially reduced by development, hydrologic change, increased nutrients, and the invasion of exotic plants. South of Lake Okeechobee, the historic pond apple swamps and sawgrass marshes have been converted to agriculture. Habitat types within the EAA are divided into five general groups: aquatic, wetland, upland, disturbed (mostly agricultural), and urban/extractive.

The aquatic communities within the EAA include both natural and man-made areas of open water such as canals, ditches, and ponds. The primary canals include Bolles, Cross, Hillsboro, Miami, North New River, and West Palm Beach. All of Compartment A of the Talisman Land Exchange property is considered to be atypical jurisdictional wetlands based on hydric soils and hydrology. Wetland vegetation is anticipated to return to the site should agricultural practices cease. Upland land cover classes include dry prairie, hardwood hammock and forests, pinelands, and mixed hardwood pine forests. Disturbed communities consist of mostly agricultural lands including pasture (improved and unimproved), row crops, sugarcane, citrus, and other agricultural lands. Most of the urban and extractive lands are concentrated around the Belle Glade area. Low impact urban areas consist of either vegetated or non vegetated lands within areas such as lawns, golf courses, road shoulders, and grassy areas surrounding development. High impact urban areas are non vegetated sites such as buildings, roads, and parking lots. Extractive cover areas consist of surface mining operations such as limestone quarries, phosphate mines, and sand pits as well as the associated industrial complexes.

5.1.1.4 Greater Everglades

The Everglades landscape is dominated by a complex of freshwater wetland communities that includes open water sloughs and marshes, dense grass and sedge dominated marshes, forested islands, and wet marl prairies. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrologic regime (FWS 1999). These

communities generally occur along a hydrologic gradient with the slough/open water marsh communities occupying the wettest areas (flooded more than nine months per year), followed by sawgrass marshes (flooded six to nine months per year), and wet marl prairie communities (flooded less than six months per year) (FWS 1999). The Everglades freshwater wetlands eventually grade into intertidal mangrove wetlands and sub tidal seagrass beds in the estuarine waters of Florida Bay.

Development and drainage over the last century have dramatically reduced the overall spatial extent of freshwater wetlands within the Everglades, with approximately half of the pre-drainage 2.96 million acres of wetlands being converted for development and agriculture (Davis and Ogden 1997). Alteration of the normal flow of freshwater through the Everglades has also contributed to conversions between community types, invasion by exotic species, and a general loss of community diversity and heterogeneity.

Many areas of WCA 3A still contain relatively good wetland habitat consisting of a complex of tree islands, sawgrass marshes, wet prairies, and aquatic sloughs. However, reduced freshwater inflow and drainage by the Miami Canal has overdrained the northern portion of WCA 3A, resulting in increased fire frequency and the associated loss of tree islands, wet prairie, and aquatic slough habitat. Northern WCA 3A is currently dominated largely by mono-specific sawgrass stands and lacks the diversity of communities that exists in southern WCA 3A. In southern WCA 3A, Wood and Tanner (1990) documented the trend toward deep water lily dominated sloughs due to impoundment. In approximately 1991, the hydrology of southern WCA 3A shifted to the deeper water and extended hydroperiods of the new, wet hydrologic era resulting in a northward shift in slough vegetation communities within the WCA 3A impoundment (Zweig and Kitchens 2008). Typical Everglades vegetation, including tree islands, wet prairies, sawgrass marshes, and aquatic sloughs also occurs throughout WCA 3B. However, a shift in vegetation has occurred in WCA 3B toward shorter hydroperiod sawgrass marshes.

Vegetative trends in ENP have included a substantial shift from the longer hydroperiod slough/open water marsh communities to shorter hydroperiod sawgrass marshes (Davis and Ogden 1997, Armentano et al. 2006). In addition, invasion of sawgrass marshes and wet prairies by exotic woody species has led to the conversion of some marsh communities to forested wetlands (Gunderson et al. 1997).

The estuarine communities of Florida Bay have also been affected by upstream changes in freshwater flows through the Everglades. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (FWS 1999).

In contrast to the vast extent of wetland communities, upland communities comprise a relatively small component of the Everglades landscape and are largely restricted to Long Pine Key, the northern shores of Florida Bay, and the many tree islands scattered throughout the region. Vegetative communities of Long Pine Key include rockland pine forest and tropical hardwood forest. In addition, substantial areas of tropical hardwood hammock occur along the northern shores of Florida Bay and on elevated portions of some forested islands.

5.1.1.4.1 Slough/Open Water Marsh

The slough/open water marsh community occurs in the lowest, wettest areas of the Everglades. This community is a complex of open water marshes containing emergent, floating aquatic, and submerged aquatic vegetation components. The emergent marsh vegetation is typically dominated by spikerushes

(*Eleocharis cellulosa* and *E. elongata*), beakrushes *(Rhynchospora tracyi* and *R. inundata*), and maidencane (*Panicum hemitomon*). Common floating aquatic dominants include fragrant water lily (*Nymphaea odorata*), floating hearts (*Nymphoides aquatica*), and spatterdock (*Nuphar lutea*); and the submerged aquatic community is typically dominated by bladderwort (*Utricularia foliosa*) and periphyton. As shown by Davis et al. (1994), vegetative trends in ENP have included the conversion of slough/open-water marsh communities to shorter hydroperiod sawgrass marshes.

5.1.1.4.2 Sawgrass Marsh

Sawgrass marshes are dominated by dense to sparse stands of *Cladium jamaicense*. Sawgrass marshes occurring on deep organic soils (more than one meter) form tall, dense, nearly monospecific stands. Sawgrass marshes occurring on shallow organic soils (less than one meter) form sparse, short stands that contain additional herbaceous species such as spikerush, water hyssop (*Bacopa caroliniana*), and marsh mermaid weed (*Proserpinaca palustris*) (Gunderson et al. 1997). The adaptations of sawgrass to flooding, burning, and oligotrophic conditions contribute to its dominance of the Everglades vegetation. Sawgrass-dominated marshes once covered an estimated 300,000 acres of the Everglades. Approximately 70,000 acres of tall, monospecific sawgrass marshes have been converted to agriculture in the EAA. Urban encroachment from the east and development within other portions of the Everglades has consumed an additional 79,000 acres of sawgrass-dominated communities (Davis and Ogden 1997).

5.1.1.4.3 Wet Marl Prairies

Wet marl prairies occur on marl soils and exposed limestone and experience the shortest hydroperiods of the slough/marsh/prairie wetland complex. Marl prairie is a sparsely vegetated community that is typically dominated by muhly grass (*Muhlenbergia capillaris*) and short-stature sawgrass. Additional important constituents include black sedge (*Schoenus nigricans*), arrowfeather (*Aristida purpurascens*), Florida little bluestem (*Schizachyrium rhizomatum*), and Elliot's lovegrass (*Eragrostis elliottii*). Periphyton mats that grow loosely attached to the vegetation and exposed limestone also form an important component of this community. Marl prairies occur in the southern Everglades along the eastern and western periphery of Shark River slough (SRS). Approximately 146,000 acres of the eastern marl prairie have been lost to urban and agricultural encroachment (Davis and Ogden 1997). Prior to the modifications, plant communities at the sites analyzed by Bernhardt and Willard (2006) in western SRS consisted of sawgrass marshes. Based on their analysis of pollen records, the authors concluded that “the current spatial distribution and community composition of marl prairies are a response to water management and land cover changes of the twentieth century, and further sampling of modern marl prairie communities and adjacent communities is necessary to document the pre- and post-drainage distribution of marl prairie” (Bernhardt and Willard 2006).

5.1.1.4.4 Tree Islands

Tree islands occur within the freshwater marshes on areas of slightly higher elevation relative to the surrounding marsh. The lower portions of tree islands are dominated by hydrophytic, evergreen, broad-leaved hardwoods such as red bay (*Persea palustris*), sweetbay (*Magnolia virginiana*), dahoon holly (*Ilex cassine*), and pond apple (*Annona glabra*). Tree islands typically have a dense shrub layer that is dominated by coco-plum (*Chrysobalanus icaco*). Additional constituents of the shrub layer commonly include buttonbush (*Cephalanthus occidentalis*) and large leather fern (*Acrostichum danaeifolium*). Elevated areas on the upstream side of some tree islands may contain an upland tropical hardwood hammock community dominated by species of West Indian origin (Gunderson et al. 1997), with species composition shifting toward the north toward more temperate hardwood hammock species. Extended periods of flooding may result in tree mortality and conversion to a non-forested community. In the

over-drained areas of WCA 3A, historic wildfires have consumed tree island vegetation and soils. Overall, the spatial extent of tree islands in WCA 3 declined by 61% between 1940 and 1995 (Patterson and Finck 1999). Portions of the WCAs have been flooded to the extent that many forested islands have lost all tropical hardwood hammock trees. Tree islands are considered an extremely important contributor to habitat heterogeneity and overall species diversity within the Everglades ecosystem because they provide nesting habitat and refugia for birds and upland species and serve as hotspots of plant species diversity within the Greater Everglades (Sklar et al. 2002, FWS 1999).

5.1.1.4.5 Mangroves

Mangrove communities are forested wetlands occurring in intertidal, low-wave-energy, estuarine, and marine environments. Extensive mangrove communities occur in the intertidal zone of Florida Bay. Mangrove forests have a dense canopy dominated by four species: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). Mangrove communities occur within a range of salinities from 0 to 40 psu. Florida Bay experiences salinities in excess of 40 psu on a seasonal basis. Declines in freshwater flow through the Everglades have altered the salinity balance and species composition of mangrove communities within Florida Bay. Changes in freshwater flow can lead to an invasion by exotic species such as Australian pine (*Casuarina equisetifoli*a) and Brazilian pepper (*Schinus terebinthifolius*).

5.1.1.4.6 Seagrass Beds

Seagrasses are submerged vascular plants that form dense rooted beds in shallow estuarine and marine environments. This community occurs in sub tidal areas that experience moderate wave energy. Within the project area, extensive seagrass beds occur in Florida Bay. The most abundant seagrasses in south Florida are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Additional species include star grass (*Halophila engelmannii*), paddle grass (*Halophila decipiens*), and Johnson's seagrass (*Halophila johnsonii*). Widgeon grass may also occur in seagrass beds in areas of low salinity. Seagrasses have an optimum salinity range of 24 to 35 psu, but can tolerate considerable short-term salinity fluctuations. Large-scale seagrass die-off has occurred in Florida Bay since 1987, with over 18 percent of the total bay area affected. Suspected causes of seagrass mortality include high salinities and temperatures during the 1980s and long-term reductions of freshwater inflow to Florida Bay (RECOVER 2009).

5.1.1.4.7 Rockland Pine Forest

Pine rocklands within the project area occur on the Miami Rock Ridge and extend into the Everglades as Long Pine Key. Pine rocklands occur on relatively flat terrain with moderately to well-drained soils. Most sites are wet for only short periods following heavy rains (Florida Natural Areas Inventory 1990). Limestone bedrock is close to the surface and the soils are typically shallow accumulations of sand, marl, and organic material. Pine rockland is an open, savanna-like community with a canopy of scattered south Florida slash pine (*Pinus elliottii* var. *densa*) and an open, low-stature understory. This is a fire-maintained community that requires regular burns to maintain the open shrub/herbaceous stratum and to control hardwood encroachment (Gunderson et al. 1997). The overstory is comprised of scattered south Florida slash pines. The shrub layer is comprised of a diverse assemblage of tropical and temperate species. Common shrubs include cabbage palm (*Sabal palmetto*), coco-plum (*Chrysobalanus icaco*), myrsine (*Rapanea punctata*), saw palmetto (*Serenoa repens*), southern sumac (*Rhus copallinum*), strangler fig (*Ficus aurea*), swamp bay (*Persea palustris*), wax myrtle (*Myrica cerifera*), white indigo berry (*Randia aculeata*), and willow-bustic (*Sideroxylon salicifolium*). The herbaceous stratum is comprised of a very diverse assemblage of grasses, sedges, and forbs. Common herbaceous species include crimson bluestem (*Schizachyrium sanguineum*), wire bluestem (*Schizachyrium gracile*), hairy bluestem

(*Andropogon longiberbis*), bushy bluestem (*Andropogon glomeratus* var. *pumilis*), candyweed (*Polygala grandiflora*), creeping morning-glory (*Evolvulus sericeus*), pineland heliotrope (*Heliotropium polyphyllum*), rabbit bells (*Crotolaria rotundifolia*), and thistle (*Cirsium horridulum*) (FWS 1999). This community occurs on areas of relatively high elevation and consequently, has been subject to intense development pressure. In addition, fragmentation, fire suppression, invasion by exotic species, and a lowered water table have negatively affected the remaining tracts of pine rockland (FWS 1999).

5.1.1.4.8 Tropical Hardwood Hammock

Tropical hardwood hammocks occur on upland sites where limestone is near the surface. Tropical hardwood hammocks within the action area occur on the Miami Rock Ridge, along the northern shores of Florida Bay, and on elevated outcrops on the upstream side of tree islands. This community consists of a closed canopy forest dominated by a diverse assemblage of hardwood tree species, a relatively open shrub layer, and a sparse herbaceous stratum. This community is dominated by native south Florida species that represent the northern extension of the ranges of species that occur throughout the West Indies, but nowhere else in the continental United States. Common canopy species include gumbo-limbo (*Bursera simaruba*), paradise tree (*Simarouba glauca*), pigeon-plum (*Coccoloba diversifolia*), strangler fig, wild mastic (*Sideroxylon foetidissimum*), willow-bustic, live oak (*Quercus virginiana*), short-leaf fig (*Ficus citrifolia*), and wild tamarind (*Lysiloma bahamense*). Common understory species include black ironwood (*Krugiodendron ferreum*), inkwood (*Exothea paniculata*), lancewood (*Ocotea coriacea*), marlberry (*Ardisia escallonoides*), poisonwood (*Metopium toxiferum*), satinleaf (*Chrysophyllum oliviforme*), and white stopper (*Eugenia axillaris*). Common species of the sparse shrub/herbaceous layer include shiny-leaf wild-coffee (*Psychotria nervosa*), rouge plant (*Rivinal humilis*), false mint (*Dicliptera sexangularis*), bamboo grass (*Lasciacis divaricata*), and woods grass (*Oplismenus hirtellus*). This community occurs on areas of relatively high elevation and consequently, has been subject to intense development pressure. Fragmentation of remaining tracts, invasion by exotic species, and alterations of water table elevations have also had negative impacts on this community. Tropical hardwood hammocks on the Miami Rock Ridge have been affected by a lowered water table associated with the reduction of freshwater flow through the Everglades. In contrast, tree islands in the WCAs have been flooded to the extent that many have lost all tropical hardwood hammock trees.

5.1.2 Fish and Wildlife Resources

Aquatic macro invertebrates form a vital link between the algal and detrital food web base of freshwater wetlands and the fishes, amphibians, reptiles, and wading birds that feed upon them. Important macro invertebrates of the freshwater aquatic community include crayfish (*Procambarus alleni*), riverine grass shrimp (*Palaemonetes paludosus*), amphipods (*Hyallela aztecus*), Florida apple snail (*Pomacea paludosa*), Seminole ramshorn (*Planorbella duryi*), and numerous species of aquatic insects (USACE 1999).

Small freshwater marsh fishes are also important processors of algae, plankton, macrophytes, and macro invertebrates. Marsh fishes provide an important food source for wading birds, amphibians, and reptiles. Common small freshwater marsh species include the native and introduced golden topminnow (*Fundulus chrysotus*), least killifish (*Heterandria formosa*), Florida flagfish (*Jordenella floridae*), golden shiner (*Notemigonus crysoleucas*), sailfin molly (*Poecilia latipinna*), bluefin killifish (*Lucania goodei*), oscar (*Astronotus ocellatus*), eastern mosquitofish (*Gambusia holbrookii*), and small sunfishes (*Lepomis* spp.) (USACE 1999). The density and distribution of marsh fish populations fluctuates with seasonal changes in water levels. Populations of marsh fishes increase during extended periods of continuous

flooding during the wet season. As marsh surface waters recede during the dry season, marsh fishes become concentrated in areas that hold water through the dry season. Concentrated dry season assemblages of marsh fishes are more susceptible to predation and provide an important food source for wading birds (USACE 1999).

Within the Greater Everglades, numerous sport and larger predatory fishes occur in deeper canals and sloughs. Common species include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), black crappie (*Pomoxis nigromaculatus*), Florida gar (*Lepisosteus platyrhincus*), threadfin shad (*Dorosoma petenense*), gizzard shad (*Dorosoma cepedianum*), yellow bullhead (*Ameiurus natilis*), white catfish (*Ameiurus catus*), bowfin (*Amia calva*), and tilapia (*Tilapia* spp.) (USACE 1999). Larger fishes are an important food source for wading birds, alligators, otters, raccoons, and mink.

The freshwater wetland complex supports a diverse assemblage of reptiles and amphibians. Common amphibians include the greater siren (*Siren lacertina*), Everglades dwarf siren (*Pseudobranchus striatus*), two-toed amphiuma (*Amphiuma means*), pig frog (*Rana grylio*), southern leopard frog (*Rana sphenocephala*), Florida cricket frog (*Acris gryllus*), southern chorus frog (*Pseudacris nigrita*), squirrel tree frog (*Hyla squirela*), and green tree frog (*Hyla cinerea*) (USACE 1999). Amphibians represent an important forage base for wading birds, alligators, and larger predatory fishes (USACE 1999).

Common reptiles of freshwater wetlands include the American alligator (*Alligator mississippiensis*), snapping turtle (*Chelydra serpentina*), striped mud turtle (*Kinosternon bauri*), mud turtle (*Kinosternon subrubrum*), cooter (*Chrysemys floridana*), Florida chicken turtle (*Deirochelys reticularia*), Florida softshell turtle (*Trionys ferox*), water snake (*Natrix sipidon*), green water snake (*Natrix cyclopion*), mud snake (*Francia abacura*), and Florida cottonmouth (*Agkistrodon piscivorus*) (USACE 1999).

The alligator was historically most abundant in the peripheral Everglades marshes and freshwater mangrove habitats, but is now most abundant in canals and the deeper slough habitats of the central Everglades. Drainage of peripheral wetlands and increasing salinity in mangrove wetlands as a result of decreased freshwater flows has limited the occurrence of alligators in these habitats (Mazzotti and Brandt 1994).

The freshwater wetlands of the Everglades are noted for their abundance and diversity of colonial wading birds. Common wading birds include the white ibis (*Eudocimus albus*), glossy ibis (*Plegadus falcenellus*), great egret (*Casmerodius albus*), great blue heron (*Ardea herodius*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), green-backed heron (*Butorides striatus*), cattle egret (*Bubulcus ibis*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nycticorax violacea*), roseate spoonbill (*Ajaia ajaja*), and wood stork (*Mycteria americana*) (USACE 1999). The number of wading birds nesting in the Everglades has decreased by approximately 90 percent, and the distribution of breeding birds has shifted away from ENP into the WCAs (Bancroft et al. 1994). The WCAs support fewer numbers of breeding pairs with relatively lower reproductive success (USACE 1999). Water management practices and wetland losses are believed to be the primary cause of the declines (Bancroft et al. 1994).

Mammals that are well-adapted to the aquatic and wetland conditions of the freshwater marsh complex include the rice rat (*Oryzomys palustris natator*), round-tailed muskrat, and river otter (*Lutra canadensis*). Additional mammals that may utilize freshwater wetlands on a temporary basis include the

white-tailed deer (*Odocoileus virginianus*), Florida panther (*Puma concolor coryi*), bobcat (*Lynx rufus*), and racoon (*Procyon lotor*).

Many of the fish and wildlife resources that inhabit the freshwater aquatic community of the Everglades are also common to Lake Okeechobee, the Northern Estuaries, and the EAA. Native habitat for fish and wildlife does not comprise a significant amount of the EAA as the alteration of the landscape for agricultural uses has resulted in the removal of nearly all historically occurring native vegetation. Although abundant wetland habitat has been replaced by agriculture, the creation of ditches, canals, and the flooding of fallow agricultural fields provides some habitat for fish and wildlife, particularly during the rainy season.

The Northern Estuaries are also home to fish and wildlife species found in estuarine and marine habitats. Sea grasses and other submerged aquatic vegetation within the Northern Estuaries provide important habitat and nursery grounds for several fish species. Many fish species spend part or all of their life in the estuary. Common recreational and commercial fish species include mutton snapper (*Lutjanus analis*), yellowtail snapper (*Ocyurus chrysurus*), lane snapper (*Lutjanus synagris*), yellowtail parrot fish (*Sparisoma rubripinne*), gag grouper (*Mycteroperca microlepis*), pinfish (*Lagodon rhomboids*), tarpon (*Megalops atlanticus*), common snook (*Centropomus undecimalus*), crevalle jack (*Cranx hippos*), spotted sea trout (*Cynoscion nebulosus*), redfish (*Sciaenops ocellatus*), mullet (*Mugil spp*.), and sheepshead (*Archosargus probatocephalus*). In addition to finfish, the estuaries support a variety of shellfish. Blue crabs, stone crabs, hard clams, and oysters are important estuarine commercial species. Submerged aquatic vegetation and algal communities are also common foraging areas for the green sea turtle. The Northern Estuaries provides forage for seabords (gulls, terns, pelicans, and others), in addition to a large number of wading birds. The Northern Estuaries are also home to marine mammals such as the Atlantic bottlenose dolphin (*Tursiops truncatus*).

5.2 FEDERALLY LISTED SPECIES

Forty federally listed threatened and endangered species are either known to exist or potentially exist within the project area and, subsequently, may be affected by the proposed project. Many of these species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation. The Corps has coordinated the existence of federally listed species with FWS and with NMFS, as appropriate. Specifically, coordination with NMFS includes listed fish, whales, and sea turtles at sea. Separate coordination with the NMFS has been initiated to assess potential affects to marine species. Coordination with FWS includes other listed plants and animals (**Table 5-2**).

Table 5-2. Status of Threatened and Endangered Species Potentially Affected by CEPP and the Corps' Affect Determination on Federally Listed Species (E: Endangered, T:Threatened, SC: Species of Special Concern, SA: Similarity of Appearance, CH: Critical Habitat; Pr E: Proposed Endangered; Pr CH: Proposed Critical Habitat).

Common Name	Scientific Name	Status	Agency	Determination
Mammals				
Florida bonneted bat	*Eumops floridanus*	Pr E	Federal	No Effect
Florida panther	*Puma concolor coryi*	E	Federal	May Affect
Florida manatee	*Trichechus manatus latirostris*	E, CH	Federal	May Affect
Big Cypress fox squirrel	*Sciurus niger avicennia*	T	State	
Florida black bear	*Ursus americanus floridanus*	T	State	
Everglades mink	*Mustela vison evergladensis*	T	State	

Common Name	Scientific Name	Status	Agency	Determination
Florida mouse	*Podomys floridanus*	SC	State	
Florida mastiff bat	*Eumops glaucinus floridanus*	E	State	
Shermans fox squirrel	*Sciurus niger shermani*	SC	State	
Blue whale*	*Balaenoptera musculus*	E	Federal	No Effect
Finback whale*	*Balaenoptera physalus*	E	Federal	No Effect
Humpback whale*	*Megaptera novaeangliae*	E	Federal	No Effect
Sei whale*	*Balaenoptera borealis*	E	Federal	No Effect
Sperm whale*	*Physeter macrocephalus*	E	Federal	No Effect
Birds				
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH	Federal	May Affect
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH	Federal	May Affect
Northern crested caracara	*Caracara cheriway*	T	Federal	No Effect
Piping plover	*Charadrius melodus*	T	Federal	No Effect
Red-cockaded woodpecker	*Picoides borealis*	E	Federal	No Effect
Roseate tern	*Sterna dougallii dougallii*	T	Federal	No Effect
Wood stork	*Mycteria americana*	E	Federal	May Affect
American oystercatcher	*Haematopus palliatus*	SC	State	
Black skimmer	*Rynchops niger*	SC	State	
Brown pelican	*Pelecanus occidentalis*	SC	State	
Burrowing owl	*Athene cunicularia*	SC	State	
Florida sandhill crane	*Grus canadensis pratensis*	T	State	
Least tern	*Sterna antillarum*	T	State	
Limpkin	*Aramus guarauna*	SC	State	
Little blue heron	*Egretta caerulea*	SC	State	
Reddish egret	*Egretta rufescens*	SC	State	
Roseate spoonbill	*Platalea ajaja*	SC	State	
Snowy egret	*Egretta thula*	SC	State	
Snowy plover	*Charadrius alexandrinus*	T	State	
Tricolored heron	*Egretta tricolor*	SC	State	
White-crowned pigeon	*Columba leucocephalus*	T	State	
White ibis	*Eudocimus albus*	SC	State	
Reptiles				
American alligator	*Alligator mississippiensis*	T/SA	Federal	May Affect
American crocodile	*Crocodylus acutus*	T, CH	Federal	May Affect
Eastern indigo snake	*Drymarchon corais couperi*	T	Federal	May Affect
Green sea turtle*	*Chelonia mydas*	E, CH**	Federal	May Affect
Hawksbill sea turtle*	*Eretmochelys imbricata*	E, CH**	Federal	May Affect
Kemp's Ridley sea turtle*	*Lepidochelys kempii*	E	Federal	May Affect
Leatherback sea turtle*	*Dermochelys coriacea*	E, CH**	Federal	May Affect
Loggerhead sea turtle*	*Caretta caretta*	T	Federal	May Affect
Gopher tortoise	*Gopherus polyphemus*	SC	State	
Miami black-headed snake	*Tantilla oolitica*	T	State	No Effect
Fish				
Gulf sturgeon*	*Acipenser oxyrinchus desotoi*	T, CH**	Federal	No Effect
Shortnose sturgeon*	*Acipenser brevirostrum*	T	Federal	No Effect
Smalltooth sawfish*	*Pristia pectinata*	E, CH	Federal	May Affect
Mangrove rivulus	*Kryptolebias marmoratus*	SC	State	
Opossum pipefish*	*Microphis brachyurus lineatus*	SC	Federal	No Effect
Mangrove gambusia	*Gambusia rhizophorae*	SC	State	

Common Name	Scientific Name	Status	Agency	Determination
Invertebrates				
Bartram's hairstreak butterfly	*Strymon acis bartrami*	C	Federal	No Effect
Elkhorn coral*	*Acropora palmata*	T, CH	Federal	No Effect
Florida leafwing butterfly	*Anaea troglodyta floridalis*	C	Federal	No Effect
Staghorn coral*	*Acropora cervicornis*	T, CH	Federal	No Effect
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	Federal	No Effect
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	T	Federal	No Effect
Florida tree snail	*Liguus fasciatus*	SC	State	
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E	Federal	No Effect
Plants				
Beach jacquemonia	*Jacquemontia reclinata*	E	Federal	No Effect
Cape Sable thoroughwort	*Chromolaena frustrata*	Pr E, Pr CH	Federal	No Effect
Crenulate lead plant	*Amorpha crenulata*	E	Federal	No Effect
Deltoid spurge	*Chamaesyce deltoidea* spp. *deltoidea*	E	Federal	May Affect
Garber's spurge	*Chamaesyce garberi*	T	Federal	May Affect
Johnson's seagrass*	*Halophila johnsonii*	E, CH	Federal	No Effect
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeenis*	E	Federal	No Effect
Small's milkpea	*Galactia smallii*	E	Federal	May Affect
Tiny polygala	*Polygala smallii*	E	Federal	May Affect
Eatons spikemoss	*Selaginella eatonii*	E	State	
Lattace vein fern	*Thelypteris reticulate*	E	State	
Mexican vanilla	*Vanilla mexicana*	E	State	
Pine-pink orchid	*Bletia purpurea*	T	State	
Tropical fern	*Schizaea pennula*	E	State	
Wright's flowering fern	*Anemia wrightii*	E	State	

*Marine species under the purview of NMFS

** Indicates critical habitat for the designated species is not within the action study area

A number of candidate animal species **(Table 5-3**) are also known to exist or potentially exist within the project area and include Bartram's hairstreak butterfly (*Strymon acis bartrami*) and Florida leafwing butterfly (*Anaea troglodyte floridalis*). Effects on these species are not anticipated due to their distribution and habitat requirements. A number of candidate plant species are known to exist or potentially exist in the study area, most of which are also associated with pine rocklands. Adverse effects to federally listed candidate plant species are not anticipated due to implementation of CEPP.

Table 5-3. List of species within CEPP project area that are candidate species for protection under the Endangered Species Act.

Common Name	Scientific Name	Federal Status
Plants		
Big pine partridge pea	*Chamaecrista* var. *keyensis*	C
Blodgett's silverbush	*Argythamnia blodgettii*	C
Carter's small-flowered flax	*Linum carteri* var. *carteri*	C
Everglades bully	*Sideroxylon reclinatum* spp. *austrofloridense*	C
Florida brickell-bush	*Brickellia mosieri*	C
Florida bristle fern	*Trichomane spunctatum* spp. *floridanum*	C
Florida pineland crabgrass	*Digitaria pauciflora*	C

Common Name	Scientific Name	Federal Status
Florida prairie-clover	*Dalea carthagenensis* var. *floridana*	C
Florida semaphore cactus	*Consolea corallicola*	C
Pineland sandmat	*Chamaesyce deltoidea* spp. *pinetorum*	C
Sand flax	*Linum arenicola*	C
Invertebrates		
Bartram's hairstreak butterfly	*Strymon acis bartrami*	C
Florida leafwing butterfly	*Anaea troglodyta floridalis*	C

5.3 STATE LISTED SPECIES

The study area also provides habitat for several state listed species (**Table 5-2**). These species are discussed further in the CEPP Project Implementation Report.

5.4 DESIGNATED CRITICAL HABITAT

In addition to threatened and endangered species, the project area also includes or is adjacent to designated critical habitat for Florida manatee, Cape Sable seaside sparrow, Everglade snail kite, and American crocodile. Critical habitat for the smalltooth sawfish, elkhorn coral, staghorn coral, and Johnson's seagrass are covered under the purview of NMFS and therefore are discussed under a separate consultation. Maps of critical habitat locations for these species under FWS purview are depicted within the species effect determination sections of this BA as appropriate.

6.0 EFFECTS DETERMINATIONS

Species were evaluated based on the existing conditions baseline (ECB 2012), which includes ERTP operations, the Future Without Project Conditions (FWO), which includes ERTP operations and the assumption that several other CERP projects would be completed (see Appendix B for more detail on existing conditions and FWO), and Alt 4R2 that is described in **Section 4.0** of this BA.

6.1 "NO EFFECT" DETERMINATION

Federally threatened or endangered species that are known to potentially exist within close proximity of the project area, but which will not likely be of concern are discussed in detail below.

6.1.1 Crenulate Lead- Plant and "No Effect" Determination

A perennial, deciduous shrub, the crenulate lead-plant is endemic to Miami-Dade County. Agricultural, urban and commercial development within Miami-Dade County have destroyed approximately 98-99% of the pine rockland communities where this species occurred, prompting the FWS to list the crenulate lead-plant as endangered in 1985 (FWS 1999). Other threats to the continued existence of this species include fire suppression, drainage and exotic plant invasion.

Its present distribution is restricted to eight known locations within a 20-square mile area from Coral Gables to Kendall, Miami-Dade County. Four of the known sites are within public parks managed by the Miami-Dade County Parks Department (FWS 1999). As the crenulate lead-plant is not known to occur within WCA-3A or ENP, the Corps has determined that CEPP will have no effect on this species.

6.1.2 Cape Sable Thoroughwort and "No Effect" Determination

The Cape Sable thoroughwort is endemic to south Florida, an herb that is 8-40 inches tall. It occurs throughout coastal rock barrens and berms and sunny edges of rockland hammock. It was proposed to be listed as endangered in December 2012, along with critical habitat. Alt 4R2 is not expected to affect coastal rock barrens, therefore the Corps has determined that CEPP will have no effect on this species.

6.1.3 Deltoid Spurge, Garber's Spurge, Small's Milkpea, and Tiny Polygala "No Effect" Determinations

Pine rocklands are the primary habitat for deltoid spurge, Garber's spurge, Small's milkpea, and tiny polygala. This community occurs on areas of relatively high elevation and consequently, has been subject to intense development pressure. In addition, pine rocklands are a fire-maintained community and require regular burns to maintain the open shrub/herbaceous stratum and to control hardwood encroachment (Gunderson 1997). Fire suppression, fragmentation, invasion by exotic species, and a lowered water table have negatively affected the remaining tracts of pine rocklands, prompting the listing of these species under the ESA (FWS 1999).

Within the project area, pine rocklands occur on the Miami Rock Ridge and extend into the Everglades as Long Pine Key. These listed plant species have the potential to occur within the rocky glades surrounding the Frog Pond Detention Area. Under CEPP, there may be potential changes to the operations of this seepage reservoir, which could potentially affect hydroperiods within this region. Although these changes are not expected to significantly alter hydroperiods, potential effects on plant species within this region could occur with project implementation. However, these effects are expected to be insignificant. Therefore, the Corps has determined the project will have no effect on deltoid spurge, Garber's spurge, Small's milkpea, or tiny polygala.

6.1.4 Okeechobee Gourd and "No Effect" Determination

The Okeechobee gourd is a climbing annual or perennial vine possessing heart to kidney-shaped leaf blades. The cream-colored flowers are bell-shaped and the light green gourd is globular or slightly oblong. The Okeechobee gourd was locally common in the extensive pond apple forest that once grew south of Lake Okeechobee. Historically, the Okeechobee gourd was found on the southern shore of Lake Okeechobee in Palm Beach County and in the Everglades. Currently this species is limited to two disjunct populations, one along the St. Johns River in Volusia, Seminole, and Lake counties in northern Florida and a second around the shoreline of Lake Okeechobee in south Florida (FWS 1999). The conversion of the pond apple forested swamps and marshes for agricultural purposes as well as water-level regulation within Lake Okeechobee have been the principal causes of the reduction in both range and number of the Okeechobee gourd. Areas around Lake Okeechobee would likely not change due to Alt 4R2, therefore, the Corps determined that the project will have no effect on Okeechobee Gourd.

6.1.5 Miami Blue Butterfly and "No Effect" Determination

The Miami blue is a small butterfly endemic to Florida and is officially listed as endangered under the ESA in April 2012. The Miami blue has a forewing length of 10 to 13 millimeters. Males and females are both bright blue dorsally, but females have an orange eyespot near their hind wing. Both sexes have a gray underside with four black spots. The Miami blue occurs at the edges of tropical hardwood hammocks, beachside scrub, and occasionally in rockland pine forests. Larval host plants include the seed pods of nickerbeans (*Caesalpinia spp.*), blackbeards (*Pithecellobium spp.*), and balloon vine (*Cardiospermum* halicababum), a non-native species. Adults feed on the nectar of Spanish needles (*Bidens pilosa*), cat tongue (*Melanthera aspera*), and other weedy flowers near disturbed hammocks.

Primarily a south Florida coastal species, the Miami blue's historic distribution ranged as far north as Hillsborough County on the Gulf Coast and Volusia County on the Atlantic Coast and extended south to the Florida Keys and the Dry Tortugas (FWC 2013b). The butterfly was thought to be extinct following Hurricane Andrew in 1992, but was observed in November 1999 at Bahia Honda State Park in the Florida Keys. More than 329 surveys conducted at locations in mainland Florida and the Keys have failed to detect other colonies of this species.

Population declines are primarily a result of loss and degradation of suitable habitat due to residential, recreational, and commercial development. In coastal areas where undeveloped lands remain, the introduction of exotics has led to the direct loss of larval host plants and nectar sources. Other perceived threats include human-caused mortality from pesticide and herbicide use. CEPP project features would not affect rockland pine forests or beachside scrub and would therefore have no affect on this species.

6.1.6 Schaus Swallowtail Butterfly and "No Effect" Determination

The Schaus swallowtail butterfly is a large dark brown and yellow butterfly originally listed as an endangered species because of population declines caused by the destruction of its tropical hardwood hammock habitat, mosquito control practices, and over-harvesting by collectors. Schaus swallowtail butterfly distribution is limited to tropical hardwood hammocks and is concentrated in the insular portions of Miami-Dade and Monroe counties, from Elliott Key in Biscayne National Park and associated smaller Keys to central Key Largo (FWS 1999). It is estimated that remaining suitable habitat for this species is 43% of the historical suitable habitat in Biscayne National Park and 17 percent for north Key Largo. The decline has been attributed primarily to habitat destruction (FWS 1999). Due to the lack of preferred subtropical hardwood hammock habitat in the action area, the Corps has determined that the proposed action would have no effect on the Schaus swallowtail butterfly.

6.1.7 Stock Island Tree Snail and "No Effect" Determination

Measuring approximately 45-55 millimeters in length, the arboreal Stock Island tree snail inhabits hardwood hammocks consisting of tropical trees and shrubs such as gumbo limbo, mahogany, ironwood, poisonwood, marlberry and wild coffee, among others. Population declines, habitat destruction and modification, pesticide use, and over-collecting led to the listing of this species as threatened in 1978 (FWS 1999).

The historic distribution of the Stock Island tree snail was thought to be limited to hardwood hammocks on Stock Island and Key West and possibly other lower Keys hammocks. Recently, the range of this species has been artificially extended through the actions of collectors who have introduced it to Key Largo and the southernmost reaches of the mainland. At present, this snail occupies six sites outside of its historic range including ENP and Big Cypress National Preserve. The Corps has determined that CEPP would not affect the subtropical hardwood hammock habitat in ENP and Big Cypress National Preserve; therefore, Alt 4R2 would not affect the Stock Island tree snail.

6.1.8 Northern Crested Caracara and "No Effect" Determination

The Northern crested caracara is listed as threatened by both FWS and the FWC. This large raptor is a dietary generalist and opportunistic feeder. Prey species include invertebrates such as crayfish, beetles, grasshoppers and small mammals, amphibians, reptiles, fish, and birds (Morrison 1998). In Florida, the caracara historically occupied native prairies, but fire suppression has caused widespread conversion of prairies to open brushland. Currently, the bulk of Florida's caracara population has been found on large cattle ranches with improved pastures and scattered cabbage palms. Dry prairies with wetter areas and scattered cabbage palm comprise typical habitat. Caracaras also occur in some improved pasturelands and even in lightly wooded areas with more limited stretches of open grassland. Within these habitats, caracaras exhibit a propensity for nesting in cabbage palms, followed by live oaks, during a nesting season that typically continues from September through June with a concentration during November to April (Morrison 1998). Caracaras forage within a variety of habitats including improved pastures, adjacent to dwellings and farm buildings, newly plowed or burned fields, agricultural lands, including sod and cane fields, citrus groves, dairies, and wetland habitats (Morrison 1996). Caracaras are non-

migratory and may be found in their home range year round. Home ranges average approximately 1,200 ha (approximately 3,000 acres), corresponding to a radius of two to three kilometers (1.2 to 1.9 miles) surrounding the nest site (Morrison and Humphrey 2001). Foraging typically occurs throughout the home range during nesting and non-nesting seasons. Due to lack of preferred habitat within the project area, the Corps has determined that CEPP will have no effect on this species (**Figure 6-1**).

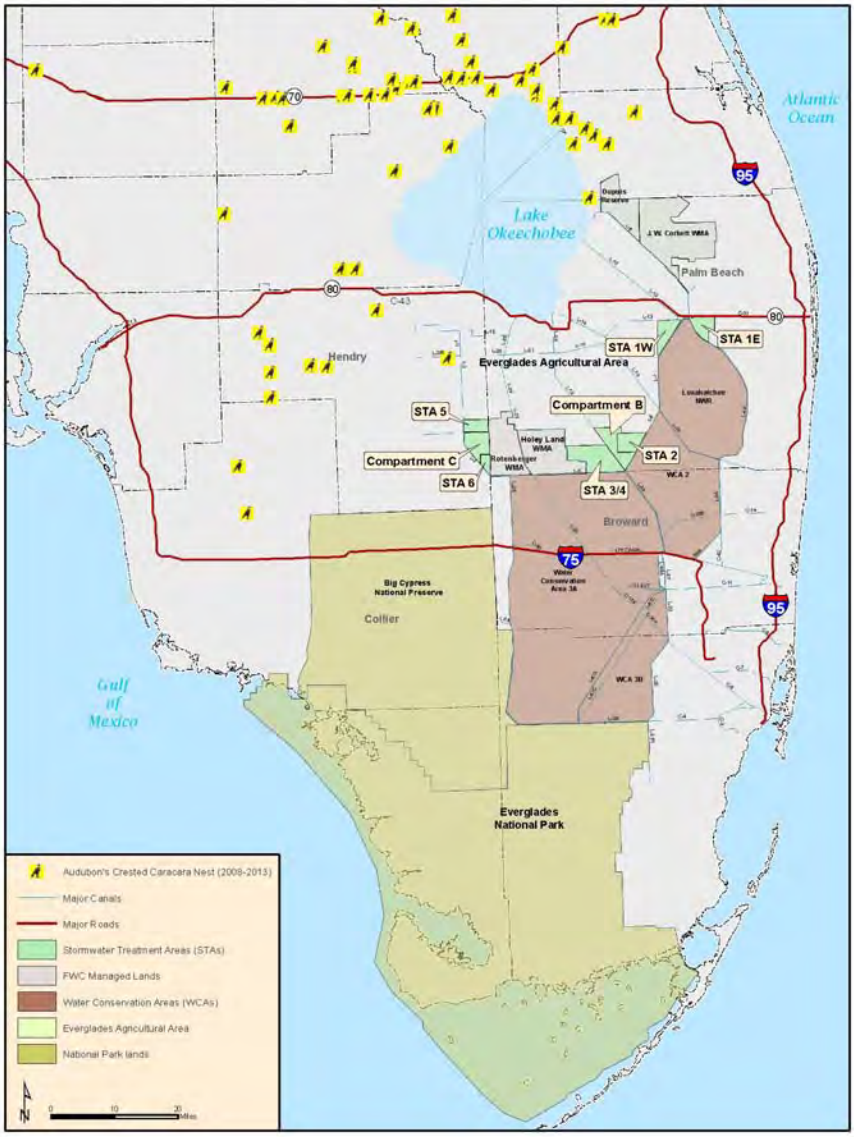


Figure 6-1. Caracara nesting locations from 2003-2013

6.1.9 Piping Plover and "No Effect" Determination

The piping plover is listed by FWS as threatened. The piping plover does not breed in Florida; breeding populations occur near the Great Lakes, the Northern Great Plains, and the Atlantic Coast. Piping plovers regularly winter in the south Florida counties of Broward, Collier, Indian River, Lee, Martin, Miami-Dade, Monroe, Palm Beach, St. Lucie, and Sarasota (Haig 1992). Piping plover nest and feed along coastal sand and gravel beaches throughout North America. Due to lack of preferred wintering

habitat within the CEPP project area, the Corps has determined that implementation of CEPP would have no effect on piping plover.

6.1.10 Red-Cockaded Woodpecker and "No Effect" Determination

The red-cockaded woodpecker is identified by its conspicuous white cheek patch, black and white cross-barred back, black cap and nape, white breast and flanks with black spots. In addition, the males have a small bright red spot on each side of the black cap. The bird is approximately 8½ inches in length with a wingspan of 14½ inches. The female is somewhat smaller and resembles the male in coloration, with the exception of a red streak alongside the black cap. The female is approximately 7⅜ inches with a wingspan of 13¼ inches (FWS 1999).

Red-cockaded woodpeckers are a social species and live in groups with a breeding pair and up to four helpers, generally male offspring from the previous year. Approximately 200 acres of mature pine forests are necessary to support each group's nesting and foraging habitat needs. Juvenile females will leave the group prior to the breeding season and establish a breeding pair within a solitary male group. Breeding pairs are monogamous and will raise a single brood each breeding season. Three to four small white eggs will be laid within the roost cavity and incubated by members of the group for a period of ten to twelve days. Chicks are also fed by members of the group and remain within the roost cavity for approximately 26 days. Insects including ants, caterpillars, moths, grasshoppers, spiders, and beetle larvae comprise approximately 85 percent of their diet. The remainder of their diet consists of wild grapes, cherries, poison ivy berries, blueberries, and nuts such as pecans (FWS 1999).

Red-cockaded woodpeckers live in mature pine forests, specifically those with longleaf pines averaging 80 to 120 years old and loblolly pines averaging 70 to 100 years old. Destruction of its preferred long-leaf pine habitat by humans or disease (pines afflicted by fungus or red-ring rot) resulted in the woodpecker becoming listed as endangered in 1970. The current range is from eastern Texas to the southeastern United States and southern Florida. Historically, red-cockaded woodpeckers were found abundantly from Texas to New Jersey and as far inland as Tennessee.

The red-cockaded woodpecker is primarily an upland species, also inhabiting hydric pine flatwoods. Due to lack of lack of appropriate habitat, the Corps has determined that there would be no effect on this species from the implementation of CEPP.

6.1.11 Roseate Tern and "No Effect" Determination

A coastal species, the roseate tern nests on open sandy beaches away from potential predation and human disturbance. This species feeds in nearshore surf on small schooling fishes. In southern Florida, the roseate tern's main nesting areas are located in the Florida Keys and the Dry Tortugas where they nest on isolated islands, rubble islets, and dredge spoils. Although suitable foraging opportunities exist along the shoreline within the project area, the proposed project is not likely to adversely affect their feeding habits or nesting areas. Therefore, the Corps has determined that there would be no effect on this species from the implementation of CEPP.

6.2 "MAY AFFECT" DETERMINATIONS

The Corps recognizes that until completion of CERP there are few opportunities within the current constraints of the Central and South Florida (C&SF) system to completely avoid effects to listed species. However, the proposed project would improve the quality, quantity, timing, and distribution of flows to the Greater Everglades, including WCA 3A, WCA 3B, ENP, and Florida Bay. The Corps has determined that CEPP may affect federally listed species occurring within the project area including American

alligator, American crocodile and its critical habitat, Eastern indigo snake, Florida panther, Florida manatee and its critical habitat, Everglade snail kite and its critical habitat, and wood stork. All standard protection measures for species would be followed during and post construction.

6.2.1 American Alligator and "May Affect" Determination

The American alligator is listed as threatened by the FWS due to similarity of appearance to American crocodile, an endangered species. A keystone species within the Everglades ecosystem, the American alligator (*Alligator mississippiensis*) is dependent on spatial and temporal patterns of water fluctuations that affect courtship and mating, nesting, and habitat use (Brandt and Mazzotti 2000). Historically, American alligators were most abundant in the peripheral Everglades marshes and freshwater mangrove habitats, but are now most abundant in canals and the deeper slough habitats of the central Everglades. Water management practices including drainage of peripheral wetlands and increasing salinity in mangrove wetlands as a result of decreased freshwater flows has limited occurrence of American alligators in these habitats (Craighead 1968, Mazzotti and Brandt 1994). A Habitat Suitability Index (HSI) for alligators was used to predict potential effects of implementation of CEPP Alt 4R2 (South Florida Natural Resources Center 2013a). The HSI measures habitat suitability annually for five components of alligator production: (1) land cover suitability, (2) breeding potential (female growth and survival from April 16 of the previous year - April 15 of the current year), (3) courtship and mating (April 16 – May 31), (4) nest building (June 15 – July 15), and egg incubation (nest flooding from July 01 – September 15).

Results indicate that implementation of Alt 4R2 would improve alligator habitat suitability throughout WCA 3A and ENP as compared with the existing conditions and FWO. The greatest increase in benefits is visible within northern WCA 3A (CEPP Zones 3A-MC, 3A-NE and 3A-NW), with improvements in alligator habitat over existing conditions (**Figure 6-2**) due to additional water deliveries within this region. Gains are smaller in central WCA 3A, WCA 3B, and ENP north and south zones, though they appear to have an increased spatial extent of slightly improved potential habitat in Alt 4R2 **(Figure 6-3).** Changes within southern WCA 3A show potential negative effects to alligator production, however, the effects appear relatively negligible (South Florida Natural Resources Center 2013a). In summary, increasing freshwater flow through the Greater Everglades into ENP under CEPP will provide increased benefits to alligators within these habitats in comparison with the existing conditions. Adverse effects to alligators that utilize the Miami Canal will occur due to backfilling of the Miami Canal. However, these effects are expected to be short-term as alligators will expand into other areas of suitable habitat created as a result of CEPP implementation.

Due to anticipated benefits with CEPP implementation, the Corps has determined that the project may affect American alligator.

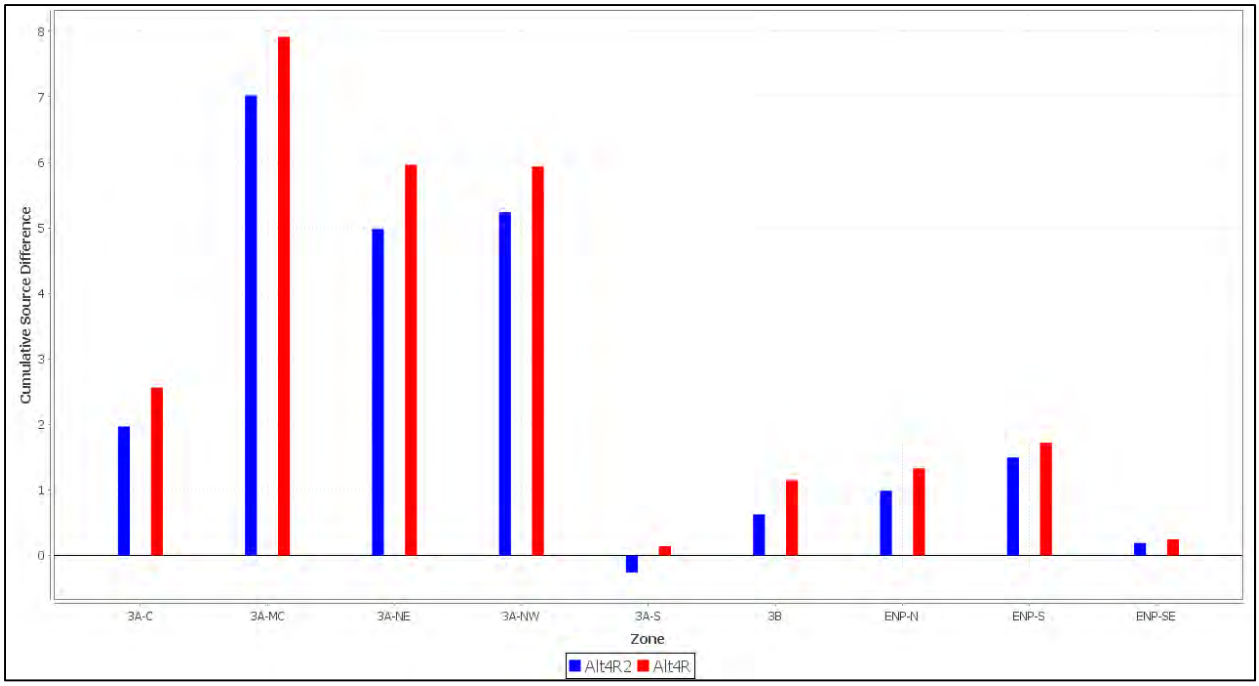


Figure 6-2. Cumulative alligator production habitat suitability (1965-2005) lift from existing conditions (ECB 2012) for Alt4R2 within each CEPP zone. A maximum score of 41 is possible if existing conditions has a suitability score of 0.0 every year and the alternative has a suitability score of 1.0 every year (South Florida Natural Resources Center 2013a)

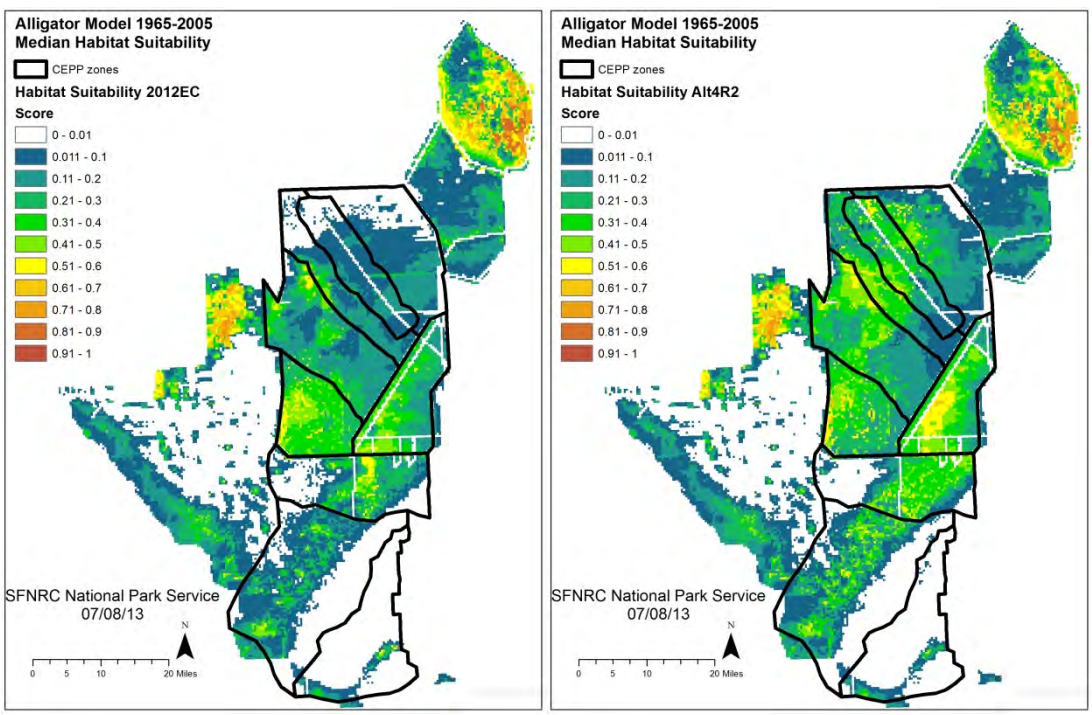


Figure 6-3. Suitable alligator habitat cumulative (1965-2005) lift above the existing conditions for the Alt 4R2 within each water conservation area (WCA) (South Florida Natural Resources Center 2013a)

6.2.2 American Crocodile and "May Affect" Determination

American crocodiles are known to exist throughout the project area, specifically around the coastal fringes from Miami to the bottom of the peninsula and up around Naples (Cherkiss 1999). The cooling canals of Florida Power and Light's Turkey Point Power Plant, which occur within the project boundary, support the most successful crocodile nesting population in south Florida (Mazzotti et al. 2007). These cooling canals offer premium nesting habitat because they satisfy the crocodile's two primary nesting requirements – suitable substrate above the normal high water level and adjacent deep-water refugia. While crocodiles prefer sandy substrates, they will often utilize canal spoil banks (Kushlan and Mazzotti 1989).

An HSI for juvenile American crocodiles was used to predict potential effects of implementation of CEPP Alt 4R2 in Florida Bay. The crocodile growth and survival index used in this analysis is one of the components of a crocodile HSI that characterizes suitable habitat for crocodiles based on habitat, location of known nest sites, salinity, and prey biomass. The growth and survival index is calculated for August through December, the period following hatching when hatchlings are most vulnerable to high salinities (Moler 1992, Mazzotti 1999, Mazzotti et al. 2007). For this analysis, data from salinity monitoring stations at Joe Bay, Trout Cove, Little Madeira Bay (the stations among the available stations closest to where the highest densities of crocodile nests are) and Long Sound, Little Blackwater Sound, Terrapin Bay, and Garfield Bight (generally closer to shoreline stations in areas where crocodiles could occur) are used as input to HSI. Each day between August 1 through December 31 is assigned a score based on the following salinity ranges: salinity <20 practical salinity units (psu) was assigned the highest score of 1 because salinity in this range is considered most favorable for juvenile crocodile growth and survival (Moler 1992, Mazzotti 1999, Mazzotti et al. 2007), salinity $\geq$ 20 and <30 psu was assigned a score of 0.6; $\geq$30 and <40 psu was assigned a score of 0.3, and >40 psu a score of 0. Average yearly and an average overall score were calculated (Brandt 2013).

Results from applying the salinity data into the juvenile crocodile HSI is shown in **Figure 6-4** (Brandt 2013). The plot shows the lift (Alt 4R2 minus existing conditions and FWO) of an index of juvenile crocodile growth and survival at sites along the northern Florida Bay shoreline for all years of the model runs. Sites in the orange box historically have had the most crocodile nesting. Results of the juvenile crocodile HSI performance for an extremely dry (1989) year are shown in **Figure 6-5.** Salinities increase during dry years, therefore, a dry year is representative of a worst case scenario. As indicated by **Figure 6-4** and **Figure 6-5**, implementation of Alt 4R2 will directly benefit juvenile crocodiles within the CEPP project area.

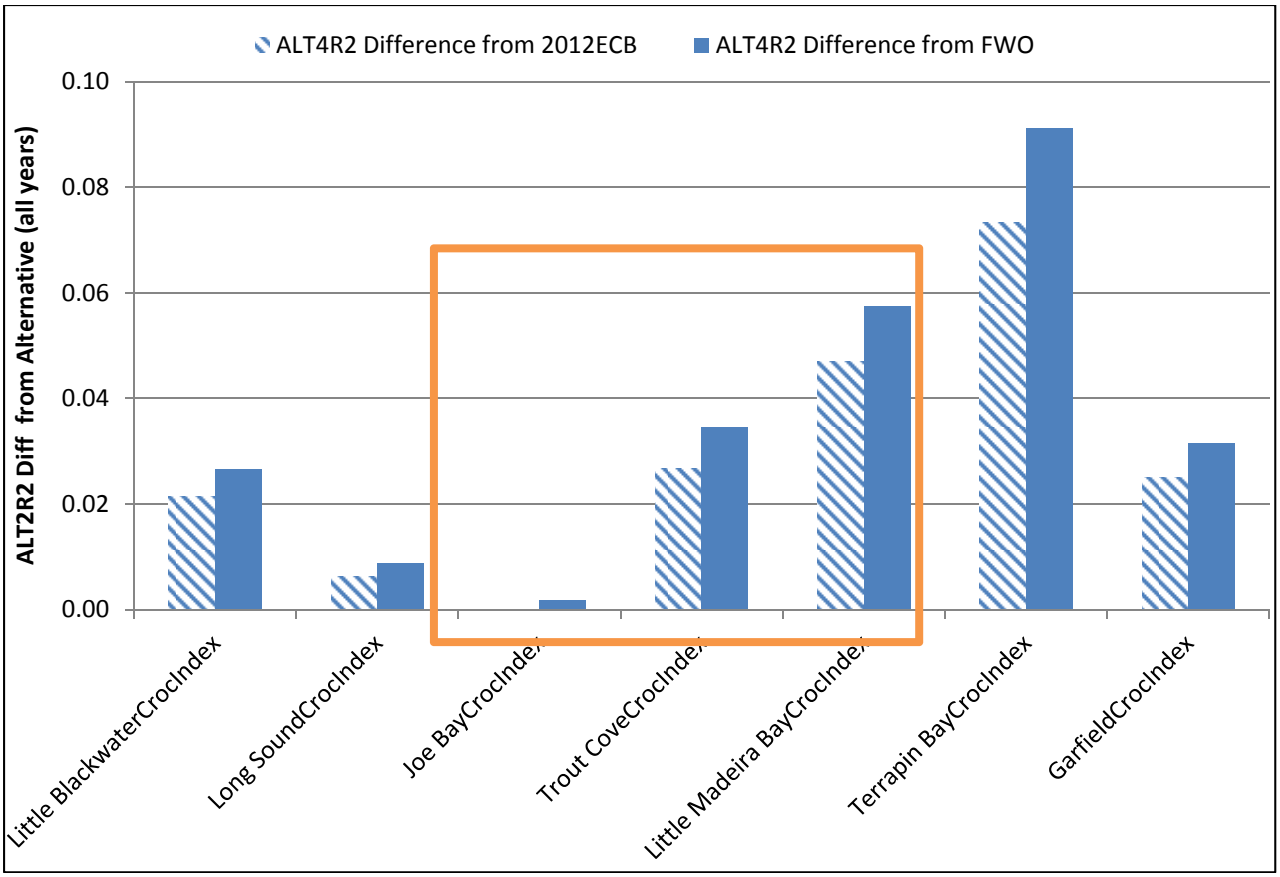


Figure 6-4. Histogram showing the results of the juvenile crocodile HSI for 7 locations of known crocodile occurrence areas across all years within Period of Record (1965-2005). Index values show lift provided by Alt 4R2 as compared with the existing conditions and FWO (Brandt 2013).

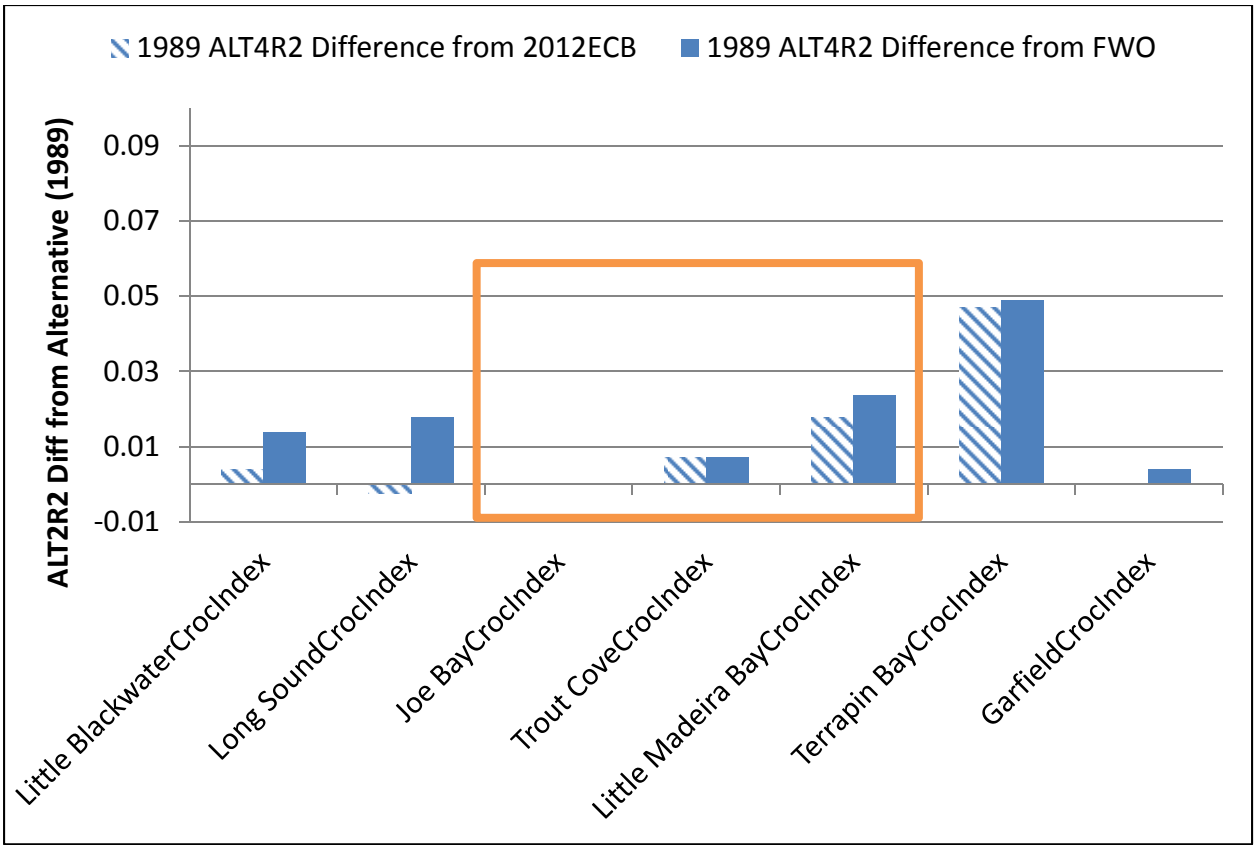


Figure 6-5. Histogram showing the results of the juvenile crocodile HSI for 7 locations of known crocodile occurrence areas for a very dry year (1989). Index values show lift provided by Alt 4R2 as compared with the existing conditions and FWO (Brandt 2013).

6.2.2.1 American Crocodile Effects Determination

Increased freshwater deliveries to ENP, Florida Bay, and Biscayne Bay are predicted to increase suitable habitat for juvenile crocodiles. Due to anticipated benefits with CEPP implementation, the Corps has determined that the project may affect American crocodile.

6.2.2.2 American Crocodile Critical Habitat

As defined in the 50 CFR 17.95 (50 parts 1 to 199, 1 October 2000), the American crocodile's critical habitat includes all land and water within the following boundary: beginning at the easternmost tip of Turkey Point, Dade County, on the coast of Biscayne Bay; then southeastward along a straight line to Christmas Point at the southernmost tip of Elliott Key; then southwestward along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Anglefish Key, Key Largo, Plantation Key, Windley Key, Upper Matecumbe Key, Lower Matecumbe Key, and Long Key; then to the westernmost tip of Middle Cape; then northward along the shore of the Gulf of Mexico to the north side of the mouth of Little Sable Creek; then eastward along a straight line to the northernmost point of Nine-Mile Pond; then northeastward along a straight line to the point of beginning. All designated American crocodile critical habitat lies within CEPP study area (**Figure 6-6**).

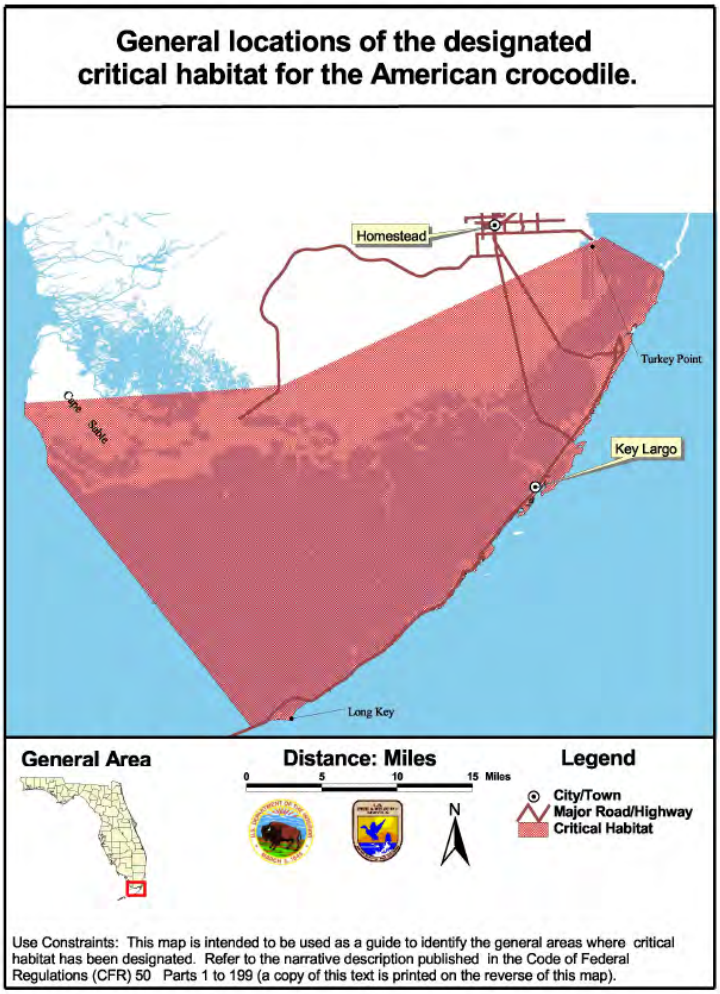


Figure 6-6. Critical habitat for American crocodile

According to 50 CFR 17.95, the easternmost tip of Turkey Point defines the northern boundary of designated critical habitat for the American crocodile and that boundary extends southwest throughout Florida Bay. Anticipated benefits of the proposed project would include improving the quality, quantity, timing, and distribution of freshwater delivered to ENP and the southern estuaries. This could potentially aid in restoring more natural salinities in estuarine habitats where critical habitat has been designated for the American crocodile. It is possible that the effects of distributing overland flow through the wetlands into Florida Bay could have positive effects on tidal wetlands and nearshore salinities that lie within American crocodile critical habitat, but these effects are expected to be minimal. Since the ideal salinity range for American crocodiles is 0 to 20 psu, project implementation has the possibility of enhancing American crocodile habitat within the project area, however, the degree to which this may occur is uncertain. Due to the expected beneficial effects from CEPP implementation, it determined that this project may affect the critical habitat for the American crocodile.

6.2.3 Eastern Indigo Snake and "May Affect" Determination

Eastern indigo snakes were listed as threatened in 1978 due primarily to habitat loss due to development. Further, as habitats become fragmented by roads, Eastern indigo snakes become increasingly vulnerable to highway mortality as they travel through their large territories (Schaefer and

Junkin 1990). Declines in Eastern indigo snake populations was also due to over-collection by the pet trade and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes (FWS 2013).

The Eastern indigo snake is the largest native non-venomous snake in North America, reaching lengths of up to 8.5 feet (Moler 1992). It is an isolated subspecies occurring in southeastern Georgia and throughout peninsular Florida. The Eastern indigo snake prefers drier habitats, but may be found in a variety of habitats including pine flatwoods, scrubby flatwoods, floodplain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muckland fields, coastal dunes, cabbage palm hammocks, and xeric sandhill communities (Schaefer and Junkin 1990, FWS 1999). Eastern indigo snakes also use agricultural lands and various types of wetlands. Observations over the last 50 years made by maintenance workers in citrus groves in east-central Florida indicate that eastern indigo snakes are most frequently observed near the canals, roads, and wet ditches (FWS 2005). It is anticipated that eastern indigo snakes would be present in sugarcane fields since one of their prey species, the King snake (*Lampropeltis getula floridanus*) has been previously documented in sugarcane fields (Krysko 2002, FWS 2005). Eastern indigo snakes need relatively large areas of undeveloped land to maintain their population. In general, adult males have larger home ranges than females or juveniles. In Florida, Smith (2003) indicated that female and male home ranges extend from 5 to 371 acres and 4 to 805 acres, respectively.

In south Florida, the Eastern indigo snake is thought to be widely distributed. Given their preference for upland habitats (Steiner et al. 1983), Eastern indigo snakes are not commonly found in great numbers in the wetland complexes of the Everglades region, even though they are found in pinelands, tropical hardwood hammocks, and mangrove forests in extreme south Florida (Duellman and Schwartz 1958, Steiner et al. 1983). They prefer dry, well drained sandy soils, and commonly use burrows and other natural holes as dens. Steiner et al. (1983) also reported that Eastern indigo snakes inhabit abandoned agricultural land and human-altered habitats in south Florida which would include levees within the Water Conservation Areas.

One of the CEPP project features to be constructed in the EAA is the A-2 FEB. This would convert approximately 14,000 acres of former agricultural land to a wetland functioning area. The proposed A-2 FEB consists almost exclusively of drained marsh that has been converted to agriculture. Only two soil types occur in the project area: Pahokee Muck and Lauderhill Muck (NRCS 2013). Both types consist of very poorly drained organic materials that commonly occur in broad freshwater marshes, which the A-2 FEB used to be and will likely be converted back to a similar habitat. Currently, the main crop is sugar cane, although rice has also been observed in some fields. A few areas have become overgrown with exotic Brazilian pepper, willow, dog fennel, and grasses including invasive exotic Napier grass.

No natural standing water features are present in the A-2 FEB project area. Natural sloughs and channels are evident in aerial photographs from the 1940s as well as those taken as recently as 2012. These natural sloughs and channels are much drier due to drainage changes, but are the first areas to be inundated during rains. Man-made drainage features such as ditches and narrow canals traverse the A-2 FEB and are continually being modified and created in response to agricultural needs.

Since Eastern indigo snakes occur primarily in upland areas, their presence within the Greater Everglades portion of the project area is somewhat limited, except within the A-2 FEB and levees throughout the project area. The hydrologic effects of the proposed project are expected to benefit existing or historic wetlands. The levees along the Miami Canal will be degraded and used to fill in the

Miami Canal. Once the Miami Canal is backfilled, created tree islands will be constructed, which would potentially provide habitat for the indigo snakes, perhaps offsetting the loss of approximately 500 acres of levee habitat. In addition, improvements to mangrove communities adjacent to Florida Bay may also benefit Eastern indigo snakes within those areas. However, eastern indigo snakes have a high probability of occurrence within the proposed A-2 FEB site and as a result of construction of the A-2 FEB are likely to be displaced, thereby removing approximately 14,500 acres of potential habitat. Therefore, the Corps' determination is that the project may affect the Eastern indigo snake.

6.2.4 Florida Manatee and "May Affect" Determination

The Florida manatee is a large, plant-eating aquatic mammal that can be found in the shallow coastal waters, rivers, and springs of Florida. The Florida manatee, *Trichechus manatus*, was listed as endangered throughout its range for both the Florida and Antillean subspecies (*T. manatus latirostris* and *T. manatus manatus*) in 1967 (32 FR 4061) and received Federal protection with the passage of the ESA in 1973. Because the Florida manatee was designated as an endangered species prior to enactment of ESA, there was no formal listing package identifying threats to the species, as required by section 4(a)(1) of the Act.

Florida manatees can be found throughout the southeastern United States. Because they are a subtropical species with little tolerance for cold, they remain near warm water sites in peninsular Florida during the winter. During periods of intense cold, Florida manatees will remain at these sites and will tend to congregate in warm springs and outfall canals associated with electric generation facilities. During warm interludes, Florida manatees move throughout the coastal waters, estuaries, bays, and rivers of both coasts of Florida and are usually found in small groups. During warmer months, Florida manatees may disperse great distances. Florida manatees have been sighted as far north as Massachusetts and as far west as Texas and in all states in between (Rathbun et al. 1982, Fertl et al. 2005). Warm weather sightings are most common in Florida and coastal Georgia. They will once again return to warmer waters when the water temperature is too cold (Hartman 1979, Stith et al. 2006). Florida manatees live in freshwater, brackish, and marine habitats, and can move freely between salinity extremes. It can be found in both clear and muddy water. Water depths of at least three to seven feet (one to two meters) are preferred and flats and shallows are avoided unless adjacent to deeper water.

Over the past centuries, the principal sources of Florida manatee mortality have been opportunistic hunting by man and deaths associated with unusually cold winters. As of July 2013, the FWC reported 672 Florida manatee deaths. Today, poaching is rare, but high mortality rates from human-related sources threaten the future of the species. In general, the largest single mortality factor is collision with boats and barges. Florida manatees also are killed in flood gates and canal locks, by entanglement or ingestion of fishing gear, and through loss of habitat and pollution (Florida Power and Light 1989). However, in 2013, most mortality was related to natural or undetermined causes (FWC 2013).

Florida manatees have been observed in conveyance canals within the project area, specifically in the lower C-111 Canal just downstream of S-197, and adjacent nearshore seagrass beds throughout Florida Bay including all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee and Buttonwood sounds. The extensive acreages of seagrass beds in the bay provide important feeding areas for Florida manatees. Florida manatees also depend upon canals as a source of freshwater and resting sites. It is highly likely that Florida manatees also depend on the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air/water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters

during the passage of winter cold fronts. **Figure 6-7** illustrates canals that Florida manatees have access to within the CEPP project area.

Under Alt 4R2, increased freshwater flows to Florida Bay and the southwestern coastal estuaries would improve salinity, therefore reducing stress on sea grasses that are important to foraging manatees. Damaging flows to the Northern Estuaries related to pulse releases would also be reduced, resulting in decreased sedimentation and silt, and increased light penetration, therefore providing better sea grass survival. Alt 4R2 includes backfilling portions of the Miami Canal north of Interstate 75, which manatees do access, however, backfilling could benefit them with less likelihood of becoming stranded in the WCAs. The Corps' determination is that CEPP may affect Florida manatee.

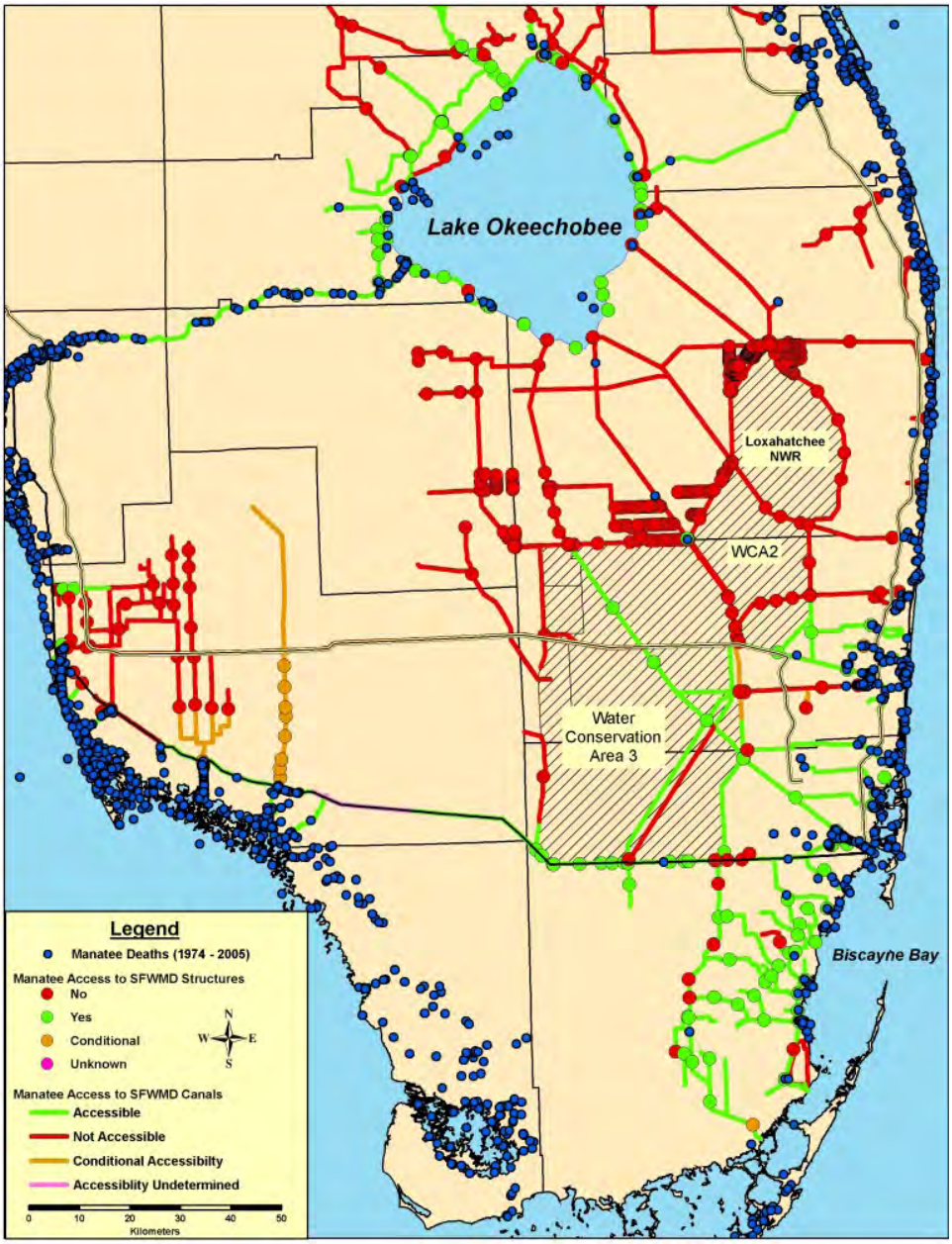


Figure 6-7. Canals that Florida manatees have access to within the Central Everglades Planning Project area

6.2.4.1 Florida Manatee Critical Habitat

Critical habitat for the Florida manatee was designated in 1976 (50 CFR 17.95). The Florida manatee's critical habitat includes all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County (**Figure 6-8)**. Another component of designated critical habitat is defined as Biscayne Bay, and all adjoining and connected lakes, rivers, canals, and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Dade County (CFR 50 Parts 1 to 199; 10-01-00). This was one of the first designations of critical habitat for an endangered species and the first for an endangered marine mammal. Critical habitat for any species is described as the specific area within the geographic area occupied by the species (at the time it is listed under the provisions of section 4 of the Act) on which are found those physical or biological features (i.e. constituent elements) essential to the conservation of the species and which may require special management considerations or protection. No specific primary or secondary constituent elements were included in the critical habitat designation. However, researchers agree that essential habitat features for the Florida manatee include seagrasses for foraging, shallow areas for resting and calving, channels for travel and migration, warm water refuges during cold weather, and fresh water for drinking (FWS 2001).

Seagrasses within Florida Bay have long suffered from high salinities due to long-term reductions of freshwater flow. Seagrasses have an optimum salinity range of 24 to 35 psu, but can tolerate considerable short-term salinity fluctuations. Reductions in the number and severity of high volume freshwater discharges to the Northern Estuaries and improvements in seasonal inflow deliveries to Florida Bay and Biscayne Bay under Alt 4R2 has the potential to improve conditions suitable for seagrass survival. In conclusion, the Corps' determination is that CEPP may affect designated critical habitat for the Florida manatee.

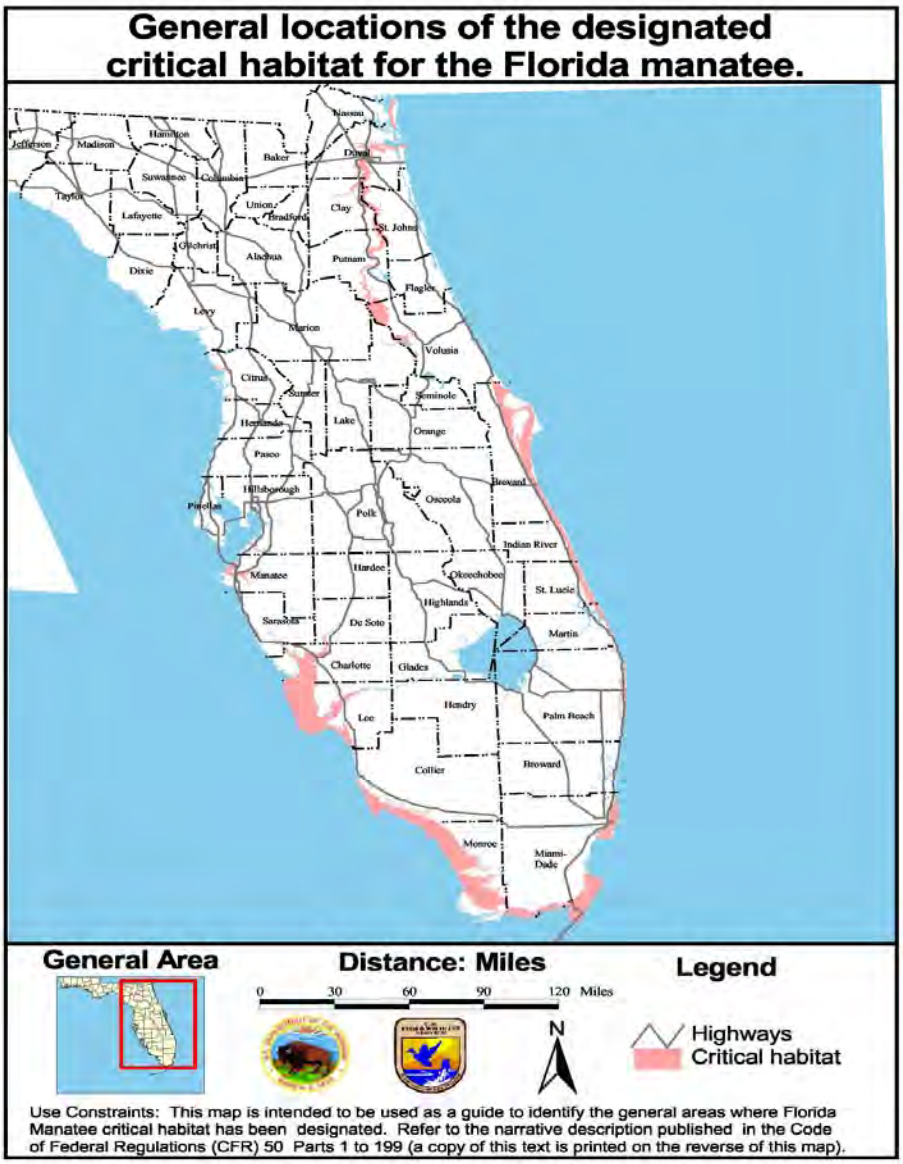


Figure 6-8. Critical habitat for Florida manatee

6.2.5 Florida Panther and "May Affect" Determination

The Florida panther, also known as cougar, mountain lion, puma, and catamount, was once the most widely distributed mammal (other than humans) in North and South America, but it is now virtually exterminated in the eastern United States. Habitat loss has driven the subspecies known as the Florida panther into a small area, where the few remaining animals are highly inbred, causing such genetic flaws as heart defects and sterility. Recently, closely-related panthers from Texas were released in Florida and are successfully breeding with the Florida panthers. Increased genetic variation and protection of habitat may save the subspecies.

One of 30 cougar subspecies, the Florida panther is tawny brown on the back and pale gray underneath, with white flecks on the head, neck, and shoulder. Male panthers weigh up to 130 pounds and females reach 70 pounds. Preferred habitat consists of cypress swamps, pine, and hardwood hammock forests. The main diet of the Florida panther consists of white-tailed deer, sometimes wild hog, rabbit, raccoon,

armadillo, and birds. Present population estimations range from 80 to 100 individuals. Florida panthers are solitary, territorial, and often travel at night. Males have a home range of up to 400 square miles and females about 50 to 100 square miles. Female panthers reach sexual maturity at about three years of age. Mating season is December through February. Gestation lasts about 90 days and females bear two to six kittens. Juvenile panthers stay with their mother for about two years. Females do not mate again until their young have dispersed. The main survival threats to the Florida panther include habitat loss due to human development and population growth, collision with vehicles, parasites, feline distemper, feline alicivirus (an upper respiratory infection), and other diseases.

Florida panthers presently inhabit lands in the EAA and ENP adjacent to the Southern Glades, and radio tracking studies have shown that they venture into the Southern Glades on occasion during post-breeding dispersion (**Figure 6-9).** Reference is made to the revised Panther Key and Panther Focus Area Map for use in determining effects to the Florida panther (**Figure 6-10**). CEPP has the potential to affect both the Primary and Secondary Zones for Florida panther habitat (**Figure 6-10**). Construction of the 14,000 acre FEB within the A-2 parcel in EAA would result in conversion of upland habitat that could be potentially used by Florida panther to transverse the area to wetland habitat, thereby eliminating potential habitat within the panther secondary zone in this region. Today, the A-2 FEB contains agricultural fields planted in sugar cane and rice. Some areas are overgrown with Brazillian pepper, willow, and dog fennel; however, most fields are regularly tilled and disked to a standard depth. In addition, increased water deliveries to ENP could affect Florida panther habitat. However, as lands within the CEPP project area become restored to their more historic natural values, the improved forage base would result in greater use by the Florida panther utilizing these areas.

Based on this information, and that the Florida panther is a wide-ranging species with the majority of sightings west of the project area, the Corp' determination is that CEPP may affect Florida panther.

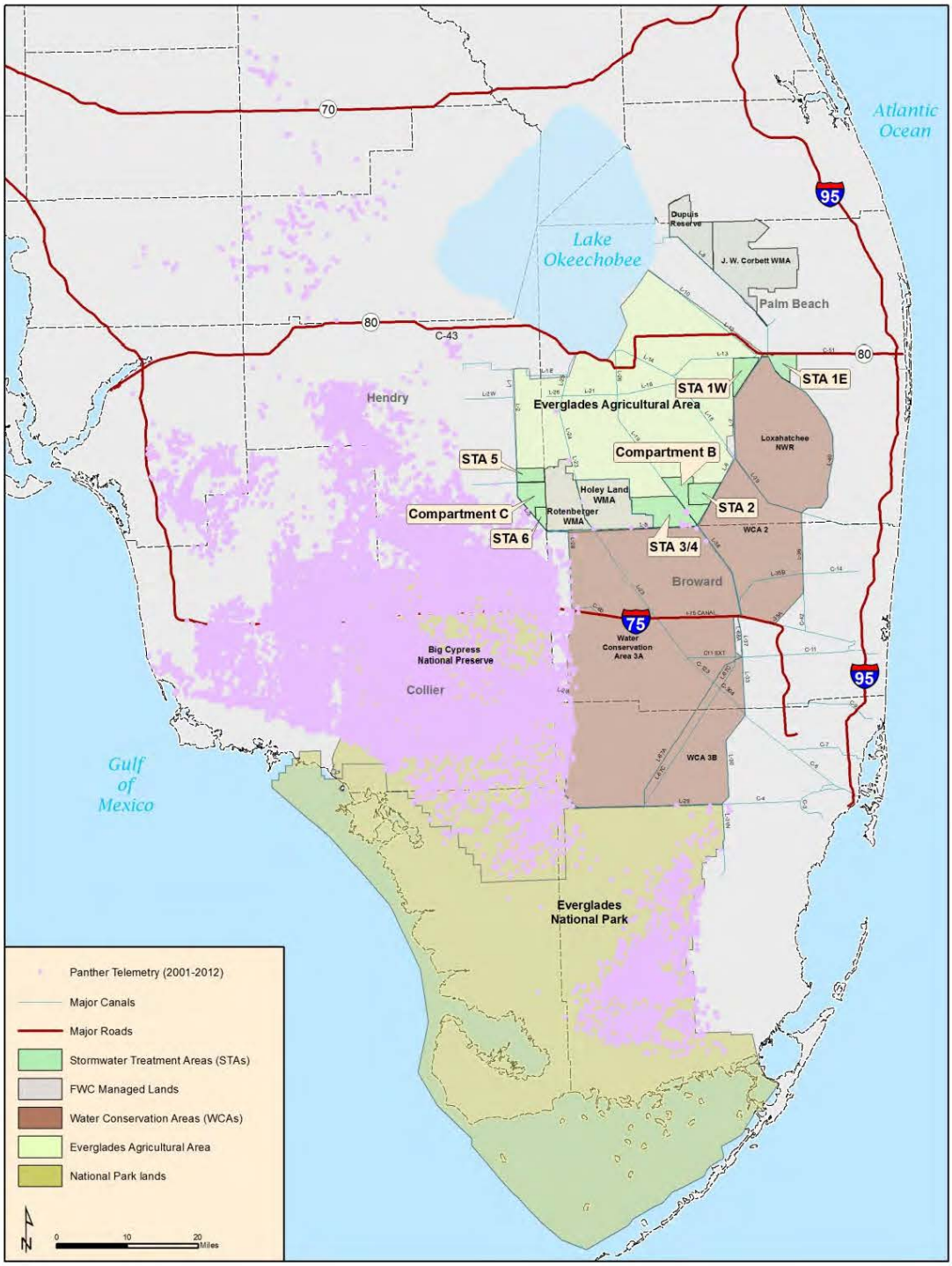


Figure 6-9. Florida panther telemetry information from 2002 – 2012

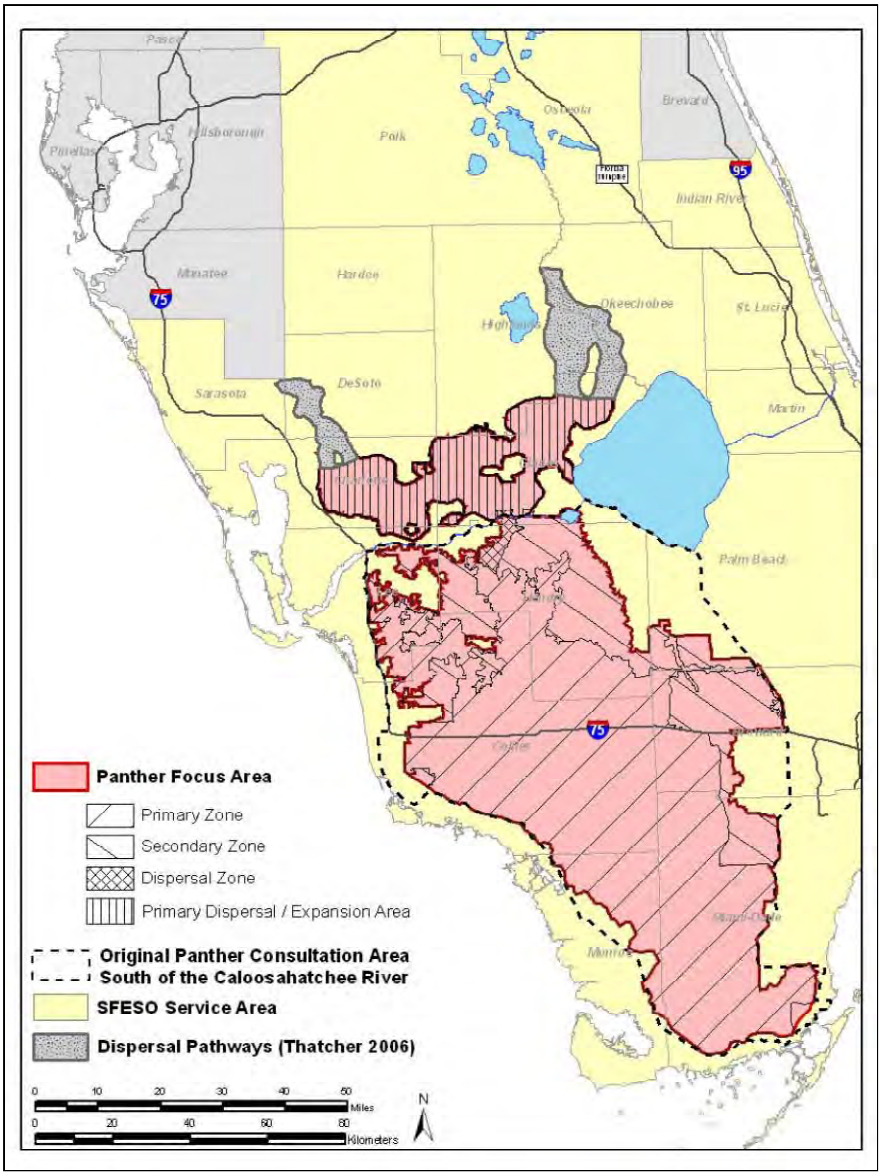


Figure 6-10. Florida panther zones in south Florida (source: Kautz et al. 2006)

6.2.6 Everglade Snail Kite and "May Affect" Determination

Background Information on Everglade Snail Kite

A wide-ranging, New World raptor, the snail kite is found primarily in lowland freshwater marshes in tropical and subtropical America from Florida, Cuba, and Mexico, and south to Argentina and Peru (FWS 1999). The Florida and Cuban subspecies of the Everglade snail kite, *R. sociabilis plumbeus,* was initially listed as endangered in 1967 due to its restricted range and highly specific diet (FWS 1999). Its survival is directly tied to the hydrology, water quality, vegetation composition and structure within the freshwater marshes that it inhabits (Martin et al. 2008, Cattau et al. 2008).

Everglade snail kite habitat consists of freshwater marshes and the shallow vegetated edges of lakes where the apple snail (*Pomacea paludosa*), the Everglade snail kite's main food source, can be found. Snail kite populations in Florida are highly nomadic and mobile; tracking favorable hydrologic conditions

and food supplies, and thus avoiding local droughts. Snail kites move widely throughout the primary wetlands of the central and southern portions of the State of Florida. Snail kite is threatened primarily by habitat loss and destruction. Widespread drainage has permanently lowered the water table in some areas. This drainage permitted development in areas that were once Everglade snail kite habitat. In addition to loss of habitat through drainage, large areas of marsh are heavily infested with water hyacinth, which inhibits the Everglade snail kite's ability to see its prey.

The Everglade snail kite has a highly specialized diet typically composed of apple snails, which are found in palustrine, emergent, long-hydroperiod wetlands. As a result, the Everglade snail kite's survival is directly dependent on the hydrology and water quality of its habitat (FWS 1999). Snail kites require foraging areas that are relatively clear and open in order to visually search for apple snails. Suitable foraging habitat for the Everglade snail kite is typically a combination of low profile marsh and a mix of shallow open water. Shallow wetlands with emergent vegetation such as spike rush (*Eleocharis* spp.), maidencane, sawgrass, and other native emergent wetland plant species provide good Everglade snail kite foraging habitat as long as the vegetation is not too dense to locate apple snails. Dense growth of plants reduces the ability of the Everglade snail kite to locate apple snails and their use of these areas is limited even when snails are in relatively high abundance (Bennetts et al. 2006). Areas of sparse emergent vegetation enable apple snails to climb near the surface to feed, breathe, and lay eggs and thus they are easily seen from the air by foraging Everglade snail kites. Suitable foraging habitats are often interspersed with tree islands or small groups of scattered shrubs and trees which serve as perching and nesting sites.

Snail kite nesting primarily occurs from December to July, with a peak in February-June, but can occur year-round. Nesting substrates include small trees such as willow, cypress (*Taxodium* spp.), and pond apple, and herbaceous vegetation such as sawgrass, cattail, bulrush (*Scirpus validus*), and reed (*Phragmites australis*). Snail kites appear to prefer woody vegetation for nesting when water levels are adequate to inundate the site (FWS 1999). Nests are more frequently placed in herbaceous vegetation during periods of low water when dry conditions beneath willow stands (which tend to grow to at higher elevations) prevent Everglade snail kites from nesting in woody vegetation (FWS 1999). Nest collapse is rare in woody vegetation but common in non-woody vegetation, especially on lake margins (FWS 1999). In order to deter predators, nesting almost always occurs over water (Sykes et al. 1995).

Snail kites construct nests using dry plant material and dry sticks, primarily from willow and wax myrtle (Sykes 1987), with a lining of green plant material that aids in incubation (FWS 1999). Courtship includes male displays to attract mates and pair bonds form from late November through early June (FWS 1999). Snail kites will lay between one and five eggs with an average of about three eggs per nest (Sykes 1995, Beissinger 1988). Each egg is laid at about a two-day interval with incubation generally commencing after the second egg is laid (Sykes 1987). Both parents incubate the eggs for a period of 24 to 30 days (Beissenger 1983). Hatching success is variable between years and between watersheds, but averages 2.3 chicks/nest (FWS 1999, Cattau et al. 2008). February, March, and April have been identified as the most successful months for hatching (Sykes 1987). Snail kites may nest more than once within a breeding season and have been documented to renest after both failed and successful nesting attempts (Sykes 1987, Beissinger 1988). Chicks are fed by both parents through the nestling period although ambisexual mate desertion has been documented (FWS 1999). Young fledge at approximately 9 to 11 weeks of age (Beissenger 1988). Adults forage no more than 6 kilometers from the nest, and generally less than a few hundred meters (Beissenger 1988, FWS 1999). When food is scarce or ecological and hydrologic conditions are unfavorable, adults may abandon the nest altogether (Sykes et al. 1995).

The Everglade snail kite occupies the watersheds of the Everglades, Kissimmee River, Caloosahatchee River, the upper St. Johns River, and Lake Okeechobee. According to the FWS (1999), "Each of these watersheds has experienced, and continues to experience, pervasive degradation due to urban development and agricultural activities." The Everglade snail kite's dependence upon each of these watersheds has shifted significantly over the last decade. Lake Okeechobee and WCA 3A, once important Everglade snail kite foraging and nesting areas, no longer support high densities of Everglade snail kites. Lake Okeechobee is of particular importance since it serves as a critical stopover point as Everglade snail kites traverse the network of wetlands within their range. This loss of suitable habitat and refugium, especially during droughts, may have significant demographic consequences (Martin et al. 2006). Once a productive breeding site, Lake Okeechobee has only made minor contributions to the Everglade snail kite population in terms of reproduction since 1996 (Cattau et al. 2008). The loss of suitable Everglade snail kite foraging and nesting areas within Lake Okeechobee have been attributed to shifts in water management regimes (Bennetts et al. 1998), along with habitat degradation due to hurricanes (Cattau et al. 2008).

Historically, WCA 3A has been a critical component within the Everglade snail kites' wetland network for foraging and reproduction. Changes in water management regimes have contributed to the lack of reproduction within this critical habitat area (Mooij et al. 2002, Zweig and Kitchens 2008, Cattau et al. 2008, 2009).

Between 2001 and 2012, Everglade snail kites were predominantly nesting in southern WCA 3A and the southeast corner of WCA 3B (**Figure 6-11**). The high dependence on one area is of concern due to stochastic events, droughts, water management regimes within the Kissimmee Chain of Lakes (KCOL), and the presence of the exotic apple snail (*Pomacea insularum*). Juvenile Everglade snail kites are not efficient at handling the exotic snail, which is larger in size than the native, and thus, their survival may be suppressed (Cattau et al. 2012).

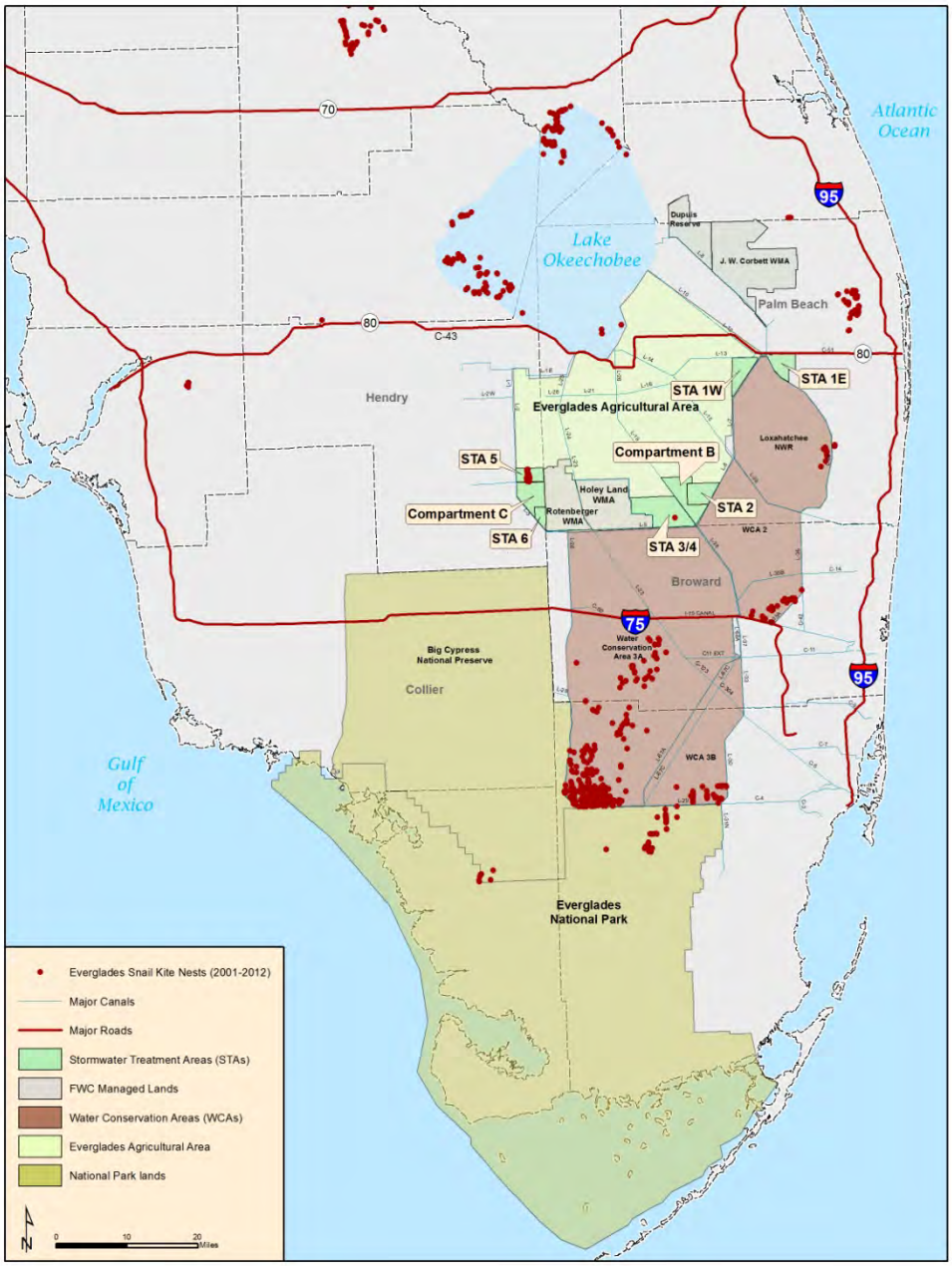


Figure 6-11. Snail kite nesting locations between 2001-2012

Recent population viability analyses predict a high probability of extinction in the next 50 years, or sooner, if current reproduction, survival, and drought frequency rates remain the same as those of the last ten years (Martin et al. 2007, Cattau et al. 2008, 2009, 2012). It is imperative to manage WCA 3A and Lake Okeechobee so that they once again become functioning components of the Everglade snail kite's network of wetlands within Florida to ensure survival of the Everglade snail kite within Florida.

The persistence of the Everglade snail kite in Florida depends upon maintaining hydrologic conditions that support the specific vegetative communities that compose their habitat along with sufficient apple snail availability across their range each year (Martin et al. 2008). WCA 3A has been previously identified as the most critical component of Everglade snail kite habitat in Florida in terms of its influence on demography (Mooij et al. 2002, Martin 2007, Martin et al. 2007). A principal concern is the lack of reproduction within this area in recent years. The Corps has funded a program to monitor nesting effort and success of the Everglade snail kite in WCA 3 since 1995 with Wiley Kitchens, Ph.D., of USGS, and the University of Florida as principal researcher. The study objectives are to track the numbers and success of Everglade snail kite nesting activities in WCA 3A as part of an on-going demographic study of the kite over its range and to identify the environmental variables related to successful breeding. The Corps is also funding Dr. Kitchens to monitor vegetation responses to altered hydrologic regimes in WCA 3A in areas of traditional Everglade snail kite nesting and foraging habitat, in accordance with recommendations in the 2006 IOP BO.

The Everglade snail kite population in Florida has progressively and dramatically decreased since 1999 (Martin et al. 2006, Cattau et al. 2008, 2009). The population essentially halved between 2000 and 2002 from approximately 3,400 to 1,700 birds; and halved again between 2006 and 2008 from approximately 1,500-1,600 birds in 2006 to approximately 685 birds in 2008. The estimated 2009 population size of 662 birds indicates that there is no sign of recovery (Cattau et al. 2009). Each decline has coincided, in part, with a severe regional drought throughout the southern portion of the Everglade snail kite's range (Martin et al. 2008, Cattau et al. 2008). Survival of both juveniles and adults rebounded shortly after the 2001 drought, but the number of young produced has not recovered from a sharp decrease that preceded the 2001 drought. Historically, the WCAs, and WCA 3A in particular, have fledged, proportionally, the large majority of young in the region. However, no young were fledged out of WCA 3A in 2001, 2005, 2007, or 2008, and only two young successfully fledged in 2009. Nesting activity is summarized in **Table 6-1** for the years 1998-2011, since the Emergency Deviations to the WCA 3A Regulation Schedule for the protection of the CSSS began in 1998. This trend of lowered regional reproduction is a cause of concern regarding the sustainability of the population. Given the 2011 population estimate (i.e. 925 birds), the extinction risk may be even greater than the previous estimate (Cattau et al. 2009). In 2010 and 2011, nesting was observed on Okeechobee for the first time since 2006, which may reflect a slight increase in habitat conditions.

Table 6-1. Successful Snail Kite Nests and the Number of Young Successfully Fledged within WCA 3A since 1998

Year	Number of Successful Nests	Number of Young Successfully Fledged
1998	84	176
1999	14	19
2000	33	56
2001	0	0
2002	22	32
2003	28	32
2004	19	29
2005	0	0
2006	13	13
2007	0	0
2008	0	0

Year	Number of Successful Nests	Number of Young Successfully Fledged
2009	1	2
2010	0	0
2011	11	11
2012	1	1

*Note: Numbers in Table 6-1 are as reported by annual surveys conducted by Wiley Kitchens, Ph.D. and his research team.

Both short-term natural disturbances (i.e. drought) and long-term habitat degradation limit the Everglade snail kite's reproductive ability. To date, most concern and interest regarding potential impacts to Everglade snail kites have focused on the higher water levels and hydroperiods, resulting in the conversion of wet prairies to sloughs within WCA 3A (Zweig 2008). The current WCA 3A Regulation Schedule does not mimic the seasonal patterns driven by the natural hydrologic cycle, resulting in water depths in WCA 3A that are too high for the period of September through January (Cattau et al. 2008). In addition, Dr. Kitchens and his research team feel that management activities associated with attempting to mitigate potential high water level impacts may well have potentially amplified those detrimental impacts to Everglade snail kite nesting and foraging activities. For example, in addition to the negative effect on reproduction, the rapid water level recession rates from the elevated stage schedule between February and July, intended to mitigate the extended hydroperiods and excessive depths between September and December, present extreme foraging difficulties to both juvenile and adult Everglade snail kites. In fact, Cattau et al. (2008) demonstrated that the recession rate had significant effects on nest success. Recession rate was defined as the stage difference between that on January 1 and the annual minimum stage divided by the number of days from January 1 to the annual minimum stage (Cattau et al. 2008).

As a result of the on-going research, Dr. Kitchens and his research team have identified three major potentially adverse effects associated with the current WCA 3A Regulation Schedule as: 1) prolonged high water levels in WCA 3A during September through January, 2) prolonged low water levels in WCA 3A during the early spring and summer, and 3) rapid recession rates.

6.2.6.1 Prolonged High Water Levels

Extreme high and low water level stressors can adversely affect snail kites throughout the species' range. Due to the legacy water management infrastructure in the highly managed C&SF system, climatic extremes cannot be entirely controlled to avoid these impacts. However, water management decisions under the current system and with the changes proposed under CEPP, have and will affect the severity and duration of these extremes. From approximately 1993 to present, which coincides with Test 7 of the MWD Experimental Program and subsequent IOP and ERTP operations, WCA 3A stages have shown relatively little annual variation compared to the previous decades, with an annual average stage of approximately 9.5 feet (2.9 meters). In addition, stages in WCA 3A have exceeded 10.5 feet (3.2 meters) in 12 of the past 17 years, while there were only approximately four occurrences of stages exceeding 10.5 feet (3.2 meters) during the 40-year period from 1953 to 1993. Stages in 1994, 1995, 1999, and 2008 also exceeded 11.5 feet (3.5 meters), and are the four highest stages within the period of record (FWS 2006).

Hydrologic modeling of IOP Alternative 7R in 2002 indicated that implementation of IOP would not relieve high water levels within WCA 3A, and in fact, would result in excessive ponding and extended

hydroperiods, further contributing to declines in the condition of nesting and foraging habitat in WCA-3A (IOP FSEIS 2006). However, in their 2002 and 2006 IOP BOs, FWS determined that IOP would adversely affect Everglade snail kites and designated Everglade snail kite critical habitat in WCA 3A, but would not likely jeopardize the species. As stated in the 2006 Final IOP BO, FWS anticipated that IOP would result in incidental take in the form of "harm" resulting from reduced ability to forage successfully due to habitat changes that affect prey availability.

High water levels during the wet season are important in maintaining quality wet prairie and emergent slough habitat (FWS 2010). However, high water levels and extended hydroperiods have resulted in vegetation shifts within WCA 3A, degrading Everglade snail kite critical habitat. The extended flooding from September to January resulting either from weather conditions, IOP, or both, appears to be shifting plant communities from wet prairies to open water sloughs (Zweig 2008, Zweig and Kitchens 2008). These shifts from one vegetation type to another may occur in a relatively short time frame (1 to 4 years) following hydrologic alteration (Armentano et al. 2006, Zweig 2008, Zweig and Kitchens 2008, Sah et al. 2008).

This vegetation transition directly affects Everglade snail kites in several ways, most importantly by reducing the amount of suitable foraging and nesting habitat, and reducing prey abundance and availability. Wetter conditions reduce the amount of woody vegetation within the area upon which Everglade snail kites rely for nesting and perch hunting. In addition, prolonged hydroperiods reduce habitat structure in the form of emergent vegetation, which is critical for apple snail aerial respiration and egg deposition (Turner 1996, Darby et al. 1999). Drying events are essential in maintaining the mosaic of vegetation types needed by a variety of wetland fauna (Sklar et al. 2002), including the Everglade snail kite (FWS 2010) and its primary food source, the apple snail (Karunaratne et al. 2006, Darby et al. 2008). However, little annual variation in water depths has occurred within WCA 3A since 1993, virtually eliminating the drying events necessary to maintain this mosaic. This is particularly apparent in southwestern WCA 3A, which has experienced excessive ponding in recent years.

A revised WCA 3A Regulation Schedule was implemented under ERTP in October 2012 to further aid in the reduction of high water levels within WCA-3A, and specifically to address the protracted flooding that occurred between September and January under IOP. The intent of expanding Zones D and E1 is to achieve the ERTP objective of managing water levels within WCA 3A for the protection of multiple species and their habitats (ERTP PM B-I). Through this modification, the Corps will have additional flexibility as compared with IOP in making water releases from WCA 3A in order to better manage recession and ascension rates, as well as to alleviate high water conditions in southern WCA 3A.

As previously discussed, water levels within portions of WCA 3A (i.e. southwestern 3A) have been too high for too long resulting in detrimental effects to vegetation, apple snails and Everglade snail kites. Under ERTP, the WCA 3A Interim Regulation Schedule Zone A has been lowered by 0.25 feet (i.e. 9.75 to 10.75 feet NGVD under IOP versus 9.50 to 10.50 feet NGVD under ERTP), thereby lowering the trigger stage for water releases from WCA 3A. By providing an additional mechanism to reduce high water levels within WCA 3A, modifications to the WCA 3A Regulation Schedule under ERTP have the potential to provide beneficial effects to the Everglade snail kite and its critical habitat within WCA 3A.

Two detrimental impacts associated with the creation of Zone E-1 observed under IOP include rapid recession rates and low water levels during the Everglade snail kite's breeding season. In order to correct these detrimental impacts under ERTP, both a recession rate and a low water level criterion have been developed. ERTP includes a recession rate criterion of 0.05 feet per week between January 1 and

June 1 (ERTP PM D) to avoid recession rates that are too rapid and thus detrimental to Everglade snail kites and apple snails. In addition, to avoid water levels that are too low at the end of the dry season, specific water depth criteria have been developed based on the stage at the WCA-3AVG. The criteria include depths favorable for Everglade snail kites, apple snails and wet prairie vegetation and were created in conjunction with the species experts (Dr. Kitchens, Dr. Darby, and Dr. Zweig) and FWS.

6.2.6.2 Prolonged Low Water Levels

Under the IOP WCA 3A Regulation Schedule, there was a high likelihood that the water levels in WCA 3A would fall below a critical threshold (below which Everglade snail kite foraging success and apple snail reproduction is severely reduced) for an extended period of time. Zone E1 was first incorporated into the WCA 3A deviation schedule under the 2000 Interim Structural and Operational Plan (ISOP) and subsequently included in IOP. The 0.5 feet (15 centimeters) reduction in the bottom zone (Zone E) of the WCA 3A Regulation Schedule was intended to help offset the effects of reduced outflows through the S-12 structures that resulted from IOP closures in the dry season and early wet season. This change resulted in a greater reduction in WCA 3A stages prior to the wet season. While this new zone may have helped to achieve the desired result of reducing high water impacts that could result from S-12 closures during the early wet season, it may have contributed to detrimental impacts to Everglade snail kite nesting and foraging within WCA 3A. During the years of ISOP and IOP operations, the low stages (as indicated by gage 3A-28) that have occurred have reached approximately 8.4 feet (2.6 meters), with the exception of 2003, when the low reached 8.9 feet (2.7 meters). In the six years prior to IOP, the low stages at Gauge 3A-28 (Site 65) had been above approximately 8.9 feet (2.7 meters) at their lowest point. A difference of 0.5 feet (15 centimeters) is not large. However, depending on where Everglade snail kites choose to nest, this difference could have a notable impact on how hydrologic conditions change near Everglade snail kite nests during the spring recession. Snail kites' reliance on the area immediately around the nest for foraging and capturing sufficient prey to feed nestlings during the two months of the nestling period make them vulnerable to rapidly changing hydrologic conditions.

Low water levels have an effect on Everglade snail kite nest success in WCA 3A (Cattau et al. 2008). If water levels become too low and food resources become too scarce, adults will abandon their nest sites and young (Sykes et al. 1995). Predation on nests is also higher when water levels are low. A strong relationship exists between annual minimum stage and juvenile Everglade snail kite survival rate (Martin et al. 2007, Cattau et al. 2008). Estimated juvenile Everglade snail kite survival rates for years when water levels fell below 10 cm was substantially lower compared to years where estimated water depths stayed above 10 cm (Cattau et al. 2008). Due to their inability to move large distances, juvenile Everglade snail kites rely upon the marshes surrounding their nests for foraging. If water levels within these marshes become too low to support foraging (due to low apple snail availability), juvenile survival will be diminished.

Recent scientific information has indicated that apple snail egg production is maximized when dry season low water levels are less than 50 cm (was previously 40 centimeters) but greater than 10 cm (Darby et al. 2002, FWS 2010). Water depths outside this range can significantly affect apple snail recruitment and survival. If water levels are less than 10 cm, apple snails cease movement and may become stranded, hence they are not only unavailable to foraging Everglade snail kites, they are also unable to successfully reproduce. Depending upon the timing and duration of the dry down, apple snail recruitment can be significantly affected by the truncation of annual egg production and stranding of juveniles (Darby et al. 2008). Since apple snails have a 1.0 to 1.5-year life span (Hanning 1979, Ferrer et al. 1990, Darby et al. 2008), they only have one opportunity (i.e. one dry season) for successful reproduction. Egg cluster production may occur from February to November (Odum 1957, Hanning

1979, Darby et al. 1999); however, approximately 77% of all apple snail egg cluster production occurs between April and June (Darby et al. 2008). Dry downs during peak apple snail egg cluster production substantially reduce recruitment (Darby et al. 2008). If possible, dry downs during this critical time frame should be avoided. The length of the dry down, age, and size of the apple snail are all important factors in apple snail recruitment and survival. Larger apple snails can survive dry downs better than smaller apple snails (Kushlan 1975, Darby et al. 2006, 2008). In fact, Darby et al. (2008) found that 70% of pre-reproductive adult-sized apple snails survived a 12-week dry down; while smaller apple snails exhibited significantly lower survival rates (less than 50% after 8 weeks dry).

There is a delicate trade-off between low and high water, and timing seems to be critical. Drying events following managed recessions have the potential to induce mortality of juvenile and adult Everglade snail kites and apple snails, whereas repeated and extended flooding tends to result in long-term degradation of the habitat, which also reduces reproduction and hinders kite recovery.

6.2.6.3 Rapid Recession Rates

Given the high water levels early in the nesting season, birds are initiating nests in upslope shallower sites. Often water managers initiate rapid recession rates to meet the target regulation schedule and avoid impacts of sustained higher water levels. These rapid recession rates have serious implications for Everglade snail kite nesting success. Breeding adults may not be able to raise their young before the water levels reach a critical low, below which apple snail availability to Everglade snail kites is drastically reduced. In addition, when water levels recede below an active Everglade snail kite nest, predation risk increases due to nest exposure to terrestrial predators (Sykes et al. 1995). As a result, nesting success is further reduced in these areas.

Rapid recession rates also result in reduced apple snail productivity. Apple snails may become stranded if water levels fall too rapidly, effectively preventing apple snails from reaching areas of deeper water. Stranded apple snails cease movement and as a result, apple snail reproduction is essentially terminated.

6.2.6.4 Potential Effects of CEPP to Snail Kite

Evaluation of potential effects to Everglade snail kites within the CEPP project area included adaptations of ERTP PMs, including depth and recession rate requirements for Everglade snail kites and apple snails, along with the Apple Snail Population Model (SFNRC 2013d) throughout a 41-year period of record (POR) from 1965 - 2005. Evaluation of critical habitat within Lake Okeechobee was not performed due to CEPP itself remaining within the Lake Okeechobee Regulation Schedule (LORS) 2008. The CEPP PIR will not be the mechanism to propose or conduct the required NEPA or biological evaluation of modifications to the LORS. However, it is expected that a revision to the current LORS 2008 schedule for Lake Okeechobee will be required prior to full utilization of the CEPP A-2 FEB feature and re-direction of the full 210,000 ac-ft/yr south to the Everglades.

ERTP PMs (PM-B, PM-C) were adapted for use in this analysis to determine potential effects on Everglade snail kite and their primary food source, Florida apple snail, due to CEPP implementation. The following methodology was used to assess depths within WCA 3A and WCA 3B:

- Analysis included Regional Simulation Model (RSM) output for ECB 2012, FWO, and Alt 4R2 for gages: 3A-NE, 3A-NW, 3A-3, 3A-4, 3A-28, 3A-SW, 3B-71, and 3B1W1 (**Figure 6-12**).
- The 2010 FWS MSTS recommended stage ranges for Everglade snail kites and apple snails were translated into recommended depth ranges.

- The RSM stage was translated to depth for each of the gages listed in step 1 using ground surface elevations provided in RSM model output (i.e. RSM stage- RSM ground surface elevation = water depth at gage).
- The RSM gage depths were then compared with 2010 FWS MSTS Everglade snail kite and apple snail recommended depth ranges for pre-breeding (December 31) and dry season low (May 1-June 1 stages) (**Table 6-2**).
- The number of times throughout the 41-year POR in which the depth were within recommended depth ranges were summed. These graphs can be found in **Table 6-3**.

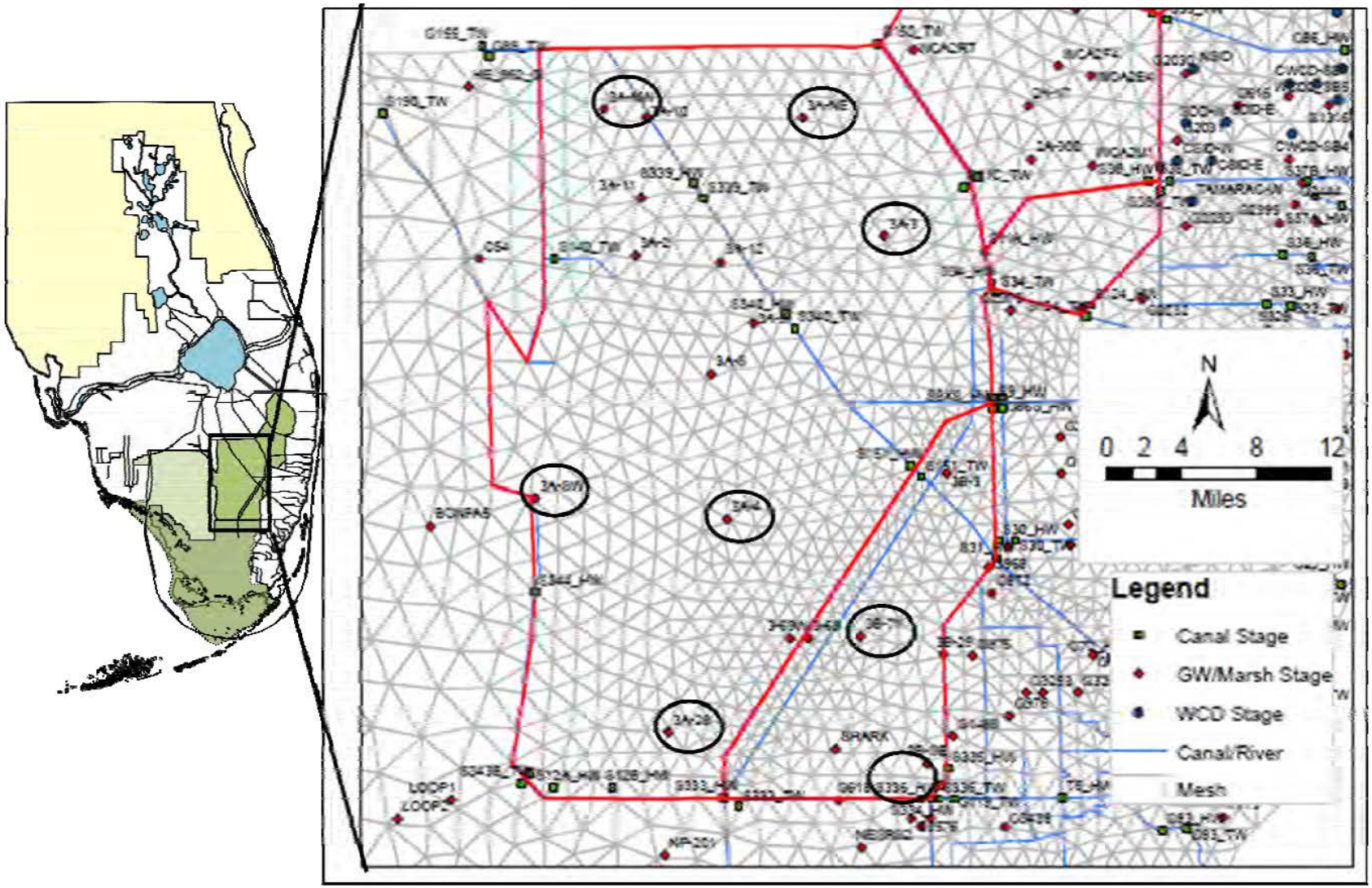


Figure 6-12. WCA 3 Gauge Locations for Snail Kite and Apple Snail Performance Measures

The number of years in which depths fell within 2010 FWS MSTS recommended ranges for Everglade snail kites and apple snails under existing conditions, FWO, and Alt 4R2 are detailed within **Table 6-2** and **Table 6-3**, respectively. As noted in **Table 6-2**, significant improvements over the existing conditions occur during the May 1 to June 1 timeframe within northern WCA 3A (3A-NW and 3A-3) as well as within WCA 3B at Gage 3B-71, while moderate increases were viewed within southwestern WCA 3A at 3A-SW, 3A-28, and in WCA 3B at 3BS1W1. Northern WCA 3A had a slight increase over the existing conditions for Gage 3A-NE. Slight declines for recommended Everglade snail kite depths were viewed within central WCA 3A at Gage 3A-4. However, it is important to note that for apple snail depth ranges a slight increase was visible at Gage 3A-4 in central WCA-3A. Significant improvements to apple snail depth ranges occurred in northern WCA 3A (3A-NE, 3A-NW, 3A-3), with a slight improvement in central WCA 3A (3A-4) and WCA 3B (3B-71 and 3BS1W1). Slight declines from existing conditions occurred in southwestern WCA 3A (3A-28 and 3A-SW) (**Table 6-3**). As noted in **Table 6-3**, there were a greater number of years across the 41-year POR in which Alt 4R2 provided depths within the 2010 FWS MSTS recommended depth range for apple snails (i.e. 1 May to 1 June: 173 across all regions for apple snails versus 84 for Everglade snail kites). This difference is largely due to the broader depth range ascribed to apple snails within the 2010 FWS MSTS as compared with that for Everglade snail kites. The apple snail depth ranges are based upon published literature from several wetland areas throughout Florida. In comparison, the depth ranges for Everglade snail kites are based on past occurrences of Everglade snail kite nesting within WCA-3A. The depth ranges for Everglade snail kite may be more narrow than the species is likely able to tolerate and thus the analysis performed likely underestimates improvements within WCA 3 for Everglade snail kites. Alt 4R2 also increased the number of times that the depth range was within recommended ranges for Everglade snail kites and apple snails within pre-breeding season except at 3A-4 for apple snails where it performed one year differently from existing conditions but the same as FWO (December 31). These pre-breeding water depths are important for a steady recession rate throughout the dry season in order to maintain within suitable depths during the dry season low (refer to 2010 FWS MSTS).

Table 6-2. Number of years in which depths fell within 2010 FWS MSTS recommended depth ranges for Everglade snail kite (ERTP PM-B)

	December 31			May 1 - June 1		
	ECB2012	**ALT 4R2**	**FWO**	**ECB2012**	**ALT 4R2**	**FWO**
Gage	3A-NE					
# years met	0	0	0	1	2	1
Gage	3A-NW					
# years met	0	11	0	3	9	3
Gage	3A-3					
# years met	8	8	9	1	17	4
Gage	3A-4					
# years met	14	14	14	13	11	11
Gage	3A-28					
# years met	3	35	2	7	9	10
Gage	3A-SW					
# years met	1	0	1	3	5	3
Gage	3B-71					

	December 31			May 1 - June 1		
	ECB2012	ALT 4R2	FWO	ECB2012	ALT 4R2	FWO
# years met	2	3	2	10	20	7
Gage	3BS1W1					
# years met	18	17	16	8	11	14
Total	46	88	44	46	84	53

Table 6-3. Number of years in which depths fell within 2010 FWS MSTS recommended depth ranges for apple snails (ERTP PM-C)

	Dec 31			May 1 – June 1		
	ECB 2012	ALT 4R2	FWO	ECB 2012	ALT 4R2	FWO
Gage	3A-NE					
# years met	0	0	0	2	20	2
Gage	3A-NW					
# years met	1	16	0	7	19	4
Gage	3A-3					
# years met	10	10	11	3	20	7
Gage	3A-4					
# years met	23	22	22	21	23	18
Gage	3A-28					
# years met	4	4	2	18	15	19
Gage	3A-SW					
# years met	2	0	2	37	31	37
Gage	3B-71					
# years met	6	6	5	25	28	5
Gage	3BS1W1					
# years met	19	21	18	13	17	13
Total	65	79	63	126	173	105

An apple snail population model was developed by Phil Darby (University of West Florida), Don DeAngelis (USGS), and Stephanie Romañach (USGS) and is being used as an Ecological Planning Tool for the CEPP. The purpose of the model is to describe the dynamics of the apple snail population a function of hydrology and temperature. The numbers and size distribution of the snails are simulated and can be calculated for any day of a year with input data. Here we present some results from the size-structured population model to simulate the response of apple snails for existing conditions and Alt 4R2 and FWO versus Alt 4R2 (**Figure 6-13 and Figure 6-14**). Conditions are presented for a dry year for each model run (Alt 4R2 and ECB 2012, and Alt 4R2 and FWO), as dry years are when restoration projects are likely to have the biggest impact, given that the system is largely rainfall driven in the wet season. Results are also shown for adult snails (> 20 mm) during the spring of a dry year, before that years' reproductive period. Adult snails during a given year are a product of egg production, and thus environmental conditions, from the previous year. End of spring results are shown as the population of snails of the size class consumed by the endangered Everglades snail kites. Based upon the results of this analysis,

implementation of Alt 4R2 provides better conditions for apple snail populations as compared to existing conditions and FWO, particularly in WCA 3A, WCA 3B, and ENP.

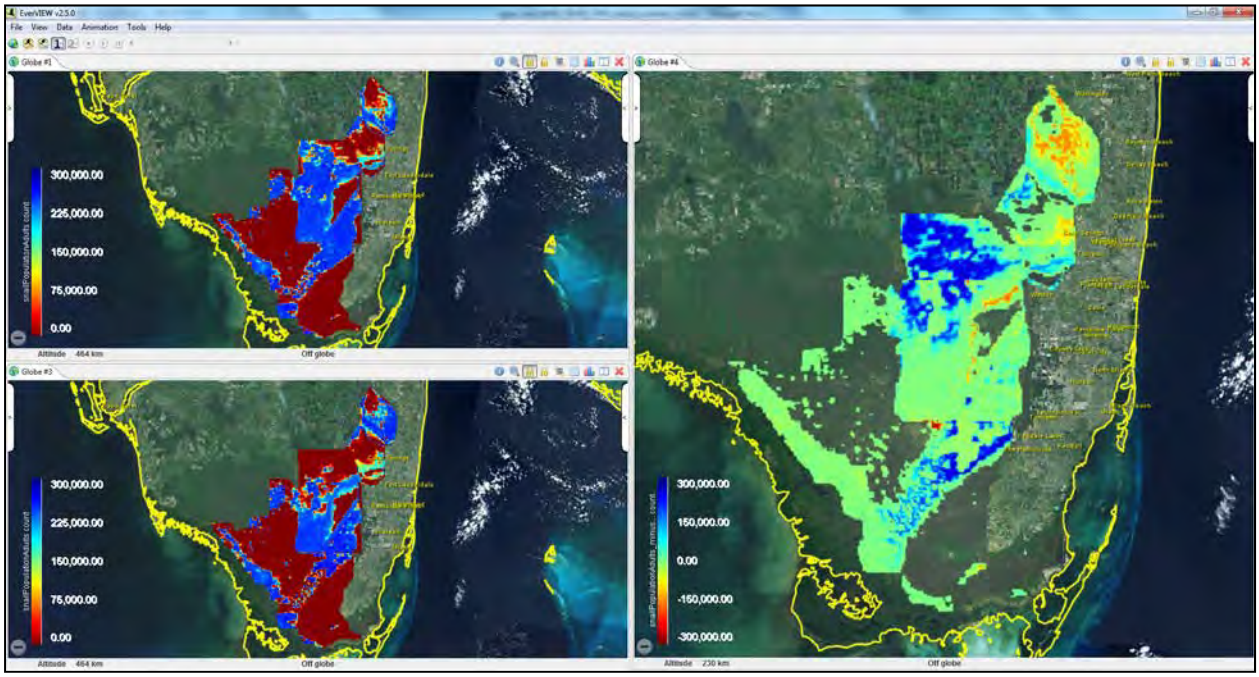


Figure 6-13. Adult snail (> 20 mm) population size as a result of Alt 4R2 (top left) vs. ECB 2012 (bottom left), and a difference map (right map panel) of Alt 4R2 minus ECB 2012.

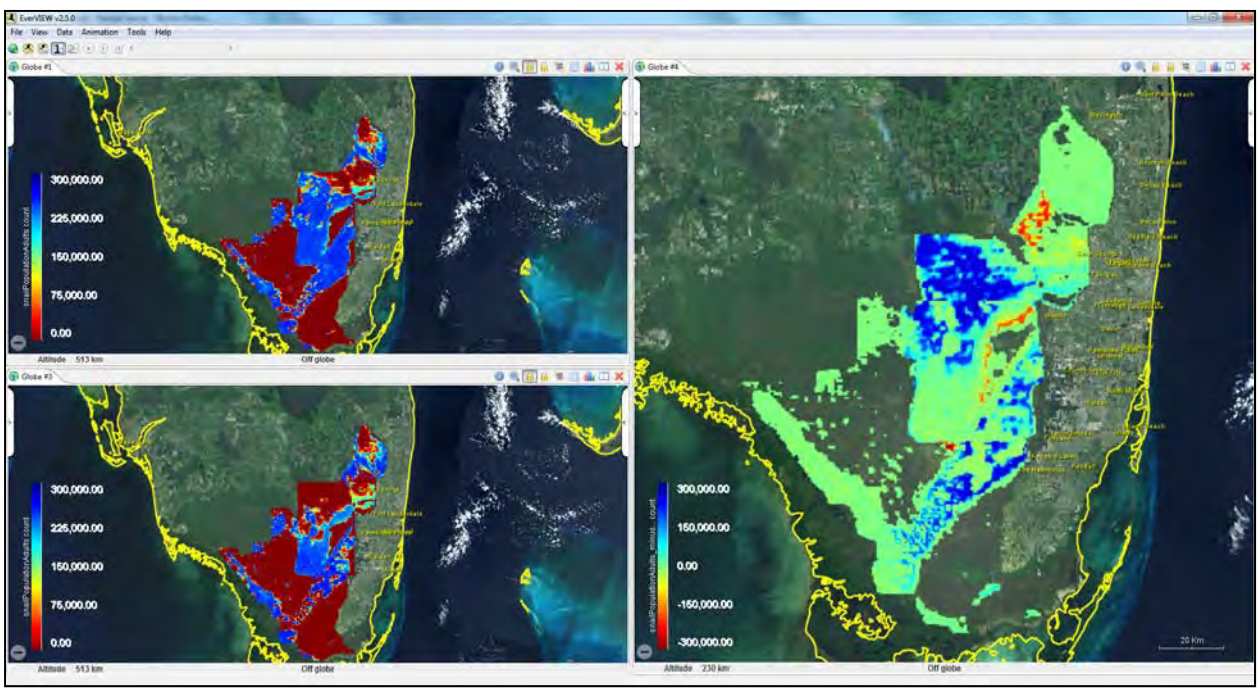


Figure 6-14. Adult snail (> 20 mm) population size as a result of Alt 4R2 (top left) vs. FWO (bottom left), and a difference map (right map panel) of Alt4R2 minus FWO.

Periphyton is a primary component of invertebrate diets, including apple snails. In addition to the potential for increased foraging opportunities, changes in vegetation resulting in expansion of wet prairie and increases in emergent vegetation would also provide habitat structure critical for apple snail aerial respiration and egg deposition (Turner 1996, Darby et al. 1999). Apple snails tend to avoid areas where water depths are greater than 50 cm (Darby et al. 2002). Avoidance of deeper depths may be related to the type and density of vegetation in deeper water areas, food availability, or energy requirements for aerial respiration (van der Walk et al. 1994, Turner 1996, Darby 1998, Darby et al. 2002). Water-lily sloughs support lower apple snail densities as compared with wet prairies (Karunaratne et al. 2006). Limited food quality and lack of emergent vegetation in sloughs may account for the lower densities. Research indicates that apple snails depend upon periphyton for food (Rich 1990, Browder et al. 1994, Sharfstein and Steinman 2001), which may be limited within deeper water environments. Karunaratne et al. (2006) observed little or no submerged macrophytes and epiphytic periphyton in the sloughs they studied in WCA 3A. In contrast, species commonly encountered within wet prairie habitat (i.e. *Eleocharis spp., Rhynchospora tracyi, Sagittaria spp*.), along with sawgrass that grows within the ecotones between the two vegetative communities, support abundant populations of epiphytic periphyton (Wetzel 1983, Browder et al. 1994, Karunaratne et al. 2006). A reduction in the number of available emergent stems for egg deposition would also contribute to the observed lower snail densities within sloughs. Drying events are needed to maintain the emergent plant species characteristic of typical apple snail habitat (Wood and Tanner 1990, Davis et al. 1994). As shown by Darby et al. (2008), apple snails can survive these events and it is the timing and duration of the dry down event that are critical determinants of apple snail survival and recruitment. CEPP would provide increased opportunities for apple snails within northern WCA 3A, and appropriate conditions for increased apple snail populations in ENP. As compared to the existing conditions and FWO, rehydration and vegetation shifts within northern WCA 3A and increased hydroperiods within WCA 3B and ENP would increase suitable habitat for apple snails, thereby increasing the spatial extent of suitable foraging opportunities for Everglade snail kites (**Table 6-3**).

6.2.6.5 Snail Kite Species Effect Determination

To improve the likelihood of successful snail kite nesting in WCA 3A, ERTP incorporated the FWS MSTS recession rate recommendation of 0.05 feet/week from January 1 until June 1 (or the onset of the wet season). CEPP used these recommendations during the planning process and ERTP PM-D was used within the analysis of CEPP alternatives. As shown in the ecological planning tool evaluations throughout this Section, Alt 4R2 performs better than both existing conditions and FWO (**Figure 6-13 and Figure 6-14**). Recession rates less than 0.05 feet/week or more than 0.05 feet but less than 0.10 foot/week are considered acceptable under certain environmental conditions. However, since rapid recession rates were identified as adversely affecting snail kite nesting in WCA 3A, recession rates that are slower than 0.05 feet/week would not have as great of a negative effect as would recession rates more than 0.05 feet but less than 0.10 feet/week. Recession rates for any given week or period of time could be determined based upon recommendations made during the WCA 3A Periodic Scientists Call. The RSMGL did not contain the ability to model flexibility and adaptive management and thus simply provides a baseline indicator of recession rates. The Corps could utilize the operational flexibility inherent within operations to achieve the recommendation.

In conclusion, with the evaluation of ERTP PMs, increased hydroperiods within northern WCA 3A, WCA 3B, and ENP as a result of CEPP implementation would have a beneficial effect on Everglade snail kite and apple snail habitat (**Table 6-1, Table 6-2, Table 6-3**). Changes in the quality, quantity, timing, and distribution of water under CEPP provides opportunities for improved vegetation in northern WCA 3A, 3B, and ENP, including expansion of sloughs and wet prairies, and contraction of sawgrass prairies. CEPP

would remain below the recommended range ascension rates for apple snails, meet FWS MSTS depth recommendations throughout much of WCA 3 and would therefore support successful apple snail oviposition. Increased periphyton would provide for an increased foraging base for the apple snails, in turn providing more foraging opportunities for the Everglade snail kite. Incorporating real-time ground monitoring and using the Periodic Scientist calls could minimize any potential negative effects to the species. The Corps has determined the project may affect Everglade snail kite.

6.2.6.6 Snail Kite Critical Habitat

Critical habitat for the Everglade snail kite was designated September 22, 1977 (42 FR 47840 47845) and includes areas of land, water, and airspace within portions of the St. Johns Reservoir, Indian River County; Cloud Lake Reservoir, St. Lucie, County; Strazzulla Reservoir, St. Lucie County; western portions of Lake Okeechobee, Glades and Hendry counties; Loxahatchee National Wildlife Refuge (WCA 1), Palm Beach County; WCA 2A, Palm Beach and Broward counties; WCA 2B, Broward County; WCA 3A, Broward and Miami-Dade counties; and ENP to the Miami-Dade/Monroe County line (**Figure 6-15)**. Because this was one of the first critical habitat designations under the ESA, there were no primary constituent elements defined. The designated area encompasses approximately 841,635 acres (340,598 hectares).

Figure 6-15. Critical habitat for Everglade snail kite

Since the designation in 1977, FWS has consulted on the loss of 18.66 acres (7.55 hectares) of critical habitat in a construction project. Construction of C&SF infrastructure resulted in impacts to less than 20 acres (8.1 hectares) of critical habitat. A FWS BO addressed the effects of construction of the Miccosukee Tribe's Government Complex Center on critical habitat, which resulted in the loss of 16.88 acres (6.83 hectares) of critical habitat. In addition, the FWS has consulted on impacts to 88,000 acres (35,612 hectares) of critical habitat resulting from prolonged flooding and temporary degradation of critical habitat because of prescribed fire. In addition to these projects, degradation of Everglade snail kite habitat has occurred because of the effects of long-term hydrologic management and eutrophication. While it is not possible to accurately estimate the changes that have occurred within each unit, approximately 40% of the original designation is estimated to be in degraded condition for Everglade snail kite nesting and foraging relative to when it was designated in 1977.

Although previously located in freshwater marshes over considerable areas of peninsular Florida, the range of the Everglade snail kite is currently more limited. This bird is now restricted to peripheral wetlands and several impoundments on the headwaters of the St. John's River, the southwest side of Lake Okeechobee, the eastern and southern portions of WCA 1, 2A, and 3, the southern portion of WCA 2B, the western edge of WCA 3B, and the northern portion of ENP.

Based upon annual surveys from 1970 to 1994, WCA 3A represents the largest and most consistently utilized portion of Everglade snail kite designated critical habitat. Over the past two decades, Everglade snail kites have shifted nesting activities to areas of higher elevation within WCA 3A in response to habitat degradation in traditional nesting areas resulting from prolonged high water levels (Bennetts et al. 1998). Nesting activity has shifted up the elevation gradient to the west, and has also moved south in response to recent increased drying rates, restricting current nesting to the southwest corner of WCA 3A (Zweig and Kitchens 2008).

Sustained high water levels have resulted in the conversion of wet prairies (preferred foraging habitat for Everglade snail kites) to aquatic sloughs in selected sites within WCA 3A, along with losses of interspersed herbaceous and woody species essential for nesting and perch hunting. Concern arose regarding sustained high water levels and their effect on the structure and function of vegetation communities in WCA 3A, portions of which are designated critical habitat for the Everglade snail kite. The principal concern is that the habitat quality, and thus the carrying capacity, of WCA 3A is already seriously degraded. Studies by Zweig (2008) and Zweig and Kitchens (2008) tend to confirm these concerns. Since 1998 and the start of water management regimes for the protection of the CSSS, Everglade snail kite production in WCA 3A has dropped (**Table 6-1**), having produced no Everglade snail kites in 2005, 2007, 2008, 2010, and only two birds in 2009 (Martin 2007, Martin et al. 2007, Cattau et al. 2009, Cattau et al. 2012). In 2011, 11 birds were reported, and in 2012 only 1 was reported. This coincides with successive annual shifts (2002, 2003, 2004, and 2005) in community types within the slough/prairies at sites reported in 2002 to be prime areas of apple snail abundance, and thus Everglade snail kite foraging, in WCA 3A. The conversion trend from emergent prairies/sloughs to deep water sloughs is certainly degradation in habitat quality for the Everglade snail kites. Habitat quality in WCA 3A is changing progressively and dramatically to less desirable habitat in this critical area, and this conversion is rapid, with changes evident in just one year (Zweig and Kitchens 2008). Potential improvements to habitat are expected with CEPP implementation due to rehydration of wetlands within northern WCA 3A and ENP. Slight improvements would be made to vegetation within southern WCA 3A and central WCA 3A is expected to remain under current conditions. The improvements would provide increased foraging and nesting habitat for the Everglade snail kite and apple snail. Water depths are not expected to change in WCA 2 or WCA 1 with implementation of CEPP.

6.2.6.7 Snail Kite Critical Habitat Effect Determination

Implementation of CEPP Alt 4R2 would have no effect on Everglade snail kite designated critical habitat within Lake Okeechobee, WCA 1, or WCA 2 because CEPP is redirecting approximately 210,000 acre feet of additional water that currently flows into the St. Lucie and Caloosahatchee Estuaries to the historical southerly flow path south through FEBs and existing STAs. The goal of CEPP is to increase hydroperiods within WCA 3 and ENP, which coincides with habitat requirements of apple snail and Everglade snail kite within WCA 3 and NESRS. In addition, implementation of Alt 4R2 substantially increased the number of years in which PM-B and PM-C were met at most gages throughout WCA 3. Based upon this information, the Corps has determined that implementation of CEPP may affect Everglade snail kite critical habitat.

6.2.7 Wood Stork and "May Affect" Determination

Background Information on the Wood Stork

The wood stork is a large, white, long-legged wading bird that relies upon shallow, freshwater wetlands for foraging. Black primary and secondary feathers, a black tail and a blackish, featherless neck distinguish the wood stork from other wading birds species. This species was federally listed as endangered under the ESA on February 28, 1984. No critical habitat has been designated for the wood stork; therefore, none will be affected.

The wood stork is found from northern Argentina, eastern Peru and western Ecuador north to Central America, Mexico, Cuba, Hispaniola, and the southeastern United States (AOU 1983). Only the population segment that breeds in the southeastern United States is listed as endangered. In the United States, wood storks were historically known to nest in all coastal states from Texas to South Carolina (Wayne 1910, Bent 1926, Howell 1932, Oberholser 1938, Cone and Hall 1970, Oberholser 1938). Dahl (1990) estimates these states lost about 38 million acres, or 45.6 percent, of their historic wetlands between the 1780s and the 1980s. However, it is important to note wetlands and wetland losses are not evenly distributed in the landscape. Hefner et al. (1994) estimated 55 percent of the 2.3 million acres of the wetlands lost in the southeastern United States between the mid-1970s and mid-1980s were located in the Gulf-Atlantic coastal flats. These wetlands were strongly preferred by wood storks as nesting habitat. Currently, wood stork nesting is known to occur in Florida, Georgia, South Carolina, and North Carolina. Breeding colonies of wood storks are currently documented in all southern Florida counties except for Okeechobee County.

The wood stork population in the southeastern United States appears to be increasing. Preliminary population totals indicate that the wood stork population has reached its highest level since it was listed as endangered in 1984. In all, approximately 11,200 wood stork pairs nested within their breeding range in the southeastern United States. Wood stork nesting was first documented in North Carolina in 2005 and wood storks have continued to nest in this state through 2009. This suggests that the northward expansion of wood stork nesting may be continuing.

The decline in the United States population of the wood stork is thought to be related to one or more of the following factors: 1) reduction in the number of available nesting sites, 2) lack of protection at nesting sites, and 3) loss of an adequate food base during the nesting season (Ogden and Nesbitt 1979). Ogden and Nesbitt (1979) indicate a reduction in nesting sites is not the cause in the population decline, because the number of nesting sites used from year to year is relatively stable. Ogden and Nesbitt suggest loss of an adequate food base is a cause of wood stork declines.

The primary cause of the wood stork population decline in the United States is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as feeding habitat by the wood stork during some portion of the year, but only a small portion of the available wetlands support foraging conditions (high prey density and favorable vegetation structure) that wood storks need to maintain growing nestlings. Browder et al. (1976) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period 1900 through 1973. They combined their data for habitat types known to be important foraging habitat for wood storks (cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and saw grass marshes) and found these habitat types have been reduced by 35 percent since 1900.

Wood storks forage primarily within freshwater marsh and wet prairie vegetation types, but can be found in a wide variety of wetland types, as long as prey are available and the water is shallow and open enough to hunt successfully (Ogden et al. 1978, Coulter 1987, Gawlik and Crozier 2004, Herring and Gawlik 2007). Calm water, about 5 to 25 cm in depth, and free of dense aquatic vegetation is ideal, however, wood storks have been observed foraging in ponds up to 40 centimeters in depth (Coulter and Bryan 1993, Gawlik 2002). Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter et al. 1999, Coulter and Bryan 1993, Herring and Gawlik 2007). During nesting, these areas must also be sufficiently close to the colony to allow wood storks to efficiently deliver prey to nestlings.

Wood storks feed almost entirely on fish between 2 and 25 cm (1 to 10 inches) in length (Kahl 1964, Ogden et al. 1976, Coulter 1987) but may occasionally consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Wood storks generally use a specialized feeding behavior called tactilocation, or grope feeding, but also forage visually under some conditions (Kushlan 1979). Wood storks typically wade through the water with their beaks immersed and open about 7 to 8 centimeters (2.5 to 3.5 inches). When the wood stork encounters prey within its bill, the mandibles snap shut, the head is raised, and the food swallowed (Kahl 1964). Occasionally, wood storks stir the water with their feet in an attempt to startle hiding prey (Rand 1956, Kahl 1964, Kushlan 1979). This foraging method allows them to forage effectively in turbid waters, at night, and under other conditions when other wading birds that employ visual foraging may not be able to forage successfully.

Studies on fish consumed by wood storks have shown that wood storks are highly selective in their feeding habits with sunfish and four other species of fish comprising the majority of their diet (Ogden et al. 1976). Ogden et al. (1976, 1978) noted that the key species consumed by wood storks included sunfishes (Centrarchidae), yellow bullhead (*Italurus natalis*), marsh killifish (*Fundulus confluentus*), flagfish (*Jordenella floridae*) and sailfin molly (*Poecilia latipinna*).

These species were also observed to be consumed in much greater proportions than they occur at feeding sites, and abundant smaller species (i.e., mosquitofish (*Gambusia* spp.), least killifish (*Heterandria formosa*), bluefin killifish (*Lucania goodei*) are under-represented, which the researchers believed was probably because their small size does not elicit a bill-snapping reflex in these tactile feeders (Coulter et al. 1999). Their studies also showed that in addition to selecting larger species of fish, wood storks consumed individuals that are significantly larger (greater than 3.5 cm) than the mean size available (2.5 centimeters), and many were greater than one-year old (Ogden et al. 1976, Coulter et al. 1999).

Hydrologic and environmental characteristics have strong effects on fish density, and these factors may be some of the most significant in determining foraging habitat suitability, particularly in southern Florida. Within the wetland systems of southern Florida, the annual hydrologic pattern is very consistent, with water levels rising over three feet during the wet season (June-September), and then receding gradually during the dry season (October-May). Wood storks nest during the dry season, and rely on the drying wetlands to concentrate prey items in the ever-narrowing wetlands (Kahl 1964). Because of the continual change in water levels during the wood stork nesting period, any one site may only be suitable for wood stork foraging for a narrow window of time when wetlands have sufficiently dried to begin concentrating prey and making water depths suitable for storks to access the wetlands (Gawlik 2002, Gawlik et al. 2004). Once the wetland has dried to where water levels are near the

ground surface, the area is no longer suitable for wood stork foraging, and will not be suitable until water levels rise and the area is again repopulated with fish. Consequently, there is a general progression in the suitability of wetlands for foraging based on their hydroperiods, with the short hydroperiod wetlands being used early in the season, the mid-range hydroperiod sites being used during the middle of the nesting season, and the longest hydroperiod areas being used later in the season (Kahl 1964, Gawlik 2002).

In addition to the concentration of fish due to normal drying, several other factors affect fish abundance in potential foraging habitats. Longer hydroperiod areas generally support more fish and larger fish (Trexler et al. 2000, Turner et al. 1999). In addition, nutrient enrichment (primarily phosphorus) within the oligotrophic Everglades wetlands generally results in increased density and biomass of fish in potential wood stork foraging sites (Rehage and Trexler 2006), and distances from dry-season refugia, such as canals, alligator holes, and similar long hydroperiod sites also affect fish density and biomass. Within the highly modified environments of southern Florida, fish availability varies with respect to hydrologic gradients, nutrient availability gradients, and it becomes very difficult to predict fish density. The foraging habitat for most wood stork colonies within southern Florida includes a wide variety of hydroperiod classes, nutrient conditions, and spatial variability.

Researchers have shown that wood storks forage most efficiently and effectively in habitats where prey densities are high, the water shallow and canopy open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Wood stork prey availability is dependent on a composite variable consisting of density (number or biomass/m^2) and the vulnerability of the prey items to capture (Gawlik 2002). For wood storks, prey vulnerability appears to be largely controlled by physical access to the foraging site, water depth, the density of submerged vegetation, and the species-specific characteristics of the prey. For example, fish populations may be very dense, but not available (vulnerable) because the water depth is too great (greater than 30 cm) for storks or the tree canopy at the site is too dense for wood storks to land.

Dense submerged and emergent vegetation may reduce foraging suitability by preventing wood storks from moving through the habitat and interfering with prey detection (Coulter and Bryan 1993). Some submerged and emergent vegetation does not detrimentally affect wood stork foraging, and may be important to maintaining fish populations. Wood storks tend to select foraging areas that have an open canopy, but occasionally use sites with 50 to 100 percent canopy closure (Coulter and Bryan 1993, Coulter et al. 1999). Foraging sites with open canopies are more easily detected from overhead as wood storks are searching for food.

Gawlik (2002) characterized wood storks as “searchers” that employ a foraging strategy of seeking out areas of high density prey and optimal (shallow) water depths, and abandoning foraging sites when prey density begins to decrease below a particular efficiency threshold, but while prey was still sufficiently available that other wading bird species were still foraging in large numbers (Gawlik 2002). Wood stork choice of foraging sites was significantly related to both prey density and water depth (Gawlik 2002). Because of this strategy, wood stork foraging opportunities are more constrained than many of the other wading bird species (Gawlik 2002).

Wood storks generally forage in wetlands between 0.5 kilometer and 74.5 kilometer away from the colony site (Bryan and Coulter 1987, Herring and Gawlik 2007), but forage most frequently within 10-20 kilometer (12 miles) of the colony (Coulter and Bryan 1993, Herring and Gawlik 2007). Maintaining this wide range of feeding site options ensures sufficient wetlands of all sizes and varying hydroperiods are

available, during shifts in seasonal and annual rainfall and surface water patterns, to support wood storks. Adults feed farthest from the nesting site prior to laying eggs, forage in wetlands closer to the colony site during incubation and early stages of raising the young, and then farther away again when the young are able to fly. Wood storks generally use wet prairie ponds early in the dry season then shift to slough ponds later in the dry season thus following water levels as they recede into the ground (Browder 1984).

Wood stork nesting habitat consists of mangroves as low as 1 meter (3 feet), cypress as tall as 30.5 meters (100 feet), and various other live or dead shrubs or trees located in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Rodgers et al. 1997, Coulter et al. 1999). Wood storks nest colonially, often in conjunction with other wading bird species, and generally occupy the large-diameter trees at a colony site (Rodgers et al. 1995). **Figure 6-16** shows the locations of wood stork colonies throughout Florida. The same colony site will be used for many years as long as the colony is undisturbed and sufficient foraging habitat remains in the surrounding wetlands. However, not all wood storks nesting in a colony will return to the same site in subsequent years (Kushlan and Frohring 1986). Natural wetland nesting sites may be abandoned if surface water is removed from beneath the trees during the nesting season (Rodgers et al. 1995). In response to this type of change to nest site hydrology, wood storks may abandon that site and establish a breeding colony in managed or impounded wetlands (Ogden 1991). Wood storks that abandon a colony early in the nesting season due to unsuitable hydrologic conditions may re-nest in other nearby areas (Borkhataria et al. 2004, Crozier and Cook 2004).

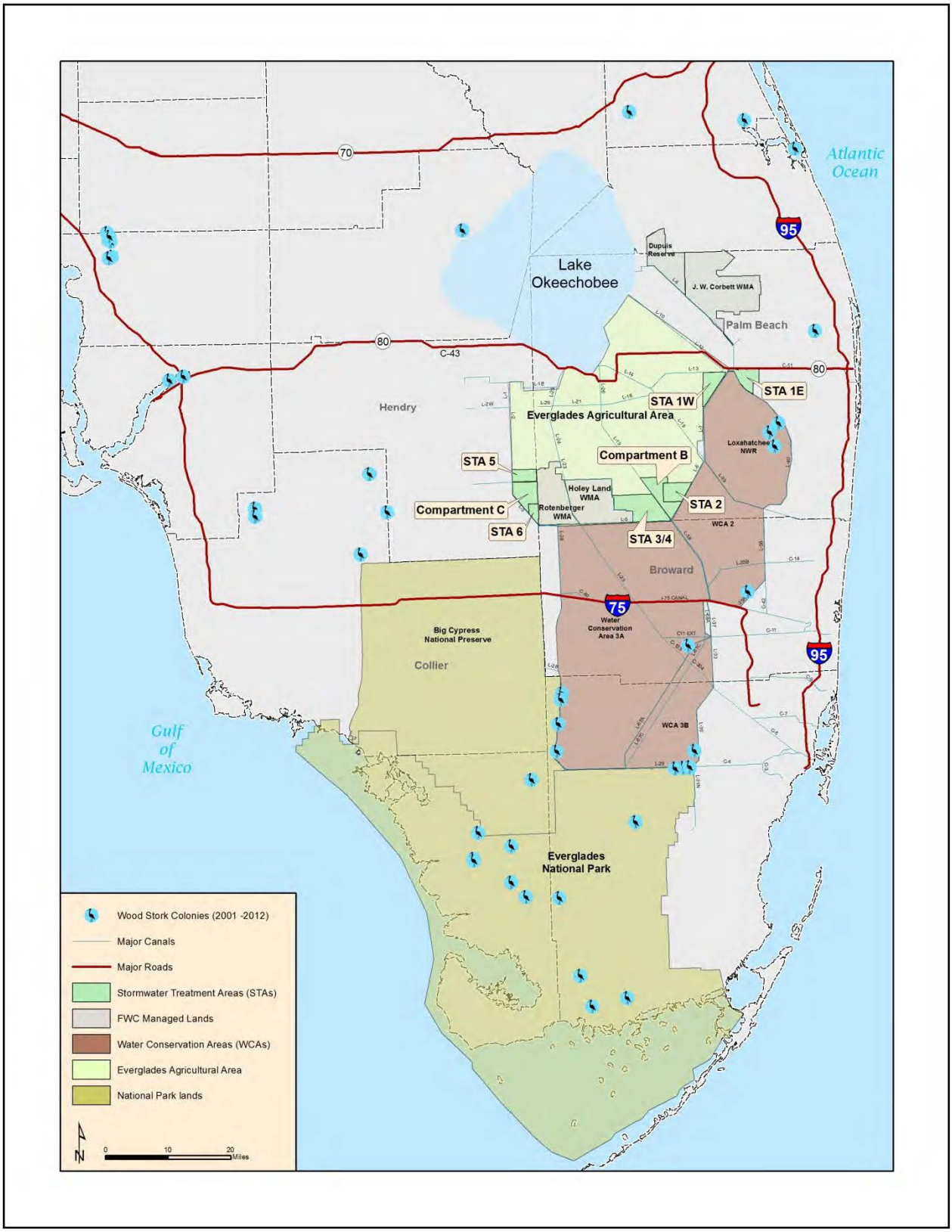


Figure 6-16. Location of wood stork colonies in Florida between 2001-2012

The wood stork life history strategy has been characterized as a "bet-hedging" strategy (Hylton et al. 2006) in which high adult survival rates and the capability of relatively high reproductive output under favorable conditions allow the species to persist during poor conditions and capitalize on favorable environmental conditions. This life-history strategy may be adapted to variable environments (Hylton et al. 2006) such as the wetland systems of southern Florida. Nest initiation date, colony size, nest abandonment, and fledging success of a wood stork colony vary from year to year based on availability of suitable wetland foraging areas, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (Frederick and Ogden 2001). While the majority of wood stork nesting occurs within traditional wood stork rookeries, a handful of new wood stork nesting colonies are discovered each year (Meyer and Frederick 2004, SFWMD 2004, 2009). These new colony locations may represent temporary shifts of historic colonies due to changes in local conditions, or they may represent formation of new colonies in areas where conditions have improved.

Breeding wood storks are believed to form new pair bonds every season. First age of breeding has been documented in 3- to 4-year-old birds but the average first age of breeding is unknown. Eggs are laid as early as October in south Florida and as late as June in north Florida (Rodgers 1990, FWS 1999). A single clutch of two to five (average three) eggs is laid per breeding season but a second clutch may be laid if a nest failure occurs early in the breeding season (Coulter et al. 1999). There is variation among years in the clutch sizes, and clutch size does not appear to be related to longitude, nest data, nesting density, or nesting numbers, and may be related to habitat conditions at the time of laying (Frederick 2009, Frederick et al. 2009). Egg laying is staggered and incubation, which lasts approximately 30 days, begins after the first egg is laid. Therefore, the eggs hatch at different times and the nestlings vary in size (Coulter et al. 1999). In the event of diminished foraging conditions, the youngest birds generally do not survive.

The young fledge in approximately eight weeks but will stay at the nest for three to four more weeks to be fed. Adults feed the young by regurgitating whole fish into the bottom of the nest about three to ten times per day. Feedings are more frequent when the birds are young (Coulter et al. 1999). When wood storks are forced to fly great distances to locate food, feedings are less frequent (Bryan et al. 1995). The total nesting period from courtship and nest-building through independence of young, lasts approximately 100 to 120 days (Coulter et al. 1999). Within a colony, nest initiation may be asynchronous, and consequently, a colony may contain active breeding wood storks for a period significantly longer than the 120 days required for a pair to raise young to independence. Adults and independent young may continue to forage around the colony site for a relatively short period following the completion of breeding. Appropriate water depths for successful foraging are particularly important for newly fledged juveniles (Borkhataria et al. 2008).

Wood storks produce an average of 1.29 fledglings per nest and 0.42 fledglings per egg which is a probability of survivorship from egg laying to fledgling of 42 percent (Rodgers and Schwikert 1997). However, in 2009, which was a banner year for nesting, over 2.6 young fledged from successful nests (Frederick et al. 2009). The greatest losses occur from egg laying to hatching with a 30 percent loss of the nest productivity. From hatching to nestlings of two weeks of age, nest productivity loss is an additional 8%. Corresponding losses for the remainder of the nesting cycles are on the average of a 6% per two week increase in age of the nestling (Rodgers and Schwikert 1997).

Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964, Kushlan et al. 1975) to sustain successful wood stork nesting. During the period when a nesting colony is active, wood storks are dependent on consistent foraging opportunities in wetlands

within their core foraging area (30 kilometer radius, FWS 2010) surrounding a nest site. The greatest energy demands occur during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). The average wood stork family requires 201 kilograms (443 pounds) of fish during the breeding season, with 50 percent of the nestling stork's food requirement occurring during the middle third of the nestling period (Kahl 1964). Although the short hydroperiod wetlands support fewer fish and lower fish biomass per unit area than long hydroperiod wetlands, these short hydroperiod wetlands were historically more extensive and provided foraging areas for wood storks during colony establishment, courtship and nest-building, egg-laying, incubation, and the early stages of nestling provisioning. This period corresponds to the greatest periods of nest failure (*i.e.* 30 percent and 8%, respectively from egg laying to hatching and from hatching to nestling survival to two weeks) (Rodgers and Schwikert 1997).

The annual climatological pattern that appears to stimulate the heaviest nesting efforts by wood storks is a combination of the average or above-average rainfall during the summer rainy season prior to colony formation and an absence of unusually rainy or cold weather during the following winter-spring nesting season. This pattern produces widespread and prolonged flooding of summer marshes that maximizes production of freshwater fishes, followed by steady drying that concentrates fish during the dry season when storks nest (Kahl 1964, Frederick et al. 2009). However, frequent heavy rains during nesting can cause water levels to increase rapidly. The abrupt increases in water levels during nesting, termed reversals (Crozier and Gawlik 2004), may cause nest abandonment, re-nesting, late nest initiation, and poor fledging success. Abandonment and poor fledging success was reported to have affected most wading bird colonies in southern Florida during 2004, 2005 and 2008 (Crozier and Cook 2004, Cook and Call 2005, SFWMD 2008).

Following the completion of the nesting season, both adult and fledgling wood storks generally begin to disperse away from the nesting colony. Fledglings have relatively high mortality rates within the first six months following fledging, most likely as a result of their lack of experience, including the selection of poor foraging locations (Hylton et al. 2006, Borkhataria et al. 2008). Post-fledging survival also appears to be variable among years, probably reflecting the environmental variability that affects wood storks and their ability to forage (Hylton et al. 2006, Borkhataria et al. 2008).

In southern Florida, both adult and juvenile wood storks consistently disperse northward following fledging in what has been described as a mass exodus (Kahl 1964). Wood storks in central Florida also appear to move northward following the completion of breeding, but generally do not move as far (Coulter et al. 1999). Many of the juvenile wood storks from southern Florida move far beyond Florida into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999, Borkhataria et al. 2004, Borkhataria et al. 2006). Some flocks of juvenile wood storks have also been reported to move well beyond the breeding range of wood storks in the months following fledging (Kahl 1964). This post-breeding northward movement appears consistent across years.

Both adult and juvenile wood storks return southward in the late fall and early winter months. In a study using satellite telemetry, Borkhataria et al. (2006) reported that nearly all wood storks that had been tagged in the southeastern United States moved into Florida near the beginning of the dry season, including all sub-adult storks that fledged from Florida and Georgia colonies. Adult wood storks that breed in Georgia remained in Florida until March, and then moved back to northern breeding colonies (Borkhataria et al. 2006). Overall, about 75 percent of all locations of radio-tagged wood storks occurred within Florida (Borkhataria et al. 2006). Preliminary analyses of the range-wide occurrence of wood storks in December, recorded during the annual Christmas bird surveys, suggest that the vast

majority of the southeastern United States wood stork population occurs in central and southern Florida. Relative abundance of wood storks in this region was 10 to 100 times higher than in northern Florida and Georgia (FWS, unpublished data). As a result of these general population-level movement patterns, during the earlier period of the wood stork breeding season in southern Florida, the wetlands upon which nesting wood storks depend are also being heavily used by a large portion of the southeastern United States wood stork population, including storks that breed in Georgia and the Carolinas, and sub-adult storks from throughout the wood stork's range. In addition, these same wetlands support a wide variety of other wading bird species (Gawlik 2002).

The original Everglades ecosystem, including the WCAs, provided abundant primary and secondary wading bird production during the summer and fall months (Holling et al. 1994). This productivity was concentrated during the dry season when water levels receded. The concentrations of food provided ideal foraging habitat for numerous wetlands species, especially large flocks of wading birds (Bancroft 1989, Ogden 1994). However, the hydrology of the Everglades ecosystem and WCA-3A has been severely altered by extensive drainage and the construction of canals and levees (Abbott and Nath 1996). The resulting system is not only spatially smaller, but also drier than historical levels (Walters et al. 1992). Breeding populations of wading birds have responded negatively to the altered hydrology (Ogden 1994, Kushlan and Fohring 1986, Bancroft 1989).

In most years within the vicinity of NESRS, IOP resulted in reduced stages during the dry season because of constraints on inflows. This may have caused increased recession rates in this area resulting in a reduction in the amount of suitable foraging habitat available near the end of wood stork nesting in the late dry season when stages in that area reached their lowest levels. In addition, reduced flows had the potential to result in the risk of drying below the Tamiami West wood stork colony potentially increasing nest depredation rates and risk of nest abandonment, particularly in drier-than-average years. The close proximity of the colony to the L-29 Canal helped to reduce the risk of drying below the colony because canal stages were maintained at a relatively stable level throughout the dry season. Modeling also indicated that IOP would occasionally result in increased water levels in NESRS during the spring dry season (2006 IOP FSEIS). These conditions presumably occurred when stages were sufficiently low that the G-3273 constraint did not restrict inflows, and water from WCA 3A was diverted into NESRS through the S-333 structure. In these cases, water levels within NESRS, in the immediate vicinity of the Tamiami West wood stork colony, would rise by up to one foot during the period when wood storks were nesting and when water levels were generally receding throughout the system. This results in an artificial reversal and would cause a reduction in wood stork foraging conditions in areas near the colony, and may be significant enough to cause colony abandonment. Because the foraging radius of the Tamiami West colony includes parts of WCA 3A and WCA 3B, ENP, the Pennsuco Wetlands, and urban areas, sufficient foraging opportunities remained in other areas to offset the poor foraging conditions that result from IOP in NESRS, but some reduction in foraging opportunities was expected.

Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964, Kushlan et al. 1975) to sustain successful wood stork nesting. During the period when a nesting colony is active, wood storks are dependent on consistent foraging opportunities in wetlands within their core foraging area (30 kilometer radius, FWS 2010) surrounding a nest site. The greatest energy demands occur during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). Although the short hydroperiod wetlands support fewer fish and lower fish biomass per unit area than long hydroperiod wetlands, these short hydroperiod wetlands were historically more extensive and provided foraging areas for wood storks during colony establishment, courtship and nest-building, egg-laying, incubation, and the early stages of nestling provisioning. This period corresponds to

the greatest periods of nest failure (i.e. 30 percent and 8%, respectively from egg laying to hatching and from hatching to nestling survival to two weeks) (Rodgers and Schwikert 1997).

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Historically, the short hydroperiod wetlands within ENP have been important for wood stork foraging during the pre-breeding season with the storks shifting to longer hydroperiod wetlands as the dry season progresses. ERTP ET-2 provides for a hydroperiod requirement between 90-210 days within CSSS habitat and thus would help to produce a mosaic of wetlands of varying hydroperiods within ENP. Hydrologic patterns that produce a maximum number of patches with high prey availability (i.e. high water levels at the end of the wet season and low water levels at the end of the dry season) are necessary for high reproductive outputs (Gawlik 2002, Gawlik et al. 2004). Depending upon the elevation and microtopography throughout the WCAs and ENP, implementation of CEPP will produce a variety of wetland habitats that would support prey densities conducive to successful wood stork foraging and nesting.

6.2.7.1 Potential Effects to the Wood Stork

Wood storks rely upon short hydroperiod wetlands (i.e. marl prairies) for pre-breeding foraging. Short hydroperiod wetlands would help increase body condition and would allow for wood storks and other wading birds to initiate nesting earlier than they do now (November versus February). This will improve nesting success by reducing potential for nest abandonment, increasing juvenile survival by ensuring prey are available within CFA and allowing juveniles to fledge prior to end of dry season/start of wet season when food availability decreases around nests.

Several models of wading birds were used to assess potential affects to wading birds within the Greater Everglades as a result of implementation of CEPP Alt 4R2 including: 1) Wood Stork Foraging Probability Index model (ENP 2012, 2013) 2) wading bird species distribution (Beerens 2013), and 3) wading bird nesting success (Beerens 2013). ERTP PMs are captured within the Beerens models.

A Wood Stork Foraging Probability Index model (ENP 2013) was used to assess potential affects to wading birds within the Greater Everglades as a result of CEPP implementation. An analysis of wood stork foraging potential was performed to predict how foraging habitat with CEPP implementation would be affected (ENP 2013). The Wood Stork Foraging Probability Index (STORKI v. 1.0) was

developed to provide rapid simulations of wood stork foraging conditions in response to modeled CERP scenarios (LoGalbo et al. 2012).

Figure 6-17 and **Figure 6-18** indicate that Alt 4R2 provides the greatest benefit within northeastern WCA 3, areas adjacent to the Miami Canal, and throughout southern ENP relative to the existing conditions. Not many wood stork colonies are currently found in northeastern WCA 3 or adjacent to the Miami Canal, however, if foraging conditions improve in these areas, wood storks could colonize there. As compared to benefits gained in northern WCA 3A, less benefits occur within northwest WCA 3A (CEPP zone 3A-NW), and southeast Everglades National Park (CEPP zone ENP-S), however, 4R2 is still an improvement over the existing conditions and FWO. Benefits generally result from the increased water deliveries to these regions which result in more suitable water depths for wood stork foraging as compared to existing conditions and the FWO.

Declines in stork foraging suitability occur within northern ENP (CEPP Zone ENP-N) with Alt4R2 relative to existing conditions or FWO. The effects of increasing flow deliveries to Everglades National Park through the Blue Shanty flowway results in downstream water depths in ENP-N substantially less suitable for wood stork foraging. As compared to Zone ENP-N, less negative effects to foraging occur in central and southern WCA 3A central (CEPP Zones 3A-C and 3A-S) with Alt4R2 as compared to existing conditions or FWO.

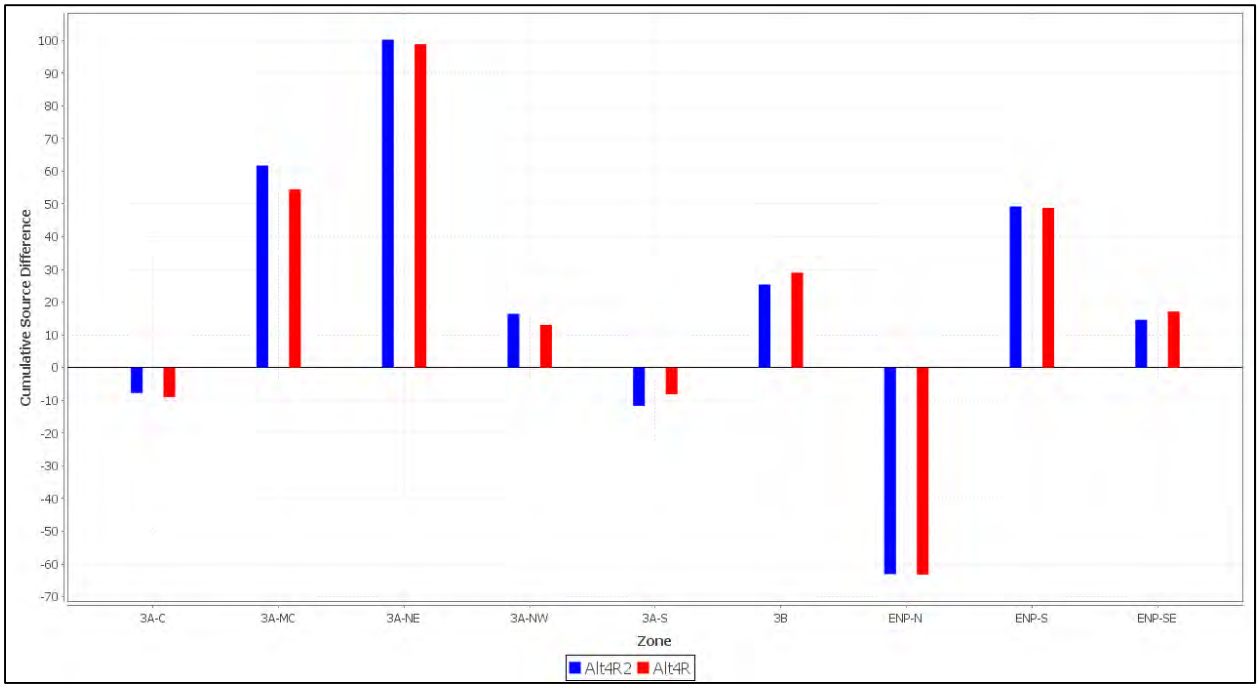

Figure 6-17. Suitable wood stork habitat cumulative (1965-2005) lift above existing conditions for Alt 4R2 within each CEPP zone. A maximum score of 1327 is possible if ECB 2012 has a suitability score of 0.0 every week and the alternative has a suitability score of 1.0 every week of the 41 year hydrologic model runs (SFNRC 2013c)

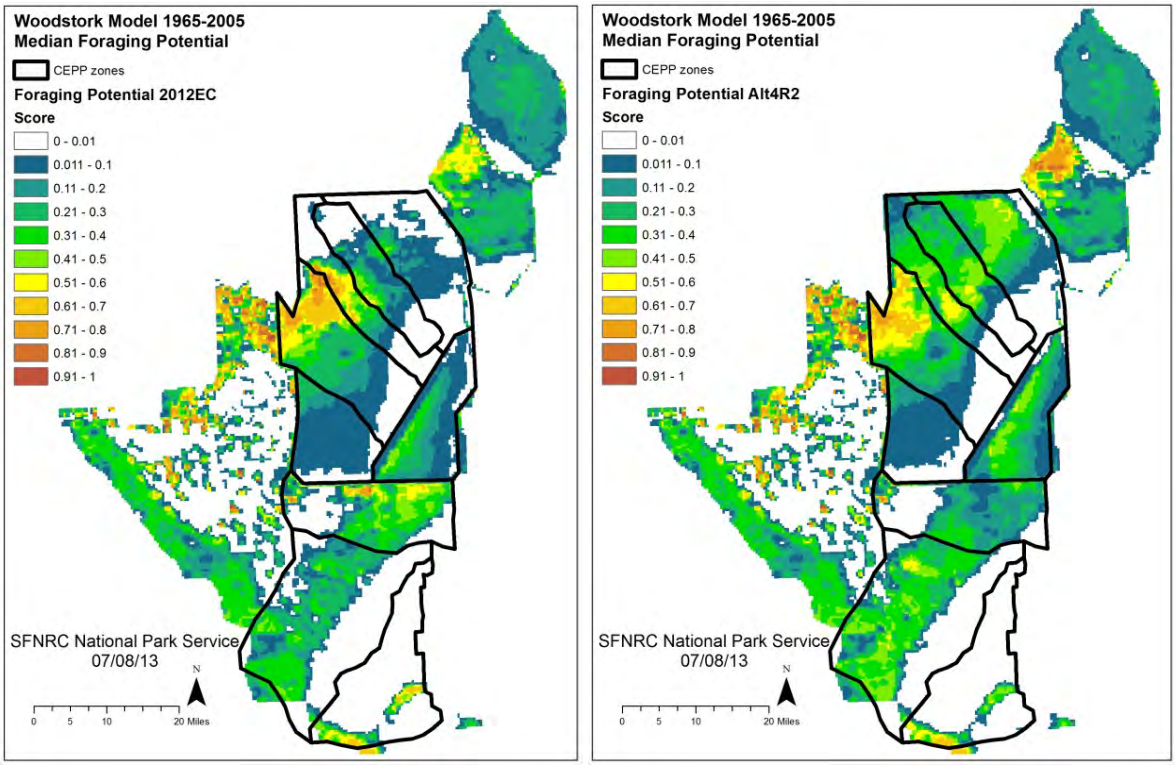

Figure 6-18. Median wood stork foraging potential suitability scores for 1965-2005. Scores vary from 0.0 (not suitable) to 1.0 (optimal foraging). Existing conditions is shown in the left panel and Alt 4R2 in the right panel (SFNRC 2013a)

Wood stork species distribution was modeled by Beerens 2013 in support of the RECOVER Greater Everglades ecological evaluation. The objectives of the spatial foraging conditions model (SFC) are to determine the average hydrological and spatial characteristics of a cell that predict the species-specific *frequency* of cell use over the study period. Wood storks generally showed increased numbers in northern WCA 3A, WCA 3B, and southern ENP under Alt 4R2 compared to the FWO (**Figure 6-19**). The existing conditions showed a similar trend in percent differences to the FWO, indicating that Alt 4R2 also performs better than existing conditions (**Figure 6-20**).

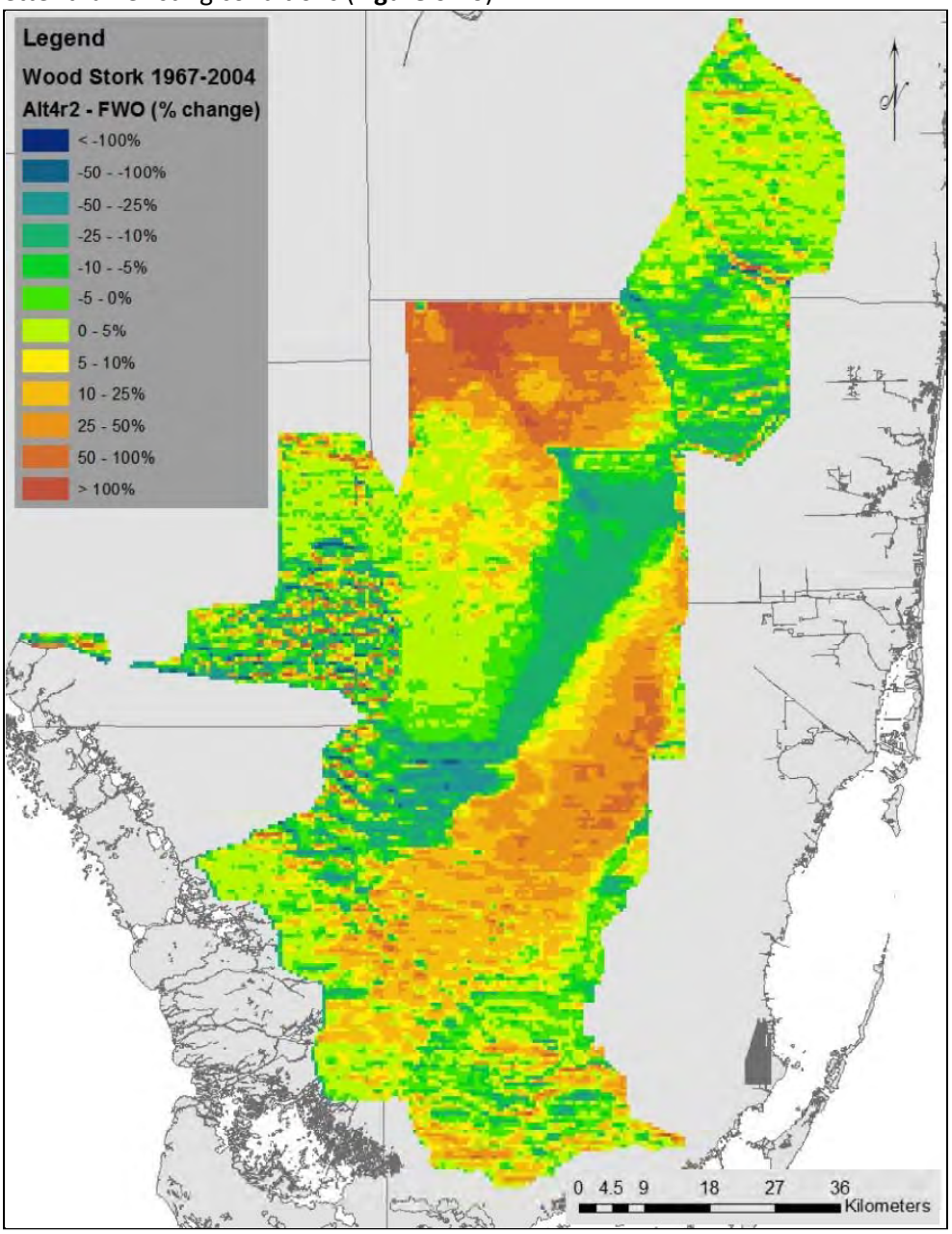

Figure 6-19. The coloration in this map represents the mean percent change in wading bird cell use (Jan – May, 1967-2004) for Alt4R2 relative to Future Without (FWO).

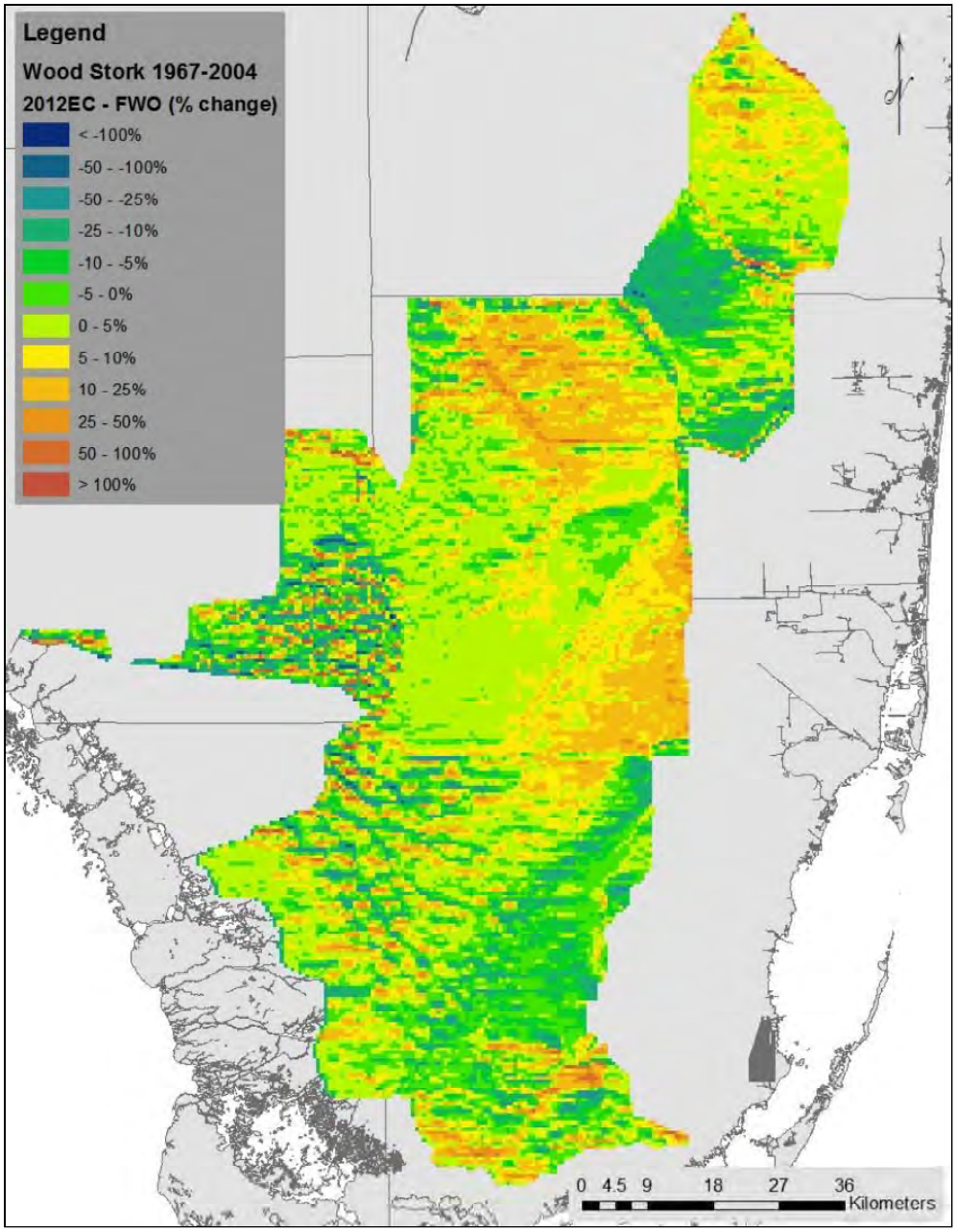

Figure 6-20. The coloration in this map represents the mean percent change in wading bird cell use (Jan – May, 1967-2004) for existing conditions relative to Future Without (FWO).

Historically, the short hydroperiod wetlands within ENP have been important for wood stork foraging during the pre-breeding season with the storks shifting to longer hydroperiod wetlands as the dry season progresses. Hydrologic patterns that produce a maximum number of patches with high prey availability (i.e. high water levels at the end of the wet season and low water levels at the end of the dry season) are necessary for high reproductive outputs (Gawlik 2002, Gawlik et al. 2004). Depending upon the elevation and microtopography throughout the WCAs and ENP, implementation of CEPP would produce a variety of wetland habitats that would support prey densities conducive to successful wading bird foraging and nesting.

Water depth and recession rate are the two most important hydrologic variables for wood storks (Gawlik et al. 2004) and wading birds. In their analysis of habitat suitability, Gawlik et al. (2004) identified feeding sites where the weekly average water depths from November to April (pre-breeding and breeding season) were between 0.0 and 0.5 feet as the most suitable. Suitability drops to 0.0 when water depths are -0.3 feet below marsh surface or greater than 0.8 feet. Wood storks and other wading birds require recession to condense their prey items into shallow pools for more effective foraging. The ERTP PM F (Strive to maintain a recession rate of 0.07 feet per week, with an optimal range of 0.06 to 0.07 feet per week, from January 1 to June 1) was moderated more often in Alt 4R2 as compared to existing conditions and FWO (**Figure 6-21**). Recession rates for any given week or period of time could be determined based upon recommendations made during the WCA 3A Periodic Scientists Call. The RSMGL did not contain the ability to model flexibility and adaptive management and thus simply provides a baseline indicator of recession rates. The Corps could utilize the operational flexibility inherent within operations to achieve the recommendation. It is recognized that areas of suitable foraging habitat will vary both within and between years due to microtopography, antecedent conditions, hydrologic and meteorological conditions, and water management actions. It is anticipated that these provisions within CEPP will help to improve foraging conditions within WCA 3A and ENP to provide a direct benefit to the wood stork and other wading bird species.

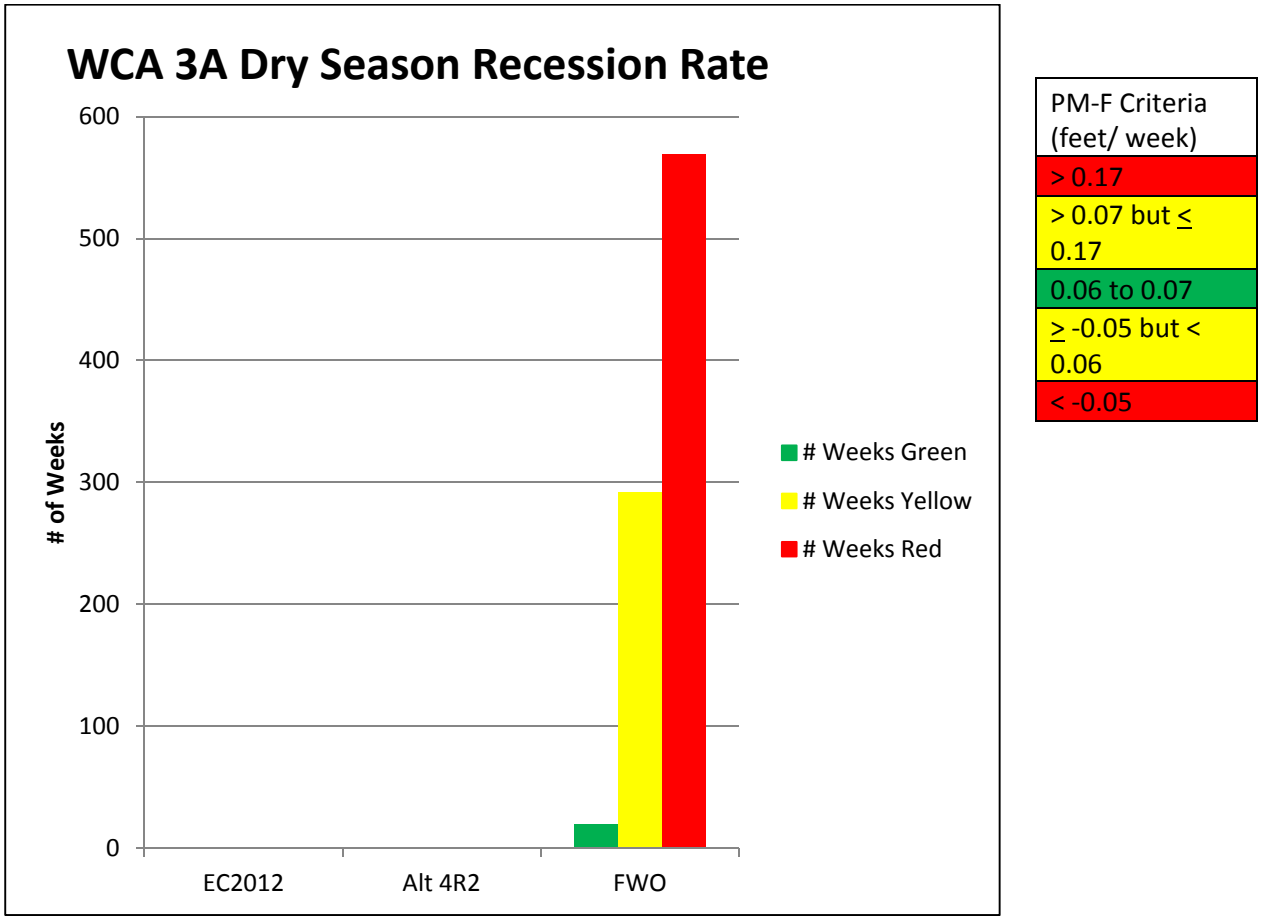

Figure 6-21. WCA 3A Dry Season Recession Rates (PM-F).

6.2.7.2 Wood Stork Species Effect Determination

Restoration of hydroperiods and hydropatterns closer to a pre-drainage condition (Pre-drainage conditions are defined as those conditions that occurred in the late 1800s, prior to the wide-scale drainage, urbanization, and compartmentalization of the Everglades) is a focal Everglades restoration objective for CERP. A related CERP restoration goal is to restore historic wading bird foraging and colonial nesting habitats in the mainland estuary zones of ENP. Therefore, the general transitioning of wood stork foraging habitat (under most climatic conditions) from Shark River Slough, which historically was a deep water white-water lily-dominated slough habitat, back into southern ENP, is considered a progressive step toward ecosystem restoration. It should be noted, however, that with Alt 4R2, a levee will be constructed within WCA 3B that will result in permanent loss of wood stork foraging habitat as well as habitat connectivity. This impact is not assessed in the wood stork foraging probability index (SFNRC 2013a).

Hydrologic changes associated with implementation of the project are expected to alter and provide an overall net benefit for wood stork foraging suitability throughout WCA 3 and ENP. Although wood stork colonies are not currently in all of the areas where foraging and habitat suitability are increasing, the potential for wood storks to colonize these areas highly increases due to the increase in foraging and habitat suitability. However, declines in foraging suitability occur in northern ENP due to increased flow deliveries through the Blue Shanty flowway. Metrics would need to be developed prior to CEPP implementation to account for any changes in the system due to construction and operation of other features, such as Modified Water Deliveries to Everglades National Park. Based upon the current information, the Corps' determination is that CEPP may affect wood stork.

6.2.8 Cape Sable Seaside Sparrow and "May affect" Determination

Background Information on the Cape Sable Seaside Sparrow

Measuring 13-14 centimeters in length, the CSSS is one of nine subspecies of seaside sparrows (Werner 1975). CSSS are non-migratory residents of freshwater to brackish marshes and their range is restricted to the lower Florida peninsula. They were originally listed as endangered in 1969 due to their restricted range (FWS 1999). Subsequent changes in their habitat have further reduced their range and continue to threaten this subspecies with extinction.

CSSS prefer mixed marl prairie communities that include muhly grass (*Muhlenbergia filipes*) for nesting (Stevenson and Anderson 1994). Marl prairie communities have short-hydroperiods (the period of time during which a wetland is covered by water) and contain a mosaic of moderately dense, clumped grasses, interspersed with open space that permit ground movements by the sparrows (FWS 1999). CSSS are generally not found in communities dominated by dense sawgrass, cattail (*Typha* spp.) monocultures, long-hydroperiod wetlands with tall, dense vegetative cover, spike rush marshes, and sites supporting woody vegetation (Werner 1975, Kushlan and Bass 1983). CSSS also avoid sites with permanent water cover (Curnutt and Pimm 1993). The combination of hydroperiod and periodic fire events are critical in the maintenance of suitable mixed marl prairie communities for the CSSS (Kushlan and Bass 1983).

CSSS nest in the spring when the marl prairies are dry. While the majority of nesting activities have been observed between March 1 and July 15 when Everglades marl prairies are dry, (Lockwood et al. 1997, 2001), nesting has been reported as early as late February (Werner 1975), and as late as early August (Dean and Morrison 2001). Males will establish breeding territories in early February (Balent et al. 1998) and defend these territories throughout the breeding season (FWS 1999). Male sparrows vocalize to

attract females and this particular breeding activity has been shown to decrease with increased surface water conditions (Nott et al. 1998, Curnutt and Pimm 1993).

Successful CSSS breeding requires that breeding season water levels remain at or below ground level in the breeding habitat. Nott et al. (1998) cited a "10-centimeter (cm)" rule for maximum water depth over which the CSSS will initiate nesting. This conclusion was based upon observations within the ENP range-wide survey in which no singing males were heard when water depths exceeded that level. However, Dean and Morrison (1998) demonstrated that nesting may occur when average water depths exceed this rule. CSSS construct their nests relatively close to the ground in clumps of grasses composed primarily of muhly, beakrushes (*Rhynchospora* spp.), and Florida little bluestem (*Schizachyrium rhizomatum)* (Pimm et al. 2002). The average early season nest height is 17 cm (6.7 inches) above ground, while the average late season nest height is 21 cm (8.3inches) above ground (Lockwood et al. 2001). The shift in average nest height after the onset of the wet season rainfall pattern, which typically begins in early June (Lockwood et al. 2001), appears to be an adaptive response to rising surface water conditions. In general, the CSSS will raise one or two broods within a season; however, if weather conditions permit, a third brood is possible (Kushlan et al. 1982, FWS 1983). A new nest is constructed for each successive brood. The end of the breeding season is triggered by the onset of the rainy season when ground water levels rise above the height of the nest off the ground (Lockwood et al. 1997).

CSSS will lay three to four eggs per clutch (Werner 1978, Pimm et al. 2002) with a hatching rate ranging between 0.66 and 1.00 (Boulton et al. 2009b). The nest cycle lasts between 34 and 44 days in length and includes a 12-13 day incubation period, 9-11 day nestling period and 10-20 days of post-fledgling care by both parents (Sprunt 1968, Trost 1968, Woolfenden 1968, Lockwood et al. 1997, Pimm et al. 2002). Nest success rate varies between 21 and 60 percent, depending upon timing of nest initiation within the breeding season (Baiser et al. 2008, Boulton et al. 2009a). Substantially higher nest success rates occur within the early portion of the breeding season (approximately 60 percent prior to June 1) followed by a decline in success as the breeding season progresses to a low of approximately 21% after June 1 (Baiser et al. 2008, Boulton et al. 2009a, Virzi et al. 2009). In most years, June 1 is a good division between the early high success period and the later, lower success period (Dr. Julie Lockwood email correspondence to FWS, October 15, 2009). Nearly all nests that fail appear to fail due to predation, and predation rates appear to increase as water level increases (Lockwood et al. 1997, 2001, Baiser et al. 2008). A complete array of nest predators has not been determined. However, raccoons *(Procyon lotor*), rice rats *(Oryzomys palustri*s), and snakes may be the chief predators (Lockwood et al. 1997, Dean and Morrison 1998, Post 2007).

A dietary generalist, CSSS feed by gleaning food items from low-lying vegetation (Ehrlich et al. 1992, Pimm et al. 2002). Common components of their diet include soft-bodied insects such as grasshoppers, spiders, moths, caterpillars, beetles, dragonflies, wasps, marine worms, shrimp, grass, and sedge seeds (Stevenson and Anderson 1994). The importance of individual food items appear to shift in response to their availability (Pimm et al. 1996, 2002).

CSSS are non-migratory with males displaying high site fidelity, defending the same territory for two to three years (Werner 1975). CSSS are capable of both short-distance and longer-range movements, but appear to be restricted to short hydroperiod prairie habitat (Dean and Morrison 1998). Large expanses of deep water or wooded habitat act as barriers to long-range movements (Dean and Morrison 1998). Recent research by Julie Lockwood, Ph.D. of Rutgers University and her students have revealed substantial movements between subpopulations east of Shark River Slough (Lockwood et al. 2008, Virzi

et al. 2009), suggesting that the CSSS has considerable capacity to colonize unoccupied suitable habitat (Sustainable Ecosystems Institute 2007).

In the 1930s, Cape Sable was the only known breeding range for the CSSS (Nicholson 1928). Areas on Cape Sable that were occupied by the CSSS in the 1930s have experienced a shift in vegetative communities from freshwater vegetation to mangroves, bare mud flats, and salt-tolerant plants, such as turtleweed (*Batis maritima*) and bushy seaside tansy (*Borrichia frutescens*) (Kushlan and Bass 1983). As a result, CSSS no longer use this area. More recently, continued alterations of CSSS habitat have occurred as a result of changes in the distribution, timing, and quantity of water flows in south Florida. Water flow changes and associated shifts in vegetation appear to be the leading contributor to the decline in CSSS population, which subsequently threaten the subspecies with extinction. Competition and predation also threatens the CSSS.

Presently, the known distribution of the CSSS is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades region (within ENP and BCNP) and the edge of Taylor Slough in the Southern Glades Wildlife and Environmental Area in Miami-Dade County. ENP staff first undertook a comprehensive survey of the CSSS in 1981 to identify all areas where sparrows were present. This survey, hereafter referred to as the range-wide survey, resulted in the first complete range map for the CSSS (Bass and Kushlan 1982, Kushlan and Bass 1983). The survey design consisted of a one-kilometer survey grid over any suspected CSSS habitat. As much of CSSS habitat is inaccessible, a helicopter was used and landed at the intersection of each grid line (i.e. every 1 kilometer). At each site, the researchers would record every CSSS seen or heard (singing males) within an approximate 200 meter radius of their landing location (Curnutt et al. 1998). From the resulting range map, Curnutt et al. (1998) divided the CSSS into six separate subpopulations, labeled as A through F (**Figure 6-22**) with subpopulation A (CSSS-A) as the only subpopulation west of Shark River Slough (SRS).

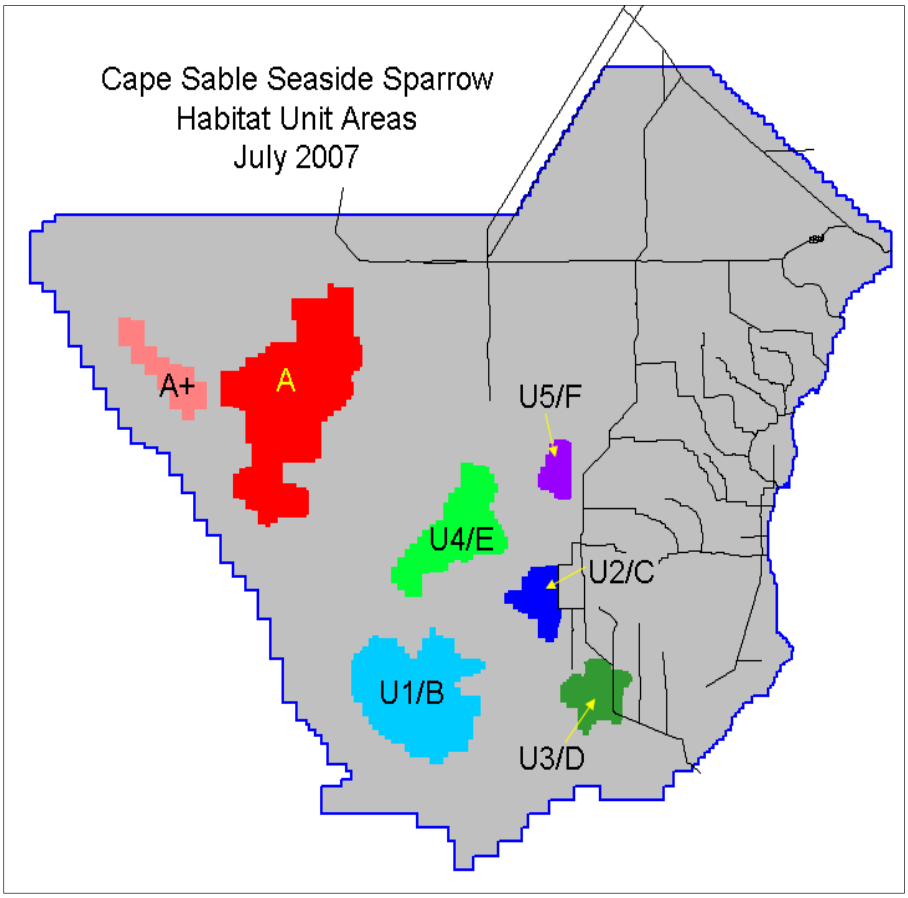

Figure 6-22. Cape Sable Seaside Sparrow Subpopulations (A-F) and Designated Critical Habitat Units (U1-U5).

After the 1981 survey, the population was not surveyed again until 1992. The range-wide survey has been performed annually since 1992, although the number of survey locations has changed from a high of over 850 sites in 1992 to a low of 250 sites in 1995 (Cassey et al. 2007).

Bass and Kushlan (1982) also devised a methodology of translating the range-wide survey results into an estimate of population size. To account for females (only males sing) and CSSS outside the audio detection range, the number of birds counted is multiplied by a factor of sixteen (15.87 rounded to 16). In order to confirm the validity of this estimation factor, Curnutt et al. (1998) compared the bird counts from the range-wide survey with actual mapped territories on intensive study plots and found it to be adequate given normal population fluctuations. More recent research indicates that this estimation factor may be overestimating population abundance within the smaller CSSS subpopulations (*i.e.* CSSS-A, C, D, F) due to the presence of floater males and a male-biased sex ratio (Boulton et al. 2009a).

Based on the range-wide surveys, total CSSS populations have declined from approximately 6,600 individuals during the period from 1981-1992, to approximately 1,456 in 2012 (**Table 6-4**). Although populations decreased significantly during the early part of that time period, they have remained relatively constant since 1993 **(Table 6-4, Figure 6-23).** Recognizing the limitations of the range-wide survey in detecting fine-scale changes in population abundance related to management actions (Walters et al. 2000, Lockwood et al. 2006), Cassey et al. (2007) translated the results of the range-wide survey into presence/absence data and then converted it into a measure of occupancy. In

their study, occupancy was defined as the fraction of the area occupied by the species in any one year as used by MacKenzie et al. (2002). Their results show that the proportion of CSSS range occupied decreased between 1981 and 1992, particularly in CSSS-C, D and F, with a second period of decline between 1992 and 1996, most notably within CSSS-A. After 1996, overall occupancy has remained relatively constant (Cassey et al. 2007).

Table 6-4. Cape Sable Seaside Sparrow Bird Count and Population Estimates by Year as Recorded by the Everglades National Park Range-Wide Survey (BC: Bird Count, EST: Estimate, NS: Not Surveyed)

Population/ Year	CSSS-A		CSSS-B		CSSS-C		CSSS-D		CSSS-E		CSSS-F		Total	
	BC	EST	BC	EST	BC	EST	BC	EST	BC	EST	BC	EST	BC	EST
1981	168	2,688	147	2,352	27	432	25	400	42	672	7	112	416	6,656
1992	163	2,608	199	3,184	3	48	7	112	37	592	2	32	411	6,576
1993	27	432	154	2,464	0	0	6	96	20	320	0	0	207	3,312
1994	5	80	139	2,224	NS	NS	NS	NS	7	112	NS	NS	151	2,416
1995	15	240	133	2,128	0	0	0	0	22	352	0	0	170	2,720
1996	24	384	118	1,888	3	48	5	80	13	208	1	16	164	2,624
1997	17	272	177	2,832	3	48	3	48	52	832	1	16	253	4,048
1998	12	192	113	1,808	5	80	3	48	57	912	1	16	191	3,056
1999a	25	400	128	2,048	9	144	11	176	48	768	1	16	222	3,552
1999b	12	192	171	2,736	4	64	NS	NS	60	960	0	0	247	3,952
2000a	28	448	114	1,824	7	112	4	64	65	1,040	0	0	218	3,488
2000b	25	400	153	2,448	4	64	1	16	44	704	7	112	234	3,744
2001	8	128	133	2,128	6	96	2	32	53	848	2	32	204	3,264
2002	6	96	119	1,904	7	112	0	0	36	576	1	16	169	2,704
2003	8	128	148	2,368	6	96	0	0	37	592	2	32	201	3,216
2004	1	16	174	2,784	8	128	0	0	40	640	1	16	224	3,584
2005	5	80	142	2,272	5	80	3	48	36	576	2	32	193	3,088
2006	7	112	130	2,080	10	160	0	0	44	704	2	32	193	3,088
2007	4	64	157	2,512	3	48	0	0	35	560	0	0	199	3,184
2008	7	112	NS	NS	3	48	1	16	23	368	0	0	34	544*
2009	6	96	NS	NS	3	48	2	32	27	432	0	0	38	608*
2010	8	128	119	1904	2	32	4	64	57	912	1	16	191	3,056
2011	11	176	NS	NS	11	176	1	16	37	592	2	32	62	992*
2012	21	336	NS	NS	6	96	14	224	46	736	4	64	91**	1456**

Note: These numbers do not reflect a significant decline in CSSS population. CSSS-B, the largest and most stable subpopulation, was not surveyed in 2008, 2009, or 2011. Adding the 2007 CSSS-B population estimate of 2,512 birds to those of the other subpopulations, the

estimated total CSSS population size is 3,056 and 3,120 birds for 2008 and 2009, respectively. Adding the 2010 CSSS-B population estimate of 1,904 birds to those of the other subpopulations, the estimated total 2011 CSSS population size is 2,896 birds.

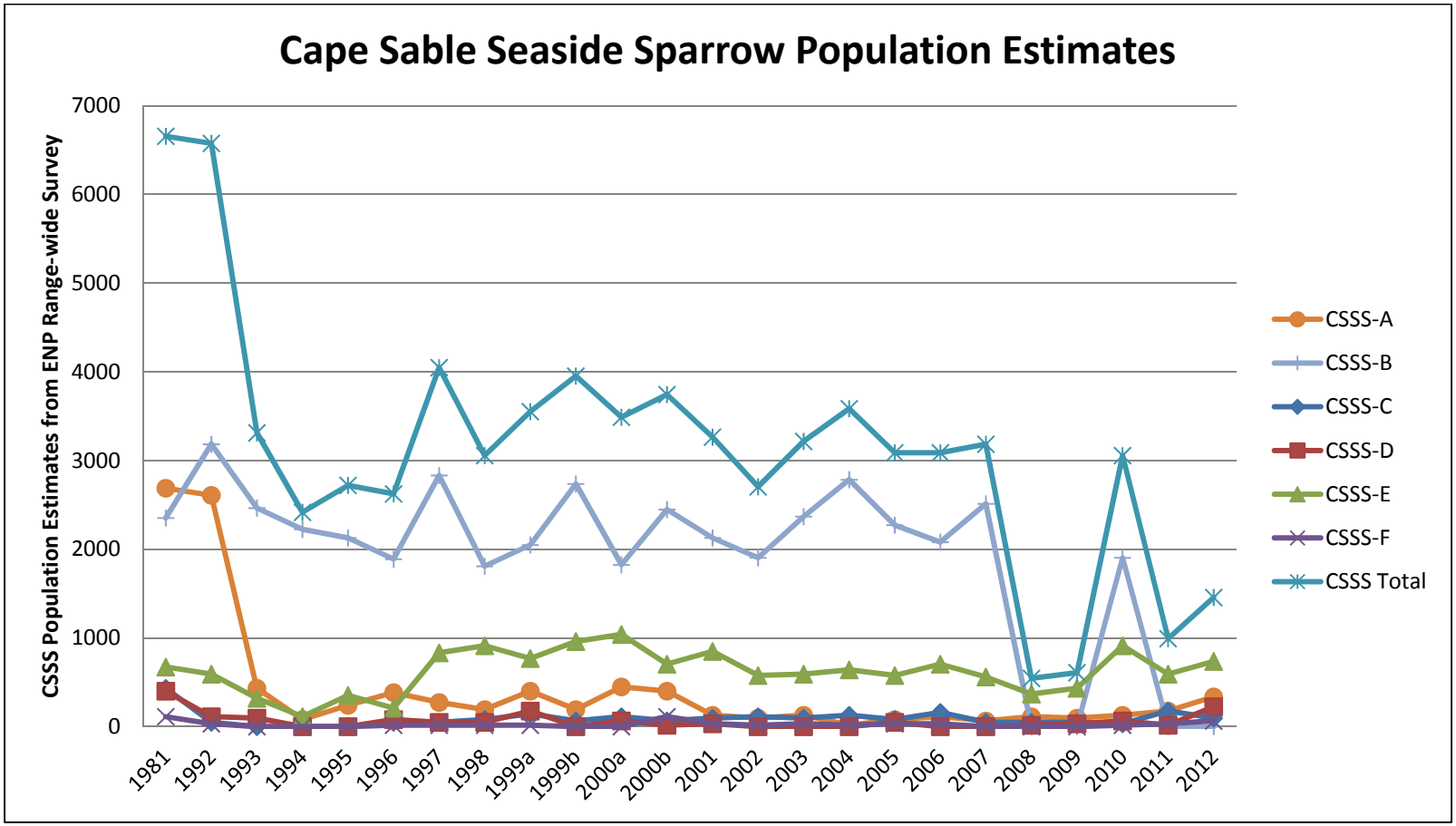

Figure 6-23. Cape Sable Seaside Sparrow Population Estimates within Each Subpopulation as Reported from the Everglades National Park Range-Wide Surveys

CSSS-A is located in western SRS immediately in the path of water discharges out of WCA 3A through the S-12 structures. Unusually intense and unseasonable rainy periods during the winter of 1992/93, along with Hurricane Andrew, and again in 1993/94 and 1994/95 caused prolonged flooding in CSSS-A, sufficient enough that the high water levels may have nearly precluded breeding in 1993 and 1995 (Walters et al. 2000). In addition, little or no breeding was possible during the 1994 and 1996 breeding seasons, due to the limited availability of suitable dry habitat. The flooding of the habitat by direct rainfall was compounded by discharges of water through the S-12 structures needed to meet the regulation schedule for WCA 3A. With an average life-span of two to three years, several consecutive years with little or no reproduction, could significantly affect population size. This is reflected in the dramatic reduction of sparrows detected in subsequent surveys in CSSS-A, in addition to the reduction in occupancy reported by Cassey et al. (2007) for the time period between 1992 and 1996. As a consequence, the FWS issued a BO in 1999 providing recommendations to the Corps on how water levels should be controlled within CSSS-A nesting habitat so that the existence of the CSSS would not be jeopardized. The Corps responded by developing changes in water management operations through emergency deviations in 1998 and 1999, two iterations of the Interim Structural and Operational Plan (ISOP) for Protection of the Cape Sable Seaside Sparrow in 2000 and 2001, culminating in the Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow in 2002, which has been in effect until December of 2012 when the Everglades Restoration Transition Plan went into effect. The ISOP/IOP goals were to keep subpopulations (particularly CSSS-A) dry during the breeding season and to also keep the habitat for sub-populations B, C, D, E, and F (CSSS-B, CSSS-C, CSSS-D, CSSS-E, and CSSS-F) from excessive drying in order to prevent adverse habitat change from unseasonable fire frequencies.

The primary objective in implementing IOP was to reduce damaging high water levels within CSSS habitat west of SRS (i.e. CSSS-A). IOP was designed to protect the CSSS to the maximum extent possible through water management operations. The purpose of IOP was to provide an improved opportunity for nesting by maintaining water levels below ground level for a minimum of 60 consecutive days between March 1 and July 15, corresponding to the CSSS breeding season. In addition, a secondary purpose of IOP was to allow CSSS habitat to recover from prolonged flooding during the mid-1990s. It is recognized in the 1999 FWS BO that there could be times when unseasonable rainfall events could overwhelm the ability of the water management system to provide the necessary dry conditions. Since implementation of IOP, the FWS recommendations for protection of the CSSS in CSSS-A were met in 2002, 2004, 2006, 2008 and 2009. Direct rainfall on CSSS-A prevented meeting the RPA requirements for 2003, 2005 and 2007, contributing to the lack of recovery of CSSS-A. As reported from the range-wide survey (**Table 6-4**), the estimated total CSSS population during IOP has remained between 2,704 bird (2002) and 3,584 birds (2004). CSSS-A population estimates during IOP ranged from a low of 16 (1 bird counted) in 2004 to a high of 128 (8 birds counted) in 2003. The population estimates for CSSS-A may be inflated due to the potential inaccuracy of the estimation factor in smaller subpopulations as suggested by recent research (Boulton et al. 2009a). In addition, it should also be noted that the estimates for a particular year have relevance for potential breeding that year, but this would not be reflected in the population estimates until the following year. Under the 2006 IOP, the S12A-C, S343A-B and S344 structures were closed during portions of the year in order to meet the FWS RPA of 60 consecutive dry days at gauge NP-205 between March 1 and July 15. Under ERTP, the S-12A-B, S343A-B and S344 closure dates remain as identified under IOP. However, under ERTP, S-12C would not have any associated closure dates designed to meet the FWS RPA for the CSSS. Due to its more eastern location, S-12C is farther removed from CSSS-A as compared with the S12A-B structures and thus has less of an impact on hydrological conditions within CSSS-A (refer to 2006 IOP FSEIS). In addition, Department of the Interior will maintain sandbags within the culverts along the Tram Road within ENP to prevent

westward flow of water from S-12C into the western marl prairies and CSSS-A. These stoppers will help to prevent S-12C flows west of the Tram Road and maintain shorter hydroperiods within the western marl prairies. Also, S-346 will be open when S-12D is open to further facilitate the movement of water into central Shark River Slough. As ERTP was implemented in October 2012, sufficient data is not available to understand if ERTP operations are having the intended effect within CSSS habitat.

Another factor in lack of recovery is change in vegetative structure resulting from physical damage during the high water events of 1993 through 1995 and a shift in the vegetative community dominants away from previous species. This phenomenon was studied by Michael Ross, Ph.D. and Jay Sah, Ph.D. of Florida International University, along with James Synder of the United States Geological Survey (USGS) in a 2003-2009 monitoring study funded by the Corps (Ross et al. 2003, 2004, 2006, Sah et al. 2007, 2008, 2009). Based upon several years of vegetation studies within CSSS habitat, the researchers concluded that the direction and magnitude of short-term vegetation change within marl prairie is dependent upon the position of the habitat within the landscape. Efforts to regulate the S-12 structures under ISOP/IOP to protect CSSS-A and its habitat west of SRS, as well as drought, have resulted in lower water depths during the sparrow breeding season as measured at gage NP-205. However, the persistence of wetter vegetation within the vicinity of gage P-34 may have limited the recovery of CSSS-A within this part of its habitat. This suggests water flow from the northwest resulting in deeper water levels and longer hydroperiods within this portion of CSSS-A habitat. As shown in **Table 6-4**, CSSS-A has not recovered under IOP operations, but has remained relatively stable since its implementation. Recent research suggests that sparrow populations are slow to recover, or cannot recover, once they reach very small population sizes due to low adult and juvenile recruitment, many unmated males, biased sex ratios, lower hatch rates and other adverse effects associated with small population size (i.e. the Allee effect) (Boulton et al. 2009a, Virzi et al. 2009).

Vegetation change is mediated by the interaction of fire and hydrology. Studies by Sah et al. (2009) revealed that not only did post-fire flooding delay the vegetation recovery process, but also caused it to follow a different trajectory in terms of species composition. This in turn, could potentially impede recolonization by the CSSS (Sah et al. 2009). The transition from one vegetation type to another (i.e. prairie to marsh) in response to hydrology may take place in as little as three to four years (Armentano et al. 2006), however, the transition from marsh to prairie may take longer (Ross et al. 2006, Sah et al. 2009). Vegetation studies within CSSS habitat (Ross et al. 2004) have shown that CSSS occupy prairies with a hydroperiod ranging between 90 and 240 days. However, solely attaining this hydroperiod requirement may not be enough to promote a transition from marsh to prairie habitat, as this likely requires the process of fire (Ross et al. 2006, Sah et al. 2009).

6.2.8.1 Potential Effects on CSSS

Presently, the known distribution of the CSSS is restricted to two areas of marl prairies east and west of SRS in the Everglades region (within ENP and BCNP) and the edge of Taylor Slough in the Southern Glades Wildlife and Environmental Area in Miami-Dade County. CSSS surveys resulted in a range map that divided the CSSS into six separate subpopulations, labeled as A through F (**Figure 6-24**), with CSSS-A as the only subpopulation west of SRS (Curnutt et al. 1998). The following analysis of Alt 4R2 compared to existing conditions and FWO is arranged by ERTP PM and ET with potential effects to each subpopulation described in greater detail.

PM-A: Number of years a minimum of 60 consecutive days at NP-205 below 6.0 feet, NGVD beginning no later than March 15 is met out of the 40 year period of record.

In order to compare alternatives in relation to PM-A, the RSM-GL simulated NP-205 daily stage was used. From this data, the annual discontinuous hydroperiod (number of days inundated), was calculated and the number of consecutive dry days within the CSSS nesting window of March 1 through July 15 were counted. For CSSS-B, CSSS-C, and CSSS-F, Alt 4R2 performs similarly to existing conditions and FWO. One region (IR-A2 and one gage (TMC) in CSSS-A, and 1 gage in CSSS-E (NE of NPA) performed worse than the existing conditions by 8, 2, and 4 years respectively (**Table 6-5 and Figures 6-25 through 6-37**).

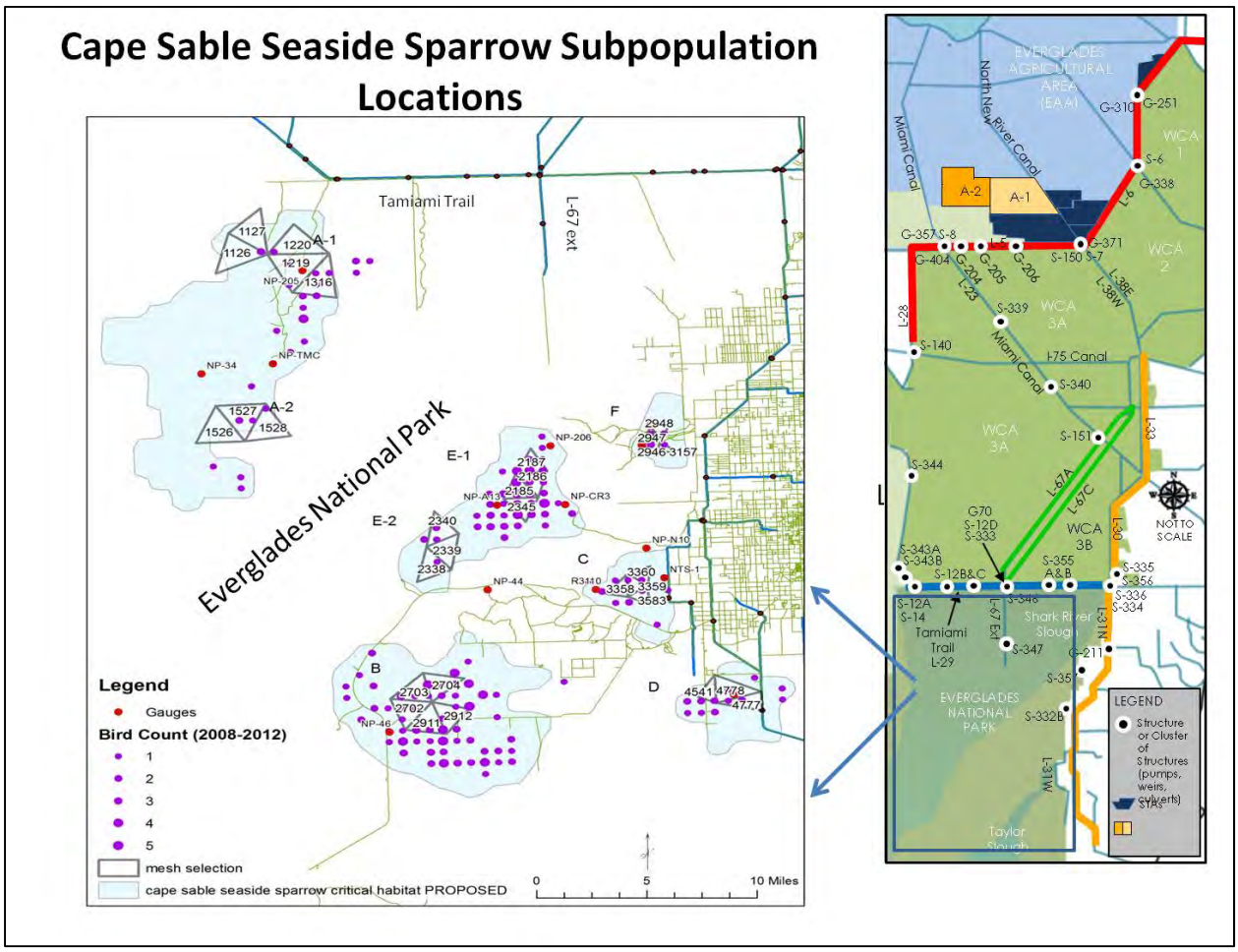

Figure 6-24. Extent of CSSS sub populations

Table 6-5. PM-A: Number of years there is a minimum of 60 consecutive days at NP-205 below 6.0 feet, NGVD beginning no later than March 15. Comparison of ECB 2012, FWO, and Alt 4R2 for each subpopulation of CSSS out of the 41 year POR.

Subpop	Gage	ECB2012	Alt 4R2	FWO
A	IR-A1 (region)	20	22	20
	IR-A2 (region)	33	25	33
	P34	29	29	29
	TMC	31	29	32
B	CY3	40	40	40
C	R3110	39	39	39
	E112	38	38	38
D	EVER4	20	20	22
E	NE of NPA13	37	33	36
F	NE of RG2	33	33	33

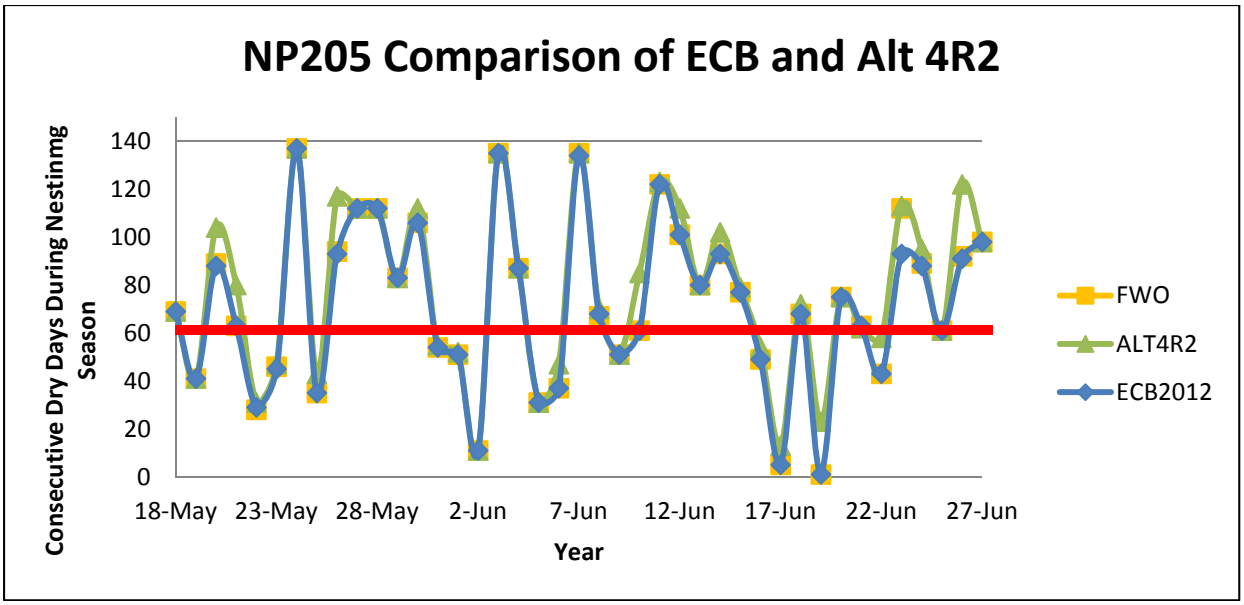

Figure 6-25. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A

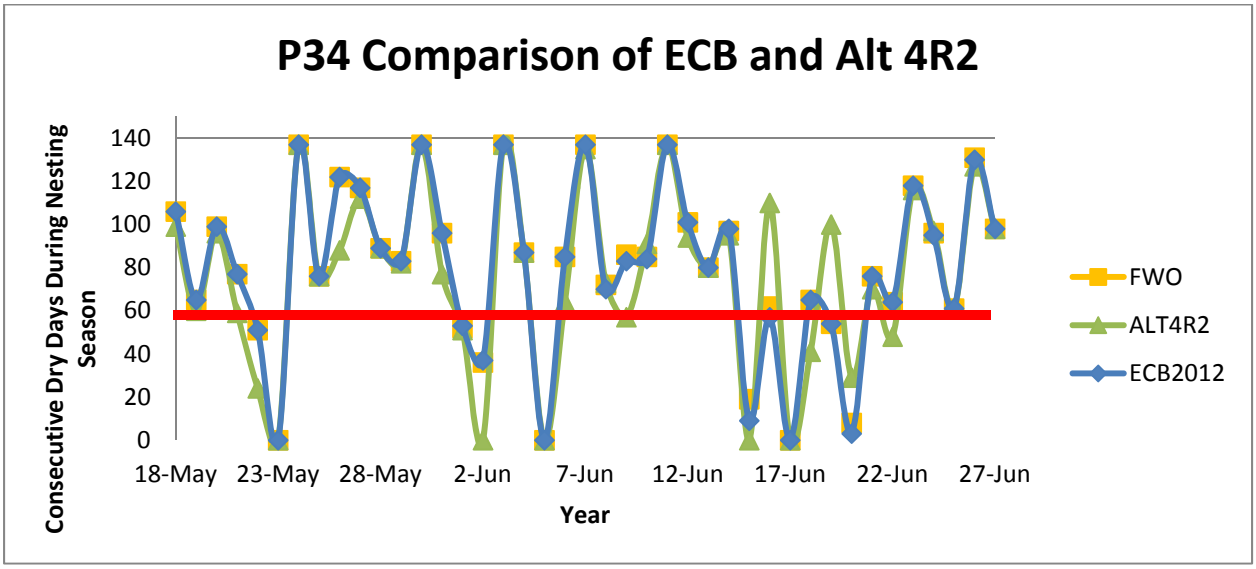

Figure 6-26. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A

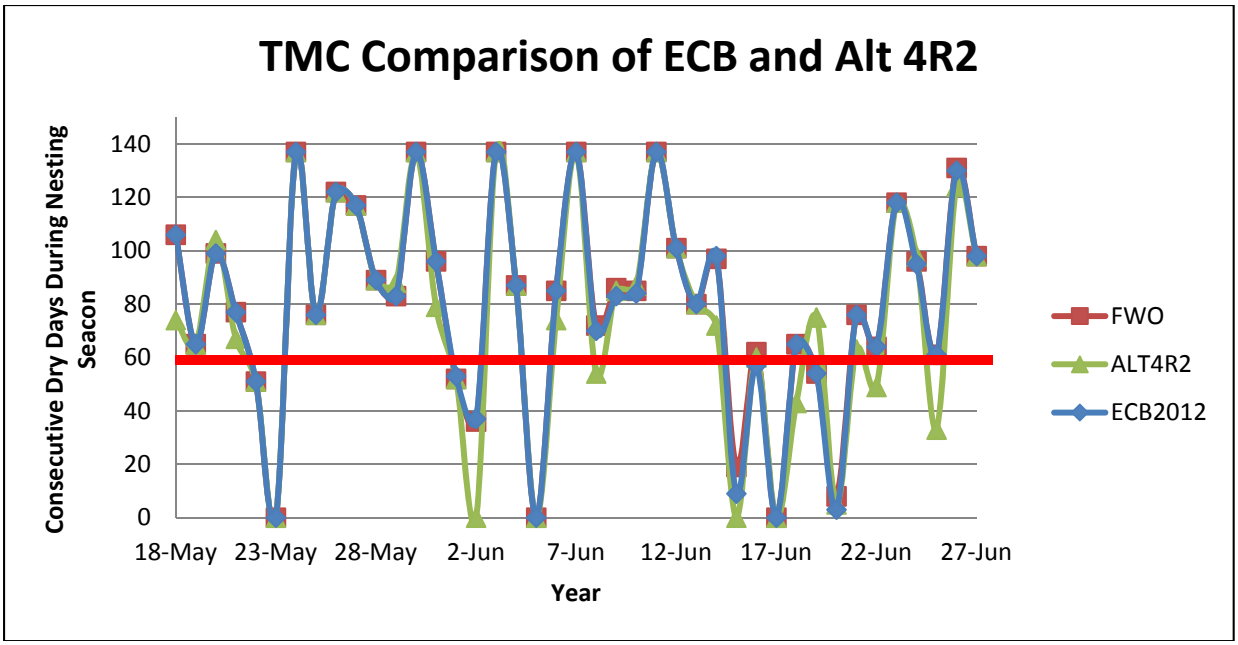

Figure 6-27. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A

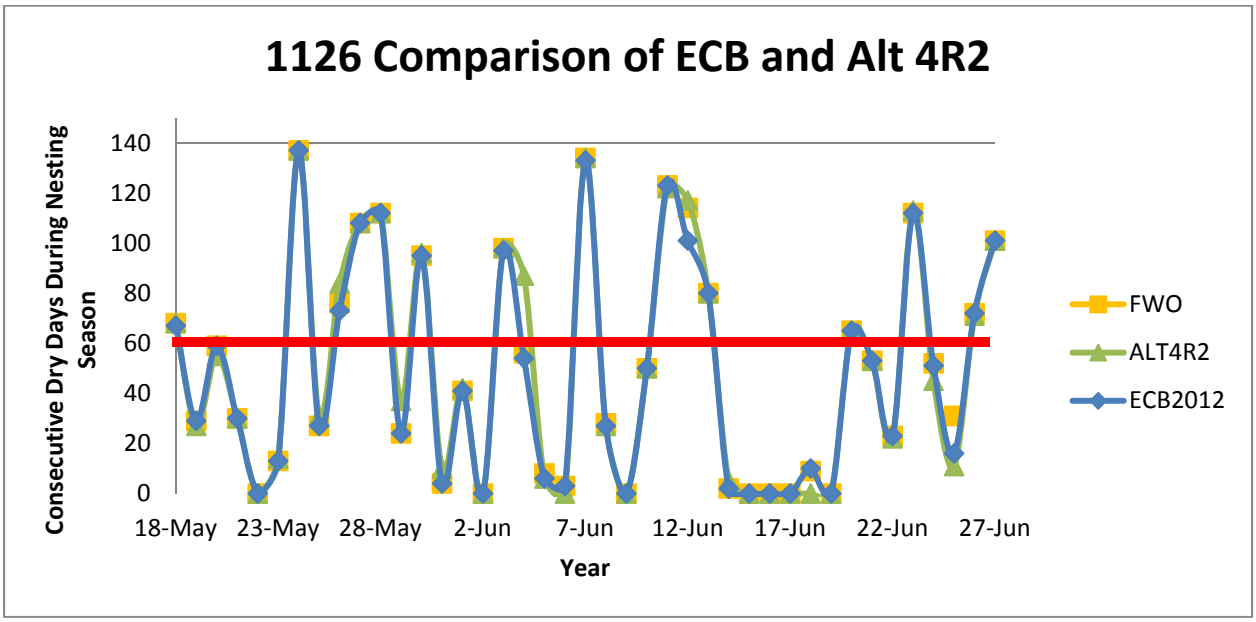

Figure 6-28. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A-1

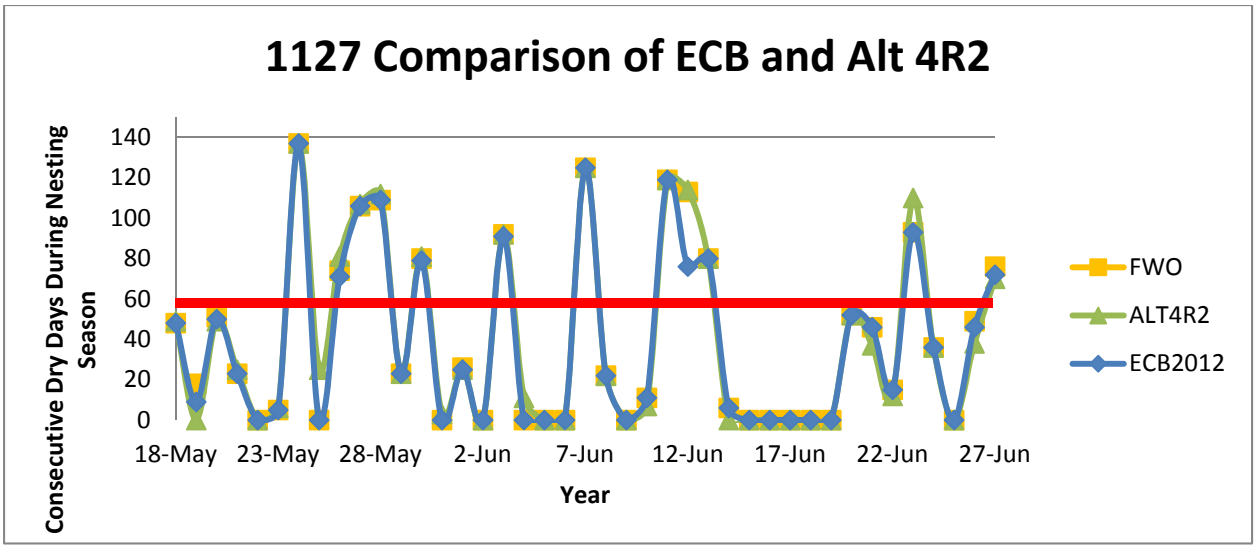

Figure 6-29. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A-1

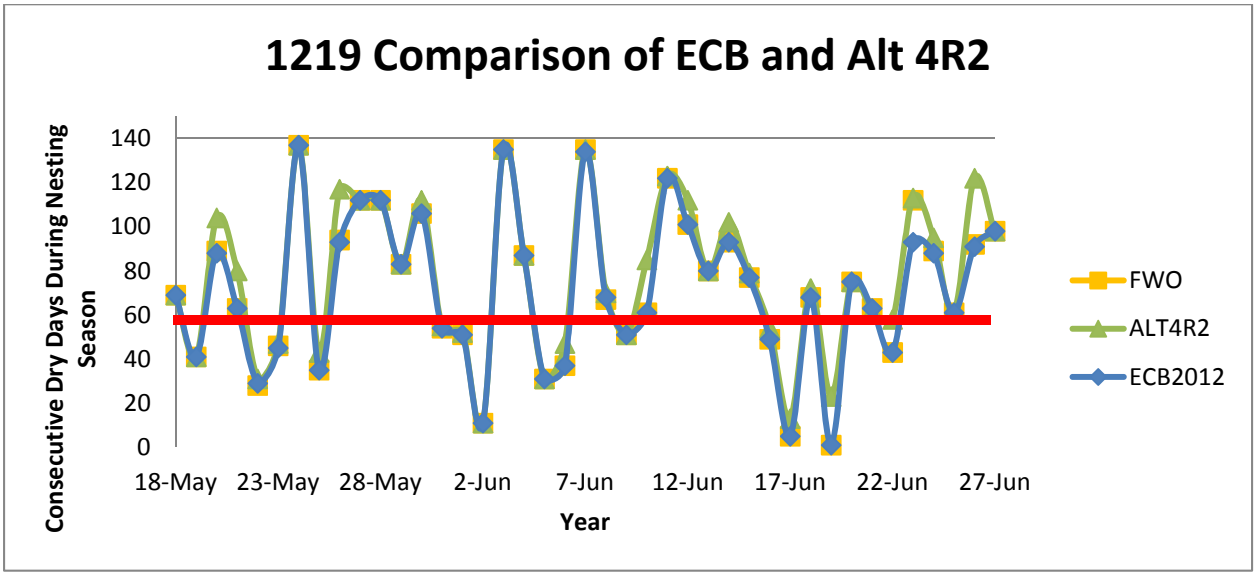

Figure 6-30. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A-1

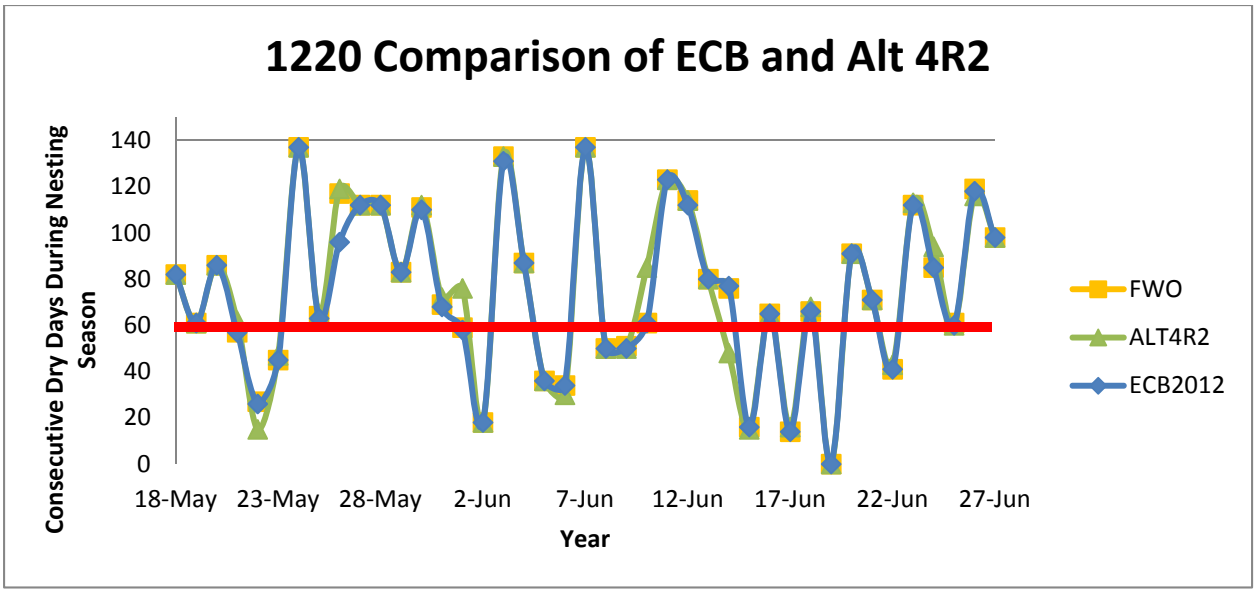

Figure 6-31. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-A-1

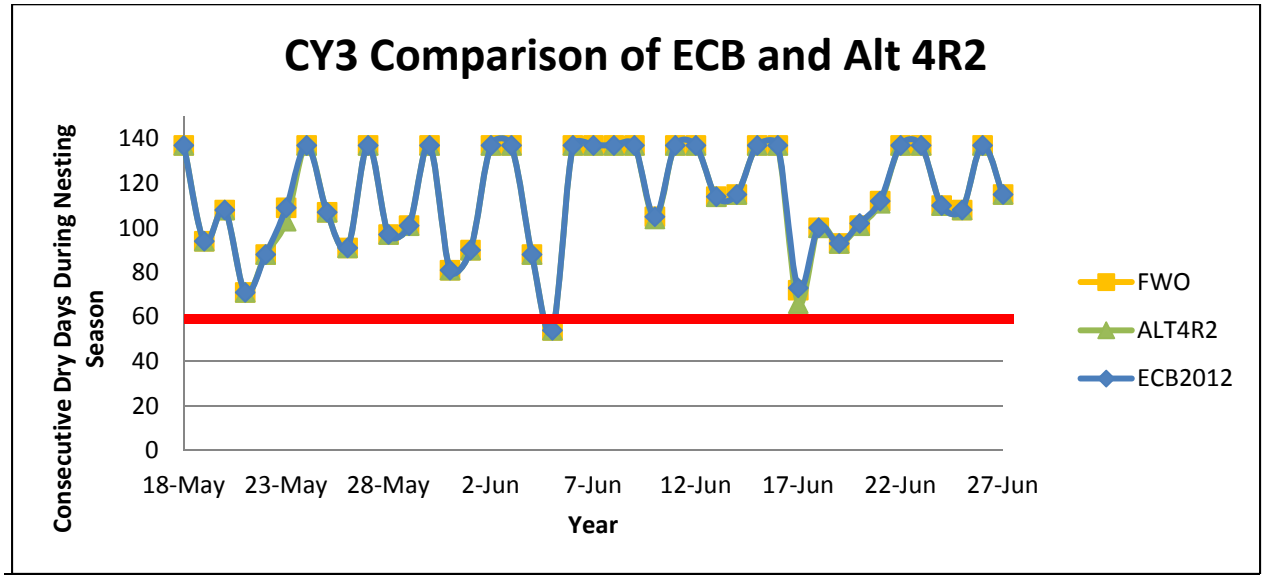

Figure 6-32. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-B

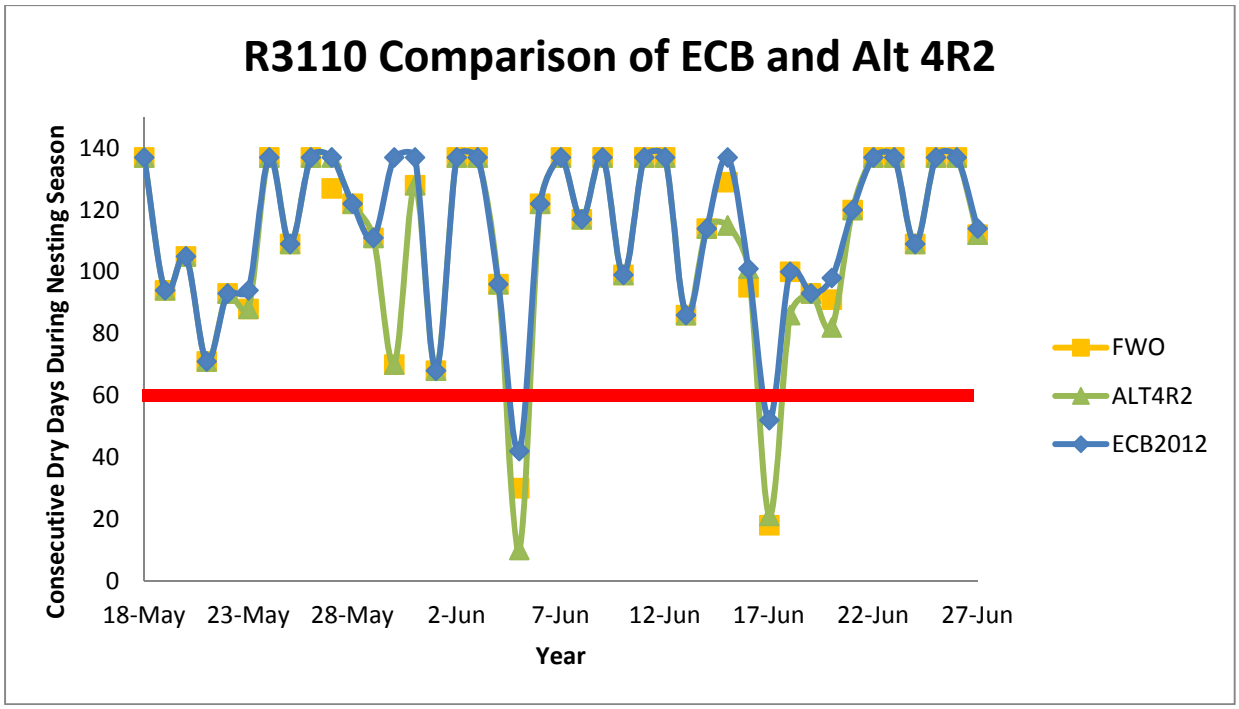

Figure 6-33. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-C

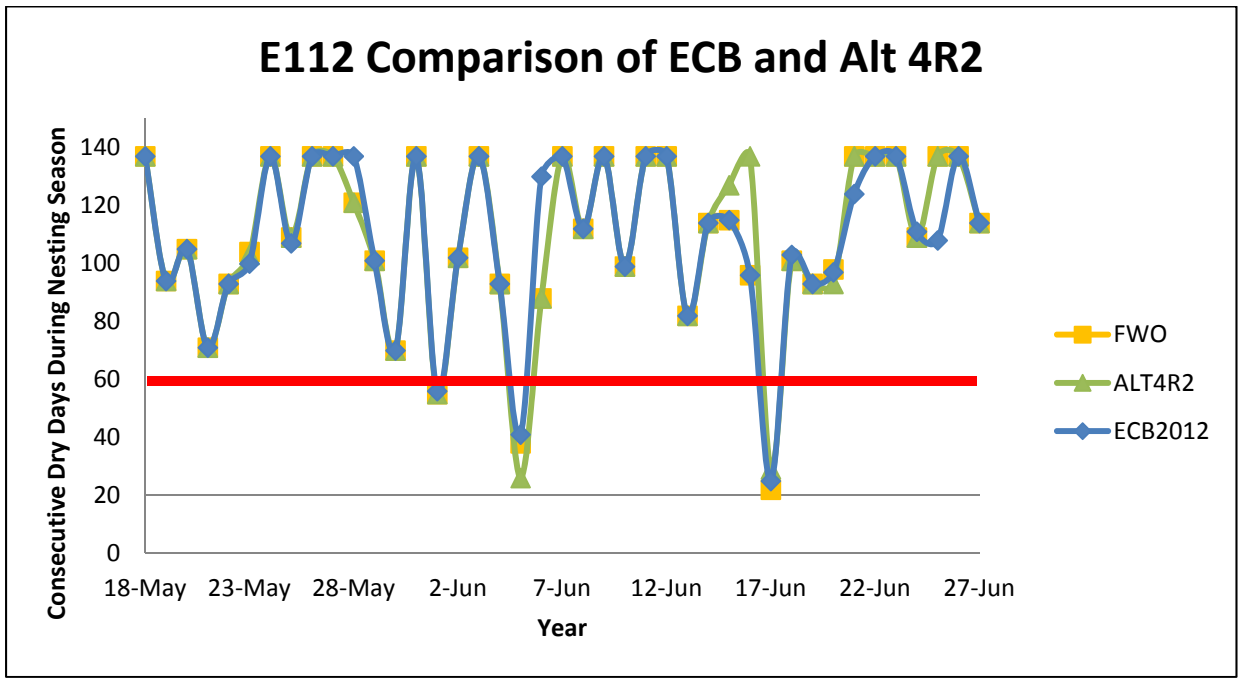

Figure 6-34. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-C

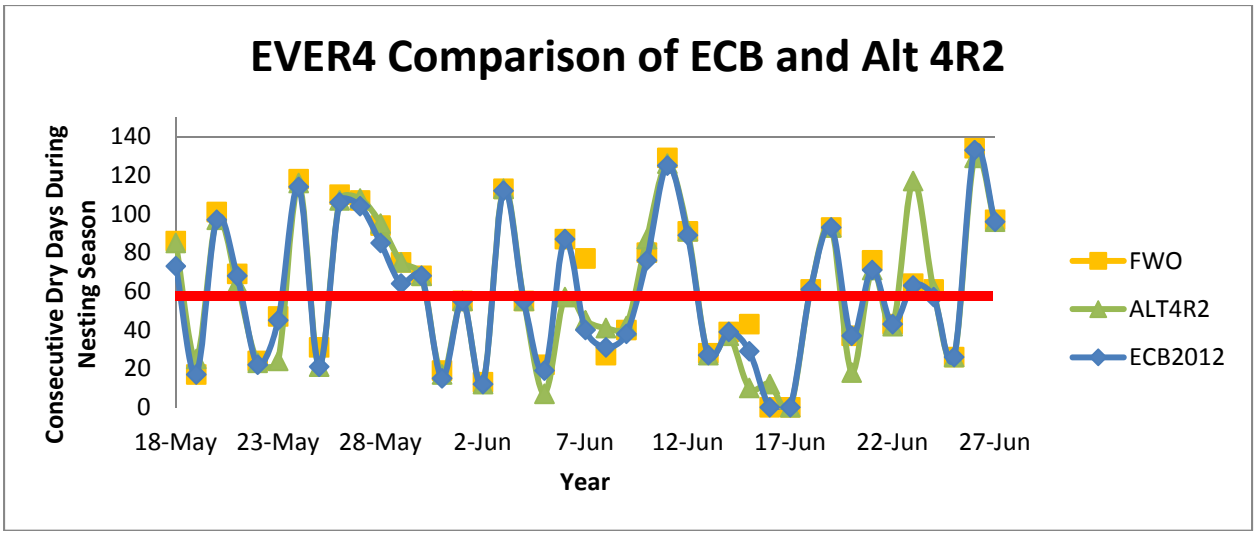

Figure 6-35. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-D

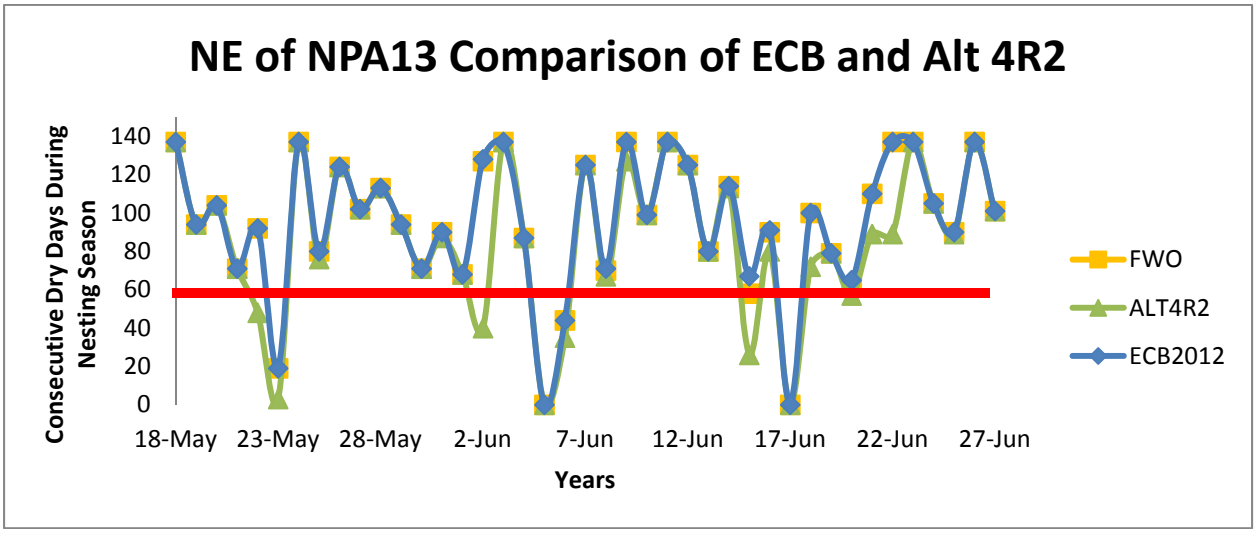

Figure 6-36. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-E

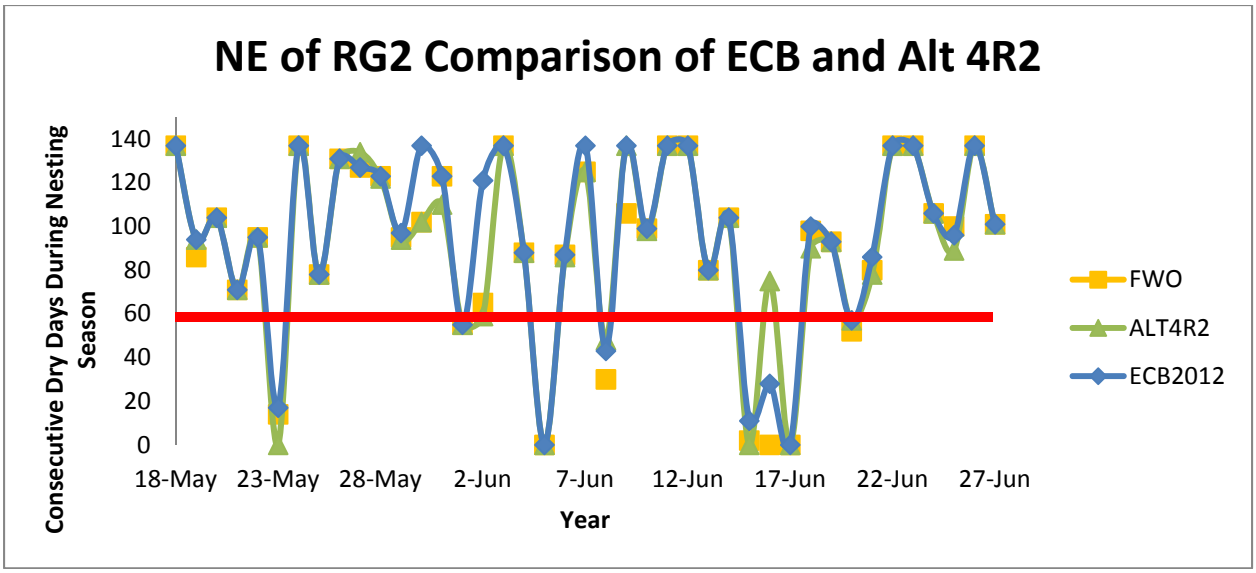

Figure 6-37. PM-A comparison of existing conditions, Alt 4R2, and FWO for CSSS-F

CSSS-A population has remained stable, but has not increased since the implementation of CSSS protective measures in 1999. Critical habitat for CSSS was revised in 2007 and CSSS-A is the only subpopulation that does not reside within designated critical habitat. The biggest difference in CSSS-A where existing conditions performed better than Alt 4R2 is 8 years at IR-A2 and 2 years at TMC. In the 2008-2012 survey, the IR-A1 had more birds present than in IR-A2 (**Figure 6-38**), and the IR-A1 increased meeting PM-A by 2 years over existing conditions and FWO. P34 had the same number of years met between all comparisons, however, only a few birds were found present in the area (**Figure 6-38**).

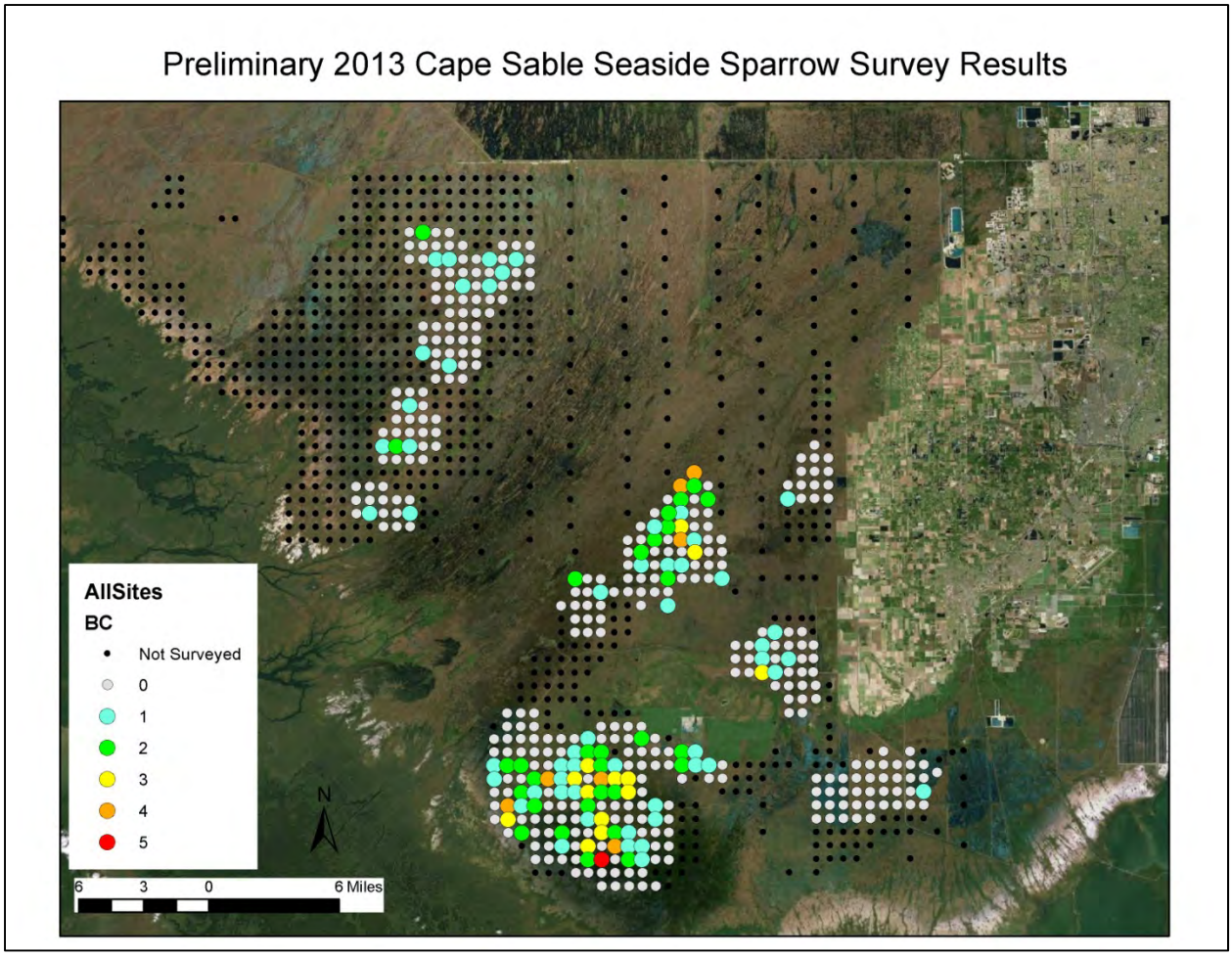

Figure 6-38. 2013 CSSS ENP survey results

CSSS-E is the second largest subpopulation, and Alt 4R2 met the criteria 4 years less than existing conditions and 3 years less than FWO. CSSS-D met the criteria the same as existing conditions but 2 years less than the FWO. Research suggests that CSSS are capable of short and long range movement (Dean and Morrison 1998), which could suggest that if the area around CSSS-E and D becomes too wet, the birds could reside in the CSSS-B area where Alt 4R2 is meeting the 60 day requirement below 6 ft of water every year. CSSS-C also meets the PM-A requirement often (38 and 39 years), as did CSSS-F (33 years), therefore potentially providing habitat for birds to move into areas of suitable habitat as others have become too wet in some years. These areas have a smaller population count than E, however, if birds from areas that are becoming too wet migrated towards B, F, and C, the populations may have a better chance of survival with increased subpopulation size.

Cape Sable seaside sparrows are largely sedentary, occupy the prairie habitats year-round and are completely dependent on the condition of the prairies. The CSSS have a short life expectancy of two to three years. This short life expectancy range identifies that for the population to sustain itself, there must not be three or more years in a row where water depths are not suitable for nesting. This means that there should not be three consecutive years in a row where the minimum of 60 consecutive dry days during the nesting season is not met.

Further analysis of gages specific to where nesting occurred in 2013 of the PM-A data looked at the durations and timing of the total number of consecutive dry days during the nesting season for each year of the POR. Tables presenting this data show that some areas exceed the greater than 60 day nesting period between March 1 and July 15, potentially allowing for multiple nests in one year. Preferable discontinuous hydroperiod durations range from 60 to 180 days, although a 40 to 80 consecutive day period is considered favorable (Pimm et al. 2002). Some of the consecutive day counts are close to 60, and may have been a day or a few days where the water level is just above the ground surface. In these cases, the cells were coded as yellow in that they may provide a suitable nesting season. Cells that are green met the 60 consecutive dry days and cells that are red did not meet the 60 consecutive dry days or even a total of 60 dry days during the nesting season. This analysis shows that for the northern CSSS sub population A (A-1), while there is still no difference between Alt 4R2, existing conditions, and FWO, 1984 was a year in which there were a total of 115 dry days for 4R2 and 57 dry days for existing conditions and FWO that has the possibility of producing a successful nest (**Table 6-6**). Table 6-6 shows that in the southern sub population A (A-2), while Alt 4R2 perform worse than existing conditions and FWO for more years and more consecutive years where there are less than 60 dry days during the nesting season, the breakdown of the days show that in 1979, there are 60 total dry days during the nesting season. **Table 6-7** shows no difference between Alt 4R2, existing conditions, and FWO in sub populations B and C, respectively. **Table 6-8** shows that while Alt 4R2 perform slightly worse than existing conditions and FWO for CSSS sub population D, there are 7 potential years where the total number of days adds up to greater than 60, therefore having the possibility of producing a successful nest. Subpopulation E-1 has 3 more potential years that have a total of greater than 60 days.

Table 6-9 shows while Alt 4R2 perform worse than FWO in the southern CSSS sub population E (E-2), there are a few years such as 1972, 2000, and 2003 where the alternatives do not meet the 60 consecutive dry day target, but they do have at least 60 dry days during the nesting season. **Table 6-9** also shows that Alt 4R2 performs better than the FWO in CSSS sub population F and that there are a few years such as 1980 and 1986 where the alternatives do not meet the 60 consecutive dry day target, but they do have at least 60 dry days during the nesting season.

Table 6-6. Total number of consecutive dry days during March 1 – July 15 for the northern CSSS sub population A-1 (left) and the southern CSSS subpopulation A-2 (right). Cells that are green have 60 or greater dry days during the nesting season. Cells that are yellow do not have 60 or more consecutive dry days during the nesting season, but do have a total of 60 or more dry days during the nesting season. Cells that are red do not have 60 dry days during the nesting season.

NP-205 (A-1)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	69, 1, 17	69, 1, 17	69, 1, 17
1966	14, 41	14, 41	14, 41
1967	88	104	89
1968	3, 3, 63	80	3, 3, 63
1969	3, 29, 14	1, 6, 31, 16	3, 28, 14
1970	45	47	46
1971	137	137	137
1972	8, 3, 35	14, 43	8, 3, 35
1973	12, 93	117	13, 94
1974	112	112	112
1975	112	112	112
1976	83, 2	83, 4	83, 2
1977	106, 22	112, 22	106, 22
1978	54	2, 55	54
1979	51, 2, 8, 8, 6, 13, 1	52, 3, 9, 29, 3	51, 2, 8, 8, 6, 13, 1
1980	11	11	11
1981	135	135	135
1982	87	87	87
1983	31	31	31
1984	37, 22	6, 9, 1, 47, 25	37, 22
1985	134	135, 1	135
1986	1, 68	1, 2, 2, 70	1, 67
1987	15, 51	14, 51	15, 51
1988	12, 61, 1	85, 2	12, 61, 1
1989	122, 9	123, 11	122, 9
1990	101, 10	112, 1	101, 10
1991	80	80	80
1992	93	102	93
1993	77	79	77
1994	2, 49	54	2, 49
1995	5, 2,	13, 1, 3	5, 2, 1
1996	2, 1, 68	9, 72	2, 1, 68
1997	13, 1	23, 10, 4	13, 1
1998	3, 75	3, 75	3, 75
1999	63	62	63
2000	37, 43, 10	44, 58	38, 43, 10
2001	93, 18	113	112
2002	88	95	89
2003	61, 23	61, 24	61, 23
2004	12, 91	122	12, 92
2005	98, 1	98, 1	98, 1

1527 (A-2)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	109	103	109
1966	69	63, 1, 2	70
1967	2, 95	3, 100	2, 96
1968	1, 73	58	1, 73
1969	8, 46	4, 44	8, 46
1970	0	0	0
1971	137	137	137
1972	76	76	76
1973	120, 1	119, 1	120, 1
1974	117	117	117
1975	89	89	89
1976	83, 2	83, 3	83, 2
1977	137	137	137
1978	9, 97	3, 53	9, 97
1979	73, 8, 2	46, 1, 8, 5	74, 8
1980	15, 21, 44	0	15, 21, 37, 5
1981	137	137	137
1982	87	87	87
1983	0	0	0
1984	92	73	93
1985	137	137	137
1986	21, 77	57	103
1987	5, 79	5, 81	5, 82
1988	84	84	86
1989	137	137	137
1990	99, 4, 2	99, 4, 2	99, 4, 2
1991	80	80	80
1992	91	5, 68	90
1993	12	0	12
1994	76, 1, 2, 1, 9, 3	52, 1	76, 1
1995	0	0	0
1996	64, 8	3, 37, 1	65, 8
1997	13, 2, 79	13, 83	13, 82
1998	6	5	8
1999	88	70	88
2000	32, 48, 10, 1	22, 45, 9	32, 48, 10, 1
2001	116, 1	116, 1	116, 1
2002	87	89	88
2003	89	61, 24	89
2004	127	118	127
2005	98	98	98

Table 6-7. Total number of consecutive dry days during March 1 – July 15 for the CSSS sub population B (left) and sub population C (right). Cells that are green have 60 or greater dry days during the nesting season. Cells that are red do not have 60 dry days during the nesting season.

2704 (B)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	137	137	137
1966	94	94	94
1967	107	107	107
1968	71	71	71
1969	91	91	91
1970	113, 1	111, 1	113, 1
1971	137	137	137
1972	107	107	107
1973	121	121	121
1974	137	137	137
1975	107	97, 3, 4	107
1976	101	101	101
1977	137	137	137
1978	84	84	84
1979	137	137	137
1980	137	137	137
1981	137	137	137
1982	88	88	88
1983	53	53	53
1984	134	134	134
1985	137	137	137
1986	119, 17	118, 17	137
1987	137	137	137
1988	99, 2	99, 2	99, 2
1989	137	137	137
1990	137	137	137
1991	110	110	110
1992	115	115	115
1993	135	97, 18, 17	135
1994	137	137	137
1995	72	65	71
1996	100	100	100
1997	93	93	93
1998	102	101	102
1999	112	110	112
2000	137	137	137
2001	137	137	137
2002	109	109	109
2003	103, 4, 13	103, 4, 13	103, 4, 13
2004	137	137	137
2005	114, 1, 5	114, 1, 5	114, 1, 5

3358 – (C)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	137	137	137
1966	94	94	94
1967	105	105	105
1968	71	71	71
1969	93	93	93
1970	88, 10, 1, 1	84	86, 7, 2
1971	137	137	137
1972	109, 3	109, 3	109
1973	125, 11	125, 3, 4	125, 3, 4
1974	126, 1	126, 1	125
1975	116	116	116
1976	101	94, 5	94, 5
1977	70, 62	70, 33, 26	70, 33, 27
1978	8, 125	2, 5, 123	8, 124
1979	68, 56	68, 56	68, 55
1980	137	1, 135	137
1981	137	137	137
1982	90, 1, 1, 26	90, 24	90, 24
1983	1, 41	11, 2, 4	32
1984	122	44, 77	44, 77
1985	124, 10	124, 4, 4	124, 9
1986	112, 4	112, 1, 1, 6	112, 4
1987	137	137	137
1988	99	99	99
1989	137	137	137
1990	137	137	123, 13
1991	82	82	82
1992	114	114	114
1993	95, 19, 9, 1, 1, 1	92, 1, 17, 7	92, 1, 17, 7
1994	95, 28	1, 92, 1, 31	1, 93, 12, 12
1995	16, 1, 27	5, 12	5, 2, 20
1996	86, 1, 8	86, 6	86, 7
1997	93	82, 10	82, 10
1998	97	82	92
1999	120, 6	111, 7, 3	111, 7, 4
2000	137	137	137
2001	137	137	137
2002	107, 1	106	106
2003	109, 3, 17	109, 3, 18	109, 4, 2, 18
2004	137	137	137
2005	111, 3	101, 8	101, 8

Table 6-8. Total number of consecutive dry days during March 1 – July 15 for the CSSS sub population D (left) and southern sub population E (E-1, right). Cells that are green have 60 or greater dry days during the nesting season. Cells that are yellow do not have 60 or more consecutive dry days during the nesting season, but do have a total of 60 or more dry days during the nesting season. Cells that are red do not have 60 dry days during the nesting season.

4541 (D)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	3, 91, 5, 4, 4	111, 5, 14	111, 6, 18
1966	6, 20, 8	3, 25, 27, 16	9, 25, 14
1967	98	102	102
1968	68	69	69
1969	24	27, 1	1, 1, 28, 1
1970	39	34	44
1971	116	118, 4, 2, 4	119, 9, 7
1972	30, 9, 7	31, 3, 12, 16	31, 3, 12, 17
1973	107	114	114
1974	102, 2	123	110
1975	90	90, 10, 10	90, 7, 2, 10
1976	62, 12, 1	75, 4, 2	75, 5, 2
1977	65, 2, 3, 8	68, 1, 3, 8	68, 1, 3, 8
1978	16	19	21, 1
1979	55	55	55
1980	13, 17	17, 22, 1	20, 29, 6
1981	114	119	119
1982	54	54, 4	54, 6
1983	14	0	14
1984	22, 62	22, 63	86
1985	20, 50, 2, 6, 27	72, 3, 38	117
1986	2, 38, 4	20, 49	5, 46
1987	5, 28, 41	5, 6, 49, 51	6, 13, 47, 47
1988	84	91	91
1989	126	126, 7	137
1990	87, 8	87, 8, 20	87, 4, 16
1991	2, 4, 33, 28	2, 45, 29	2, 44, 29
1992	18, 70	20, 75	22, 75
1993	1, 25	22	2, 8, 31
1994	1	13, 4	1, 9
1995	0	0	0
1996	42, 22	46, 23	2, 47, 23
1997	93	93	93
1998	2, 26, 14, 1	15, 27, 4	31, 29, 5
1999	76	85	2, 104
2000	40, 47	43, 54, 1	100, 2
2001	63, 34, 13	100, 29, 1	100, 29, 4
2002	74	90	91
2003	26, 11, 2, 1	26, 18, 6, 1	26, 19, 7, 5
2004	137	135	137
2005	99	101	101

2185 (E-1)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	137	137	137
1966	94	94	94
1967	104	104	104
1968	71	71	71
1969	92	15, 48, 12, 1	92
1970	19	3	19
1971	137	137	137
1972	80, 1, 5	76, 1	80, 4
1973	124	124	124
1974	102	102	102
1975	113, 2	113, 1	113, 1
1976	94	94	94
1977	71, 35, 4, 14	71, 34, 2, 3, 6	71, 34, 3, 6, 6
1978	90	87	90
1979	68, 37	68, 5	68, 13, 3, 3, 1
1980	1, 128	14, 29, 40, 4	1, 127
1981	137	137	137
1982	87	87	87
1983	0	0	0
1984	44, 39, 10, 7	32, 5, 35, 8, 2, 1	44, 38, 9, 7
1985	125	125	125
1986	26, 71	25, 67	26, 70
1987	137	5, 127	137
1988	99	99	99
1989	137	137	137
1990	125, 1, 1	125, 1, 1	125, 1, 1
1991	80	80	80
1992	114	113	114
1993	67, 1, 17	26	58, 15
1994	91, 1, 10, 1, 10	80, 8, 8	90, 8, 9
1995	0	0	0
1996	100	2, 72, 10	100
1997	79, 1	79	79, 1
1998	65	57	62
1999	110	89	110
2000	137	44, 89	137
2001	137	137	137
2002	105	105	105
2003	90, 9, 3	89, 6	90, 9, 3
2004	137	137	137
2005	101	101	101

Table 6-9. Total number of consecutive dry days during March 1 – July 15 for the southern CSSS sub population E (E-2, left) and sub population F (right). Cells that are green have 60 or greater dry days during the nesting season. Cells that are yellow do not have 60 or more consecutive dry days during the nesting season, but do have a total of 60 or more dry days during the nesting season. Cells that are red do not have 60 dry days during the nesting season.

2339 (E-2)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	137	137	137
1966	81	3, 70	81
1967	104	104	104
1968	71	70	71
1969	1, 8, 10, 33	2, 3, 1, 29	1, 7, 9, 32
1970	0	0	0
1971	137	137	137
1972	76	24, 1, 36	35, 1, 40
1973	5, 2, 1, 79	3, 1, 75	4, 2, 78
1974	106	106	106
1975	90, 1	90	90
1976	88	88	88
1977	71, 34, 3, 14	71, 33, 2, 6, 6	71, 33, 2, 7, 6
1978	74	71	74
1979	56, 1, 8	51	55, 2, 1
1980	24, 44, 46	18	24, 41, 2, 40, 5
1981	131	2, 124	131
1982	87	87	87
1983	0	0	0
1984	22, 59	2, 9, 45	22, 58
1985	124	124	124
1986	103	25, 71	103
1987	5, 101	5, 98	5, 103
1988	99	98	99
1989	137	137	137
1990	117	117	117
1991	80	80	80
1992	97	23, 72	97
1993	64, 1, 1	17, 3	64, 1, 1
1994	68	33, 5, 17	68
1995	0	0	0
1996	9, 72, 1, 2, 1	2, 13, 44	9, 72, 1
1997	79	79	79
1998	40	35	40
1999	100	84	100
2000	44, 46, 2, 3	36, 43	44, 46, 1, 2
2001	137	137	137
2002	91, 5	90, 4	91, 5
2003	26, 23, 20	16, 8, 21, 19	26, 23, 19
2004	137	135	137
2005	98	98	98

2947 (F)	ECB 2012	Alt 4R2	FWO
Year	# consecutive days	# consecutive days	# consecutive days
1965	137	137	137
1966	94	94	86
1967	104	104	104
1968	71	71	71
1969	95	95	95
1970	17	0	14
1971	137	137	137
1972	78	78	78
1973	131	131	131
1974	127, 6, 2	134, 2	127, 5, 1
1975	123	122	123
1976	97	94	95, 1
1977	137	102, 33	102, 34
1978	123	9, 110	123
1979	55, 17	55	55, 1
1980	121	9, 59	1, 33, 2, 65
1981	137	137	137
1982	88	88	88
1983	0	0	0
1984	87	86	87
1985	137	125, 3	125, 7
1986	25, 43	25, 48	24, 30, 2
1987	137	137	30, 106
1988	99	98	99
1989	137	137	137
1990	137	137	137
1991	80	80	80
1992	104	104	104
1993	1, 11	0	2
1994	28, 4, 10, 1, 1	75, 33	0
1995	0	0	0
1996	100	90	98
1997	93, 4	93	93, 2
1998	57	57	52
1999	86, 8, 7	77, 8, 5	80, 8, 6
2000	137	137	137
2001	137	137	137
2002	106	106	106
2003	96	89	100
2004	137	137	137
2005	101	101	101

Ecological Target 1

ET-1 (NP-205, CSSS-A): Strive to reach a water level of < 7.0 feet, NGVD at NP-205 by December 31 for nesting season water levels to reach 6.0 feet, NGVD by mid-March.

Alt 4R2 performed the same as the FWO for ET-1, with both meeting the requirement 1 extra year than the existing conditions (**Table 6-10**).

Table 6-10. Comparison of ECB 2012, Alt 4R2 and FWO: Number of years ET-1 was met

ET-1	ECB 2012	Alt 4R2	FWO
# years met	38	39	39

Ecological Target 2

ET-2 (CSSS): Strive to maintain a hydroperiod between 90 and 210 days (three to seven months) per year throughout sparrow habitat to maintain marl prairie vegetation.

RSMGL results for each CSSS subpopulation are depicted in **Table 6-11** and **Figure 6-39**. Alt 4R2, existing conditions, and FWO were compared to understand how many years out of the 41 year POR the hydroperiod between 90 and 210 days (three to seven months) were met to maintain marl prairie vegetation. Alt 4R2 only performed better than the FWO in the Northern Sub population A (A-1) by meeting the ET-2 criteria 6 more years than the existing conditions and 4 more years than FWO. Alt 4R2 performed worse than the existing conditions and FWO in CSSS-A-2 and B (1 year), CSSS-C (3 and 4 years), CSSS-D (1 and 4 years), CSSS-E1 (6 years), CSSS-E2 (2 years), and CSSS-F (3 and 4 years) Line graphs are presented in **Figures 6-40 through 6-49** to show visually show the differences between existing conditions, Alt 4R2, and FWO.

Table 6-11. Number of years out of the period of record that the hydroperiod was between 90 and 210 days each year throughout sparrow habitat in order to maintain marl prairie vegetation (ET-2)

CSSS Sub Population	ECB 2012	Alt 4R2	FWO
A-1	4	10	6
A-2	9	8	9
B	25	24	25
C	18	15	19
D	11	10	16
E-1	24	18	24
E-2	12	10	12
F	17	14	18

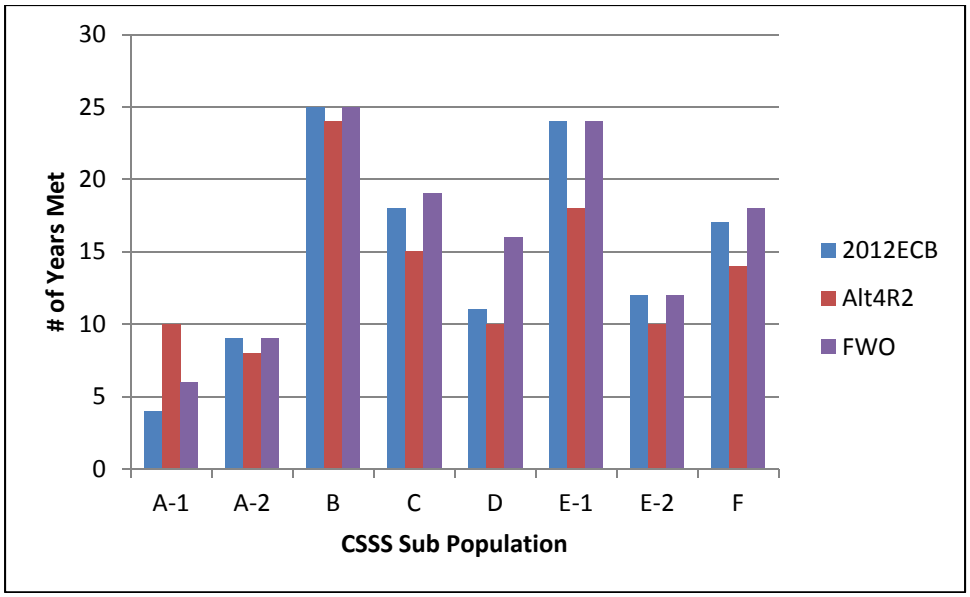

Figure 6-39. Number of years out of the period of record that the hydroperiod was between 90 and 210 days each year throughout sparrow habitat in order to maintain marl prairie vegetation

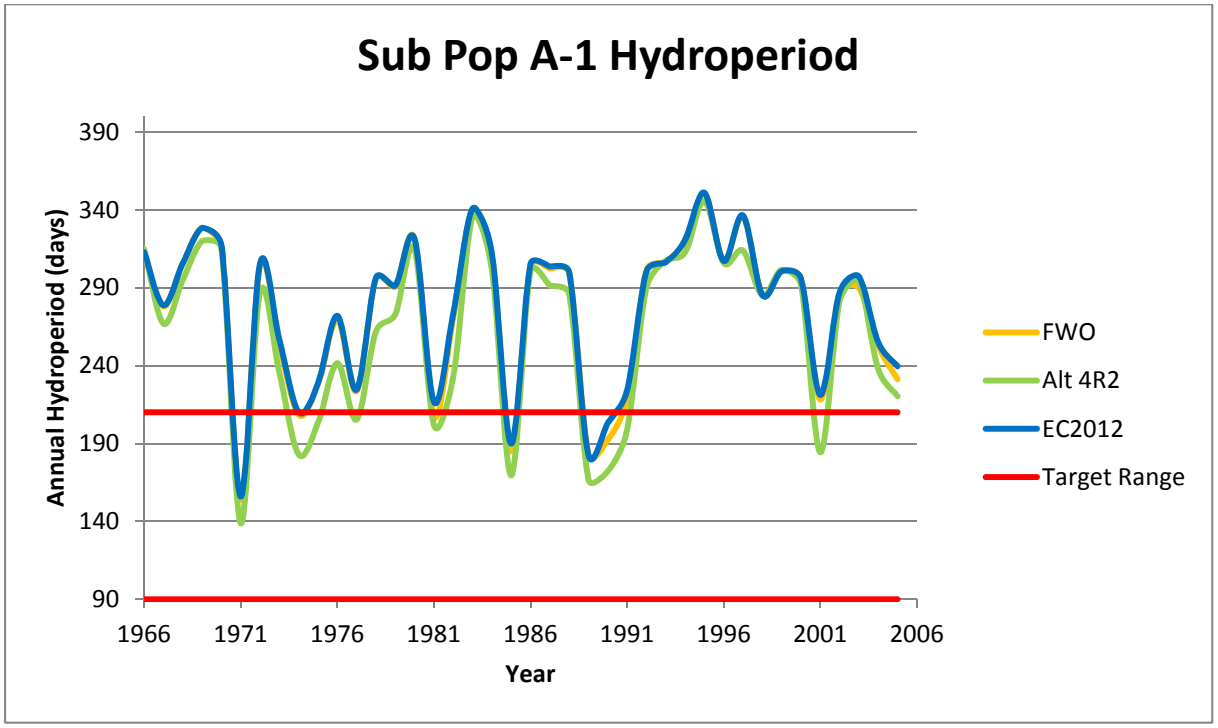

Figure 6-40. CSSS-A-1 comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

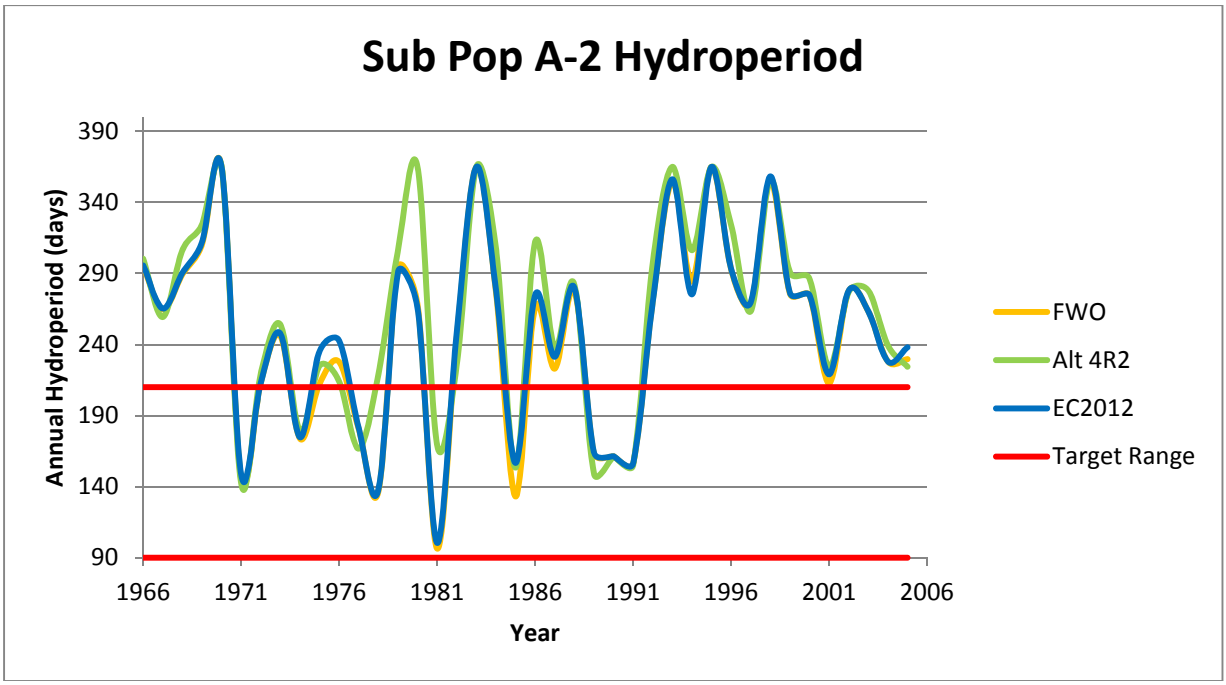

Figure 6-41. CSSS-A-2 comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

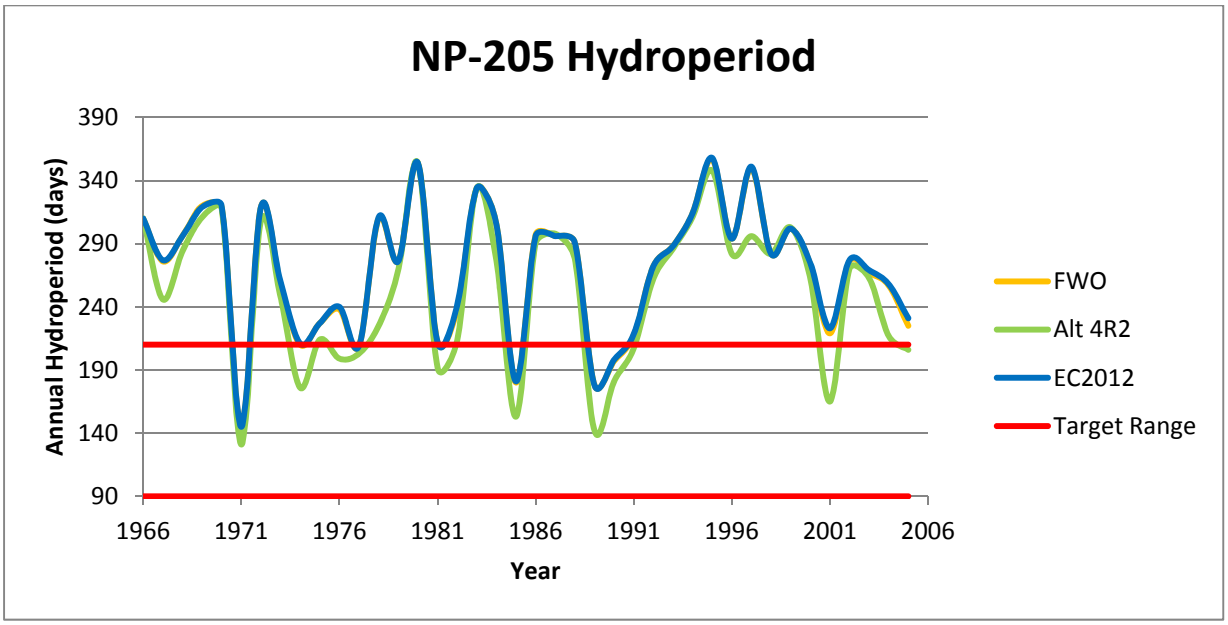

Figure 6-42. CSSS-A comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

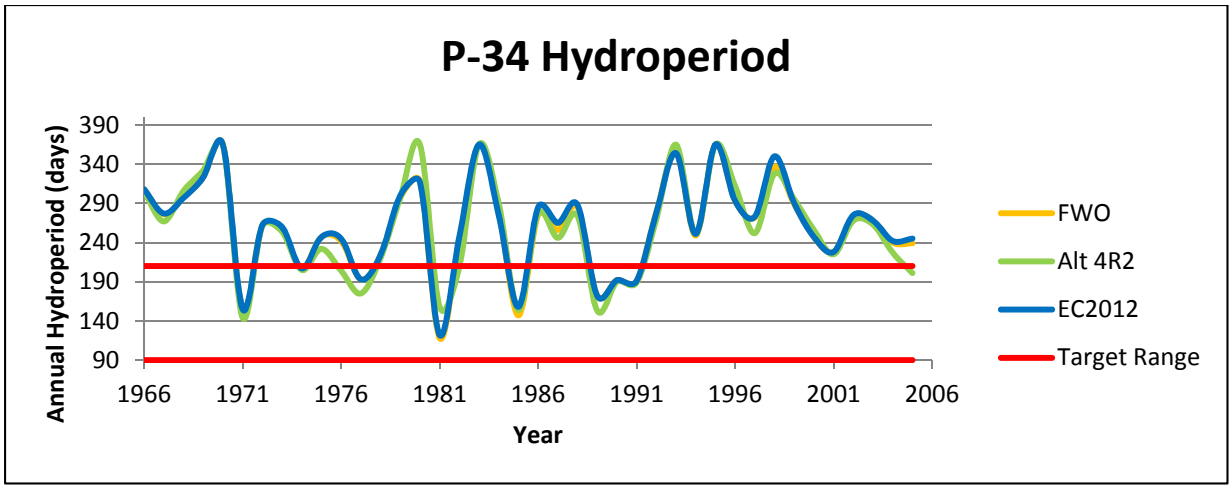

Figure 6-43. CSSS-A comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

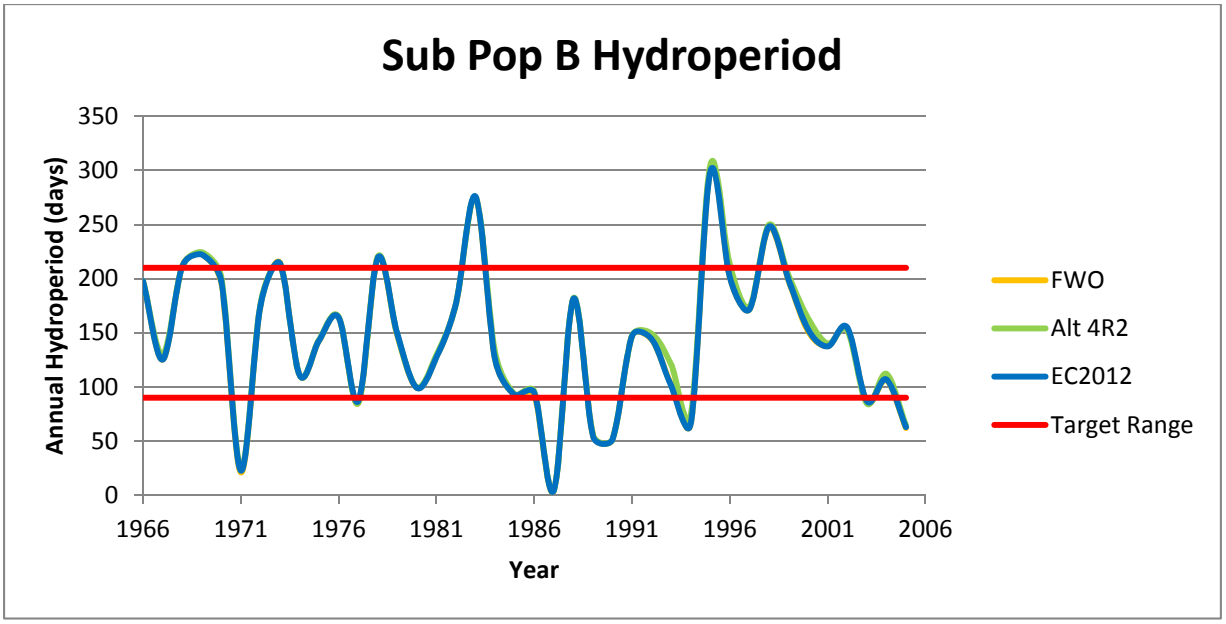

Figure 6-44. CSSS-B comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

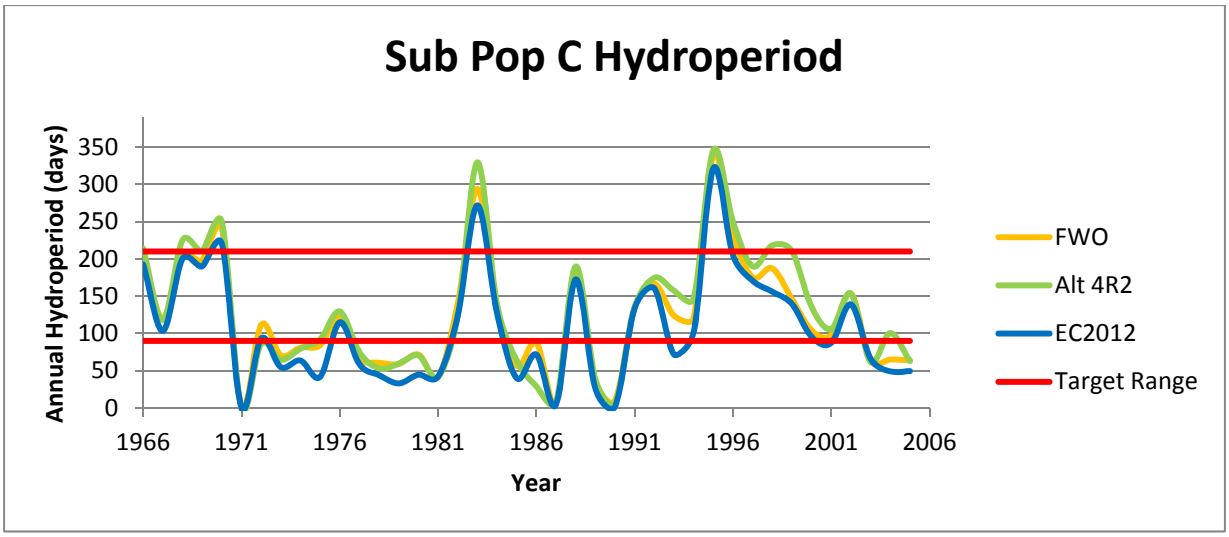

Figure 6-45. CSSS-C comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

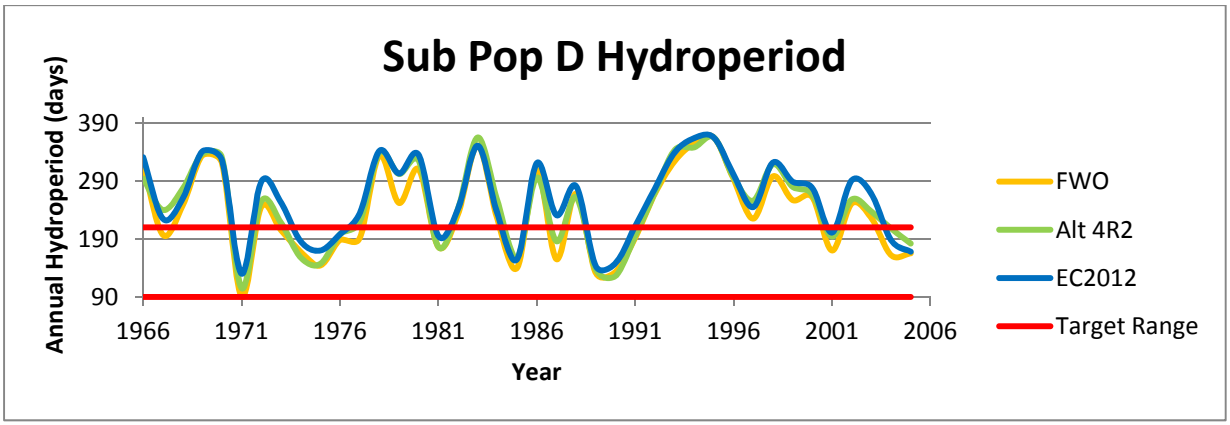

Figure 6-46. CSSS-D comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

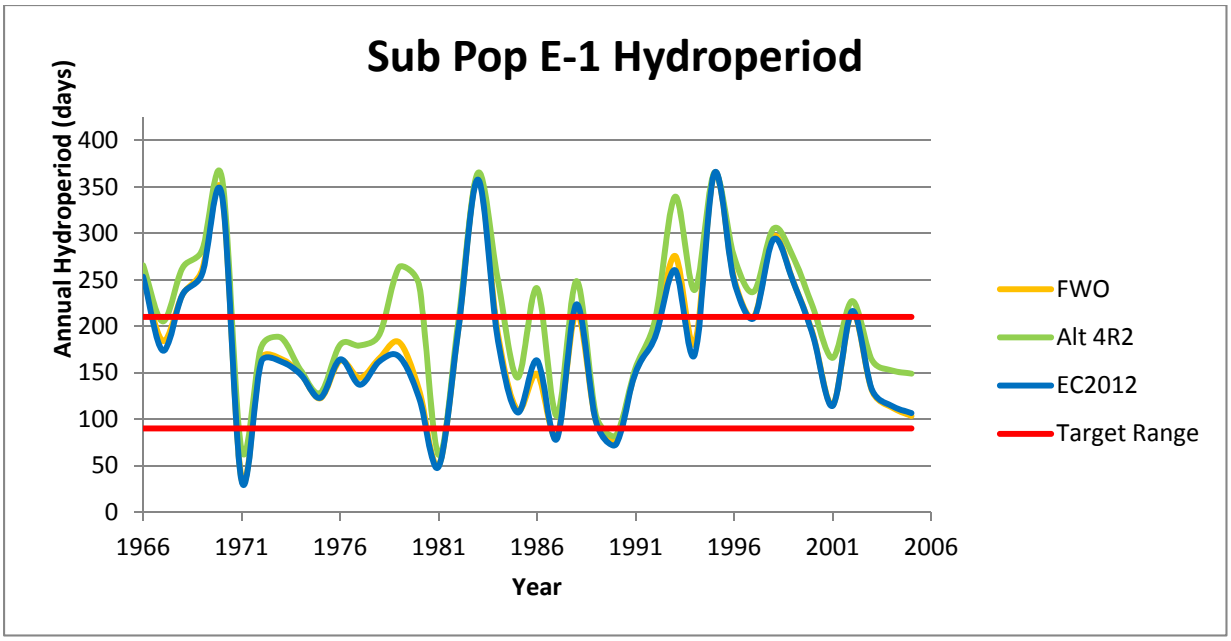

Figure 6-47. CSSS-E-1 comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

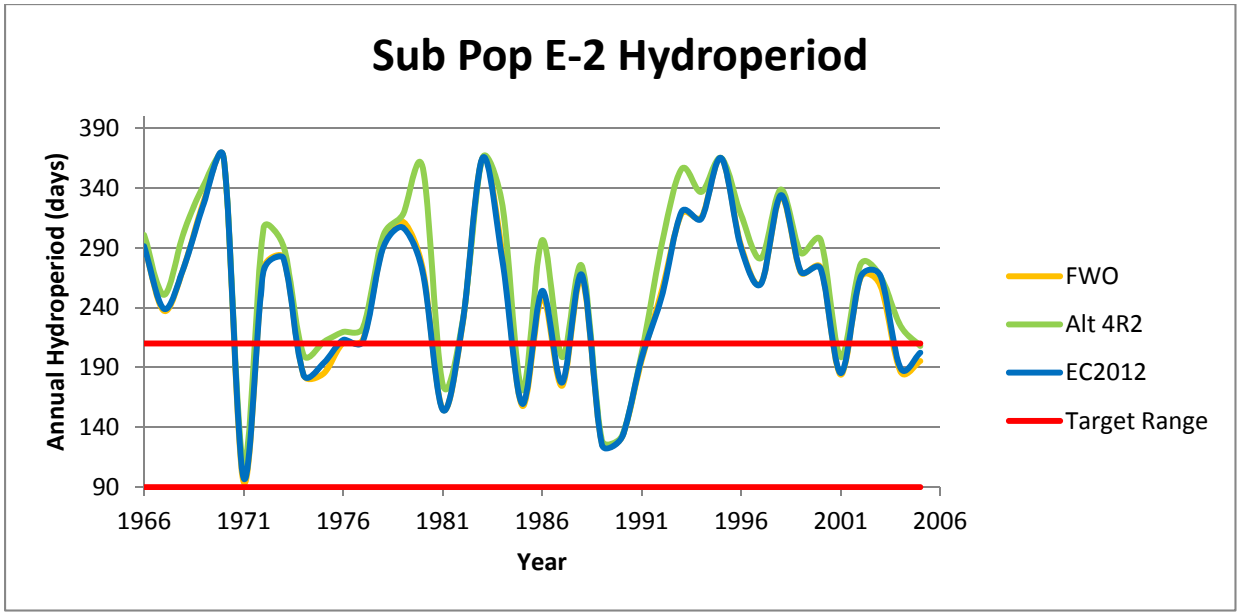

Figure 6-48. CSSS-E-2 comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

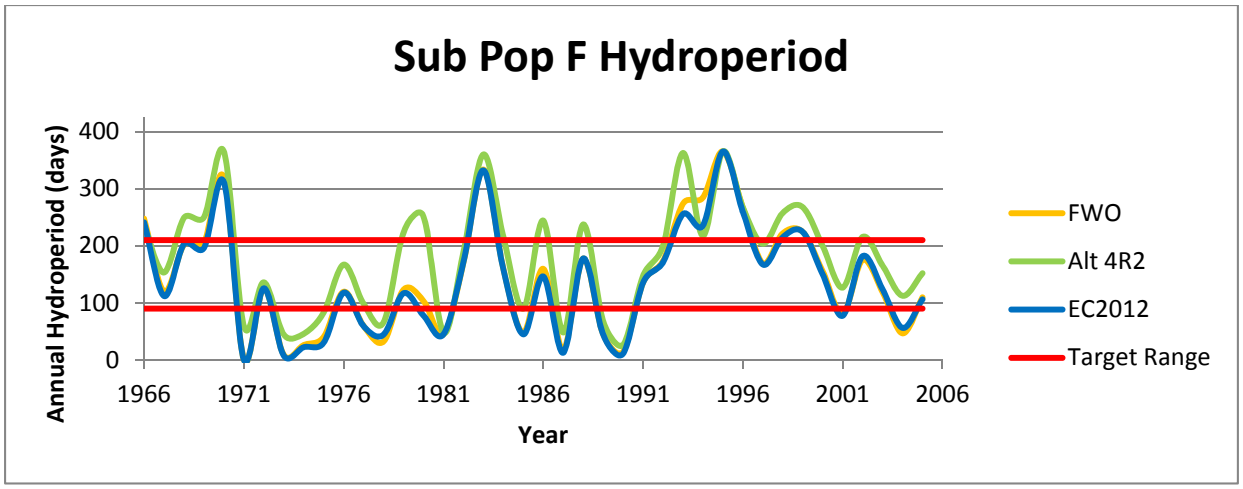

Figure 6-49. CSSS-F comparison of existing conditions, Alt 4R2, and FWO for the number of days between target hydroperiod of 90-210 days per year

Marl Prairie Indicator

A HSI for marl prairie habitat was used to predict potential effects of implementation of CEPP Alt 4R2 as compared to existing conditions and FWO. The HSI predicts hydrologic suitability of marl prairies based on CSSS survey presence data and threshold ranges (Pearlstien et. al. 2011). The HSI measures marl prairie habitat suitability annually for four metrics: (1) average wet season water depths from June – October, (2) average dry season water depths from November – May, (3) discontinuous annual hydroperiods from May-April of the next year, and (4) maximum continuous dry days during the nesting season from March 1- July 15.

Suitability for marl prairie habitat is decreased in the vicinity of CSSS-B, CSSS-D, CSSS-E, and CSSS-F for Alt 4R2 relative to the existing conditions and FWO (**Figure 6-50**). Notable changes occur within the eastern marl prairies in the vicinity of CSSS-E, along the eastern edge of SRS that decrease the marl prairie habitat suitability, shifting into wetter habitats with Alt 4R2 (**Figure 6-51**). Increased hydroperiods within the eastern marl prairies may potentially result in a shift in vegetation. Ross and Sah (2004) noted differences in species composition within wet prairies based upon hydroperiod. Shorter hydroperiod prairies were dominated by *Muhlenbergia*, *Schizachyrium* and *Paspalum*, while longer hydroperiod prairies consisted of *Cladium, Schoenus,* and *Rhynchospora.* Compared to the existing conditions and FWO, differences in marl prairie habitat suitability within CSSS-B, CSSS-D, and CSSS-F for Alt 4R2 were minor.

Analyses of marl prairie habitat suitability with the northwestern marl prairies in the vicinity of CSSS-A reveal negligible benefits for Alt 4R2 as compared with the existing conditions and FWO. Pollen data indicate that the marl prairies west of SRS are not a natural feature of the Everglades landscape but developed after twentieth century hydrologic modification of the system reduced flow to the region (Bernhardt and Willard 2006). Prior to the modifications, plant communities at the sites analyzed by Bernhardt and Willard (2006) in western SRS consisted of sawgrass marshes. The authors concluded that "the current spatial distribution and community composition of marl prairies are a response to water management and land cover changes of the twentieth century, and further sampling of modern marl prairie communities and adjacent communities is necessary to document the pre- and post-drainage distribution of marl prairie" (Bernhardt and Willard 2006). Habitat suitability within central and southern CSSS-A (and flanking regions to the east) decline while habitat suitability in northern CSSS-

A and regions northeast of CSSS-A slightly improve (**Figure 6-51**). Alt 4R2 provides negligible benefits within CSSS-C compared to the existing conditions and FWO.

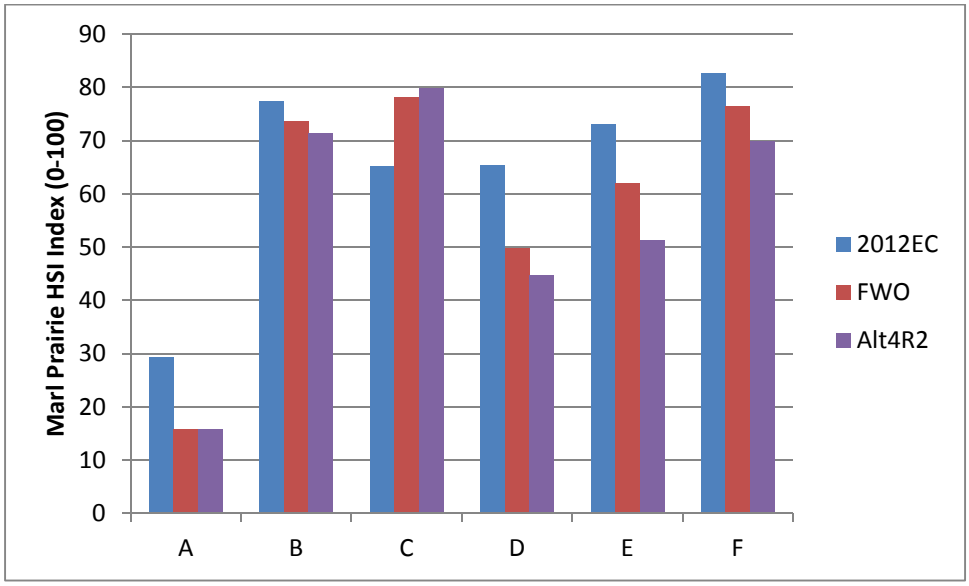

Figure 6-50. Average marl prairie suitability index scores (1965-2005) for existing conditions, Alt 4R2, and FWO.

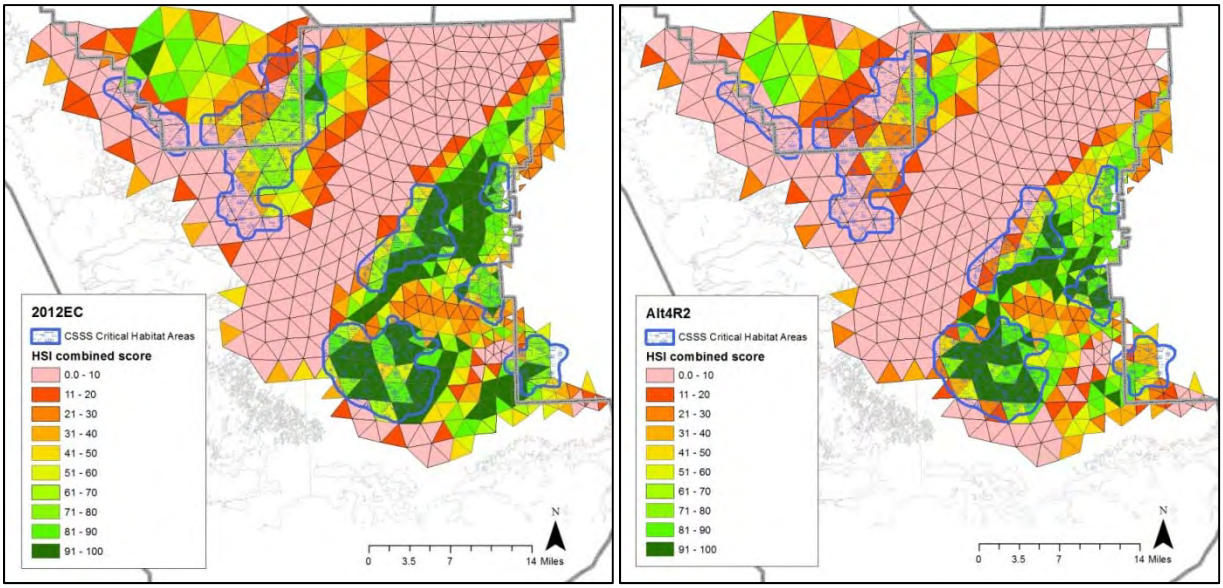

Figure 6-51. Habitat suitability of existing conditions is presented in the left panel and Alt 4R2 habitat suitability for the combined marl prairie indicator scores at each RSM cell south of Tamiami Trail. Scores vary from 0.0 (not suitable) to 100.0 (most suitable). Subpopulation areas for the Cape Sable seaside sparrow are shown as a blue outline

6.2.8.2 CSSS Species and "May Affect" Determination

The goal of CEPP and the future CERP is to rehydrate the greater Everglades and provide higher volumes of freshwater into ENP. Overall, CEPP would decrease the number of years that meet the 60-day dry nesting constraint (PM-A) in CSSS-A and E as compared to the existing conditions. While the number of years that PM-A is met is not many, Alt 4R2 remains consistent with the existing conditions and FWO for

all other subpopulations for PM-A, with the exception of CSSS-D where the FWO met more years than Alt 4R2 and existing conditions (**Table 6-5**).

Additional analysis of PM-A, using 60 consecutive nesting days below 6 feet for 3 or more years in a row, revealed that potentially a few more years would have met the criteria in some of the subpopulations (**Table 6-5**). In 1979, CSSS-A-1 and CSSS-A-2 (56 and 46 days, respectively (with total days over 60) would have met the criteria in total days, which is between two years that did not meet the 60 day requirement, potentially allowing for CSSS nesting during that year to recuperate during that particular nesting season.

Areas within the eastern marl prairies along the boundary of ENP suffer from over-drainage, reduced water flow, exotic tree invasion and frequent human-induced fires (Lockwood et al. 2003, Ross et al. 2006). To alleviate the perpetual drier conditions and its associated problems, increased water flows within this area are required. Alt 4R2 provides more water to SRS and the southern marl prairies. Increased hydroperiods within the eastern marl prairies may act to alleviate some of the problems associated with drier conditions and promote a shift in species community composition. However, marl prairie habitat suitability was met less than the existing conditions and FWO for CSSS-A, CSSS-B, CSSS-D, CSSS-E, and CSSS-F (**Figure 6-50 and Figure 6-51**). Restoring conditions back to pre-drainage conditions would not be suitable for marl prairie habitats, however, CEPP does not meet targets for full pre-drainage conditions.

Since the proposed action potentially raises groundwater levels in sensitive areas for the sparrow, hydrological changes associated with implementation of the action are expected to alter some of the physical and biological features essential to the nesting success and overall conservation of the subspecies. In order to protect CSSS, structural closings implemented under 2006 IOP and preserved under 2012 ERTP were also retained under CEPP. Further changes in operations that limit flows into ENP for protection of CSSS have the potential to limit CEPP benefits to the northern estuaries, WCA 3A, ENP, Florida Bay, the southwestern coastal estuaries, and other threatened and endangered species within those areas, most notably American crocodile, smalltooth sawfish, Florida manatee, Florida panther, and wood stork. Although the action related hydrologic changes as compared to the existing conditions are expected to be minimal throughout much of CSSS habitat with improvements seen within some areas (northern CSSS-A, CSSS-F), the Corps has determined the action may affect CSSS. Metrics could be developed prior to CEPP implementation to incorporate real-time monitoring since other projects will be built and operated prior to CEPP. These projects would provide interim increased water flows to the area and provide information about the transition in the system to higher water levels. This interim process would potentially minimize effects to the subspecies as well as ensure CEPP benefits are realized in other areas of the system.

6.2.8.3 Cape Sable Seaside Sparrow Critical Habitat

Critical habitat for the CSSS was designated on August 11, 1977 (42 FR 42840) and revised on November 6, 2007 (72 FR 62735 62766). Currently, the critical habitat includes areas of land, water, and airspace in the Taylor Slough vicinity of ENP in Miami-Dade and Monroe counties, Florida. Primary constituent elements include suitable soil, vegetation, hydrologic conditions, and forage base. The designated area encompasses approximately 156,350 acres (63,273 hectares). CSSS-A is the only area occupied by sparrows that does not have associated designated critical habitat.

Designated critical habitat for the CSSS includes areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Dade, and Monroe counties, with the following components: those portions of ENP

within T57S R36E, T57S R36E, T57S R37E, T58S R35E, T58S R36E, T58S R37E, T58S R35E, T58S R36E, T59S R35E, T59S R36E, T59S R37E. Areas outside of ENP within T55S R37E Sec. 36, T55S R38E Sec. 31, 32, T56S R37E Sec. 1, 2, 11-14, 23-26, T56S R38E Sec. 5-7, 18, 19, T57S R37E Sec. 5-8, T58S R38E Sec. 27, 29-32, T59S R38E Sec. 4 (CFR Vol. 72, No. 214 / 11-6-07). All of the designated CSSS critical habitat lies within CEPP study area (**Figure 6-52**).

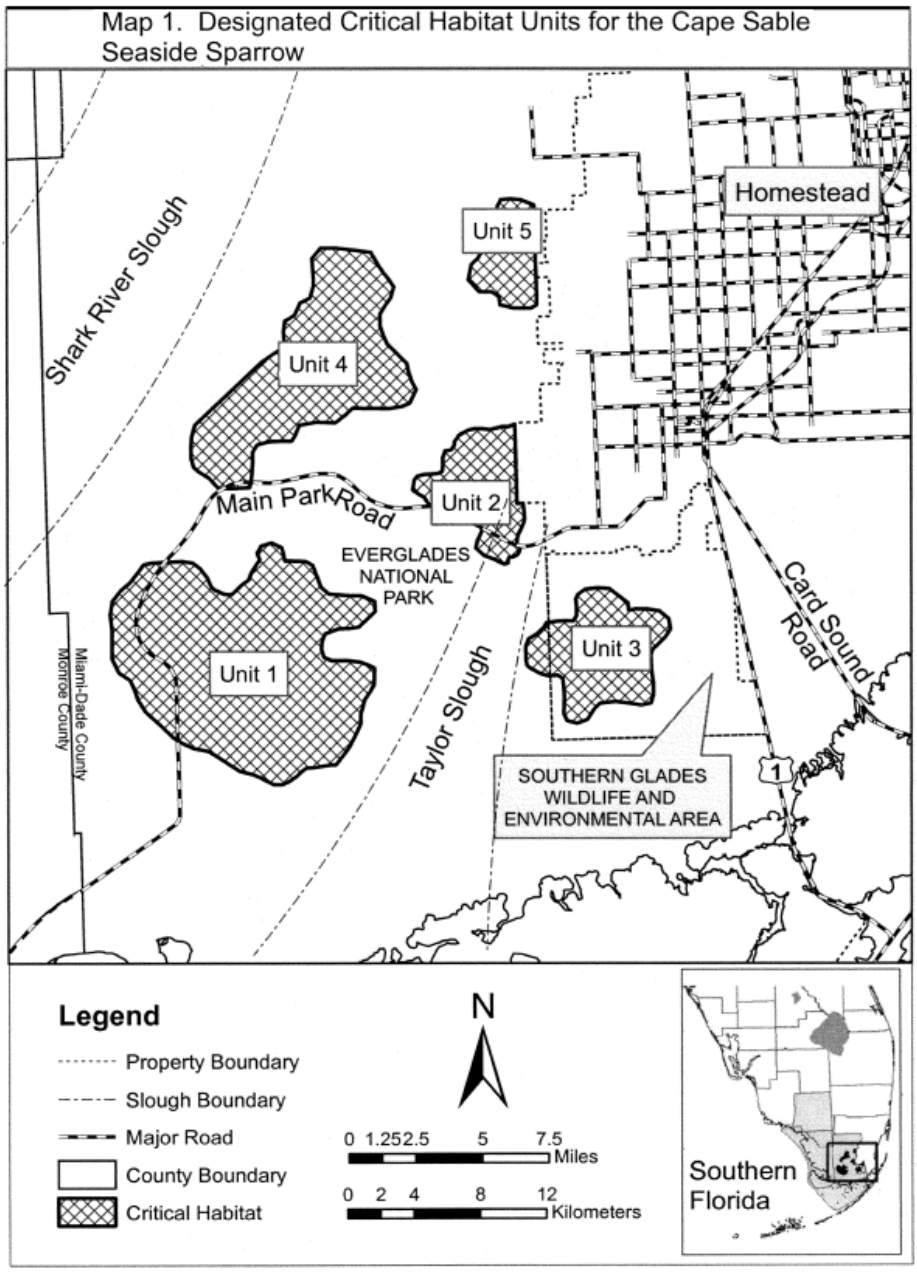

Figure 6-52. Critical habitat for the Cape Sable seaside sparrow

Because the majority of designated critical habitat lies within ENP, there have been relatively few human-related structural impacts to the land. However, about 471.5 acres (190.8 hectares) of critical habitat were altered during construction of the S-332B detention areas and a portion of the B-C connector. No other permanent alteration of critical habitat is known. Degradation of critical habitat

has resulted from flooding within the area of CSSS-D, and frequent fires and woody vegetation encroachment in overdrained areas near CSSS-C and CSSS-F. Degradation of these habitats is not permanent, and they may improve through restoration efforts.

In order to predict the project related effects on the CSSS, one must consider those physical and biological features that are essential to the conservation of the species and their habitat. These include, but are not limited to space for individual and population growth and for normal behavior, food, water, air, light, minerals, or other nutritional or physiological requirements, cover or shelter, sites for breeding, reproduction, and rearing (or development) of offspring, and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. These requirements, which are based on the biological needs of this species, are described in the final critical habitat designation published in the Federal Register on 6 November 2007 (FR Vol. 72, No. 214).

Primary constituent elements are physical and biological features that have been identified as elements essential to the conservation of the species. As described in the Federal Register (FR Vol. 72, No. 214), the primary constituent elements include:

- Soils that are widespread in the Everglades' short-hydroperiod marshes and support the vegetation types that the CSSS rely on
- Plant species that are characteristic of CSSS habitat in a variety of hydrologic conditions that provide structure sufficient to support CSSS nests, and that comprise the substrate that CSSS utilize when there is standing water
- Contiguous open habitat because CSSS require large, expansive, contiguous habitat patches with sparse woody shrubs or trees
- Hydrologic conditions that would prevent flooding sparrow nests, maintain hospitable conditions for CSSS occupying these areas, and generally support the vegetation species that are essential to CSSS
- Overall the habitat features that support the invertebrate prey base the CSSS rely on and the variability and uniqueness of habitat

Evaluations of project effects to the primary constituent elements are discussed below:

6.2.8.3.1 Calcitic Marl Soils

Marl soils are characteristic of the short-hydroperiod freshwater marl prairies of the southern Everglades and support the vegetation community on which CSSS depend. Presently, soils in the marl prairie landscape within CSSS habitat vary in physical and chemical characteristics due to the variation in topography, hydrology, and vegetation (Sah et al. 2007). Alteration of soil characteristics due to project operations would be difficult to detect in the short term.

6.2.8.3.2 Herbaceous Vegetation

Greater than 15 percent combined cover of live and standing dead vegetation of one or more of the following species: muhly grass, Florida little bluestem, black sedge, and cordgrass (*Spartina bakeri*) are largely characteristic of areas where CSSS occur. They act as cover and substrate for foraging, nesting, and normal behavior for sparrows during a variety of environmental conditions. Although many other herbaceous plant species also occur within CSSS habitat (Ross et al. 2006), and some of these may have important roles in the life history of the CSSS, the species identified in the primary constituent relationship consistently occur in areas occupied by sparrows (Sah et al. 2007). With a trend indicating longer hydroperiods affecting the vegetative community composition in CSSS critical habitats, it may be difficult to separate project level effects from other factors (i.e. sea level rise; C-111 SC Project).

6.2.8.3.3 Contiguous Open Habitat

CSSS subpopulations require large, expansive, contiguous habitat patches with few or sparse woody shrubs or trees. The components of this primary constituent element are largely predicated on a combination of hydroperiod and periodic fire events. Fires prevent hardwood vegetation from invading these communities and prevent the accretion of dead plant material, both of which decrease the suitability of this habitat type for CSSS. Implementation of the proposed project could extend hydroperiods causing a minimal effect on the occurrence of natural fires in the area.

6.2.8.3.4 Hydrologic Regime-Nesting Criteria

As stated, favorable nesting habitat requires short hydroperiod vegetation characteristic of mixed marl prairie communities. A measure of the potential for CSSS nesting success is the number of consecutive days between March 1 and July 15 that water levels are below ground surface. Preferable discontinuous hydroperiod durations range from 60 to 180 days, although a 40 to 80 consecutive day period is considered favorable (Pimm et al. 2002).

In order to maintain suitable vegetative composition conducive for successful nesting, it is important that water depth, as measured from the water surface down to the soil surface, does not exceed 7.9 inches (20 cm) more than 30 days during the period from March 15 to June 30 at a frequency of more than two out of every ten years. Water depths greater than 7.9 inches (20 centimeters) during this period will result in elevated nest failure rates (Lockwood et al. 2001, Pimm et al. 2002). If these water depths occur for short periods during nesting season, CSSS may be able to re-nest within the same season. These depths, if they occur for sustained periods (more than 30 days) within CSSS nesting season, will reduce successful nesting to a level that will be insufficient to support a population if they occur more frequently than two out of every ten years. This has occurred within portions of the CSSS range.

6.2.8.4 Potential Effects to Cape Sable Seaside Sparrow Critical Habitat

Effects to each Unit are discussed below.

6.2.8.4.1 Critical Habitat Unit 1/CSSS-B Description

Critical habitat Unit 1 represents the largest CSSS subpopulation and has remained relatively stable since implementation of IOP operations in 2002. Wet prairie vegetation dominates within this unit (Ross et al. 2006). This Unit meets the hydroperiod criteria between 90-210 days per year the most number of years out of the 41 year POR compared to all other units (24 years in Alt 4R2, 25 years in FWO). Alt 4R2 performs slightly different than the hydrologic regime from existing conditions or FWO (**Table 6-10**).

6.2.8.4.2 Critical Habitat Unit 2/ CSSS-C Description

Habitat of varying suitability occurs within Unit 2. Long-hydroperiod marshes occur south of the S-332 pump station, while areas to the north are overdrained and prone to frequent fires. The most recent fire occurred in March 2007 when the Frog Pond fire swept through this area. The habitat has yet to fully recover (Sah et al. 2008, Virzi et al. 2009). The variable habitat conditions are thought to be a consequence of the 1980 construction of the S-332 pump station, located at the boundary of ENP and Taylor Slough. Unit 2 holds relatively few CSSS. During intensive nest surveys in 2008, Virzi et al. (2009) documented four females and five males, nine nest attempts and reported nest survival as 22.8%. Previous research has indicated that habitat is unsuitable for CSSS for two to three years after it burns. This remains consistent with the range wide survey results; surveys in 2010 revealed that 2 birds were counted, giving a population estimate of 32, in 2011 11 birds were counted with a population estimate of 176, and in 2012, 6 were counted with a population estimate of 96. The bird count/population

estimate has not been as high as year 2011 since before the 2007 fire. Recent research has indicated that within Unit 2, CSSS-C is suffering from the ill-effects of small population size including fewer breeding individuals, male-biased sex ratios, lower hatch rates, and lower juvenile return rates (Boulton et al. 2009a, Virzi et al. 2009). This unit meets the hydroperiod criteria of 90-210 days per year 15 out of the 41 year POR as compared to the existing conditions of 18 years, and FWO that meets the criteria 19 years **(Table 6-11)**.

6.2.8.4.3 Critical Habitat Unit 3/CSSS-D Description

Since 1981, when an estimated 400 CSSS resided within Unit 3, this subpopulation experienced a continual decline in population size (Cassey et al. 2007). CSSS-D is a small, dynamic subpopulation that fluctuates annually; occupancy within Unit 3 is low and detection probability is highly variable. Thought to be functionally extirpated in 2007 (Lockwood et al. 2007), CSSS were again encountered within this area in 2009 when Virzi et al. (2009) encountered four males and two females **(Table 6-4)**. However, in 2012, 14 birds were counted with a population estimate of 224, which is substantially higher than between the years 2007 and 2011. Prior to the 2012 survey, vegetation within this critical habitat unit was thought to be unsuitable for CSSS breeding. Since 2000, high water levels and longer hydroperiods have prevailed resulting in a sawgrass-dominated community interspersed with patches of muhly grass at higher elevations (Ross et al. 2003). This unit meets the hydroperiod criteria of 90-210 days per year 10 out of the 41 year POR as compared to the existing conditions of 11 and FWO that meets the criteria 16 years (**Table 6-11**).

6.2.8.4.4 Critical Habitat Unit 4/CSSS-E Description

Located along the eastern edge of Shark River Slough, critical habitat Unit 4 encompasses approximately 66 square kilometers. The Rocky Glades separate Unit 4 and CSSS-E from the other eastern subpopulations. Unit 4 holds the second greatest number of CSSS among all subpopulations. This unit is expected to be affected by an altered hydroperiod that is too long to support marl prairie habitat requirements. This unit meets the hydroperiod criteria of 90-210 days per year at E-1 for 18 out of the 41 year POR as compared to the existing conditions and FWO that meets the criteria 24 years. For E-2, Alt 4R2 meets the criteria 10 years versus the existing conditions and FWO at 12 years (**Table 6-11**).

6.2.8.4.5 Critical Habitat Unit 5/CSSS-F Description

The most easterly of all the CSSS critical habitat units, Unit 5 is located at the ENP boundary in proximity to agricultural and residential development. Habitat within this critical habitat unit suffers from over-drainage, reduced water flow, exotic tree invasion and frequent human-induced fires (Lockwood et al. 2003, Ross et al. 2006). To alleviate the perpetual drier conditions and its associated problems, increased water flows within this area are required. Unit 5 consists of approximately 14 square kilometers and thus is the smallest of all the units. Surveys from 2007-2009 detected no CSSS within this unit, whereas in 2010 there was one bird count and in 2011, two were detected (**Table 6-4**). This unit meets the hydroperiod criteria of 90-210 days per year 14 out of the 41 year POR as compared to the existing conditions at 17 years and FWO that meets the criteria 18 years (**Table 6-11**).

6.2.8.5 Cape Sable Seaside Sparrow Critical Habitat Effect Determination

The 1999 FWS RPA stated that in addition to the 60-day dry nesting constraint the Corps would have to ensure that 30%, 45%, and 60% of required regulatory releases crossing Tamiami Trail enter ENP east of the L-67 Extension in 2000, 2001, and 2002, respectively, or produce hydroperiods and water levels in the vicinity of subpopulations C, E, and F that meet or exceed those produced by the 30%, 45%, and 60% targets. Hydroperiods and water levels in the vicinity of subpopulations C, E, and F would also have to be

produced that equal or exceed conditions that would be produced by implementing the exact provisions of Test 7, Phase II operations (Corps 1995).

The CEPP goal of increasing the hydroperiod throughout WCA 3A and ENP does not coincide with the hydroperiods needed to maintain a drier, marl prairie habitat that is necessary for the CSSS. Alt 4R2 performed the worst in CSSS-E across all ecological targets as compared to the existing conditions and FWO. Most of the CSSS habitats have hydroperiods that are too deep for too long to be conducive for the species, which mirrors the existing conditions and FWO in most cases **(Figure 6-40 through Figure 6-49**). Subpopulations E-1 and F perform outside of the target range on the higher end more often than the existing conditions for Alt 4R2. CSSS-F and CSSS-C perform below the target range of 90 days more often than going above the 210 days (too wet). Too dry (less than 90 days) of conditions are more conducive to nesting than too wet (above 210 days) due to reasons discussed above. CSSS-B, the largest of the subpopulations, met the ET-2 hydroperiod criterion in 29 of the 41 year POR, which is similar to the existing conditions. Within other subpopulations, hydroperiod targets are only met approximately half of the POR or less under existing conditions, Alt 4R2, and/or FWO (**Table 6-11** and **Figures 6-40 through 6-49**). Therefore, the Corps concludes that CEPP may affect CSSS critical habitat.

6.2.9 Other Species Discussion – Bald Eagle

On July 9, 2007, the FWS published the final rule in the Federal Register announcing the removal of the bald eagle from the Federal list of endangered and threatened wildlife. The rule became effective on August 8, 2007. However, this species remains protected under the Migratory Bird Treaty Act and the Bald Eagle Protection Act, therefore potential impacts from project activities are discussed below.

The bald eagle occurs in various habitats near lakes, large rivers and coastlines. Most breeding eagles construct nests within several hundred yards of open water (FWS, 1999). Shorelines, such as the shorelines around Lake Okeechobee, the Okeechobee Waterway, and estuaries provide fishing and loafing perches, nest trees, and open flight paths for the bald eagle (FWS, 1999). The bald eagle primarily feeds on fish, but is known to occasionally prey on small mammals and will feed on carrion. Bald eagles are known to nest around the study area. Nesting season occurs from October through May. The bald eagle mates for life and uses the same nesting site year after year, if the territory is available. According to the FWC database, for the period of 2000-2004, two nests were reported in close proximity to Lake Okeechobee. One nest, located in Palm Beach County near Lake Harbor, was last listed as active in 2003. The second nest, located in Glades County northeast of Lake Port, was active in 2004. Bald eagle nesting locations from 2001-2011 are shown in **Figure 6-53**.

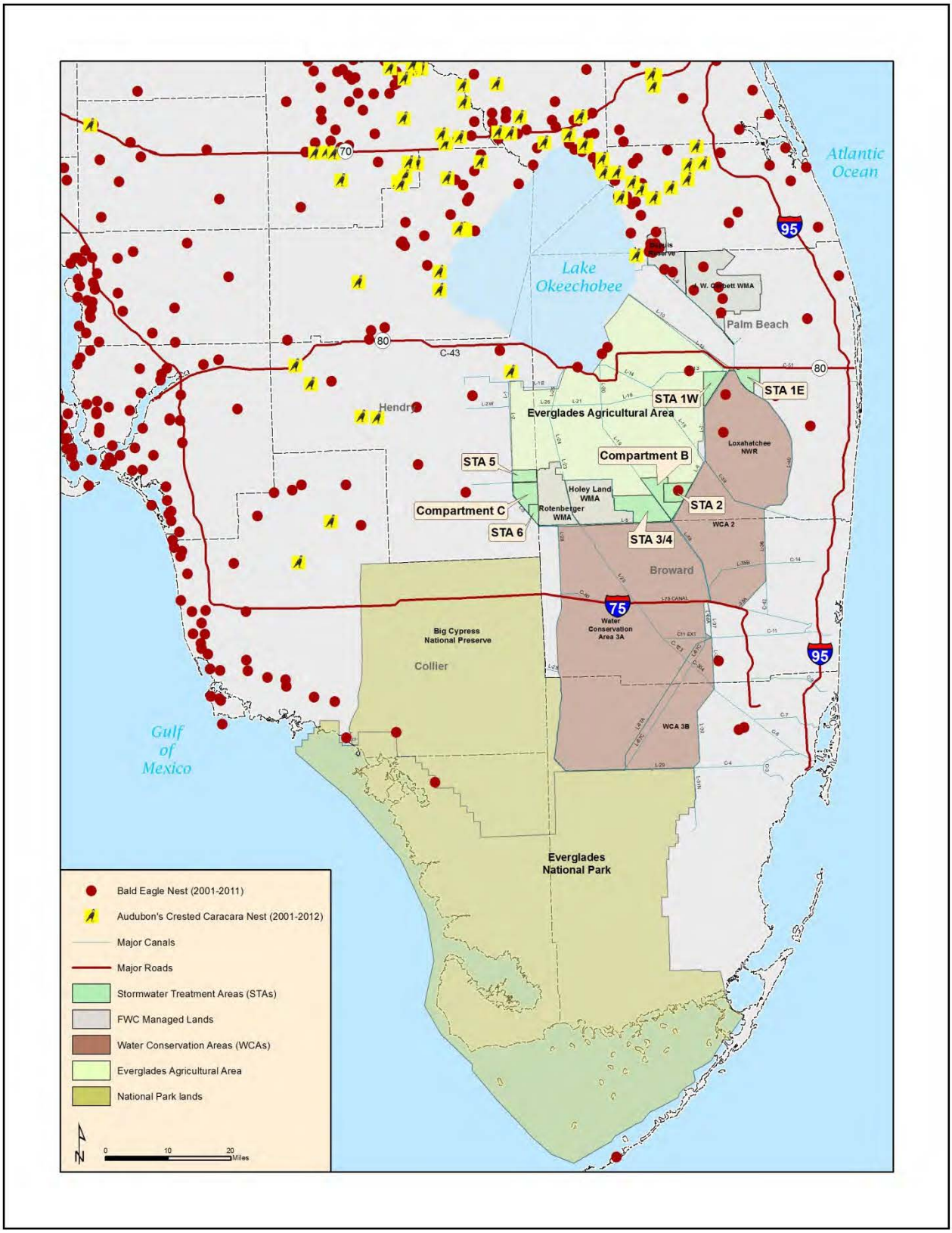

Figure 6-53. Bald eagle nest locations from 2001-2011

In south Florida, nests are often in the ecotone between forest and marsh or water, and are constructed in dominant or codominant living pines (*Pinus spp*.) or bald cypress (*Taxodium distichum*) (McKewan and Hirth, 1979). Approximately ten percent of eagle nests are located in dead pine trees, while two to three percent occur in other species, such as Australian pine (*Casuarina equisetifolia*) and live oak (*Quercus virginiana*). The stature of nest trees decreases from north to south (Wood et al., 1989) and in Florida Bay eagles nest in black (*Avicennia germinans*) and red mangroves (*Rhizophora mangle*) almost exclusively (96.9 percent), half of which are snags (Curnutt and Robertson, 1994). Suitable habitat for bald eagles is any forested area with potential nesting trees that are within 1.9 miles (3 kilometers) of large open water, such as borrow pits, lakes, rivers, and large canals. Due to the confirmation of nests in Florida Bay it can be surmised that habitat is conducive for bald eagle nesting and foraging within the study area.

7.0 CONSERVATION MEASURES

The Corps acknowledges the potential usage and occurrence of the previously discussed threatened and endangered species and/or critical habitat within the CEPP study area. Species and habitat monitoring would continue to identify population trends for the CSSS, Everglade snail kite, wood stork, and the vegetation characteristic of their habitats. CSSS mitigation measures could include preemptive measures to offset the potential adverse effects of the project including translocation of species to more suitable habitat, improvement of habitat within ENP, and/or improvement of habitat within some of the critical habitat areas that will be improved by CEPP, such as CSSS-A. Habitat restoration measures discussed with the FWS also include prescribed fire, evaluation of the role of woody vegetation in CSSS habitat, and removal of woody vegetation. Monitoring that would help determine the current CSSS population would be useful in determining actual project effects, and could include development of a spatially explicit population estimator, conducting intensive nesting monitoring, conducting helicopter surveys, population modeling, and hydrologic monitoring.

The Corps proposes to use panther credits in the Picayune Strand Restoration Project to offset the loss of habitat due to construction of the 14, 000 acre FEB site. Additional monitoring of panthers should not be necessary due to use of the approved mitigation bank. Applicable listed species guidelines and conservation measures will be followed and coordinated with the Service. The Corps would implement construction conservation measures as outlined in the *Habitat Management Guidelines for the Wood Stork in the southeast Region* (USFWS 2009), standard protection measures for the manatee, and *Draft Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2004) to avoid and minimize adverse effects on those species during construction activities. Monitoring for listed species that could occur in or around the project area during construction would be specified in the contract specifications.

8.0 CONCLUSIONS

State-Listed Species: Effects of project activities are not likely to adversely affect state protected species (**Table 5-2**). Impacts to state-listed wading bird species will be similar to those described for the federally endangered wood stork. Modifications to the existing C&SF project are designed to improve hydrologic conditions for wading birds through increasing foraging opportunities within WCA 3 and ENP, thereby directly benefitting these species within the CEPP study area.

Federally-Listed Species: The Corps acknowledges the probable existence of 40 federally-listed threatened, endangered, and candidate species within the boundaries of the CEPP study area. This BA was prepared with the best available scientific and commercial information. Federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which would not likely be of concern due to reasons discussed in Section 6 include the

following: Crenulate lead plant, cape sable thoroughwort, Deltoid's spurge, Garber's spurge, Small's milkpea, tiny polygala, Okeechobee gourd, Miami blue butterfly, Schaus swallowtail butterfly, stock island tree snail, piping plover, red-cockaded woodpecker, Roseate tern, and Northern crested caracara.

The Corps acknowledges the potential existence of fifteen federally listed threatened and endangered species under NMFS purview within the boundaries of the CEPP study area. Although the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and the loggerhead sea turtle are known to potentially exist within close proximity of the project area, any project related impacts through restoration efforts will ultimately benefit estuarine and nearshore communities and associated biota. Based on available information, it is evident that the smalltooth sawfish, resides, travels, and/or forages within the study area and could be affected by CEPP implementation. Other federally threatened or endangered species that are known to exist or potentially exist in the CEPP project area, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Johnson's seagrass, the Gulf sturgeon, blue whale, fin whale, humpback whale, sei whale, sperm whale, elkhorn, and staghorn stony corals. The Corps has determined that the proposed project will have "no effect" on the above species utilizing the study area.

The conversion of agricultural land to a FEB in the EAA will result in a loss of habitat for the indigo snake and the Florida panther. However, increased water flows through the WCA 3 and ENP would indirectly increase foraging habitat for the panther as some of its prey eats fish. Constructed tree islands along the Miami Canal backfill could potentially create some deer habitat to also increase prey, as well as potentially providing some upland habitat for indigo snake. Eastern indigo snakes currently inhabit EAA agricultural fields used for sugar cane production and regularly burned. Soils in this area are hydric (wetland) soils that will support wetlands, which is not typically the type of area the snakes are found in. Eastern indigo snakes would still have relatively large areas of undeveloped and agricultural land in the EAA to maintain their population.

Within the Greater Everglades, altered hydrology has led to degradation of the native vegetation communities, such as tree islands, sawgrass marsh mosaic, and marl prairies, and the expansion of undesirable cattail monocultures. As habitats have been degraded, abundance and diversity of wildlife populations have been affected as well. Restoration of sheetflow and historic hydropatterns within WCA 3 and ENP will result in beneficial shifts toward more desirable vegetation communities, landscape patterns, and animal populations.

Wood storks would benefit from increased freshwater sheetflow due to an increased foraging base in WCA 2, 3, and ENP. Based on Beeren's frequency of use model, wood stork use and foraging would increase due to implementation of CEPP (Bereens 2013). Changes in the quality, quantity, timing, and distribution of water under CEPP provides opportunities for improved vegetation in northern WCA 3A, 3B, and ENP, including expansion of sloughs and wet prairies, and contraction of sawgrass prairies, thus benefiting the Everglades snail kite. Conversion back to sloughs and wet prairies would provide improved apple snail ascension rates and meet the FWS MSTS depth recommendations, which support successful apple snail oviposition, a key factor in snail kite survival. Designated Everglade snail kite critical habitat would also be improved with increased sheetflow to WCAs and ENP. There would be no effect on Everglade snail kite designated critical habitat within Lake Okeechobee, WCA 1, or WCA 2 because CEPP is redirecting approximately 210,000 acre feet of additional water that currently flows into the St. Lucie and Caloosahatchee Estuaries to the historical southerly flow path south through FEBs and existing STAs.

Based on the best available information, it is evident that the CSSS would likely be affected by CEPP implementation. However, neither existing nor projected future conditions provide an ideal outlook for the CSSS. Comparisons of existing conditions and the CEPP recommended plan (Section 6) show that some areas utilized by sparrows are slightly improved by CEPP implementation, while others remain the same or slightly worse than existing conditions. Slight improvements to critical habitat areas in CSSS-A, CSSS-F, and CSSS-B (some metrics) could potentially provide the interim habitat needed to keep the CSSS population as is, with potential for physical habitat improvements as well. Natural fluctuations in climate and weather are difficult to predict (e.g., Hurricane Andrew where a decline in species population happened afterwards). Actions discussed in Section 7 of this document may help improve undesirable conditions in areas formerly inhabited by the sparrow prior to CEPP implementation, potentially contributing to an increase in the CSSS population.

Changes in hydrology of the freshwater systems have led to effects on the estuarine and marine environments of Florida Bay and Biscayne Bay. Alterations in seasonal deliveries to Florida Bay have resulted in extreme salinity fluctuations. Implementation of CEPP would improve the production of bay flora and fauna by moderating unnatural shifts in salinity through improvements to freshwater delivered to coastal wetlands and downstream estuaries in ENP, Florida Bay, and Biscayne Bay. These improvements directly benefit the American crocodile and its critical habitat and Florida manatee and its critical habitat with increased freshwater flows to the estuaries. CEPP has the potential to reduce the frequency and volume of high level flows from Lake Okeechobee to the Caloosahatchee River Estuary and the St. Lucie Estuary, thus reducing the potential for adverse impacts on estuarine and nearshore biota associated with EFH. This is a significant improvement for estuarine systems compared to existing conditions.

The Corps recognizes the need for re-initiation of consultation if modifications to the project are made and/or additional information involving potential effects to listed species becomes available. The Corps commits to maintain ongoing communications with the FWS, NMFS, and FWC in the event of project modifications. This document is being submitted for formal consultation with the FWS pursuant to Section 7 of the ESA.

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Appendix A

Fish and Wildlife Service Planning Aid Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

January 20, 2012

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Pantano:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including but not limited to the project goals and objectives, management actions that should be considered (*e.g.*, project components), ecological performance measures, and to provide a list of Threatened and Endangered species that may be encountered within the Study Area.

BACKGROUND

Project Purpose

While CERP has made considerable progress on projects on the periphery of the remaining Everglades, less has been achieved in the most critical areas of the central Everglades. Construction has begun on the first generation of CERP project modifications already authorized by Congress. These include the Picayune Strand, Indian River Lagoon South and Site 1 projects. Project Implementation Reports have been completed, or are nearing completion, for the second generation of CERP projects for Congressional authorization. These include the Biscayne Bay Coastal Wetlands, Broward County Water Preserve Area, Caloosahatchee River (C-43) West Basin Storage Reservoir, and C-111 Spreader Canal Western projects.

The next step for implementation of the Plan, and the main focus of CEPP, is to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south. This will allow for restoration of natural habitat conditions and water flow in the central Everglades and re-connect the central Everglades ecosystem with Everglades National Park (ENP) and Florida Bay. The Corps, who is leading the planning effort in partnership with the South Florida Water Management District (SFWMD), has recommended that the Everglades Agricultural Area Storage and Treatment (EAA), Decompartmentalization of Water Conservation Area 3 (Decomp PIR 1), and Everglades Seepage Management (ESM) projects form the core of CEPP. These are highly interdependent features of the Plan that must be formulated and optimized in a comprehensive and integrated manner.

Planning Process

The CEPP will be one of five nationwide pilot projects to utilize a streamlined planning process with the goal of significantly reducing the amount of time it takes to plan projects. Over the last decade it has become apparent that the current Corps planning process is perceived by sponsors, State and Federal partners, Congress and the public as taking too long, being too cumbersome, too detailed, too expensive and does not lead to a better product or decision commensurate with the added years of effort to an already long process. The Corps and senior leadership at the Office of the Assistant Secretary of the Army (Civil Works) have initiated a pilot program for candidate planning studies designed to assess the effectiveness of transforming the Civil Works Planning Program to better meet the needs of the nation's water resources challenges.

Based on the above, the proposed approach for the CEPP is to incorporate the new science and understanding of the hydrology of the ecosystem and build upon the information and tools developed by SFWMD in support of a more streamlined planning process that utilizes the concepts for transformation of the Corps planning process. A general outline of the proposed process for CEPP is shown in Figure 1.

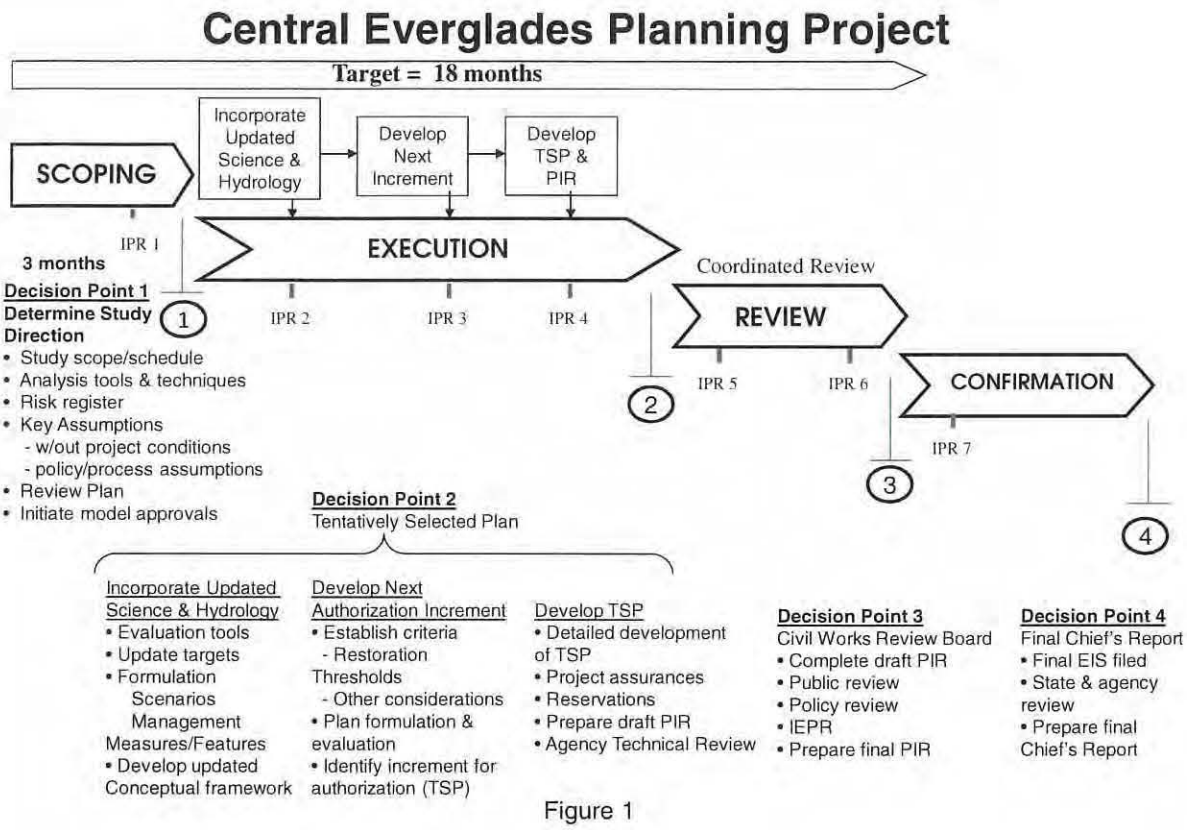

Figure 1: General outline of the proposed process for CEPP.

Project Objectives

The major goal of the project, as stated by project managers, is to redirect water that is currently discharged to the east and west coast estuaries from Lake Okeechobee and restore water flow to the south, allowing for restoration of natural habitat conditions and water flow in the central Everglades. This will re-connect the central Everglades ecosystem with ENP and Florida Bay. This portion of the Plan will include those components that provide for storage, treatment and conveyance south of Lake Okeechobee, removal of canals and levees within central Everglades and seepage management features to protect the urban and agricultural areas to the east from the increased flow of water through the central portion of the system. An integrated study effort on these components is needed to set the direction for the next decade of implementation of the Plan. The goal of the study effort would be to develop an integrated, comprehensive technical plan for delivering the right quantity, quality, timing and distribution of water needed to restore and reconnect the central Everglades ecosystem. The study area for the CEPP has been defined to include Lake Okeechobee, Caloosahatchee and St. Lucie Estuaries, EAA, Greater Everglades, ENP, and Biscayne and Florida Bays (Figure 2).

To achieve the goals stated above, the Corps and SFWMD have drafted preliminary project objectives as follows:

- Restore seasonal hydroperiods and freshwater distribution that support a natural mosaic of wetland and upland habitat in the Everglades System.
- Improve sheet flow patterns and surface water depths and durations in order to reduce soil subsidence, frequency of damaging fires, and decline of tree islands.
- Reduce water loss out of the natural system to promote appropriate dry season recession rates for wildlife utilization.
- Restore more natural water level responses to rainfall predicted by project modeling that will promote plant and animal diversity and habitat function.
- Increase oyster habitat and sea grass populations in the Northern Estuaries by reducing salinity fluctuations from freshwater regulatory pulse discharges.

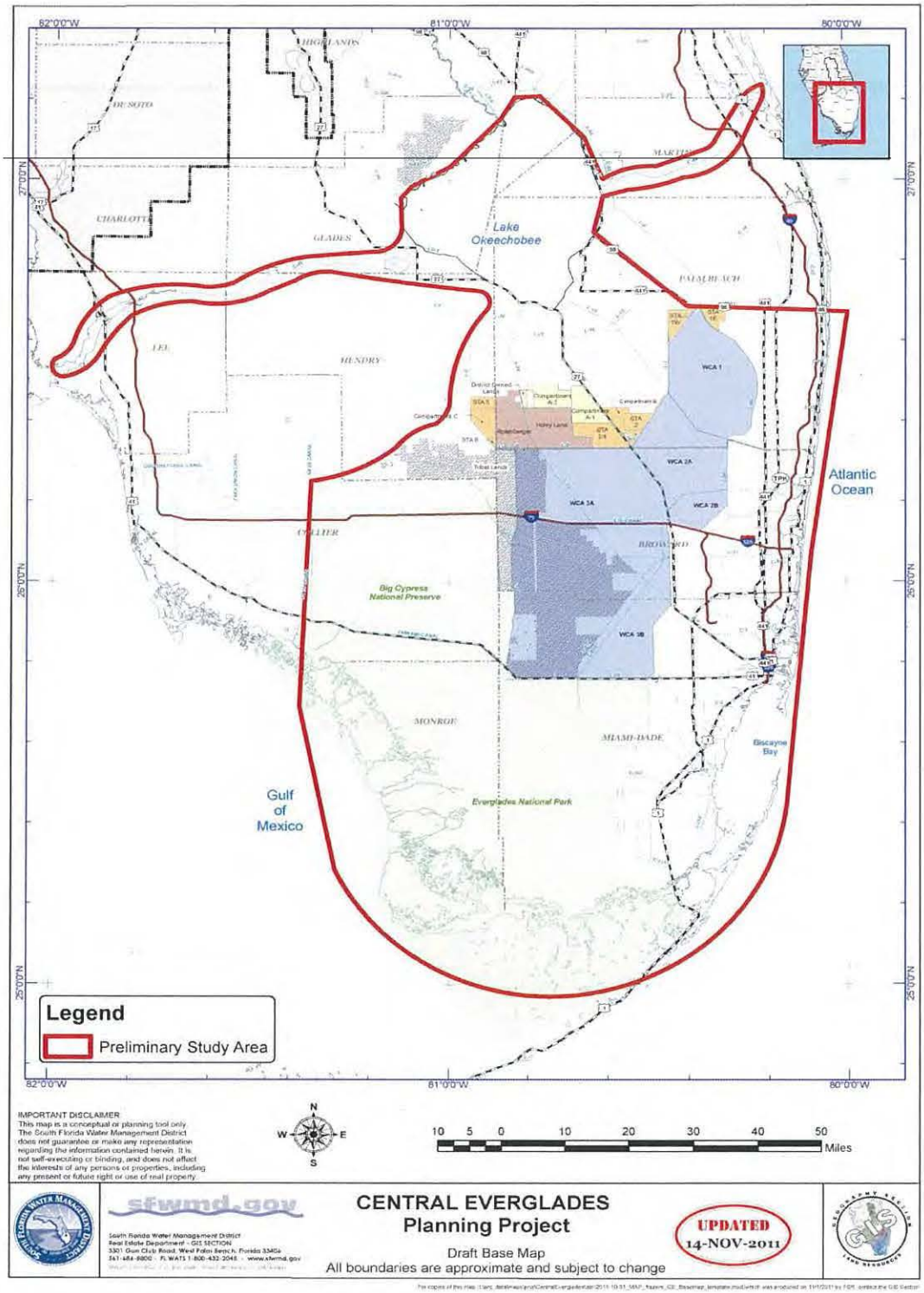

Figure 2. Central Everglades Planning Project Study Area.

Performance Measures

An interagency environmental sub-team of the Project Delivery Team (PDT), composed of scientists, engineers and planners, have drafted a list of hydrology based Performance Measures (PM) listed below. The group concentrated on Restoration Coordination and Verification (RECOVER)-approved PMs to avoid delays associated with having controversial PMs vetted. While these PMs are familiar to most and have been used in the past they will need to be adapted, in most cases, to work with the primary hydrologic model being utilized in CEPP, the Regional Simulation Model (RSM). Additionally, they are hydrologic PMs and reflect hydrologic benefits and not necessarily the desired ecological and other environmental benefits expected to result from the project. To remedy this, an interagency team led by Department of Interior scientists has drafted a list of additional environmental tools and PMs to be run separately and interjected into the planning process. A list of these tools appears below the Primary PMs. Some ecological tools that the team agreed, were not ready for use at this time, have not been included in the list (see meeting minutes available from Corps for additional information).

Preliminary List of Performance Measures

1. Lake Okeechobee Performance Measure - Lake Stage.
2. Northern Estuaries Performance Measure - Salinity Envelopes.
3. Greater Everglades Performance Measure - Inundation Duration in the Ridge and Slough Landscape.
4. Greater Everglades Performance Measure - Sheet flow in the Everglades Ridge and Slough Landscape.
5. Greater Everglades Performance Measure - Number and Duration of Dry Events in Shark River Slough.
6. Greater Everglades Performance Measure - Slough Vegetation Suitability.
7. Greater Everglades Performance Measure - Hydrologic Surrogate for Soil Oxidation.
8. Greater Everglades Aquatic Trophic Levels Small-Sized Freshwater Fish Density (RECOVER Greater Everglades #1).*
9. Everview Viewing Windows (refer to Section 2.2 of River of Grass document, page 23)*.

* Denotes Performance Measures that will be used as planning tools.

Additional Ecological

1. Everglades Landscape Vegetation Succession Model (ELVeS.)
2. Wood Stork Foraging Probability.
3. Cape Sable Seaside Sparrow Hydrologic Indicator.
4. Apple Snail Population Model.
5. Oyster Habitat Suitability Index for Northern Estuaries.

The ecological sub-team is advising the PDT to use all available ecological tools that will provide additional useful information. Two models that may be completed in time for use on this project are the amphibian community index, alligator production index and alligator population model. These indices may appear on the list above in the future.

The PMs and tools listed above are for evaluating alternative performance as it relates to environmental restoration, however there are PMs for other concerns that the Corps should include in its planning process. Examples of these would be agriculture and water supply metrics.

Models

The primary application of models in the CEPP will be in the assessment of regional-level hydrologic planning. More detailed models will also be brought to bear on specific questions related to hydraulic and water quality constraints. At this time, the modeling strategy does not consider the application of detailed flood event modeling (or hydrodynamic levee assessment) or water quality fate/succession modeling within the Everglades Protection Area given the schedule of the CEPP. Depending on the outcomes of the CEPP scoping phase and risk registry development, it is possible that key elements of this strategy may need to be revisited.

Several models will be used during the execution phase of project planning and can be categorized as screening, planning and detailed models. The Reservoir Sizing and Operations Screening (RESOPS) model is a spreadsheet application which will test alternative storage configurations that consider the interconnectivity of Lake Okeechobee, the Lake Okeechobee Service Area, the northern estuary watershed systems, and the Everglades. Models which will be used for planning include the RSM Basin, RSM Glades-LECSA, and South Florida Water Management Model (SFWMM). Detailed models include the Dynamic Model for Stormwater Treatment Areas (DMSTA) and the HEC-RAS. For more detailed information on CEPP modeling please refer to the Corps' Central Everglades Study DRAFT Modeling Strategy.

Risk Register

The risk register workshop was a good exercise for the inter-disciplinary, multi-agency PDT team. It brought the larger group into a sub-team setting to begin focusing on the risks associated with the expedited Corps planning process. Risk registers were developed by four sub-teams consisting of (1) Cultural Resources/Real Estate; (2) Environmental; (3) Engineering, Hydrology, Hydraulics, Geotech and Operations; and (4) Planning. Risks were identified and valued in a qualitative nature based on best professional judgment and agreement within each group. It is expected that a "living" document will be created by the Corps and updated on a regular basis.

SERVICE RECOMMENDATIONS

Project Purpose

While the Service fully supports this effort and approach, it is necessary to point out that there are many restoration opportunities within the Central Everglades that would not be captured by simply undertaking the three specific projects suggested: EAA storage component; Decomp PIR 1 Project; and ESM Project. Primarily, the reconnection of WCA-3B as a flow-through system connecting WCA-3A to ENP is the most critical part of Everglades restoration remaining to be planned. This component of the Modified Water Deliveries (MWD) to ENP Project was called Conveyance and Seepage and has undergone initial planning during the Combined Structural and Operational Plan. Since then, funding for MWD has been exhausted, and the Conveyance and Seepage Project set aside. The Service suggests, and will provide alternative scenarios, that this critical element be made a core component of CEPP. The initial phase of this component could be as simple as continued use of the L-67A culvert approved for the Decompartmentalization Physical Model and a new weir on the L-29 levee. The optimal approach, however, would be implementation of the original plan (1994 GDM) which consisted of 3 gates (S-349 A,B and C) in the L-67A canal, 3 weirs or culverts in the L-67 A levee, degradation of the L-67 C levee and canal, and 3 weirs on the L-29 levee to allow flow across the Tamiami Trail.

Additional opportunities that should be included in CEPP are the relaxation of the G-3273 constraint, integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and expansion of the S-333 structure to allow greater flow out of the ponded areas of WCA-3A into Northeast Shark River Slough (NESRS). Also, if the Combined Operational Plan is going to be delayed or absorbed into CEPP then an operational plan that utilizes the newly constructed 1-mile bridge should be incorporated. Other opportunities include defining environmental water regulation schedules for WCAs 2 and 3B and refining the schedule for 3A.

It is also important that the Corps and SFWMD, as quickly as possible, determine the size and type of available storage and treatment areas in the EAA to help guide the team in formulating downstream project features. There is considerable speculation as to the amount of water that the project will deliver south which is entirely predicated on the amount of storage and treatment available in the EAA. Team members and the public are initially being asked to provide comments and lay out issues for an as yet undefined project. This will hinder stakeholder and public buy-in and support. Even if tentative plans are numerous, they need to be discussed early in the process.

It may be the case that some proposed components of the project become less important (*e.g.*, seepage management) as more is learned about the quality of water delivered south. The Service does not feel that a completed seepage management project, without the delivery of additional water for the environment, constitutes a valid restoration project. The Corps should notify the Service regarding the best time to provide important information regarding the design and detailed operations of stormwater treatment areas and storage reservoirs and their effects on listed species, migratory birds, and other wildlife resources.

A project feature that should not be considered during the CEPP is further modification of the S-12 structures closure regime for protection of the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). Once the Everglades Restoration Transition Plan (ERTP) is authorized (Record of Decision scheduled late February 2012) the S-12 closure regime will be relaxed due to the addition of year-round operational capability at S-12 C. With the additional "untested" risk to the Cape Sable seaside sparrow subpopulation A and its habitat from ERTP operations, the Service strongly recommends that restoration become more focused on shifting flow eastward towards the original flow path of WCA 3B to NESRS. No further management changes to the S-12s should be considered until more flow has been restored into northeastern ENP.

Planning Process

The Service fully supports the use of an expedited planning process for the CEPP. The process used to plan CERP projects over the past decade is cumbersome and has not always resulted in a better plan. The proposed expedited process will identify issues early and elevate these issues through the vertical management team for timely decisions, reducing delay at the PDT level. The complexity previously required of project implementation reports will be reduced, thus allowing preparation of these documents in much shorter time periods. In an effort to identify and process the added risk of completing a rapid and possibly less detailed study, the Corps has implemented a risk registry procedure where team members and other public stakeholders were asked to identify major risks and suggest ways in which to mitigate the risk.

An area of concern regarding the expedited process is how PDT meetings are being conducted. As we approach the 3-month mark there have only been two PDT meetings. These were conducted as short (~3 hour) meetings prior to public workshops. Dialogue among PDT members and between the team and project management regarding critical project planning elements was restricted. Draft language, such as project objectives, on which the PDT members were asked to comment, was not shared prior to the meeting. The Service suggests that the Corps and SFWMD convene a PDT meeting in the style previously used during CERP to discuss critical project elements as soon as possible.

As noted above, the primary performance measures listed to date are hydrologic. There are a number of ecological planning tools that have been developed and are being linked to RSM output that could be used in the planning process. The Service encourages the Corps and SFWMD to seek out and use available ecological planning tools to help to ensure that evaluations include both hydrologic and ecologic information. Consideration should be given to ecological planning tools in Florida Bay and Biscayne Bay as well as Greater Everglades.

Adaptive management and the monitoring associated with it is a key part of the science strategy for CERP and should be for CEPP as well, yet there has been no discussion on development of an adaptive management plan for CEPP. The Service recommends that development of an adaptive management plan occur in conjunction with the CEPP planning process.

Project Objectives

The Service appreciates the challenging work completed by the Corps and SFWMD staff on the initial draft project objectives. This task is difficult because of the scope and enormity of the project study area. The Corps and SFWMD project managers should refine the scope and study area to more precisely fit the first increment of the CEPP as soon as possible. This will allow the team to refine the objectives and identify PMs and model applications that will be useful in determining project benefits.

Specific comments on the draft project objectives are as follows:

- "Reduce water loss out of the natural system…" We assume that this is referring to seepage loss since the Seepage Management project was identified as a core component of CEPP but it is not clear. It may refer to the loss of freshwater to tide. The seepage component is not primarily for wildlife benefit but for flood protection and the objective should reflect this. Please clarify this objective.

- "Restore more natural water level responses to rainfall predicted by project modeling…" This needs to be reworded or better explained. Does this imply that the model predicts rainfall? We assume the desire is to have the system respond more naturally to rainfall patterns.

- "Increase oyster habitat and sea-grass populations in the Northern Estuaries by reducing salinity fluctuations from freshwater regulatory pulse discharges." There is a misconception contained within this objective that by reducing salinity fluctuations you increase oyster and seagrass habitats. This is not the case as additional management actions are needed for this to occur. The Service also suggests this objective be reworded to include the restoration of the overall ecological function of the estuaries as measured by oyster and sea-grass populations. Detailed questions regarding this objective are as follow:

    - What is meant by seagrass population, species composition, density, acreage increase, etc?
    - Is *Vallisneria* included under seagrass since it is an important component of the Caloosahatchee River restoration?
    - Which Northern Estuaries will the CEPP improve (St. Lucie, Caloosahatchee, etc.)?
    - Will muck removal in estuaries or addition of artificial substrates (oyster cultch) be included in the Management Measures as part of the CEPP to claim maximum ecological benefits for Northern Estuaries oyster and seagrass health and abundance?

Performance Measures

The process used by the Ecological sub-team to select the project PMs is working well and the draft suite of PMs listed above is suitable to detect hydrologic benefits. Concerns we have at this point are whether the RECOVER approved and vetted PMs previously used in CERP can be modified to use RSM output. Additionally, the estuarine performance measures proposed utilize an array of models including the SFWMM; or 2x2. Will the SFWMM be used to evaluate project alternatives (perhaps solely in the estuaries)?

Also of concern is how output from the additional ecological tools will be used to formulate alternatives to optimize benefits for natural resources throughout the system. The Service recommends that conclusions and recommendations drawn from these specialized tools be considered between alternative runs to make the next iteration more beneficial for natural resources. Additionally, the information will be used to better relate hydrologic change to environmental lift predicted by the preferred alternative.

Examples of the resource-specific ecological tools currently under consideration are listed previously in this document and minutes from a recent Ecological sub-team meeting indicate that most of the models are ready for use. One issue that arose is whether the models can accept RSM hydrologic model output. Most of the ecological models were set up to work on a fixed grid so the RSM output needs to be manipulated to get it into a fixed-grid format. Modelers from the Corps, Joint Ecological Modeling group and other agencies are working on ways to eliminate this problem.

Models

Since the River of Grass modeling tools and PMs have been moderately peer-reviewed, their use during CEPP will be appropriate as long as the Corps' certification process is either completed or these PMs exempted from certification.

There are some concerns with using the RESOPS model in conjunction with the Regional Simulation Model – Glades Lower Ease Coast Service Area (RSM-Glades LECSA) model. RSM-Glades LECSA is a daily time-step model that will be using output from RESOPS which utilizes a monthly time-step. This will automatically create inherent errors in the model results.

The RSM Basin model covers the Kissimmee Basin, Lake Okeechobee, St. Lucie River, and Caloosahatchee River. Unfortunately, this model does not provide individual gauge data, which the Service has used previously to assess impacts and implement terms and conditions within its biological opinions. Rather than simulating gauge data, this model represents stage as an average water level condition across an entire water body. Also, model documentation for RSM Basin does not discuss ground water. The spatial extent of the RSM Basin model includes an intensive surface water / ground water interaction. This interaction in the Everglades headwaters needs to be defined and verified for accuracy. It is unclear whether the surficial aquifer is simulated in this model.

A similar concern exists for the RSM Glades-LECSA model which simulates hydrology within 1-square mile grid cells without providing individual gauge data. Since the Corps and SFWMD water management sections base their management actions on individual gauge data as the Service bases its nondiscretionary terms and conditions on gauge data, a cross-walk between simulated hydrology across a large area to that at specific gauges will be needed. The hydrologic effects of the proposed action at key gauge sites identified by the Service during this and previous consultations should be provided.

The modeling strategy for CEPP does not consider any detailed flood event modeling or levee assessments. L-29 levee concerns have presented a human health and safety constraint in WCA-3A, thus a levee assessment with flood event modeling will likely become necessary especially since more water is predicted to move south through the system into WCA-3A.

Recent water quality legal and scientific issues throughout the Everglades necessitate the need for water quality assessments and modeling. It has been noted that the DMSTA model does not allow for extreme events, such as droughts and hurricanes. Thus, DMSTA is expected to predict +/-23 percent of the mean phosphorus concentrations. DMSTA may be useful in the planning process, but it will likely need more refinement for project level simulations.

Climate Change Scenarios

Given the range of uncertainties in dealing with climate change and urbanization it is important that these be incorporated into the planning process in the best way feasible. The planning team should evaluate available tools and information that can be used to assess future impacts of climate change including sea level rise and changes in urbanization (which may affect water supply). One possible tool has resulted from work conducted by an MIT research team (Service, U.S. Geological Survey, and MIT) that developed a series of scenarios in collaboration with a wide range of stakeholders, including representatives from Federal, State, and local government. These scenarios have four top-level dimensions selected by the stakeholders: climate change, population, financial resources, and planning assumptions. Within these dimensions, stakeholders developed a bounded range of possible values from the best available science, including sea level rise, land use, agriculture, conservation lands, and transportation corridors. This climate change model covers the CEPP area and it is recommended that the team determine how best to incorporate this information into the planning process and/or identify other climate change information that can be used during planning.

Project Schedule

The following table (Table 1) highlights some issues identified with the current draft schedule as it pertains to Service activities.

Table 1. Comments on the draft schedule as it pertains to Service activities.

Activity ID	Activity Name	Start	End	Notes
1060	Prepare Draft PIR and EIS	1 May 2012	2 Oct 2012	What will be evaluated in this draft PIR/EIS? The TSP will be selected 4 months later (1110). Will the Corps be assessing all the potential TSPs that are under consideration (1400)?
1410	Complete Draft PIR/EIS Report	4 Feb 2013	7 Feb 2013	This occurs a week after the TSP Approval (1110). How does the Corps propose to evaluate the TSP for the EIS in less than 4 days?
1570	FWS Prepares Coordination Act Report	4 Feb 2013 *14 Dec 2012*	20 Mar 2013 *8 Feb 2013*	Is this the draft or final CAR? The draft CAR is usually completed about 45 days after the TSP (1120) and a couple weeks prior to the draft EIS (1420). If we are given the TSP when the EIS begins evaluating it we can start this activity earlier (see the italics dates for example).
1540	USACE Starts Biological Assessment	1 Feb 2013	22 Mar 2013	This activity lists 1550 as a successor. What is 1550? The FWS BO is activity 1560.
1560	FWS Prepares Biological Opinion	25 Mar 2013	2 Oct 2013 *12 Aug 2013*	The Service has 135 calendar days to prepare the BO under the Act. It appears that the current schedule has 135 work days. I think this makes the end date 12 Aug 2013 which lines up with 1240. The predecessor to the BO is listed as 1550. What is 1550?
	Final FWS Coordination Act Report	*9 Apr 2012*	*27 May 2013*	This activity is not included in the schedule. The end date for this is usually prior to the final EIS going to public review (see the italics dates for example).

Threatened and Endangered Species List

The Service has received a request from the Corps (email dated January 20, 2012) for a preliminary list of Threatened and Endangered Species that may be encountered within the project area. The following table (Table 2) is a preliminary list that will be finalized later when an official request from the Corps has been received.

Table 2: Threatened and Endangered species that may be present in the CEPP project area.

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	CRITICAL HABITAT
Mammals			
Florida bonneted bat	*Eumops floridanus*	Candidate	No
Florida panther	*Puma (=Felis) concolor coryi*	Endangered	No
West Indian manatee	*Trichechus manatus*	Endangered	Yes
Birds			
Northern Crested caracara	*Caracara cheriway*	Threatened	No
Bald eagle*	*Haliaeetus leucocephalus*	Delisted	No
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	Endangered	Yes
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	Endangered	Yes
Piping plover	*Charadrius melodus*	Threatened	No
Red-cockaded woodpecker	*Picoides borealis*	Endangered	No
Roseate tern	*Sterna dougallii dougallii*	Threatened	No
Wood stork	*Mycteria Americana*	Endangered	No
Reptiles			
American alligator	*Alligator mississippiensis*	Threatened	No
American crocodile	*Crocodylus acutus*	Endangered	Yes
Eastern indigo snake	*Drymarchon corais couperi*	Threatened	No
Green sea turtle**	*Chelonia mydas*	Endangered	Yes
Hawksbill sea turtle**	*Eretmochelys imbricata*	Endangered	Yes
Kemp's ridley sea turtle**	*Lepidochelys kempii*	Endangered	No
Leatherback sea turtle**	*Dermochelys coriacea*	Endangered	Yes
Loggerhead sea turtle**	*Caretta caretta*	Threatened	No
Plants			
Big Pine partridge pea	*Chamaecrista lineata* var. *keyensis*	Candidate	No
Blodgett's silverbush	*Argythamnia blodgettii*	Candidate	No
Cape Sable thoroughwort	*Chromolaena frustrata*	Candidate	No
Crenulate lead-plant	*Amorpha crenulata*	Endangered	No
Deltoid spurge	*Chamaesyce deltoidea* ssp. *deltoidea*	Endangered	No
Florida brickell-bush	*Brickellia mosieri*	Candidate	No

Florida pineland crabgrass	*Digitaria pauciflora*	Candidate	No
Florida prairie-clover	*Dalea carthagenensis* var. *floridana*	Candidate	No
Florida semaphore cactus	*Consolea corallicola*	Candidate	No
Johnson's seagrass	*Halophila johnsonii*	Threatened	No
Garber's spurge	*Chamaesyce garberi*	Threatened	No
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeensis*	Endangered	No
Pineland sandmat	*Chamaesyce deltoidea* ssp. *pinetorum*	Candidate	No
Tiny polygala	*Polygala smallii*	Endangered	No
Invertebrates			
Bartram's hairstreak butterfly	*Strymon acis bartrami*	Candidate	No
Florida leafwing butterfly	*Anaea troglodyta floridalis*	Candidate	No
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	Endangered	No
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	Endangered	No
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	Threatened	No
Fish			
Smalltooth sawfish**	*Pristis pectinata*	Endangered	No

* The bald eagle has been delisted under the Act but continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

** Species under the purview of the NMFS-NOAA Fisheries for consultation under the Act.

CONCLUSION

The guidance and recommendations that we provide in this PAL aim to assist us in our obligations to consider the effects of the project on all of the trust resources that we must address to fulfill our responsibilities under the FWCA and Act. We applaud the progress made so far by the CEPP PDT as well as the team's common vision for restoration and commitment to the expedited planning process. We look forward to continuing our working relationship with the Corps staff and other partners and stakeholders throughout the remainder of the CEPP planning process. If you have any questions regarding the contents of this PAL, please contact Kevin Palmer or Lori Miller at 772-562-3909.

Sincerely yours,

Larry Williams
Field Supervisor
South Florida Ecological Services

cc: electronic copy only
Corps, Jacksonville, Florida (Eric Bush, Eric Summa, Kimberly Vitec, Gina Ralph)
Corps, West Palm Beach, Florida (Kim Taplin, Lt Col. Michael Kinard)
DEP, Tallahassee, Florida (Greg Knecht)
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ENP, Homestead, Florida (Bob Johnson, Carol Mitchell)
FWC, Tallahassee, Florida (Mary Ann Poole)
FWC, West Palm Beach, Florida (Chuck Collins)
Service, Atlanta, Georgia (David Flemming, Dave Horning)
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 27, 2012

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Pantano:

The U.S. Fish and Wildlife Service (Service) has prepared this second in a series of Planning Aid Letters (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including, but not limited to, management measure screening, alternative formulation, modeling strategy, and natural resource considerations.

Review of major points from previous PAL

- Reconnection of Water Conservation Area (WCA) 3B as a flow-through system connecting WCA-3A to Everglades National Park (ENP) is the most critical part of restoration remaining to be planned. All options should be analyzed regarding how and to what extent this critical reconnection should be made.
- Relaxation of the G-3273 constraint, the integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and the expansion of S-333 structure to allow greater flow out of the ponded areas of WCA-3A into Northeast Shark River Slough (NESRS) should be included in CEPP.
- Regulation schedules for WCAs 2 and 3B should be defined and the regulation schedule for WCA-3A should be refined.
- Further modification of the S-12s should not be considered as it was screened out in the recent Everglades Restoration Transition Plan (ERTP) for protection of the Cape Sable Seaside Sparrow (CSSS) (*Ammodramus maritimus mirabilis*). Once ERTP is authorized, the S-12C closure regime will be relaxed allowing for year-round operations.

TAKE PRIDE IN AMERICA

Project Status

Since the last PAL was submitted on January 24, 2012, the Corps and South Florida Water Management District (SFWMD) project managers briefed their vertical management teams on the progress of the project at a Decision Point One meeting held on January 27, 2012. The purpose of this meeting was to determine study direction and receive feedback on the study scope and schedule. The team was directed to proceed to the next phase of the project, the Execution phase. This phase will last roughly 12 months and result in development of a Tentatively Selected Plan (TSP) and Project Implementation Report for the first increment of the CEPP Project. Detail regarding the team's progress during the first 2 months of the Execution phase will follow in this letter. The next milestone will be an In-Progress Review to the Corps' vertical management team on March 29, 2012. This letter will help inform that briefing.

Management Measures and Screening

Background

A draft list of coarse or general management measures was presented to the Project Delivery Team (PDT) at a meeting on January 31, 2012 (Table 1). These measures were compiled from work other teams had completed on previous CERP projects, and grouped by geographic location (*i.e.*, above and below the red line (an imaginary line used in modeling) designating the bottom of the Everglades Agricultural Area [EAA]). The team agreed to employ a first-cut screening of these measures using information generated from the other teams that considered them (*e.g.*, partitioning Lake Okeechobee was screened out during previous project deliberations and so it would be screened out of CEPP on this basis).

Table 1. List of general management measures grouped by geographic location. Quantity and quality are located above the red line in the EAA; Conveyance and distribution measures are located in the Greater Everglades downstream of the EAA; and Seepage management measures are located between the Greater Everglades and populated areas of the Miami Rock Ridge along the protective levee.

Quantity and Quality	Conveyance and Distribution	Seepage Management
Higher lake levels	Plug or backfill canal to marsh grade	Detention area
Partition Lake Okeechobee	Shallowing of canal	New pump stations
Above-ground storage reservoir	Gated structure in canal	Groundwater wells
Ecoreservoir	Pipeline	Line/pipe canals
Operational changes	Spreader canal	Recharge area
Stormwater Treatment Area	Levee removal/degradation	Flood attenuation reservoir
Flow equalization basin	Increase flow resistance in canals	Relocate existing canals
Dry/wet flow way	Culverts within existing levees	New canals
Aquifer Storage and Recovery	Spoil mound removal	Relocate existing pump stations
	Operational changes	Operational changes
	Bridging	Raise canal stages
	Cap canals	Step-down levees
	Pumping stations	In-ground seepage barriers
	Levee/berm construction	

The management measures remaining after the first round of screening (Table 2) have been added to a spreadsheet currently being called the *CEPP Component and Alternative Development and Screening Tool (CEPP Roadmap)*. This spreadsheet is a central depository of all information the team will generate and use to screen and combine management measures into components, and combine components into a final array of alternatives. The next step will be to define the process the team will use to analyze available information (model output and other data) using hydrologic and ecological targets, and screen out certain measures while combining others into functional components and alternatives. As seen in Table 2, the names and numbers of management measures in each category have changed somewhat from the original list. The Service recommends that a brief write-up be included with the matrix to show the evolution of how some of the measures were screened and others were fleshed out in detail.

Table 2. Management measures as listed in the latest version (March 7, 2012) of the CEPP Component and Alternative Development and Screening Tool (The Roadmap). These are the remaining measures after the first screening iteration.

Quantity and Quality	Conveyance and Distribution	Seepage Management
Operational Flexibility	Degrade Levees	Detention area
Shallow Reservoir (FEB)	Gap Levee	New pump stations
Deep Reservoir	Remove Levee	Raise Canal Stages
Strategic Aquifer Storage and Recovery	Spreader Canal	Flood attenuation reservoir
Stormwater Treatment Area	Pumping Stations	Relocate existing canals
	Canal Conveyance	New canals
	Focused Flows	Relocate existing pump stations
	Canal Backfill	Operational changes
	Spoil mound removal	In-ground seepage barriers
	Canal Plugging	
	Gated Control Structures	
	Culverts	
	Weirs	
	Operational Flexibility	
	DOI Bridging	
	Structural Improvements	
	Swales	
	Culvert/Canal Maintenance	
	Collector Canals	

Issues and Concerns

There is uncertainty as to how the next screening phase will be implemented. The team has been briefed by the modeling group, which indicated that some "upfront" modeling products will be used to screen and optimize management measures for compilation into components and subsequently into alternatives. The Service recommends that the Corps quickly define the methodology that will be used during this step and make sure that the modeling sensitivity, and hydrologic and ecological targets are robust enough to potentially remove or retain management measures. The Service would like to be included in discussions regarding the ecological targets that will be used during this process.

At a February 29, 2012, Core Planning Team meeting, the S-12 operational regime for protection of the CSSS was added to the *CEPP Roadmap* (second level of screening) with little discussion. The Service would like to reiterate comments from the first PAL that changes to the S-12 operations should be considered as part of the first-cut screening methodology because changes to all of the S-12 structures were considered during ERTP. In fact, the primary focus of ERTP was determining operational flexibility and optimizing the S-12 closure regime for improving WCA-3A water management while maintaining protection for the CSSS. During the recent ERTP multi-agency PDT meetings all options for change to the S-12 structures were screened out with the exception of S-12C, which became operational year round in the final plan. It is our understanding that there is no project objective in CEPP for the modification of these structures since the goal of the project is to restore flow to NESRS. It is unclear, at present, how the preliminary modeling will provide necessary information on S-12 operations to screen them out. The modeling group has indicated that the preliminary modeling will not consider impediments to flow along the Tamiami Trail or operations. The CEPP team has agreed to eliminate measures and components from other CERP projects, such as Decompartmentalization, due to the extensive study and project work done in those projects. The Service recommends the same screening process be incorporated for exclusion of the S-12 A/B, S-344, and S-343 structure operations for maintaining protection of the CSSS. We believe the team should focus on the primary goal of the project which is to restore flow from WCA-3A to WCA-3B and into NESRS.

The Service is also concerned about the process by which alternatives will be developed and evaluated. The general alternative formulation and evaluation process has been described by the Corps as a series of screening iterations using "upfront" modeling output whereby management measures are screened or combined into components which will then be screened out or combined to form the final array of alternatives. Relying on modeling products to choose alternative features for the final array of alternatives without regards to operations, adaptive management, and past experience could result in a plan with adverse impacts to the landscape and threatened and endangered species. The Service requests that we receive model output pertaining to threatened and endangered species, throughout the planning process from screening through alternative formulation, so that we may help the team identify all possible means to reduce or eliminate impacts and ensure the TSP will help restore these imperiled species [Act section 7(a)(1)].

Use of New Science in Planning

It is critical for the PDT to begin discussing the "transition strategy" for how we will slowly introduce larger volumes of water into a system which has had its spatial extent reduced by 50 percent and its biological systems acclimated to reduced water flow. For the purposes of comparing modeled alternative runs it may be appropriate to use Natural System Model-based hydrologic targets; however, it should be understood that the first increment of CEPP will probably not meet these, and they may be inappropriate for use in some areas of the system. It is likely that both species and their habitat will be impacted during the transition to full restoration and careful planning will be needed to ensure these natural resources remain on the landscape. Excessive increases in flow volumes could overwhelm the system and disrupt timing,

which could be harmful to tree islands, wetland dependent bird nesting and foraging, apple snail survival and reproduction, among others. Both the landscape and species response will need time to adjust to new conditions.

In addition to the new science learned during the 2 day Science Workshop for CEPP, the team should also use information learned from other CERP projects. A good example of this is the Multi-species Transition Strategy (MSTS) used during ERTP-1. A group of interagency scientists, in coordination with species experts, compiled the latest information regarding a number of species and defined a WCA-3A water management strategy. This science-based strategy was designed for snail kites, apple snails, wading birds, and vegetation found within WCA-3A and was based on the current hydrologic system. For CEPP, this strategy can be refined and other species and locations within the project area can be added. One of the key benefits from the MSTS and ERTP-1 was opening a communication channel between regional water operators and interagency scientists responsible for managing the system for natural resources. The Periodic Scientist Calls and seasonal scientist meetings are simple and effective forms of adaptive management and should be utilized in CEPP.

The Service recommends that threatened and endangered species be considered regularly throughout the CEPP planning process, from screening through alternative formulation, to ensure species protection while restoring the ecosystem. The Service understands that the PDT would like to have definitive answers as to how threatened or endangered species will be affected by certain aspects of the project, and the Service will work with PDT to provide those answers as soon as feasible within the process. Most importantly, in the end, the CEPP water control and operational plan will have to be analyzed (by the Service) to determine any effects to threatened and endangered species.

CSSS Nesting and Habitat Criteria

CSSS inhabit the relatively short hydroperiod marl marsh which flanks the Taylor and Shark River Sloughs in the ENP. Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water level or stage is above ground surface) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat ([Kushlan et al. 1982]; Olmsted 1984; Kushlan 1990a; Wetzel 2001; Ross et al. 2006). Recent observed average annual hydroperiods in subpopulation A (CSSS-A), as measured at NP-205 near the sparrow's core breeding habitat in western Shark Slough, have been in the range of 240 days or more. The effect of these longer hydroperiods in consecutive years has been the conversion of short hydroperiod marsh suitable for sparrow nesting to a sawgrass-dominated, wetter, marsh-type habitat unsuitable for sparrows. While the habitat occupied by sparrows can tolerate occasional average annual hydroperiods to 240 or more days this condition should not occur in concurrent years. Hydroperiods of 60 to 180 days should be experienced at the highest frequencies (*e.g.*, 7 out of 10 years) with occasional years ranging from 210 to 240 days. The opposite is true in the eastern subpopulations where hydroperiods are shorter resulting in higher threats of catastrophic fires and woody plant encroachment. CEPP is expected to alleviate these conditions by shifting more water into NESRS.

Targets for CEPP alternative performance, with regards to sparrow nesting, in the vicinity of the six sparrow subpopulations (A-F) will remain the same as during Interim Operational Plan and ERTP-1. For all CSSS subpopulations the target is at least 60 consecutive days and preferably 80 or more consecutive days in most years during the nesting season from March 1 through July 15 with water levels at or below ground surface. For CSSS-A this equates to 60 days at or below 6.0 feet National Geodetic Vertical Datum (NGVD) at NP-205. In understanding this target, it is important to note that, due to topographic variation within the sparrow's habitat, available habitat at a higher elevation than the NP-205 reference point will remain dry for longer than habitat at the reference point elevation. Therefore this requirement, with current protective operations of S-12A/B, S-343, and S-344, should provide the 80 dry days required for completion of two successive broods over a larger percentage of habitat above 6.0 feet NGVD. At a stage elevation of 6.0 feet NGVD at NP-205, roughly 40 percent of the habitat is available for nesting by CSSS.

This requirement is less critical, though still important, in the eastern subpopulations (B, C, E, and F) because the habitat in these areas has been too dry in recent years and has become more susceptible to damaging human-induced and naturally occurring wildfires. It is anticipated that CEPP will greatly improve the habitat in these eastern populations due to the fact that a large proportion of current and new water from the project will be distributed to NESRS east of the L-67 extension. Subpopulation D, located to the east of Taylor Slough, has been maintained too wet in recent years due to its proximity to the C-111 Canal. The CERP Project, C-111 Spreader Canal, has implemented protective measures and habitat restoration actions for the benefit of this subpopulation.

Modeling

The Service recommends that the PDT not rely solely on modeling for CEPP. Values produced from modeling are not intended to be taken literally, but rather for observing trends and for making comparisons. All of the models being used in CEPP have a +/- 0.50 foot error along with inherent errors in data and topography. Best available science, best professional judgment, ecosystem observations from monitoring, and adaptive management should be the primary tools used to design and select the TSP as discussed in the PDT kick-off meeting.

It is the Service's understanding that early model runs, using preliminary performance measures and ecological targets, will be performed as a way to pre-screen alternatives. During this modeling process, the Service recommends making the model output of any screened-out scenarios available to the PDT members for their agency analyses to avoid any pre-decisional determinations. Current Everglades' performance measures and ecological targets, including those developed in the ERTP-1, should also be included as screening tools and in alternative model runs.

The Service also wants to point out that using NSM-4.6.2 targets for the entire Everglades may not be desirable. Models tend to work well in some areas of the project area and less in other areas. Some of these differences are due to current topographic information and mapping as well as resolution of the models. The CEPP planning and modeling cannot ignore micro-topography as it is extremely important to the species and their habitats.

Climate

The Service recommends that the CEPP PDT discuss and consider the current and predicted climate regimes that influence the rainfall patterns of the Florida Peninsula. Local, regional, and global regimes have important consequences for ecosystems, species, and habitats and should be a part of the planning process. Examples of regimes to be discussed are effects to land and sea breezes and tropical weather due to, but not limited to, the Atlantic Multi-Decadal Oscillation and the El Nino Southern Oscillation.

Climate Change

Climate change should also be a part of the active dialog in planning for Everglades restoration in determining the viability of recommended restoration targets and solutions with emphasis around the perimeter of the Greater Everglades. The Service recommends the use of "Addressing the Challenge of Climate Change in the Greater Everglades Landscape" research imitative that was recently completed by a group of researchers at the Department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT) in coordination with the Service and U.S. Geological Survey. The study investigates possible trajectories of future landscape changes in and around the Greater Everglades landscape relative to four main drivers: climate change, shifts in planning approaches and regulations, population change, and variations in financial resources. This research identifies some of the major challenges to future conservation efforts and illustrates a planning method which can generate conservation strategies resilient to a variety of climatic and socioeconomic conditions (Vargas-Moreno and Flaxman 2011). CEPP needs to ensure that the theory and practice of restoration fits with the forecast of a changing environment (Harris et al. 2006). Sea level rise, especially, should be considered and planned for as it will likely affect structural operations, water management plans, ecology, and landscapes. We feel it is important to include the MIT scenarios in discussions and planning to insure we investigate the best methods to restore our resources.

In summary, the Service continues to support the strategy and vision for accomplishing this challenging but critical restoration project. We commend the Corps' sustained efforts to complete CEPP within the expedited schedule. We pledge our continuing support in planning of restoration projects to maximize opportunities and minimize potential adverse effects to the natural system. For assistance or if you have questions regarding the contents of this PAL, please contact Lori Miller or Kevin Palmer at 772-562-3909.

Sincerely yours,

Larry Williams

Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
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United States Department of the Interior

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December 12, 2012

Eric Bush
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Dear Colonel Dodd:

The U.S. Fish and Wildlife Service (Service) has prepared this third in a series of Planning Aid Letters (PAL) to assist in developing the Central Everglades Planning Project (CEPP), an expedited planning process to implement portions of the Comprehensive Everglades Restoration Plan (CERP) located in the central Everglades. This PAL is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the report of the Secretary of Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the Act. The purpose of this PAL is to provide the U.S. Army Corps of Engineers (Corps) with recommendations regarding several aspects of the planning process including, but not limited to, management measure screening, alternative formulation, modeling strategy, and natural resource considerations.

Project Status

Since the last PAL was submitted on March 27, 2012, the interagency CEPP team has achieved several milestones including the completion of the 'screening phase' of alternative evaluation, brief introduction of the draft final array consisting of 5 alternatives, and several Internal Progress Review briefings of the vertical management teams of the Corps and South Florida Water Management District (District). The final step of the roughly 12-month long Execution phase, which started in late January 2012, will be an analysis of the final array of alternatives using the Regional Simulation Model (RSM) and RECOVER performance measures which will aid the team in selecting the Tentatively Selected Plan (TSP). The Project Implementation Report (PIR) will follow after the selection of the TSP. The focus of this letter will be on comments and recommendations regarding the conceptual design and modeling of the final array of alternatives. The Service understands that a 'hybird' alternative, or one in which contains the best components from several of the final alternatives, could be defined and selected as the TSP. It is unclear at this time if this alternative would then need a separate model run to satisfy the CERP Programmatic Regulations.

Draft Final Array of Alternatives

Background

For the past several months, the core planning team members, in conjunction with the project planning team (PDT) and participants of the Working Group-sponsored public workshops, have been analyzing screening level model output to determine which of the previously identified management measures should be retained and grouped into alternative scenarios (more detail regarding this process will be included in the Corps' PIR and Environmental Impact Statement). The latest of two tiers of screening level analyses allowed the group to reduce the number of draft alternative scenarios from 10 to 5 (Figures 1 – 5). All of these alternatives retain the same configuration above the redline but differ to varying degrees from the Hydropattern Restoration Feature (HRF) south through the green and blue lines and along the yellow line which represents the seepage management barrier along the urban boundary of the Everglades. The approach taken was to have a set of alternatives, composed of a wide array of management measures with three likely scenarios bound by "bookends" representing a minimum and maximum scenario. These alternatives will be simulated by the Regional Simulation Model (RSM) and evaluated using a set of REstoration COordination and VERification (RECOVER) performance measures. Scores from these metrics will be combined with estimated costs and entered into the Corps cost-benefit analysis to determine which of the alternatives are cost effective.

General Comments about the Alternatives

- All of the alternatives state that the A-2 Flow Equalization Basin (FEB) will be integrated with the FEB on A-1, which is now in the Future Without Project condition for CEPP; however, the operation of these basins is unclear at this time. Will the A-1 be used to collect up to 60,000 acre/feet of runoff from the Everglades Agricultural Area while the A-2 handles the 200,000 acre/feet of "new water" produced by CEPP?
- There are certain aspects about the project that have been shelved for decisions to be made at a later date. These include: conveyance capacity from Lake Okeechobee to the FEBs, operational plan for the entire project, L-6 diversion, eastern Hydropattern Restoration Feature (HRF), Miami Canal backfill method, planted spoil mound retention, L-28 cuts, C-11 Extension cuts, etc. It is unclear whether the RSM modeling of the final array will help us make these decisions.
- The Service suggests that an assumptions category be included for each alternative that would contain separable elements of the project such as retention of the Decompartmentalization Physical Model (DPM) Project and any modifications to the Tamiami Trail which the Department of Interior (DOI) would make under the Tamiami Trail Next Steps Project.
- There is no discussion of plugs in the L-67A Canal associated with the gated structures to help channel the flow into the pocket. Additionally, there is no discussion of cutoff walls to prevent short-circuiting of water down the pocket. The Service assumes that enough length of L-67 C canal and levee will be degraded to allow the water to flow into Water Conservation Area (WCA)-3B.

- The Service suggests that climate change scenarios be run on all of the alternatives instead of just the TSP.
- The Service is concerned about flow effects to Biscayne Bay under CEPP. Blue Line model sensitivity runs conducted in August 2012 indicated significant reduction in flows to the bay for several scenarios that are likely due to CEPP seepage management features. Total freshwater flow volumes currently entering Biscayne Bay are required for the protection of fish and wildlife resources in the bay, including threatened and endangered species. The Service believes that any CEPP alternative that causes reduction in flows to Biscayne Bay should be re-evaluated and potentially revised to maintain current or greater flows to the bay.
- The preliminary RECOVER analysis, of CEPPs effects on Lake Okeechobee, indicate that there is little difference between the FEB scenario and the existing condition base and future without project condition. However, the analysis does note that there may be times when higher stages impact the vegetation communities present in the lake. An adaptive management plan should be used to identify areas where CEPP can improve lake health in the future.

Specific Comments about the Alternatives

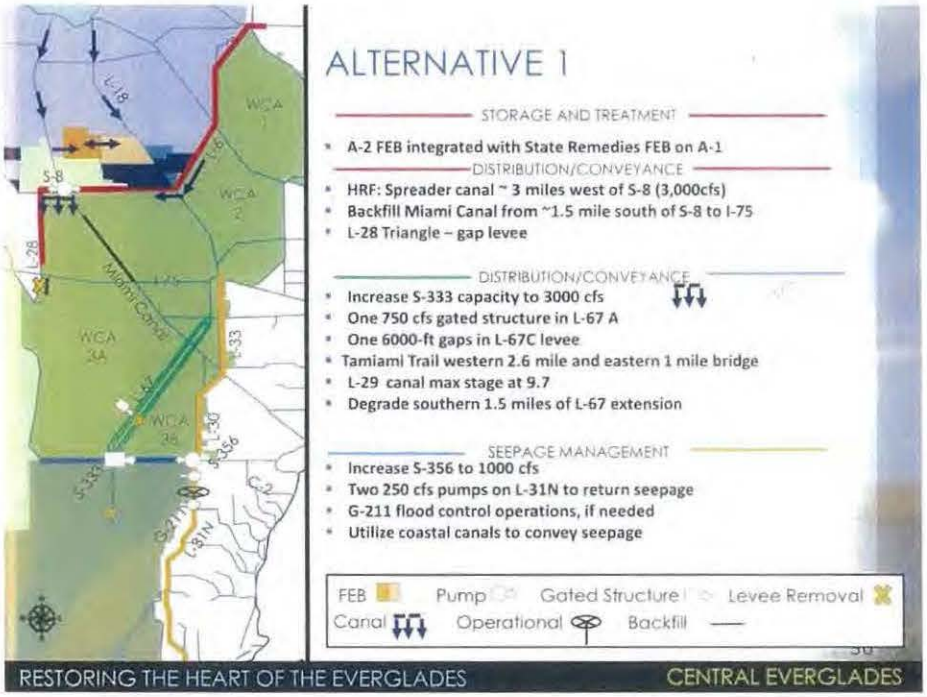

Figure 1. Alternative 1 of the Draft Final Array of alternatives for CEPP.

Alternative 1 was originally intended to be the minimal action plan or "bookend" and avoided any flow of water into WCA-3B. There is now a structure present on the L-67A and it is unclear if this is the retained DPM culvert or an additional culvert set. If we are planning to retain the

DPM structure, then this would be a cost savings for CEPP and it could possibly mean additional funding for monitoring of the DPM Project. The Service suggests that it should be listed as separate from the CEPP Project.

Additionally, it is not likely that one structure in the L-67A can provide enough flow into WCA-3B to alleviate concerns about the amount of time the WCA-3A regulation schedule would remain in Zone A. Although this alternative includes expansion of the S-333 structure capacity to 3,000 cubic feet per second (cfs), it is unclear at this time how this would be done and whether the hydraulic head in southern WCA-3A (under the lowered schedule implemented by the Everglades Restoration Transition Plan [ERTP]) would be sufficient to sustain 3,000-cfs flows.

The two 250-cfs pumps on the L-31N are not desirable as planned in this alternative. All other structures on the L-31 discharge into detention basins separate from the Everglades National Park (ENP) to reduce the likelihood of exotic fish transfer and to prevent impacts from poor quality water entering directly into the Park. Also, the location of the southern pump, which is currently sited directly north of and adjacent to the 8.5 Square Mile Area, would likely impact that projects ability to collect and remove seepage coming from Northeast Shark Slough (NESRS).

Finally, it is unclear how the benefit of degrading the lower 1.5-miles of the L-67 Extension will be evaluated. The Service does not recall data being generated by the iModel during the screening phase regarding partial degradation of the L-67 Extension. The Service recommends that this feature either be fully removed or left in place until future iterations of CEPP.

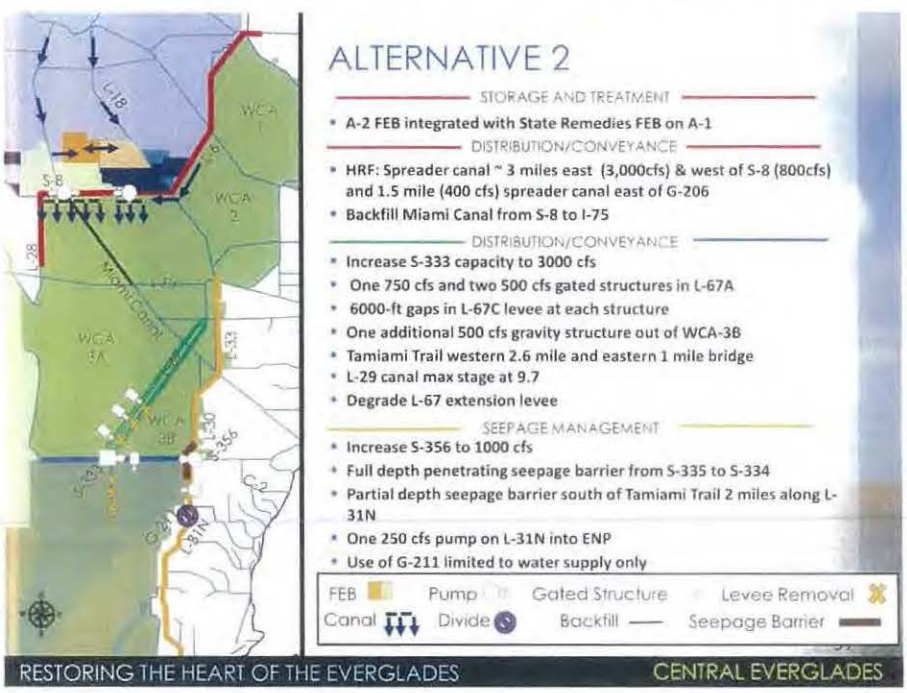

Figure 2. Alternative 2 of the Draft Final Array of alternatives for CEPP.

Alternative 2 is preferable to the Service at this point because it allows for a wider distribution of flows throughout the system while doing it in a passive manner. This alternative would allow rehydration of a majority of WCA-3B up to the newly defined stage at Site 71. Once this level is reached the structures on L-67A could be cycled off while discharge is increased at the S-333 with improved capacity. There is some uncertainty whether the one additional structure on the L-29, in conjunction with the existing S-355s, will match the inflows into WCA-3B. The RSM model output should be able to resolve this issue. An additional weir(s) may be necessary along the L-29 to ensure that new water added to WCA-3B can be discharged into the NESRS.

Degradation of the remaining portion of the L-67 Extension should benefit the spread of water at the downstream end of the S-12 structures. This would allow more water to move through the S-12 C and D and S-333 and help reduce the long hydroperiods currently observed in the western marl prairies.

Again, we believe direct discharge into ENP from L-31N is undesirable at this time, especially given that there is capacity in the South Dade Conveyance System and new Frog Pond detention areas associated with the C-111 Spreader Canal Project.

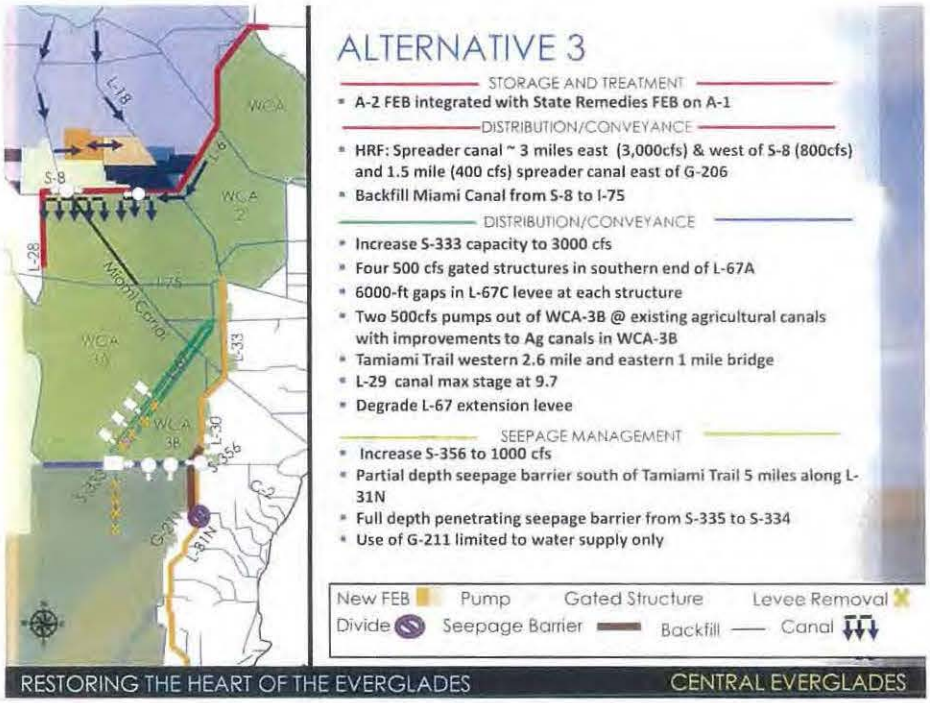

Figure 3. Alternative 3 of the Draft Final Array of alternatives for CEPP.

Should Alternative 2 not be able to move a sufficient amount of water from WCA-3A through WCA-3B passively (since this project is not providing additional storage of water in the North), then it may be necessary to utilize a temporary pump on the L-29 to facilitate the flow through

WCA-3B. Alternative 3 includes temporary pumps to move more water through WCA-3B, however, it seems to be slightly overbuilt for this increment of CEPP. The Service suggests removing one of the four structures on the L-67A and one of the temporary pumps on L-29. With the removal of those two features, this alternative would still move more water through WCA-3B than Alternative 2 but at less cost than currently conceptualized.

The Service would like to reiterate its desire to have the first increment of CEPP restore flow to as much of WCA-3B as possible and distribute flows east along a wide expanse of Tamiami Trail. We have recently been made aware by project managers that inclusion of pumps in this project is controversial. If a temporary pump on the L-29 means the difference between starting the restoration of WCA-3B at this time or delaying its restoration conceivably to a much later date, then a temporary pump seems desirable. A temporary pump on the L-29 would move clean water from WCA-3B into the NESRS of ENP.

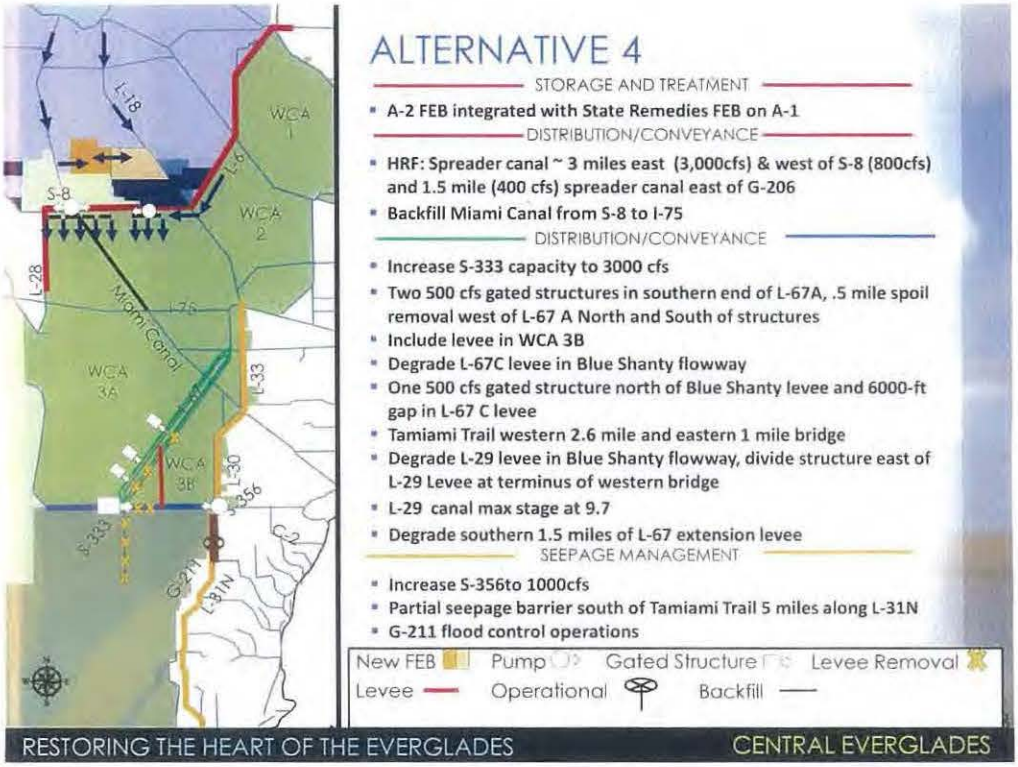

Figure 4. Alternative 4 of the Draft Final Array of alternatives for CEPP.

Alternative 4 is the "Blue Shanty Plan" and was originally designed to prevent high water from reaching the eastern portions of Tamiami Trail, in the event that DOI would not be able to modify the entire length of Tamiami Trail to accommodate higher water levels. This alternative originally included a temporary berm extending from L-67 A south to approximately 2 miles into ENP and a divide structure in the L-29 borrow canal. As the project progressed, we learned that DOI will, in fact, elevate the entire length of the Trail and that we should not consider it a

constraint in CEPP. We also learned that the temporary berm would actually need to be a full-sized levee and that the National Park Service could not accept building a levee in a wilderness area.

The current conceptualization of this alternative retains the levee in WCA-3B and the divide structure in the L-29 in an effort to reduce the need for seepage management on the eastern side of WCA-3B. The Service does not feel that construction of a levee (roughly 20 acres of filled wetland) through WCA-3B and the resulting delay in shifting flows eastward through WCA-3B fits a first increment project like CEPP. If seepage management is needed in WCA-3B, in addition to the existing L-30/S-356 conveyance system and/or the Pensucco Wetlands, the Service feels that a seepage barrier along the already existing levee system would be the prudent choice.

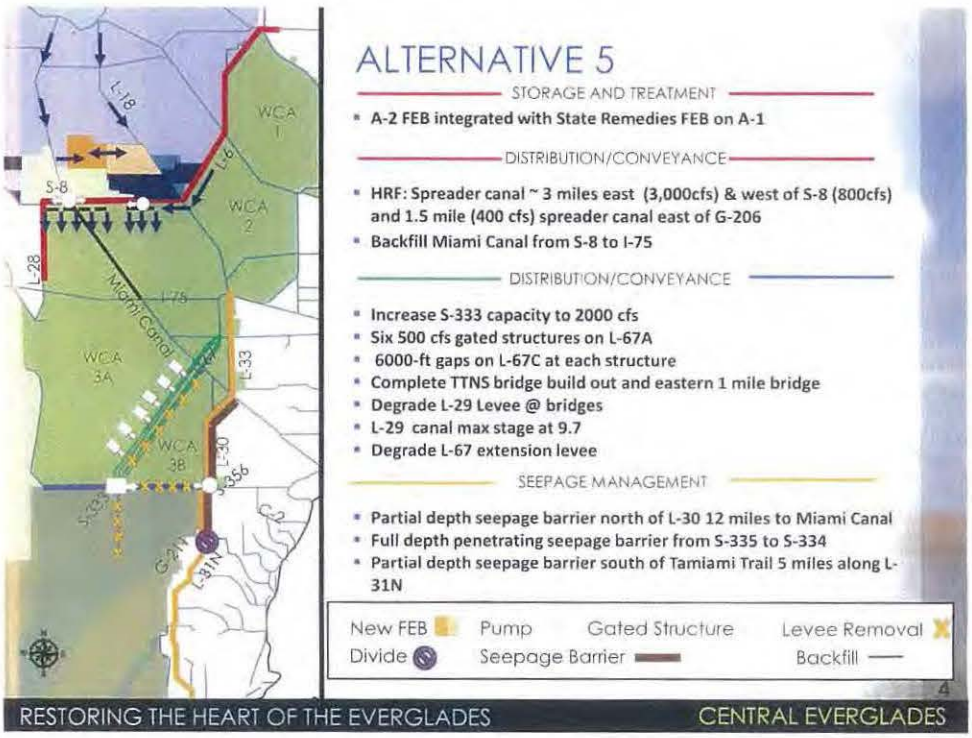

Figure 5. Alternative 5 of the Draft Final Array of alternatives for CEPP.

Although Alternative 5 contains some management measures that have the potential to move us closer to CERP-level restoration, it does not seem consistent with the scale of the other parts of the project. It is unlikely that enough flow could be provided in the dry season, without additional storage, to prevent WCA-3B from drying out in dry to average years if the entire L-29 is removed.

The Service believes this alternative should be removed at this time or modified to come more in line with the other alternatives. This would allow a potential hybrid plan to be included in the final array of alternatives.

Final Comments on CEPP Alternatives

The Service supports the Corps and District endeavors to model and analyze the proposed final array of alternatives. The Service is prepared to evaluate any and all data made available related to effects to threatened and endangered species, and all natural resources within the project area. We have a good idea of how these alternatives will perform from previous iModel results, and we believe Alternative 2 provides the most benefit to all areas of the system while still meeting the intent of an incremental project. We are concerned; however, that enough water will not be able to move through WCA-3B in this scenario which is why Alternative 3 with its temporary pump to facilitate the movement of water should be closely analyzed. We advocate, as we always have, a passive restoration system but understand the difficulty in flowing water across a degraded landscape that has lost much of its slough patterning and contains a high percentage of dense sawgrass. If, it is found through further modeling, a temporary pump could be utilized to effectively facilitate greater flow through WCA-3B into NESRS then the Service would support its temporary use. During the screening phase, plans that distributed water throughout WCA-3B, both with and without pumps, performed the best in the western marl prairies and WCA-3B while also providing substantial hydrologic lift in downstream areas of NESRS in ENP (Table 1). We look forward to receiving the first batch of RSM model output.

Table 1. The table below shows iModel screening output for the WCA-3B flow-through plans (Opt_3A1 – Opt_3B3) along with the target and base conditions. A1 and A2 scenarios do not include pumps while B2 and B3 do contain pumps which facilitate the movement of water from WCA-3B into NESRS (via L-29). Note that all plans make significant improvements above existing condition in NESRS (locations NE2 and P33). Plans with pumps improve hydroperiods in the western marl prairie (NP 205) over the existing conditions (ECB).

Hydroperiod							
Location	Target	ECB	FWO	Opt_3A1	Opt_3A2	Opt_3B2	Opt_3B3
				without pumps		with pumps	
NP205	58.14	73.53	74.04	79.37	78.95	67.54	66.00
Site71	99.53	93.36	91.16	97.01	97.10	99.02	96.73
NE2	99.53	87.75	87.28	99.67	99.86	99.77	100.00
P33	98.78	89.34	89.10	99.86	99.91	100.00	100.00
Average Water Depth							
NP205	-0.10	0.15	0.15	0.26	0.25	0.10	0.08
Site71	1.82	0.84	0.80	1.24	1.31	1.21	0.76
NE2	2.07	0.94	0.93	1.98	2.02	2.10	2.15
P33	2.05	0.96	0.96	1.57	1.62	1.65	1.65

Review of major points from previous PALs

- Reconnection of WCA-3B as a flow-through system connecting WCA-3A to ENP is the most critical part of restoration remaining to be planned. All options should be analyzed regarding how and to what extent this critical reconnection can be made.
- Relaxation of the G-3273 constraint, the integration of the S-356 pump station to control seepage in the L-30 and L-31N canals, and the expansion of S-333 structure to allow greater flow out of the ponded areas of WCA-3A into NESRS should be included in CEPP.
- Regulation schedules for WCAs 2 and 3B should be defined and the regulation schedule for WCA-3A should be refined.
- Further modification of the S-12s should not be considered as it was screened out in the recent ERTP for protection of the Cape Sable Seaside Sparrow (CSSS) (*Ammodramus maritimus mirabilis*). Once ERTP is authorized, the S-12C closure regime will be relaxed allowing for year-round operations.
- The general alternative formulation and evaluation process uses "upfront" modeling output whereby management measures are screened or combined into components which will then be screened out or combined to form the final array of alternatives. Relying on modeling products to choose alternative features for the final array of alternatives without regards to operations, adaptive management, and past experience could result in a plan with adverse impacts to the landscape and threatened and endangered species. The Service requests that we receive model output pertaining to threatened and endangered species throughout the planning process (including alternative screening, alternative formulation, operational plans, and adaptive management) so that we may help the team identify all possible means to reduce or eliminate impacts and ensure the TSP will help restore these imperiled species.
- It is critical for the PDT to begin discussing the "transition strategy" for how we will slowly introduce larger volumes of water into a system which has had its spatial extent reduced by 50 percent and its biological systems acclimated to reduced water flow.
- For the purposes of comparing modeled alternative runs it may be appropriate to use Natural System Model-based hydrologic targets; however, it should be understood that the first increment of CEPP will probably not meet these, and they may be inappropriate for use in some areas of the system.
- Use of the 2010 Multi-species Transition Strategy refined during ERTP-1 is highly recommended. A group of interagency scientists, in coordination with species experts, compiled the latest information regarding a number of species and defined a WCA-3A water management strategy. This science-based strategy was designed for Everglade snail kites (*Rostrhamus sociabilis plumbeus*), apple snails (*Pomacea paludosa*), wading birds, and vegetation found within WCA-3A and was based on the current hydrologic system. For CEPP, this strategy can be refined and other species and locations within the project area can be added.

- The Periodic Scientist Calls and seasonal scientist meetings should be utilized in CEPP. These meetings maintain a communication channel between regional water operators and interagency scientists responsible for managing the system for natural resources.
- The Service recommends that threatened and endangered species be considered regularly throughout the CEPP planning process, from screening, alternative formulation, water management plans, through adaptive management to ensure species protection while restoring the ecosystem.
- CSSS inhabit the relatively short hydroperiod marl marsh that flanks the Taylor and Shark River Sloughs in the ENP. Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water level or stage is above ground surface) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat. Recent observed average annual hydroperiods (since 2002 and implementation of Interim Operations Plan [IOP]) in subpopulation A (CSSS-A) as measured at NP-205 near the sparrow's core breeding habitat in western Shark Slough, have been in the range of 240 days or more. While the habitat occupied by sparrows can tolerate occasional average annual hydroperiods of 240 or more days this condition should not occur in concurrent years. Hydroperiods of 60 to 180 days should be experienced at the highest frequencies (*e.g.*, 7 out of 10 years) with occasional years ranging from 210 to 240 days. The opposite is true in the eastern subpopulations where hydroperiods are shorter resulting in higher threats of catastrophic fires and woody plant encroachment.
- Targets for CEPP alternative performance, with regards to sparrow nesting, in the vicinity of the six sparrow subpopulations (A-F) will remain the same as during IOP and ERTP-1. For all CSSS subpopulations the target is at least 60 consecutive days and preferably 80 or more consecutive days in most years during the nesting season from March 1 through July 15 with water levels at or below ground surface. For CSSS-A this equates to 60 days at or below 6.0 feet National Geodetic Vertical Datum (NGVD) at NP-205. In understanding this target, it is important to note that, due to topographic variation within the sparrow's habitat, available habitat at a higher elevation than the NP-205 reference point will remain dry for longer than habitat at the reference point elevation. Therefore this requirement, with current protective operations of S-12A/B, S-343, and S-344, should provide the 80 dry days required for completion of two successive broods over a larger percentage of habitat above 6.0 feet NGVD. At a stage elevation of 6.0 feet NGVD at NP-205, roughly 40 percent of the habitat is available for nesting by CSSS.
- The Service recommends that the PDT not rely solely on modeling for CEPP. Best available science, best professional judgment, ecosystem observations from monitoring, and adaptive management should be the primary tools used to design and select the TSP as discussed in the PDT kick-off meeting.
- The Service recommends making the model output of any screened-out scenarios available to the PDT members for their agency analyses to avoid any pre-decisional determinations. Current Everglades' performance measures and ecological targets, including those developed in the ERTP-1, should also be included as screening tools and in alternative model runs.

- The Service also wants to point out that using NSM-4.6.2 targets for the entire Everglades may not be desirable. The CEPP planning and modeling cannot ignore micro-topography as it is extremely important to the species and their habitats.
- The Service recommends that the CEPP PDT discuss and consider the current and predicted climate regimes that influence the rainfall patterns of the Florida Peninsula.
- Climate change should also be a part of the active dialog in planning for Everglades restoration in determining the viability of recommended restoration targets and solutions with emphasis around the perimeter of the Greater Everglades. Along with the Corps' climate change scenarios, the Service recommends the use of "Addressing the Challenge of Climate Change in the Greater Everglades Landscape" research initiative that was recently completed by a group of researchers at the Department of Urban Studies and Planning at the Massachusetts Institute of Technology (MIT) in coordination with the Service and U.S. Geological Survey. Sea level rise, especially, should be considered and planned for as it will likely affect structural operations, water management plans, ecology, and landscapes. We feel it is important to include the MIT scenarios in discussions and planning to insure we investigate the best methods to restore our resources.

In summary, the Service continues to support the strategy and vision for accomplishing this challenging but critical restoration project. We commend the Corps' sustained efforts to complete CEPP within the expedited schedule. We pledge our continuing support in planning of restoration projects to maximize opportunities and minimize potential adverse effects to the natural system. For assistance or if you have questions regarding the contents of this PAL, please contact Lori Miller or Kevin Palmer at 772-562-3909.

Sincerely yours,

Daniel R Rogalski

for Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
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ENP, Homestead, Florida (Bob Johnson, Carol Mitchell)
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FWC, West Palm Beach, Florida (Chuck Collins, Barron Moody)
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APPENDIX B
Central Everglades Planning Project Biological Assessment

Modeling Assumptions for the Future Without Project, Existing Conditions 2012 Baseline, and Alternative 4R2

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
2012 Existing Conditions (2012EC) Baseline
Table of Assumptions

Note: RSMBN CEPP 2012EC (2/28/13) is identical to the RSMBN CEPP ECB (12/13/12)

Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/12, as reflected in the LOSA Ledger produced by the Water Use Bureau • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  ○ Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  ○ Lake Okeechobee regulatory releases limited to 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal based on studies performed by USACE.
	  ○ A regional hydrologic surrogate for the 2010 Adaptive Protocol operations utilized. This attempts to mimic desired timing of releases without estimating salinity criteria
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  ○ S354 – 400 cfs
	  ○ S351 – 600 cfs
	  ○ S352 – 400 cfs

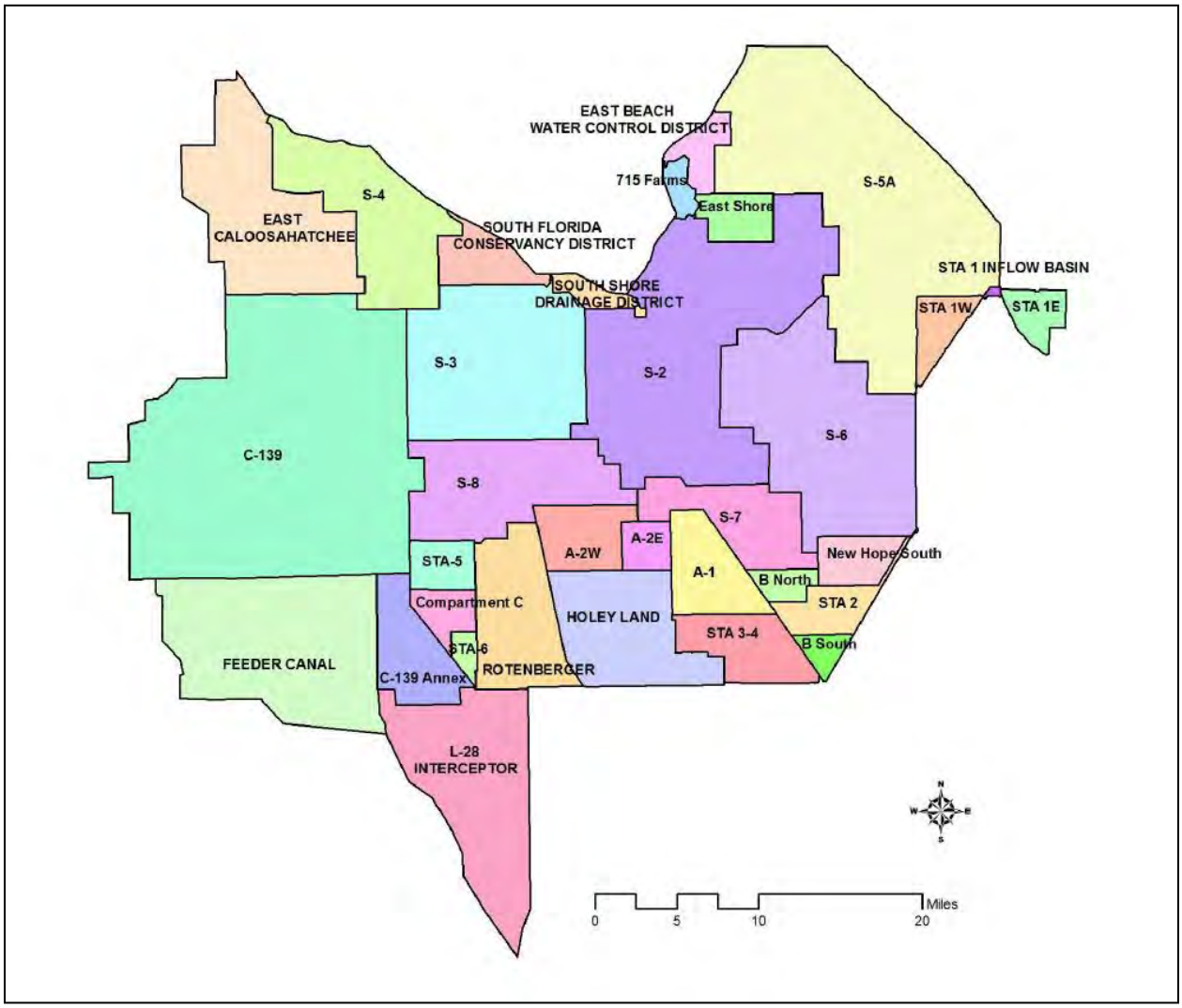
Feature	
	○ All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft. • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Kissimmee River inflows based on interim schedule for Kissimmee Chain of Lakes using the UKISS model • Restored reaches / pools of Kissimmee River as of 2010 • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). • Public water supply daily intake from the river is included in the analysis.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row). • Excess C-44 basin runoff is allowed to backflow into the Lake if the lake stage is 0.25 ft below the Zone D pulse release line. • Basin demands include the Florida Power & Light reservoir at Indiantown.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage • The 2-in10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement

Feature	
Everglades Agricultural Area	• Model water-body components as shown in Figure 1 below. • Simulated runoff from the North New River – Hillsboro basin will be apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin • EAA runoff and irrigation demand compared to SFWMM (ECB) simulated runoff and demand from 1965-2005 for reasonability • Compartment C land in the Miami Canal Basin between STA-5 and STA-6 is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area. • Compartment B (excluding cell 4) land in the North New River/Hillsboro is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area.

Stormwater Treatment Areas	• STAs are simulated as single waterbodies
	• STA-1E: 6,546 acres total area
	• STA-1W: 7,488 acres total area
	• S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E
	• STA-2: includes first four cells: 9,910 acres total area
	• STA-3/4: 17,126 acres total area
	• STA-5: includes first 3 cells: 7,619 acres total area
	• STA-6: 2,486 acres total area
	• Assumed operations of STAs:
	  ○ 0.5 ft minimum depth below which supply from external sources is triggered
	  ○ 4 ft maximum depth above which inflows are discontinued
	• STA-3/4 receives Lake Okeechobee regulatory releases approximately at 60,000 acre-feet annual average for the entire period of record.

Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL ECB.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5; G406 flows routed to STA6 • C139 basin demand is met primarily by local groundwater

Feature	
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.



Water-Body Components:

Miami Water-Body = S3 + S8 + A-2W

NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + B North
+ B South + New Hope South

WPB Water-Body = S-5A

Fig. 1 RSMBSN Basin Definition within the EAA: 2012 Existing Conditions Simulation

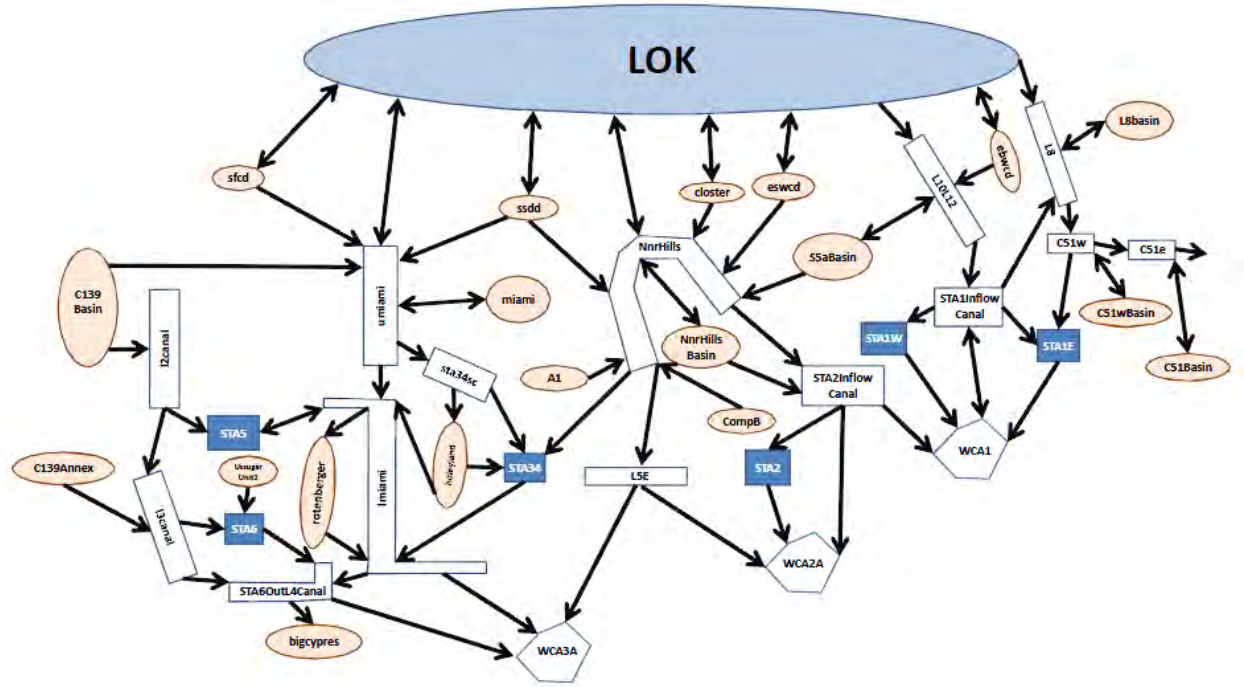


Fig. 2 RSMBSN Link-Node Routing Diagram: 2012 Existing Conditions Simulation

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- 2012EC assumptions were updated from the CEPP 12/13/2012 ECB scenario at the time that the CEPP tentatively selected plan was identified.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
2012 Existing Conditions (2012EC)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. • Modified at locations where reservoirs are introduced (STA1-E, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed.
Lake Belt Lakes	• Based on 2005 Lake Belt Lake coverage obtained from USACE.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System

Feature	
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012). • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2006) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • Tamiami Trail culverts east of the L67 Extension are simulated. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Partial construction of C-111 project reservoirs consistent with the 2009 as-built information from USACE (does not include contract 8 or contract 9). A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • S-332DX1 is not operated. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay

Feature	
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Industrial pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.

Canal Operations	• C&SF system and operating rules in effect in 2012
	• Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion
	• Includes existing secondary drainage/water supply system
	• C-4 Flood Mitigation Project
	• Western C-4, S-380 structure retained open
	• C-11 Water Quality Treatment Critical Project (S-381 and S-9A).
	  ○ S9/S9A operations modified for performance consistency with SFWMM ECB.
	• S-25B and S-26 pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary
	• Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry
	• ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure
	• Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1
	  ○ Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15
	  ○ Structure S-12B is closed Jan. 1 to July 15
	• South Dade Conveyance System operations will follow ERTP for protection of the Cape Sable seaside sparrow

Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data.

Feature	
	• Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN ECB simulation.

Notes

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.
- 2012EC assumptions were updated from the CEPP 12/13/2012 ECB scenario at the time that the CEPP tentatively selected plan was identified.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
2050 Future Without Project Baseline (FWO)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  o Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  o Lake Okeechobee regulatory releases limited to 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal based on studies performed by USACE.
	  o Releases via S-77 can be diverted into C43 Reservoir
	• No Lake Okeechobee environmental releases.
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and s-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  o S354 – 400 cfs
	  o S351 – 600 cfs
	  o S352 – 400 cfs
	  o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages

Feature	
	recover to greater than 11.2 ft. • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.

St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row).
	• Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is 0.25 ft. below the Zone D pulse release line before being pumped into the C-44 reservoir.
	• Basin demands include the Florida Power & Light reservoir at Indiantown.
	• Indian River Lagoon South Project features
	  • Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin
	  • C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint
	  • C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint
	  • C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint
	  • All proposed reservoirs meet estuary demands

Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons/month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal

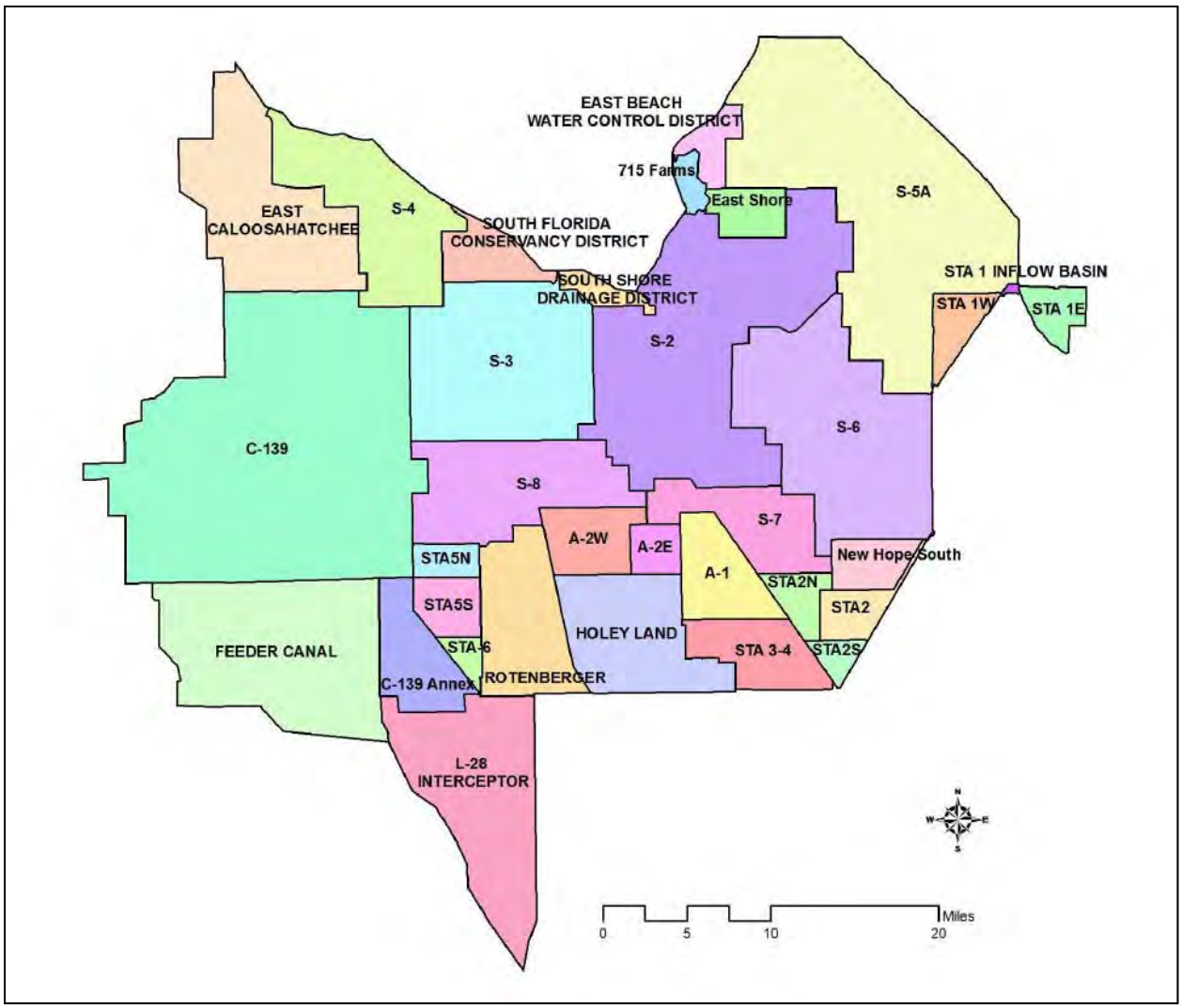
Feature	
	rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.

Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies
	• STA-1E: 6,546 acres total area
	• STA-1W: 7,488 acres total area
	• S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E
	• STA-2: cells 1,2 & 3: 7,681 acres total area
	• STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area
	• STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area
	• STA-3/4: 17,126 acres total area
	• STA-5N: includes cells 1 & 2: 5,081 acres total area
	• STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area
	• STA-6: expanded with phase 2: 3,054 acres total area
	• Assumed operations of STAs:
	  • 0.5 ft minimum depth below which supply from external sources is triggered
	  • 4 ft maximum depth above which inflows are discontinued
	  • Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK regulatory discharge and available A1FEB storage.
	  • STA-3/4 receives Lake Okeechobee regulation target releases approximately at 60,000 acre-feet annual average for the entire

Feature	

	period of record.
	• A 15,853-acre Flow Equalization Basin (FEB) located north of STA-3/4.
	• Assumed operations of A1FEB:
	  • FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south
	  • FEB outflows are used to help meet established inflow targets (as estimated using the Dynamic Model for Stormwater Treatment Areas) at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK regulatory discharge are not sufficient.
	  • 0.5 ft minimum depth below which no releases are allowed
	  • 3.8 ft maximum depth above which inflows are discontinued
	  • Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures.
	  • Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower North New River canal.

Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6C139 basin demand is met primarily by local groundwater
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan



Water-Body Components:
Miami Water-Body = S3 + S8
NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + New Hope South
WPB Water-Body = S-5A
A1FEB = A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Future Without Project Baseline Simulation

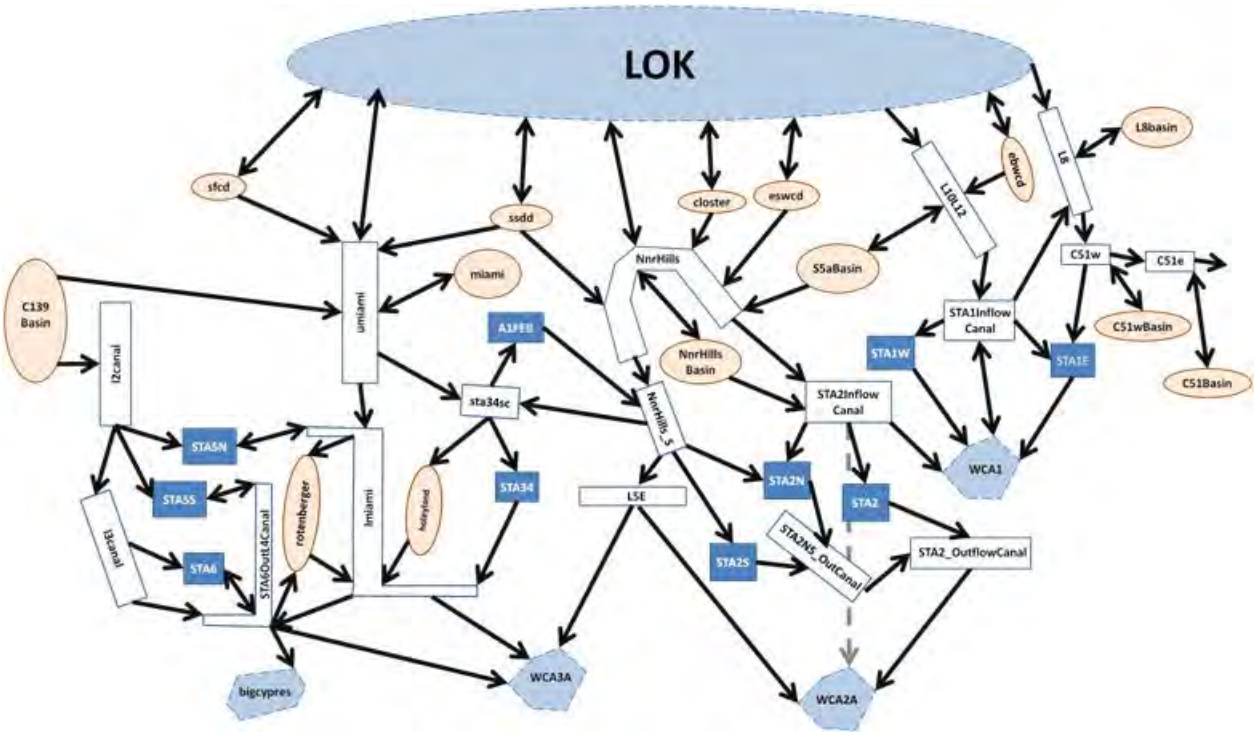


Fig. 2 RSMBSN Link-Node Routing Diagram: Future Without Project Baseline Simulation

Note:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
2050 Future Without Project Baseline (FWO)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. • Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.

Feature	
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2010 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is based on 2010 permits. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2010 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open

Feature	
	• C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15
Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal and CERP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

`Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Initial Operating Regime Baseline 1 (IORBL1)
Table of Assumptions

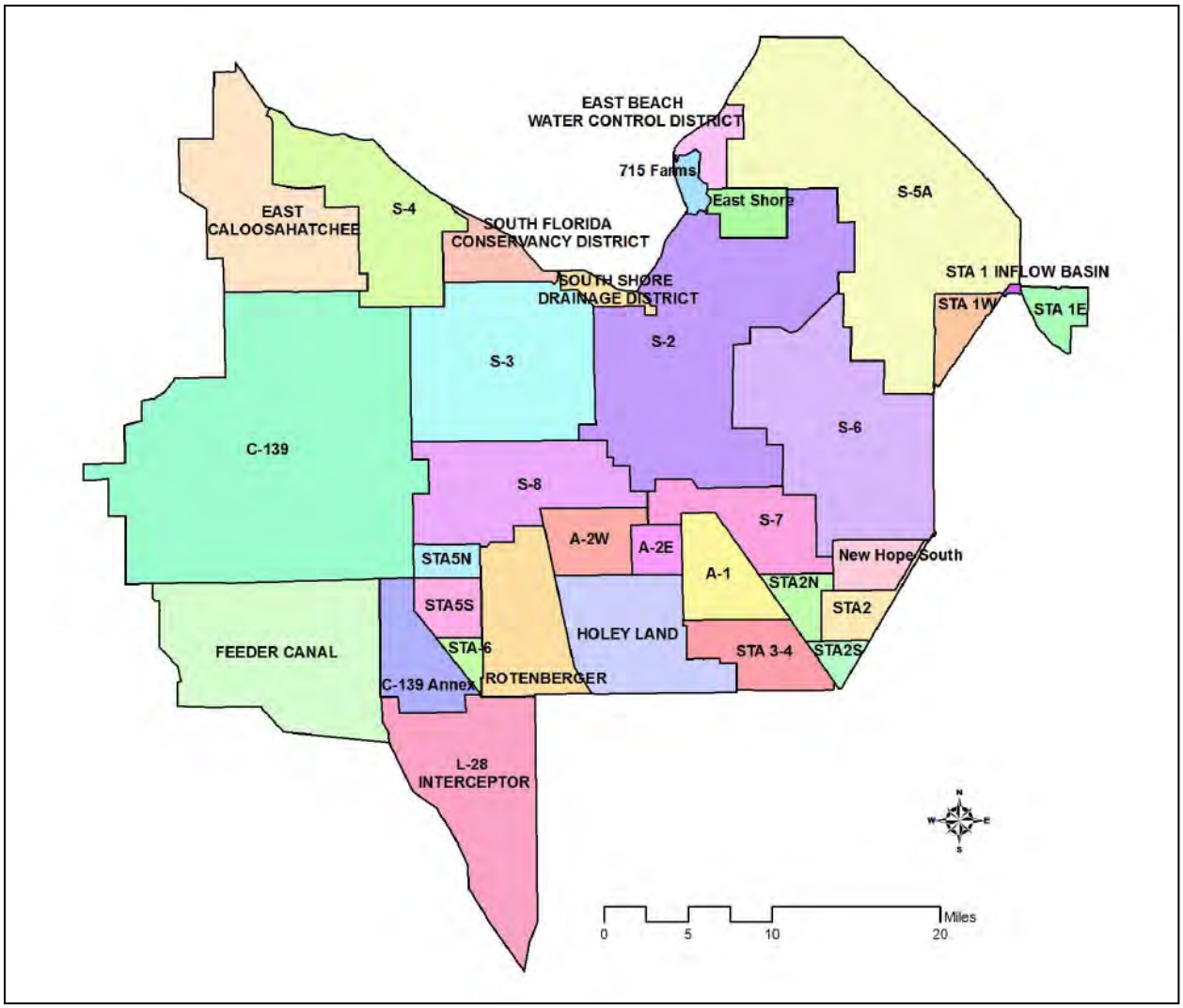
Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The topography dataset for RSM was updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  o Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  o Lake Okeechobee regulatory releases limited to 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal based on studies performed by USACE.
	  o Releases via S-77 can be diverted into C43 Reservoir
	• No Lake Okeechobee environmental releases.
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  o S354 – 400 cfs
	  o S351 – 600 cfs
	  o S352 – 400 cfs

Feature	
	o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft. • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row). • Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is 0.25 ft. below the Zone D pulse release line before being pumped into the C-44 reservoir. • Basin demands include the Florida Power & Light reservoir at Indiantown. • Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint o All proposed reservoirs meet estuary demands o IRL operations assumed are consistent with the March 2010 St. Lucie River Water Reservation Rule update. o Excess C23 basin water not needed to meet estuary demands can be diverted to the C44 reservoir if capacity exists.
Seminole Brighton	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage.

Feature	
Reservation	• The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area • STA-3/4: 17,126 acres total area • STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area • Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered

Feature	
	o 4 ft maximum depth above which inflows are discontinued o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK regulatory discharge and available A1FEB storage. o STA-3/4 receives Lake Okeechobee regulation target releases approximately at 60,000 acre-feet annual average for the entire period of record. • A 15,853-acre Flow Equalization Basin (FEB) located north of STA-3/4 with assumed operations as follows: o FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south. o FEB outflows are used to help meet established inflow targets (as estimated using the Dynamic Model for Stormwater Treatment Areas) at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK regulatory discharge are not sufficient. o 0.5 ft minimum depth below which no releases are allowed o 3.8 ft maximum depth above which inflows are discontinued o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures. o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower North New River canal. o Structure capacities and water quality operating rules are consistent with modeling assumptions assumed during the A-1 FEB EIS application process.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6C139 basin demand is met primarily by local groundwater
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2W
NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + New Hope South
WPB Water-Body = S-5A
A1FEB = A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Initial Operating Regime Baseline Simulation

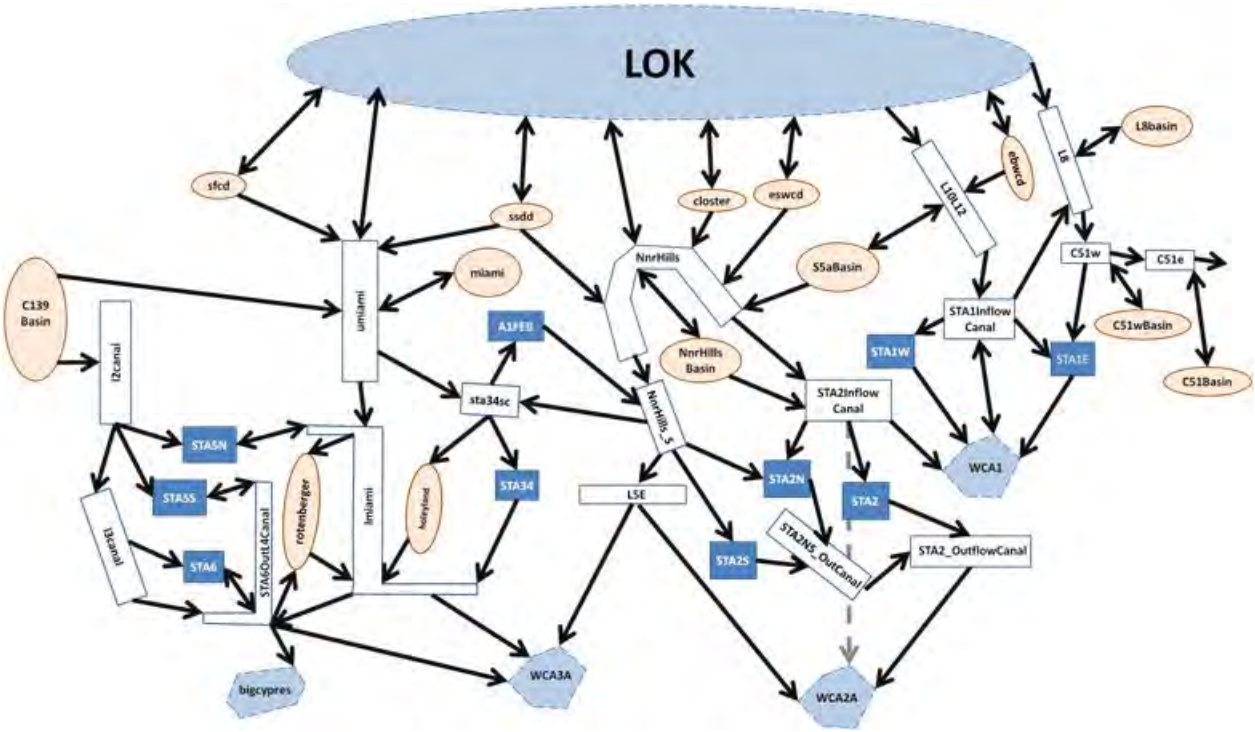


Fig. 2 RSMBSN Link-Node Routing Diagram: Initial Operating Regime Baseline Simulation

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- IORBL assumptions were updated from the CEPP 12/13/2012 FWO scenario at the time that the CEPP tentatively selected plan was identified and then adjusted for the IRL project to produce the IORBL1.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Updated Tentatively Selected Plan (ALT4R2)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005. • Rainfall estimates have been revised and updated for 1965-2005. • Revised evapotranspiration methods have been used for 1965-2005.
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004; • High Accuracy Elevation Data, US Geological Survey 2007; • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004; • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007; • Palm Beach County LiDAR Surve, Dewberry and Davis, 2004; and • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information . • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass.
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).
Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008) o CEPP optimized release guidance in order to improve selected performance within LOK, the northern estuaries and LOSA while meeting environmental targets in the Glades. o Lake Okeechobee can send flood releases south through the Miami Canal and North New River Canal to the FEB when the LOK stage is above the bottom of Zone D and the FEB depth is below 2' (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Lake Okeechobee can send flood releases south to help meet water-quality based flow targets at STA-3/4, STA-2N, and STA-2S when the LOK stage is above the bottom of the Baseflow Zone (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Includes Lake Okeechobee regulatory releases to tide via L8 canal.

Feature	
	o Releases via S-77 can be diverted into C43 Reservoir • Lake Okeechobee Water Shortage Management (LOWSM) Plan. • Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized). • "Temporary" forward pumps as follows: o S354 – 400 cfs o S351 – 600 cfs o S352 – 400 cfs o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model. • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	o St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). o Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is 0.25 ft. below the Zone D pulse release line before being pumped into the C-44 reservoir. o Basin demands include the Florida Power & Light reservoir at Indiantown. o Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin; o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint; C44 reservoir releases water back to Lake Okeechobee when Lake stages are below the bottom of the Baseflow Zone. o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint; o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint;

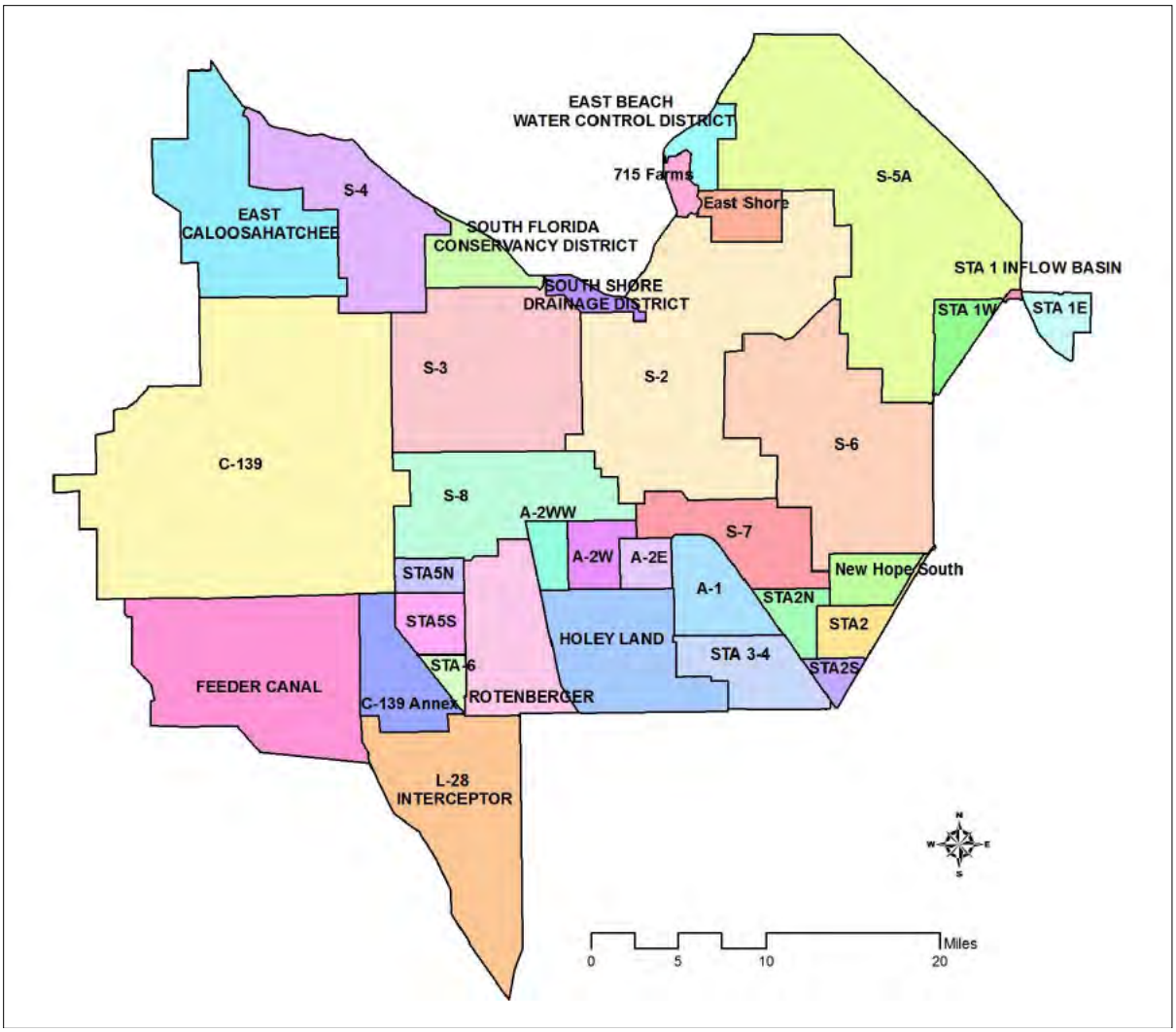
Feature	
	o All proposed reservoirs meet estuary demands. o IRL operations assumed are consistent with the March 2010 St. Lucie River Water Reservation Rule update. o Excess C23 basin water not needed to meet estuary demands can be diverted to the C44 reservoir if capacity exists. o C44 reservoir can discharge to C44 canal and backflow to Lake Okeechobee when the lake is below the baseflow zone.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM. • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area • STA-3/4: 17,126 acres total area

Feature	
	• STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area • Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered; o 4 ft maximum depth above which inflows are discontinued; and o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK flood releases and available FEB storage. • A 29,617-acre Flow Equalization Basin (FEB) is located north of STA-3/4 and Holeyland. The total footprint represents the original 15,853-acre A-1 footprint plus the additional 13,764-acre A-2 footprint operated as follows: o Assumed average topography of 9.63 ft NGVD. FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south; o FEB outflows are used to help meet established inflow targets at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK flood releases are not sufficient; o 0.5 ft minimum depth below which no releases are allowed; o 3.8 ft maximum depth above which inflows are discontinued; o No supplemental water supply provided to FEB; o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures; and o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower Miami and lower North New River canals.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for keeping the water table from going lower than half a foot below land surface elevation. • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FL Fish and Wildlife Conservation (FWC) Commission and the SFWMD.
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA. (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.

Feature	
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6. • C139 basin demand is met primarily by local groundwater.
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- The RSMBN CEPP representation of ALT4R2 is the same as the June 2, 2013 ALT4R1 scenario.



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2WW
NNR/HILLS Water-Body = S2 + S6 + S7 + New Hope South
WPB Water-Body = S-5A
FEB = A-2W + A-2E + A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Updated Tentatively Selected Plan (ALT4R2)

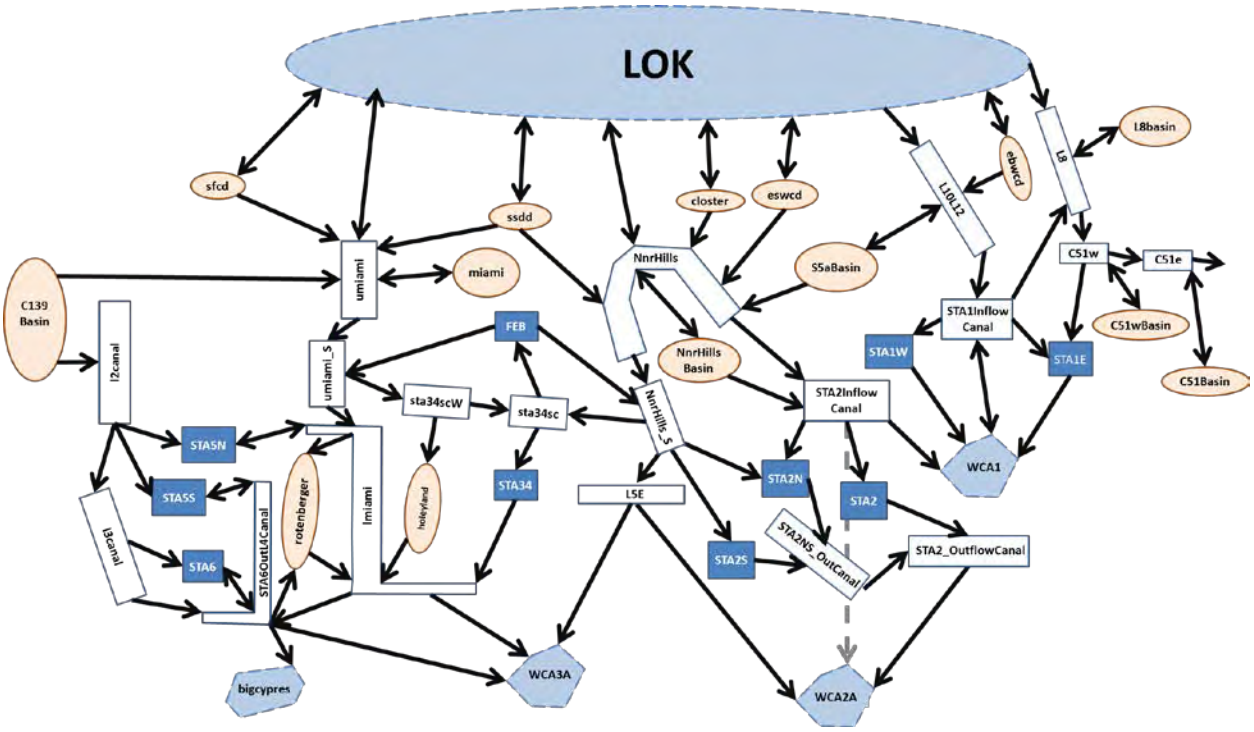


Fig. 2 RSMBSN Link-Node Routing Diagram: Updated Tentatively Selected Plan (ALT4R2)

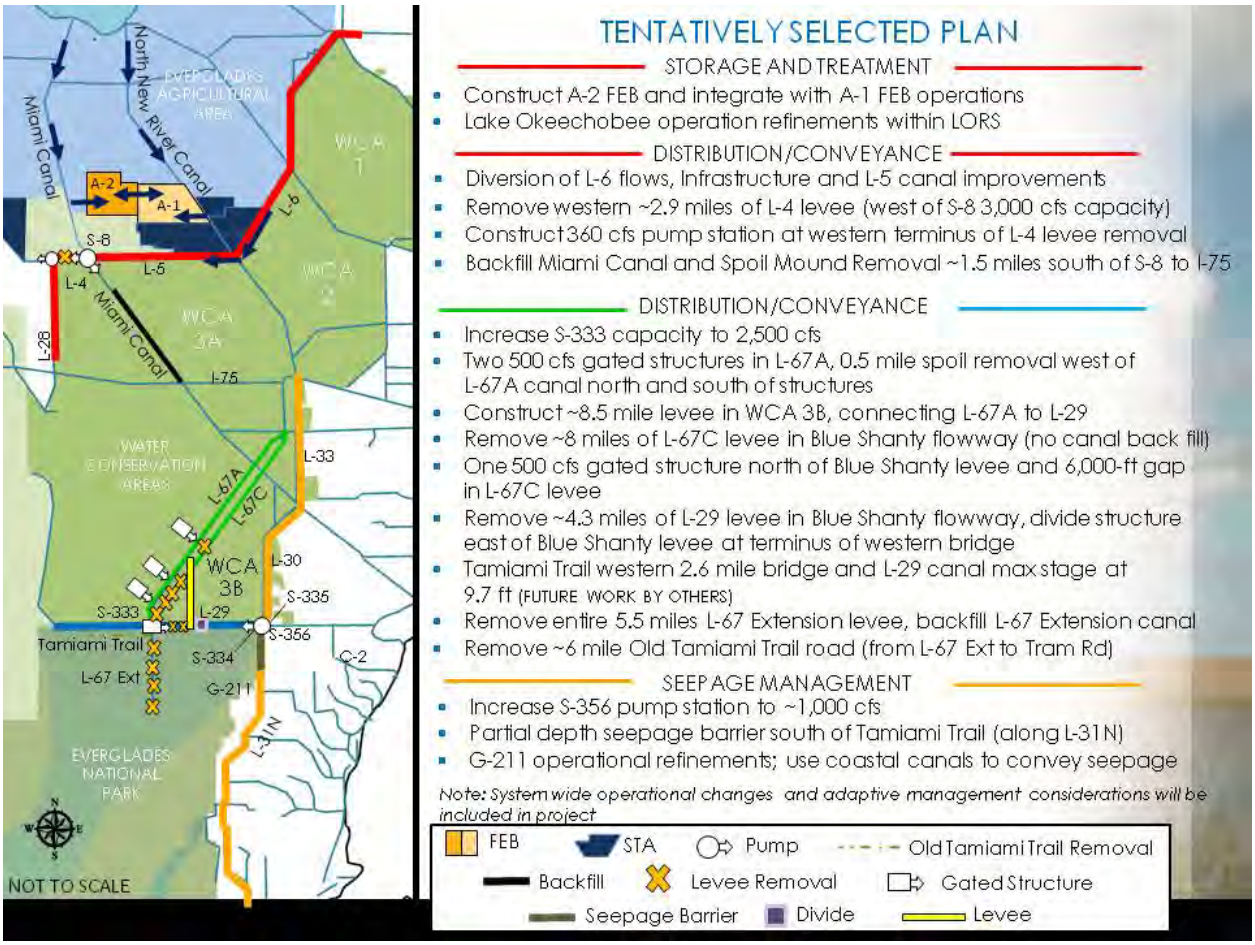


Fig. 3 CEPP ALT4R2 Features as defined by CEPP project team

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
Updated Tentatively Selected Plan (ALT4R2)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively. Operations refined in RSM model to closer represent project intent and outcomes.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 10.5 ft in WCA-2A, defined as when WCA2-U1 marsh gauge falls below 10.5 ft or L38 canal stage falls below 10.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Diversion of L-6 flows with additional 500 cfs structure and improvements to the L-5 canal • STA-3/4 outflows routed based on Rainfall Driven Operations (RDO) – a maximum of 2500 cfs is routed to S8 and G404, with the remainder being sent to S7 • Western L-4 levee degrade with 1.5 miles retained west of S8 (west of S-8 = 3,000 cfs capacity) • Miami Canal backfilled and spoil mound removed 1.5 miles south of S-8 to I-75 • Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • One 500 cfs gated structure in L-67A north of Blue Shanty levee (S345D) and associated gap in L-67C levee

Feature	
	• Two 500 cfs gated structures in L-67A (S345F & S345G) discharging into Blue Shanty Flowway • Environmental target deliveries through the S345s are determined through RDO and is spatially distributed as 40% to 345D, 35% to 345F and 25% to 345G • Blue Shanty Flowway assumed as follows: o Construction of ~8.5 mile levee in WCA 3B, connecting L-67A to L-29 o Removal of L-67C levee in Blue Shanty Flowway (no canal back fill) o Removal of L-29 levee in Blue Shanty Flowway. • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A, defined as when 3-69W marsh gauge falls below 7.5 ft or CA3 canal stage falls below 7.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. The environmental component of the schedule is defined by RDO. If hydraulic capacity exists at the 345s, then flood control discharges are made into 3B instead of at the S12s. • S-333 capacity increased to 2,500 cfs • L29 Divide structure assumed and is operated to send water from L29W to L29E to equilibrate canals when L29E falls below 7 ft. • L29 canal can receive inflow up to 9.7 ft (applies to both E and W segments / i.e. S333 & S356 as well as S345F & S345G structure on Blue Shanty Flowway) • G-3273 constraint for operation of S-333 assumed to be 9.5 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Western 2.6 mile Tamiami Trail Bridge, modeled as a 2.6 mile long weir, and is located east of Osceola Camp and west of Frog City. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located.

Feature	
	• Removal of the entire 5.5 miles L-67 Extension levee, with backfill of L-67 Extension canal • S-355A & S-355B are operated. • Capacity of S-356 pump increased to 1000 cfs. S-356 is operated to manage seepage. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area. o An additional length of seepage canal is assumed in the model to allow water to be collected for S357 operation. • Partial depth, approximately 4 mile long seepage barrier south of Tamiami Trail (along L-31N)
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Modeling of the TSP assumes an additional public water supply withdrawal of 12 MGD in Service Area 2 and 5 MGD in Service Area 3. • Residential Self Supported (RSS) pumpage are based on 2030 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is also based on 2030 projections of industrial use from the Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2012 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open • C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary

Feature	
	• Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15 • Water supply deliveries from regional system (from WCA3A: S-151/S-337) are used to maintain the L30 canal with a minimum seasonal level varying from 6.25 ft in the dry season to 5.2 ft. at the beginning of the wet season • G-211 / S338 operational refinements; use coastal canals to convey seepage toward Biscayne Bay during drier times.
Canal Configuration	• Canal configuration same as calibration except no L-67 Extension Canal and CERP & CEPP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

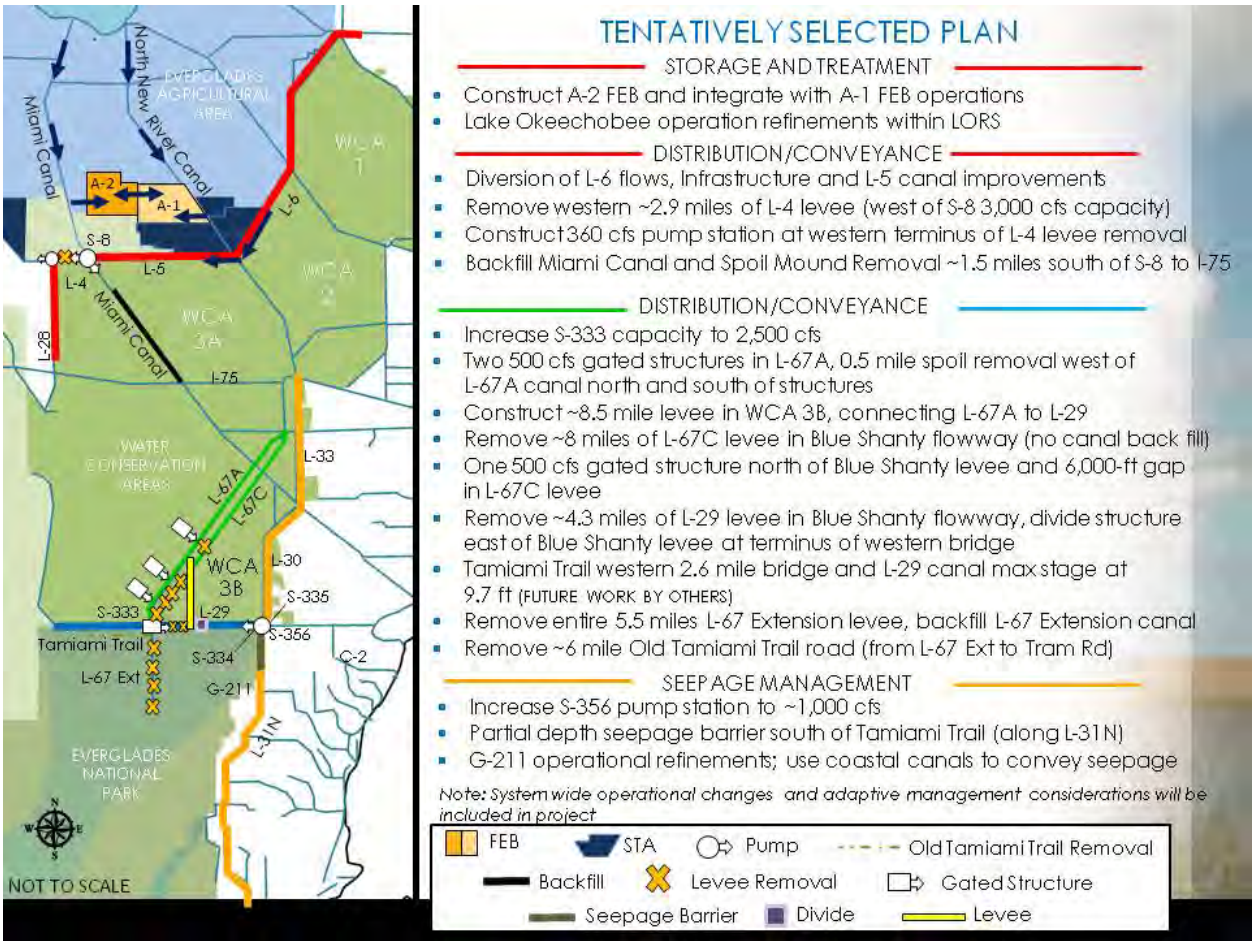


Fig. 1 CEPP ALT4R2 Features as defined by CEPP project team

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

A.5.2.1 US Fish and Wildlife Service Request for Additional Information

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

September 4, 2013

Colonel Alan M. Dodd
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service CPA Code: 04EF2000-2012-CPA-0270
Service Consultation Code: 04EF2000-2012-F-0290
Date Received: August 6, 2013
Project: Central Everglades Planning Project

Dear Colonel Dodd:

The U.S. Fish and Wildlife Service (Service) has reviewed the information in your Biological Assessment (BA), dated August 5, 2013, for the above referenced project in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act or ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). We appreciate the hard work your staff has dedicated to the development of this complex document. We are providing comments and requesting additional information needed to properly evaluate the Central Everglades Planning Project (CEPP) and to determine an appropriate strategy for ESA consultation.

PROJECT DESCRIPTION

The purpose of the CEPP is to assess Federal and non-Federal interest in implementing components of the Comprehensive Everglades Restoration Plan (CERP). Ecological conditions and functions within the central portion of the Everglades ridge and slough community continue to decline due to lack of sufficient quantities of clean freshwater into the central Everglades and associated timing and distribution problems. The U.S. Army Corps of Engineers (Corps) and the South Florida Water Management District (District) initiated the CEPP in November 2011 to evaluate alternatives for restoring ecosystem conditions and opportunities for providing for other water-related needs in the region.

The plan formulation strategy for CEPP followed the natural southerly flow of water from Lake Okeechobee through the Everglades ecosystem to Florida Bay. The strategy involved the formulation of management measures and components that serve to capture, store,

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and deliver water to restore the central portions of the Everglades (including Water Conservation Area [WCA] 3 and Everglades National Park), while improving the northern (St Lucie, and Caloosahatchee Estuaries) and southern (Biscayne and Florida Bays) estuary ecosystems, and making water supply more available for municipal and agricultural users.

The Corps' BA evaluated the effects of CEPP on federally-listed species and critical habitats and made the following effect determinations under the Act:

Common Name	Scientific Name	Status*	Determination
Mammals			
Florida bonneted bat	*Eumops floridanus*	PrE	No Effect
Florida panther	*Puma concolor coryi*	E	May Affect
Florida manatee	*Trichechus manatus latirostris*	E, CH	May Affect
Birds			
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH	May Affect
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH	May Affect
Northern crested caracara	*Caracara cheriway*	T	No Effect
Piping plover	*Charadrius melodus*	T	No Effect
Red-cockaded woodpecker	*Picoides borealis*	E	No Effect
Roseate tern	*Sterna dougallii dougallii*	T	No Effect
Wood stork	*Mycteria americana*	E	May Affect
Reptiles			
American alligator	*Alligator mississippiensis*	T/SA	May Affect
American crocodile	*Crocodylus acutus*	T, CH	May Affect
Eastern indigo snake	*Drymarchon corais couperi*	T	May Affect
Gopher tortoise	*Gopherus polyphemus*	C	
Invertebrates			
Bartram's hairstreak butterfly	*Strymon acis bartrami*	C	No Effect
Florida leafwing butterfly	*Anaea troglodyta floridalis*	C	No Effect
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	No Effect
Stock Island tree snail	*Orthalicus reses* (not incl. nesodryas)	T	No Effect
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E	No Effect
Plants			
Beach jacquemonia	*Jacquemontia reclinata*	E	No Effect
Big pine partridge pea	*Chamaecrista* var. *keyensis*	C	
Blodgett's silverbush	*Argythamnia blodgettii*	C	
Cape Sable thoroughwort	*Chromolaena frustrata*	PrE, PrCH	No Effect
Carter's small-flowered flax	*Linum carteri* var. *carteri*	C	
Crenulate lead plant	*Amorpha crenulata*	E	No Effect
Deltoid spurge	*Chamaesyce deltoidea spp. deltoidea*	E	May Affect
Everglades bully	*Sideroxylon reclinatum spp. austrofloridense*	C	

Plants (continued)			
Florida brickell-bush	*Brickellia mosieri*	C	
Florida bristle fern	*Trichomanes punctatum spp. floridanum*	C	
Florida pineland crabgrass	*Digitaria pauciflora*	C	
Florida prairie-clover	*Dalea carthagenensis* var. *floridana*	C	
Florida semaphore cactus	*Consolea corallicola*	PrE	
Garber's spurge	*Chamaesyce garberi*	T	May Affect
Okeechobee gourd	*Cucurbita okeechobeensis ssp. okeechobeenis*	E	No Effect
Pineland sandmat	*Chamaesyce deltoidea spp. pinetorum*	C	
Sand flax	*Linum arenicola*	C	
Small's milkpea	*Galactia smallii*	E	May Affect
Tiny polygala	*Polygala smallii*	E	May Affect

*Status Codes: E= Endangered, T=Threatened, T/SA=Threatened Similar Appearance, C= Candidate, CH=Critical Habitat, PrE=Proposed Endangered; PrCH=Proposed Critical Habitat.

The Corps has further refined these determinations and requested formal consultation on the Cape Sable seaside sparrow (CSSS), Everglade snail kite, wood stork, Florida panther, and eastern indigo snake. The Corps requests informal consultation on the American crocodile, Florida manatee, deltoid spurge, Garber's spurge, Small's milkpea, and tiny polygala. The Corps did not make an effect determination on the Florida semaphore cactus (proposed endangered).

REQUEST FOR ADDITIONAL INFORMATION

We have reviewed the information in your BA, and have some additional questions and comments we believe should be addressed to make it correct and complete. Recognizing the status of the Cape Sable seaside sparrow, Everglade snail kite, wood stork, Florida panther, and eastern indigo snake, we are requesting additional information to assist us in determining the proper path for ESA consultation.

General Comment No. 1: We spent many hours reviewing and providing comments to the Corps on the first draft of the BA (May 2013). We were concerned to see that many of those comments, particularly those relating to the snail kite and CSSS, were not addressed in this draft.

General Comment No. 2: There is increasing discussion in public forums and in the draft Project Implementation Report (PIR) about how incremental implementation of CEPP will take place; however, there is no mention of incremental impacts on listed species. This will affect the timing and magnitude of impacts to species and needs to be discussed in the BA.

General Comment No. 3: There is no description of any known unrelated future non-Federal activities ("cumulative effects") reasonably certain to occur within the action area that are likely to affect the listed species.

General Comment No. 4: The Service requests the following information on the acreages to complete the eastern indigo snake analysis:

1. Miami Canal spoil mounds to be degraded,
2. L-4 degrade,
3. L-29 degrade,
4. L-67C gap degrade,
5. L-67C flow way degrade,
6. L-67 extension levee degrade,
7. Old Tamiami Trail Road degrade,
8. Tree islands to be created on the Miami Canal, and
9. The upland areas on the new Blue Shanty Levee.

General Comment No. 5: The use of Existing Condition Baseline (ECB) verses ECB 2012 yields different results (*e.g.*, hydroperiods in indicator region A-1) that are not intuitive to those familiar with the Everglades Restoration Transition Plan (ERTP). As we recall, ERTP did not result in benefits to Subpopulation A (CSSS-A) (as it was meant to make conditions in WCA-3A better while maintaining CSSS-A) but now the baseline has been modified. ERTP has barely been in place a year and we have little data to judge its effect on sparrows in CSSS-A or to analyze a proposed change to the base conditions from a model run that is unsupported by on-the-ground data (*e.g.*, ERTP lowered the top of the 3A regulation schedule, however, this cannot be met in the real world because the system is not designed to do so). An analysis should be included to determine what, if any, effect the changing of the base conditions has on sparrow results and the extent that ERTP will indeed provide the modeled base condition.

General Comment No. 6: Is the acreage (or general location, if exact acreages are not known) impacted in CSSS-D demonstrated by the CEPP modeling the same acreage as that shown impacted under the C-111 Spreader Canal Project? If so, are they really an impact? If not, are they cumulative and what impact to sparrows in this area will occur from the additional impact?

Page 41.
The BA indicates that total annual flows to Biscayne Bay are expected to increase under CEPP, which should improve crocodile habitat. However, the Corps failed to note that the seasonal timing of flows changes and that there are reductions in flows to some areas of Biscayne Bay during the dry season. What are the effects of this on juvenile crocodile survival/habitat?

Page 41.
Additionally, if you are not requesting a formal consultation on crocodiles then your effect determination should be changed from "may affect" to "may affect, but not likely to adversely affect."

Page 44.
The only effect ascribed to indigo snake in the A-2 Flow Equalization Basin is "displacement." We believe it is just as likely that eastern indigo snakes will be injured or killed due to their tendency to occupy burrows or other underground refugia in vegetative areas where they may not be readily observable by equipment/vehicle operators.

Page 48.
The analysis of effects of CEPP on the Florida panther is missing. Please include an analysis of how many acres are fallow and provide habitat for panthers, and how many acres of panther habitat will be lost or altered with implementation of CEPP. Please also include a discussion of the credits available at Picayune for compensation of adverse effects. Also, recognize that any panther compensation through restoration activities at Picayune must be complete before impacts to panthers from CEPP occur.

Page 54.
The BA indicates that kite nesting activity has been low "since the Emergency Deviations to the WCA 3A Regulation Schedule" in 1998. Is it the Corps' determination that these deviations are responsible for the kite population decline? Please also provide a population graph that shows each year for which kite nesting data are available and discuss whether nesting success was considered good or poor on a per year basis.

Page 58. Section 6.2.6.4.
The BA applies the Multi-Species Transition Strategy (MSTS) inappropriately in that it cannot be used to evaluate effects of water depth on kites. The MSTS windows can only be used to evaluate the 3AVG stage, and the target area for that and the snail recommendation is southwest WCA3A (no other areas within the Everglades). This is explained further in the MSTS white paper and the Service's 2010 ERTP Biological Opinion. At this time, the Corps' snail kite analysis is insufficient.

Page 58.
Please provide the kite analyses for gages W-2 and 3AS3W1. These gages were defined in the 2010 ERTP Biological Opinion as very important to monitoring and analyzing the kite and snails by the Service and Dr. Darby. This was noted early on and throughout the CEPP planning process.

Page 64. Section 6.2.6.5 Snail Kite Species Effect Determination
The BA states, "*The Corps could utilize the operational flexibility inherent*" to achieve appropriate snail kite recession rates. Please explain what operation capabilities exist now and in the future with CEPP that could be used to benefit snail kites (especially with regards to recession rates). Is this part of the project description that the Corps will provide?

Page 77.
The BA presents a discussion of where foraging conditions, as indicated by hydrologic changes, may occur relative to Alternative (Alt) 4R2. It should also indicate the number of wood stork rookeries that could be either adversely affected or benefitted by the project. The BA also needs to present an analysis of likely effects from these hydrologic changes (particularly the negative effects) to the wood stork.

Page 79.
The BA states, "*Wood storks generally showed increased numbers in northern WCA 3A, WCA 3B, and southern ENP under Alt 4R2 compared to the FWO (Figure 6-19). The existing conditions showed a similar trend in percent differences to the FWO, indicating that Alt 4R2 also performs better than existing conditions (Figure 6-20).*" The BA does present two color-coded graphics depicting differences, but neither of these show the difference between Alt 4R2 and the existing condition. Nor are there any data tabulated to support the previous conclusion of "increased numbers" of wood storks.

Page 81.
In regards to recommendations made during Periodic Scientist calls regarding wood storks, the BA states, "*The Corps could utilize the operational flexibility inherent within operations to achieve the recommendation.*" Again, what flexibilities exist now for storks and what would under the CEPP? Is this part of the project description that the Corps will provide?

Page 81. Figure 6-21.
In ERTP, the Service used water depth and recession rate graphs to depict whether conditions were going to become too dry or too wet at sites near rookeries within the core foraging areas. The Corps provides a "stop light" column graph that shows conditions are not good, but there is no indication as to whether conditions are becoming drier or wetter or if recession rates are too fast or too slow for foraging. Please provide site-specific analyses of water depths and recession rates.

Page 82. 6.2.7.2 Wood Stork Species Effect Determination
The Corps recognizes an impact to wood storks via permanent loss of wetland habitat from the construction of the proposed Blue Shanty Levee, yet they did not assess it in the BA. Additionally, there is no discussion in this section of the potential effects to existing wood stork colonies, only a discussion of potential benefits to areas that could be used by storks in the future. Please address these issues.

Page 83.
The BA indicates that CSSS research by Lockwood "*have revealed substantial movements between subpopulations east of SRS suggesting that the CSSS has considerable capacity to colonize unoccupied suitable habitat.*" Lockwood's research showed that only 4 of 299 tagged birds moved from one subpopulation to another. Please explain how this equates to "considerable capacity"? Are you stating that movements between subpopulations

is likely or only that it is possible, but rarely documented (and most of these birds were males). Additionally, are you assuming that there is suitable habitat outside the known subpopulations? If so, where would that be?

Page 92. Table 6-5.
Table is missing data for E-2.

Page 93.
The X axis scale is incorrectly labeled in Figures 6-25 through 6-37.

Page 100.
The BA states "*Research suggests that CSSS are capable of short and long range movement which could suggest that if the area around CSSS-E and CSSS-D becomes too wet, the birds could reside in the CSSS-B...*" The vast majority of research on CSSS movement documents that they exhibit strong site fidelity moving only within several hectares of their natal site. The distance between either CSSS-E or CSSS-D and CSSS-B are at the upper (*i.e.*, longest) range of the distances recorded for CSSS movement. Also, most of these movements have only been recorded over contiguous prairie habitat. Your statement that birds could move to and reside in CSSS-B, pre-supposes that those immigrating sparrows: (a) know that CSSS-B exists, (b) know which direction to fly to get there; (c) have the energetic resources to travel that distance, (d) will encounter suitable habitat, space, and forage conditions in CSSS-B, and probably most importantly, (e) that enough birds will make this journey to make a difference to the population's persistence. We recommend you base your analysis on likely effects of the project on the species of interest without drawing overly speculative conclusions from available sources.

Page 100.
The BA states "*These areas* [CSSS-F and CSSS-C] *have a smaller population count than E, however, if birds from areas that are becoming too wet migrated towards B, F, and C, the populations may have a better chance of survival with increased subpopulation size.*" What evidence do you have to support this conclusion (is there available sparrow habitat that is not being utilized in F and C)?

Page 100.
Please also provide information that the likelihood that sparrow movement is a viable alternative to enhancement of habitat within the subpopulations as a means to improve subpopulation size and survival.

Page101.
Field research has shown that even though a 60-day dry period criterion is met, other conditions such as weather, temperature, food availability, etc. may delay the onset of breeding by up to a month. The 60-day criterion should be considered a minimum in terms of nesting condition availability. The CEPP modeling does not seem to indicate that water moves to the east as much

as originally anticipated; therefore, please discuss the effects on CSSS-A of continued low numbers of years (22 out of 40) meeting the 60-day criterion in Indicator Region-A1 and the significant reduction to 25 years in Indicator Region-A2, in a subpopulation that at one time was the largest, and has been severely reduced since 1993 with no indication of meaningful recovery to date. Please also discuss the same for CSSS-D and E.

Page 102. Table 6-6 through 6-9.
It appears that the Corps used different locations (*i.e.*, single gauge locations instead of the indicator regions we provided them) for this metric than were used for the hydroperiod metric. The metrics should use the same indicator regions. Also, these tables contain a wealth of information on the potential length of CSSS breeding season. Although it is understood the PM-A metric was one tool to evaluate effects of the project on nesting, a more complete understanding of effects could be obtained by expanding the analysis to include consideration of multiple (2 or more) consecutive years meeting/not meeting the target in IR-A2, and an average continuous dry period over the period of record compared for each scenario (in the case of multiple days per year, use the largest number of contiguous days). This may indicate overall effects between the scenarios rather than just identifying years as red, yellow, or green. Also, in multiple consecutive wet (*i.e.*, yellow or red) years, what operational flexibility is there in the system to potentially avoid cumulative impacts to sparrow habitat? Additionally, please describe the conditions in the 1990s that seem to result in more negative effects in CSSS sub populations A-2, E-1 and E-2.

Page 106. Ecological Target 2.
Please discuss the potential effects of Ecological Target 2 analysis on the CSSS. This metric is the key indicator that affects the quality of habitat for sparrows. In every subpopulation except for A-1, this metric indicates a degraded condition with the project (and specifically in CSSS-E-1). In every subpopulation except B, this metric is met less than half the period of record (8 to 18 years). What have been and what will be the long term ramifications of this? There are much data available from the RSM model and post-processing, but very little of it was used in this analysis. An analysis of acreage changes by scenario should have been performed to quantify effects.

Page 112. Marl Prairie Indicator.
Given the availability of RSM post-processed data, the BA should include an analysis on the aerial extent of changes (acreages, distribution, location, etc.). The marl prairie indicator shows a 50 percent reduction in the index for CSSS-A, 30 percent reduction for CSSS-D and E, 16 percent reduction for CSSS-F, 8 percent reduction for CSSS-B, with only a 19 percent increase in the indicator for CSSS-C one of the smallest subpopulations. What is your interpretation of these effects on the sparrow?

Page 112.
The BA states that "*differences in marl prairie habitat suitability within CSSS-B, CSSS-D, and CSSS-F for Alt 4R2 were minor.*" However, there are no values or statistics to back up that

statement. There appears to be a 30 percent drop in habitat suitability in CSSS- D from the existing condition to Alt 4R2. Please explain how a 30 percent drop is a "minor" difference in habitat suitability for sparrows.

Page 114. Third paragraph.
The BA states, "*Further changes in operations that limit flows into ENP for protection of CSSS have the potential to limit CEPP benefits to the northern estuaries, WCA-3A, ENP, Florida Bay, the southwestern coastal estuaries, and other threatened and endangered species....*" This statement is misleading in that it lacks definition of the "changes in operations" and quantification of flows that could actually reduce downstream benefits. It also does not recognize the level of uncertainty with the method used to calculate potential benefits. As written, it is an unfounded statement and should be either substantiated with evidence or removed from the BA.

Page 114.
The BA states "*...the action related hydrologic changes as compared to the existing conditions are expected to be minimal throughout much of CSSS habitat ...*". Given the degree of negative effects indicated by the hydroperiod and marl prairie metrics, it is not apparent to the Service how the Corps reached this conclusion. Please explain.

Page 117. 6.2.8.3.4 Hydrologic Regime-Nesting Criteria.
It appears that the author has mixed the nesting and habitat performance measures and did not include an analysis of these criteria. Please do an analysis for this metric.

Page 118. Section 6.2.8.4.4.
Modeling seems to indicate the greatest potential for habitat change due to the CEPP will occur in CSSS-E. Please quantify the acreages and locations of where the altered hydroperiod will occur in CSSS-E. The result of this assessment will be a primary factor in determining adverse modification of critical habitat for CSSS.

Page 119.
The BA states, "*The CEPP goal of increasing the hydroperiod throughout WCA 3A and ENP does not coincide with the hydroperiods needed to maintain a drier, marl prairie habitat that is necessary for the CSSS.*" This is an inappropriate statement in that it generalizes the CSSS's requirements (relative to the CEPP) and perpetuates inaccuracies to the reader that the CEPP and the existence of CSSS are in opposition. It is not just a question of water depth, but where, when, and how long that depth occurs. To say the CEPP "does not coincide" with the needs of the CSSS minimizes the efforts that the Service and the Corps have put forth over the last 15 years to shift flows from WCA-3A easterly and into Everglades National Park. The Corps' statement also presupposes a level of knowledge about the habitat, topography, CSSS population size, and overall uncertainty of the CEPP that is not demonstrated in the BA.

Page 121. Conservation Measures
The BA identifies a number of CSSS conservation measures but does not indicate a willingness to implement them. Does the Corps intend to implement any or all of these measures as part of the proposed action?

Page 121. Conservation Measures
The BA states, "*Additional monitoring of panthers should not be necessary due to use of the approved mitigation bank.*" We cannot agree to this statement at this time. It may be appropriate to use a proportional amount of CEPP funding to monitor panthers at Picayune in accordance with the amount of compensation. It is not acceptable to have no accounting of whether or not the panther credits "purchased" were maintained as anticipated in the original compensation agreement.

Page 123.
The BA concludes, "*Comparisons of existing conditions and the CEPP recommended plan (Section 6) show that some areas utilized by sparrows are slightly improved by CEPP implementation, while others remain the same or slightly worse than existing conditions. Slight improvements to critical habitat areas in CSSS-A, CSSS-F, and CSSS-B (some metrics) could potentially provide the interim habitat needed to keep the CSSS population as is, with potential for physical habitat improvements as well.*" The Corps' analysis is not sufficient to support these conclusions. A more robust analysis is needed to provide a better understanding of the processes underlying the current decline of the species, actions needed for its recovery, and how the proposed project will interact with those.

The Service continues to support this project as a significant step forward in Everglades restoration and conservation. At this time, we have not determined when we will conclude consultation under the Act for those species which the Corps has requested formal consultation. We recognize the time-sensitive nature of the Corps' new planning process. We will work diligently to find a mutually successful conclusion under the Act. Thank you for your cooperation and efforts in protecting federally-listed species. We are available to your staff to discuss possible solutions to information gaps in the BAs effects analyses. If you have any questions regarding this letter, please contact Kevin Palmer by email Kevin_Palmer@fws.gov, or by telephone at 772-469-4280.

Sincerely yours,

for Larry Williams
Field Supervisor
South Florida Ecological Services Office

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