CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN

CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR PROJECT

FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND FINAL ENVIRONMENTAL IMPACT STATEMENT

November 2010

This Report Contains [5] Volumes

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CENTRAL AND SOUTHERN FLORIDA PROJECT
CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR
FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

Table of Updates

Summary of Changes, Additions, Modifications since Chief's Report Submittal:

Addendum A – Project Costs, Main Report, Plan Recommendations, and MCACES Update: located after title page for Main Report Document

Addendum B – Response to Assistant Secretary of the Army's (ASA) Review: located after Addendum A at the front of the Main Report

Addendum C – Engineering – Appendix A: update Final Interagency Modeling Center Technical Memorandum Spreadsheet Model and Water Budget Analysis for C-43 Project Delivery Team March 6, 2007 MSR 262 (page A-126)

– Engineering – Appendix A: update Final Interagency Modeling Center Technical Memorandum Application of Spreadsheet Model to Evaluation of C-43 Storage Reservoir Project Alternatives for C-43 Project Delivery Team March 23, 2007 MSR 264 (page A-184)

Executive Summary Main Report: revised with Chief's Report line item revisions:

Main Report Section 10 Recommendations: updated with Chiefs Report Section 10 rewrite and signature page included.

Cost Estimates – Appendix B: updated MCACES B.3

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WEST BASIN STORAGE RESERVOIR PROJECT

FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
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FINAL ENVIRONMENTAL IMPACT STATEMENT

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

November 2010

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CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR
FINAL INTEGRATED
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AND
ENVIRONMENTAL IMPACT STATEMENT
ADDENDUM A

Addendum Purpose:

The purpose of this Addendum is to document changes to project costs as presented in the Final Integrated Project Implementation Report and Environmental Impact Statement of July 2007, based on a revised project real estate cost completed in accordance with CECW-SAD memorandum dated July 30, 2009 signed by the Director of Civil Works, U.S. Army Corps of Engineers. The current guidance for the CERP, Land Valuation and Crediting is as follows:

a. Consistent with long-standing USACE practice, and as supported by the unique land credit provision for CERP contained in Section 601 (e)(5)(A) of WRDA 2000, tracts acquired by the SFWMD that are acquired and provided in furtherance of a CERP project should be valued and credited as individual tracts regardless of whether the acquisition was prior to or after execution of the Project Partnership Agreement (PPA) for that project. This general principle would not apply where the SFWMD acquired contiguous tracts that are required for a CERP project but it acquired such tracts prior to the PPA for a reason and use other than for implementation of the CERP project. A determination that a tract was acquired "in furtherance of a CERP project" should be supported by documentation existing at the time of acquisition.

b. The unique statutory land credit provision for CERP projects is clear that the non-Federal sponsor will be afforded credit for the value of lands, or interests in lands, that it provides in accordance with a PIR "regardless of the date of acquisition." *See* Section 601 (e)(5)(A) of WRDA 2000. To effectuate the clear intent of Congress reflected in this credit provision, land use restrictions imposed in furtherance of a CERP project after acquisition of a tract by the SFWMD should not be considered in valuing that tract for crediting purposes.

c. For the same reasons as expressed in subparagraph b. above, demolition of improvements after a tract was acquired in furtherance of a CERP project should not change the approach to value from that applicable at the time of acquisition. Accordingly, the tract should be valued for crediting purposes as it was improved when acquired by the SFWMD. To accomplish this result, the contributory value of the improvements, as of the date of the SFWMD's acquisition, should be added to the market value of the land on the date it is provided for the project as appraised in accordance with its highest and best use on the date of acquisition.

3. Incidental Costs. The SFWMD has requested that it be afforded credit for the costs incurred by other non-Federal governmental entities incidental to acquisition of project lands by such entities. The wording of Section 601 (e)(5)(A) is clear that credit may be afforded only for "incidental costs for land acquired by a non-Federal sponsor." Credit may be afforded for traditional incidental acquisition costs that are incurred by SFWMD (such as appraisal costs, mapping costs, or relocation assistance benefits) as well as costs actually incurred by SFWMD in obtaining the required real property rights from other non-Federal governmental entities. However, to be eligible for credit to be afforded to the SFWMD for incidental acquisition costs, SFWMD must have, in fact, incurred those costs. This Addendum is consistent with that guidance memorandum. This Addendum includes documentation and page number references for all edits to information contained in the Final PIR/EIS. This Addendum, as approved by CECW, will be appended to the Chief's Report and forwarded with it and the Final PIR/EIS to ASA (CW) for approval and transmission to Congress.

The increase in real estate costs does not affect alternative selection or site selection for the Caloosahatchee River (C-43) West Basin Storage Reservoir. Each alternative includes the same project footprint. As a result, the increase in real estate costs are the same for each of the four alternatives evaluated for this project. The change increases total project costs for all alternatives by the identical dollar amount and thus all alternatives maintain the same relative differences for the sake of comparison and alternative selection.

The Final Caloosahatchee River (C-43) West Basin Storage Reservoir PIR recommends 170,000 ac-ft of storage on approximately 10,700 ac with pump capacity of 1500 cfs. Originally estimated at FY07 (October 2006) price levels, the fully funded cost estimate was $565,700,000. This addendum reflects changes in the project costs due to revised project real estate costs. In addition, all project costs have been escalated to FY10 (October 2009) price levels, resulting in a revised fully funded cost estimate of $610,736,000.

Edits are organized by Final PIR section following the structure of the table of contents. This Addendum, as approved by CECW, will be appended to the Final PIR/EIS and forwarded with the Chief's Report to ASA(CW) for approval and transmission to Congress.

MAIN REPORT

The following revisions to the original text are proposed for the Main Report:

Executive Summary

1. Page xv, fourth paragraph, fifteenth line, change $2,740 to $2,825.

2. Page xvi, first paragraph, second line, change $7,146 to $8,035.

3. Page xx, third paragraph, fourth line, change $507,241,000 to $570,480,000.

4. Page xxi, replace Table ES-1 with the following table:

TABLE ES-1: CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR COSTS OCTOBER 2009 PRICE LEVELS (INITIAL COSTS ROUNDED TO THE NEAREST $10,000)

Ecosystem Restoration Elements	TOTALS
Construction	
02 Relocations	$1,180,000
03 Reservoir	$12,780,000
04 Dams (embankments, slurry wall, drains, soil cement, perimeter canal, spillways, structures, etc.)	$278,780,000
09 Channels and Canals	$5,180,000
13 Pumping Plants	$83,300,000
14 Recreation	$2,930,000
15 Floodway Control-Diversion Structures	$18,430,000
Sub-Total Construction Cost	**$402,580,000**
Non-Construction	
01 Lands and Damages	$84,650,000
30 Planning, Engineering, and Design	$51,880,000
31 Construction Management	$31,370,000
Sub-Total Non-Construction Cost	**$167,900,000**
TOTAL INITIAL COST	**$570,480,000**

*The costs in this table are MII costs and can be found in the MII report in Appendix B Cost Estimates.

5. Page xxi, first paragraph, first sentence, change $3,000,000 to $3,100,000.

Section 1.0 Introduction

1. Page 1-11, last paragraph, change to read:

Storage of water within the C-43 Basin had been established as one of the primary management measures contributing to the goals and purposes of the Restudy. Based on these findings, the SFWMD originally acquired approximately 12,372 acres (including easements) using State funds and Federal funds. SFWMD exchanged approximately 541 acres of this previously acquired land for approximately 600 acres adjacent to the property originally acquired. As the PIR development process was initiated, there was an effort to identify early opportunities to obtain system-wide benefits by utilizing readily available lands. One of these opportunities was the evaluation of a potential reservoir located in the western Caloosahatchee River Basin on lands acquired by SFWMD with both Department of Interior (DOI) and SFWMD funds (please see Real Estate Appendix D, section D1.10.2 for more information).

2. Page 1-21, paragraph 1.9, change to read as follows:

1.9 LAND ACQUISITION ACTIVITIES

As described previously, storage of water within the Caloosahatchee Basin has been established as one of the primary management measures contributing to the goals and purposes of the Restudy. The SFWMD and others have been very proactive in acquiring lands needed for CERP implementation. Based on the findings of the Restudy and CWMP, which both call for a storage reservoir in the Caloosahatchee Basin, the SFWMD, Department of Interior and the U.S. Army Corps of Engineers, Jacksonville District participated in the selection of the site for acquisition of the Berry Grove lands. An opportunity arose in October 2000 to acquire over 12,000 acres of grove land which was determined by SFWMD and the U.S. Army Corps of Engineers, Jacksonville District to be an ideal location for a reservoir for the C-43 reservoir project approved in the Central and Southern Florida Project, Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, April 1999. The Federal funds used for this project were appropriated to the DOI and a Grant Agreement entitled Everglades Watershed Restoration-Grant Number LWCF-1 was executed to acquire south Florida ecosystem restoration project lands in the C-43 Basin. The Florida Division of State Lands, in cooperation with the staff of the SFWMD, reached an agreement that allowed the SFWMD to acquire the Berry Groves. In addition the South Florida Water Management District acquired adjacent properties as a key component for Everglades restoration (February 2000). To date the State of Florida has purchased a total of 12,372 acres in the immediate area in anticipation of reservoir construction with Federal funding provided by the DOI at a total of approximately $32,800,000, a portion of which ($27,566,669) will be credited to the Federal government towards the acquisition of lands required for this project. SFWMD exchanged approximately 541 acres of this previously acquired land for approximately 600 acres adjacent to the property originally acquired. The revised total land would be approximately 12,430 acres. Of this approximately 12,430 acres, the Caloosahatchee River (C-43) West Basin Storage Reservoir project will require approximately 10,700 acres, of which approximately 10,480 acres will be required in fee, approximately 20 acres will be required in perpetual channel easement and approximately 200 acres will be required in temporary easements for staging areas.

Section 2.0 Existing Conditions/Affected Environment

No proposed edits

Section 3.0 Future Without Project Conditions
No proposed edits

Section 4.0 Identification of Problems and Opportunities
No proposed edits

Section 5.0 Formulation of Alternative Plans

1. Page 5-34, replace the first paragraph with the following language:

The costs in this section are ROM costs for consistent comparison of alternatives. These costs will not match the MII project costs.

Section 6.0 Environmental Effects of the Selected Alternative Plan
No proposed edits

Section 7.0 The Selected Alternative Plan

1. Page 7-12, second paragraph, first line, replace $2,519,000 with $2,930,000.

2. Page 7-12, second paragraph, third line, replace $2,972,000 with $3,457,000.

3. Page 7-13, first paragraph, fifth line, replace 4 7/8 with 4 3/8.

4. Page 7-13, replace Table 7-1 with the following table:

TABLE 7-1: SUMMARY OF RECREATION COSTS AND BENEFITS (OCTOBER 2009 PRICE LEVEL)

Recreation Construction Costs	**$2,930,000**
PED & S/A (18%)	$527,400
Total Recreation Construction	**$3,457,000**
Construction Duration	12 months
Interest During Construction Costs	$75,000
Total Recreation Investment	**$3,532,000**
Period of Analysis	40 years
Annualized Cost	$189,000
OMRR&R	$25,000
Average Annual Costs	**$214,000**
Annual Benefits	
User Day Value	$7.27
Daily Use	145
Annual Use	52,925
Average Annual Benefit	**$384,700**

5. Page 7-13, second paragraph, second line, replace $160,000 with $170,700.

6. Page 7-13, last paragraph, fifth line, replace October 2006 with October 2009.

7. Page 7-14, replace Table 7-2 with the following table:

TABLE 7-2: PROJECT COSTS FOR THE SELECTED ALTERNATIVE PLAN (OCTOBER 2009 PRICE LEVEL) (Initial cost rounded to the nearest $10,000)

Ecosystem Restoration Elements	TOTALS
Construction	
02 Relocations	$1,180,000
03 Reservoir	$12,780,000
04 Dams (embankments, slurry wall, drains, soil cement, perimeter canal, spillways, structures, etc.)	$278,780,000
09 Channels and Canals	$5,180,000
13 Pumping Plants	$83,300,000
14 Recreation	$2,930,000
15 Floodway Control-Diversion Structures	$18,430,000
Sub-Total Construction Cost	**$402,580,000**
Non-Construction	
01 Lands and Damages	$84,650,000
30 Planning, Engineering, and Design	$51,880,000
31 Construction Management	$31,370,000
Sub-Total Non-Construction Cost	**$167,900,000**
TOTAL INITIAL COST	**$570,480,000**

*The costs in this table are MII costs and can be found in the MII report in Appendix B Cost Estimates.

8. Page 7-14, first paragraph, second line, replace October 2006 with October 2009.

9. Page 7-15, replace Table 7-3 with the following table:

TABLE 7-3: COMPARISON OF YELLOW BOOK AND SELECTED ALTERNATIVE PLAN FIRST COST FOR CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR PROJECT (OCT 2009 PRICE LEVEL)

Component	Yellow Book	Project First Cost	Fully Funded Cost
Caloosahatchee River (C-43) West Basin Storage Reservoir	$400,000,000	$570,480,000	$610,736,000*

* revised fully funded cost estimate based upon revised land valuation and crediting policy.

10. Page 7-15, first paragraph, second line, change $35,100,000 to $36,200,000

11. Page 7-15, first paragraph, fourth line, change $160,000 to $170,700.

12. Page 7-15, first paragraph, fifth line, change $2,740 to $2,825.

13. Page 7-17, last paragraph, first line, change $$27,567,669 to $27,566,659.

14. Page 7-18, Section 7.5.3, first paragraph, change first two sentences to read:

The existing conditions section of this document (Section 2) includes a summary of the Phase I/II Environmental Site Assessment (ESA) studies done on the properties originally acquired (totaling approximately 12,372 acres) and property the later acquired in an exchange (totaling approximately 600 acres) for the reservoir project. These are the Berry Groves tract composed of approximately 9,000 acres, the Bryan Paul Grove tract composed of approximately 600 acres, the MG Enterprises LLC property composed of approximately 2,399 acres, and the Griffin property composed of approximately 954 acres.

15. Page 7-22, third paragraph, eighth line, change $3,000,000 to $3,100,000.

Section 8.0 Plan Implementation

1. Page 8-2, revised values for the “Total Cost” column in Table 8-1 are listed below. The federal and non-federal cost share break-down has been updated using the revised numbers.

TABLE 8-1: COST APPORTIONMENT TABLE FOR THE CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR (OCTOBER 2009 PRICE LEVEL ROUNDED TO THE NEAREST $10,000)

Item	Non-Federal Cost	Federal Cost	Total Cost
PED	$25,940,000	$25,940,000	$51,880,000
Lands & Damages*	$56,810,000	$27,840,000	$84,650,000
Construction Management**	$15,685,000	$15,685,000	$31,370,000
Construction Total	$186,805,000	$215,775,000	$402,580,000
Total	$285,240,000	$285,240,000	$570,480,000

* The numbers in this table are consistent with the revised MCACES cost report included in this Addendum in edits to Appendix B.

Section 9 Summary of Coordination
No proposed edits

Section 10.0 Recommendations
The recommendations section contains several changes to the 2007 report, to include an update of costs and several items of local cooperation. The costs were updated to reflect October 2009 price levels. The items of local cooperation were updated to include standard ecosystem restoration clauses, standard language regarding floodplain management and flood insurance programs, as well as changes reflecting the Master Agreement executed with the South Florida Water Management District in 2009.

The recommendations section of the July 2007 Final PIR shall be replaced by the following:

The Caloosahatchee River (C-43) West Basin Storage Reservoir project will provide an above-ground storage reservoir (including pump stations and water control structures) and associated conveyance canals as a cost-effective solution to achieving estuarine restoration benefits in the Caloosahatchee Estuary, which is integral to achieving system-wide benefits in the south Florida ecosystem. The Project will help reduce wet season high volume flows from Lake Okeechobee and contributing basin runoff from the lower West Caloosahatchee River Basin by capturing and storing a portion of these flows in the reservoir. Then during the dry season when water levels are at their lowest, water will be released from the reservoir to the Caloosahatchee River (C-43 Canal) to promote a healthy salinity balance in the estuary, thereby reducing saltwater migration into the freshwater portion of the estuary. In addition, the plan achieves the benefits of the Project as previously developed for the CERP.

This Project is integral to achieving restoration in the Caloosahatchee Estuary and plays an important role in meeting the CERP system-wide ecosystem restoration goals and objectives and other water-related needs of the region. Fish and wildlife habitat benefits of the Caloosahatchee River (C-43) West Basin Storage Reservoir project includes improving the timing of water deliveries to the estuary thereby providing a salinity range suitable for a healthy ecosystem and reestablishment of natural hydropatterns within existing natural areas, improvement in seagrass beds in the estuary, and increase habitat for the eastern oyster, blue crab, and other fish and marine organisms. The Project is expected to produce a total of 12,809 average annual habitat units (HUs). Further, this Project is a critical building block upon which a subsequent study will be able to evaluate and achieve broader ecosystem restoration objectives in the Caloosahatchee River Watershed (includes the East Caloosahatchee River (upper) and West Caloosahatchee River (lower) fresh water river basin and the tidal basin).

I find that the Caloosahatchee River (C-43) West Basin Storage Reservoir project, located in western Hendry County, is an integral part of CERP. The Caloosahatchee River (C-43) West Basin Storage Reservoir project Recommended Plan features a reservoir with a storage capability of 170,000 ac-ft, a normal pool storage depth between 15 and 25 feet feet with a footprint of approximately 10,700 acres (of which approximately 10,480 acres are required in fee, approximately 20 acres will be perpetual easements, and approximately 200 acres will be used on a temporary basis for staging area).. The reservoir includes an individual inflow pump station of 1500 cfs capacity, discharge structures, emergency overflow spillways, and seepage control canals with associated structures. The reservoir may also provide opportunities to increase flood damage reduction capabilities through operational changes to the C&SF Project and local drainage systems. However, these opportunities are considered incidental and are not claimed as benefits. Additionally, the reservoir may provide some water quality improvements in the Townsend, Banana Branch and Ft. Simmons Branch canals and other areas. Again, these opportunities are considered incidental and are not claimed as benefits.

Therefore, I recommend that the Caloosahatchee River (C-43) West Basin Storage Reservoir project as described in the section of the report entitled “The Selected Plan”, with such modifications that may be deemed advisable at the discretion of the Chief of Engineers, be authorized for construction. The total estimated first cost for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is $570,480,000 (October 2009 price level).The total first cost for the Caloosahatchee River (C-43) West Basin Storage Reservoir project includes recreation features totaling $2,930,000. The estimated total annual cost of OMRR&R of the ecosystem restoration elements is $3,100,000 with an estimated Federal annual OMRR&R cost of $1,550,000 and an estimated non-Federal OMRR&R cost of $1,550,000. The estimated cost for OMRR&R of the recreation elements is $25,000 which is 100 percent non-Federal.

The above recommendations are made with the provision that the non-Federal sponsor and the Secretary of the Army shall enter into a binding agreement defining the terms and conditions of cooperation for implementing the Project, and that the non-Federal sponsor agrees to perform the following items of local cooperation:

a. Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the Water Resources Development Act of 2000 as amended including authority to perform design and construction of project features consistent with Federal law and regulation.

b. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations that the Government and the Non-Federal Sponsor jointly determine to be necessary for the construction, operation, maintenance, repair, replacement and rehabilitation of the Project and valuation will be in accordance with the Master Agreement.

c. Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other projects.

d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the non-Federal sponsor owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project;

e. Assume responsibility for operating, maintaining, repairing, replacing, and rehabilitating (OMRR&R) the Project or completed functional portions of the Project, including mitigation features, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Cost sharing for OMRR&R will be in accordance with Section 601 of WRDA 2000 as amended;

f. The non-Federal Sponsor shall operate, maintain, repair, replace and rehabilitate the recreation features of the Project with responsibility for 100 percent of the cost;

g. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

h. Unless otherwise provided for in the statutory authorization for this Project, comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the Project or separable element;

i. Hold and save the Government free from all damages arising from construction, operation, maintenance, repair, replacement and rehabilitation of the Project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;

j. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as will properly reflect total project costs and comply with the provisions of the Master Agreement;

k. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the Project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;

l. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-ways that the Government determines necessary for construction, operation, maintenance, repair, replacement and rehabilitation;

m. As between the Government and the non-Federal Sponsor, the non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA;

n. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

p. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42

U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708[revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)];

q. Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with the Florida State Historic Preservation Officer, and as necessary, the Advisory Council on Historic Preservation, prior to construction as part of the preconstruction engineering and design phase of the project;

r. Provide 50 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to the Project that are in excess of one percent of the total amount authorized to be appropriated for the Project;

s. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized and in accordance with Section 601 (e)(3) of the WRDA of 2000, as amended, and in accordance with the Master Agreement;

t. The Non-Federal Sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority.

1. Not less than once each year the Non-Federal Sponsor shall inform affected interests of the extent of protection afforded by the Project.

2. The Non-Federal Sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

3. The Non-Federal Sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a PPA for the Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the Project. As required by Section 402, as

amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the Project. The Non-Federal Sponsor shall provide an information copy of the plan to the Government upon its preparation.

4. The Non-Federal Sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the Project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, that could reduce the level of protection the Project affords, hinder operation or maintenance of the Project, or interfere with the Project's proper function.

u. 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. The Federal Government and the non-Federal sponsor are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation, and protection of the natural system as defined in Section 601 of WRDA 2000, for so long as the project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and objectives of the CERP, as the Plan is defined in the Programmatic Regulations. The non-Federal sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:

1. Ensure, through appropriate and legally enforceable means under Florida law, that the quantity, quality, timing, and distribution of existing water that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report is available and beneficial to the natural system, will be available at the time the Project Partnership Agreement for the project is executed and will remain available for so long as the Project remains authorized.

2. (a) Prior to the execution of the Project Partnership Agreement, reserve or allocate for the natural system the necessary amount of water that will be made available by the project that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report.

   (b) After the Project Partnership Agreement is signed and the project becomes operational, make such revisions under Florida law to this reservation or allocation of water that the non-Federal sponsor determines, as a result of changed circumstances or new information, is necessary for the natural system.

3. For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any revision in the reservation of water or other legally enforceable means of protecting water be proposed by the non-Federal sponsor, so that the Federal Government can assure itself that the changed reservation or legally enforceable means of protecting water conform with the non-Federal sponsor's commitments under paragraphs 1 and 2. Any change to a reservation of water made available by the project shall require an amendment to the Project Partnership Agreement.

Section 601(e)(5)(B) of the WRDA 2000 authorizes the Secretary of the Army to provide credit to the non-Federal sponsor for work completed by it during the period of construction pursuant to a PCA and a determination by the Secretary that the work is integral to the CERP. As part of its initiative for early implementation of certain expedited CERP projects, formerly known as the "Acceler8 Program", the non-Federal sponsor has stated that it may construct portions of the Caloosahatchee River (C-43) West Basin Storage Reservoir project consistent with this report, in advance of Congressional authorization and the signing of a PCA. The non-Federal sponsor is exploring alternative project delivery methods to expedite implementation of the Project. Such delivery methods may include public-private partnerships in which the non-Federal sponsor contracts with a private or not-for-profit entity for services that may include designing, building, operating or financing these components. I believe that it would be in the public interest for this Project to be implemented expeditiously due to the early benefits to the surrounding habitat, as well as hydrologic benefits to Federal lands and estuaries in other portions of the south Florida ecosystem. Therefore, I recommend that should the non-Federal sponsor construct portions of the Caloosahatchee River (C-43) West Basin Storage Reservoir project prior to the execution of a PAC for this Project, the non-Federal sponsor be credited for such construction costs at the time the PAC for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is executed. Such credit would be applied toward the non-Federal sponsor's share of the costs associated with the implementation of the CERP as authorized by Section 601(e)(5)(C) of WRDA 2000, shall not include cash reimbursements, and shall be subject to: a) the authorization of the Caloosahatchee River (C-43) West Basin Storage Reservoir project by law; b) a determination by the Secretary of the Army that the activities are integral to the CERP restoration project; c) a certification by the District Engineer that the costs are reasonable, allowable, necessary, auditable, and allocable; and d) a certification by the District Engineer that the activities have been implemented in accordance with USACE design and construction standards and applicable Federal and State laws.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding.

However, prior to transmittal to the Congress, the Sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Alfred A. Pantano
Colonel, Corps of Engineers
District Engineer

ANNEXES AND APPENDIXES

No revisions to Annexes A-F are necessary as a result of renegotiated real estate costs or escalated (October 2009) project costs.

Appendix A Engineering

1. Page A-62, section A.5.6.3, second line, replace $3,360,000 with $3,100,000.

Appendix B Cost Estimates

1. Page B-16 through B-28, replace the 2007 MCACES with the revised enclosed MCACES.

2. Page B-30 through B-32, replace the 2007 Fully Funded Cost Estimate with the revised enclosed Fully Funded Cost Estimate.

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This estimate is for the Selected Alternative Plan, Alternative 3B, a 170,000 acre-foot storage reservior with 1,500 cubic feet per second pump capacity.

Estimated by USACE- SAJ and Stanley Consultants/Acceler8/SFWMD
Designed by Stanley Consultants/Acceler8/SFWMD
Prepared by Milton Switanek
Preparation Date 10/20/2009
Effective Date of Pricing 10/20/2009
Estimated Construction Time 1,025 Days
This report is not copyrighted, but the information contained herein is For Official Use Only.

Labor ID: LFL2009 EQ ID: EP07R03

Currency in US dollars

TRACES MII Version 3.01

Date	Author	Note
5/16/2007	T. Leeser	Project Name:C43 Project Number: 114458 Project Type (e.g., Reconnaissance, Feasibility, Bid): PIR (Study Authority is the Water Resources Development Act of 2000) Scope of Work: Alternative B as described in the PIR, Appendix A, Engineering. Authorized Cost (if any): Not yet authorized. Contingency Amount (if any): 25%. This is a variation from Corps' guidance to allow for uncertainties in the design of the embankment and auxiliary structures. Some features have 30% contingency. Contingency on real estate is 25% on Federal administrative costs and 7% on non-Federal administrative costs, zero on RE Fee costs (per RE e-mail from A.Ayuso dated 6/19/07.) PED Amount (if any): 10% S&A Amount (if any): 7.6% Backup itemized and provided by CO. Sales Tax: 7% Job Office Overhead: 8% Home Office Overhead: 5% Profit: 10.1% Computed by weighted guidelines method. Bonds and Insurance: 1.5% Estimated Contract Award Date (mo/yr): Based on A8/SFWMD schedule (see below) as described in e-mail from LuAnn McVicar, SFWMD, to Gin Hightower, USACE, dated 14 May 2007. 1) Clearing & Grubbing contract - contract award 12 July 07. 2) Embankment Structure Pre-load contract - advertise week of 13 August 07; contract award 11 October 07. 3) Reservoir & Pump Stations contract (main contract) - Release RFPs on 18 September 07 (to pre-qualified group of contractors); Release RFBs (to RFP short-listed group of contractors) on 19 December 07; award contract on 14 February 08. Estimated Construction Start Date (mo/yr): 8/2007 (see above) Estimated Construction Midpoint Date (mo/yr): 2/2009 Estimated Construction Complete Date (mo/yr): Based on 1,025 days (per Stanley Consultants' 30% design cost estimate) this is 3 years or 8/2010. CWCCIS Indices used: Engineer Manual 1110-2-1304 dated 30 Mar 2007 Subfeature Date Index Published Index Composite 10/05 641.50 Composite 10/06 659.42 Estimate revised to reflect Tentatively Selected Plan, Alternative 3B. This estimate relies on the MCACES Gold cost estimate prepared by Stanley Consultant's for the Accelerate Program (A8)/South Florida Water Management District dated 5/31/06. Stanley Consultant's estimate uses the labor/equipment/materials makeup for costs and is crew/productivity based. The direct costs in Stanley Consultant's estimate are the basis of the unit costs in this estimate, for all cost items except as noted. The estimate is dated 5/31/06 so these costs are escalated to FY 2007 price levels. In addition, Stanley Consultants prepared a Technical Memorandum for the SFWMD/A8 program on the Townsend Canal Improvements. The TM included a cost summary; the costs are used herein. These costs are also escalated since the cost table in the TM equates the costs to their previous cost estimate and adds the two to obtain a revised total cost. Scope of Work: Taken from Draft Project Implementation Report dated April 2007, Engineering Appendix, beginning on page A-56. A two-cell 170,000 acre-foot above ground storage reservoir, a 1,500 cubic feet per second pumping station and a selection of water control structures. The reservoir project site would consist of approximately 10,500 acres. Site preparation: Clearing and grubbing the entire site to eight inches depth. Site work and access road: Maintenance of existing paved entrance road during construction and construction of a new entrance road after construction of the reservoir. Townsend Canal improvements: Widen channel bottom, add scour protection across entire channel width. Embankment: 14-foot wide crest (including soil cement protection), 3 horizontal to 1 vertical side slopes. Cell One elevation is +55 feet, NAVD, and Cell Two elevation is +54 feet. Construction material is random fill, with the borrow area on-site. Upstream slope protection and an interior drain are included, as well as a soil-bentonite wall. Downstream of the embankment is a 100-foot wide bend with a 24-foot access road. There is an interior embankment separating Cells One and Two, with a crest elevation of +50 feet, NAVD, also covered in soil-cement. Side slopes: To be seeded and sodded.

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Project Notes Page ii

Date	Author	Note
5/16/2007	T. Leeser	Relocations: Of electric and water utilities. Structures: Two pump stations, two outlet structure sluice gates, three perimeter canal structures (roller, slide and weir gates), two crested spillways, one balancing structure sluice gate and eight gated culverts (slide and weir gates). Demolition: Of two existing pump stations. Recreation features: A major recreation attraction of the C-43 Storage Reservoir, Part 1 will be an approximately 12-mile multi-purpose trail loop atop the levee constructed as part of the project. Recreation facilities proposed include: parking and toilet facilities (clivas multrum waterless vault toilets), information kiosk, canoe/kayak launch facility, a shade structure, traffic-control fencing and a pedestrian footbridge bridge over the perimeter canal to provide public access to the reservoir.
6/18/2007	T. Leeser	Revised estimate to remove four structures to be built by others, S-16 through S-19, per e-mail PM to EN-C (B. Marlowe to T. Leeser) on 15 June 2007. Changed real estate costs per e-mail from RE (A. Ayuso) dated 6/18/07.
6/27/2007	T. Leeser	Revised estimate to incorporate change in scope of work that raises dam/embankment height. Per DP e-mail on scope change and as coordinated through EN/ETL, increased quantities for random fill/embankment from 19,772,438 to 22,011,438 cy and for soil cement from 789,659 to 824,659 cubic yards. Also as directed through EN/ETL, increased contingency on other features expected to change slightly in design , by a corresponding amount (22,011,438/19,772,438=1.11), to 30% (25% X 1.11 = 28%, used 30%). Also per EN/ETL e-mail dated 28 June 2007, added manatee gate.
7/18/2007	T. Leeser	As a result of Independent Technical Review, profit on the prime contractor was changed by adjusting the weighted profit guidelines computation to better reflect project conditions. Also, separate profits were calculated for each subcontractor using the weighted profit guidelines (per EI 01D010). As a result, the non-construction costs 'Planning, Engineering and Design' and 'Construction Management' were revised. The cost book was changed to Region III and cost factors were updated (e.g., fuel) to reflect current pricing.
10/20/2009	Switanek	Revised Estimate to reflect current 2008 cost book and escalated by Cost Growth Index (USACE) to 2010 dollars as of 20 Oct 09. Also included $84,654,000 real estate cost without escalation and contigency. Because escalation and contigency was already included in Real- Estates cost estimate.

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Project Cost Summary Report Page 1

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Project Cost Summary Report			420,126,352	54,279,427	96,076,391	570,482,169
CONSTRUCTION COST	1	LS	276,220,352	44,692,453	81,670,071	402,582,876
02 Relocations	1	EA	815,000	131,867	236,717	1,183,584
0203 Cemetery, Utilities, & Structure	1	EA	815,000	131,867	236,717	1,183,584
04 Dams	1	EA	190,744,046	30,862,387	57,171,227	278,777,660
0401 Perimeter Dam and Canal, Separator Dam	1	EA	181,515,921	29,369,276	53,954,856	264,840,053
0402 Crested Spillways	1	EA	834,714	135,057	290,931	1,260,702
0403 Main Outlet Structures	1	EA	6,174,188	998,984	2,151,952	9,325,123
1500 Balancing Structure	1	EA	2,219,223	359,070	773,488	3,351,781
03 Reservoirs	1	EA	8,799,218	1,423,713	2,555,733	12,778,664
0300 Reservoirs	1	EA	8,799,218	1,423,713	2,555,733	12,778,664
14 Recreation Facilities	1	EA	2,519,000	407,574	0	2,926,574
1400 Recreation Facilities	1	EA	2,519,000	407,574	0	2,926,574
13 Pumping Plant	1	EA	57,357,560	9,280,453	16,659,503	83,297,517
1300 Pumping Plant	1	EA	57,357,560	9,280,453	16,659,503	83,297,517
15 Floodway Control-Diversion Struc	1	EA	12,415,183	2,008,777	4,009,884	18,433,844
1500 Floodway Control-Diversion Struc	1	EA	12,415,183	2,008,777	4,009,884	18,433,844
09 Channels and Canals	1	EA	3,570,345	577,682	1,037,007	5,185,033
0902 Canals	1	EA	3,570,345	577,682	1,037,007	5,185,033
NON-CONSTRUCTION COST	1	LS	143,906,000	9,586,974	14,406,320	167,899,294
01 Lands and Damages	1	EA	84,654,000	0	0	84,654,000
Construction Contracts Documents	1	EA	84,654,000	0	0	84,654,000
30 Planning, Engineering and Design	1	EA	37,652,000	6,092,094	8,132,600	51,876,694
Construction Contracts Documents	1	EA	28,000,000	4,530,400	8,132,600	40,663,000
Project Implementation Report	1	EA	9,652,000	1,561,694	0	11,213,694
31 Construction Management	1	EA	21,600,000	3,494,880	6,273,720	31,368,600
Construction Contracts	1	EA	21,600,000	3,494,880	6,273,720	31,368,600

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Project Barecost to Direct Cost Report Page 2

Description	Quantity	UOM	BareCost	DirectCost	SubCMU	CostToPrime	PrimeCMU	ContractCost
Project Barecost to Direct Cost Report			353,142,489	353,142,489	17,265,779	370,408,268	49,718,084	420,126,352
CONSTRUCTION COST	1	LS	209,236,489	209,236,489	17,265,779	226,502,268	49,718,084	276,220,352
02 Relocations	1	EA	815,000	815,000	0	815,000	0	815,000
0203 Cemetery, Utilities, & Structure	1	EA	815,000	815,000	0	815,000	0	815,000
04 Dams	1	EA	149,139,486	149,139,486	4,913,673	154,053,159	36,690,887	190,744,046
0401 Perimeter Dam and Canal, Separator Dam	1	EA	142,907,285	142,907,285	3,326,949	146,234,234	35,281,687	181,515,921
0402 Crested Spillways	1	EA	563,723	563,723	143,524	707,247	127,467	834,714
0403 Main Outlet Structures	1	EA	4,169,729	4,169,729	1,061,617	5,231,346	942,842	6,174,188
1500 Balancing Structure	1	EA	1,498,749	1,498,749	381,583	1,880,332	338,891	2,219,223
03 Reservoirs	1	EA	7,036,077	7,036,077	9,057	7,045,134	1,754,084	8,799,218
0300 Reservoirs	1	EA	7,036,077	7,036,077	9,057	7,045,134	1,754,084	8,799,218
14 Recreation Facilities	1	EA	2,519,000	2,519,000	0	2,519,000	0	2,519,000
1400 Recreation Facilities	1	EA	2,519,000	2,519,000	0	2,519,000	0	2,519,000
13 Pumping Plant	1	EA	38,736,345	38,736,345	9,862,308	48,598,653	8,758,907	57,357,560
1300 Pumping Plant	1	EA	38,736,345	38,736,345	9,862,308	48,598,653	8,758,907	57,357,560
15 Floodway Control-Diversion Struc	1	EA	8,384,576	8,384,576	2,134,721	10,519,297	1,895,887	12,415,183
1500 Floodway Control-Diversion Struc	1	EA	8,384,576	8,384,576	2,134,721	10,519,297	1,895,887	12,415,183
09 Channels and Canals	1	EA	2,606,005	2,606,005	346,020	2,952,025	618,320	3,570,345
0902 Canals	1	EA	2,606,005	2,606,005	346,020	2,952,025	618,320	3,570,345
NON-CONSTRUCTION COST	1	LS	143,906,000	143,906,000	0	143,906,000	0	143,906,000
01 Lands and Damages	1	EA	84,654,000	84,654,000	0	84,654,000	0	84,654,000
Construction Contracts Documents	1	EA	84,654,000	84,654,000	0	84,654,000	0	84,654,000
30 Planning, Engineering and Design	1	EA	37,652,000	37,652,000	0	37,652,000	0	37,652,000
Construction Contracts Documents	1	EA	28,000,000	28,000,000	0	28,000,000	0	28,000,000
Project Implementation Report	1	EA	9,652,000	9,652,000	0	9,652,000	0	9,652,000
31 Construction Management	1	EA	21,600,000	21,600,000	0	21,600,000	0	21,600,000
Construction Contracts	1	EA	21,600,000	21,600,000	0	21,600,000	0	21,600,000

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Project Direct Cost Report Page 3

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost
Project Direct Cost Report			0	0	0	0	353,142,489	353,142,489
CONSTRUCTION COST	1	LS	0	0	0	0	209,236,489	209,236,489
02 Relocations	1	EA	0	0	0	0	815,000	815,000
0203 Cemetery, Utilities, & Structure	1	EA	0	0	0	0	815,000	815,000
020318 Utilities	1	EA	0	0	0	0	815,000	815,000
02031816 Electrical	1	EA	0	0	0	0	815,000	815,000
04 Dams	1	EA	0	0	0	0	149,139,486	149,139,486
0401 Perimeter Dam and Canal, Separator Dam	1	EA	0	0	0	0	142,907,285	142,907,285
Seeding	1	EA	0	0	0	0	359,136	359,136
Clearing and Grubbing	1	EA	0	0	0	0	8,727,330	8,727,330
Stripping	1	EA	0	0	0	0	1,198,400	1,198,400
Blanket Drain	1	EA	0	0	0	0	8,421,847	8,421,847
Toe Drain	1	EA	0	0	0	0	994,164	994,164
Toe Drain Outfall End Treatment	1	EA	0	0	0	0	7,919	7,919
Embankment/Random Fill	1	EA	0	0	0	0	56,129,167	56,129,167
Chimney Drain	1	EA	0	0	0	0	441,548	441,548
Slurry Wall	1	EA	0	0	0	0	18,616,634	18,616,634
Soil Cement	1	EA	0	0	0	0	40,325,825	40,325,825
Select Fill	1	EA	0	0	0	0	349,730	349,730
Sodding	1	EA	0	0	0	0	4,780,095	4,780,095
Instruments and Controls	1	EA	0	0	0	0	37,599	37,599
Sitework	1	EA	0	0	0	0	2,517,891	2,517,891
0402 Crested Spillways	1	EA	0	0	0	0	563,723	563,723
C43CS-1	1	EA	0	0	0	0	330,648	330,648
C43CS-2	1	EA	0	0	0	0	233,075	233,075
0403 Main Outlet Structures	1	EA	0	0	0	0	4,169,729	4,169,729
C43S-1	1	EA	0	0	0	0	2,037,768	2,037,768
C43S-8	1	EA	0	0	0	0	2,131,961	2,131,961
1500 Balancing Structure	1	EA	0	0	0	0	1,498,749	1,498,749
C43S-12	1	EA	0	0	0	0	1,498,749	1,498,749

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Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost
03 Reservoirs	1	EA	0	0	0	0	7,036,077	7,036,077
0300 Reservoirs	1	EA	0	0	0	0	7,036,077	7,036,077
030001 Mob, Demob & Preparatory Work	1	EA	0	0	0	0	7,000,000	7,000,000
030048 Demolition	1	EA	0	0	0	0	36,077	36,077
03004802 Site Work	1	EA	0	0	0	0	36,077	36,077
03004802 04 Removal of Structures	1	EA	0	0	0	0	36,077	36,077
Large Pump Station	1	EA	0	0	0	0	12,359	12,359
Small Pump Stations	1	EA	0	0	0	0	23,718	23,718
14 Recreation Facilities	1	EA	0	0	0	0	2,519,000	2,519,000
1400 Recreation Facilities	1	EA	0	0	0	0	2,519,000	2,519,000
Levee/Reservoir Area	1	EA	0	0	0	0	2,015,000	2,015,000
Double Lane Boat Ramp	1	EA	0	0	0	0	2,000,000	2,000,000
Vehicle Gate	1	EA	0	0	0	0	15,000	15,000
Entrance/Perimeter Area	1	EA	0	0	0	0	504,000	504,000
Shade Trees	1	EA	0	0	0	0	50,000	50,000
Footbridge	1	EA	0	0	0	0	135,000	135,000
Shade Shelter	1	EA	0	0	0	0	75,000	75,000
Canoe Launch	1	EA	0	0	0	0	39,000	39,000
Information Kiosk	1	EA	0	0	0	0	15,000	15,000
Parking Area Handicap Access	1	EA	0	0	0	0	50,000	50,000
Waterless Vault Toilet Facility	1	EA	0	0	0	0	90,000	90,000
Traffic Control Fencing	1	EA	0	0	0	0	50,000	50,000
13 Pumping Plant	1	EA	0	0	0	0	38,736,345	38,736,345
1300 Pumping Plant	1	EA	0	0	0	0	38,736,345	38,736,345
Pump Stations	1	EA	0	0	0	0	38,736,345	38,736,345
C43P-1	1	EA	0	0	0	0	34,395,990	34,395,990
C43P-4	1	EA	0	0	0	0	4,340,355	4,340,355
15 Floodway Control-Diversion Struc	1	EA	0	0	0	0	8,384,576	8,384,576
1500 Floodway Control-Diversion Struc	1	EA	0	0	0	0	8,384,576	8,384,576
Local Channel Gated Culverts	1	EA	0	0	0	0	3,688,939	3,688,939

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Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost
C43S-7	1	EA	0	0	0	0	1,117,465	1,117,465
C43S-9	1	EA	0	0	0	0	706,012	706,012
C43S-14	1	EA	0	0	0	0	831,405	831,405
C43S-15	1	EA	0	0	0	0	1,034,057	1,034,057
1500 Perimeter Canal Structures	1	EA	0	0	0	0	4,695,637	4,695,637
Gated Culvert C43S-3	1	EA	0	0	0	0	1,275,476	1,275,476
Gated Spillway C43S-10	1	EA	0	0	0	0	1,429,262	1,429,262
Gated Spillway C43S-11	1	EA	0	0	0	0	1,990,899	1,990,899
09 Channels and Canals	1	EA	0	0	0	0	2,606,005	2,606,005
0902 Canals	1	EA	0	0	0	0	2,606,005	2,606,005
Manatee Protection Structure	1	EA	0	0	0	0	1,359,070	1,359,070
Townsend Canal Improvements	1	EA	0	0	0	0	1,246,935	1,246,935
Channel Excavation	1	EA	0	0	0	0	430,318	430,318
Rip rap	1	EA	0	0	0	0	563,452	563,452
Remove Weir	1	EA	0	0	0	0	253,165	253,165
NON-CONSTRUCTION COST	1	LS	0	0	0	0	143,906,000	143,906,000
01 Lands and Damages	1	EA	0	0	0	0	84,654,000	84,654,000
Construction Contracts Documents	1	EA	0	0	0	0	84,654,000	84,654,000
30 Planning, Engineering and Design	1	EA	0	0	0	0	37,652,000	37,652,000
Construction Contracts Documents	1	EA	0	0	0	0	28,000,000	28,000,000
302301 Plans and Specifications (P&S)	1	EA	0	0	0	0	22,400,000	22,400,000
302310 Engineering & Design During	1	EA	0	0	0	0	5,600,000	5,600,000
Project Implementation Report	1	EA	0	0	0	0	9,652,000	9,652,000
31 Construction Management	1	EA	0	0	0	0	21,600,000	21,600,000
Construction Contracts	1	EA	0	0	0	0	21,600,000	21,600,000

Labor ID: LFL2009 EQ ID: EP07R03 Currency in US dollars TRACES MII Version 3.01

Print Date Mon 26 October 2009
Eff. Date 10/20/2009

U.S. Army Corps of Engineers
Project : swit_C43_WSRB_10_20_2009
Jacksonville District Cost report

Time 10:17:39

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Labor ID: LFL2009 EQ ID: EP07R03 Currency in US dollars TRACES MII Version 3.01

WBS 4 C-43 Basin Aquifer Storage Reservoir - Part 1 Project
FY2009/BY2011Fully Funded Estimate
(Amounts in Thousands of Dollars)

Effective Date: October 1, 2009

Fea	Description	Start Date	End Date	Mid Pt. Date	Infl Factor	Fully Funded Estimate	Fully Funded Cont.	Adj. To Total	Fully Funded Total	Adj. To Fed	Federal	Non-Federal	Remarks
						506,518	104,218	-	610,736	-	305,368	305,368	
01	LANDS & DAMAGES					84,654	0	0	84,654	0	42,327	42,327	
	C-43 Part 1 (DP1)	May-08	Jun-10	May-09	1.000	84,654	0		84,654		42,327	42,327	PM Updated Based on MCASES
				N/A	1.000	0	0		0		0	0	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
02	RELOCATIONS					1,019	255	0	1,274	0	637	637	
	Cemetery, Utilities & Structures	Nov-12	Apr-16	Jul-14	1.076	1,019	255		1,274		637	637	PM Updated Based on MCASES
				N/A	1.000	0	0		0		0	0	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
03	RESERVOIRS					11,002	2,751	0	13,753	0	6,876	6,876	
	Mob/Demob/Prep Work	Nov-12	Apr-16	Jul-14	1.076	11,002	2,751		13,753		6,876	6,876	PM Updated Based on MCASES
				N/A	1.000	0	0		0		0	0	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
04	DAMS					238,493	61,528	0	300,021	0	150,010	150,010	
	Perimeter Dam/Canal/Sep Dam	Nov-12	Apr-16	Jul-14	1.076	226,955	58,067		285,022		142,511	142,511	PM Updated Based on MCASES
	Crested Spillway	Nov-12	Apr-16	Jul-14	1.076	1,044	313		1,357		679	679	26-Oct-09
	Main Outlet Structures	Nov-12	Apr-16	Jul-14	1.076	7,720	2,316		10,036		5,018	5,018	
	C43S-12	Nov-12	Apr-16	Jul-14	1.076	2,774	832		3,606		1,803	1,803	
		Nov-12	Apr-16	Jul-14	1.076	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
09	CHANNELS & CANALS					4,464	1,116	0	5,580	0	2,790	2,790	
	Townsend Canal Improvements	Nov-12	Apr-16	Jul-14	1.076	2,143	536		2,678		1,339	1,339	PM Updated Based on MCASES
	Manatee Protection Structure	Nov-12	Apr-16	Jul-14	1.076	2,321	580		2,902		1,451	1,451	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
13	PUMPING PLANTS					71,716	17,929	0	89,645	0	44,822	44,822	
	C43P-1	Nov-12	Apr-16	Jul-14	1.076	63,827	15,957		79,784		39,892	39,892	PM Updated Based on MCASES
	C43P-4	Nov-12	Apr-16	Jul-14	1.076	7,889	1,972		9,861		4,930	4,930	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
14	RECREATION FAC					3,150	0	0	3,150	0	1,575	1,575	
	Levee/Reservoir Area	Nov-12	Apr-16	Jul-14	1.076	2,520	0		2,520		1,260	1,260	PM Updated Based on MCASES
	Entrance/Perimeter Area	Nov-12	Apr-16	Jul-14	1.076	630	0		630		315	315	26-Oct-09
		Nov-12	Apr-16	Jul-14	1.076	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	

15	FL CNTR & DIV STR					15,523	4,316	0	19,839	0	9,919	9,919	
				N/A	1.000	0	0		0		0	0	PM Updated Based on MCASES
	Gated Culvert C43S-3	Nov-12	Apr-16	Jul-14	1.076	2,375	660		3,035		1,518	1,518	26-Oct-09
	Gated Spillway C43S-10	Nov-12	Apr-16	Jul-14	1.076	2,639	734		3,373		1,686	1,686	
	Gated Spillway C43S-11	Nov-12	Apr-16	Jul-14	1.076	3,679	1,023		4,702		2,351	2,351	
	C43S-7	Nov-12	Apr-16	Jul-14	1.076	2,065	574		2,639		1,319	1,319	
	C43S-9	Nov-12	Apr-16	Jul-14	1.076	1,304	363		1,666		833	833	
	C43S-14	Nov-12	Apr-16	Jul-14	1.076	1,552	432		1,984		992	992	
	C43S-15	Nov-12	Apr-16	Jul-14	1.076	1,909	531		2,440		1,220	1,220	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
30	PE&D					46,645	8,861	0	55,505	0	27,753	27,753	
	PIR	Oct-06	Mar-09	Dec-07	1.000	11,214	0		11,214		5,607	5,607	PM Updated Based on MCASES
	P&S/EDC	Oct-07	Apr-16	Dec-11	1.089	35,431	8,861		44,291		22,146	22,146	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	
31	CONST MNGT					29,852	7,463	0	37,315	0	18,658	18,658	
	S&A	Nov-12	Apr-16	Jul-14	1.190	29,852	7,463		37,315		18,658	18,658	PM Updated Based on MCASES
				N/A	1.000	0	0		0		0	0	26-Oct-09
				N/A	1.000	0	0		0		0	0	
				N/A	1.000	0	0		0		0	0	

Appendix C Environmental Information
No proposed edits

Appendix D Real Estate

The Real Estate Appendix is up-dated in accordance with CECW-SAD memorandum dated July 30, 2009 signed by the Director of Civil Works, U.S. Army Corps of Engineers. The current guidance for the CERP, Land Valuation and Crediting is as follows:

a. Consistent with long-standing USACE practice, and as supported by the unique land credit provision for CERP contained in Section 601 (e)(5)(A) of WRDA 2000, tracts acquired by the SFWMD that are acquired and provided in furtherance of a CERP project should be valued and credited as individual tracts regardless of whether the acquisition was prior to or after execution of the PPA for that project. This general principle would not apply where the SFWMD acquired contiguous tracts that are required for a CERP project but it acquired such tracts prior to the PPA for a reason and use other than for implementation of the CERP project. A determination that a tract was acquired "in furtherance of a CERP project" should be supported by documentation existing at the time of acquisition.

b. The unique statutory land credit provision for CERP projects is clear that the non-Federal sponsor will be afforded credit for the value of lands, or interests in lands, that it provides in accordance with a PIR "regardless of the date of acquisition." *See* Section 601 (e)(5)(A) of WRDA 2000. To effectuate the clear intent of Congress reflected in this credit provision, land use restrictions imposed in furtherance of a CERP project after acquisition of a tract by the SFWMD should not be considered in valuing that tract for crediting purposes.

c. For the same reasons as expressed in subparagraph b. above, demolition of improvements after a tract was acquired in furtherance of a CERP project should not change the approach to value from that applicable at the time of acquisition. Accordingly, the tract should be valued for crediting purposes as it was improved when acquired by the SFWMD. To accomplish this result, the contributory value of the improvements, as of the date of the SFWMD's acquisition, should be added to the market value of the land on the date it is provided for the project as appraised in accordance with its highest and best use on the date of acquisition.

3. Incidental costs. The SFWMD has requested that it be afforded credit for the costs incurred by other non-federal governmental entities incidental to acquisition of project lands by such entities. the wording of section 601 (e)(5)(a) is clear that credit may be afforded only for "incidental costs for land acquired by a non-federal sponsor." credit may be afforded for traditional incidental acquisition costs that are incurred by SFWMD (such as appraisal costs, mapping costs, or relocation assistance benefits) as well as costs actually incurred by SFWMD in obtaining the required real property rights from other non-federal governmental entities. however, to be eligible for credit to be afforded to the SFWMD for incidental acquisition costs, SFWMD must have, in fact, incurred those costs.

1. Page D-7, Paragraph D.5.1, first paragraph, first sentence change to read as follows:

The Caloosahatchee River (C-43) West Basin Storage Reservoir project area encompasses approximately 10,700 acres consisting of approximately 10,480 acres in fee, approximately

20 acres of perpetual channel easement, and 200 acres in temporary easement that lie within approximately 12,430 acres owned by SFWMD.

2. Pages D-8 and D-9, last paragraph, change to read as follows:

The Reservoir currently under consideration will be constructed on property formerly owned by J&H Grove Holdings, L.C. (Berry Groves), the Griffin Family Limited Partnership, the MG Enterprises, L.L.C and the Bryan Paul Citrus. All these lands are currently owned in fee by the SFWMD.

3. Page D-23, Section D.9, first paragraph, fourth sentence, eleventh through seventeenth line, change sentence to read as follows:

SFWMD exchanged 541.31 acres within its ownership for 600.17 acres owned by Bryan Paul Citrus and identified on the map and table as GX100-008 and GX100-009 respectively. The exchange added an additional approximately 58 acres for an estimated total of 12,430 acres for SFWMD ownership in fee and easement that is available and sufficient interest for project purposes.

4. Page D-23, Section D.9, second paragraph, first and second bullets, change to read:
    - SFWMD's total initial land acquisition consisted of approximately 12,372 acres including approximately 20 acres of easement.
    - SFWMD exchanged approximately 541 of these acres for approximately 600 acres owned by Bryan Paul Citrus for a new total of approximately 12,430 acres.

5. Page D-24 first, second, third, fourth and fifth bullets, change to read as follows and Delete Note: *Note Costs in $x1000:

    - Federal Fund contribution for approximately 7,080 acres is estimated at $27,502,294 for land cost and $64,375 for acquisition cost for an estimated total of $27,566,669.
    - Federal administrative costs for 10,700 acres is an estimated amount of $273,000 with 30% contingency.
    - Total estimated Federal cost share $27,840,000.
    - State funds contribution for both the 7,080 acres as well as the remaining 3,620 acres is an estimated amount of $54,970,000 for land cost and an estimated amount of $1,840,000 for administrative/acquisition costs with contingencies included.
    - Total estimated real estate costs for the 10,700 acres required for the project are the sum of $27,566,669 Federal + $273,000 Federal +$54,970,000 non-Federal + $1,840,000 non-Federal which amounts to $84,650,000.00 (Rounded).

6. Page D-27 fourth paragraph should read:

In accordance with CECW-SAD memorandum dated July 30, 2009 signed by the Director of Civil Works, U.S. Army Corps of Engineers. The current guidance for the CERP, Land Valuation and Crediting is as follows:

a. Consistent with long-standing USACE practice, and as supported by the unique land credit provision for CERP contained in Section 601 (e)(5)(A) of WRDA 2000, tracts acquired by the SFWMD that are acquired and provided in furtherance of a CERP project should be valued and credited as individual tracts regardless of whether the acquisition was prior to or after execution of the PPA for that project. This general principle would not apply where the SFWMD acquired contiguous tracts that are required for a CERP project but it acquired such tracts prior to the PPA for a reason and use other than for implementation of the CERP project. A determination that a tract was acquired "in furtherance of a CERP project" should be supported by documentation existing at the time of acquisition.

b. The unique statutory land credit provision for CERP projects is clear that the non-Federal sponsor will be afforded credit for the value of lands, or interests in lands, that it provides in accordance with a PIR "regardless of the date of acquisition." *See* Section 601 (e)(5)(A) of WRDA 2000. To effectuate the clear intent of Congress reflected in this credit provision, land use restrictions imposed in furtherance of a CERP project after acquisition of a tract by the SFWMD should not be considered in valuing that tract for crediting purposes.

c. For the same reasons as expressed in subparagraph b. above, demolition of improvements after a tract was acquired in furtherance of a CERP project should not change the approach to value from that applicable at the time of acquisition. Accordingly, the tract should be valued for crediting purposes as it was improved when acquired by the SFWMD. To accomplish this result, the contributory value of the improvements, as of the date of the SFWMD's acquisition, should be added to the market value of the land on the date it is provided for the project as appraised in accordance with its highest and best use on the date of acquisition.

3. Incidental costs. The SFWMD has requested that it be afforded credit for the costs incurred by other non-federal governmental entities incidental to acquisition of project lands by such entities. the wording of section 601 (e)(5)(a) is clear that credit may be afforded only for "incidental costs for land acquired by a non-federal sponsor." credit may be afforded for traditional incidental acquisition costs that are incurred by SFWMD (such as appraisal costs, mapping costs, or relocation assistance benefits) as well as costs actually incurred by SFWMD in obtaining the required real property rights from other non-federal governmental entities. However, to be eligible for credit to be afforded to the SFWMD for incidental acquisition costs, SFWMD must have, in fact, incurred those costs.

However, the national valuation and crediting policy will not apply to any lands acquired for any project utilizing Federal funds, (Farm Bill and/or Land and Conservation Act funds), provided to any non-Federal Sponsor. The actual acquisition costs of SFWMD or any other non-Federal Sponsor will be utilized in the plan formulation, cost estimating, evaluation, and crediting in accordance with the terms and conditions of any Department of Interior Grant as well as the Framework Agreement executed 3 October 1996 by and between the United States Department of Interior, the United States Department of the Army, the State of Florida, Department of Environmental Protection, and the South Florida Water Management District. This will be applicable to all lands included or described in any Department of Interior (DOI) Grant Agreement.

The approximately 3,620 acres acquired by SFWMD with only State/SFWMD funds were acquired in May and June 2003 after April 30, 1999 the date the C&SF Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Impact Statement (PEIS) - April 1999.

7. Page D-28 paragraph D.9.2.1 Certification and Crediting for Actual and Incidental Costs Acquired under the Department of Interior Grants should be changed to read as follows:

Pursuant to the terms and conditions of the Department of Interior Grant Agreement, SFWMD submitted and Department of Interior reviewed and approved the actual acquisition costs and SFWMD's administrative/incidental costs, (excluding SFWMD's staff costs) for the acquisition of J&H Grove Holdings, L.C. (Berry Grove) properties consisting of approximately 9,003 acres in the amount of $71,500,000, of which $32,800,000 were Federal funds. Of the approximately 7,080 acres of the approximately 9,003 acres required for the project, the Federal share for the lands would be approximately $27,566,669 as shown in ***Table D-2***, ***Table D-3***, and ***Table D-4***. These figures may be increased or decreased based on a more detailed analysis during the crediting review process after approval of the Project, execution of a Project Cooperation Agreement and certification of the land.

8. Page D-34, paragraphs D.20 & D.21 should be changed to read as follows:

D.20 BASELINE COST ESTIMATE (*Table D-3)* AND MCACES COST ESTIMATE (*Table D-4)*

The actual acquisition costs and administrative costs provided by SFWMD were considered in the final computation. SFWMD cost towards the land and incidental costs is estimated at $56,810,000 (Rounded) with contingency. The Federal cost is estimated at $27,840,000 (Rounded), which includes the Federal share of the land costs as well as future federal administrative costs. The total real estate cost with contingency is estimated at $84,650,000 (Rounded). These figures are subject to modification and verification during the crediting review process.

D.21 BASELINE COST ESTIMATE (*Table D-3*) AND MCACES COST ESTIMATE (*Table D-4)*

The actual acquisition costs and administrative costs provided by SFWMD were considered in the final computation. The total real estate cost with contingency is estimated at $84,650,000 (Rounded).

9. Page D-35, replace Table D-3 with the following table:

TABLE D-3: SUMMARY OF BASELINE COST ESTIMATE

PROJECT: Caloosahatchee River (C-43) West Basin Storage Reservoir

DATE: October 2009

LANDS AND DAMAGES:

ESTATE	ACRES	NON-FEDERAL COST	FEDERAL COST	TOTAL
FEE-With Federal and State funds	7080.00	$28,236,243	$27,502,294	
FEE-With only State funds	3400.00	$19,816,684		
EASEMENT				
CHANNEL	20.00	$0		
WORK AREA	200.00	$750,000		
CONTINGENCY 30% on $20,566,684 non-fed funds		$6,170,005.20		
SUBTOTAL	10700.00	$54,972,932	$27,502,294	
IMPROVEMENTS	0	$0		$0
SEVERANCE:		$0		
SUBTOTAL	0	$54,972,932	$27,502,294	$82,475,226
MINERALS				$0
TOTAL LANDS AND DAMAGES				**$82,475,226**
ACQ/ADMIN				
FED			$210,000	
FED-DOI			$64,375	
NON-FED		$1,416,271		
SUBTOTAL		$1,416,271	$274,375	
FED CONTINGENCY 30% ON $210,000			$63,000	
NON-FED CONTINGENCY 30% ON $1,416,271		$424,881		
	SUBTOTAL	$1,841,153	$337,375	$2,178,528
TOTAL PROJECT COST		$56,814,084	$27,839,669	**$84,653,753**
TOTAL ESTIMATED RE COSTS (RD DOWN)				**$84,650,000**

10. Page D-36, replace Table D-4 with the following table:

TABLE D-4: MCACES PROJECT REAL ESTATE COSTS

MCACES PROJECT REAL ESTATE COSTS

PROJECT: Caloosahatchee River (C-43) West Basin Storage Reservoir

DATE: October 2009

01A	PROJECT PLANNING	FEDERAL	NON-FEDERAL	TOTALS
	Other	100,000	0	100,000
	Project Cooperation Agreement	15,000	0	15,000
01AX	Contingencies (30%)	34,500	0	34,500
	Subtotal	149,500	0	**149,500**
01B	LANDS AND DAMAGES/PERMITS			
01B40	Acquisition/Review of PS	95,000		95,000
01B40	DOI Grant Funds	64,375		64,375
01B20	Acquisition by PS		1,416,271	1,416,271
01BX	Contingency (30%) on $95,000 Fed and (30%) on $1,416,271 non-Fed	28,500	424,881	453,381
	Subtotal	187,875	1,841,152	**2,029,027**
01F	PL 91-646 ASSISTANCE			
01F20	By PS		0	0
01FX	Contingencies (30%)		0	0
	Subtotal		0	**0**
01R	REAL ESTATE LAND PAYMENTS			
01R1B	Land Payments by PS (state funds only)		20,566,684	20,566,684
01R1B	Land Payments by PS (federal and state funds)	27,502,294	28,236,243	55,738,537
01R2B	PL91-646 Relocation Payment by PS		0	0
01R2D	Review of PS			0
01RX	Contingencies (30%)	0	6,170,005	6,170,005
	Subtotal	27,502,294	54,972,932	**82,475,226**
	TOTALS	**27,839,669**	**56,814,085**	**84,653,754**
	ROUNDED DOWN TO			**84,650,000**

11. Page D-36, comments below Table D-4: MCACES PROJECT REAL ESTATE COSTS should be deleted.

Appendix E Agency /Public Coordination
No Proposed edits

Appendix F Plan Formulation
No Proposed Edits

Appendix G Economic and Social Considerations

1. Page G-56, second paragraph, first line, replace $6.79 with $7.27.

2. Page G-56, second paragraph, third line, replace $359,000 with $384,700.

3. Page G-56, second paragraph, third line, replace $199,000 with $214,000.

4. Page G-56, replace Table G-31 with the following table:

TABLE G-31: SUMMARY OF RECREATION COSTS AND BENEFITS (OCTOBER 2009 PRICE LEVEL)

Recreation Construction Costs	**$2,930,000**
PED & S/A (18%)	$527,400
Total Recreation Construction	**$3,457,000**
Construction Duration	12 months
Interest During Construction Costs	$75,000
Total Recreation Investment	**$3,532,000**
Period of Analysis	40 years
Annualized Cost	$189,000
OMRR&R	$25,000
Average Annual Costs	**$214,000**
Annual Benefits	
User Day Value	$7.27
Daily Use	145
Annual Use	52,925
Average Annual Benefit	**$384,700**

5. Page G-56, replace Table G-32 with the following table:

TABLE G-32: SENSITIVITY ANALYSIS USING MULTIPLE SCENARIOS (OCTOBER 2009 PRICE LEVELS)

Scenario	Annual Users	Daily Users	Annual Benefit
Most Likely	52,925	145	$170,700
Worst Case	32,850	90	$17,800
SCORP Guidelines	464,280	1,272	$3,154,000

6. Page G-57. first paragraph, first line, replace $160,000 with $170,700.

Appendix H Recreation

1. Page H-1, third paragraph, fifteenth line, replace $2,519,000 to $2,930,000.

2. Page H-2, first paragraph, second line, change $2,972,000 to $3,457,000.

3. Page H-7, second paragraph, fourteenth line, change $504,000 to $586,000.

4. Page H-8, replace Table H-2 with the following table:

TABLE H-2: ENTRANCE AND PERIMETER CANAL RECREATION FEATURES (OCTOBER 2009 PRICE LEVELS)

Features	Quantity	Unit Cost	Total Cost
Shade Trees	200	$290	$58,000
Footbridge	1	$159,000	$159,000
Shade Shelter 10' x 20'	3	$29,000	$87,000
Canoe Launch	1	$45,000	$45,000
Information Kiosk	1	$17,000	$17,000
Parking Area Handicap Access	15 Spaces	$58,000	$58,000
Waterless Vault Toilet Facility	2 units	$52,000	$104,000
Traffic Control Fencing	Lump Sum	$58,000	$58,000
Entrance and Perimeter Canal Site Total			**$586,000**

5. Page H-9, first paragraph, second sentence, change $2,015,000 to $2,341,000.

6. Page H-9, replace Table H-3 with the following table:

TABLE H-3: LEVEE AND RESERVOIR IMPOUNDMENT RECREATION FEATURES (OCTOBER 2009 PRICE LEVELS)

Feature	Quantity	Unit Cost	Total Cost
Double-lane boat ramp (linear feet)	2	$1,161,800	$2,323,600
Finger Pier (handicapped accessible)	1	Included in boat ramp	
Vehicle Gate	1	$17,400	$17,400
Paved road from bridge up levee and down to boat ramp	LF	Included in project costs	$0
Levee and Reservoir Impoundment Site Total			**$2,341,000**

7. Page H-12, replace Table H-5 with the following table:

TABLE H-5: CONVERSION OF POINTS TO DOLLAR VALUES (OCTOBER 2009 PRICE LEVELS)

General Recreation Point Values	General Recreation Dollar Values
0	$3.59
10	4.26
20	4.71
30	5.39
40	6.73
50	7.63
60	8.30
70	8.75
80	9.65
90	10.32
100	10.77

8. Page H- 4, second paragraph, fifth line, replace 4 7/8 percent with 4 3/8 percent.

9. Page H-16, replace Table H-7 with the following table:

TABLE H-7: SUMMARY OF RECREATION COSTS AND BENEFITS (OCTOBER 2009 PRICE LEVELS)

Recreation Construction Costs	**$2,930,000**
PED & S/A (18%)	$527,400
Total Recreation Construction	**$3,457,000**
Construction Duration	12 months
Interest During Construction Costs	$75,000
Total Recreation Investment	**$3,532,000**
Period of Analysis	40 years
Annualized Cost	$189,000
OMRR&R	$25,000
Average Annual Costs	**$214,000**
Annual Benefits	
User Day Value	$7.27
Daily Use	145
Annual Use	52,925
Average Annual Benefit	**$384,700**

10. Page H-16, third paragraph, second line, replace $160,000 with $170,700.

11. Page H-17, replace Table H-8 with the following table:

TABLE H-8: SENSITIVITY ANALYSIS USING MULTIPLE SCENARIOS (OCTOBER 2009 PRICE LEVELS)

Scenario	Annual Users	Daily Users	Annual Benefit
Most Likely	52,925	145	$170,700
Worst Case	32,850	90	$17,800
SCORP Guidelines	464,280	1,272	$3,154,000

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CENTRAL AND SOUTHERN FLORIDA PROJECT
CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR
FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT
ADDENDUM B

Addendum Purpose:

The purpose of this Addendum is intended to serve as a response to comments received in May and June 2010 from the Assistant Secretary of the Army's (ASA) review of the Final Caloosahatchee River (C-43) West Basin Storage Reservoir Project Final Integrated Project Implementation Report and Environmental Impact Statement of July 2007. Comments received focus on challenges encountered with the hydrologic modeling and implications thereof on plan selection.

Project Status:

The Final Caloosahatchee River (C-43) West Basin Storage Reservoir Project Implementation Report (PIR) and Environmental Impact Statement successfully underwent a Civil Works Review Board briefing in August 2007. The project Chief's Report was signed on 11 March 2010 following a two and half year delay resulting from programmatic level decision making regarding land valuation and crediting. In April 2010, the Caloosahatchee River (C-43) West Basin Storage Reservoir Final PIR was submitted to the office of the ASA. The Final PIR was slated for transmittal to the Office of Management and Budget (OMB) for review on 16 July 2010. Transmittal is currently delayed pending resolution of ASA comments.

ASA Comments:

Initial comments were received from the ASA's office in May 2010. After an initial response, the US Army Corps of Engineers received a second round of comments from the ASA in late June 2010. This second round of comments expands upon a single remaining unresolved comment regarding challenges in the hydrologic modeling and its role in plan selection as described in the Final PIR. A summary of these comments follows:

1. The PIR lacks complete and valid feasibility-level engineering analyses to support project justification.
2. The PIR had an incomplete description of project's Hydraulic and Hydrologic (H&H) performance.
    - Failed to characterize the recommended plan's impacts on downstream flows, estuary conditions, or reservoir operations.

- The PIR did not indicate amount of storage that would likely be beneficial for this basin, i.e. a target for restoring the estuary.

3. The report does not sufficiently assure that the right plan is recommended or that the plans would achieve their respective intended outputs to warrant Federal investment.
4. There is no indication that the Corps reviewed the H&H modeling. The modeling and analyses need to be revised and subjected to ATR and model review guidance.

Project Modeling and Plan Selection:

The hydrologic modeling completed for the Caloosahatchee River (C-43) West Basin Storage Reservoir project utilized an iterative and prudent methodology compliant with USACE plan formulation guidance in place at that time (2006-2007). The initial modeling of alternatives and plan selection was completed using the MIKESHE model. MIKESHE is an industry standard model developed by the Danish Hydrologic Institute and is a USACE certified engineering model approved for use on CERP projects. During the team level QA/QC review of the MIKESHE model output, it was recognized that errors existed in the model runs. The impact of the error on the outcome of each alternative was uncertain. As a result, a determination of the impact if any on the ranking/order of the benefits (environmental lift) of the alternatives could not be ascertained. In order to validate the plan selection and address the MIKESHE output errors, the Interagency Modeling Center (IMC) developed a spreadsheet analysis. This analysis was used in addition to the MIKESHE model to calculate flow at the S-79 structure (**FIGURE 1**) (see Engineering Appendix A, Attachment A: IMC Technical Memorandum for the Caloosahatchee River (C-43) West Basin Storage Reservoir Spreadsheet Model for Alternative Evaluation, pg. 124, for detailed hydrologic output including flow frequency and duration data).

FIGURE 1: CALOOSAHATCHEE WATERSHED

The results were then used to conduct a Next Added Increment (NAI) analysis on each of the final alternatives. This Spreadsheet analysis served as a parallel alternative analysis approach to verify plan selection, although the MIKESHE model remained the model on record for use in ranking the project alternatives. A brief summary of the final alternatives is provided in the table below (**TABLE 1**).

TABLE 1: SUMMARY OF FINAL ARRAY OF COST EFFECTIVE ALTERNATIVES

Alternative 1	No Action (Future-Without Project)
Alternative 2	100,000 ac-ft reservoir, 1,500 cfs pump capacity
Alternative 3B	170,000 ac-ft reservoir, 1,500 cfs pump capacity
Alternative 3C	170,000 ac-ft reservoir, 3,800 cfs pump capacity
Alternative 4A	220,000 ac-ft reservoir, 3,800 cfs pump capacity

FIGURE 2 depicts the parallel approaches to alternative analysis. Both approaches were initiated with flow data generated by the USACE approved South Florida Water Management Model (SFWMM 2X2). In the first approach MIKESHE was then used to model flows from S-77 to S-79. MIKESHE output at S-79 was fed into a salinity regression model that was used in combination with HSI models to generate habitat units (HUs). The second approach fed SFWMM 2X2 output at S-79 into the IMC Spreadsheet tool to produce modified flow estimates at S-79. This output was then fed into the same salinity regression model and HSI models to

generate HUs using the methodology from the first approach. The IMC Spreadsheet approach does not use the MIKESHE output at any point.

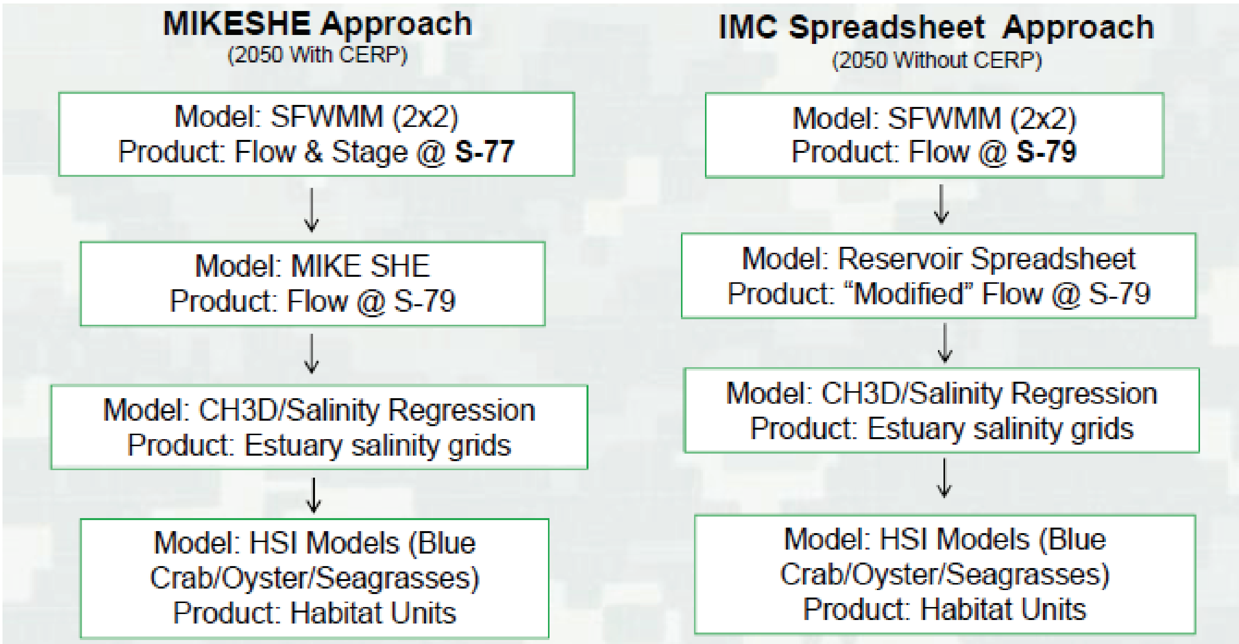

FIGURE 2: PARALLEL APPROACHES TO ALTERNATIVE ANALYSIS

TABLE 2 below presents the average annual lift (HUs) and average annual cost ($) comparison for the two approaches for each of the alternatives in the final array.

TABLE 2: SUMMARY OF NAI (SPREADSHEET) AND SYSTEM-WIDE (MIKESHE) AVERAGE ANNUAL HABITAT UNIT LIFT AND AVERAGE ANNUAL COST/AVERAGE ANNUAL HABITAT UNIT FOR EACH ALTERNATIVE IN THE FINAL ARRAY (OCTOBER 2006 PRICE LEVELS[1])

Alternative	AAHU lift (MIKESHE)	AAHU lift (Spreadsheet)	AA$/AAHU (MIKESHE)	AA$/AAHU (Spreadsheet)	Total Cost
2	10,628	13,624	$2,725	$2,126	$504,120,000
3B	12,809	15,297	$2,440	$2,043	$560,140,000
3C	16,397	17,694	$2,236	$2,072	$601,620,000
4A	15,907	18,410	$2,757	$2,382	$640,420,000

Note – The Costs presented in this analysis are planning level costs for comparison with original alternatives, as presented in Section 5 of the report. The costs have been revised based on additional engineering and design. The actual costs are presented in the updated MCACES analysis. NED costs do not include Recreation Cost for Plan Formulation.

Both the MIKESHE model approach and the IMC Spreadsheet analysis provided consistent results regarding the appropriate scale of the proposed reservoir (170,000 ac-ft storage, rather than 100,000 ac-ft or 220,000 ac-ft) as indicated in the highlighted cells in **TABLE 2**. Because the benefits per dollar achieved for alternatives 3C and 3B were close, the team selected the less expensive alternative; Alternative 3B, which cost approximately $41 million less than alternative 3C in 2007 ($560 versus $601 million). The difference in cost is primarily associated with the smaller pump capacity in Alternative 3B.

Report Review and Approval Process

The parallel approaches to alternative analysis were presented to the USACE Vertical Team in a series of In Progress Reviews (IPRs) in early 2007 and endorsed by USACE Headquarters and the SFWMD in April of 2007. As a component of the South Florida Water Management District (SFWMD) Acceler8 program, this project had thorough engineering-level analyses included in the Final PIR. The design was completed to 90% plans and specs, which is far beyond what is typical for a standard USACE feasibility level report.

Interagency technical reviews (ITR) of the Caloosahatchee River (C-43) West Basin Storage Reservoir document were carried out through collaboration with the National Ecosystem Restoration Planning Center of Expertise (PCX) in compliance with guidance at the time of Final PIR completion (2007). Extensive external scientific peer review through the National Academy of Science (NAS) has been conducted at the Comprehensive Everglades Restoration Plan (CERP) programmatic level and will continue throughout the planning and implementation of the CERP program through the NAS biennial reports to Congress. In particular, the NAS promoted the use of traditional water storage technologies and the use of adaptive management principles within the formulation process. Both of these comments have been integrated into the formulation and design of the C-43 WBSR project. The Caloosahatchee River (C-43) West Basin Storage Reservoir Chief's Report states that no further IEPR was deemed necessary or recommended for the study. In addition, no further IEPR is needed in response to WRDA 2007, since C-43 studies had been initiated and alternatives identified more than two years prior to its enactment and the final report had been submitted for approval prior to its passage.

The MIKESHE hydrologic model used in alternative analysis and plan selection is a USACE certified engineering model approved by the USACE Science, Engineering, and Technology (SET) for use on CERP projects. The IMC Spreadsheet was a water budget analysis tool utilized for plan comparison and, unlike the MIKESHE, was not considered a hydrologic engineering model, which excluded it from the review requirements specified in the existing Engineering Model Certification guidance. The *IMC Spreadsheet Technical Memorandum for the Caloosahatchee River (C-43) West Basin Storage Reservoir Spreadsheet Model for Alternative Evaluation,* which presents the spreadsheet analysis output, is included in the Engineering Appendix of the Final PIR and underwent ITR in 2007 as part of Final PIR package. A list of significant meetings, reviews, and approval milestones are captured in the timeline below (**TABLE 3**).

TABLE 3: C-43 WBSR PROJECT TIMELINE 2006-2007

Action	Date
Evaluate Alternatives (MIKESHE)	**Summer 2006**
MIKESHE problems realized	**Oct-06**
ITR pre-AFB	**25-Oct-06**
AFB	**2-Nov-06**
QRB Guidance- abandon MIKESHE, develop spreadsheet model for plan formulation to achieve DPIR in July 2007	**1-Jan-07**
Management Guidance - use MIKESHE for plan selection, spreadsheet for assurances (IOR, NAI)	**1-Feb-07**
HQ review of PIR completion strategy	**20-Feb-07**
Spreadsheet Analysis (NAI/Alternative Analysis)	**Mar-07**
HQ/SAD **IPR**	**16-Mar-07**
2nd HQ/SAD **IPR**	**22-Mar-07**
ITR on Draft PIR	**28-Mar-07**
Management Guidance - release DPIR for public and agency review	**13-Apr-07**
DPIR **IPR**	**18-Jun-07**
ITR on Final PIR	**11-Jul-07**
CWRB	**23-Aug-07**
90% P&S Rcieved	**17-Sep-07**
Chief's Report	**11-Mar-10**

Conclusion:

In conclusion, the team feels that the Final PIR contains valid and complete feasibility level engineering analysis to support plan selection in accordance with plan formulation guidance. Both the Draft and Final PIRs met all review requirements in place at that time. The ASA is correct in stating that the underlying H&H model (MIKESHE) used in plan selection had unresolved errors. However, the team sought to address these errors by utilizing a second alternative analysis method to validate plan selection. These two approaches produced results justifying the selected alternative as a reasonable sized reservoir to benefit the Caloosahatchee Estuary. The Final PIR recognized the need for follow-on analyses and potentially additional storage to benefit the estuary, which is consistent with the principles of adaptive management and the incremental adaptive restoration approach espoused by the NAS.

CENTRAL AND SOUTHERN FLORIDA PROJECT
CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR
FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

Responsible Agencies: The lead agency is the U.S. Army Corps of Engineers, Jacksonville District. The South Florida Water Management District is the non-Federal cost sharing partner for the project. Other participating agencies are the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the National Park Service, the Florida Fish and Wildlife Conservation Commission, the U.S. Geological Survey, the Natural Resources Conservation Service, and the Florida Department of Environmental Protection. The U.S. Fish and Wildlife Service, Florida Department of Environmental Protection, Everglades National Park, U.S. Environmental Protection Agency and Florida Fish and Wildlife Conservation Commission were invited to be Cooperating Agencies. None of these agencies accepted this invitation; therefore there are no cooperating agencies for this environmental impact statement (EIS).

Abstract: This report documents studies for the Caloosahatchee River (C-43) West Basin Storage Reservoir project, in accordance with the requirements of Section 601(d) of the Water Resources Development Act of 2000 (WRDA 2000) and recommends authorization of this project. This Project addresses the need to restore the 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 fresh water to the estuary during dry periods. These two primary functions help to moderate unnatural changes in salinity which is extremely detrimental to estuarine communities.

The purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to contribute to the restoration of the Caloosahatchee Estuary as part of a comprehensive plan for restoring the south Florida ecosystem. The project provides approximately 170,000 acre-feet (ac-ft) of above-ground storage volume in a two-cell reservoir with normal pool depths when the reservoir is full varying from 15 feet at the southeast corner to 25 feet at the northwest corner. Major features of the project include external and internal embankments, canals, two pump stations, internal control and outflow water control structures, and environmentally responsible design features. The project provides deepwater habitat within the impoundment cells, including refugia (created by embankment excavation) for fish and other aquatic animals during extremely dry periods. The perimeter canal may also include littoral areas which may be utilized as forage and nursery habitat by wading birds. The configuration and extent of these areas will be determined during detailed design work. Reservoir operations will also incidentally improve water quality in the Caloosahatchee Estuary, since some of the nutrient-laden runoff and lake water will be stored in the reservoir, allowing for the settling of nutrients and other pollutants within the reservoir cells prior to delivery to the estuary.

This Final Project Implementation Report and Environmental Impact Statement describes public and agency involvement in project development (including comments received and responses), explains the plan formulation and alternative evaluation and plan selection processes, and documents recommended plan features, including costs and environmental benefits.

THE OFFICIAL CLOSING DATE FOR THE RECEIPT OF COMMENT IS 30 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY OF THIS EIS APPEARS IN THE FEDERAL REGISTER.

If you require further information on this document, contact:
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NOTE: This report includes an integrated Environmental Impact Statement within the Final Project Implementation Report. An asterisk in the Table of Contents notes sections required for compliance with the National Environmental Policy Act.

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FOREWORD
A note to the reader of this Final PIR/EIS

The State of Florida has developed a program called "Acceler8" for the purpose of accelerating design and construction of a number of critical restoration projects consistent with the Comprehensive Everglades Restoration Plan (CERP) prior to one or more of the following: administration approval, Congressional committee resolution, Congressional authorization, or Federal construction funding. The State anticipates the Acceler8 program will provide immediate environmental, social, and economic benefits in the south Florida region. All Acceler8 projects must be specifically authorized by Congress before becoming a part of the Federal CERP. Anticipated Acceler8 crediting is based upon future legislation which specifically provides for it, since Acceler8 efforts are performed prior to a project cooperation agreement (PCA) execution and not creditable under existing authority. The South Florida Water Management District (SFWMD) is the state agency responsible for water resources management in south Florida and acts as the non-Federal sponsor for Federal water resources projects, including the CERP. The SFWMD is also the lead State agency responsible for implementing the Acceler8 program and will need to acquire Department of the Army permits under Section 404 of the Clean Water Act prior to construction.

Of the projects that make up SFWMD's Acceler8 program, the following projects were initially authorized CERP Projects under Water Resources Development Act of 2000 (WRDA 2000): C-44 Basin Storage Reservoir, Everglades Agricultural Area Storage Reservoir-Phase I, Site 1 Impoundment, Water Conservation Areas 3A and 3B Levee Seepage, C-11 Impoundment, C-9 Impoundment, and C-111 Spreader Canal. One Acceler8 project, Acme Basin B, potentially falls under the WRDA 2000 programmatic authority provisions. Three other Acceler8 projects require separate Federal authorization: Biscayne Bay Coastal Wetlands, Caloosahatchee River (C-43) West Basin Storage Reservoir, and the Picayune Strand Restoration Project (PSRP). While Federal authorization is required for crediting purposes, it is not required for construction performed by the State.

The U.S. Army Corps of Engineers (USACE) and SFWMD anticipate that the SFWMD will accelerate construction and attainment of ecosystem restoration benefits and other benefits of certain CERP projects by obtaining required permits and initiating construction upon completion of the Final Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) for the associated Federal CERP project.

The SFWMD proposes to initiate construction of the Caloosahatchee River (C-43) West Reservoir Acceler8 Project prior to implementation of the Federal Caloosahatchee River (C-43) West Basin Storage Reservoir project. The USACE is proceeding with two separate and independent but related actions, the feasibility-level evaluation of the Federal project and the regulatory evaluation of the SFWMD's proposed Acceler8 project, both of which are described in this Final PIR/EIS. The SFWMD's Caloosahatchee River (C-43) West Reservoir Acceler8 project is the same as the National Environmental Policy Act (NEPA) preferred alternative or Federal Recommended Plan, described in this Final PIR/EIS. The purposes of the Federal Recommended Plan identified in this Final PIR and the SFWMD's Acceler8 project are consistent. Therefore, it is anticipated that this Final PIR/EIS will also serve as the basis for the Regulatory Division's NEPA evaluation of the SFWMD's proposed Acceler8 project.

This Final PIR/EIS is posted on the CERP website:
(http://www.evergladesplan.org)

CENTRAL AND SOUTHERN FLORIDA PROJECT CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), Jacksonville District, in cooperation with its cost-sharing partner, the South Florida Water Management District (SFWMD), has prepared an Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) for the Caloosahatchee River (C-43) West Basin Storage Reservoir project, located in Hendry County, Florida. This report describes the purpose and need for the project, location, alternatives considered, and the selected alternative plan (SAP), including plan implementation. The report also contains the evaluations conducted reaffirming that an above-ground storage reservoir in the Caloosahatchee River (C-43 Canal) basin is a cost-effective solution for achieving the benefits of the project and the goals and purposes of the Comprehensive Everglades Restoration Plan (CERP).

The purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to contribute to the restoration of the Caloosahatchee Estuary as part of a comprehensive plan for restoring the south Florida ecosystem. The SAP provides approximately 170,000 acre-feet (ac-ft) of above-ground storage volume in a two-cell reservoir with normal pool depths when the reservoir is full that vary from 15 feet at the southeast corner to 25 feet at the northwest corner. Project features encompass approximately 10,700 acres acquired partially with funds provided by the Federal government via Department of Interior (DOI) funds for Everglades Restoration and partially with funds provided by the State of Florida. Major features of the SAP include external and internal embankments, canals, two pump stations, internal control and outflow water control structures, 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.

In addition, the recent recommendations of the National Research Council (NRC) of the National Academies in the final selection of the SAP were considered. The NRC has reviewed the first five years of work on CERP. Starting in 2004, 12 science and engineering experts studied CERP's progress and, after two years of study, issued their findings: *Progress Toward Restoring the Everglades: The First Biennial Review, 2006*. Biennial evaluations will continue through the 30-year lifetime of CERP. The NRC recognizes that

Everglades' restoration is a complex undertaking with many scientific uncertainties, which can slow the rate of progress. The NRC concluded that if the construction of a restoration project is delayed until all scientific uncertainties are eliminated, there will be many negative consequences including: continued decline of the Everglades ecosystem, lagging public support, and increased project costs. The NRC identified an approach referred to as Incremental Adaptive Restoration where an incremental approach using steps that are large enough to provide some restoration benefits now, while addressing critical scientific uncertainties and taking actions to promote learning that can guide the remainder of the project design. Constructing projects using a phased approach will enable assessments of benefits and impacts to the environment as each phase is constructed. Remaining phases will then be adapted to optimize performance based on actual findings from the earlier phases.

To address changing conditions, concerns and issues which have arisen since the Restudy analysis of the Caloosahatchee River Watershed, it is recommend that project use an Incremental Adaptive Restoration approach of two PIRs, in which the first PIR, the Caloosahatchee River (C-43) West Basin Storage Reservoir will address the most immediate needs of the estuary, while ensuring that it is fully compatible and consistent with the CERP. The second PIR would be a more comprehensive study that could provide a complete solution to addressing the broader needs of the entire basin.

This report has been prepared in accordance with the requirements of Section 601(d) of the Water Resources Development Act of 2000 (WRDA 2000) and Programmatic Regulations for the CERP (33 Code of Federal Regulations [CFR] Part 385) and will be circulated for public and agency review and comment in accordance with the National Environmental Policy Act (NEPA). This PIR and EIS take into consideration public and agency comments, which will be the basis for the Chief of Engineer's Report to be submitted to the Assistant Secretary of the Army (Civil Works) for transmittal to Congress.

PURPOSE AND NEED FOR THE PROJECT

The Caloosahatchee River and Estuary is at the head of a vast estuarine and marine ecosystem that includes aquatic preserves (Matlacha Pass Aquatic Preserve, Estero Bay Aquatic Preserve, Pine Island Sound Aquatic Preserve, Charlotte Harbor National Estuary, and the Caloosahatchee, Matlacha Pass and Ding Darling National Wildlife Refuges), along with numerous other Federal, state, and local parks and recreation areas. Restoration of a healthy, productive aquatic ecosystem in the Caloosahatchee River is essential to maintaining the ecological integrity and associated economic activity in these publicly owned and managed areas.

The Caloosahatchee Estuary (which is generally considered to be that portion of the Caloosahatchee River west of the W. P. Franklin Lock and Dam, Structure S-79, including the Matlacha Pass, San Carlos Bay, and Estero Bay areas at the mouth of the Caloosahatchee River, ***Figure ES-1*** and ***Figure ES-2***) encompasses approximately 80 square miles of estuarine habitat on Florida's southwest coast in the vicinity of Fort Myers, Florida. The Fort Myers area, including Cape Coral, Fort Myers Beach, Sanibel and Captiva Islands, Bonita Springs and unincorporated areas is one of the fastest growing areas in the

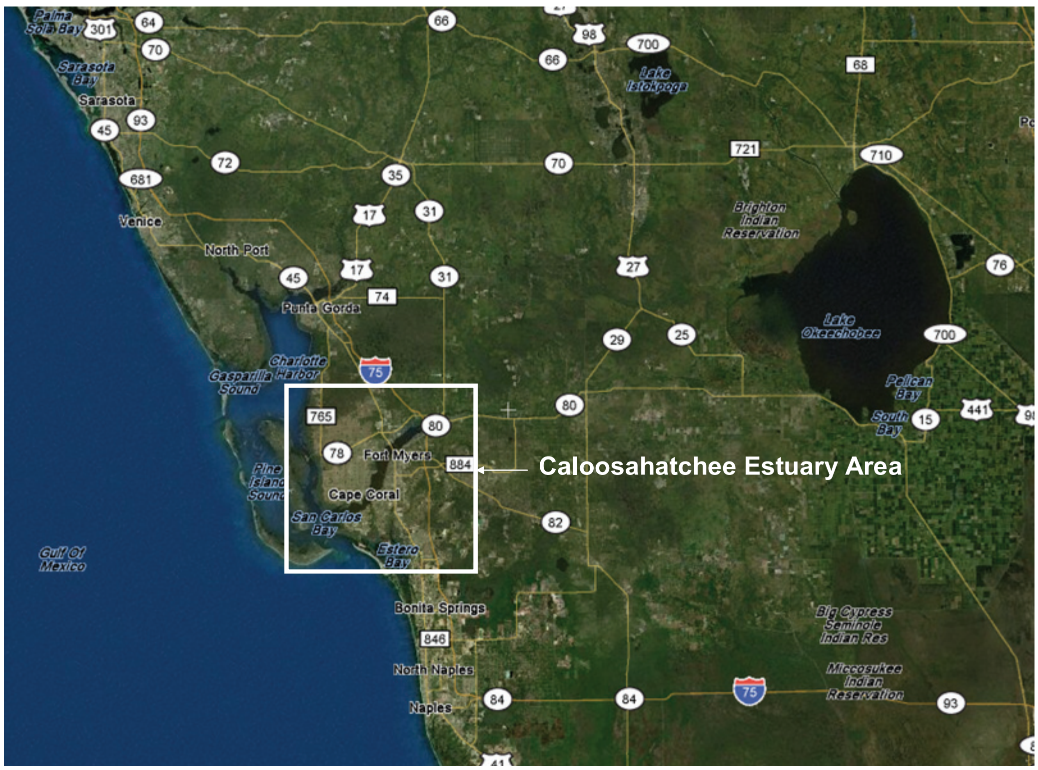

FIGURE ES-1: PROJECT VICINITY MAP

FIGURE ES-2: CALOOSAHATCHEE ESTUARY AREA MAP

Southeastern United States (2000 population approximately 440,000 according to United States [U.S.] census figures) and is an extremely popular tourist destination. The Caloosahatchee Estuary is connected to Lake Okeechobee by the Caloosahatchee River (C-43 Canal), a man-made connection to the lake originally created in the late 19th century. As part of the Central and Southern Florida (C&SF) Project for Flood Control and Other Purposes, the Caloosahatchee River has been widened and deepened to ensure that high water levels in Lake Okeechobee can be managed to prevent harmful high water levels in the lake and flooding in adjacent areas. The Caloosahatchee River is part of the federally maintained Okeechobee Waterway, and also serves to provide water supply deliveries from Lake Okeechobee to urban and agricultural areas in the basin while conveying basin runoff away from urban and agricultural areas.

Currently, there is not enough storage capacity in the regional water management system to minimize or prevent the possible harmful effects of periodic high volume discharges of freshwater to the Caloosahatchee Estuary. Conversely, during dry periods, there is sometimes not enough freshwater available in the regional system to maintain desirable salinity levels in the estuary. The combined result of too much and too little freshwater flowing to the Caloosahatchee Estuary is a degraded estuarine ecological community, characterized by declines in the abundance and diversity of native finfish and shellfish populations and other marine and estuarine species, poor water quality, and reductions in the extent of submerged habitat suitable for sea grass and oysters (two primary indicators of healthy estuarine communities in south Florida) and other higher trophic level species, including threatened and endangered species (e.g., manatees, wood storks).

To restore ecological function and productivity in the Caloosahatchee Estuary, CERP, approved by Congress in the WRDA 2000, included an above-ground reservoir along the Caloosahatchee River to capture and store basin runoff and excess freshwater released from Lake Okeechobee. By capturing this excess water the reservoir can also serve as a source of environmental water supply to the estuary during dry periods. The need for additional storage to restore, protect, and preserve the Caloosahatchee Estuary, including Federal trust lands and other publicly owned and managed areas in and around the Caloosahatchee Estuary has also been validated by other planning efforts, including the Caloosahatchee Water Management Plan (2000) and Lower West Coast Water Supply Plan (2005-2006) prepared by the SFWMD. In accordance with Federal and state requirements for implementing CERP projects, this Final PIR was prepared to reaffirm that an above-ground storage reservoir in the Caloosahatchee River (C-43 Canal) Basin is a cost-effective solution for achieving CERP goals and Caloosahatchee River (C-43) West Basin Storage Reservoir project objectives and to present the results of evaluations required by Federal and state regulations.

WHAT WILL HAPPEN WITHOUT THE PROJECT?

Environmental conditions have declined sharply in the Caloosahatchee Estuary area due to flood control and water management actions in the study area. Additionally, since the greater Fort Myers area population has already increased considerably since the CERP was approved in 2000 and is projected to continue to increase, increasing demands for freshwater will be placed on the Caloosahatchee River and its tributaries to meet competing municipal, agricultural, and environmental water supply needs in the basin. The expected result is that undesirable high salinity levels will also continue to recur in the Caloosahatchee Estuary, and those events will likely be greater in severity and duration.

Economically, the decline in estuary functions has already had and will continue to create periodic significant adverse impacts on commercial, recreational and associated economic activities.

Without actions taken to reduce the effects of too much and too little freshwater entering the Caloosahatchee Estuary at the wrong times, the estuarine ecosystem will continue to be degraded with the potential for some estuarine species to disappear entirely. If the recommended plan for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is not constructed, ecologically damaging discharges of basin runoff and flood control releases from Lake Okeechobee will continue during wet periods, causing periodic unnatural low salinity levels in the Caloosahatchee Estuary and adjacent estuarine and marine areas, including adjacent parks, refuges, preserves and other publicly owned and managed areas.

The net ecological effect of continued degradation of the Caloosahatchee Estuary will be further loss and limited possibility for recovery of primary and secondary productivity, including forage and nursery areas in submerged habitats and adjacent wetlands. The reduction in the abundance and spatial distribution of primary organisms such as submerged vegetation, invertebrates, small fish, and other prey organisms normally part of a healthy estuarine community will continue to be adversely impacted and be magnified in higher-level organisms such as pelagic fish, marine mammals, birds, and other aquatic-dependent wildlife (including threatened and endangered species).

PLAN FORMULATION, EVALUATION, AND SELECTION

Previous ecosystem restoration and water supply planning efforts including the C&SF Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic EIS (USACE and SFWMD, April 1999) have established the need for and the beneficial effects of an above-ground reservoir in the Caloosahatchee River (C-43 Canal) Basin as part of a comprehensive plan to achieve restoration objectives for the Caloosahatchee Estuary.

The Comprehensive Review Study included two primary structural components focused on improving environmental conditions in the Caloosahatchee River and Estuary: 1) an approximately 160,000 ac-ft reservoir with associated aquifer storage and recovery (ASR) wells and 2) basin runoff backpumping and stormwater treatment facilities. Due to technical uncertainty and implementation issues, the ASR features (Part 2) originally associated with a storage reservoir in the Caloosahatchee Basin will be evaluated and implemented separately. The availability and effectiveness of storing basin runoff, treating it and returning (back-pumping) it to Lake Okeechobee will also be further evaluated as part of a future study.

For this project, plan formulation efforts involved reaffirming that an above-ground storage reservoir, as originally described in the Comprehensive Review Study, is a cost-effective means for achieving the purposes of the project consistent with the goals and objectives of the CERP. After reaffirming that the benefits of the project could be achieved with an above-ground reservoir, formulation efforts focused on optimizing reservoir size and features on lands already acquired using DOI funds for project implementation, combined with a consideration of planning and policy constraints such as the WRDA 2000 Savings Clause.

After consideration of an initial array of alternative plans involving storage volumes ranging from 100,000 to 220,000 ac-ft with various inflow pump sizes, a final array of four alternative plans were selected consisting of:

- Alternative 2: 100,000 ac-ft storage reservoir with 1,500 cubic feet per second (cfs) pump capacity
- Alternative 3B: 170,000 ac-ft storage reservoir with 1,500 cfs pump capacity
- Alternative 3C: 170,000 ac-ft storage reservoir with 3,800 cfs pump capacity
- Alternative 4A: 220,000 ac-ft storage reservoir with 3,800 cfs pump capacity

Based on performance measures and habitat suitability indices (HSI), a system formulation evaluation was performed comparing the performance of each of the alternative plans together with the remaining components of CERP to the No-Action Alternative (future without-project condition). The system formulation evaluation examines differences in the magnitude of the alternative plan outputs to illustrate which plan performs best in a system-wide context. One of the key assumptions for the system formulation model simulations was that water supply deliveries from Lake Okeechobee to the Caloosahatchee River would be constrained to the same volumes as provided in the Comprehensive Review Study. This assumption was included in the hydrologic simulation to maintain the benefits provided by the CERP in the Everglades and other south Florida basins due to projected increased demands for water supply in the Caloosahatchee Basin subsequent to the completion of the Comprehensive Review Study. The Tentatively Selected Plan (TSP) was identified from the system formulation evaluation.

After the TSP was identified, a next-added increment (NAI) analysis was performed to show how well the TSP would perform without the effects of other CERP projects (i.e., assuming no further investment of public funds after this project, is the TSP still a good investment?). In the NAI analysis, the planning constraint on water supply deliveries to the Caloosahatchee River was removed from the model simulation, to ensure that current levels of service for water supply in the Caloosahatchee Basin could still be met with implementation of the TSP.

Although it is clear based on the evaluations performed that plans with greater storage capacity and pump sizes would produce more benefits (Alternative 3C was identified as the NER plan) for the Caloosahatchee Estuary, the increase in benefits is associated with increasing cost (including additional real estate interest) and increasing technical uncertainties regarding canal conveyance capacity, modifications to existing infrastructure and embankment design.

Alternative 3B is recommended for implementation, rather than Alternative 3C, which has been identified as the NER alternative plan. Alternative 3B meets the policy criteria established in Corps of Engineers guidance for planning in a collaboration environment[1]. This guidance provides that any alternative plan can be selected "if it has, on balance, net beneficial effects after considering all plan effects, beneficial and adverse…" Alternative 3B is clearly of less scope and cost than Alternative 3C, reduces uncertainty and financial risk to the government, and meets the Administration's policies for high priority outputs. Because Alternative 3B is an increment of Alternative 3C, this plan also supports adaptive implementation recommendations established by the NRC. The study considered various scales of reservoir storage and identified no alternative smaller than 3B which was more economical. For these reasons Alternative 3B is the recommended plan and no ASA(CW) waiver is required.

DESCRIPTION OF THE SELECTED ALTERNATIVE PLAN

The term "selected alternative plan" refers to the alternative that has been recommended for implementation. For the purposes of complying with the NEPA and in the spirit of NEPA, the plan that would be recommended for authorization is termed the "preferred alternative." For NEPA, a plan is not "selected" until it has been fully coordinated, is subject to alterations based on public involvement, and is then formally accepted by Congress or the Chief of Engineers, as appropriate, and authorized with the signing of a Record of Decision (ROD) or Finding of No Significant Impact (FONSI). Throughout this document, the analysis includes the NEPA evaluation and uses the term "selected alternative plan" or "selected plan" interchangeably as the preferred alternative. "Selected" throughout this document is meant to discern which alternative the team is recommending to Congress and the Chief of Engineers for further development and implementation

The selected plan ("preferred alternative") (***Figure ES-3***), Alternative 3B, consists of two cells and associated features totaling approximately 10,700 acres providing a normal maximum storage capacity of approximately 170,000 ac-ft surrounded by a perimeter embankment and canals. The SAP will require approximately 10,480 acres of fee and 20 acres of perpetual channel easement. Approximately 200 additional acres will be required on a temporary basis during project construction for staging areas. Major features of the SAP for the Caloosahatchee River (C-43) West Basin Storage Reservoir project include:

[1] EC 1105-2-409 "Planning in a Collaborative Environment"

- External (dam) embankments varying in height from 32-37 feet above existing grade;
- Soil-Bentonite slurry walls within and beneath the external embankments;
- An internal (dam) embankment separating the two reservoir cells with an approximate height of 31 feet above existing grade ;
- An inflow pump station consisting of diesel-powered pumps with a total pumping capacity of 1,500 cfs;
- A perimeter canal;
- A perimeter canal pump station consisting of electric-powered pumps with a total pumping capacity of 195 cfs;
- Numerous spillways, culverts, perimeter canal structures, an internal cell balancing structure, and outlet structures;

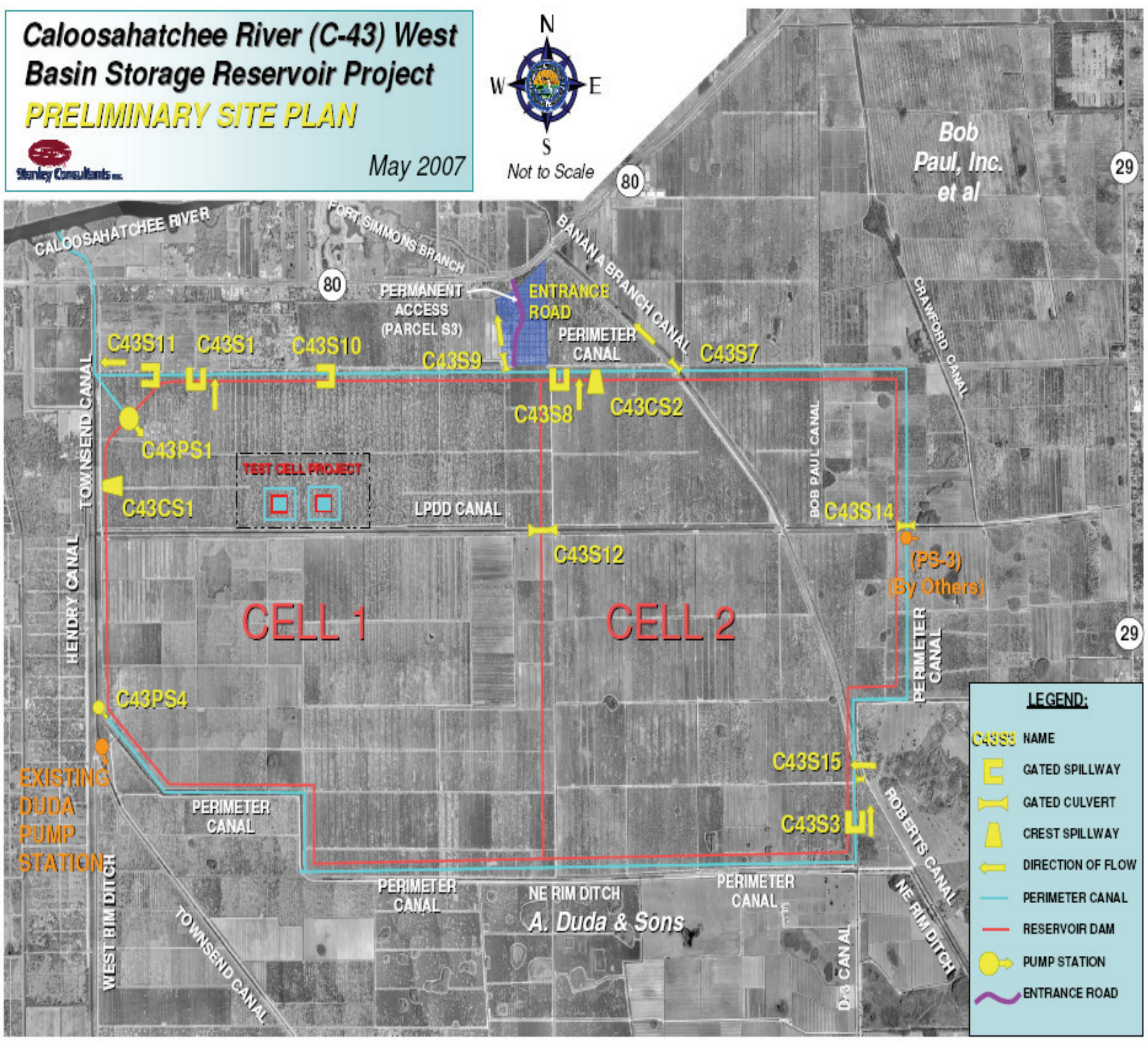

FIGURE ES-3: SELECTED ALTERNATIVE PLAN FEATURES

The external embankments include drainage features, and the top of the embankments and the upper portion of the outward side will be covered with soil-cement. The internal embankment does not include drainage structures, but will be covered on both sides with soil-cement. The reservoir is designed to withstand hurricane force winds of over 160 miles per hour (mph), as well as a combination of hurricane force winds with a rainfall event of over 54 inches in a 72-hour period.

The operation of the SAP is keyed to conditions at the W. P. Franklin Lock and Dam (structure S-79) on the Caloosahatchee River, as the flows over the dam are a good indicator of the resulting health of the estuary. The project will be operated to improve environmental conditions in the Caloosahatchee Estuary by reducing flows over S-79 during wet periods, and helping to maintain a minimum flow of 450 cfs at S-79 during dry periods. The S-79 structure is located approximately ten miles down-river (west) of the project site.

Project operations involve pumping inflows from the Caloosahatchee River (C-43) via an existing canal (Townsend Canal) into Cell 1. An internal cell balancing structure in the internal embankment will allow water in Cell 1 to enter Cell 2. Water may be released from both cells by outlet structures into the perimeter canal for delivery back to the Caloosahatchee River via the Townsend Canal and two other direct connections (Fort Simmons Branch and Banana Branch Canal) to the C-43 Canal. Other project structures help to maintain water levels in the perimeter canal and Townsend Canal, and provide water supply deliveries to adjacent lands affected by construction and operation of the reservoir.

BENEFITS OF THE SELECTED ALTERNATIVE PLAN

The SAP 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 SAP also helps to maintain a desirable minimum flow of fresh water to the estuary during dry periods. These two primary functions help to moderate unnatural changes in salinity that are detrimental to estuarine communities.

Based on a salinity model, the area within the Caloosahatchee Estuary system beneficially affected by the project conservatively encompasses at least 71,000 acres in the Caloosahatchee River, San Carlos Bay, and a portion of Pine Island Sound, although in all likelihood the area beneficially affected by project implementation will be much larger, including portions of Pine Island Sound, Estero Bay, and the Gulf of Mexico. These acres are within the navigable waters of the United States and within the navigation servitude of the United States.

The SAP also provides deepwater habitat within the impoundment cells, including refugia (created by embankment excavation) for fish and other aquatic animals during extremely dry periods. The perimeter canal may also include littoral areas which may be utilized as forage and nursery habitat by wading birds. The configuration and extent of these areas will be determined during detailed design work.

Though not designed specifically to provide water treatment benefits, the reservoir is expected to reduce downstream nutrient loads by retaining approximately 20 percent of the total phosphorus load that enters the reservoir. The reservoir's average hydraulic residence time of around 200 days is expected to result in substantial removal of pesticides and heavy metals through settling of suspended solids.

In accordance with the CERP Programmatic Regulations (33 CFR Part 385) and the Draft Programmatic Guidance Memoranda, the selection of plans for individual CERP projects is based on the performance of alternative plans when evaluated together with the rest of the CERP. This ensures that from a south Florida ecosystem-wide perspective, the SAP will contribute toward the achievement of system-wide restoration goals and objectives established for CERP, as well as the other water-related needs of the region. Plans must also be justified as the NAI (the next project to be added to a system of projects that includes only those that already have been approved and are likely to be implemented by the time the project being evaluated is completed). For this project, no other CERP projects were included in the NAI analysis, since other projects were not likely to be implemented by the time this project would be completed.

To evaluate the contribution of the SAP toward system-wide restoration goals and objectives, HSIs developed for the study area focused on the change in suitability of habitat in the Caloosahatchee Estuary. For analytical purposes, the area within the Caloosahatchee Estuary system beneficially affected by the project was assumed to encompass approximately 71,000 acres within the navigable waters of the United States and is within the navigation servitude of the United States. HSIs for the following key indicators of estuarine health were developed to evaluate project effects: oysters, sea grass, and *Vallisineria* ("tape grass" or "eel grass"; a submerged fresh water plant found in rivers and streams). Based on the HSIs, for the system formulation evaluation, the SAP will generate an average annual increase of approximately 12,809 habitat units within the affected area compared to without-project conditions (without any attempt to optimize system-formulation operations to further improve the Caloosahatchee Estuary). The average annual cost per average annual habitat unit for the system formulation evaluation is approximately $2,825. The cost per acre of affected habitat (based on the total area of benefit) for this project is $8,035.

The NAI evaluation (using the same HSI and evaluation methodology as the system formulation evaluation) demonstrates that as a stand-alone project (i.e., without the benefit of other CERP water storage projects that would further reduce the harmful effects of excess fresh water on the Caloosahatchee Estuary), the SAP will generate an average annual increase of approximately 15,300 habitat units within the affected area compared to without-project conditions.

The area of benefit is recognized as significant at a local, regional, state and national level. The benefited area includes Matlacha Pass and Pine Island Sound state aquatic preserves. San Carlos Bay as well as the Caloosahatchee River are designated as a Federal Manatee Refuge. In addition, there are five national wildlife refuges in the benefits area including J.N. Ding Darling National Wildlife Refuge, Caloosahatchee National Wildlife Refuge, Matlacha Pass National Wildlife Refuge, Pine Island National Wildlife Refuge, and Island Bay National Wildlife Refuge. There has also been significant public recognition of the importance of this area through continued support of this project by the local public as well as governments.

Water for the Natural System and Other Water-Related Needs

WRDA 2000 requires that an analysis of water made available by CERP projects for the natural system be included in each PIR. This water must be reserved or allocated by the State of Florida prior to execution of a project operation agreement. PIRs must also include an analysis of water made available by the project to meet other water related needs (such as water supply and aquifer protection). An evaluation of water made available by the Caloosahatchee River (C-43) West Basin Storage Reservoir project was completed based on the requirements of draft Programmatic Guidance Memorandum 4 ("Identifying Water Made Available for the Natural System and Other Water-Related Needs").

The primary functions of the reservoir are two-fold: to capture excess basin runoff and discharges from Lake Okeechobee during periods of high volume flows, and to provide an additional source of water to maintain desirable salinity in the Caloosahatchee Estuary during periods of low flow. Since the estuarine system does not need additional fresh water during periods of excess flow, the analysis of water made available focused on the additional water delivered from the reservoir to the Caloosahatchee River and Estuary during periods when additional flows are needed to meet estuary flow targets. The additional water delivered from the reservoir to meet estuary flow targets (as measured by flows at the S-79 structure over the period of analysis) ranged from approximately

160,000 ac-ft at least ten percent of the time to approximately 27,600 ac-ft 90 percent of the time, with a median value of approximately 106,000 ac-ft per year. The State of Florida will reserve or allocate for the natural system the additional water made available by the project.

The conceptual intent of the project is that the reservoir will be operated to supply water to the Caloosahatchee River based on maintaining desirable salinity levels in the Caloosahatchee Estuary system. The project will not provide any additional water for water supply or other water-related needs in the Caloosahatchee River Basin. The Draft Project Operating Manual is consistent with the conceptual intent and this assumption. However, project operations include water supply deliveries to agricultural lands adjacent to the reservoir where water supply canals were interrupted due to the location of the reservoir and the severance of surface water connections to the Caloosahatchee River.

The Savings Clause

In addition to identifying water for the natural system and other water-related needs, Section 601(h)(5) ("Savings Clause") of WRDA 2000 also requires PIRs to include an analysis of project effects on existing legal sources of water for municipal and agricultural water supplies, the Seminole and Miccosukee Tribes, Everglades National Park (ENP), and fish and wildlife. The Savings Clause also requires an analysis of potential project impacts on the existing level of service for flood protection. These Savings Clause analyses were completed based on the requirements of draft Programmatic Guidance Memorandum 3 ("Savings Clause Requirements").

Consistent with the conceptual intent described above and the Draft Project Operating Manual, it was assumed that project operations will not reduce the quantity of water in the Caloosahatchee River Basin available for water supply, including sources for municipal and agricultural interests and fish and wildlife. Sources of water for the Seminole and Miccosukee Tribes and ENP are influenced by the regional water management system (C&SF Project, including Lake Okeechobee), and are not affected by this project.

An analysis of potential affects on water stages and elevations on lands adjacent to the reservoir was conducted with a local-scale hydrologic simulation model (MIKESHE). Differences in groundwater elevations and durations were calculated for various points in the vicinity of the reservoir site. These model results indicated that the project will not create harmful and adverse changes to water levels on adjacent lands.

ADVERSE EFFECTS OF THE SELECTED ALTERNATIVE PLAN

Several potential adverse effects of the SAP have been considered during this study. First, implementation of the SAP will impact approximately 125 acres of wetlands within the project footprint. The loss of this wetland habitat will be offset by the increase in ecosystem function and quality in the Caloosahatchee Estuary.

Second, the SAP will cause a shift in nutrient load from the wet season to the dry season; however, the SAP will decrease the frequency in which the monthly TN load exceeds the dry season, wet season, and annual targets established by F DEP (dry-season 190 tons/month, wet-season 350 tons/month, annual 3,000 tons/month).

While it is possible that nitrogen fixation within the reservoir will result in short-term increases in TN loading to S-79, the average annual TN load at S-79 will be reduced. Improvements will occur in the overall average water quality conditions at S-79 as well as downstream in the estuary. Given the uncertainty in the threshold chlorophyll-a concentration required for the restoration of the ecological function of the estuary, the degree to which the reservoir project will improve downstream water quality is unknown at this time. Based on the evidence presented here, it appears that the project will not cause or contribute to water quality degradation under future conditions. Prior to beginning operation, the State of Florida will require an application for a water quality permit to determine compliance with applicable water quality standards

Another concern raised during development of the draft report was the possibility that project operations would reduce the quantity of water available from existing sources for agricultural and urban water supply interests in the basin. Conceptually, the SAP is to be operated to capture excess basin runoff and releases from Lake Okeechobee that would be harmful if discharged to the Caloosahatchee Estuary. Storing such flows would not affect the quantities of water needed to meet water supply demands in those periods. The SAP also includes structures and operations to provide water supply to replace any existing legal source on adjacent lands that were affected by project implementation. The Project Operating Manual contains the operational intent and instructions to operators to ensure that water supply deliveries in the basin and adjacent to the reservoir are not adversely affected by project operations.

The USACE and USFWS have completed formal consultation under Section 7 of the Endangered Species Act (ESA) to identify and evaluate possible adverse impacts to the Florida panther, eastern indigo snake, and Audubon's crested caracara as a result of the Caloosahatchee River (C-43) West Basin Storage Reservoir. Potential adverse impacts to the Florida panther include the loss of

10,335 acres of panther habitat which will be compensated for through the protection and restoration of 102,129 acres off-site through implementation of Band 1/Acceler8 projects included in CERP. Potential adverse impacts to the eastern indigo snake include the direct loss of 10,264 acres of eastern indigo snake habitat resulting in the incidental take of up to 54 snakes during initial construction and operations. In addition to standard protection measures, initial and subsequent rehydrations of the reservoir will be monitored and reviewed to determine if snakes are re-populating the reservoir during drydown events. Potential adverse impacts to Audubon's crested caracara includes the incidental take of up to two adult pairs of caracara in the form of harassment, as well as up to two caracara nest sites for up to five consecutive breeding seasons. Monitoring and surveys of the birds will be conducted to minimize future impacts. The USACE has also completed informal consultation with the USFWS for the West Indian manatee. A manatee barrier will be placed at the confluence of the Townsend Canal and Caloosahatchee River to minimize potential impacts to the West Indian manatee. The USACE has concluded Section 7 Endangered Species Act (ESA) consultation with the USFWS.

In public outreach efforts to date, one potential environmental justice issue has been identified: the loss of jobs for low income and minority workers as a result of acquiring agricultural land for the construction of the reservoir. The expected loss in employment will occur to seasonal and/or temporary migrant workers. As can be noted in the future land use section, agricultural acreage in the surrounding study area and counties is expected to increase. The Caloosahatchee River (C-43) West Basin Storage Reservoir Project provides an opportunity to somewhat alleviate the potential loss of jobs for low income and minority workers by providing jobs during construction of the project, some of which could provide seasonal and temporary employment. In addition, it is anticipated that adjacent lands will continue to support agricultural operations.

A final potential adverse effect that was studied in detail is the hazard potential. The hazard potential for a dam is defined by the possible consequences that may result from the release of stored water due to dam failure or mis-operation of the dam or appurtenances during both normal and flood flow conditions. According to the joint USACE and SFWMD Design Criteria Memorandum, DCM-1, there are three classification levels of the hazard potential for a dam: Low Hazard Potential, Significant Hazard Potential and High Hazard Potential (SFWMD, 2005).

Based upon this classification system and its criteria, the proposed C-43 West Basin Storage Reservoir has been classified as a high hazard potential impoundment. A dam break analysis indicated that a dam failure would compromise the safety of existing residents living near the proposed reservoir possibly resulting in the loss of life. In addition, the proximity of a major highway (SR80), the anticipated future development of areas near the facility, along with the size of the facility and volume of impounded water would all likely increase the potential for loss of life and high economic and infrastructure losses.

The High Hazard Potential classification of the C-43 West Basin Storage Reservoir means that the reservoir has been designed with the most stringent safety requirements and features designed to ensure that a weather extreme event or even a dam break would not compromise the safety of nearby residents. An extensive freeboard analysis and design process has been conducted to ensure the integrity and safety of the impoundment in cases of wind and wave run-up within the reservoir. This analysis is provided in the Engineering Appendix

PROJECT COST ESTIMATES AND COST APPORTIONMENT

The total initial estimated cost of the project, including all costs for construction, lands, easements, relocations, rights-of-way and disposals (LERRD), and pre-construction engineering and design (PED) and construction management costs is $570,480,000. Project construction costs will be shared equally between the Federal government and the non-Federal sponsor in accordance with Section 601 of the WRDA 2000 to maintain a 50/50 cost share as measured cumulatively for the entire CERP Program. Operations and maintenance (O&M) costs will be cost-shared 50/50 in accordance with the O&M cost-sharing provisions of Section 601 of WRDA 2000.

Section 601 of WRDA 2000 and USACE policy requires that the non-Federal sponsor must obtain and provide certification of LERRDs necessary for project implementation. ***Table ES-1*** provides additional details on initial costs for construction and non-construction items.

TABLE ES-1: CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR COSTS OCTOBER 2006 PRICE LEVELS (INITIAL COSTS ROUNDED TO THE NEAREST $10,000)

Ecosystem Restoration Elements	TOTALS
Construction	
Relocations	$1,180,000
Reservoir	$12,780,000
Reservoir (embankments, slurry wall, drains, soil cement, perimeter canal, spillways, structures, etc.)	$278,780,000
Channels and Canals	$5,180,000
Pumping Plants	$83,300,000
Recreation	$2,930,000
Floodway Control-Diversion Structures	$18,430,000
Sub-Total Construction Cost	**$402,580,000**
Non-Construction	
Lands and Damages	$84,650,000
Planning, Engineering, and Design	$51,880,000
Construction Management	$31,37000,000
Sub-Total Non-Construction Cost	**$167,900,000**
TOTAL INITIAL COST	**$570,480,000**

The estimated average annual cost for operations and maintenance is $3,100,000 (rounded to the nearest $10,000).

The costs shown above are updated, detailed costs and are not exactly equivalent to the costs that were utilized in the Economic Appendix cost/effectiveness and incremental costs analysis (CE/ICA). These updated costs were used, due to more detailed cost estimates becoming available, which warranted further justification of the original CE/ICA that was used for plan formulation and selection as can be noted in Appendix E.

SELECTED ALTERNATIVE PLAN IMPLEMENTATION

"ACCELER8"

The State of Florida has developed a program called "Acceler8" to accelerate design and construction of critical restoration projects prior to one or more of the following actions: administration approval, Congressional committee resolution, Congressional authorization, and appropriation of Federal funds for CERP project construction and operation. Acceler8 projects are consistent with CERP projects, and are typically increments of a larger plan described in CERP PIRs. The "C-43 (Caloosahatchee River) West Reservoir" project is one of the projects included in the Acceler8 program (www.evergladesnow.org).

The State has determined that Acceler8 projects will provide immediate environmental, social, and economic benefits in the south Florida region, and has begun design and construction work in anticipation that future authority will provide for credit toward the fifty percent non-Federal cost-sharing requirements of WRDA 2000. The SFWMD is the lead agency for the State of Florida for implementing the Acceler8 program. The SFWMD proposes to initiate construction on the Caloosahatchee River (C-43) West Basin Storage Reservoir project prior to implementation of the Federal project, and has already constructed test cells at the project site to evaluate seepage and embankment design and water quality effects.

This report contains a recommendation that the non-Federal sponsor (SFWMD) receive credit toward the non-Federal cost-share for work completed prior to entering into a project cooperation agreement, provided that the work is integral to the CERP project and subject to certifications that: 1) the costs are reasonable, allowable, necessary, auditable, and allocable; and 2) that the activities were implemented in accordance with USACE design and construction standards and applicable laws.

Detailed design of the Caloosahatchee River (C-43) West Basin Storage Reservoir project will be accomplished by the SFWMD as part of the State of Florida's Acceler8 program. Design information and details will be coordinated and reviewed by the USACE pursuant to the Design Agreement between USACE and SFWMD dated May 12, 2000. Activities during the construction phase will be in accordance with the Acceler8 program and will be the responsibility of the SFWMD.

Real estate interests for LERRDs will be the responsibility of the SFWMD.

A draft Project Operating Manual is included with this report. An Interim Project Operating Manual will be completed during subsequent detailed design efforts to reflect design modifications. A Final Project Operating Manual will be prepared following completion of operational testing and monitoring which occurs at the end of the construction phase. The USACE and SFWMD will share in the responsibilities for conducting water management operations during operational testing and monitoring of the project.

In coordinating completion of the CERP PIR with Acceler8 activities, the USACE is proceeding with two separate and independent but related actions: the feasibility-level evaluation of the Federal project described in this final report and the regulatory evaluation of the SFWMD's proposed project as part of an application for a Department of the Army Section 404 (Clean Water Act) permit. The SFWMD's Acceler8 project is consistent with the SAP included in this final report. It is anticipated that the Final Integrated PIR and EIS to be prepared for this project will be considered as part of the regulatory permit application and provide the basis for the NEPA evaluation of the proposed Acceler8 project. A Section 404 permit decision will not be made until at least 30 days after the Notice of Availability of the Final Integrated PIR and EIS and execution of a Regulatory Record of Decision by the District Commander.

The scheduled construction start date for the Acceler8 project is initiation of clearing and grubbing, and embankment structure pre-loading in December 2007, and reservoir construction in February 2008, pending receipt of all required authorizations and approvals. It should be noted that the clearing and grubbing activities in uplands do not include any discharge of dredge or fill material into waters of the United States, thus there is no Department of Army permit associated with this work. Department of the Army authorization will be required prior to embankment structure pre-loading and reservoir construction.

STAKEHOLDER PERSPECTIVES

Initial public and agency comments received in response to a 2003 public notice of intent to prepare a Draft Integrated PIR and EIS focused on impacts to existing wildlife habitat in the vicinity of the reservoir site, the adequacy of habitat to be created within the reservoir, water quality impacts, recreation features to be included in the project, potential impacts to water supplies and reservoir operations, and potential impacts to a portion of State Road 80 adjacent to the reservoir.

Since 2003, several hurricanes passing over south Florida created exceptionally high volumes of fresh water entering the Caloosahatchee Estuary from local basin runoff and from Lake Okeechobee. In response to public concerns raised about impacts to both the Caloosahatchee and St. Lucie estuaries and the effect of high water levels in Lake Okeechobee on Herbert Hoover Dike, the USACE, Jacksonville District announced plans in early 2006 (during plan formulation efforts for this project) to prepare a supplemental EIS (separate from this PIR and EIS) to investigate modification of the Lake Okeechobee Regulation Schedule (LORS), or water control plan, to address these and related concerns.

Many stakeholders, local governments and representatives of non-governmental environmental organizations provided similar written comments and statements at recent public meetings on the proposed changes to Lake Okeechobee's Regulation Schedule (LORS). The primary focus of their concern was the releases the lake would make to the Caloosahatchee River under the new regulation schedule and the effect those release would have on the health of the estuary. Some raised concerns about how the harmful effects of both excessive amounts of fresh water entering the estuary during the wet season and of insufficient fresh water to maintain desirable salinity levels in the estuary during dry periods affects the local economy. For example, in an October 2006 letter, the City of Sanibel commented:

> *"Sanibel Island's economy and its way of life depend upon the health of the Caloosahatchee River and Estuary. The Estuary provides essential habitat for fish populations that are central to the region's economy and recreational fishing economies. The City of Sanibel is particularly dependent on the health of the Caloosahatchee Estuary, as tourism generated by the diverse estuarine ecosystem in which it is located is central to the Island's economy."*

Similarly, the City of Fort Myers commented:

> *"The Caloosahatchee River and the estuary must be protected. The local economy is reliant on these waters through both the tourism industry and the fishing industry. We cannot afford to lose this most precious environmental and economic resource to the damaging effects of increased water releases from Lake Okeechobee."*

Since this Caloosahatchee River (C-43) West Basin Storage Reservoir Final PIR and EIS will be circulated for public and agency review and comment, and since it involves many of the same stakeholders and issues, it is expected that comments similar to those received on the LORS, Draft Supplemental EIS (USACE, Jacksonville District, August 2006) will be submitted for this project.

ENVIRONMENTAL OPERATING PRINCIPLES

The proposed project is consistent with the USACE "Environmental Operating Principles" (http://www.hq.usace.army.mil/cepa/envprinciples.htm), particularly with respect to the south Florida ecosystem-wide approach for plan formulation, evaluation, and selection, and a holistic consideration of water resources needs and solutions to water resources problems in the study area. The SAP incorporates monitoring, and CERP has an adaptive assessment and management program in place to ensure that projects, including the Caloosahatchee River (C-43) West Basin Storage Reservoir project, are achieving intended purposes. Project implementation, including plan formulation, involved collaborative interactions with the multiple agencies represented on the Project Delivery Team (PDT). Study area stakeholder groups and members of the general public have had multiple opportunities to receive information on the project and to provide comments and recommendations via public meetings, internet postings, teleconferences, and interagency PDT meetings.

INDEPENDENT TECHNICAL REVIEW

An external independent technical review (ITR) was performed on both the Draft and Final PIR and EIS by a multi-disciplinary team consisting of technical staff from the USACE Wilmington, Savannah, Walla Walla, Rock Island and Mobile Districts, in accordance with recent Corps policy regarding coordination with the National Ecosystem Restoration Center of Expertise and the National Cost Engineering Directorate of Expertise. Significant comments addressed during ITR included:

- Environmental benefits quantification methodology and spatial extent;
- Use of a hydrodynamic modeling tool to evaluate salinity changes in the estuary;
- Project real estate requirements; and,
- Development of project cost estimates.

In general, the ITR Team found that the information presented in the report describing the plan formulation and evaluation supported plan selection. All concerns resulting from ITR of the Final PIR have been resolved.

UNRESOLVED ISSUES

There are no significant unresolved issues with respect to the design of features to be constructed, cost estimates, and expected project outputs.

The implementing agencies (USACE, SFWMD, and U.S. Department of Interior) agree that there are remaining water resources problems in the Caloosahatchee River Basin which were not fully addressed by the SAP, including providing additional pumping and storage capacity, the need for additional water storage and management features in the Eastern Caloosahatchee River (upper) basin, and improving basin water quality. These concerns were also clearly articulated by other Federal, state, and local agencies and stakeholder groups in the study area. To address these and other unmet needs, a subsequent PIR will be initiated upon completion of this PIR.

Related to the need to investigate additional water storage and management options in the Caloosahatchee River Basin, concerns have also been raised about the ASR features of the CERP associated with the C-43 Basin Storage Reservoir (Restudy). During the initial planning for CERP, ASR wells were formulated in association with several of the CERP reservoirs (including the C-43 Basin Storage Reservoir [Restudy]) to provide an additional source of water and to improve the efficiency of the reservoir operations. However, at this time, a number of technical, regulatory, cost, and efficiency uncertainties remain unresolved for ASR as originally envisioned for CERP. To address these uncertainties, pilot projects have been initiated and a study is underway to more fully evaluate regional ASR performance and implementation issues. If these investigations indicate that ASR technology is a feasible and cost-effective means of achieving ecosystem restoration goals and objectives in the Caloosahatchee Basin, a third PIR (C-43 Basin ASR PIR) may be initiated to incorporate those features.

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INTRODUCTION

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1.0 INTRODUCTION

The Comprehensive Everglades Restoration Plan (CERP or "the Plan") provides a framework for the restoration of ecological function for the diverse and significant habitats of the south Florida ecosystem, including the Everglades, which encompasses 18,000 square miles from Orlando to the Florida Reef Tract. Everglades National Park (ENP) (the largest national park east of the Mississippi River, comprising a significant portion of the greater Everglades ecosystem) is a World Heritage Site, an International Biosphere Preserve, and a Wetland of International Importance. The Everglades and the south Florida ecosystem are affected by competing demands for recreation, development, natural and commercial resources, and include 68 federally listed threatened and endangered plants and animals.

First authorized by Congress in 1948, the Central and Southern Florida (C&SF) Project expanded the existing network of canals, levees, water storage areas and water control structures in south Florida. Project objectives included flood damage reduction, regional water supply, prevention of saltwater intrusion, preservation of fish and wildlife, recreation and navigation. While fulfilling these objectives, the project has had unintended adverse effects on the natural environment that constitutes the Everglades and south Florida ecosystem by disrupting the pre-existing hydrologic regime. As a result, in 1996, the United States Army Corps of Engineers (USACE), in conjunction with the South Florida Water Management District (SFWMD), was directed to develop a comprehensive plan to restore, preserve, and protect the south Florida ecosystem while also providing for other water-related needs of the region such as water supply and flood protection. The resulting plan submitted to Congress on July 1, 1999, is called the CERP, and consists of proposed structural and operational modifications to the C&SF Project.

The CERP was approved as a framework for the restoration of the natural system in Section 601 of the Water Resources Development Act of 2000 (WRDA 2000). The Plan consists of 68 components to restore, preserve, and protect the south Florida ecosystem while providing for other water-related needs of the region. The Plan's components will be implemented over an approximately 40-year period. Together, these components will benefit the ecological functioning of more than 2.4 million acres of the south Florida ecosystem by improving and/or restoring the proper quantity, quality, timing and distribution of water made available for the natural system while also addressing urban and agricultural water supply concerns and maintaining existing levels of flood protection.

Significantly less water flows through the ecosystem today compared to the past. An average of 1.7 billion gallons of water per day that once flowed through the ecosystem is now discharged to the Atlantic Ocean or the Gulf of Mexico via

C&SF Project canals. The CERP will capture a significant amount of this water in above-ground, in-ground, and underground storage areas, retain this water and redistribute it as needed. Specifically, this water will be stored in 330 aquifer storage and recovery (ASR) wells, over 217,000 acres of new reservoirs, and wetland treatment areas. In addition, various means of seepage control along the remaining Everglades will retain more water in the Everglades ecosystem, thereby increasing the volume of water retained in the natural system. Finally, wastewater reuse facilities are included in the Plan to provide a source of additional water to meet restoration needs.

The natural alternating flooding and drying periods, termed hydroperiods, are vital to the Everglades ecosystem and have been severely altered by human activities. Restoring natural patterns of inundation and variability of water flows and levels is an integral part of the CERP. Specifically, the CERP modifies the timing of water held and released into the ecosystem so that it more closely matches historical natural patterns. Changes in water delivery schedules will be made in some areas to alleviate extreme fluctuations. Lake Okeechobee water levels will be modified to improve the health of the lake. In other areas, the rainfall-driven operational plan will improve the timing of water flows.

The final factor in the water equation is the real extent and movement of water through the system. The remaining Everglades ecosystem has been separated, or compartmentalized, by canals and levees. The CERP will remove over 240 miles of levees and canals to improve the connectivity of natural areas and restore sheetflow. In addition, excess phosphorus, mercury and other contaminants have diminished water quality in the south Florida ecosystem. The water quality of the Everglades Water Conservation Areas (WCAs), the coastal estuaries, Florida Bay and the Keys shows similar signs of degradation. The CERP will help improve the quality of water discharged to natural areas by directing flow through wetlands-based treatment areas totaling approximately 36,000 acres.

The CERP established the need for and the beneficial effects of an above-ground reservoir in the Caloosahatchee River (C-43 Canal) basin as part of a comprehensive plan for achieving restoration objectives for the Caloosahatchee Estuary. The Comprehensive Review Study included two primary structural components focused on improving environmental conditions in the Caloosahatchee River and Estuary: (1) an approximately 160,000 acre-foot reservoir with associated ASR wells and (2) basin runoff backpumping and stormwater treatment facilities. Due to technical uncertainty and implementation issues, the ASR features originally associated with a storage reservoir in the Caloosahatchee Basin will be evaluated and implemented separately (Part 2). The availability and effectiveness of storing basin runoff for backpumping to the C-43 Canal and Lake Okeechobee will also be further evaluated as part of future CERP updates.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project will contribute to the restoration of the Caloosahatchee Estuary as part of a comprehensive plan for restoring the south Florida ecosystem. This final report has been prepared in accordance with the requirements of Section 601(d) of the WRDA 2000 and Programmatic Regulations for the CERP (33 Code of Federal Regulations [CFR] Part 385). The Caloosahatchee River (C-43) West Basin Storage Reservoir project area is shown in ***Figure 1-1***.

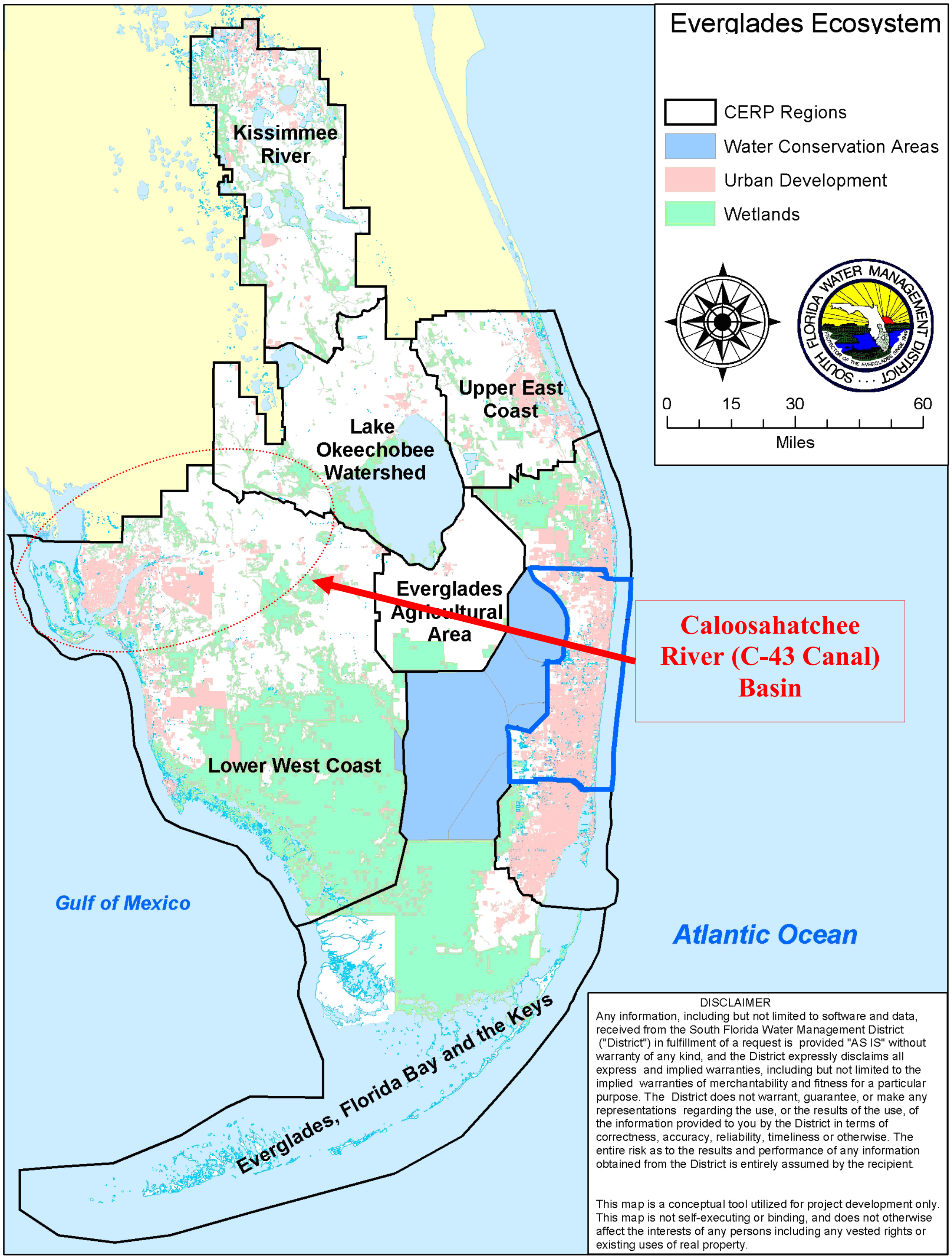

FIGURE 1-1: LOCATION OF THE CALOOSAHATCHEE RIVER & ESTUARY

1.1 REPORT AUTHORITY

The CERP was approved in Section 601 of WRDA 2000, which states, in part:

> *(b) Comprehensive Everglades Restoration Plan Approval –*
>
> *(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.*

The authority for the preparation of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project Implementation Report (PIR), one of a number of site-specific projects, is contained in Section 601(d) of WRDA 2000, which states:

> *(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).*

Section 601(h)(4) of WRDA 2000 further requires that a PIR document the following:

> *(4) PROJECT-SPECIFIC ASSURANCES-*
>
> *(A) PROJECT IMPLEMENTATION REPORTS-*
>
> *(i) IN GENERAL- The Secretary and the non-Federal sponsor shall develop project implementation reports in accordance with section 10.3.1 of the Plan.*
>
> *(ii) COORDINATION- In developing a project implementation report, the Secretary and the non-Federal sponsor shall coordinate with appropriate Federal, State, tribal, and local governments.*
>
> *(iii) REQUIREMENTS- A project implementation report shall--*

(I) be consistent with the Plan and the programmatic regulations promulgated under paragraph (3);
(II) describe how each of the requirements stated in paragraph (3)(B) is satisfied;
(III) comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);
(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system;
(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement, under State law, subclauses (IV) and (VI);
(VI) comply with applicable water quality standards and applicable water quality permitting requirements under subsection (b)(2)(A)(ii);
(VII) be based on the best available science; and
(VIII) include an analysis concerning the cost-effectiveness and engineering feasibility of the project.

1.2 PROJECT AREA

Located on Florida's lower southwest coast, the Caloosahatchee River (which is also commonly referred to as the C-43 Canal) region extends approximately 70 miles from Lake Okeechobee to the lower Charlotte Harbor Basin at San Carlos Bay. The Caloosahatchee River watershed constitutes the northern portion of the SFWMD Lower West Coast planning area. The Caloosahatchee River watershed covers an area of 1,125,000 acres in parts of Lee, Glades, Charlotte, and Hendry counties. The watershed can be further subdivided into seven drainage basins based on their hydrologic characteristics, hydrologic control features, and topography. Moving from east to west these basins are the C-21, East Caloosahatchee, West Caloosahatchee, Orange River, S-236, Telegraph Swamp, and the Tidal Caloosahatchee Basin (***Figure 1-2***). The population of the four counties that make up the Caloosahatchee River Basin was 630,000 in 2000 and is expected to nearly double to 1,220,000 by 2050. Major land uses in the area include agriculture (dominated by citrus, sugar cane, vegetables, sod, and cattle production), urban and municipal development, and natural areas.

The Caloosahatchee River watershed (or C-43 Basin) drains an area of about 1,758 square miles. Originally the Caloosahatchee River was a shallow meandering river. Prior to human disturbance, water moved slowly from the uplands and wetlands to the river and then downstream to the estuary. The lower Caloosahatchee River near its convergence with San Carlos Bay supported luxuriant seagrass beds with high light transmittance to the substrate and low nutrient and suspended solids concentrations. The interior basin was dominated by seasonally flooded cypress savannas and freshwater marshes with interspersed pine-dominated uplands, while the lower tidal portion consists of a coastal fringe of mangroves with extensive beaches and numerous estuaries (SFWMD 2000).

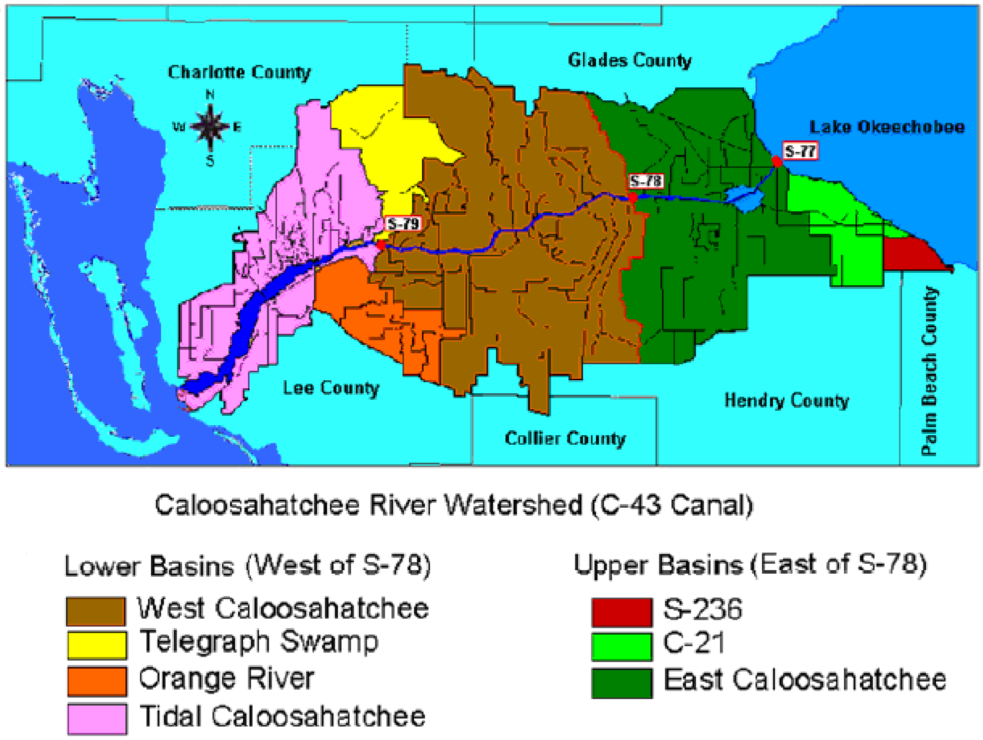

FIGURE 1-2: CALOOSAHATCHEE BASIN STUDY AREA

The Caloosahatchee River now serves as the western reach of the cross-state Okeechobee Waterway that connects Lake Okeechobee to the Gulf of Mexico at Fort Myers on the west coast. The Caloosahatchee River was hydrologically connected to Lake Okeechobee in 1881 by private interests, which resulted in the first lowering of the lake's water table. From 1910 to 1930, the canal's 65-mile course was channelized to improve navigation and flood control. Three lock-and-dam structures, (S-77, S-78, and S-79) were constructed to control flow and stage height in the lake and canal. From a hurricane gate located on the southwestern shore of Lake Okeechobee at Moore Haven (S-77), the Caloosahatchee River drains to the west for about five miles through very flat terrain into Lake Hicpochee. From Lake Hicpochee, the canal joins the upper reach of the Caloosahatchee River. The river is controlled by two navigation locks, one at Ortona (Ortona Lock and Dam or S-78), 15-miles downstream from Moore Haven and the other at Olga near Fort Myers (W.P. Franklin Lock and Dam or S-79). The S-78 aids in control of water levels on adjacent lands upstream and is the boundary that separates the Eastern Caloosahatchee Basin from the Western Caloosahatchee Basin. The S-79 is the most downstream structure and marks the beginning of the Caloosahatchee Estuary. The S-79 structure helps maintain specific water levels upstream, regulates freshwater discharges into the estuary, and serves as an impediment to saltwater intrusion upstream of the lock.

1.3 PROJECT PURPOSE AND SCOPE

The Caloosahatchee River and Estuary is at the head of a vast estuarine and marine ecosystem that includes aquatic preserves (Matlacha Pass Aquatic Preserve, Estero Bay Aquatic Preserve, and Pine Island Sound Aquatic Preserve; the Charlotte Harbor National Estuary; and the Caloosahatchee, Matlacha Pass and Ding Darling National Wildlife Refuges), along with numerous other Federal, state, and local parks and recreation areas. Restoration of a healthy, productive aquatic ecosystem in the Caloosahatchee River is essential to maintaining the ecological integrity and associated economic activity in these publicly owned and managed areas.

The Caloosahatchee Estuary (***Figure 1-3***), which is generally considered to be that portion of the Caloosahatchee River west of the W. P. Franklin Lock and Dam, including the Matlacha Pass, San Carlos Bay, and Estero Bay areas at the mouth of the Caloosahatchee River, encompasses approximately 80 square miles of estuarine habitat on Florida's southwest coast in the vicinity of Fort Myers, Florida. The Fort Myers area, including Cape Coral, Fort Myers Beach, Sanibel and Captiva Islands, Bonita Springs and unincorporated areas is one of the fastest growing areas in the southeastern United States (2000 population approximately 440,000 according to U.S. Census figures) and is an extremely popular tourist destination.

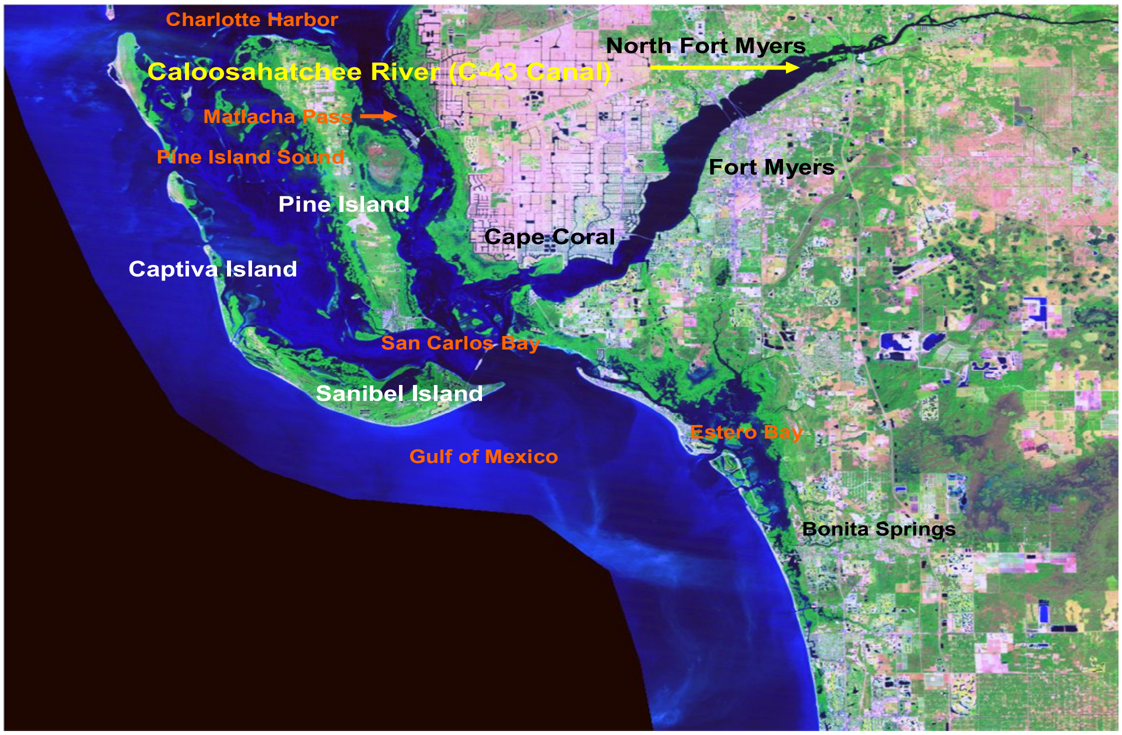

FIGURE 1-3: CALOOSAHATCHEE ESTUARY

Currently, there is not enough storage capacity in the regional water management system to minimize or prevent the harmful effects of periodic high-volume discharges of freshwater to the Caloosahatchee Estuary. Conversely, during dry periods, there is sometimes not enough freshwater available in the regional system to maintain desirable salinity levels in the estuary. The combined result of too much and too little freshwater flowing to the Caloosahatchee Estuary is a degraded estuarine ecological community, characterized by declines in the abundance and diversity of native finfish and shellfish populations and other marine and estuarine species, poor water quality, and reductions in the extent of submerged habitat suitable for sea grass and oysters (two primary indicators of healthy estuarine communities in South Florida) and other higher trophic level species, including threatened and endangered species (e.g., manatees, wood storks).

To restore ecological function and productivity in the Caloosahatchee Estuary, the CERP approved by Congress in WRDA 2000 included an above-ground reservoir along the C-43 Canal to capture and store basin runoff and excess freshwater released from Lake Okeechobee. By capturing this excess water the reservoir can also serve as a source of environmental water supply to the estuary during dry periods. The need for additional storage to restore, protect, and preserve the Caloosahatchee Estuary, including Federal trust lands and other publicly owned and managed areas in and around the Caloosahatchee Estuary has also been validated by other planning efforts, including the Caloosahatchee

Water Management Plan (CWMP) (2000) and Lower West Coast Water Supply Plan (2005-2006) prepared by the SFWMD. In accordance with Federal and state requirements for implementing CERP projects, this final PIR was prepared to reaffirm that an above-ground storage reservoir in the Caloosahatchee Basin is a cost-effective solution for achieving CERP goals and Caloosahatchee River (C-43) West Basin Storage Reservoir project objectives and to present the results of evaluations required by Federal and state regulations.

The primary restoration objective for the Caloosahatchee River (C-43) West Basin Storage Reservoir identified in the Restudy was:

> *"… to capture C-43 Basin runoff and releases from Lake Okeechobee. These facilities will be designed for water supply benefits, some flood attenuation, to provide environmental water supply deliveries to the Caloosahatchee Estuary, and water quality benefits to reduce salinity and nutrient impacts of runoff to the estuary…"*

Primary system benefits would include:

(1) Improvements in salinity and
(2) Improvements in water quality in the estuary.

Secondary system benefits would include:

(1) Improvements in flood attenuation within the basin; and
(2) A possible additional water supply source for agricultural and urban uses (via runoff capture and reuse methodology) once the needs of the estuary are met.

The Restudy recommended a plan that included restoration efforts in the Caloosahatchee River (C-43) region. The CERP project scope included the following description:

> *"This feature includes above-ground reservoir(s) with a total storage capacity of approximately 160,000 acre-feet and aquifer storage and recovery wells with a capacity of approximately 220 million gallons per day and associated pre- and post water quality treatment located in the C-43 Basin in Henry, Glades, or Lee Counties. The initial design of the reservoir(s) assumed 20,000 acres with water levels fluctuating up to 8 feet above grade. The final size, depth and configuration of this facility will be determined through more detailed planning and design. The initial design of the wells assumed 44 wells, each with the capacity of 5 million gallons per day with chlorination for pre-treatment and aeration for post-treatment. The level and extent of treatment and*

> *number of the aquifer storage and recovery wells may be modified based on findings from a proposed aquifer storage and recovery pilot project (U.S. Environmental Protection Agency, 1999)"*

The plan formulated in the Restudy alternative for the Caloosahatchee Basin was to capture water in reservoir(s) to provide desirable flow volumes through the S-79 structure to achieve the appropriate salinity envelope in the Caloosahatchee estuary. Through screening and evaluation of plan components proposed in the Restudy it was determined that above ground water storage provided the most cost effective alternative for freshwater attenuation (CERP, Volume 1; Section 7.2).

As previously stated, during completion of the CERP Master Program Management Plan (MPMP) in August of 2000, the project was divided into two parts, Part I: The Caloosahatchee Basin Storage Reservoir Project, and Part II: The Caloosahatchee Basin ASR Project.

This PIR addresses formulation, evaluation, and justification of a separable reservoir project in the lower Caloosahatchee River basin by reaffirming that a reservoir in the lower basin will achieve the benefits of the Restudy Plan for the Caloosahatchee Basin in a cost-effective manner. It demonstrates that a reservoir has been optimized, and acknowledges that the project is part of a more comprehensive plan for the Caloosahatchee Basin.

Since this project located in the lower portion of the Caloosahatchee Basin is focused on estuary restoration, it has limited capability to provide additional water to meet water supply demands in the upper Caloosahatchee River basin. A subsequent study will address the water supply needs and water quality issues of the upper basin. This later study will also address any additional restoration needs and demands in the lower Caloosahatchee River basin not met by the Caloosahatchee River (C-43) West Basin Storage Reservoir project.

Storage of water within the C-43 Basin had been established as one of the primary management measures contributing to the goals and purposes of the Restudy. Based on these findings, the SFWMD originally acquired approximately 12,372 acres (including easements) using State funds and Federal funds. SFWMD is in the process of exchanging approximately 541 acres of this previously acquired land for approximately 600 acres adjacent to the property originally acquired. As the PIR development process was initiated, there was an effort to identify early opportunities to obtain system-wide benefits by utilizing readily available lands. One of these opportunities was the evaluation of a potential reservoir located in the western Caloosahatchee River Basin on lands acquired by SFWMD with both Department of Interior (DOI) and SFWMD funds (please see Real Estate Appendix D, section D1.10.2 for more information).

Draft Programmatic Regulations Guidance Memoranda #1 and #2 instruct project teams to affirm and optimize the component identified in the Restudy unless conditions or planning objectives have changed, or if the component no longer meets the purposes outlined in the Restudy, to formulate new alternatives. Additionally, for projects where the non-Federal sponsor has already acquired lands, formulation of alternative plans using other sites will be minimized if the intended project purposes can be achieved and no more cost-effective sites are identified during formulation. Additional management measures to address the new circumstances should be developed and screening should occur based on the project's evaluation criteria and performance measures. As stated in CERP Guidance Memorandum #2:

> **Reaffirmation:** If the project as described in the Plan is reaffirmed, then the Project Delivery Team's (PDT) efforts will focus on development of design alternatives and optimization of the project features, cost-effectiveness, satisfaction of programmatic regulations requirements for PIRs, Micro-Computer Aided Cost Engineering System (MCACES) cost estimates, and the integrated National Environmental Policy Act (NEPA) documentation to supplement the information contained in the Programmatic Environmental Impact Statement (PEIS) for the Plan, in accordance with the concept of tiering under NEPA.
>
> **Reformulation:** When the project described in the Plan no longer achieves the benefits of the project as described in the Plan, additional formulation will be required prior to initiating detailed design of the selected plan. However, the formulation completed and described in the Plan will provide the foundation for the PDT to formulate additional alternatives. The new or changed circumstances requiring additional formulation should be documented.

The plan formulation for this project focuses on reaffirming that an above-ground storage reservoir in the Caloosahatchee Basin continues to meet the goals, objectives, and purposes for the project as described in the Restudy. Accordingly, in reviewing the findings of the Restudy, the team has determined that based on the current conditions, the project as described in the Restudy still achieves the benefits of the project in a cost-effective manner. A summary of the events that led up to the decisions on how to approach the project is found in ***Figure 1-4*** located at the end of this section.

1.4 RELATIONSHIP TO OTHER USACE/NON-FEDERAL SPONSOR EFFORTS, STUDIES, DOCUMENTS, AND REPORTS

Listed within this section are brief descriptions of other key projects related to the Caloosahatchee River (C-43) West Basin Storage Reservoir project. Included in the description are the objectives and/or study area.

1.4.1 CERP Components

Each of the projects listed below is a CERP component as outlined in the Restudy.

1.4.1.1 C-43 Basin Aquifer Storage and Recovery Project, Part 2

The C-43 Basin ASR Project (Part 2) includes ASR wells with a capacity of approximately 220 million gallons per day and associated pre- and post- water quality treatment that is co-located with the reservoir. The initial design of the wells assumed 44 wells, each with a capacity of five million gallons per day with chlorination for pre-treatment and aeration for post-treatment. The level and extent of treatment and number of the ASR wells may be modified based on findings from the ASR pilot project. The ASR pilot project is being conducted in parallel with a regional study on ASR.

1.4.1.2 Caloosahatchee Backpumping with Stormwater Treatment

The purpose of this project is to capture excess Caloosahatchee River Basin runoff, which will be used to augment regional system water supply. This feature as described in the Restudy includes pump stations and stormwater treatment areas (STAs) with a total capacity of approximately 20,000 acre-feet located in the Caloosahatchee River Basin in Hendry and Glades counties. The initial design of the STAs assumed 5,000 acres with the water level fluctuating up to four feet above grade. The final size, depth, and configuration of these facilities will be determined through more detailed planning and design. This project will be further evaluated under a separate PIR in the future.

1.4.1.3 Southwest Florida Feasibility Study

The Southwest Florida Feasibility Study (SWFFS) covers approximately 4,300 square miles of Florida's southern peninsula. The study area encompasses all of Lee County, most of Collier and Hendry counties, and portions of Charlotte, Glades, and Monroe counties. In the SWFFS study area, the Caloosahatchee River serves as the western outlet for discharges of stormwater and flood releases from Lake Okeechobee to the Gulf of Mexico and is a major source of surface water supply for the basin. The SWFFS will provide a comprehensive review of the water issues that faces southwest Florida, and is not limited to those related to the C&SF Project. The SWFFS will develop and address alternatives that protect and restore early wet-season and overland sheet flow conditions that provide for restoration of amphibian, reptile, macro invertebrate, and forage fish populations. The SWFFS will consider the impacts of freshwater pulsing and/or depletion of freshwater flows to estuaries, improvement of shellfish and fisheries habitat, and protection and restoration of shoreline wetlands that are unique to southwest Florida such as mangroves. Wide-ranging federal and state-listed threaten and endangered species, such as the Florida panther, wood stork and Florida black bear, as well as migratory birds and endemic species will be prioritized in the study's alternative development and analysis. The study will look at the protection and/or restoration of existing natural resources through land acquisition and conservation easement. The study will plan for proper infrastructure before or, as development occurs, not after. It will develop a water resources plan for the entire southwest Florida area and provide for ecosystem and marine/estuary restoration and protection, environmental quality, flood protection, water supply and other water-related purposes.

Recommendations for restoration of natural areas within the Caloosahatchee River Basin, which are not consistent with the Caloosahatchee River (C-43) West Basin Storage Reservoir project purpose, will be conveyed to the SWFFS for assessment and evaluation, since restoration of natural areas is consistent with the SWFFS purpose. Environmental benefits from Caloosahatchee River (C-43) West Basin Storage Reservoir project will be based on the improved estuary conditions resulting from modifying the salinity regime as a result of changes in the flows to the estuary, and any nutrient load reductions that result from the reservoir storage features. Additional environmental benefits may result from additional features implemented by the SWFFS. The SWFFS includes as one of its objectives the increase in the spatial extent of functional wetlands. The SWFFS will study/evaluate the potential for sites to be re-hydrated within the SWFFS project study area, which includes the Caloosahatchee River Basin. The SWFFS will formulate for environmental benefits in the estuary and in the upland areas, even in the C-43 watershed. The Caloosahatchee River (C-43) West Basin Storage Reservoir project will only have environmental benefits in the estuary, not in the upland areas, unless specifically adjacent to a reservoir. However, recommendations for restoration of natural areas within the Caloosahatchee River Basin not consistent with the Caloosahatchee River (C-43) West Basin Storage Reservoir project purpose will be conveyed to the SWFFS for assessment and evaluation

1.4.1.4 Lake Okeechobee Watershed Project

Lake Okeechobee (approximately 730 square miles) is located in portions of Palm Beach, Martin, Okeechobee, Glades, and Hendry Counties. Water flows into the Lake primarily from the Kissimmee River, Fisheating Creek, and Taylor Creek/Nubbin Slough. The Lake is the principal natural reservoir in south Florida and discharges water east through the St. Lucie Canal (C-44) into the St. Lucie Estuary, west through the Caloosahatchee River (C-43) into the Caloosahatchee Estuary, and south through four major canals in the Everglades Agricultural Area (EAA) into the Water Conservation Areas (WCA). Water levels in the Lake are currently regulated by a complex system of pump stations, spillways, and locks, in accordance with a regulation schedule developed by the

South Florida Water Management District (SFWMD) and the Army Corps of Engineers Jacksonville District (USACE).

The Comprehensive Everglades Restoration Plan contained in the Restudy includes five components that make up the Lake Okeechobee Watershed Study.

North of Lake Okeechobee Storage Reservoir–This feature includes an above-ground reservoir with total storage capacity of approximately 200,000 acre-feet and a 2,500-acre stormwater treatment area located in the Kissimmee River Region, north of Lake Okeechobee.

Taylor Creek/Nubbin Slough Storage and Treatment Area–This feature includes an above-ground reservoir with a total storage capacity of approximately 50,000 acre-feet and a stormwater treatment area with a capacity of approximately 20,000 acre-feet in the Taylor Creek/Nubbin Slough Basin.

Lake Okeechobee Watershed Water Quality Treatment Facilities–This feature will attenuate peak flows and reduce phosphorus loading into Lake Okeechobee by restoring the hydrology of selected isolated and riverine wetlands in the region by plugging drainage ditches that were established for agriculture water supply, and flood control.

Lake Okeechobee Tributary Sediment Dredging–This feature will remove phosphorus in canals located in areas with high phosphorus concentrations that discharge runoff in the Lake Okeechobee Watershed.

Lake Istokpoga Regulation Schedule–This component will examine Lake Istokpoga regulation schedule in order to develop a long-term comprehensive management plan while balancing water supply and flood control needs, while providing ecological benefits in the basin.

1.4.2 Non-CERP Components

The C&SF Project was authorized by the Flood Control Act of 1948 and modified by subsequent acts, as a plan of improvement for flood control, drainage, and other purposes covering an 18,000 square mile area of C&SF. Within the C-43 Basin Storage Reservoir Project area, C&SF canals include Canals 43, 20, and 21. A number of efforts are currently underway by the USACE to modify the C&SF Project for environmental improvements are listed below.

1.4.2.1 Manatee Protection

The West Indian manatee (*Trichechus manatus*) is listed as a Federally endangered species and is one of the most endangered species in Florida. As a response to recent manatee mortality trends associated with water control structures, this project will provide operational changes and implement the installation of a manatee protection system at seven sector gates at navigational locks near Lake Okeechobee. The beneficial outcome of this project will be the reduction of risk, injury, and mortality of the manatee. The seven sector gates include S-193 at Okeechobee and S-310 at Clewiston on Lake Okeechobee; St. Lucie Lock, and Port Mayaca Lock on the St. Lucie canal; and Moore Haven Lock, Ortona Lock, and W.P. Franklin Lock on the Caloosahatchee River.

1.4.2.2 Caloosahatchee River Oxbow Restoration

The Caloosahatchee River oxbows that are currently being investigated under the authority of the USACE's Section 206 Continuing Authorities Program are located between S-79 and the boundary between Lee and Hendry Counties. The purpose of this project is to restore degraded oxbows, which support the only remaining natural riverine habitat in the altered Caloosahatchee River system. These areas provide important habitat for the critical ecosystem functions of feeding, nesting, refuge and nursery areas for aquatic dependent species, some of which are State and Federally listed species. These areas serve as a critical link in the life cycle of many organisms, from macroinvertebrate communities to fish, birds, reptiles, and mammals. The Caloosahatchee River oxbow restoration will impact future hydrologic conditions of the Caloosahatchee River by increasing river flow through the oxbows. This will result in improved water quality by removal of anaerobic sediments and increased productivity and ecological value by providing a diversity of functioning habitats. Restoring the historic river oxbows also slightly increases the natural storage capacity of the Caloosahatchee River and attenuates the river's hydrograph below the oxbows.

1.4.2.3 Lake Okeechobee Regulation Schedule

Lake Okeechobee is regulated to provide flood control, navigation, water supply, regional groundwater and salinity control, enhancement of fish and wildlife, and recreation. The current regulation schedule, Water Supply/Environmental (WSE), was approved in July 2000 for the regulation of Lake Okeechobee water levels. Per Restoration Coordination and Verification (RECOVER) system-wide determinations for all CERP projects, the current WSE schedule described in the existing conditions section is assumed to be the same regulation schedule in place for future without project conditions. WSE incorporates tributary hydrologic conditions and climate forecasts into the operational guidelines and is used in conjunction with the Operational Guidelines Decision Tree. The operational flexibility of the WSE schedule allows for adjustments to be made in the timing and magnitude of Lake Okeechobee regulatory discharges based on conditions in the Lake tributary basins and in the extended meteorological and climate outlooks. However, in the near future, the USACE plans to complete a detailed study of the Lake Okeechobee regulation schedule similar to the Final

Environmental Impact Statement (EIS) (FEIS, USACE 31 March 2000) that was completed for the Lake Okeechobee Regulation Schedule Study (LORSS).

1.4.2.4 State Initiatives

In addition to the Federal projects, there are multiple state projects that will also have an impact on future water quality both upstream and downstream of S-79. They are:

- SFWMD Lake Okeechobee Protection Plan;
- Florida Department of Environmental Protection (FDEP) Lake Okeechobee Total Maximum Daily Loads (TMDL);
- SFWMD Caloosahatchee Minimum Flows and Levels (MFL);
- SFWMD Caloosahatchee Water Management Plan (CWMP);
- FDEP Caloosahatchee Basin TMDL;
- Florida Department of Agriculture and Consumer Services (FDACS)/FDEP Agricultural Best Management Practices (BMP) Program for the Caloosahatchee Basin;
- SFWMD Urban Irrigation and Landscape BMP Implementation Projects;
- SFWMD Stormwater Management Regulations;
- Lee and Hendry Counties Stormwater Management Projects.
- Northern Everglades Initiative, Caloosahatchee River Watershed Protection Plan
  In June 2007, the Florida Legislature passed Senate Bill 392, The Northern Everglades and Estuaries Protection Program, which expands the Lake Okeechobee Protection Act to include protection and restoration of the Lake Okeechobee watershed and the Caloosahatchee and St. Lucie Rivers and estuaries, provides a dedicated State funding source for Northern Everglades restoration.

  The South Florida Water Management District (SFWMD) announced in July 2007 the allocation of $3.4 million to support 16 projects along Florida's lower west coast that will improve water quality in the Caloosahatchee River and estuary. The local projects, ranging from neighborhood sewer system improvements to treatment marshes and sediment removal, will be completed over the next six months to provide immediate pollution-control measures.

1.5 PROGRAMMATIC REGULATIONS GUIDANCE MEMORANDA

WRDA 2000 required the development of Programmatic Regulations to provide additional guidance for the implementation of CERP. Section 385.5 of the Programmatic Regulations specifically requires the development of six program-wide Guidance Memoranda (GM) that are consistent with the Programmatic Regulations and applicable law, and establish additional procedures to achieve the goals and purposes of the Plan. The GM are fundamental to the integrated framework; provide direction for using the tools for planning, implementation, and evaluation; and provide assurances that the goals and purposes of the Plan will be achieved. The GM address numerous topics including common methods, general procedures, and guidance to implement the Plan. The six program-wide subjects for the GM as set forth in the Programmatic Regulations are:

- GM#1: Project Implementation Reports
- GM#2: Formulation and Evaluation of Alternatives for PIRs
- GM#3: Savings Clause Requirements
- GM#4: Identifying Water Made Available for the Natural System and for Other Water-related Needs
- GM#5: Operating Manuals
- GM#6: Assessment Activities for Adaptive Management

These GM are currently in draft form and were used to develop this PIR.

1.6 RELEVANT DOCUMENTS AND REPORTS

Reservoir storage was identified in the Restudy as the key component for the restoration of the Caloosahatchee River and estuary. The Restudy analysis identified a conceptual C-43 Basin Storage Reservoir Project of approximately 160,000 acre-feet of above ground storage for environmental restoration for the Caloosahatchee River and Estuary. This storage amount was established through various previously completed modeling efforts. In the Restudy analysis of the Caloosahatchee Basin, an acceptable salinity range for the estuarine ecosystem was established that translated to mean monthly freshwater inflows of 300 cubic feet per second (cfs) to 2800 cfs at S-79. This flow target included the need for low flow augmentation and minimizing high flow discharge events to improve estuarine water quality and to protect and restore estuarine habitat and biota. This flow target at S-79 helped produce modeling results indicating the most efficient size for determining the storage capacity of reservoirs to capture local basin and Lake Okeechobee inflows.

Since the Restudy, additional information has been developed (improved modeling, improved analysis of local hydrology and water budgets, and new estimates of land use and water demands) that refines the amount of storage identified as necessary to meet the needs of the Caloosahatchee Estuary and Basin. In 1998, the SFWMD undertook a water supply planning initiative to ensure prudent management of south Florida’s water resources. As a result of this initiative, the SFWMD released the CWMP in the year 2000. The CWMP analysis determined that the projected surface water needs of the Caloosahatchee River and Estuary can be met during a one-in-ten drought condition with the development of water management and storage infrastructure that effectively captures and stores surface water flows in the basin. The CWMP determined that improved management for surface water through storage could increase freshwater availability in the region and reduce potential impacts resulting from water use. The CWMP identified that at a conceptual level a storage reservoir with a capacity of 220,000 acre-feet (ac-ft) located in the lower West Caloosahatchee Basin would be adequate for environmental restoration of the Caloosahatchee Estuary.

Although the Restudy alternative provided information on the necessary storage volume, it did not provide project-specific details such as a location for the reservoir. Unlike the Restudy, the CWMP identified a suitable location for the storage reservoir in the Caloosahatchee Basin. Based on the findings of the CWMP, the West Basin Berry Groves site, together with adjacent and separately owned land south of the Caloosahatchee River, was identified as the ideal location for placement of a reservoir to meet the needs of the estuary.

Despite differences between the Restudy and the CWMP, both planning efforts arrived at the similar conclusion that above-ground water storage reservoirs were the most cost effective and appropriate method for the attenuation of freshwater runoff and capture of Lake Okeechobee inflows in the Caloosahatchee Basin.

1.7 CERP MASTER IMPLEMENTATION SEQUENCING PLAN

Included within Section 10 of the *Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* dated April 1, 1999, was the original sequencing plan for the implementation of the CERP. Section 10 described the project implementation process and the schedules developed to implement the recommended Plan. Subsequent to the completion of the aforementioned environmental impact statement (EIS), the Implementation Plan was first updated in July 2001 and was known as the Master Implementation Schedule (MIS 1.0). MIS 1.0 updated the Implementation Plan and documented the status of CERP at that time.

The Master Implementation Sequencing Plan 1.0 (MISP 1.0), dated March 2005, built on these previous efforts and incorporated new information, implementation experience to date, and changes in legislation. The new information included the requirements in WRDA 2000 and the subsequent programmatic regulations, as well as the effects of the streamlining contained in the State of Florida's Acceler8 initiative (an accelerated implementation schedule for several CERP components). Acceler8 will hasten CERP implementation while maintaining the relationship of the MISP and the partnership between SFWMD and the USACE. The MISP 1.0 identified the Caloosahatchee River (C-43) West Basin Storage Reservoir project as a Band 1 project (completion in 2010) that would be constructed by the State of Florida under their Acceler8 program. The recommendations contained in this report for additional investigations in the Caloosahatchee Basin may lead to an update of the next version of the MISP.

1.8 THE STATE OF FLORIDA'S ACCELER8 PLAN

The State of Florida has developed a plan called "Acceler8" for the purpose of accelerating design and construction of a number of critical restoration projects consistent with the CERP but prior to one or more of the following: Administration approval, Congressional committee resolution, Congressional authorization, or Federal construction funding. The State anticipates the Acceler8 program will provide immediate environmental, social, and economic benefits in the south Florida region. All Acceler8 projects must be specifically authorized by Congress before becoming a part of the Federal CERP. The SFWMD is the State agency responsible for water resources management in south Florida and acts as the non-Federal sponsor for Federal water resources projects, including CERP. The SFWMD is the lead agency for the State on implementing the Acceler8 plan and will need to acquire the Department of the Army permits under Section 404 of the Clean Water Act prior to construction.

The Acceler8 program consists of a number of projects, including "C-43 West Storage Reservoir Project." The Acceler8's C-43 Reservoir is referred to in this PIR as the Caloosahatchee River (C-43) West Basin Storage Reservoir project (see www.Acceler8Evergladesnow.org). The USACE and SFWMD anticipate that the SFWMD will accelerate construction and achievement of benefits of certain CERP projects by obtaining required permits and initiating construction upon completion of the Final EIS for the Federal CERP project.

The SFWMD proposes to construct the C-43 West Storage Reservoir Project, prior to implementation of the Federal Caloosahatchee River (C-43) West Basin Storage Reservoir project. The USACE is proceeding with two separate and independent but related actions: the planning evaluation of the Federal project and the regulatory evaluation of the SFWMD's proposed project, both of which are described in this Final PIR/EIS. The C-43 West Storage Reservoir Acceler8 project is the same as the selected alternative plan, described in this Final PIR/EIS. Therefore, it is anticipated that this Final PIR/EIS will also serve as the basis for the Regulatory Division's NEPA evaluation of the SFWMD's proposed Acceler8 project.

Concurrent with the Final PIR/EIS, the USACE Regulatory Division is circulating a Public Notice which describes the Acceler8 project and provides additional information applicable to the regulatory evaluation and is not included in this Final PIR/EIS. The Public Notice is available for public and agency review at the same time as this Final PIR/EIS for the proposed Federal project. For details of the SFWMD's proposed Acceler8 project or a copy of the

Public Notice, the reader is referred to the USACE's Jacksonville District web site at http://www.saj.usace.army.mil/pao/hotTopics/acceler8.htm.

1.9 LAND ACQUISITION ACTIVITIES

As described previously, storage of water within the Caloosahatchee Basin has been established as one of the primary management measures contributing to the goals and purposes of the Restudy. The SFWMD and others have been very proactive in acquiring lands needed for CERP implementation. Based on the findings of the Restudy and CWMP, which both call for a storage reservoir in the Caloosahatchee Basin, the SFWMD determined the best location to use both State and Federal funds to acquire property in the Caloosahatchee Basin. The Federal funds used for this project were appropriated to the DOI and a Grant Agreement entitled Everglades Watershed Restoration-Grant Number LWCF-1 was executed to acquire south Florida ecosystem restoration project lands in the C-43 Basin. The Florida Division of State Lands, in cooperation with the staff of the SFWMD, reached an agreement that allowed the SFWMD to acquire the Berry Groves and some adjacent property as a key component for Everglades restoration (February 2000). To date the State of Florida has purchased a total of 12,372 acres in the immediate area in anticipation of reservoir construction with Federal funding provided by the DOI at a total of approximately $32,800,000, a portion of which ($27,567,669) will be credited to the Federal government towards the acquisition of lands required for this project. SFWMD is the process of exchanging approximately 541 acres of this previously acquired land for approximately 600 acres adjacent to the property originally acquired. The revised total land would be approximately 12,430 acres. Of this approximately 12,430 acres, the Caloosahatchee River (C-43) West Basin Storage Reservoir project will require approximately 10,700 acres, of which approximately 10,480 acres will be required in fee, approximately 20 acres will be required in perpetual channel easement and approximately 200 acres will be required in temporary easements for staging areas.

The amount of the Federal credit may be increased or decreased based on more detailed analysis during the crediting review process after approval of the Project, execution of a Project Cooperation Agreement (PCA) and certification of land.

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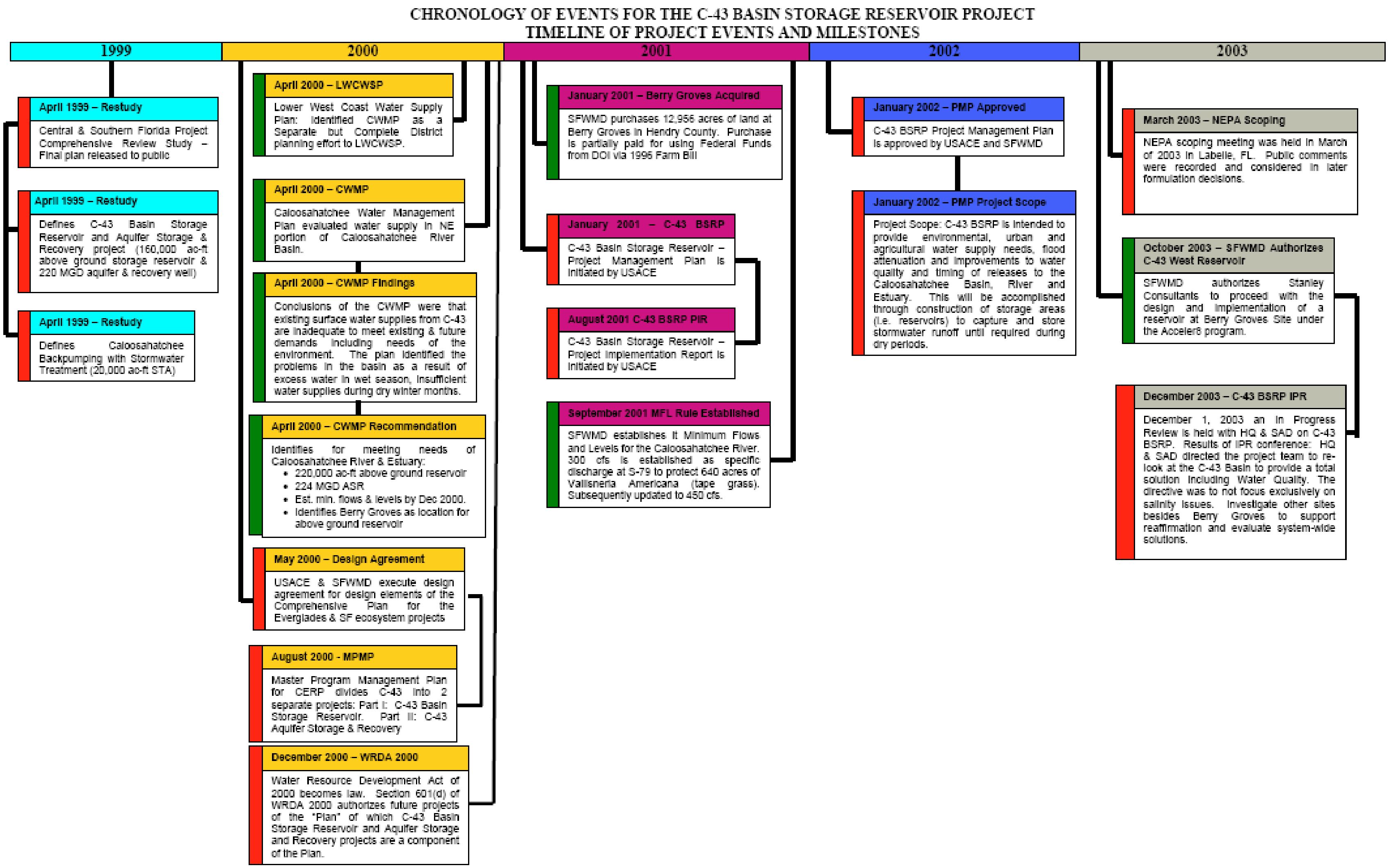

FIGURE 1-4: TIMELINE OF EVENTS AND MILESTONES FOR THE PROJECT

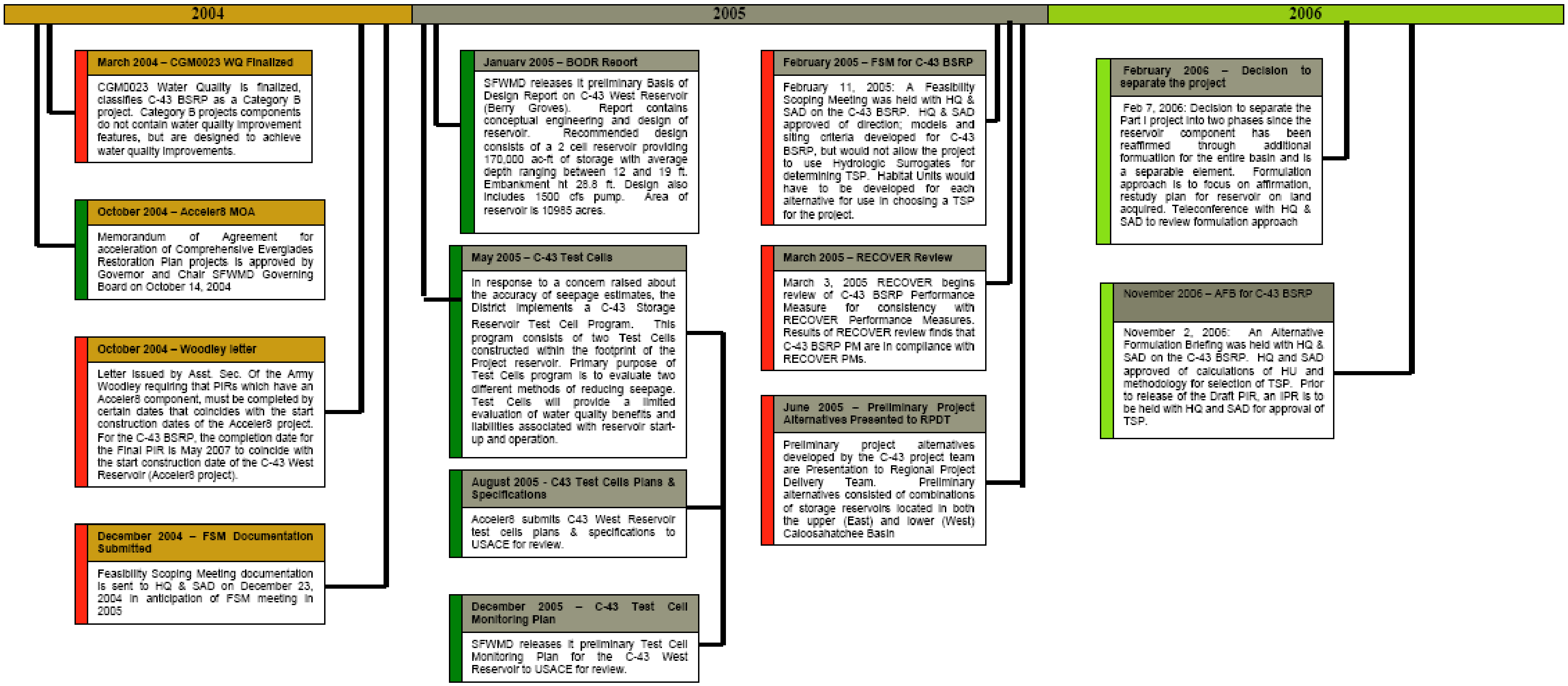

FIGURE 1-4: TIMELINE OF EVENTS AND MILESTONES FOR THE PROJECT (CONTINUED)

SECTION 2
EXISTING CONDITIONS/AFFECTED ENVIRONMENT

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2.0 EXISTING CONDITIONS/AFFECTED ENVIRONMENT

2.1 GENERAL ENVIRONMENT

The Caloosahatchee River and Estuary extend about 70 miles from Lake Okeechobee to San Carlos Bay on Florida's southwest coast. The river basin drains an area of approximately 1,758 square miles. The Caloosahatchee River was originally a shallow, meandering river with headwaters in the proximity of Lake Hicpochee (Science Subgroup 1996). A canal was dredged to connect the Caloosahatchee to Lake Okeechobee in 1881, in order to lower the water table of Lake Okeechobee. It was first channelized to improve navigation and flood control from 1910 to 1930. Three lock-and-dam structures were added to control flow and stage height.

The most downstream structure (S-79) marks the beginning of the Caloosahatchee Estuary. Also referred to as the W.P. Franklin Lock and Dam, this structure maintains specific water levels upstream, regulates freshwater discharge into the estuary, and acts as a barrier to saltwater intrusion into the river. The Moore Haven Lock (S-77), located on the southwest shore of Lake Okeechobee, regulates lake waters. The Ortona Lock (S-78) aids in control of water levels on adjacent lands upstream and separates the Caloosahatchee River (C-43) into eastern and western basins.

Land use within the Caloosahatchee Watershed is dominated by pasture and agriculture, particularly in the upper part of the Caloosahatchee River basin. The West Coast has seen extremely high rates of urbanization in recent years. The major urban areas that occur along the Tidal Caloosahatchee watershed are Ft. Myers, on the south bank, and the large residential areas of Cape Coral and North Ft. Myers, on the north bank.

The Caloosahatchee River serves as an outlet from Lake Okeechobee to the Gulf of Mexico and is the major source of surface water supply for the lower west coast region. It provides agricultural and residential irrigation and public water supplies and is a source of drainage for private drainage systems and local drainage districts. The Caloosahatchee River makes up part of the Okeechobee Waterway, linking the Gulf of Mexico to the Atlantic Ocean through Lake Okeechobee and the St. Lucie Canal and River.

The project footprint covers approximately 10,700 acres, approximately 10,480 acres of land required in fee, approximately 20 acres of perpetual channel easement and approximately 200 acres of temporary easements for staging areas with all the land being located in Hendry County west of LaBelle. The site is a few miles south of State Road (SR) 80 and approximately two miles west of SR 29. The property is predominantly owned by the SFWMD and is under a leasing agreement with Jack M. Berry, Inc. for agricultural land use. Currently the

SFWMD is processing an exchange of 541.31 acres located north of the project boundary for the 600.1-acre Paul Property. This was necessitated by a requirement to locate the reservoir footprint away from existing power lines to the north and a need for additional lands to the east or west in order to maintain storage. The project site is currently a producing citrus grove. The site contains three major arterial canals that transport water for the purpose of irrigation and attenuation of Caloosahatchee Basin runoff waters. Two of the three canals, Roberts and Townsend, lie along the eastern and western perimeters of the footprint, respectively, The Header Canal, also called the LPDD Canal, transects the entire reservoir area and its use is primarily to cross feed water between the Roberts and Townsend Canals. These major canals are shown in ***Figure 2-1***.

Approximately 267 acres within the project site have been impacted through construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir Test Cells Project. The SFWMD initiated construction of the test cells in January 2006, in order to evaluate seepage and water quality effects and improve embankment design. The test cells are also shown in ***Figure 2-1***.

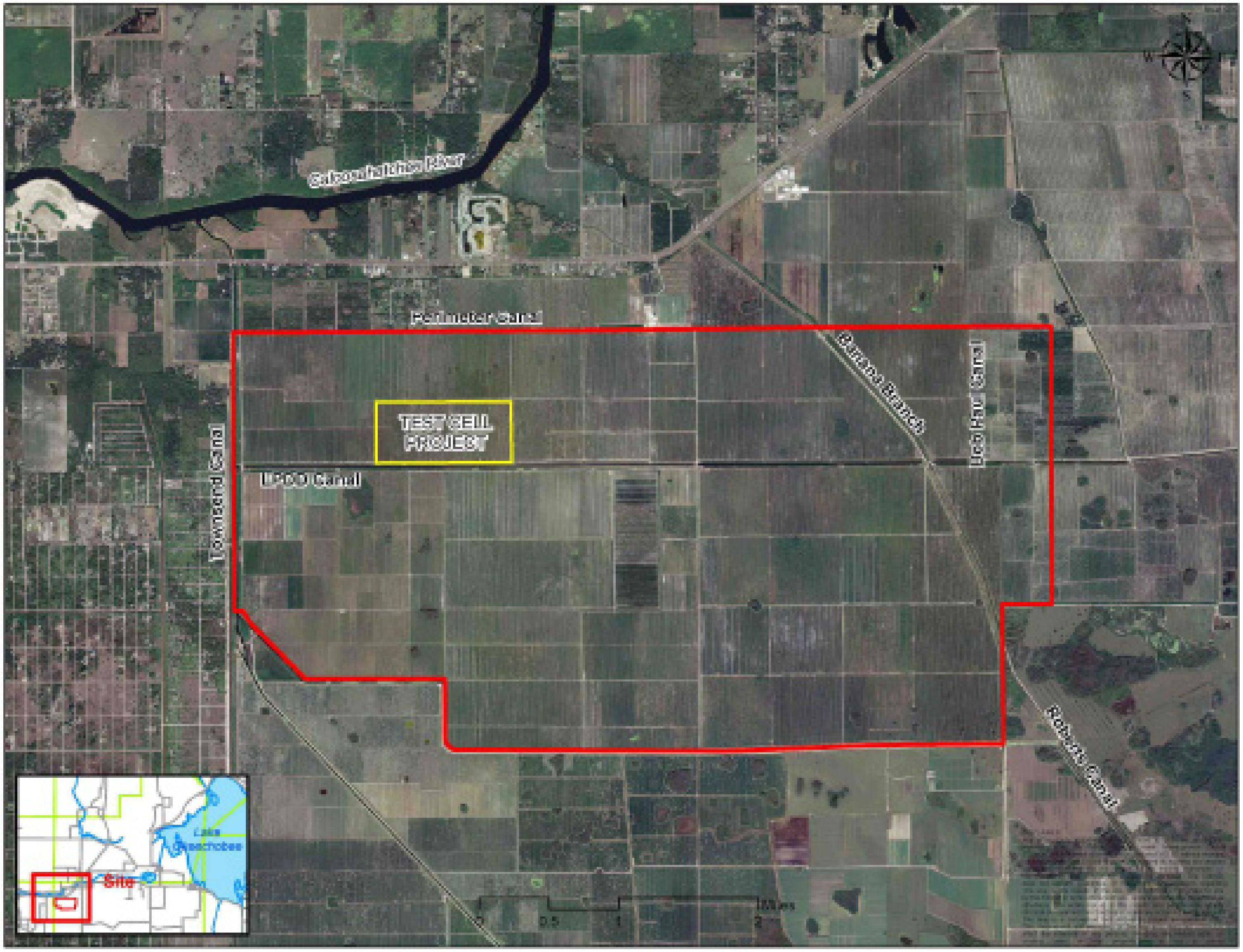


FIGURE 2-1: CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR SITE MAP

2.2 CLIMATE

The climate in southern Florida is subtropical and humid, with temperatures ranging from 60°F (16°C) in midwinter to around 80°F (27°C) in summer. The summer heat and humidity is tempered by frequent afternoon and evening thundershowers, which accounts for most of the region's rainfall. The winter months are dryer.

Average yearly rainfall is approximately 52 inches within the basin, with monthly averages ranging from two to ten inches. Two-thirds of the annual rainfall occurs in the wet season from May to October. There is also a high variability in rainfall at different locations in the basin. The inland portion of the basin receives more rain than the coast during the dry season. On average the wet season rainfall is greater along the coast. Although November is usually the driest month of the year, April is the month with the greatest water demand. During the spring months, cold fronts stall to the north of southwest Florida, causing drier weather and forcing water tables to their lowest levels of the year. This time of year is prone to frequent wild fires, sparked by the dry conditions.

Since climate will influence but not be influenced by the proposed project, it will not be further discussed in the evaluation of environmental effects later in this report.

2.2.1 Sea Level Rise

Sea level rise will have the most impact on coastal canals and communities, with loss of flood protection and increased saltwater intrusion being the primary impacts. Additionally, coastal ecosystems and estuaries may be adversely affected and would require additional deliveries of fresh water to maintain desirable salinity patterns and healthy ecosystems.

Sea-level rise is one of the more certain consequences of climate change, and because it affects the land/ocean interface, it has the potential for environmental impacts on coastal areas. Sea level rise will be discussed in Section 3.2 Future Without Project Condition, but will not be discussed in the evaluation of environmental effects later in this report since it will not be influenced by the proposed project.

2.3 PHYSICAL LANDSCAPE

2.3.1 Geology

A portion of the Caloosahatchee Drainage Basin, which encompasses both Collier and Hendry Counties, lies within the physiographic region denoted as the Sandy Flatlands or Gulf Coastal Lowlands, is characterized by terraced plains.

These terraced plains largely control the topography of the area that extends northward into Glades and Charlotte counties, westward to the Gulf of Mexico, and southward into Monroe County. The sands were deposited as three marine terraces: Talbot, Pamlico, and Silver Bluff, all of which were produced during the Pleistocene Epoch. The Talbot terrace ranges from 25 to 42 feet above sea level and is considered the highest in elevation within the subject area. The Pamlico terrace ranges from eight to 25 feet above sea level, and the Silver Bluff terrace, the lowest in elevation; is less than ten feet above sea level and gradates toward the western seaboard.

2.3.2 Soils

The soils of the Caloosahatchee River Basin are dominated by somewhat poorly drained sandy soils. These soils are considered recent deposits of limestone origin, underlain by marl and/or limestone.

A geotechnical engineering evaluation performed at the project site encountered a surficial layer of sands with isolated zones of silty sand material, one to fifteen feet thick. Below this sandy deposit, a layer of interbedded zones of silty sand, clayey sand, sandy clay, and sandy silt materials, 1 foot to 20 feet thick, was encountered. Below this sand/silt/clay mix deposit, limestone material was generally encountered with a thickness ranging from 2 feet to 12 feet, with isolated areas where the limestone deposit was thicker than 30 feet. Some of the borings performed did not encounter the limestone material. Below the limestone material and until boring termination depths, clayey deposits were encountered. These clayey deposits mainly consist of sandy silt, sandy clay, and clayey sand materials.

2.3.3 Aquifers

Three major aquifers, or producing zones, and three confining beds have been identified within the sequence of rocks for the study area. The upper surficial aquifer consists of sands, shells, and limestones, within the sediments of the Ft. Thompson and Tamiami Formations that are Holocene-Pliocene age, respectively. This aquifer and the lower Tamiami/Ochopee aquifer are separated by the Bonita Springs Marl confining unit. Below the lower Tamiami aquifer lies another confining unit of the Miocene age sediments, Upper Peace River confinement. The Sandstone aquifer is sandwiched between the Upper Peace River and Basal Peace River confining unit.

The lower Hawthorn/Tampa producing zone (which includes the basal part of the lower Hawthorn aquifer of Sproul et al., 1972) and the Suwannee aquifer are considered parts of the Floridan Aquifer System (FAS).

2.4 HYDROLOGY

Water for urban and agricultural uses in the Caloosahatchee River (C-43) Basin is supplied from both groundwater and surface water systems. Surface water is used primarily for agricultural irrigation, with groundwater being used in areas that do not have access to the river. In addition, the Caloosahatchee River is a potable water supply source in Lee County. Groundwater and surface water are dependent upon rainfall for recharge.

The Caloosahatchee River (C-43 Canal) receives water from Lake Okeechobee, runoff from the basin, and base flow from the Surficial Aquifer System (SAS). The river in turn supplies water for public supply, agriculture, and the environment. This source can be unreliable during the dry season or in periods of inadequate rainfall, when releases are required from Lake Okeechobee to meet demand. The USACE manages the Caloosahatchee River (C-43 Canal) via a regulation schedule, which presently accommodates navigation, flood protection, water supply, and environmental needs.

The Lake Okeechobee Demand Service Area (LOSA), defined as the area that is or could be supplied by surface water from the Caloosahatchee River, is the primary source for agricultural irrigation and surface potable water supply in the Caloosahatchee Basin. This area extends from the Franklin Lock (S-79) eastward to the Moore Haven Lock (S-77) and includes land in Lee, Glades, and Hendry counties.

Other surface water bodies in the Caloosahatchee Basin area include lakes, rivers, and canals. These areas provide storage and allow conveyance of surface water. Lake Hicpochee is the largest lake in the area and is bisected by the Caloosahatchee River (C-43) just west of Lake Okeechobee. Numerous canals and tributaries in the basin area drain into the Caloosahatchee River. The major tributaries are the Orange River and Telegraph Slough, which drain into the Caloosahatchee River (C-43) in the western portion of the basin near W. P. Franklin Lock and Dam (S-79). The majority of the canals in the basin were constructed as surface water drainage systems rather than for water supply purposes.

Surface water flows in the basin are derived from rainfall within the basin and discharge from Lake Okeechobee. Runoff from the West Caloosahatchee Basin is slightly higher than runoff from the East Caloosahatchee Basin indicating greater flow attenuation in the eastern basin due to the flatness and thick, sandy soils (Fan and Burgess, 1983). Inflow from Lake Okeechobee is the primary flow in the river during the dry season. Water is released from the lake to meet the supplemental agricultural water demand as well as supplying water for municipal consumptive use. Water is also released to reduce lake stages before the hurricane season. High volume water releases to lower Lake

Okeechobee during high rainfall seasons may result in very high flows to the estuary. There is little water storage in the basin. The intensive drainage on the south side of the river provides little storage. The north side of the river is largely undeveloped west of Lake Hicpochee, and although there is considerable wetland water storage, it is not managed water storage.

Groundwater is an important component of the agricultural water supply in the freshwater portion of the Caloosahatchee Basin. The groundwater resources in the area include the surface aquifer, the intermediate aquifer and the Floridan aquifer system (FAS). The yield and storage of the groundwater is highly variable throughout the basin. Where ever it is possible, surface water has been used for irrigation purposes. The surface aquifer system (SAS) is used for some irrigation in eastern Hendry and Glades counties.

The intermediate aquifers are used primarily for irrigation in the western portion of Hendry County. There is local recharge to both the surficial and intermediate aquifers. The Floridan aquifer which is located in the northwest corner of the Caloosahatchee Basis is used for irrigation in northern Glades County (groundwater is mixed with surface water for irrigation use). The water from the FAS is too highly mineralized elsewhere in the basin. This deep aquifer is recharged from outside the area.

There are three structures that provide for navigation and water control in the Caloosahatchee River (C-43 Canal). These structures serve to control the water stages in Caloosahatchee River (C-43) from Lake Okeechobee and the Moore Haven Lock (S-77) to W. P. Franklin Lock and Dam (S-79). Water levels upstream of the Ortona Lock (S-78) are maintained at approximately 11 feet National Geodetic Vertical Datum (NGVD), and three feet NGVD downstream. The W. P. Franklin Lock and Dam (S-79) serves as a saltwater barrier and maintains an upstream level of approximately three feet while the downstream NGVD elevation is generally near one foot. The operation schedule for these structures is dependent on rainfall conditions, agricultural practices, the need for regulatory releases from Lake Okeechobee, and the need to provide water quality control for the Public Water Supply (PWS) facilities. Detailed operation information for structures S-77, S-78, and S-79 can be obtained from the Water Control Plan for Lake Okeechobee and the Everglades Agricultural Area (EAA), Jacksonville District, USACE, July 2000.

The project site has numerous agricultural canals that provide water control. A large, deep, east/west canal (Header Canal) bisects the north central portion of the grove and drains into the Townsend Canal along the western and southern boundaries. Other smaller east/west canals drain into north/south canals that drain into the Header Canal. In most areas, north/south ditches are spaced every 250 feet and drain beds containing nine to ten rows of citrus trees. ***Figure***

2-2, Caloosahatchee River (C-43) West Basin Storage Reservoir Wetland and Surface Water Map, shows the extensive network of canals and ditches within the project site.

2.5 WATER MANAGEMENT

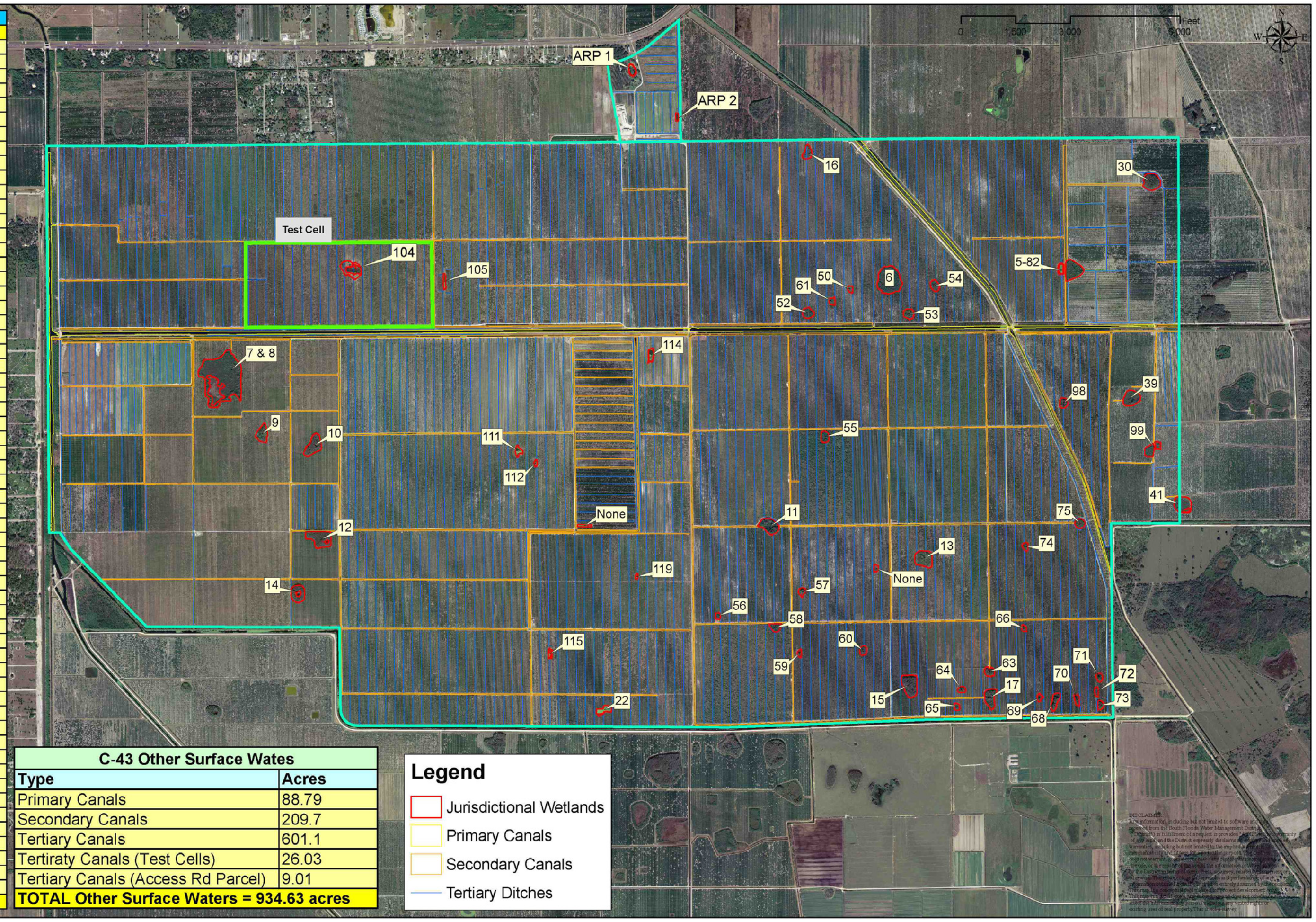
2.5.1 Water Supply

The Caloosahatchee River is the major source of surface water supply for the lower west coast region. It provides agriculture and lawn irrigation, potable water supply and also provides drainage for private drainage systems and local drainage districts.

The Caloosahatchee River Estuary is a large system where the waters of the Gulf of Mexico mix with the freshwater inflows from the river, sloughs, and overland sheetflow in the basin. The area is characterized by a shallow bay, widespread seagrass beds and sand flats. Extensive mangrove forests dominate undeveloped areas of the shoreline.

Lake Okeechobee is the largest freshwater lake in the southeastern United States, covering 730 square miles. It receives significant volumes of runoff from the Kissimmee River (beginning near Orlando), the Upper Chain of Lakes, Lake Istokpoga, and numerous small inflows along its the north shore. During the predevelopment period, Lake Okeechobee discharged to the south and west, into the Everglades and occasionally into the Caloosahatchee Basin during high water periods. The USACE and the SFWMD now control outflows from Lake Okeechobee and can direct flows via an intricate canal system southward into the EAA, to the southeastern coastal urban areas, to the Atlantic Ocean via the St. Lucie River, or to the Gulf of Mexico via the Caloosahatchee River. Inflows to Lake Okeechobee are now faster than they were during the pre-development period, due to channelization of the Upper Chain of Lakes and the Kissimmee River. Additionally, Lake Okeechobee is now confined within its banks by encircling levees (the Herbert Hoover Dike [HHD]) and the historic overflows to the south can no longer occur. During unusually wet years, Lake Okeechobee levels rise until water must be released to the west and east coasts through the Caloosahatchee (C-43) and St. Lucie (C-44). Thus, the Caloosahatchee River (C-43 Canal) now carries late wet season flows that are higher than occurred prior to its connection to Lake Okeechobee. During the end of the dry season or during unusually dry years, flows in the river are lower than historic flows, due to increased water supply demand in the basin.

C-43 WSR Wetlands			
SFWMD ID #	USFWS ID #	TYPE	Acres
283510	16	PSS1,3	1.55
293118	30	PFO2	4.04
283617	5-82	PSS3	4.66
283507	6	PSS1,3	9.15
283609	54	PSS1,3	1.35
283506	50	PSS1,3	0.51
283505	61	PSS1,3	0.64
283504	52	PSS1,3	1.65
283508	53	PSS1,3	1.48
280555	7 & 8	PSS1,3	28.51
290624	39	PSS1,3	3.58
280112	98	PSS1,3	1.17
280550	9	PFO2,3	2.58
280259	55	PSS1,3	1.32
280549	10	PFO2,3	3.98
290627	99	PSS1,3	0.66
290625	99	PSS1,3	1.61
290626	41	PSS1,3	4.04
280258	11	PFO2	3.86
280113	75	PSS3	1.38
280847	12	PFO2	5.40
281260	74	PSS3	0.61
281214	13	PSS3	4.22
281115	61	PSS1,3	0.48
280848	14	PFO2	3.46
281116	57	PSS3	0.77
281057	56	PSS1,3	0.51
281156	58	PSS1,3	1.28
281261	66	PFO2	0.42
281173	60	PSS3	0.94
281174	59	PSS3	0.42
281269	63	PFO2	1.33
281263	71	PSS3	0.78
281172	15	PFO2	4.91
281271	64	PSS1,3	0.67
281262	72	PSS3	0.49
281268	17	PSS3	3.07
281266	68	PFO2	1.76
281267	69	PSS3	0.51
281265	70	PFO2	0.83
281264	73	PFO2	0.81
281270	65	PSS3	0.58
283611	5-82	PEM1/2	0.44
283611	5-82	PAB3/4Hx	0.63
283402	105	PAB4Hx	0.61
280352	114	PAB3/4Hx	1.13
280453	111	PAB3/4Hx	0.82
280354	112	PAB3/4Hx	0.33
280351	None	PAB3/4Hx	0.50
281046	119	PAB3/4Hx	0.18
281045	115	PEM1/2	0.33
281045	115	PAB3/4Hx	0.30
281044	22	PAB3/4Hx	1.36
281044	22	PAB3/4Hx	0.19
TC # 1	104	PEM1/2	4.50
TC # 2	104	POWHx	1.89
ARP 2	None	POWHx	0.38
ARP 1	None	PUB	0.98
ARP 1	None	PEM1/2	0.19
Total Wetland Acres = 126.68			



C-43 Other Surface Wates	
Type	Acres
Primary Canals	88.79
Secondary Canals	209.7
Tertiary Canals	601.1
Tertiraty Canals (Test Cells)	26.03
Tertiary Canals (Access Rd Parcel)	9.01
TOTAL Other Surface Waters = 934.63 acres	

Acceler8
South Florida Water Management District
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West Palm Beach, FL 33401
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EXHIBIT 1

C-43 West Storage Reservoir
Wetland and Surface Water Map

UPDATED 6/19/07

FIGURE 2-2: CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR WETLAND AND SURFACE WATER MAP

2.5.2 Water Demands

Non-environmental surface water demands within the basin are primarily agricultural with some potable water supply, commercial and industrial uses. The commercial and industrial demands vary greatly by type of business. In the project vicinity, commercial and industrial demands constitute about one percent of the overall water demand. Because the demand is relatively small and difficult to generalize, an average demand is not calculated for this use category. The emphasis is placed on estimation of agricultural and potable water uses.

A thorough investigation of water use for the Caloosahatchee River and surrounding basins was conducted by the SFWMD for the CWMP. Detailed information derived from this investigation can be found in the SFWMD CWMP Planning Document, April 2000. ***Table 2-1*** summarizes the water use allocation for major agricultural land use categories for the CWMP area based on the Integrated Surface Water/Ground Water Model.

TABLE 2-1: SUMMARY OF 1995 WATER USE DEMAND BASED ON THE INTEGRATED SURFACE WATER/GROUND WATER MODEL FOR MAJOR AGRICULTURAL LAND USE CATEGORIES

Crop	Water Use (acre-feet/year)
Citrus	143,000
Sugarcane	110,000
Vegetables	36,000
Total	290,000

Note: Based on 1995 land use, MIKESHE results indicate an additional 30,000 acre-ft/year of irrigation in addition to citrus, sugarcane and vegetables.

2.5.3 Water Usage

Every five years, the U.S. Geological Survey (USGS) estimates annual water withdrawals for Florida at the county-level. The most recent publication of findings was entitled "Water Withdrawals, Use, Discharge, and Trends in Florida, 1995" (USGS, 1995). Water use estimates for 2000 were not published at the time of this analysis. However, unpublished water use estimates for 2000 for the counties included in this water use analysis were obtained from the USGS. These uses are distributed as public-supply and self-supply domestic (residential), commercial, industrial, government, and recreational water use estimates, along with unaccounted-for water loss estimates. ***Table 2-2*** presents the USGS estimate of water use, excluding mining and power generation water use, for 2000 for the four county study area. Total public-supply water use for the region is estimated at 71.85 million gallons per day (MGD), and total municipal and industrial (M&I) water use is estimated at 115.17 MGD. The addition of the 680.63 MGD of agricultural water use increases total water use for the region to 796.24 MGD. Agricultural water use accounts for 85 percent of the total use; public-supply water use accounts for nine percent and recreational self-supply accounts for about 3 percent.

On the county level, the largest total water user in the study area in 2000 was Hendry County, mainly because of agricultural water use. Hendry County used a total of 512.11 MGD, or 64 percent, of the total regional water use. Of this amount, 503.91 MGD (or 98 percent) was agricultural use and 4.72 MGD was public-supply M&I water use. Lee County's public-supply water use was about 52 MGD. Lee County's total water use was 144.95 MGD, the third highest in the region. Lee County had the highest self-supply domestic water use in the region at 8.86 MGD. Lee County also had high recreational water use of 22.66 MGD.

TABLE 2-2: USGS ESTIMATED TOTAL WATER USE, FOR SELECTED COUNTIES, 2000-EXCLUDING MINING AND POWER GENERATION (MGD)

	Municipal and Industrial							
		Self-Supply						
County	Public Supply	Domestic	Commercial	Industrial	Recreation	Sub Total	Agriculture	Grand Total
Charlotte	14.21	3.55	0.11	0	3.48	21.35	47.19	68.54
Glades	0.55	0.61	0.04	0	0.42	1.62	69.02	70.64
Hendry	4.72	1.67	0.21	0.51	1.09	8.2	503.91	512.11
Lee	52.37	8.86	0.46	0.09	22.66	84.4	60.51	144.95
Total	71.85	14.69	0.82	0.6	27.65	115.57	680.63	796.24

NOTE: Recreation self-supply water use includes golf course irrigation.
Source: USGS unpublished data, 2002.

2.6 WATER QUALITY

The water quality conditions upstream and downstream of the S-79 structure were evaluated as part of recent Florida Department of Environmental Protection (FDEP) efforts within the Caloosahatchee River (C-43) Basin. The FDEP Verified List for the Caloosahatchee, (FDEP June, 2005) identifies impaired waters in the Caloosahatchee River (C-43) sub-basin as well as the Caloosahatchee Estuary sub-basins. The report was prepared in order to meet the requirements of the Federal Clean Water Act (CWA). Under Florida's implementation of the CWA, waters listed as impaired are then subject to the development of Total Maximum Daily Loads (TMDLs) intended to limit the future discharge of the offending pollutant by point and non-point contributors.

The FDEP has divided the Caloosahatchee Basin into five planning units. Two planning units, East Caloosahatchee and West Caloosahatchee, are the two sub-basins that are upstream of the S-79 structure on the Caloosahatchee River (C-43 Canal). The three remaining planning units, Telegraph Swamp, Orange River, and Caloosahatchee Estuary, are downstream of the S-79 structure. To date, the EPA and DEP have developed several TMDLs within the Caloosahatchee Basin. For instance, for water body 3256 located in the East Caloosahatchee Planning Unit, TMDLs have been proposed for BOD, total nitrogen, and total phosphorus. In addition a TMDL has been developed for fecal coliform for 9-mile canal. As part of the subsequent Caloosahatchee Watershed PIR, the Corps and the SFWMD will coordinate with EPA and DEP in the ongoing development of additional TMDLs for the basin. In 2002, the FDEP performed a study to determine the relative loadings of total nitrogen and total phosphorus in the Caloosahatchee River (C-43) Basin (Janicki, 2002). This report ranks the sub-basins within the Caloosahatchee River (C-43) Basin in terms of their relative contribution of total nitrogen (TN) and total phosphorus (TP).

A third study, the Caloosahatchee Water Quality Data Collection Program" (ERD, 2002) sponsored by the SFWMD, quantifies pollutant concentrations and loads from the various sub-basins within the Caloosahatchee River (C-43) Basin. Summaries of water quality conditions for upstream and downstream of S-79 are presented below using the above referenced documents as well as other existing information.

2.6.1 Water Quality Conditions Upstream of S-79

2.6.1.1 Impaired Waters

The East Caloosahatchee and West Caloosahatchee planning units are the two sub-basins that lie upstream of the S-79 structure. While all of the East Caloosahatchee sub-basin is upstream of the planned reservoir, approximately 70 percent of the West Caloosahatchee sub-basin is upstream of the planned reservoir. The water quality conditions in these two sub-basins will have a significant impact on the reservoir water quality. The predominant land use in both of these planning units is agriculture. Water quality impairments in this sub-basin are primarily caused by non-point sources rather than point discharges from sewage treatment plants or other industrial activity. Within the East Caloosahatchee unit, six water body segments have been identified as impaired. Within the West Caloosahatchee planning unit, a total of three water body segments have been identified as impaired. The impairments are lead, coliforms, iron, dissolved oxygen, copper, and nutrients. In the West Caloosahatchee planning unit, there are three water bodies that have been identified as impaired; one is impaired for iron and lead, one is impaired for nutrients, and the third water body, the Townsend Canal (located immediately upstream of the planned reservoir intake) which has direct interest to this project, is impaired for copper and lead.

2.6.1.2 Pollutant Loading

Water quality pollutant loading upstream of the S-79 structure is composed of loading from runoff generated within the basin and from loading that results from Lake Okeechobee releases. Excluding the load from Lake Okeechobee releases, approximately 50 percent of the TN load resulting from runoff in the Caloosahatchee Basin comes from basin lands upstream of S-79. Similarly, excluding the phosphorus load from Lake Okeechobee releases, approximately 65 percent of the TP load resulting from runoff in the Caloosahatchee Basin comes from basin lands upstream of the S-79. When Lake Okeechobee flows and loads are included, more than 75 percent of TN and TP loads to the Caloosahatchee Estuary are a result of discharges at S-79 (ERD, 2002).

2.6.2 Water Quality Conditions Downstream of S-79

2.6.2.1 Impaired Waters

The three watershed planning units downstream of S-79 are Telegraph Swamp, Orange River, and Caloosahatchee Estuary. Within these three planning units, land use patterns transition from agricultural/natural areas in the east to residential in the west. In the FDEP Verified List, there are no impaired waters in Telegraph Swamp planning unit.

As the furthest downstream planning unit, the Caloosahatchee Estuary has to contend with its own pollution plus pollutants from the four upstream planning units. According to the June 2005 (FDEP) Verified List for the Caloosahatchee, the estuary-planning unit has 13 impaired water body segments, six of which are part of the main estuary and seven of which are tributary streams. All thirteen listed water body segments are impaired for coliforms (either total or fecal), seven are impaired for nutrients, six are impaired for dissolved oxygen, three are impaired for heavy metals (copper, lead), and one is impaired for specific conductivity. The FDEP Basin Status Report (FDEP 2002) states that the observed water quality violations are probably linked to urban land uses within the Caloosahatchee Estuary planning unit, poorly flushed residential tributary streams, and the effect of heavy pollutant loads discharged from upstream sub-basins.

2.6.2.2 Pollutant Loading

Within the Caloosahatchee Estuary planning unit there are a total of 31 permitted sewage treatment plants. The Caloosahatchee pollutant loading report (ERD 2002) includes pollutant-loading estimates for the four largest sewage treatment plants in the Caloosahatchee Estuary as well as for eight tributaries downstream of the S-79 structure. This report includes loading estimates for the following pollutants: ammonia, nitrate, nitrite, total kjeldahl nitrogen, TN, orthophosphorus, TP, and total suspended solids. With the exception of ammonia, ten percent or less of the wet or dry season load of each of these pollutants to the Caloosahatchee Estuary comes from the portion of the watershed downstream of the S-79 structure. During the dry season, approximately five percent of the total ammonia load in the estuary comes from the portion of the watershed downstream of the S-79 structure; however, during the wet season, approximately 40 percent of the ammonia load to the estuary comes from downstream of the S-79 structure. A relatively large amount of the ammonia loading from downstream of the S-79 structure comes from the four large sewage treatment plants. The Caloosahatchee Estuary non-point sources of TN and TP contribute around 20 percent of the total loads delivered to the estuary.

2.6.3 Sediment Quality

Unlike the St. Lucie Estuary, a geographically extensive muck sediment layer is not present in the Caloosahatchee Estuary. This is evidenced by the presence of both freshwater and marine submerged aquatic vegetation (SAV) that usually do not coexist in areas where muck sediments are present. Scientists from the SFWMD and U.S. Fish and Wildlife Service (USFWS) have concluded that flocculent sediments are not a significant cause of water quality problems in the main channel of the Caloosahatchee Estuary.

In 1999 the USGS collected 58 sediment samples from downstream of the S-79 structure and two sediment samples from just upstream of the structure. The five sampling locations relative to the S-79 structure were downstream at mile 3.1, 9.3, 10.5, 12.2, and 23.8. Samples were tested for physical characteristics, organic content, pesticides, and heavy metals. Heavy metal results were compared with Florida Sediment Quality Assessment Guidelines (SQAG). Samples from five sites contained heavy metals (chromium, copper, lead, mercury, and zinc) at levels that exceed the Probable Effects Level (PEL) concentration published in the Florida SQAGs. Although a limited number of samples exceeded the PEL concentrations, bioaccumulation and bioconcentration studies would have to be done to quantify the impact of these sediments on in-situ biota. At present, there is no reason to believe that sediment contamination is a significant concern within the main stem of the estuary.

2.7 PLANT COMMUNITIES

The project footprint is currently an active citrus grove. Natural/biological features and land use within the Caloosahatchee River (C-43) West Basin Storage Reservoir project area were initially reviewed using the 2000 Florida Land Use, Cover and Forms Classification System (FLUCFCS) Geographic Information System (GIS) data. Citrus grove covers approximately 90 percent of the study site, more than any other land cover type. The citrus grove land use classification includes acreage covered by citrus trees, grove maintenance roads, and small berms, brush piles, and other small features related to citrus grove operations. Open water comprises 8.9 percent of the site and includes extensive agricultural canals/ditches, classified as streams and waterways, and excavated ponds, classified as reservoirs less than 10 acres in size. Wetlands which are further discussed in Section 2.8 below comprise 1.1 percent of the site and include mixed wetland hardwoods, willow and elderberry, exotic wetland hardwoods, cypress, wetland shrub, and freshwater marsh.

Citrus groves, row crops and improved pasture with scattered cypress and mixed wetland hardwoods flank the project to the north, east, and south. The area to the north of the project site also contains some low-density residential areas. Forested uplands (parceled into low-density residential lots, various stages of development) such as pine flatwoods, longleaf pine-xeric oak, sand pine, and xeric oak are adjacent to the west of the project. At a landscape level, the Caloosahatchee River (C-43) West Basin Storage Reservoir project is surrounded by a matrix of agricultural, forested, and wetland land cover types, with pockets of urban land use. Urban areas are present to the southwest and northeast of the project area with small parcels along the Caloosahatchee River. Regions to the northwest and southeast of the project area are generally undeveloped.

2.7.1 Exotic Species

Because of its mild climate, international seaports, cultural diversity, and lenient importation laws, Florida has been the epicenter for more exotic species than almost any other region in the country. Some species have remained localized around the release sites, some have died off, and many have extended their ranges to other states. The most severe exotic species threats to the southwest Florida ecosystem come from plants, rather than animals. Therefore, the emphasis on exotics in Florida has been on flora, rather than fauna. The top seven exotic plant species include: Australian pine (*Casuarina* spp.), water hyacinth (*Eichornia crassipes*), hydrilla (*Hydrilla verticillata*), Old World climbing fern (*Lygodium microphyllum*), Melaleuca (*Melaleuca quinquenervia*), torpedo grass (*Panicum repens*) and Brazilian pepper (*Schinus terebinthefolius*) (Schmitz 1994).

Three of the exotic species found in the wetlands (Brazilian pepper, water lettuce, and water hyacinth) are classified by the Florida Exotic Pest Plant Council (EPPC) as Category I exotic species. Category I species are invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.

2.8 WETLANDS

The 2000 FLUCCS GIS data set developed by the SFWMD for the Southwest Florida Feasibility Study (SWFFS) represents the most accurate wetland information available for the Caloosahatchee River Basin and was used for preliminary analyses of wetlands present in the Caloosahatchee River (C-43) West Basin Storage Reservoir Project site. Additional information on wetland location, acreage, type, and habitat function within the reservoir footprint was obtained during interagency field surveys conducted June 8 to 11, 2004, and February 21, 2007; during helicopter surveys conducted June 14 and 15, 2004; and from National Wetlands Inventory Maps and the SFWMD's November 2006 Department of the Army Permit application for the Acceler8 C-43 West Storage Reservoir Project.

In July 2004, the PDT used the Wetland Rapid Assessment Procedure (WRAP) (Miller and Gunsulas, August 1999) to assess existing wetland function within the Berry Grove property. The WRAP analysis and score sheets are further described in the Final CAR contained in ***Annex A***. IN 2007, the SFWMD, USACE, USFWS, and USEPA used the Uniform Mitigation Assessment Methodology (UMAM) Chapter 62-345 F.A.C., to reassess existing wetland function within the project area for SFWMD's Acceler8 regulatory action. The UMAM analysis was performed as a result of the State of Florida adopting UMAM as a rule in February 2004. Subsequently the USACE Regulatory Division agreed to use UMAM as the preferred functional assessment for evaluating impacts to aquatic resources for determining compensatory mitigation. See the Final CAR in ***Annex A*** for more detailed information on wetlands.

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil, for all or part of the year. Wetlands have characteristic soils, water saturation (hydrology), and plant species. The protracted inundation supports the development of distinctive wetland (hydric) soils. The hydrology largely determines the types of plant and animal communities living in and on the soil. Wetlands may support vegetation more commonly associated with water (aquatic species), land (terrestrial species), and/or facultative species that are adapted to both aquatic and terrestrial communities. Wetlands usually support the growth of plants that are particularly adapted to wet conditions (hydrophytes).

Based on the 2000 land use/cover data and maps, wetlands comprise approximately 135,277 acres (15.9%) of the land cover within the Caloosahatchee Basin. The wetland cover classes occurring in the Caloosahatchee River Basin include freshwater marsh and wet prairie, slough waters, wetland hardwood forest, wetland coniferous forest (cypress swamp and cypress/pine/cabbage palm) wetland mixed forest, mangrove swamp, and salt marsh. Other aquatic habitats in the Caloosahatchee River Basin include streams and waterways, lakes, and reservoirs. Those habitats comprise approximately 21,682 acres (2.5%) of the land cover within the Caloosahatchee River Basin.

Based on 2000 land use/cover maps, field surveys, and additional information referenced above, 51 wetlands were identified within the reservoir footprint. Those 51 wetlands comprise approximately 112 acres (less than 1.1%) of the land cover within the reservoir footprint, and include several different land use cover classes (freshwater marsh, wet prairie mixed wetland hardwood, mixed wetland hardwood shrub, cypress, cypress/pine/cabbage palm, exotic wetland hardwood, and "reservoir less than 10 acres). Additional aquatic habitats identified include other surface waters such as agricultural ditches and canals which comprise approximately 914.5 acres (8.8%) of the land cover within the reservoir footprint. The remaining land cover within the footprint is predominantly citrus groves. These acreages were refined during a field visit by the USACE Regulatory Division on February 21, 2007, to verify the jurisdictional limits of the upland/wetland boundaries. As shown in ***Figure 2-2***, jurisdictional wetlands comprise 131.40 acres and other surface water comprises 925.62 acres of the total project area. Of these totals, 6.39 acres of wetlands and 26.03 acres of tertiary canals have already been impacted as a result of construction of the Caloosahatchee River West Basin Storage Reservoir Test Cells Project with 125 acres of wetlands and 899.59 acres of other surface waters remaining. This acreage also includes the entire limits of a wetland on the eastern perimeter of the project that is partially within the project footprint.

Development of the on-site citrus groves included perimeter ditching and regular placement of internal ditches to facilitate rapid removal of excess stormwater and control the depth of the water table. Surface water management regulations require that drainage/irrigation systems be engineered to reduce the potential for off-site flooding from increased runoff. Regulations also require that runoff from small storms be detained to prevent surface water quality degradation from fertilizers and pesticide use. Thus, efforts have been made to incorporate as many existing wetlands and flow ways into the local agricultural reservoir and wet detention system (i.e., impounded wetlands) to attenuate stormwater runoff and provide water quality treatment through sedimentation and nutrient uptake by wetland plants. Small outlying wetlands that could not be included in the reservoir system were not converted to citrus and were left in the landscape sometimes surrounded by ditches and/or dikes. Consequently, the water delivery to and the timing, depth, and duration of inundation of the on-site wetlands was altered resulting in changes to the vegetative community composition over time. For example, impounded wetlands may have become over-inundated while isolated wetlands generally have shortened hydroperiods when compared to hydrologic conditions prior to the citrus grove development.

Thus, wetlands in citrus groves are typically considered "impacted" wetlands or have been converted to reservoirs or wet detention areas.

2.9 FISH AND WILDLIFE RESOURCES

Life cycles, community structure and population densities of the fauna of south Florida are intricately linked to regional hydrology. The existing condition of fish and wildlife has been strongly influenced by the cumulative effects of drainage activities in the early 20th century, the C&SF Project, and the ensuing agricultural and urban development. A critical link in the aquatic food webs, and one that appears to have been adversely impacted by hydrologic alterations, is the intermediate trophic level of the small aquatic fauna. Small marsh fish, macro-invertebrates, and herpetofauna form the link between algal and detrital food web bases of the Everglades, and the larger fish, alligators, and wading birds that feed upon them. Aquatic fauna populations of south Florida are currently diminished due to a reduction in the spatial extent of Everglades wetlands (estimated loss of 50 percent) and changes in hydrology of the remaining wetlands.

As an active citrus grove, the proposed project site provides some limited wildlife habitat.

2.9.1 Estuarine and Riverine Invertebrates

The open bottom habitats in the estuarine and tidal Caloosahatchee are composed of mixtures of sand, mud, shell, and bedrock. Mollusks compose one the larger groups of macroinvertebrates within the Caloosahatchee ecosystems. The wedge clam (*Rangia cuneata)* and marsh clam (*Polymesoda carolineata)* are commonly found associated with mud and sandy bottoms in the Caloosahatchee Estuary. The common oyster (*Crassostrea virginica*) is the dominant species in the oyster reef community. Oyster bars serve as a food source and provide habitat for numerous estuarine species including other mollusks, polychaete worms, decapod crustaceans, and various boring sponges. The more common shrimp species include the pistol (*Alpheus* spp.), common (*Palaemonetes* spp.), grass (*Hippolyte* spp.) and broken-back (*Hippolyte pleuracantha*). The fisheries for the blue crab (*Callinectes sapidus*) are the largest, year-round fisheries in the upper and middle portion of the Caloosahatchee River. Other crab species occurring within the region are the spider (*Libinia emarginata*), fiddler (*Uca* spp.), horseshoe (*Limulus polyphemus*), stone (*Menippe mercenaria*) and hermit (*Pagurus* spp.). Sand dollar (*Echinarachnius* spp.) and starfish (*Solaster* spp., *Crossaster* spp. and *Ophioderma* spp.) are predatory invertebrates also found within the Caloosahatchee Estuary.

2.9.2 Amphibians and Reptiles

Many non-listed reptile and amphibian species are found in the Caloosahatchee Basin. These species provide recreational opportunities for residents as well as a forage base for many listed and non-listed wildlife species. Florida softshell and Florida red-belly turtles are common in the area. Southern black racers (*Coluber c. priapus*) and numerous water snakes are present throughout the waters of the basin. Other snake species likely to use these areas include the corn snake (*Elaphe guttata guttata*), yellow rat snake (*E. obsolete quadrivittata*), Everglades rat snake (*E. obsoleta rossalleni*), Florida kingsnake (*Lampropeltis getulus floridana*), Eastern coral snake (*Micrurus fulvius*), Florida cottonmouth (*Agkistrodon piscivorus conanti*), dusky pygmy rattlesnake (*Sistrurus miliarius barbouri*), Eastern diamondback rattlesnake (*Crotalus adamanteus*), coachwhip (*Masticophis flagellum flagellum*), rough green snake (*Opheodrys aestivus*), southern ringneck (*Diadophis punctatus punctatus*) and Eastern mud snake (*Farancia abacura abacura*). Alligators (*Alligator mississippiensis*) are numerous throughout southern Florida. Lizards found in the area include the six-lined racerunner (*Cnemidophorus sexlineatus*), southeastern five-lined skink (*Eumeces inexpectatus*), ground skink (*Scincella lateralis*) and green anole (*Anolis carolinensis*). Amphibians likely to be present include the southern toad (*Bufo terrestris*), spring peeper (*Hyla crucifer*), green treefrog (*H. cinerea*), Florida chorus frog (*Pseudacris nigrita verrucosa*), pig frog (*Rana grylio*) and southern leopard frog (*R. utricularia*).

2.9.3 Fish

The freshwater fishes of the Caloosahatchee River are a mix of northern freshwater species, marine species, and exotics. Among the principally marine species are the tarpon (*Megalops atlantica*), American eel (*Anguilla rostrata*), and mullet (*Mugil* spp.). These fish occasionally move far inland via canals and rivers. Freshwater fishes occupy at least nine different habitats common to the watershed. These include ponds, lakes, streams, marshes, prairies, river channels, and oxbows. These habitats may be broken down even further based on seasonal factors such as deep marsh and shallow marsh and seasonal or permanent ponds. Water quality, flora, and topographic distinctions of similar sites may also influence site suitability for certain species.

Aquatic habitats throughout the basin have been altered through channelization of river segments or are artificially created. Nevertheless, most areas support fishery resources of recreational and commercial importance. Recreational fishing is prevalent throughout the basin. Fishery resources are an economically important resource and have a large annual dollar value. Estuaries provide important habitat (i.e., nursery, escape cover, feeding grounds) for a variety of freshwater, marine, and estuarine-dependent fish and shellfish. Most economically important saltwater fishes and crustaceans spawn offshore and then use estuarine areas for nursery habitat. Different species use the same location in different seasons, and different life stages of the same species use different locations. Some marine species have estuarine-dependent life stages, typically larval and juvenile stages, which use estuaries as nursery habitat. Larvae or juveniles immigrate on incoming tides and take advantage of the high productivity of the estuary.

Factors affecting the composition of the freshwater fish community in southwest Florida are fluctuating water levels, predation, geographic location, and habitat alteration. When water levels remain high for an extended time, larger predatory fish move into refuges previously safe from carnivores, and the smaller fish disperse into new shallows (Kushlan 1976a). The increased habitat space permits the expansion of the fish population. Continued decreases in water levels concentrate physical, chemical and biological materials and may eventually cause a fish kill or feeding frenzy. In addition to fluctuating water levels and predator-prey interactions, fish community composition differs geographically. Each aquatic habitat type exhibits a different set of physical/chemical characteristic and fish community.

Destruction of littoral zones, plant removal, channel dredging, contaminated run-off from agricultural lands and urban centers, and the drawdown of shallow aquifers are major examples of habitat alteration. Habitat alterations may also be caused by opening undisturbed water to invasion by exotic plants and fishes. Roadside ditches provide a convenient corridor for transporting species across former obstacles.

Six of the species of exotic fish currently established in southern Florida are members of the tropical secondary freshwater family Cichlidae, a highly diversified group considered to be in many ways the ecological counterpart of the centrarchids. Members of this family are generally well adapted to withstand drought. It is anticipated that the spread of cichlids will be at the expense of the native centrarchids. The future of both the exotic and native fish fauna should be a matter of concern.

2.9.4 Birds

The south Florida ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North America and winter in the tropics of the Caribbean and South America. Because the south Florida ecosystem is located near Cuba and the West Indies, it draws Caribbean species that rarely appear elsewhere in North America. Fifteen species of herons, storks, and ibises nest in the south Florida ecosystem and are considered ecological indicators because of their wide foraging ranges, relatively narrow food requirements, and relatively specific habitat requirements. In addition, forested uplands and wetlands serve as important resting areas for migrating passerine birds. Coastal Florida is often the last stop before these species cross the Gulf Stream or continue their migration south to Cuba. Development has eliminated many of the traditional forested stopover areas making remaining forested areas in south Florida more important to these species.

2.9.5 Mammals

Mammals found in the Caloosahatchee River Basin may include hispid cotton rat (*Sigmodon hispidis*), field mouse (*Peromyscus spp.*), raccoon (*Procyon lotor*), opossum (*Didelphis virginianus*), rabbit, mink, river otter, white-tailed deer (*Odocoileus virginianus*), bobcat, and black bear. Raccoon, opossum, rabbits and other small mammals provide prey items for larger mammals, including the endangered Florida panther. Deer and other fur-bearing animals provide recreational opportunities for residents through hunting, trapping, and wildlife viewing.

The bottlenose dolphin (*Tursiops truncatus*) and West Indian manatee (*Trichechus manatus*) are the only marine mammals that are likely to be found in the Caloosahatchee Estuary.

2.9.6 Protected Species

Nineteen federally listed species may potentially occur in the proposed project footprint or may be impacted by operations of the project. Although some of these species may be impacted by the loss of habitat within the project footprint, when implemented, the project has the potential to significantly contribute towards environmental restoration beyond the project footprint. For additional information on these species please refer to the Final Biological Assessment (BA) for the C-43 West Storage Reservoir Project found in ***Annex A***. The site information included in this report is based on surveys referenced in the BA. ***Table 2-3*** lists the threatened and endangered species within the Caloosahatchee River (C-43) West Basin Storage Reservoir study area. Please note that although beautiful paw-paw was originally provided by USFWS as a potential affected species for this project, once the project site was determined the beautiful paw-paw was removed from species needing consultation.

TABLE 2-3: FEDERALLY LISTED THREATENED (T) AND ENDANGERED (E) SPECIES IN THE CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR STUDY AREA

Scientific Name	Common Name	Status
Caretta Caretta	Loggerhead sea turtle	T
Chelonia mydas	Green sea turtle	E
Crocodylus acutus	American crocodile	E
Dermochelys coriacea	Leatherback sea turtle	E
Drymarchon corais couperi	Eastern indigo snake	T
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochelys kempii	Kemp's (=Atlantic) ridley sea turtle	E
Ammodramus savannarum floridanus	Florida grasshopper sparrow	E
Aphelocoma coerulescens	Florida scrub jay	T
Charadrius melodus	Piping plover	T
Haliaeetus leucocephalus	Bald eagle	T
Mycteria americana	Wood stork	E
Picoides borealis	Red-cockaded woodpecker	E
Polyborus plancus audubonii	Audubon's crested caracara	T
Rostrhamus sociabilis plumbeus	Everglades snail kite	E
Felis concolor coryi	Florida panther	E
Trichechus manatus latirostris	West Indian manatee	E
Cucurbita okeechobeensis	Okeechobee gourd	E
Pristia pectinata	Smalltooth sawfish	E

2.9.6.1 Snail Kite

The snail kite (*Rostrhamus sociabilis plumbeus*) inhabits the watersheds of the Everglades, lakes Okeechobee and Kissimmee, the upper St. Johns River, and the Caloosahatchee Basin. Critical habitat for the snail kite is present immediately adjacent to the Caloosahatchee Basin inside of the Herbert Hoover Dike (HHD) in Lake Okeechobee. The snail kite could also be found foraging in a number of native wetlands and in canals and ditches adjacent to the project area. This medium-sized raptor has a highly specific diet composed almost entirely of Florida apple snails (*Pomacea paludosa*), which are found in palustrine emergent, long hydroperiod wetlands. As a result, the snail kite's survival is directly dependent on the hydrology and water quality of its habitat (Service 1999).

One snail kite was observed on a wire and eating a snail along SR 80 during a February 2006 survey. This location was approximately 0.75 miles west of the project footprint. In addition, during several field visits 2004-2006, populations of two species of apple snails, the Florida apple snail (*Pomacea paludosa*) and the exotic ramshorn apple snail (*Marisa cornuarietis*) were observed in large ditches of the project site. The network of large agricultural ditches provides suitable foraging opportunities but evidence of foraging/feeding (shell discards) was not observed.

2.9.6.2 Wood Stork

The wood stork (*Myctria Americana*) is primarily associated with freshwater and estuarine habitats for nesting, roosting, and foraging. They have nested, at one time or another, in every county in south Florida. Typical foraging sites include freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Wood storks use a specialized feeding behavior called tactolocation, or grope feeding. A foraging wood stork wades through the water with its beak immersed and partially open (seven to eight centimeters [cm]). When it touches a prey item, a wood stork snaps its mandibles shut, raises its head, and swallows what it has caught (Kahl 1964). This unique feeding method of the wood stork gives it specialized habitat requirements; the habitats on which wood storks depend have been disrupted by changes in the distribution, timing, and quantity of water flows in south Florida. The loss or degradation of wetlands in central and south Florida is one of the principal threats to the wood stork.

The majority of the lands within the project footprint fall within the 18.6-mile core foraging area (CFA) of three wood stork colonies (see ***Annex A***). The BA only identified two colonies with a CFA that overlapped the project site but since that time a new colony has been identified. Individual wood storks have been observed foraging and loafing onsite, primarily in the tertiary and secondary canals. Within the project there are limited acres of wetlands that provide suitable wood stork foraging habitat. Wood stork foraging habitat available within the project site includes 6.72 acres of wetlands and 778.34 acres of ditches/canals as identified in ***Annex A***.

2.9.6.3 West Indian Manatee

The West Indian manatee is recognized as an endangered species by both the USFWS and Florida Fish and Wildlife Conservation Commission (FFWCC). Manatees are also protected under the provisions of the Marine Mammal Protection Act of 1972, and by Florida law. The manatee, or sea cow, is a large, plant-eating aquatic mammal that can be found in the shallow coastal water, rivers, and springs of Florida. Florida is essentially the northernmost extent of the West Indian manatee's range, though some manatees are occasionally spotted as far north as Virginia and the Carolinas (Florida Power & Light [FP&L], 1989). The endangered West Indian manatee is regularly found in the Caloosahatchee River and the Charlotte Harbor estuary. This large, aquatic mammal migrates along the Florida coast through fresh, brackish, and marine waters, with a seasonal distribution based on water temperatures. Water depths of at least three to seven feet are preferred. Water temperatures below 20 degrees Celsius increase the manatee's susceptibility to cold-stress and cold-induced mortality. Distribution is also controlled by the availability of aquatic vegetation, proximity to channels of at least two meters in depth, and location of fresh water sources (Service 1999). During the summer months manatees range throughout water bodies of south Florida, usually in small groups. In the winter months they tend to congregate in warm water areas such as springs and electric generation facilities (FP&L, 1989).

Designated critical habitat for the manatee is located in the Caloosahatchee River Basin. Critical habitat extends downstream from the SR 31 Bridge and includes all United States territorial waters adjoining the coast and islands of Lee County.

Primary threats to manatees today consist of collisions with watercraft, degradation of seagrasses and accidents occurring at water control structures. Navigational locks along the Caloosahatchee River have a history of causing manatee mortality. Sixteen navigational lock/water control structure-caused manatee deaths have been recorded near Ortona Lock (S-78) between 1980 and 2001. Throughout those same years, six were discovered near S-77 at Moore Haven, and just one in 1999 at the Franklin Lock (S-79). Existing operational protocols for the structures and locks (unaffected by project planning for the Caloosahatchee River [C-43] West Basin Storage Reservoir) are important considerations in reducing these deaths.

Manatees have been known to utilize the Townsend Canal, which lies immediately adjacent to and west of the project footprint. During times of inflow from the Caloosahatchee River, manatees are capable of passing over the weir and traveling southward into the Townsend Canal. Individuals have been observed at the outfall area immediately west of the project boundary as well as at the mouth of the canal in the Caloosahatchee River. However, manatees cannot access the main distribution canal (i.e., Header Canal) for the grove property due to differences in elevation.

2.9.6.4 Southern Bald Eagle

The bald eagle is currently listed as a threatened species by both the USFWS and FFWCC. However, effective August 8, 2007, the bald eagle will be removed from the national list of threatened and endangered species. The bald eagle will continue to be protected by the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. The southern bald eagle (*Haliaeetus leucocephalus*) is considered common and known to breed throughout the state. Nest sites are usually located near large rivers, lakes, or estuaries where they feed primarily on fish and water-dependent birds. Their distribution is influenced by the availability of suitable nest and perch sites near large, open waterbodies, typically with high amounts of water-to-land edge (Service 1999). The bald eagle is the only eagle unique to

North America. It ranges over most of the continent, from the northern reaches of Alaska and Canada down to northern Mexico. Current threats to the bald eagle include habitat loss and fragmentation, collisions with cars and powerlines, and shooting (USFWS 1998).

Data obtained from the Florida Fish and Wildlife Conservation Commission (FFWCC) 2004 Eagle Nest Database indicate that the closest documented bald eagle's nest, HE002, is located 3.4 miles east of the project and east of SR 29. This nest was documented to be last active during the 2003 nesting season. No other nests were observed in the project vicinity during field efforts in the summer of 2004 or spring of 2006.

2.9.6.5 Eastern Indigo Snake

The threatened eastern indigo snake (*Drymarchon corais couperi*) is present throughout the state, but its abundance is reduced to a point where it is uncommon. Its known habitat includes pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human altered habitats. This species was listed as a result of dramatic population declines caused by over-collecting for the domestic and international pet trade as well as mortalities caused by rattlesnake collectors who gassed gopher tortoise burrows to collect snakes. Since its listing, habitat loss and fragmentation by residential and commercial expansion have become much more significant threats to this species (USFWS 1999).

Specific information on the status of this species within the project area is not available; however, indigo snakes are known to occur in the Caloosahatchee River Basin in low densities and are known to occur along roads and the banks of larger ditches and canals in citrus groves, particularly if burrows (e.g., tortoise, armadillo, small mammal, and/or land crab), debris piles, or other shelter are in close proximity. Although the eastern indigo snake was not observed during field visits, suitable habitat exists on the project site; therefore, it could potentially occur. Additionally, the species is known to utilize a variety of habitat types including citrus groves.

2.9.6.6 Florida Scrub-Jay

The Florida scrub-jay (*Aphelocoma coerulescens*), a threatened species, is present in limited areas of scrub habitat in the study area. It is a relict species of fire-dominated oak scrub habitat that occurs on well-drained sandy soils in peninsular Florida. Scrub-jays are extremely habitat-specific, sedentary, and territorial. Florida scrub-jays form family groupings; fledglings remain with their parents in their natal territory as helpers. The Florida scrub-jay is listed as a threatened species because of loss, fragmentation, and degradation of scrub habitats throughout Florida, due primarily to urbanization, agriculture, and fire suppression. During the last 10 to 23 years, the population has declined by an estimated 25 to 50 percent, and they have been extirpated from seven counties statewide.

No individuals, nests or appropriate habitat were detected in the project footprint during site visits. The nearest documented Florida scrub jay habitat and population occurs 1.1 miles west of the project area. This colony is beyond the foraging distance for the species to access the project area.

2.9.6.7 Red-Cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) was listed as threatened in 1970. The red-cockaded woodpecker is one of 22 species of woodpeckers native to North America. Its historic range encompasses the southeastern Unite States from eastern Texas to Oklahoma to New Jersey, and it was characterized as "abundant" in the 19th century literature. Throughout the 20th century, however, the species' distribution within its historic range has become fragmented, and its total population numbers have decreased dramatically due to the destruction of its habitat. Although south Florida is not a designated recovery population for the red-cockaded woodpecker, the area contains significant support populations for recovery of the species in the southeast. Additional population surveys and research on habitat requirements within the hydric pine flatwoods of south Florida are needed to assess the current status of the birds and to adapt conservation measures used elsewhere to the distinct conditions in this area. The nearest documented red-cockaded woodpecker population occurs approximately 14 miles northwest of the project area (FFWCC data).

2.9.6.8 Florida Panther

The Florida panther (*Puma concolor coryi*), a subspecies of mountain lion, is one of the most endangered large mammals in the world. The most recent population estimate for the Florida panther is a total of 87 individuals, not including denning kittens (McBride 2003). This small population in south Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee. The panther presently inhabits a contiguous system of large private ranches and public conservation lands in Broward, Collier, Glades, Hendry, Lee, Miami-Dade, Monroe, and Palm Beach counties totaling more than 809,400 ha. Panthers have a strong affinity for hardwood forests and mixed swamps but also use freshwater marshes, prairie and shrub/scrub habitats, agricultural lands (i.e., wooded pasture, rangeland, citrus groves, row crops, etc.), and even urban areas. Geographic isolation, habitat loss, population decline, and associated inbreeding have resulted in a significant loss of genetic variability and overall health of the Florida panther population. Natural gene exchange ceased when the panther became geographically isolated from other subspecies of *Puma concolor*. Population viability projects have concluded that under current demographic and genetic conditions, and without implementation of recovery actions, the panther will probably become extinct within two to four decades.

The Caloosahatchee Basin plays an important role in the recovery of the Florida panther. The USFWS has organized a multi-agency subgroup of the Multi-species/Ecosystem Recovery Implementation Team (MERIT) to produce a Florida panther landscape conservation strategy. That strategy included the identification and prioritization of habitat zones (dispersal, primary, and secondary zones) that are essential for effective Florida panther conservation. In addition to protection of habitat for adult home ranges, the strategy includes provision of corridors for dispersal of juveniles between larger areas of contiguous habitat. Dispersal across the Caloosahatchee River, between existing primary habitat south of the river and habitat that is presently only occasionally used by panthers north of the river, is considered essential for recovery of the species.

The proposed project is located within the USFWS Consultation Area and includes areas within the panther primary, secondary, and "other" zones, as identified by the Florida panther subteam of the MERIT and USFWS Consultation Area updates. The most recent available FFWCC telemetry data of radio collared Florida panthers, current through January 2004, depicts three (3) Florida panthers and one (1) Texas cougar (*Felis concolor*) within a five-mile radius of the project area. A more landscape level inspection (25-mile radius) identifies habitat utilization by several additional panthers, particularly within Okaloacoochee Slough State Forest and other conservation lands.

2.9.6.9 Audubon's Crested Caracara

Audubon's crested caracara (*Polyborus plancus audobonii*) is another federally listed species present in the Caloosahatchee Basin. It is a large, boldly patterned raptor, with a crest and unusually long legs. It is a resident, diurnal, and non-migratory species that occurs in Florida as well as the southeastern United States and Central America. In Florida, this species is found in the prairie area of the south-central region of the state. Historically, this species was a common resident in Florida from northern Brevard County, south to Ft. Pierce, Lake Okeechobee, and Hendry County. Today, the region of greatest abundance for this large raptor is a five-county area north and west of Lake Okeechobee. The preferred native habitat is dry or wet prairie with scattered cabbage palms (Service 1999). Improved and unimproved pastures are also highly utilized. Effect determinations for caracara are based mostly on potential impacts within the primary nest zone (i.e., within a radius of 985 feet from a nest tree) or the secondary zone (a radius of 6,600 feet). Additionally, potential effects within juvenile congregation areas are also considered.

The project falls within the caracara USFWS Consultation Area. One caracara nest site was confirmed to the north of the project during spring 2006 surveys. This nest is located along the southern edge of the SR 80 right-of-way (ROW) and approximately 4,750 feet north of the project boundary. While individuals were not observed foraging in the project footprint, a portion of the project falls within 2000 meters (secondary zone) of this nest, as defined in the Standard Local Operating Procedures for Endangered Species (SLOPES). In addition, a possible nest was identified approximately 1,065 feet south of the project boundary, within a pasture of the A. Duda & Sons, Inc. property. Individuals from the possible nest site were seen flying into and out of the Caloosahatchee (C-43) West Basin Storage Reservoir project site. While the project area provides only sub-optimal foraging habitat for the species, and individuals were only observed utilizing the project area in the southeast portion of the footprint, it does fall within the home range of both the confirmed and possible nests.

2.9.6.10 Florida Grasshopper Sparrow

The Florida grasshopper sparrow (*Ammodramus savannarum floridanus*) is a subspecies of grasshopper sparrow that is endemic to the dry prairie of C&SF. This subspecies is extremely habitat-specific and relies on fire every two to three years to maintain its habitat. It is now known to occur only from Highlands, Okeechobee, Osceola, and Polk counties, but other populations may occur in Glades County, which may bring it into the study area considered in this PIR. The species is not known to occur in Hendry County but populations may occur in nearby Glades County (USFWS 4-11-02 Planning Aid Letter [PAL]). The nearest Florida grasshopper sparrow record in the 1999 Florida Natural Areas Inventory (FNAI) database is a 1984 observation located 17.3 miles north of the project. Mapping of potential Florida grasshopper sparrow habitat (Shriver and Vickery, 1999) shows marginal habitat zones to the northeast and southeast of the project, and the project area falls within the Florida grasshopper sparrow USFWS Consultation Area. However, the nearest marginal habitat zone is located approximately 2.5 miles to the southeast of the project footprint. No grasshopper sparrows were observed during field surveys and no suitable habitat exists in the project area.

2.9.6.11 Piping Plover

A wintering population of piping plovers (*Charadrius melodus*) uses the tidal area of the Caloosahatchee River. The piping plover was listed as threatened along the Atlantic coast in 1985. It is a small, migratory shorebird that breeds only in three geographic locations of North America: sandy beaches along the Atlantic Ocean: sand shorelines throughout the Great Lakes: and on riverine systems and prairie wetlands of the Northern Great Plains. This species does not breed in Florida, but all three breeding populations winter here. Bunche Beach, at the mouth of the Caloosahatchee River, has a population of wintering piping plovers and is also designated critical habitat for this species. The USFWS established critical habitat areas for the species, which include several locations on barrier islands west of the Caloosahatchee Estuary. The nearest piping plover critical habitat zone to the project area includes Punta Rassa, a mainland location at the southwestern edge of the Caloosahatchee Estuary, and Bunch Beach.

2.9.6.12 Okeechobee Gourd

The Okeechobee gourd (*Cucurbita okeechobeensis*) is a vine that was locally common in the extensive pond apple forest that once grew south of Lake Okeechobee (Small 1922). It is a vine that is now restricted in the wild to two small distinct populations; one along the St. Johns River which separates Volusia, Seminole, and Lake Counties in North Florida, and a second around the shoreline of Lake Okeechobee in South Florida.

2.9.6.13 American Crocodile

The USFWS and the FFWCC list the American Crocodile (*Crocodylus acutus*) as endangered. This species occurs in extreme south Florida primarily in Biscayne and Florida Bays. Crocodiles have been observed as far north as the coasts of Lee and Collier counties, but these counties are not thought to support a significant resident population of crocodiles. The American crocodile has not been documented in Hendry County but is present in coastal counties of the Caloosahatchee River Basin, namely Lee and Collier counties. The nearest documented individual occurrence to the project is on Sanibel Island in Lee County. The American crocodile is known to inhabit mangrove and seagrass habitats in coastal areas of south Florida. In addition to the American Crocodile, the American alligator is listed for similarity of appearance to the American Crocodile. The American alligator is abundant throughout South Florida.

2.9.6.14 Sea Turtles

Sea turtles including the Atlantic loggerhead turtle (*Caretta caretta*), Atlantic green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), Kemp's ridley turtle (*Lepidochelys kempii*), and hawksbill turtle (*Eretmochelys imbricata*) are listed as endangered by the USFWS and FFWCC 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 forage in the near shore waters, bays and sounds of Florida and come ashore at night to nest on the beaches above the high tide line.

Alterations in the timing and quantity of freshwater flowing through the estuary has an impact on natural biodiversity by affecting food availability, predation pressure, reproductive success, and most likely has caused chronic and acute stress to these species.

2.9.7 Essential Fish Habitat

The National Marine Fisheries Service (NMFS) website lists the Caloosahatchee estuary as essential fish habitat for juvenile Brown shrimp (*Penaeus aztecus*), juvenile Gray snapper (*Lutjanus griseus*), juvenile Pink shrimp (*Penaeus duorarum*), adult and juvenile Red drum, (*Sciaenops ocellatus*), adult and juvenile Spanish mackerel (*Scomberomorus maculatus*), and juvenile Stone crab (*Menippe mercenaria*).

Aquatic habitats within the Caloosahatchee Basin have been altered through the channelization of the river. Nevertheless, the basin continues to support fishery resources of some recreational or commercial importance. At least 70 percent of Florida's recreationally or commercially sought fishes depend on estuaries for at least part of their life histories (Harris *et al.* 1983; Estevez 1998; Lindall 1973). Seagrass communities within the Caloosahatchee Estuary provide critical refugia for juvenile fish such as red drum, grouper, snook, and spotted seatrout. The decline in juvenile abundance and distribution of these and other species, along with an overall decrease in species richness may be related to the loss of seagrass habitat and/or a result of alterations in the salinity regime and the timing of the freshwater discharges from the S-79 structure.

2.10 ESTUARINE RESOURCES

The Caloosahatchee Estuary is located on the southwest coast of Florida (***Figure*** 2-3**)**. The major source of freshwater is the Caloosahatchee River, which runs 65 kilometers (km) from Lake Okeechobee to the head of the estuary at the Franklin Lock and Dam (S-79). The estuary extends about 40 km downstream to Shell Point where it empties into San Carlos Bay (***Figure 2-4***). Major environmental concerns for the Caloosahatchee Estuary are altered freshwater inflows and extreme variation in salinity levels, eutrophication and habitat loss.

FIGURE 2-3: THE CALOOSAHATCHEE RIVER, ESTUARY, AND SOUTHERN CHARLOTTE HARBOR WATERSHED

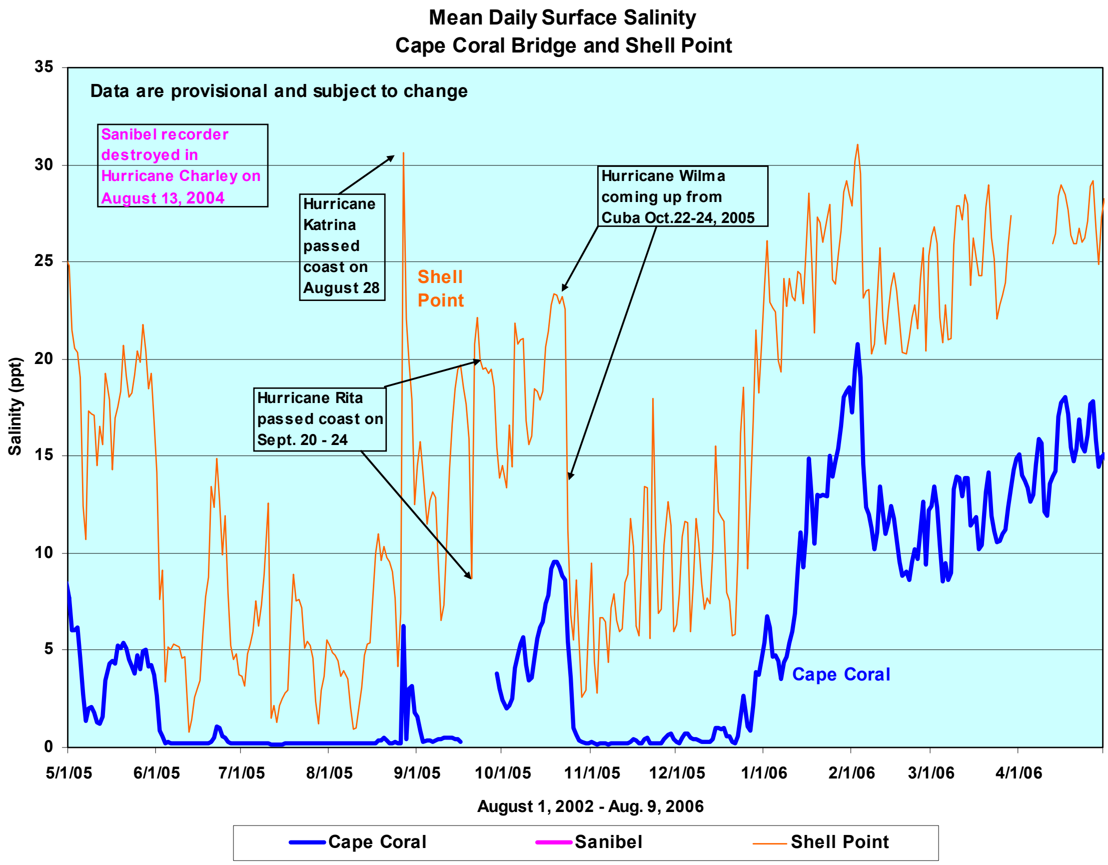
The Caloosahatchee River historically bisected its basin and probably only rarely received water from outside its watershed or from Lake Okeechobee except during extreme regional flooding events that sent water to the marshlands at the headwater of the river. Now the river functions as a primary canal (C-43) that conveys both basin runoff and regulatory releases from Lake Okeechobee. The canal has undergone a number of alterations to facilitate this increased freshwater discharge, including channelization, bank/levee stabilization, and the addition of the three locks and dams. The last structure before the canal flows into the estuary (S-79) maintains specific water levels upstream, discharges freshwater into the estuary, and acts as a barrier to salinity and tidal action, which historically extended far upstream. Therefore, when S-79 was completed, it truncated the estuary and now spatially limits the dry season oligohaline (freshwater and low salinity brackish water) zone of the estuary, as well as the free passage of organisms seeking refuge, nursery, and breeding areas characteristic of this zone.

FIGURE 2-4: CALOOSAHATCHEE ESTUARY SALINITY SENSORS AND IMPORTANT LANDMARKS

The long-term mean monthly discharge measured at S-79 ranges between 300 and 3,000 cfs. However, daily and monthly flows often exceed this long term average, with prolonged flows commonly exceeding the 4,500 cfs monthly average that adversely affect the San Carlos Bay area. Flows above this threshold (occasionally exceeding 10,000 cfs) can push freshwater into Pine Island Sound and the Gulf of Mexico, thus impacting ecologically and commercially important high-salinity marine resources that historically were not directly affected by Caloosahatchee River discharges. During the dry season, the combination of limited rainfall, lack of water storage in the basin and withdrawals to meet human demands for irrigation and potable water often results in periods of no freshwater discharge to the estuary. Saline water can intrude all the way upstream to S-79 eliminating the oligohaline zone and threatening species that require low salinity to complete their life cycle (Chamberlain and Doering 1998a; 1998b, Doering et al. 2002; SFWMD 2002).

Excessive variation in discharge and salinity (***Figure 2-5***) occurs in the Caloosahatchee Estuary (Chamberlain and Doering 1998a), resulting in a constant flux of estuarine biota between those favoring higher salinity and those favoring lower salinity (Bulger et al. 1990). Optimal salinity conditions may not last long enough for organisms to complete their life cycle and the estuary can become devoid of some populations, even keystone species that support major ecosystem components along the estuary's salinity gradient.

Environmental research by the SFWMD began in the Caloosahatchee Estuary during the mid-1980s and focused on the impacts associated with the extreme variability in freshwater inflow from S-79 (Chamberlain and Doering 1998a). The purpose of the research was to determine the proper timing and volume of freshwater inflows required to support valued ecosystem components (VECs) such as oysters and SAV, as well as the impacts of flows on general biotic indicators, such as plankton and benthic invertebrates (SFWMD 1998). This research has resulted in the development of optimum S-79 flow ranges and delivery patterns for the estuary (Chamberlain and Doering 1998b; Doering et al. 2002; Volety et al. 2003). This information forms the scientific basis for development of hydrologic performance measures for Comprehensive Everglades Restoration Plan (CERP), the SWFFS, and Lake Okeechobee, as well as meeting legislative mandates for the establishment of minimum flows and levels (MFL).



Note: The timing and influence of three hurricanes is depicted here.

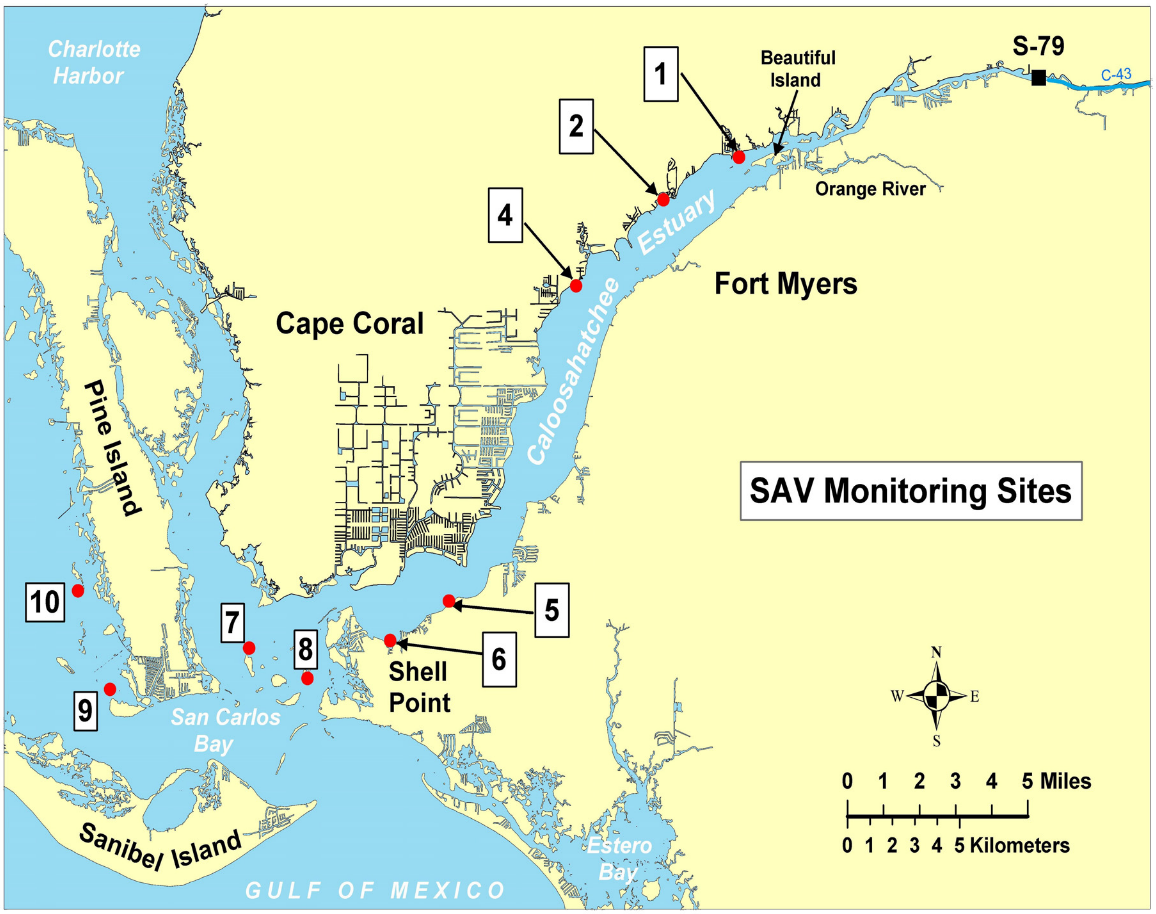
FIGURE 2-5: DAILY AVERAGE SALINITY COLLECTED BY CONTINUOUS SENSORS AT TWO DOWNSTREAM LOCATIONS (CAPE CORAL BRIDGE AND SHELL POINT AT THE RIVER MOUTH) IN THE CALOOSAHATCHEE ESTUARY

A distribution of monthly average inflows with the greatest frequency range from 300 to 1,500 cfs and a peak between 300-800 cfs was initially determined by SFWMD scientists to be the most beneficial for the species evaluated. This original frequency distribution was reported as provisional (Chamberlain and Doering 1995, 1998a, and 1998b), with the intent to update it as more information became available about the salinity requirements of key biota. This original flow recommendation was used to formulate the MFL and identified 300 cfs as the required average monthly inflow from S-79 for protecting the oligohaline zone of the estuary and the submerged plant, *Vallisneria americana*. The MFL was based on a flow-salinity relationship that was predicated on the delivery of S-79 discharges. However, salinity in the estuary is also influenced by additional inflows from creeks and groundwater downstream of S-79. On average, when flow at S-79 is 300 cfs, an additional 150-200 cfs comes from downstream sources for a total of approximately 450 cfs. However, during low flow conditions the entire system is drier than normal and the downstream contribution is much lower than 150-200 cfs, so 300 cfs at S-79 is insufficient to achieve the MFL salinity criteria. The original basin flow optimization model used historic S-79 flow data from 1965 to 1990 to recommend a time series of basin flows (Labadie 1995: Otero et al 1995). More resent efforts use a 2000 Base and subsequent modeling related to the Restudy, the CWMP, and the Caloosahatchee River (C-43) West Basin Storage Reservoir CERP project have resulted in reconsideration of the original time series of flows to the estuary. The time series denoted as EST05 (see Section 4.3.1.1 of this report for a more detail explanation of the ESTO5 flow distribution) goes farther toward providing a higher level of protection in the upper estuary than previous time series by establishing a low flow limit of 450 cfs from S-79, which is consistent with meeting the total flow requirements associated with the MFL and its salinity criteria for protecting *Vallisneria*.

The discharge of water at S-79 also is a major determinant of macro-nutrient concentrations and other aspects of water quality in the Caloosahatchee Estuary. Influence of this discharge can be detected nearly 60 km downstream in Pine Island Sound (Doering and Chamberlain 1999). This control of water quality stems from the overwhelming dominance of the Caloosahatchee River at S-79 as a source of nutrients and other materials to the downstream estuary.

Loss of habitat has also been of concern. Hardening of the shoreline, increased freshwater discharge and oyster mining are thought to have singly or in combination reduced mangrove, seagrass and oyster bar habitats (e.g. Harris et al 1983).

Several prominent species are among those identified for long term monitoring and environmental assessment because they constitute important habitat in the Caloosahatchee, San Carlos Bay, Matlacha Pass and Pine Island Sound. In addition to tape grass (*Vallisneria americana*) that serves as an indicator of estuarine health in the upper estuary, oysters and marine seagrasses represent the more downstream, seaward portions of the system (***Figure 2-6***).



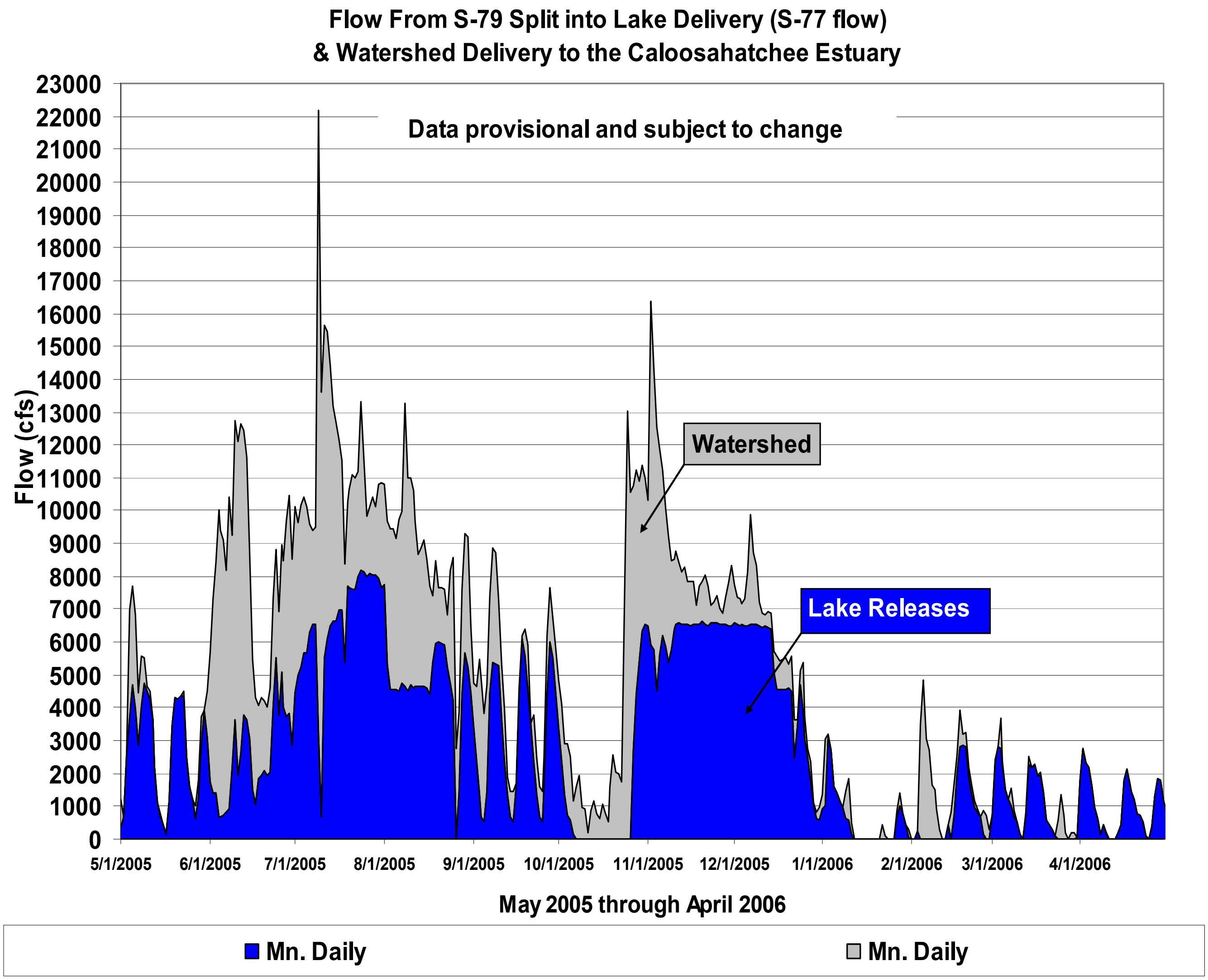
Note: *Vallisneria americana* is found at stations 1-2, *Halodule wrightii* at stations 5-10, *Thalassia testudinum* at stations 8-10. Oysters are located throughout the region downstream of station 5, but the core population is between stations 6 and 7.

FIGURE 2-6: CALOOSAHATCHEE ESTUARY SAV MONITORING STATIONS AND GENERAL OYSTER LOCATIONS

2.10.1 Recent Hurricane Impacts

In water year 2006 (WY2006) [May 2005-April 2006]), three hurricanes either directly or indirectly impacted the estuary. Hurricanes Katrina and Rita passed to the west in the Gulf of Mexico and the tidal surge associated with both caused spikes in water levels and salinity (***Figure 2-5***). During the fourth week in October 2005, Hurricane Wilma made landfill south of the region near Naples, which also caused similar spikes. Rainfall associated with Wilma brought tremendous rainfall to the basin and to Lake Okeechobee and its tributaries, which resulted in large releases from S-79 that extended to January 2006

(***Figure 2-7***). These releases drove down salinity at Shell Point (Marker H sensor) and San Carlos Bay. Salinity in the estuary upstream of Shell Point at Cape Coral was near zero parts per thousand (ppt) (freshwater) for almost two months because of the indirect impacts from Wilma.



Note: The portion of the discharge accounted for by Lake Okeechobee releases is shown in blue.

FIGURE 2-7: TOTAL DISCHARGE INTO THE CALOOSAHATCHEE ESTUARY (WATERSHED RELEASES) AT S-79

2.10.2 Estuarine Indicators

2.10.2.1 Freshwater Inflow at S-79 and Salinity at Ft. Myers

There were releases from Lake Okeechobee every month of WY2006. This was in part related to a high lake level remaining from WY2005 as a result of Hurricanes Frances and Jeanne. Therefore, Level II–III pulses were still being made to the Caloosahatchee through S-79 in October of 2005 (***Figure 2-7***). A very wet June 2005 throughout the upper district resulted in a dramatic increase in basin discharges, coupled with regulatory releases from Lake Okeechobee through August 2005. These discharges were followed by four Level III pulses, lasting into October 2005. As a result, salinity remained very low (0 ppt at Cape Coral Bridge) for four months (***Figure 2-5***). Salinities began to recover during mid-October until Hurricane Wilma (see description in the previous section). During January and the remainder of WY2006, salinities again began to recover as discharges at S-79 declined, with only Level I pulse releases being made at the end of WY2006 (April 2006). However, heavy basin rains during the 2006 wet season resulted in a single day's discharge of 21,000 cfs and average monthly discharge during September that exceeded 7,000 cfs (with no flow from Lake Okeechobee). This very wet season has been followed by a very dry season, that even with small environmental releases from the Lake Okeechobee, has resulted in violation of the MFL rule.

The long-term average discharge at S-79 is approximately 1.2 million ac-ft per year. In WY2006, discharge at S-79 was 3.6 million ac-ft, 2.2 million ac-ft of which were discharges coming from Lake Okeechobee. Most of the total annual discharge (3.3 million ac-ft or 92 %) entered the estuary through S-79 in the first eight months. WY2006 was the second consecutive year that annual discharge to the estuary was well above normal (WY2005 = 2.0 million ac-ft).

As discussed above, research and modeling conducted by the SFWMD has resulted in the identification of a preferred average monthly flow distribution between 450 and 2,800 cfs to protect and promote desirable estuarine biota and resources. In an ordinary year, flows less than 450 cfs occur for approximately 4.2 months and are greater than 2,800 cfs for 2.6 months. Thus, in an average year under current conditions, flows exceed the target about seven months per year. In WY2006, mean monthly flows were above the upper limit of the envelope, which occurred during the first eight months of WY2006 (May through December 2005). Flows exceeded 4,500 cfs during six of those eight months, which can have significant negative impacts on seagrass in San Carlos Bay. Half (4) of the flow exceedances were attributed to average monthly flows greater than 8,000 cfs, which can extend freshwater influence well into lower Pine Island Sound.

Surface salinity recorded at the Fort Myers sensor (***Figure 2-8***) during WY2006 did not exceed either of the two MFL criteria. Even though daily average salinity was greater than (>)10 ppt during three days near the beginning of February 2006 (maximum = 11.25 ppt), it did not exceed the one day limit of 20 ppt. In addition, the maximum 30 day average salinity at the same location was 6.0 ppt, well below the MFL target of 10 ppt. The period of record for salinity at Fort Myers extends back to 1992. During the 15 years of record, WY1995, WY2004, and now WY2006 are the only three years in which neither of the two criteria were exceeded (criteria: 1) moving 30-day average salinity of less than (<) 10 ppt at Fort Myers Yacht Bain; and 2) a daily average salinity of < 20 ppt). However, the dry season extending into 2007 has been extremely dry and has resulted in salinity that exceeds the monthly criteria (***Figure 2-8***).

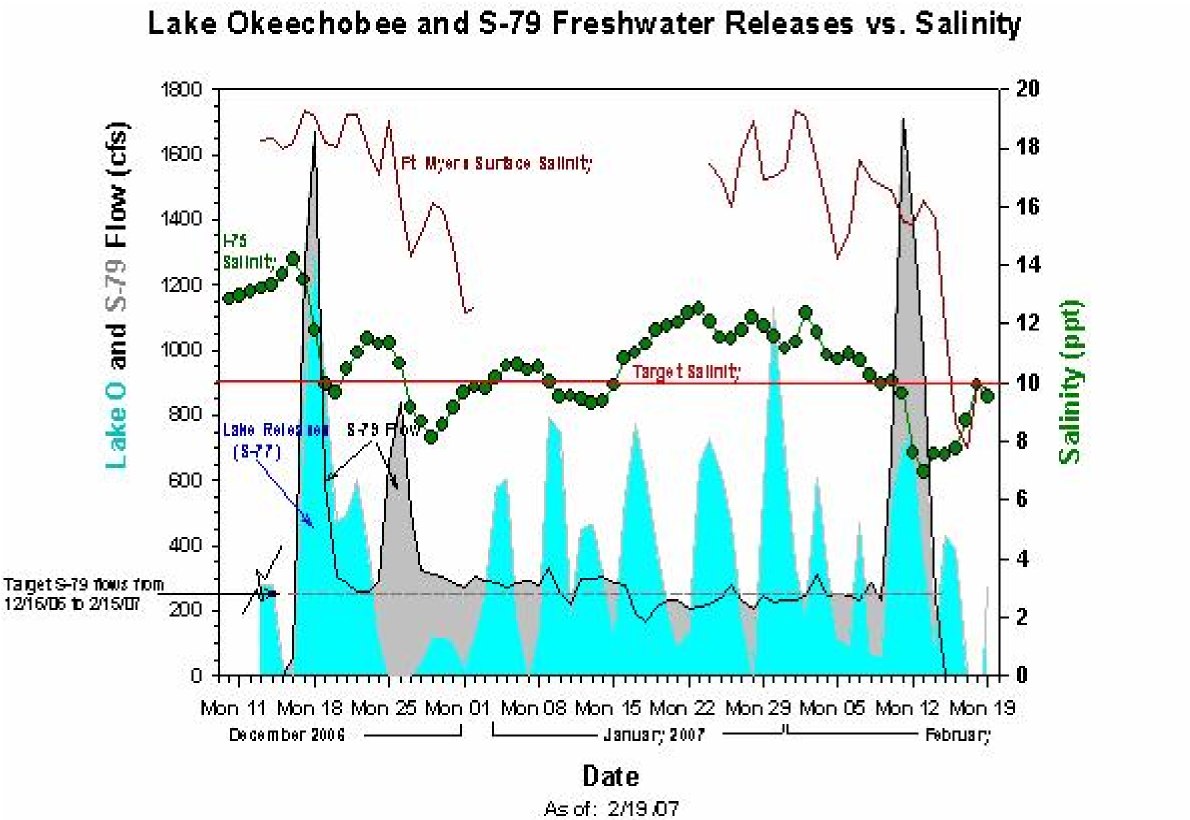
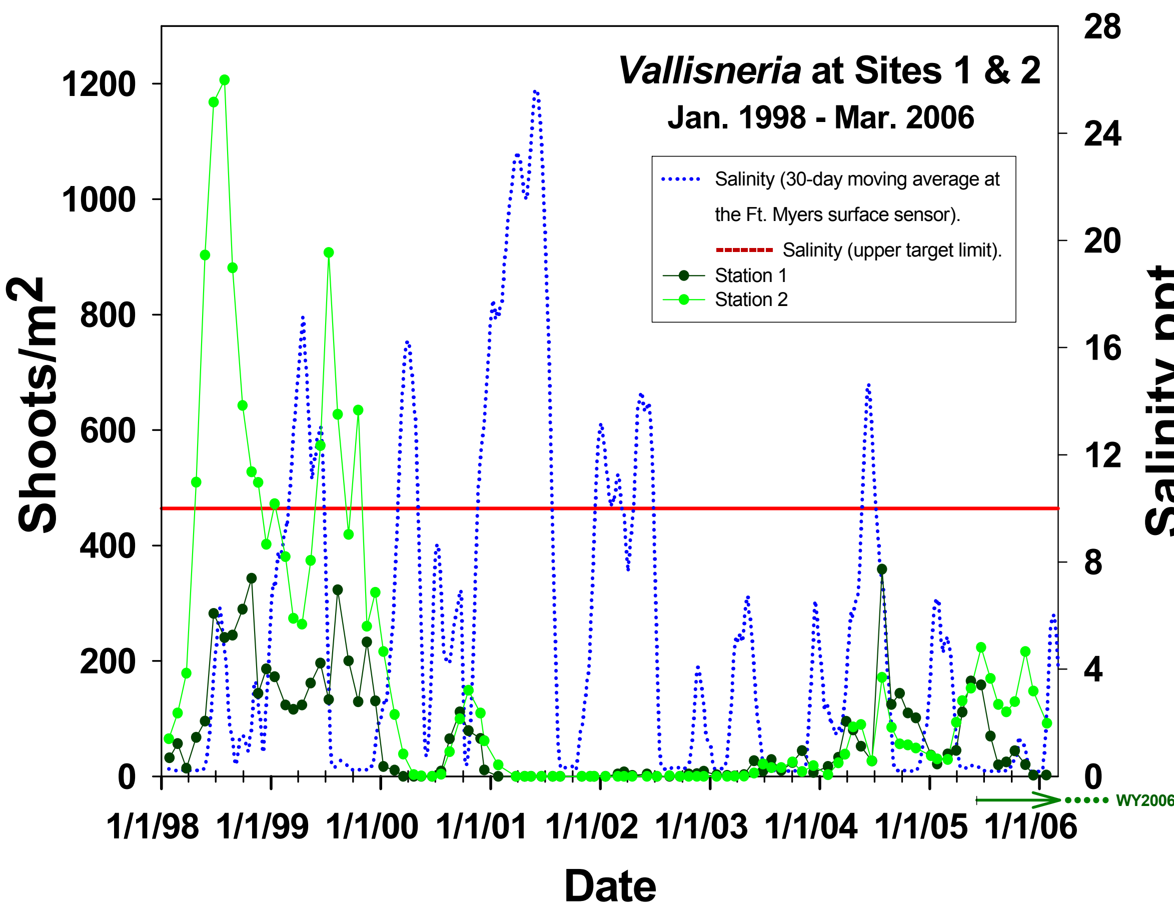


FIGURE 2-8: FRESHWATER FLOW THROUGH S-77 AND S-79 COMPARED TO SALINITY AT INTERSTATE-75 BRIDGE AND FT. MYERS

2.10.2.2 Tape Grass in the Upper Caloosahatchee

Due to high salinity experienced during the 2001 drought, tape grass beds in the upper Caloosahatchee Estuary essentially vanished, and have been in recovery since that period (***Figure 2-9***). There was an apparent slight trend toward increasing plant density since the growing season of 2003. During WY2004, the beds began to recover in the spring-summer growing season, coinciding with favorable salinity conditions. Similar seasonal growth patterns were evident in the spring-summer growing season of 2005 (WY2006).

Before the 2001 drought, plant density was significantly greater at Station 2. WY2006 was the first time since the drought that this pattern was evident. During the high freshwater inflows in June, plant density decreased upstream at Station 1, possibly due to the associated drop in water clarity, while more plants persisted at Station 2 during November 2005 through March 2006 than in previous years since 2001. However, due to the unusually high salinity associated with the 2007 dry season (***Figure 2-9***), the plants have again almost disappeared.



(Note: Recent data are from stations monitored by the Sanibel-Captiva Conservation Foundation and Mote Marine Laboratory.)

FIGURE 2-9: TAPE GRASS (*VALLISNERIA AMERICANA*) SHOOT DENSITY IN THE UPPER CALOOSAHATCHEE ESTUARY

2.10.2.3 Oysters

Based on WY2004 aerial surveys, there are presently only 3.02 acres of Eastern oysters (*Crassostrea virginica*) in the lower Caloosahatchee Estuary and 15.04 acres in lower Charlotte Harbor. Most of these are located in the Shell Point region. This low number of oysters, especially to the east, is a result of the combination of: 1) high freshwater inflows into the estuary from the basin and Lake Okeechobee, 2) the lack of suitable substrate, and 3) shell mining in the twentieth century for construction material that decimated the live oyster population and their substrate in this region.

A preliminary target for the aerial extent of oyster reefs is 40 and 60 acres respectively in these two regions during the next 10 to 15 years. With the addition of hard substrate, this target can be increased to 200–300 acres upstream of Shell Point and 150-200 acres downstream. Eighty-seven volunteers from Florida Gulf Coast University, concerned citizens, SFWMD, and other state, Federal, and local agencies placed 200 shell-bags at two locations upstream of Shell Point (Iona Cove and Piney Point) during October and November 2005 to provide recruitment substrate for oyster reef development.

Monitoring of oysters' health and recruitment began in 2000. Results indicate that oysters in the Caloosahatchee Estuary spawn continuously from April–October, a period that coincides with freshwater releases into the estuary. High freshwater flows flush out oyster larvae and spat from upstream areas with suitable cultch and/or reduce salinities to levels that are unfavorable for spat settlement and survival. Recruitment during WY2005 was among the lowest observed (Volety; personal communication, 2005), which included the 2005 spring start-up. The high flows, which drastically increased during June 2006, resulted in another poor year for oyster survival and recruitment, especially upstream of Shell Point.

2.10.2.4 Marine Seagrass

Seagrasses have been sporadically surveyed in the Caloosahatchee by aerial photography since the 1940s. More recently, aerial surveys were conducted in 1999, 2002–2003, and 2004. No aerial surveys were conducted during 2005 or 2006. There appears to have been a dramatic increase in aerial extent of seagrass in the region between 1999 and 2002-2003 (***Table 2-4***). This increase may be due to the quality of the photography rather than a real change. Methodological and other differences between surveys preclude a reliable trend analysis (Corbett et al, 2006). However, with that said, this increase does follow the 2000-2001 drought when flows from S-79 were low and salinity in the seagrass areas were consistently in the preferred range.

Processing of the 2004 survey was completed during this WY2006 (***Figure 2-10***). The results of this survey indicate that there are approximately 38,494 acres in the combined Lower Caloosahatchee, Matlacha, San Carlos Bay and Pine Island Sound regions, with respective individual coverage of 62 acres, 7168, 3905, and 27359 acres.

TABLE 2-4 AERIAL EXTENT OF SEAGRASS

Year	Acres of Seagrass
Water Year 1999	38,197.16
Water Year 2002 and 2003	43,590.91
Water Year 2004	38,494

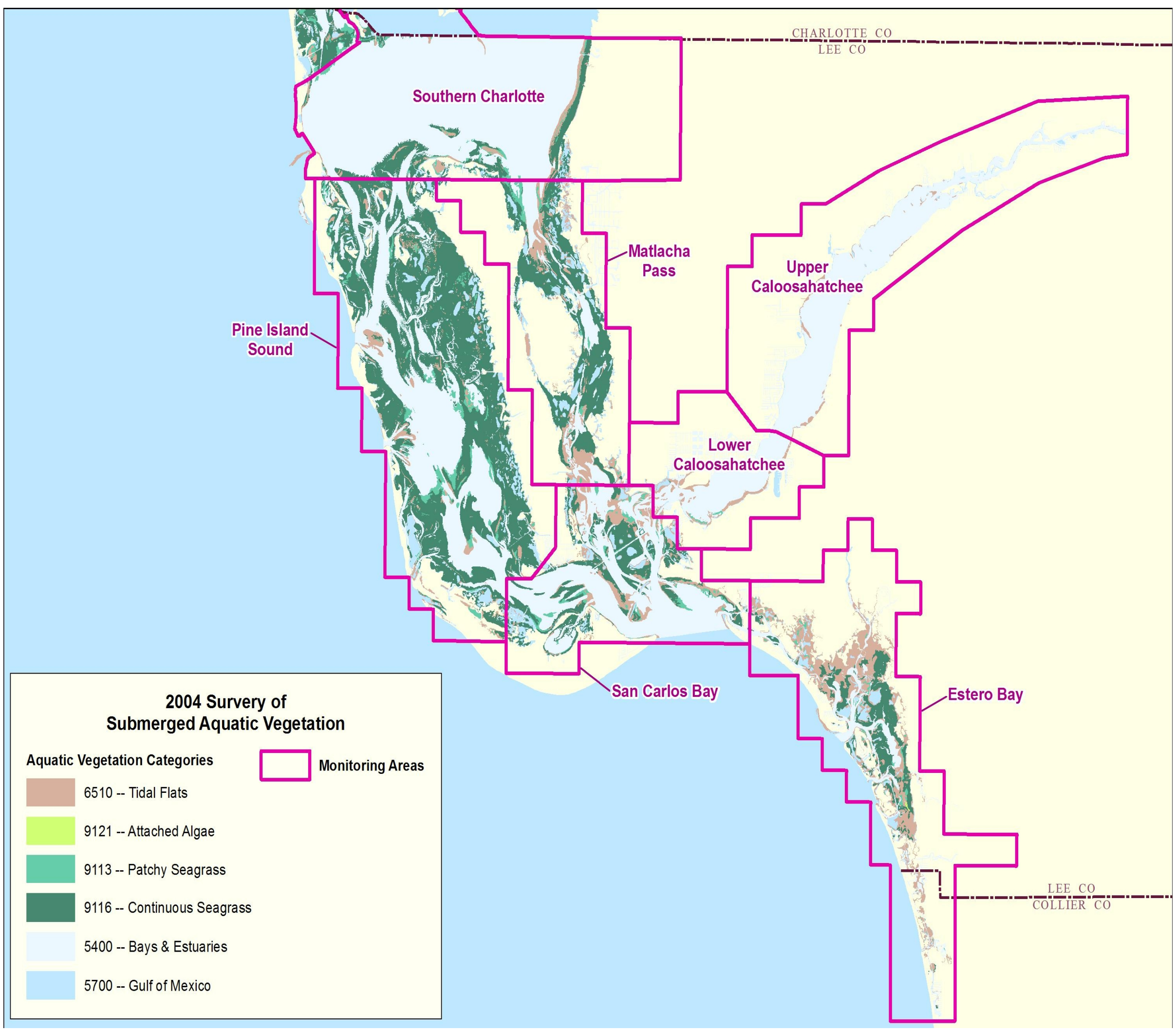


FIGURE 2-10: MAP DEPICTING RESULTS OF SEAGRASS AERIAL SURVEY CONDUCTED IN 2004 AND PROCESSED IN WY2006

Manual (in-water) seagrass monitoring by the Sanibel-Captiva Conservation Foundation Marine Laboratory indicates WY2006 was a very poor year for seagrass at all stations sampled, both upstream of Shell Point and in San Carlos Bay (***Figure 2-11***). This follows a poor WY2005 for *Halodule* upstream of Shell Point when shoot density remained below 200 m^{-2}. During WY2006, *Halodule* remained low upstream, while *Halodule* and especially *Thalassia* fell to a new seasonal low in San Carlos Bay following the large discharges that began in June 2005. These low densities persisted into the winter dry season and recent field trips indicate that *Thalassia's* percent of seagrass species composition has significantly declined.

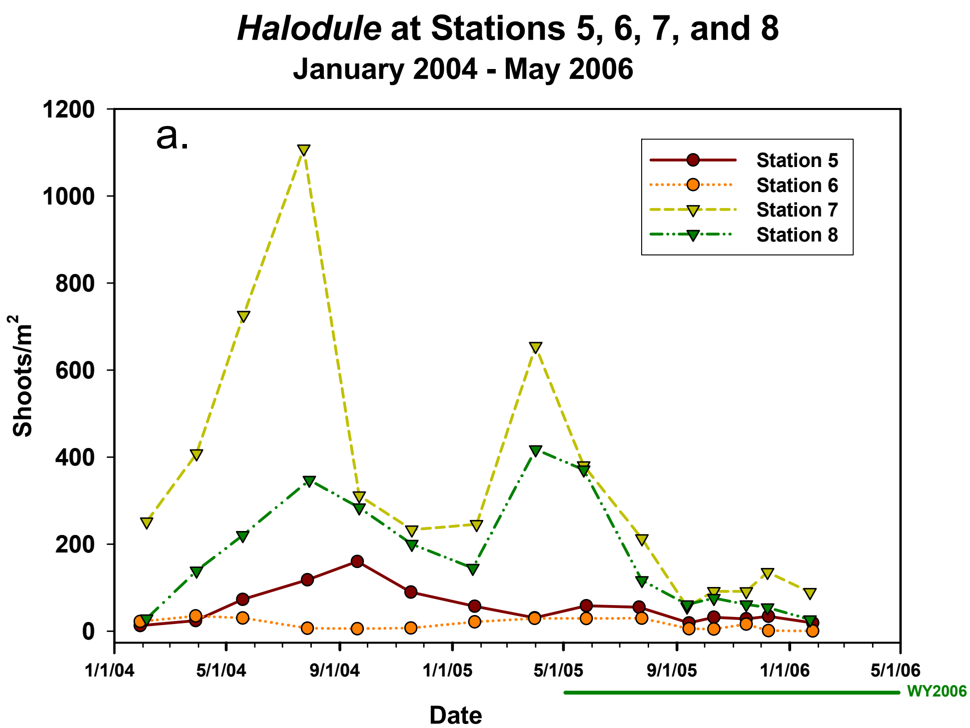


Figure A

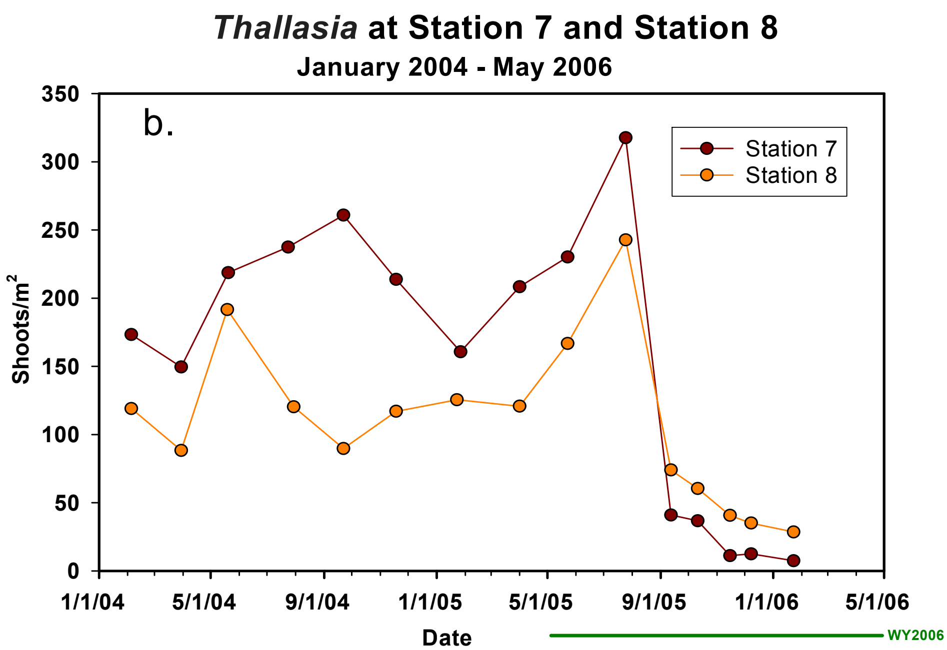


Figure B

(Note: Data collected by the Sanibel-Captiva Conservation Foundation)

FIGURE 2-11: DENSITY OF SEAGRASS: (FIGURE A.) *HALODULE WRIGHTII* (SHOAL GRASS); AND (FIGURE B) *THALASSIA TESTUDINUM* (TURTLE GRASS) IN THE CALOOSAHATCHEE ESTUARY AND SAN CARLOS BAY

2.11 AIR QUALITY

A few common air pollutants are found all over Florida. The existing air quality within south Florida is considered good, and the region attains all National Ambient Air Quality Standards. There are no non-attainment areas in the State of Florida. The current sources of air pollution are area-wide, resulting from autos in urban areas, land clearing, and partly from various licensed emitters (SWFRPC, 2002). Large industrial polluters are limited.

2.12 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The reservoir currently under consideration will be constructed on property formerly owned by J&H Grove Holdings, L.C. (Berry Groves), the Griffin Family Limited Partnership, the MG Enterprises, L.L.C. and the Bryan Paul Citrus. All these lands are currently owned in fee by the SFWMD except the Bryan Paul Citrus parcel that will be an exchange of 541.31 acres of SFWMD ownership in exchange for 600.17 acres of the Bryan Paul Citrus property. Prior to the 1960s these lands were primarily used as unimproved pasture. For the last 30 to 40 years these four parcels have been used to cultivate citrus. Over the operating life of these groves, fertilizers, herbicides and pesticides have been applied routinely as part of normal agricultural operations. From the 1960s to 1980s, pesticide use would have included the application of persistent organic compounds such as DDT, chlordane, and toxaphene. Use of these and other persistent pesticides has since been severely restricted by the U.S. Environmental Protection Agency (USEPA). Normal farm operations would also typically result in point-source contamination associated with maintenance areas, pesticide mixing and loading sites, and fuel storage areas. The non-Federal sponsor shall be responsible for ensuring that the development and execution of Federal, State and/or locally required HTRW response actions are accomplished at 100 percent non-project cost. No cost sharing credit will be given for the cost of response actions.

Prior to and after the acquisition of each of these land parcels, a Phase I and Phase II Environmental Site Assessment (ESA) were performed to identify and characterize contaminated sites within the properties. In addition to identifying human health impacts, the site assessments also investigated the presence of widespread residual soil contamination in the cultivated areas to determine if the level of contamination might pose a threat to wildlife inhabiting the proposed reservoir. All site assessments were performed in general accordance with the American Society for Testing and Materials Standard Practice for Environmental Site Assessments (ASTMS Practice E 1527-00). These site assessments typically focus on identifying contamination that is a threat to human health. Analytical results were compared to FDEP SQAG and the Florida Administrative Code Soil Cleanup Target Levels (SCTL) and Groundwater Cleanup Target Levels (GCTL). In those cases where contaminant concentrations were at or above the relevant guidelines, an Environmental Risk Assessment (ERA) was performed to determine if the contamination would pose a risk to affected species. The risk assessments focused on the potential for bioaccumulation of residual contaminants by avian species that might feed on fish caught from the reservoir. In particular, the USFWS identified the listed snail kite as the species at greatest risk. Short summaries of the environmental audits for each property are provided below. A detailed discussion can be found in section 9.25 of this report.

2.12.1 Berry Groves Property

The 9,000 acre Berry Grove property, only a portion of which will be utilized in the Caloosahatchee River (C-43) West Basin Storage Reservoir Project, is owned by the SFWMD. Phase I and Phase II ESA studies as well as ERAs were performed on this parcel during the period from December 1999 through 2006. These investigations identified more than 40 potential point source contamination sites within the parcel boundaries. These point source sites typically consist of refueling sites, maintenance sheds, pesticide storage/mixing sites, and irrigation pump stations. Seventeen (17) of the 40 sites were designated as requiring no further action because further investigation determined that contamination was not present at levels requiring remedial action. Fifteen (15) of the sites were identified as presenting a contingent hazardous, toxic, and radioactive waste (HTRW) risk because contamination has been identified and quantified but remediation has either not begun or been completed. An additional five sites were identified in March 2003 as requiring remediation. The 40 contaminated sites discussed above can be generally categorized as point source contamination sites in which the contamination is contained within an area of a few acres or less. Though most of these sites have been re-mediated as of February 2007, remediation of the remaining sites will be completed prior to transferring control of the land from the lessee to the SFWMD.

Of greater concern to the USACE and the USFWS is the widespread presence of elevated copper concentrations in the cultivated soils on the Berry Groves property. The presence of elevated copper in the soils is a result of the application of fungicides that have been applied to the citrus groves. To investigate the risk posed by copper, a Phase III ERA was conducted by the URS Corporation under contract with the SFWMD and in coordination with the USFWS. The purpose of the ERA was to determine the risk that elevated concentrations of copper in the soil posed to populations of invertebrates, fish, and birds (the listed snail kite, for instance) that would use the Caloosahatchee River (C-43) West Basin Storage Reservoir for habitat.

At the onset of this study, the 9,000 acre Berry Grove property was divided into 181 fifty-acre grids for purposes of sampling shallow soils for copper content. A total of 89 of these plots were randomly selected for sampling for residual copper in the surface soils. Copper concentrations in composite samples collected from these plots ranged from 13.1 (Grid 100) to 169 milligrams per kilogram (mg/kg) (Grid 125), resulting in a contractor calculated geometric mean of 51.9 mg/kg (95 percent upper confidence level of 56.6), which exceeds the threshold effects concentration (TEC) of 32 mg/kg for effects on benthic invertebrates. In fact, seventy-five of eighty-nine 50-acre grids exceeded the TEC. Since copper concentration in Grids 58, 124, 125, and 134 exceeded the probable effect concentration (PEC) of 108 mg/kg, discrete samples were collected in 2002 from those grids to look for potential contamination hot spots.

In 2003, the FDEP adopted a new PEC for copper (150 mg/kg) reducing the number of grids with copper concentrations exceeding the PEC to one (Grid 125). Additionally, a site-specific ecological risk assessment was performed in 2003 which concluded that impacts were likely for the benthic community. It also predicted potential risk for the Everglades snail kite if copper concentrations in soil exceed 85 mg/kg (interim screening concentration for risk to the snail kite). Contamination in Grids 56 and 145, in addition to grids 58, 124, 125, and 134, exceeded 85 mg/kg. Therefore, in 2005, discrete samples were collected from

Grids 56 and 145 to locate potential contamination hot spots. Lastly, in 2005, delineation sampling of copper contamination in the above-noted six grids was performed. The delineation sampling indicated copper exceeded 85 mg/kg in Grid 135 as well, but was less than 85 mg/kg in Grid 145. The consultant's final report recommended remediation of copper contamination in soils of Grids 56, 58, 124, 125, 134, 135, and 143.

2.12.2 MG Enterprises LLC Property

The 2,399 acre MG Enterprises LLC property is owned by the SFWMD. The entire property will be utilized in the reservoir project. The MG Enterprises LLC property is located south and west of the larger Berry Groves property. The MG Enterprises LLC property has been used to cultivate citrus for the last 30 or more years. Like the Berry Groves property, persistent pesticides such as DDT, toxaphene, and chlordane were probably widely used until the application of such chemicals was restricted by the USEPA in the 1980s. A Phase II ESA report was prepared in March 2003 by Environmental Consulting & Technology, Inc. (ECT) on behalf of the SFWMD. This report identified five areas of potential concern including the cultivated areas, canal sediments, two maintenance areas, and an exploratory oil/gas well. Grid based testing was performed in the cultivated areas such as was done on the Berry Groves property. The results of these sediment analyses indicated the presence of aldrin and aldicarb at levels exceeding the threshold concentrations. A preliminary ERA was done using a fugacity-based food chain model to determine the risk that elevated aldrin concentrations might pose to avian species. The results of this modeling indicated that at the highest detected concentration (29 ug/kg), the calculated hazard quotient ranged from 0.01 to 0.02 for birds exposed to the contamination. Two of the remaining four suspected areas, Maintenance Area A and Maintenance Area B, require corrective action. Soils samples collected in the vicinity of Maintenance Area A had high levels of endrin, copper, and zinc. No contamination of groundwater was detected at this site. Soil samples collected in the vicinity of Maintenance Area B had high levels of anthracene, flourene, and acenaphthalene. No groundwater contamination was detected at this site.

2.12.3 Griffin Property

The approximately 954 acre Griffin property is owned by the SFWMD, and all will be utilized in the Reservoir project. The Griffin property is located south and west of the larger Berry Groves property. The Griffin property (954 acres) has been used to cultivate citrus for the last 30 or more years. The Phase I and Phase II ESA report identified five areas of potential concern including the cultivated areas, canal sediments, maintenance area/chemical barn, fertilizer mix/load area, and burn area. Grid based testing in the cultivated areas was performed by dividing the property into 20 cells of 50 acres each. Discrete samples were collected from 10 five-acre sub-grids on each larger grid and composited into one sample. The results of these sediment analyses indicated evidence of low level contamination of barium, copper, lead, mercury, zinc and paraquat. However, none of these analytes exhibited concentrations which exceeded the SQAG PEC. Aldicarb was detected in one sample grid at a concentration of 67 ug/kg which exceeds the site-specific SQAC of 1.75 uk/kg developed specifically for this site. Soils contaminated with polyaromatic hydrocarbons (PAHs) were found at the maintenance area/chemical barn. At the burn area, soils contaminated with copper were found. Seven sediment samples were collected from the drainage canal. One of these samples contained residual copper at a concentration exceeding the TEC of 32 mg/kg but not exceeding the interim screening concentration of 85 mg/kg. Another sample contained pentacholorophenol (PCP) at a concentration of 32 mg/kg which is well below the site-specific effect level of 617 ug/kg. Remediation was recommended for the maintenance area, and burn area.

2.12.4 Bryan Paul Citrus Property

The approximately 600-acre Bryan Paul Citrus property is located east of the Berry Groves property and has not been acquired by the SFWMD. It will be acquired in an exchange for approximately 541 acres of the Berry Grove property. In the 1960s the property was converted from a cattle ranch to row crops such as tomatoes, watermelons, and peppers. In 1972, the property was converted to citrus groves (see Appendix D "Real Estate Plan").

In 2004, the SFWMD conducted a Phase I and Phase II Environmental Assessment as part of a due diligence investigation prior to acquiring the lands. The Phase I assessment identified the following seven sites of environmental concern: 1) pump stations, 2) former nursery barn, 3) C-1 mixing site, 4) auxiliary tank area, 5) solid waste site, 6) burn area, and 7) grove area. To test the grove area for the presence of elevated pesticide and heavy metal residues in the soils, the 600 acres were divided into a grid composed of 119 five-acre squares. Soil samples from each of the 119 cells were collected and then composited into ten samples. The resulting 12 composite soil samples were submitted to the laboratory for analysis. The results of the analysis indicated that the soil in two grids (8 and 9) had elevated chlordane levels in excess of the recommended 100 ug/kg limit. Further testing indicated that approximately 13 acres in the vicinity of grids 8 and 9 had chlordane impacted soils.

At the solid waste area, soil samples were collected from below the buried waste. These samples indicated that the soils were not impacted though the presence of buried solid waste would have to be addressed. At the burn area, soil samples were collected to determine if concentrations of heavy metals exceed the standards. At the former pump stations, soil samples were collected and analyzed for petroleum and heavy metal contamination. The results indicate that the visibly contaminated soils should be removed. At the burn site, the analysis of soils indicated that the surrounding soils were not impacted. However, the removal of ash was recommended by the environmental consultant. From the drainage canal, eight soil/sediment samples were collected for analysis. The results indicated that canal sediments were not contaminated; however, some canal bank soil directly adjacent to a burn area had high levels of barium, copper, and silver. The consultant's recommendation was to remove the canal bank soil that appears to be contaminated by the adjacent burn site.

2.13 CULTURAL RESOURCES

Cultural resource surveys (Florida State Department of Historic Preservation numbers 2004-8676 and 2006-07757) have been conducted for the Caloosahatchee River (C-43) West Basin Storage Reservoir site. Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were determined to lack integrity and determined not eligible for listing on the National Register of Historic Places. The prehistoric archeological site (8HB129) is located near the edge of the proposed project.

2.14 SOCIOECONOMICS

As a result of the flood protection and available supply of drinking water supplied by the C&SF project, the population of southwest Florida has grown to approximately 880,000 persons as of the year 2000. By the year 2050, the population of southwest Florida is expected to reach two million people. Lee County has one of the fastest growing populations in both south Florida and in the state. The coastal areas in these counties have become highly urbanized. As a result, this urbanization has caused development to move eastward into areas that were once agricultural or natural.

The Governor's Commission for a sustainable south Florida identified agriculture and tourism as "critical industries" for maintaining the economy in the southern part of the state. In Lee and Hendry County, agriculture is a major industry and citrus production predominates. A rapidly expanding human population demanding more developable lands and advancing agricultural development now threatens the relatively pristine natural areas. The tourism industry is also dependent upon the region's ability to sustain its economy and its quality of life through management of its resources. Agriculture and tourism depend on a system that can provide vital water supply needs and flood protection.

2.14.1 Population

Population for the four counties in the study area (Charlotte, Glades, Lee and Hendry County) increased at a high growth rate during the period from 1990 to 2000 (***Table 2-5***). Charlotte increased at 27.6 %, Lee at 31.6 %, Glades at 39.3 % and Hendry at 40.5 %. The population of Florida and the United States increased 23.5 % and 13.1 % respectively over the same period.

TABLE 2-5: CHARLOTTE, GLADES, LEE AND HENDRY COUNTY 2000 POPULATION

		Race							
	Population, 2000	**White**	**%**	**Black**	**%**	**Hispanic**	**%**	**Other**	**%**
Florida	15,982,378	12,466,255	78.0%	2,333,427	14.6%	2,685,040	16.8%	1,182,696	7.4%
Charlotte County	141,627	131,147	92.6%	6,232	4.4%	4,674	3.3%	4,249	3.0%
Census Tract 101	3,556	2,916	82.0%	525	14.8%	191	5.4%	115	3.2%
Glades County	10,786	8,305	77.0%	1,133	10.5%	1,629	15.1%	1,348	12.5%
Census Tract 1	2,018	1,975	97.9%	2	0.1%	21	1.0%	41	2.0%
Census Tract 2	5,669	4,590	81.0%	415	7.3%	1,353	23.9%	664	11.7%
Census Tract 3	2,889	1,577	54.6%	697	24.1%	220	7.6%	615	21.3%
Lee County	475,639	417,135	87.7%	31,392	6.6%	45,186	9.5%	27,112	5.7%
Fort Meyers MSA	440,888	386,598	87.7%	29,035	6.6%	42,042	9.5%	25,255	5.7%
Hendry County	36,210	23,935	66.1%	5,323	14.7%	14,339	39.6%	7,083	19.6%
Census Tract 1	6,567	4,973	75.7%	729	11.1%	2,655	40.4%	41	0.6%
Census Tract 2	7,506	3,750	50.0%	2,898	38.6%	2,007	26.7%	664	8.8%
Census Tract 3	6,926	4,222	61.0%	132	1.9%	4,256	61.4%	615	8.9%
Census Tract 4	11,066	8,503	76.8%	802	7.2%	3,738	33.8%	1,761	15.9%

Hendry County has a large percentage of people that claim Hispanic origin. Of the 36,210 residents in the county during the year 2000, almost 40% (14,339 persons) are of Hispanic origin. Glades, Charlotte and Lee counties all have lower proportions of persons of Hispanic origin than does the rest of the state. Florida's African-American population is 2,333,427, which is 14.6% of the State's total population. Hendry County has a total African-American population that is slightly higher than that of the state total. There are also three census tracts in the study area that have a higher African-American representation than that of the state.

The Native-American population of the study area represents less than one percent of the aggregate population of the study area.

2.14.2 Economy

Generally, a strong wholesale and retail trade, government and service sectors characterize Florida's economy. Florida's warm weather and extensive coastline attracts vacationers and other visitors and helps make the state a significant retirement destination for people all over the country. Agricultural production is also an important sector of the state's economy, and is especially significant to portions of the study area. Compared to the national economy, the manufacturing sector has played less of a role in Florida, but high technology manufacturing has begun to emerge as a significant sector in the state over the last decade.

The unemployment rate for Florida is 5.1 % (2003), which is greater than that of Lee (4.0%) and Charlotte (4.4%) counties. Hendry and Glades counties had unemployment rates that were much greater than the state total, with Glades' unemployment rate at 8.7% and Hendry County's unemployment rate at 11.7% (***Table 2-6***).

TABLE 2-6: INCOME AND EMPLOYMENT FOR COUNTIES AND CENSUS TRACTS

	Income					Employment	
	Median Household, 1999	**Personal Per Capita, 1999**	**Persons Below Poverty Level**	**% Below Poverty Level**	**Average Household Size**	**In Labor Force (+16 yrs old)**	**Unemployed**
Florida	38,819	21,806	1,997,797	12.5%	2.46	7,407,458	412,411
Charlotte County	36,379	21,557	11,613	8.2%	2.18	52,512	1,822
Census Tract 101	41,274	17,560	165	4.6%	2.47	1,176	27
Glades County	38,819	15,338	1,639	15.2%	2.51	3,677	357
Census Tract 1	27,604	17,216	374	18.5%	2.47	1,873	29
Census Tract 2	31,170	14,597	938	16.5%	2.72	4,268	256
Census Tract 3	34,091	15,471	175	6.1%	2.62	2,324	72
Lee County	40,319	24,542	46,137	9.7%	2.31	186,417	7,234
Fort Myers MSA	40,139	24,542	42,316	9.6%	2.31	3,120	230
Hendry County	33,592	13,663	8,727	24.1%	3.09	14,579	1,235
Census Tract 1	37,210	15,460	1,197	18.2%	2.92	3,120	230
Census Tract 2	31,760	13,047	2,034	27.1%	3.15	3,318	420
Census Tract 3	34,250	12,315	1,894	27.3%	3.55	3,512	237
Census Tract 4	33,022	15,417	2,492	22.5%	2.87	4,425	280

Personal per capita income in Florida is $21,806 (1999), but is somewhat lower in Charlotte County at $21,557, and substantially lower in Glades County at $15,338 and Hendry at $13,663. Lee County experiences higher per capita income than that of the state average. Every rural census tract associated with the study area has lower than the state average per capita income.

In 1999 it was reported that 12.5% of Florida's population lived below the poverty level, while 24.1% of Hendry County's population lived below the poverty level, and 15.2% of Glades County lived below the poverty level. Charlotte County and the census tracts associated with it are both below the state poverty level figures. All Census tracts in Hendry County are above the poverty level than that of the state.

2.14.3 Commercial and Recreational Fishing

There exists some commercial fishing in the Caloosahatchee Estuary. The Florida Statistical Abstract (FSA) contains estimates for the direct employment in fishing in Lee County. According to the FSA, the fishing industry in Lee

County involves an estimated 40 businesses (FSA, 1997), with 180 employees, and an estimated annual payroll of $3.54 million. The use of cast nets in the estuary is reported to be common. In addition, there is reported to be substantial crabbing activity in the estuary. In Lee County, there are 638 saltwater products licenses and 267 permits for blue crab fishing.

The Caloosahatchee Estuary has important ecological connections with offshore commercial fish stocks. As described in Nelson (1992), many commercial finfish and invertebrate species use estuaries for critical stages of their development. ***Appendix G*** presents commercial landings, trips, and value data collected by the FDEP for the Pine Island Sound/San Carlos Bay area. As indicated in this appendix, in 1997 the value of the commercial landings from this area was approximately $1.7 million. The finfish and bait shrimp fisheries account for most of the landings and value. Although the shrimp landings are small, there is a significant offshore pink shrimp fishery that is based on Sanibel Island. This fishery is reflected in 1997 pink shrimp landings data for Lee County, which totaled 4,033,537 pounds. The Caloosahatchee Estuary and the area affected by freshwater releases from Lake Okeechobee comprise part of the nursery habitat for this fishery. The finfish and bait shrimp poundage, trips, and value data vary widely from year to year. This is due to changes in the fish population dynamics, fishing conditions, and fishing effort.

The Caloosahatchee Estuary also supports guided sport fishing and recreational fisheries. Nelson (1992) described the following recreational species as “highly abundant”, “abundant”, or “common” in the Caloosahatchee Estuary: tarpon, sea catfish, snook, crevalle jack, silver perch, pinfish, spotted seatrout, red drum, black drum, and stripped mullet.

2.15 EXISTING LAND USE

The Caloosahatchee River (C-43) West Basin Storage Reservoir is proposed for construction in north-western Hendry County. This reservoir is intended to reduce the fresh water pulses into Charlotte Harbor and the Caloosahatchee Estuary, and provide water storage for meeting environmental needs. Additional water, after environmental needs are met, could be used as supplemental water to help meet the needs of agriculture and urban communities in southwest Florida. The study area includes Lee, Hendry, Glades and parts of Charlotte County. Collier County is located in the general vicinity of the study area. ***Figure 2-12*** depicts the 2000 land use map for the southwest Florida region. This map was generated for the SWFFS and includes the Caloosahatchee River (C-43) West Basin Storage Reservoir study area.

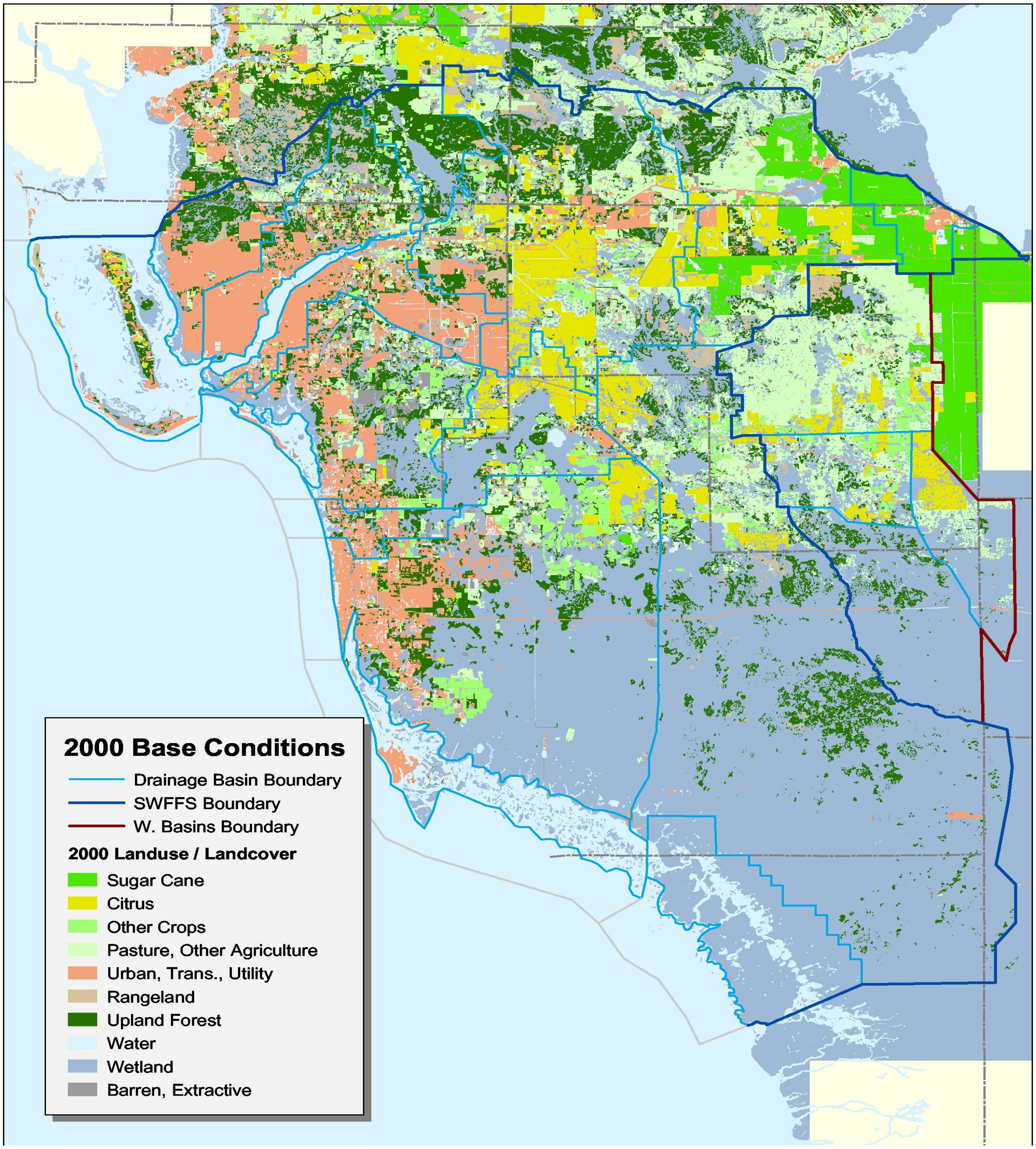


FIGURE 2-12: MAP DEPICTS THE 2000 LAND USE MAP FOR THE SOUTH WEST FLORIDA REGION

Much of the land use/cover change occurring in southwest Florida over the past several years can be categorized as either the creation of new developments in previously natural or agricultural areas, or the change in the types of agriculture practiced. Most of the new development appears to be in golf course/residential areas concentrated near Interstate 75 in Lee County. A majority of these residential areas and small reservoirs were associated with new golf course communities. ***Table 2-7*** presents the number of acres associated with existing golf courses.

TABLE 2-7 GOLF COURSE ACREAGE

County	Year	Acreage
Lee	2000	8,962
Hendry	2000	120
Glades	2000	220
Charlotte	2000	460

The agricultural areas are inland from the urban areas and the Gulf Coast. They are being encroached upon by the urban areas and undergoing conversion within agricultural types. Much of Lee County is being converted from cattle farms to citrus, and there is a great deal of conversion year to year between pasture and row crops.

2.15.1 Agricultural Land Use

The Study Area continues to experience growth in irrigated agricultural acreage, especially citrus. The irrigated crops in this region are citrus, sugarcane, vegetables, sod, and greenhouse/nursery. Growth in citrus acreage is usually on land that was formerly pastureland. Descriptions of the agricultural acreage in each county are included ***Table 2-8.***

TABLE 2-8: TOTAL LAND AND FARM ACREAGE

Item	Florida	Charlotte	Glades	Hendry	Lee
Total Land Acreage	34,513,162	443,907	495,123	737,622	514,323
Farms	44,081	284	231	456	643
Farm Acreage	10,414,877	191,529	379,278	606,839	134,649

Source: USDA, NASS, 2002 Census of Agriculture

The following acreage by specific crop types was obtained from the Lower West Coast Water Supply Plan (LWCWSP) and pertains to acreage in 1995. The Caloosahatchee River (C-43) West Basin Storage Reservoir study area does not coincide exactly with the LWCWSP study area, but falls within the study area. Citrus is by far the dominant agricultural crop in the Lower West Coast (LWC) study area, and occupies approximately one-half of agricultural acreage in the region. Between 1968 and 1980 acreage remained at about the same level.

From about 1984 until about 1992, acreage grew rapidly, associated with the inter-regional movement of citrus acreage southward from Central Florida following several severe winter freezes in the mid-1980s. Since approximately 1992, citrus growth has slowed in the area. Tropical fruits (primarily avocados and mangos) and nuts are produced only in Lee County. In 1995, there were 1,930 acres of tropical fruits and nuts in Lee County. Vegetable crops grown in the study area include cucumbers, peppers, tomatoes, squash, eggplant, watermelons, Latin vegetables, snap beans, and potatoes. Different types of vegetables are often grown interchangeably, and in 1995 there were 44,231 acres of land used for vegetable production.

Hendry and Glades county areas are the only parts of the study area where sugarcane is produced. As a result of the cultivation practices used for sugarcane, 25 percent of the land used for sugarcane production is fallow in any given year. In 1995, a total of 35,443 acres of sugarcane were produced in the Hendry County Area. The seed corn production in southeastern Charlotte County varies from year to year, based primarily on the demand for seed corn, which in turn is dependent on seed corn production in other parts of the country. This variation in production is more a fluctuation than a trend. The estimate for seed corn production is 2,100 acres and 1,000 acres for soybeans. While fluctuations are anticipated, the magnitude of this acreage is typical. Rice in southern Glades County is grown during the summer months in rotation with sugarcane or winter vegetables, and takes place on land that would otherwise be fallow. Rice acreage in southern Glades County was assessed at 200 acres in 1995.

In 1995, there were a total of 650 acres of irrigated sod production in the LWC planning area. In 1995, there were 6,089 acres of greenhouse/nursery operations in the LWC planning area, and this is projected to increase to 10,627 acres by the year 2020.

2.16 NOISE

Within the major natural areas of south Florida, external sources of noise are limited and of low occurrence. Rural areas have typical noise levels in the range of 34-70 decibels, and urban areas may attain 90 decibels or greater. Noise generated on the project site is basically limited to agricultural machinery.

2.17 RECREATION AND AESTHETICS

Recreational opportunities in the basin include hiking, boating, fishing, and camping. Numerous recreation areas, such as Ortona Lock Recreation Area, Caloosahatchee Regional Park, and W.P. Franklin Lock Recreational Area, are extensively used by natives and visitors alike. Since the river is used for boat traffic between the east and west coasts of Florida, boat traffic is moderately heavy and boating and fishing occurs in the area. The river banks are too steep to be useful for bank fishing. Several access points and three USACE lock structures are located along the river. Additionally, the FFWCC owns ramps at Wayside Park in Hendry County and at the intersection of SR 80 and Highland, east of Fort Myers, in Lee County. All the recreation sites along the river are well used, particularly on weekends.

Within the project footprint there are currently no recreation opportunities, as it is an active citrus grove. The visual aesthetics are characterized by limited viewsheds controlled by low topographic relief, typical of views of citrus groves, with a few remaining wetland areas scattered within the grove.

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SECTION 3
FUTURE WITHOUT PROJECT CONDITIONS

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3.0 FUTURE WITHOUT PROJECT CONDITIONS

The future "without project" condition describes the planning area's future if there is no federal action taken to solve the current problems. This condition is vitally important to the evaluation and comparison of alternative plans and to identify impacts (both beneficial and adverse) attributable to proposed federal actions. The without plan condition is the same as the "No Action" alternative that is required to be considered by the federal regulations implementing the National Environmental Policy Act (NEPA).

The assumption for this future without project analysis is that the project footprint would be in agricultural production as a citrus grove in 2050. Please see Section 3.15 Land Use for a more detailed description of future conditions of the project site and surrounding areas.

3.1 GENERAL ENVIRONMENTAL SETTING

The general environmental trends in the future without project condition are tied to the increase in population and decrease in quality and quantity of natural areas, as well as the continued high and low flows to the Caloosahatchee Estuary. The distribution of these high and low flows may change as increased demands on the water in Lake Okeechobee develop. Urban growth in Lee County has the potential to impact the region's environmental and water resources. Urban and industrial areas will increase, while range lands and upland forests will decrease. Wetland and aquatic habitat quality will continue to decline, as extreme flows from Lake Okeechobee will continue to cause huge variances in the salinity regime. The quantity and quality of fresh- and saltwater SAV will decline. This will generally leave less habitat for wildlife, resulting in a detriment to many threatened and endangered species as well as a decline in general ecological diversity of the region. The project site would most likely continue to be a producing citrus grove in the future without project condition.

Regulatory impacts were considered when compiling the future without project conditions. The MIKESHE model assumed no net loss of wetlands in the basin in the future without project (FWOP) scenario due to regulatory mitigation requirements. Under section 404 of the Federal Clean Water Act (CWA) permits are required for the discharge of dredge or fill material in waters of the United States including wetlands. In addition, unavoidable impacts to wetlands or other aquatic resources require compensatory mitigation. There are some exemptions under the CWA for agricultural activities. Digging ditches and farming uplands does not require a permit so this activity could occur in the basin without any USACE permit. Clearing and filling for development would likely require a permit. In that situation, mitigation may be done on site through enhancement and preservation of existing wetlands or offsite. In addition, through the federal permit process the regulatory division of USACE evaluates compliance with other environmental laws such as Endangered Species Act (ESA).

3.2 CLIMATE

The National Oceanic Atmospheric Administration (NOAA) published historic rates of sea level rise at some NOAA stations in Florida (***Table 3-1***). The closest station to the Caloosahatchee River (C-43) West Basin Storage Reservoir Project area is Fort Myers; therefore, this station will be used to estimate sea level rise. The historic rate of sea level rise at Fort Myers is 2.29 millimeters per year (mm/yr) with a standard error of 0.452. Under current trends, it is estimated that sea level will rise 14 cm between 1990 and 2050 (2.29mm/yr x 60yr x 1/10cm/mm = 13.74 cm ≈ 14 cm).

TABLE 3-1: HISTORIC RATE OF SEA LEVEL RISE AT NOAA STATIONS IN FLORIDA

Atlantic Coast			Gulf Coast		
NOAA station name	Rate of sea level rise (mm/yr)	Standard error	NOAA station name	Rate of sea level rise (mm/yr)	Standard error
Fernandina Beach	2.04	0.12	Key West	2.27	0.09
Mayport	2.43	0.18	Naples	2.08	0.43
Miami Beach	2.39	0.22	**Ft. Myers**	**2.29**	**0.45**
-------	-------	-------	St. Petersburg	2.40	0.18
-------	-------	-------	Cedar Key	1.87	0.11

(Source: Sea Level Variations for the United States 1854-1999, NOAA, technical Report NOS CO-OPS 36, National Ocean Service, Silver Spring MD, Chris Zervas, 2001.)

Normalized sea level projections for 2025, 2050, and 2100, compared with 1990 level are shown in ***Table 3-2***. The normalized projection estimates represent the projected acceleration in sea level compared with historic trends due to the greenhouse contribution.

TABLE 3-2: NORMALIZED SEA LEVEL PROJECTIONS FOR 2025, 2050 AND 2100, COMPARED WITH 1990 LEVELS

Cumulative probability (%)	Exceedance frequency (%)	2025 (cm)	2050 (cm)	2075 (cm)	2100 (cm)
10	90	-1	-1	0	1
20	80	1	3	6	10
30	70	3	6	10	16
40	60	4	8	14	20
50	50	5	10	17	25
60	40	6	13	21	30
70	30	8	15	24	36
80	20	9	18	29	44
90	10	12	23	37	55
95	5	14	27	43	66
99	1	19	35	57	92
Mean		5	**11**	18	27
Standard deviation		6	10	15	23

To estimate sea level rise at a particular location, historic rate of sea level rise is added to the projected rise that would occur if current trends were to continue. For example, the historic rate of sea level rise at Fort Myers is 2.29 mm/yr with a standard error of 0.452 mm (***Table 3-3***). Under current trends, sea level will rise 14 cm between 1990 and 2050 (2.29mm/yr x 60yr x 1/10cm/mm = 13.74 cm ≈ 14 cm). Adding this 14 cm to the normalized values in ***Table 3-2***, the mean estimate for 2050 is 24 cm.

Since the historic rates of sea level rise in ***Table 3-1*** include the local vertical land motion, there is no need to adjust the estimated sea level rise to include historic vertical land motion unless there is strong evidence that the historical rate in vertical land motion has increased or decreased.

Table 3-3 shows the probabilities of various sea level rise amounts in the vicinity of Fort Myers for years 2025, 2050, 2075, and 2100.

TABLE 3-3: PROBABILITY DISTRIBUTION OF SEA LEVEL RISE FOR FORT MYERS FOR YEARS 2025, 2050, AND 2100

Cumulative probability (%)	Percent chance exceedance	2025		2050		2075		2100	
		cm	ft	cm	ft	cm	ft	cm	ft
10	90	7	0.2	13	0.4	19	0.6	26	0.9
20	80	9	0.3	17	.6	25	0.8	35	1.1
30	70	11	0.4	20	0.7	29	1.0	41	1.3
40	60	12	0.4	22	0.7	33	1.1	45	1.5
50	50	13	0.4	24	0.8	36	1.2	50	1.6
60	40	14	0.5	27	0.9	40	1.3	55	1.8
70	30	16	0.5	29	1.0	43	1.4	61	2.0
80	20	17	0.6	32	1.0	48	1.6	69	2.3
90	10	20	0.7	37	1.2	56	1.8	80	2.6
95	5	22	0.7	41	1.3	62	2.0	91	3.0
99	1	27	0.9	49	1.6	76	2.5	117	3.8
Mean		13	0.4	25	0.8	37	1.2	52	1.7

3.3 PHYSICAL LANDSCAPE

The lands within the project area would be developed consistent with surrounding land use patterns. The surrounding areas are predicted to still be in agricultural production in 2050. If the site remained a citrus grove, the geology and soils would not change significantly from the existing description.

3.4 HYDROLOGY

Changes to local hydrology are driven by changes in land use, water supply, water quality, and changes caused by other water resource projects in the watershed. Urban development and encroachment on previously undeveloped and low intensity agricultural lands in some areas of the Caloosahatchee Basin would be expected to increase the intensity and volume of runoff to local drainage systems and the Caloosahatchee River (C-43 Canal) during the wet season, thereby increasing flow rates and contributing to poor water quality. The increase in total area of impervious urban lands will also further decrease dry season base flows because less water infiltrates to the groundwater system, resulting in declining water table elevations.

As explained above, it is anticipated that a sea level rise of approximately 24 cm will occur over the period through the year 2050. This will impact control levels for canals within the Caloosahatchee River Basin to maintain a stable saltwater interface.

All of these factors would contribute to increasing ecological stress in the Caloosahatchee Estuary.

3.5 WATER MANAGEMENT

This section discusses the physical facilities and operational changes that are planned for the study area and are assumed to be in place for the future without plan condition.

3.5.1 Central and Southern Florida Project Modifications

The C&SF Project was authorized by the Flood Control Act of 1948, and modified by subsequent acts, as a plan of improvement for flood control, drainage, and other purposes covering an 18,000 square mile area of both central and southern Florida (C&SF). Within the Caloosahatchee River (C-43) West Basin Storage Reservoir Project area, C&SF canals include the C-43, C-20, and C-21. A number of efforts are currently underway by the USACE to modify the C&SF Project for environmental improvement. The following C&SF Project modifications are either in the planning, design, or construction phases and are included in the future without plan condition: 1) manatee protection, 2) other projects and structures, and 3) Lake Okeechobee Regulation Schedule (LORS).

3.5.1.1 Manatee Protection

The West Indian manatee (*Trichechus manatus*) is listed as a federally endangered species and is one of the most endangered species in Florida. As a response to recent manatee mortality trends associated with water control structures, the manatee protection C&SF modification project will provide operational changes and implement the installation of a manatee protection system at seven sector gates at navigational locks near Lake Okeechobee. The beneficial outcome of this modification project will be the reduction of risk, injury, and mortality of the manatee. The seven sector gates include S-193 at Okeechobee and S-310 at Clewiston on Lake Okeechobee; St. Lucie Lock and Port Mayaca Lock on the St. Lucie canal; and Moore Haven Lock, Ortona Lock, and W.P. Franklin Lock on the Caloosahatchee River. The future without plan condition for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project assumes that the automatic gate sensor devices are installed on these lock sector gates.

3.5.1.2 Other Projects and Structures

Existing projects and structures discussed in the existing conditions section of this report are assumed to remain in place and should be considered future without project conditions.

3.5.1.3 Lake Okeechobee Regulation Schedule

As part of the operation of the C&SF Project, the USACE establishes a water regulation schedule for Lake Okeechobee. A regulation schedule is a guideline for water managers to use in regulating the inflow and outflow of water through the various water control structures such as pumps, spillways and locks. Typically, a regulation schedule has water level thresholds which vary with the time of year and trigger discharges. The threshold values of regulation schedules define the release zones and are traditionally displayed graphically. Additionally, a corresponding table is typically used to identify the structure discharge rules for release zones.

Water levels are driven largely by climatic conditions across the entire watershed. One challenge of managing stage within Lake Okeechobee is that inflows to the lake frequently exceed total outflow capacity, causing the lake to rise very quickly. These sudden rises in stage may trigger discharges through the major outlets to the coastal estuaries in an effort to control excessive buildup of water in Lake Okeechobee. While the timing and magnitude of these releases is important for preserving the level of service for flood protection in the region, it also has significant impacts on the natural habitats of the downstream estuaries.

There is a need to manage Lake Okeechobee at a lower stage. Evidence of this has been clearly established for ecological reasons, such as the continued deterioration of Lake Okeechobee's littoral zone and both the Caloosahatchee and St. Lucie estuaries. The need to manage the lake lower also stems from integrity issues with the Herbert Hoover Dike (HHD) levee system that protects the surrounding communities from flood damage.

The goal of the new LORS is to implement a regulation schedule that would improve the health of Lake Okeechobee and the St. Lucie and Caloosahatchee estuaries, while continuing to ensure public health and safety, and with minimal or no impact to the competing project (lake) purposes. These goals are:

a. Ensure public health and safety
b. Manage Lake Okeechobee at optimal lake levels to allow recovery of the lake's environment and natural resources
c. Reduce high regulatory releases to the estuaries
d. Continue to meet Congressionally authorized project purposes including, flood control, water supply, navigation, fish and wildlife enhancement, and recreation

The 2007 LORS will result in water management operational guidance to be used on a daily basis in the management of Lake Okeechobee. Through the 2007LORS plan, the management of Lake Okeechobee water levels and determination of Lake Okeechobee releases to the Water Conservation Areas (WCAs) and to tide (estuaries) is based on seasonally varying lake elevations divided into three bands. These bands include “High Lake Management,” “Operational,” and “Water Shortage Management.” The High Lake Management Band is meant to address public health and safety, especially related to the structural integrity of HHD by providing the ability to make releases up to the maximum capacity that lake outlets will allow. The Operational Band is meant to facilitate authorized project purposes by providing the ability to make releases of various volumes, including no release; and Lake Okeechobee outlet canals should be maintained within their optimum water management elevations. The Water Shortage Management Band pertains to low lake levels which necessitate rationing water supplies. In this band, Lake Okeechobee outlet canals may be maintained below their optimum water management elevations. The water supply releases made within this band are made according to the SFWMD’s draft Lake Okeechobee Water Shortage Management Plan (LOWSM).

The 2007 LORS provides the ability to make long-term, low-volume releases to the Caloosahatchee Estuary, St. Lucie Estuary, and WCAs. These releases include low-volume pulse releases and base flow releases to the Caloosahatchee and St. Lucie estuaries that allow Lake Okeechobee to be maintained at more desirable levels throughout the year. A pulse release attempts to simulate a natural rainstorm event within the basins. The receiving body would respond to the pulse release in a similar fashion as if a rainstorm had occurred in the upstream watershed. Although an average flow rate is targeted for the duration of the pulse release, daily releases vary. The pulse releases and base flow releases are intended to regulate lake levels and reduce the potential for future prolonged high-volume releases to the estuaries. The base flow releases also provide a benefit of maintaining desirable salinity levels in the estuaries. By regulating lake levels, these low-volume releases improve public health and safety performance by reducing risk to the HHD and provide improved benefits for the health of Lake Okeechobee and the estuaries.

3.6 WATER QUALITY

Future water quality conditions in the basin will be directly influenced by future land use, the operation schedule of Lake Okeechobee, and the implementation of Best Management Practices (BMPs) to control nutrient discharges. There are multiple state and Federal projects that will have an impact on future water quality loads within the freshwater Caloosahatchee Basin (upstream of S-79) as well as from the Caloosahatchee Estuary Basin (downstream of S-79). Two CERP projects, the Lake Okeechobee Nutrient Removal project and the Lake Okeechobee Sediment Removal project will result in reduced nutrient loading from discharges at S-79. Non-CERP programs that will impact water quality within the basin include:

1. USACE and SFWMD Revised LORS
2. SFWMD Lake Okeechobee Protection Plan
3. FDEP Lake Okeechobee Total Maximum Daily Loads (TMDL);
4. SFWMD Caloosahatchee Minimum Flows and Levels (MFL);
5. SFWMD Caloosahatchee River Water Management Plan (CWMP);
6. FDEP Caloosahatchee Basin TMDL
7. FDACS/FDEP Agricultural BMP Program for the Caloosahatchee Basin
8. SFWMD Urban Irrigation and Landscape BMP Implementation Projects
9. SFWMD Stormwater Management Regulations; and
10. Lee and Hendry Counties Stormwater Management Projects.

The Revised LORS is intended to decrease the frequency and severity of large volume discharges from the lake to the Caloosahatchee (C-43) and St. Lucie (C-44) rivers. The Lake Okeechobee Protection Plan and the Lake Okeechobee TMDL regulatory program will reduce nutrient loading into the lake through structural and non-structural measures. When implemented these programs should result in a reduction of nutrients contained in Lake Okeechobee discharges which in turn will reduce nutrient loading to the Caloosahatchee Estuary. The Caloosahatchee MFL program and CWMP are intended to ensure that urban, agricultural, and environmental water demands are met in the future. To the extent these projects alter the timing of river flows to the estuary, the shifting of nutrient loads from the wet to the dry season will result. The TMDL program for the Caloosahatchee will coincide with the development of numeric nutrient standards as well as the implementation of agricultural BMPs to meet those standards. Local government stormwater protection programs and projects within the basin will result in a reduction of pollutant loading from existing and future development. The net result of these programs should be a reduction of nutrient and other pollutant loads to the estuary in 2050.

Projections of future water quality in the Caloosahatchee River and Estuary are presented below. The estimates for Future Without Conditions have been developed under the assumption that non-CERP projects are successfully implemented by 2050 while CERP projects have not been implemented. In the absence of the CERP projects, the state will still be compelled by the TMDL regulations to achieve similar reductions in nutrient loads in order to meet requirements of the CWA.

3.6.1 Freshwater Caloosahatchee Sub-Basin (Upstream of S-79)

Flows at S-79 consist of runoff from the freshwater Caloosahatchee Basin as well as discharge from Lake Okeechobee. As this basin becomes more urban or more intensely cultivated, the quantity of runoff will increase which will likely result in higher nutrient loads. There are several commonly used methods to estimate the impact of land use changes on the quality of rainfall runoff. A quick and fairly standard method for calculating average annual pollutant loading is to adapt the rational method used for estimating rainfall runoff. This load quantification methodology requires estimates for land use acreages, average annual rainfall, land use specific loading factors, and land use specific runoff factors. Loading estimates were prepared using land use specific runoff quality factors adapted from Harper (2003). The results of the analysis indicate that nitrogen and phosphorus loading from the freshwater Caloosahatchee Basin will increase by approximately eight percent. The increase in nitrogen and phosphorus loading expected under 2050 future without conditions is a reflection of the increase in the volume of runoff which will accompany urbanization of rural areas. If the implementation of BMPs to control runoff quantity and quality are moderately successful, it is likely that 2050 future without nutrient loads from this basin will be no higher than existing condition loads.

It is difficult to predict how much the average annual flow from Lake Okeechobee will change if CERP is not implemented. However, since there is a great desire to reduce the magnitude and frequency of extremely large discharge events at S-79, it is likely that 2050 without project average annual flow through S-77 will be reduced relative to the existing flow quantity. At the same time, efforts to reduce nutrient loading in Lake Okeechobee are likely to result in an improvement in the quality of water discharged from the lake. The net impact of reduced S-77 releases and improved lake water quality is a reduction in nutrient loads contributed by the lake to the estuary. Overall, nutrient loads delivered through S-79 to the estuary are expected to be no more than presently delivered to the estuary. If BMPs are implemented within the basin and are moderately effective, nutrient loads from upstream of S-79 in the future without condition should be less than the existing condition loads.

3.6.2 Caloosahatchee Estuary (Downstream of S-79)

Water quality conditions in the Caloosahatchee Estuary are influenced by nutrient loads at S-79, by runoff from the estuary sub-basin, and nutrient loads contributed by point source contributors such as wastewater treatment plants. Under the future without 2050 condition, the fraction of nutrient loads within the estuary that are contributed by flows from upstream of S-79 will continue to be between 65 percent and 75 percent as in the present condition.

Using present land use and future land use projections combined with typical runoff coefficients, it appears that the quantity of runoff from the estuary sub-basin may increase by up to 25 percent if no BMPs are implemented. The actual increase in runoff and nutrient load is likely to be significantly less than 25 percent since most of the shift in land use is to new urban development that will be required to have stormwater ponds. These ponds are effective in reducing offsite runoff as well as providing effective removal of non-nutrient pollutants such as hydrocarbons and heavy metals.

Since the 2050 population will be substantially greater than the year 2000 population, the quantity of treated wastewater effluent discharged to the estuary will increase. Regardless, with the expected implementation of TMDLs for the discharge of nutrients into the estuary, it is not unreasonable to expect that by 2050 most existing wastewater treatment plants and all future plants will incorporate tertiary treatment processes to remove nutrients. If the TMDL program is effective, the 2050 nutrient loads from wastewater effluent will be similar to or less than the present nutrient loads.

3.6.3 Summary

The overall change in nutrient loads delivered to the estuary under the future without condition will depend upon the success of the implementation of BMPs to control point and non-point discharge quality. Nutrient loads to the estuary will likely increase by ten percent or more if no BMPs or nutrient TMDLs are implemented in the Caloosahatchee Basin. If the implementation of BMPs substantially reduces non-point source nutrient loads and tertiary wastewater treatment is implemented basin wide, the 2050 future without nutrient loads may decrease by more than 25 percent as compared to the existing condition.

3.7 PLANT COMMUNITIES

The project site would most likely continue to be a producing citrus grove in the future without project condition. Consequently, the plant communities would be almost identical to those in the existing conditions.

3.7.1 Exotic Plants

Exotic plants have the potential for devastating effects to the entire south Florida ecosystem in the future. Species such as Melaleuca, Lygodium, Brazilian pepper, and Australian pine are all well established in south Florida and have the potential to drastically alter the entire ecosystem. The abundance and distribution of exotic/nuisance vegetation (e.g., Brazilian pepper) that provide little to no value for wildlife is expected to increase unless intensive control and removal efforts are successfully implemented. However, there are many efforts occurring to control exotic plants, including a CERP project entitled *Melaleuca Eradication Project and Other Exotic Plants-Implement Biological Controls*. If this occurs, the future without project would still include exotic plants but would likely include a different array of damaging plants, as controls are developed for established exotics and new exotics are introduced into the system. Because the project site is predominantly agriculture, it is not likely that exotics would be a predominant feature in the landscape. Within the project footprint, the exotic vegetation distribution along canals might change as biological controls become available for various exotics and/or new exotic plants invade the site.

It is difficult to forecast the future success of exotic control programs. Through a concerted effort across many agencies, there has been good success in controlling Melalecua in South Florida. It is still a major exotic pest, but it is now controlled rather than spreading. If similar resources are invested to control other major exotic pests in south Florida (such as those listed above), there is good reason to believe these programs would be a success. However, since there are a large number of exotic pest plants and limited resources to invest in this problem, it is hard to determine what will occur. If the programs are at least somewhat successful a more natural ecosystem will evolve due to other restoration efforts. If the ecosystem is overwhelmed with exotics and adequate exotic control programs are not implemented, exotic plants are expected to continue to spread and multiply at an alarming rate.

3.8 WETLANDS

This site would most likely continue to be a producing citrus grove in the future without project condition. Therefore the description of wetlands would be almost identical to that in existing conditions. It is likely that the quality of the wetlands may continue to decline as fluctuations in the hydrology continue and water quality declines as a result of agricultural run-off.

3.9 FISH AND WILDLIFE RESOURCES

Land use projections for 2050 predict that the acreage of natural habitats (e.g., upland forests and wetlands) and low intensity agricultural lands (e.g., unimproved and woodland pastures) in the area will decline. As these lands are developed or converted to more intensive uses, the quality of fish and wildlife habitat will likely decrease and become more fragmented. Wetland and aquatic habitat quality will continue to decline as extreme flows from Lake Okeechobee continue to cause huge variation in the salinity regime. The quantity and quality of fresh and saltwater SAV will also decline. Marshes will continue to deteriorate and convert to monocultural stands of emergent plants such as cattail, or convert to shrub/scrub habitats containing exotic or nuisance species. Both monocultures and exotic/nuisance shrub/scrub communities are low quality habitats.

Loss and degradation of habitat have generally resulted in the reduction of reptile and amphibian populations and that trend would likely continue. Populations of several furbearing animals that are dependent on higher quality habitats (e.g., muskrat, mink, and river otter) or that require large areas of contiguous habitat to survive (e.g., black bear) are also projected to decrease by 2050. Raccoons, opossums and other species that can survive in fragmented habitats with greater human presence will increase by 2050. In general seabird and shorebird populations show decreasing population trends and are projected to continue to decline into 2050. Waterfowl, wading birds, raptors, rails, coots, and gallinules are also expected to decrease by the year 2050 as estuarine and freshwater habitat quality continues to decline under future without project conditions. The above predictions are based almost exclusively on the deterioration of wetland and forested habitats adjacent to the study area.

The project site in the future without project would not change significantly from the existing condition, although anticipated urbanization and fragmentation of surrounding natural areas will result in an overall decline in wildlife resources in the future.

Within the Caloosahatchee Estuary, salinity and proximity to SAV, mangroves, or marsh edge strongly determine the distribution of most fishes. For example, fish abundance declines dramatically with distance from marsh edge (Baltz et al. 1993). SAV, mangroves, and marsh habitats provide cover for juvenile fishes and adults of smaller species, as well as substrate for epiphytes and epifauna, which small fishes consume. Larger predatory fishes, such as spotted seatrout and red drum, forage along the edges of such intertidal habitats for small fishes, blue crab, and shrimp. Fishes that live in the open water of estuarine bays, such as bay anchovy and Gulf menhaden, gain refuge from sight-feeding predators in the turbid water. Those prey species are typically filter feeders, which eat zooplankton and phytoplankton. Demersal fishes, such as flounders, live in proximity to the bottom and are typically indistinguishable from the substrate. The deterioration of SAV and marsh habitats may temporarily benefit some estuarine-dependant fisheries, but an eventual decline in productivity will result as detrital input and SAV are significantly reduced due to extreme variations in salinity levels. The long-term loss of nursery habitat will result in population declines for many species of estuarine and marine fishes and macroinvertebrates, including those whose young of the year use fresher habitats.

3.9.1 Threatened and Endangered Species

As an active citrus grove, the proposed project site would continue to provide limited habitat value for threatened and endangered species. Direct loss of habitat, as well as fragmentation of habitat in surrounding areas, is likely to result in a continued decline in threatened, endangered, and state listed species. Section 9 of the Endangered Species Act (ESA) prohibits the unauthorized "take" of listed species on public and private lands, as a result of Federal and non-Federal actions. Future Federal actions unrelated to the proposed action but located in the study area, will require separate consultations pursuant to Section 7 of the ESA. In addition, future non-federal actions will be coordinated with USFWS through Section 10 of the ESA.

3.9.2 Essential Fish Habitat

Aquatic habitats within the Caloosahatchee Basin have been altered through the channelization of the river. Nevertheless, the basin continues to support fishery resources of some recreational and commercial importance. At least 70 percent of Florida's recreationally or commercially sought fishes depend on estuaries for at least part of their life histories (Harris et al. 1983, Estevez 1998, Lindall 1973). Seagrass communities within the Caloosahatchee Estuary provide critical refugia for juvenile fish such as redfish, grouper, snook, and spotted seatrout. The decline in juvenile abundance and distribution of these and other species, along with an overall decrease in species richness may be related to the loss of seagrass habitat and/or a result of alterations in the salinity regime and the timing of the freshwater discharges from the S-79 structure. The future without project condition would result in a loss of essential fish habitat by projected further disruptions in the distribution, timing and quantity of water flows into the Caloosahatchee Estuary.

3.10 ESTUARINE RESOURCES

Without the Caloosahatchee River (C-43) West Basin Storage Reservoir Project, conditions in the estuary will continue to worsen between the present state and 2050. Annual variability in flow and salinity will remain high and established MFLs for the region will not be met. This will lead to salinity extremes outside of the tolerance ranges of many estuarine organisms and result in decreased species diversity. Further, there will be declines in estuarine habitat (SAV and oysters) and as a result, additional declines in the species that utilize these habitats.

Without the reduction of extreme flow and high salinity events, oyster reefs will eventually loose a large percent of the adult population and the ability to produce enough spat to reestablish previously stressed reefs. Without continued settlement, reefs (substrate) will eventually breakdown and become buried in the soft organic sediments. SAV will continue to follow current trends of spatial reduction. There will be substantial losses of *Vallisneria* and its seed bank, possibly to the point of no recovery, in the low salinity areas as it tends to be more fragile than the higher salinity species. In addition, water clarity is expected to decrease resulting in additional stress on the SAV.

3.11 AIR QUALITY

Due to increased population and urbanization, air quality in the future is expected to be degraded, while still complying with air quality standards.

3.12 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

The four major land parcels acquired or being acquired for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project are the Berry Groves tract, Bryan Paul tract, the MG Enterprises, LLC property, and the Griffin property. Over the last six years, the SFWMD has performed multiple Environmental Site Assessments as well as worked to remediate most of the point source contamination sites (a description of the findings of these assessments and completed remediation efforts are found in the existing conditions portion of this report). At present, most of this land is leased to agricultural operators who continue to cultivate the thousands of acres of citrus groves located on the properties. If the reservoir project is not constructed, it is likely that the SFWMD will either continue to lease the land to citrus farmers or sell the land to willing buyers. With no reservoir on the site, the potential for bioaccumulation of copper or other toxic substances from contaminated site soils is much less since this usually occurs when the soils are submerged. If the properties continue to be used as working groves, the application of pesticides will continue. New point source contamination sites on the properties will likely occur, but these new sites may be contaminated to a lesser extent than in the past given modern best management practice (BMPs) for the application of fertilizers, pesticides, herbicides and fungicides. Overall, since the future without condition will not include a reservoir on the site, the properties will pose only a typical HTRW risk to the environment similar to other citrus operations.

3.13 CULTURAL RESOURCES

Without the proposed project, archeological site 8HN129 may be destroyed as a result of development or expansion of citrus production. Since the site is located in the uplands, even though it is adjacent to a large wetland, it is probable that the site would be destroyed without evaluation or mitigation.

3.14 SOCIO-ECONOMIC CONDITIONS

Competition for regional water resources has intensified with the increase in population and agriculture industry growth. This places a strain on existing resources, which will eventually surpass the readily available sources. When the needs of the natural system are then factored in, demands become greater and conflicts among competing water users will become even more severe.

While most people recognize the need for a healthy ecosystem to support the region's economy and jobs, many people are concerned that restoration projects will displace farms and other businesses, limit development, reduce available water supply and reduce job opportunities. By contrast, continued degradation of the southwest Florida ecosystem will adversely affect the tourism and recreational industry that are important to the regional economy. The economic future of the area will depend on both continued agriculture presence and new residential and commercial prospects. There is local concern that the infrastructure and services demanded by a growing residential population will exceed the means of producing the infrastructure and services.

3.14.1 Population Projections

Population for the four counties in the immediate study area (Charlotte, Glades, Lee and Hendry counties) increased at a high rate during the period from 1990 to 2000 (***Table 3-4***). Charlotte increased 27.6 percent, Lee 31.6 percent, Glades 39.3 percent, and Hendry 40.5 percent. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectively over the same period.

According to the population projection derived from the Florida Bureau of Economic and Business Resources (BEBR), population in Charlotte County is expected to increase over 83 percent from 2000 to 2050; in Glades County, to increase by 74 percent; Hendry County, to increase by 96 percent; and Lee County, to grow by 97 percent. Florida as a whole is projected to grow 86 percent by 2050. The projected growth of the entire south Florida nine-county area is anticipated to be 78 percent over the same 50-year period. These estimated population increases are reflected in future without project condition water demands and land use patterns.

TABLE 3-4: CHARLOTTE, GLADES, HENDRY & LEE COUNTIES, POPULATION ESTIMATES 2000-2050 (1,000S) (BEBR PROJECTIONS, US CENSUS (2000))

Area	2000	2010	2020	2030	2040	2050
Florida	15,982.4	18,866.7	21,792.6	24,528.6	27,118.7	29,714.5
Charlotte County	141.6	169.5	198.9	225.9	242.8	259.8
Glades County	10.6	12.4	14.2	16	17.2	18.4
Hendry County	36.2	44.4	53.3	61.8	66.4	71.1
Lee County	440.9	546.8	653.3	753.9	810.3	866.9

3.15 LAND USE

Future land use projections in the Caloosahatchee Basin were updated as part of the larger regional Southwest Florida Feasibility Study (SWFFS). These regional projections will serve as a starting point for describing the C-43 project study area's land use. These projections have been reviewed by agricultural and governmental interests in the study area and will be used as the most likely future scenario. These land use figures have been incorporated into C-43 project modeling efforts and presented in this PIR. The projections resulting from the SWFFS update apply to 2025 and 2050 conditions. For the C-43 study area, the 2025 land uses have been extended to reflect expected 2050 conditions. It is not anticipated that the agricultural acreages will increase or decrease substantially between 2025 and 2050, but the total urban acreages will increase in area and increase in density to account for the increase in population.

Land use in the Caloosahatchee Basin is split between agricultural land use, urban/metropolitan land and conservation land. In the eastern portion of the Caloosahatchee Basin, Hendry, Charlotte, and Glades counties have been predominantly agriculture and rural in nature, while in the western portion of the basin, Lee County is more urban and supports industrial and commercial development. The land use, as described by the Southwest Florida Regional Planning Council (SWFRPC), details Hendry County as remaining largely agricultural, with urbanized areas in Clewiston to the east and La Belle to the west, and intermittent preserves and wetlands throughout. Additionally there are two main industrial concerns in Hendry County, one west of Clewiston and one near the Lee County border. Like Hendry County, Glades County remains largely agricultural in 2025, with some urbanized areas (La Belle's northern reaches and Moore Haven on Lake Okeechobee) and preserves and wetlands throughout. Within the study area, Charlotte County will remain vastly agricultural with some preserves and wetlands areas.

The predominant land use in the Caloosahatchee Basin is agricultural, and is expected to remain so in the future. The study area continues to experience growth in irrigated agricultural acreage. The irrigated crops in this region are citrus (the dominant irrigated crop), sugar cane, vegetables, sod, and greenhouse/nursery. Over the past two decades, southwest Florida has had the fastest growing citrus acreage in the state. Growth in citrus acreage is usually on land that was formerly pastureland. Sugar cane closely follows citrus in dominance in terms of crops grown in the Caloosahatchee Basin. It is produced in the Caloosahatchee Basin in close vicinity to Lake Okeechobee (in Hendry and Glades counties). Sugar cane acreage has continued to increase since 1995 and is expected to continue to increase in the future. Irrigation is typically applied from the surface water sources in the Caloosahatchee Basin and consequently, subsidence is not a significant problem due to the soils being generally sandy, rather than organic.

In terms of urban and industrial development, Lee County is the most populous part of the study area. The Fort Myers/Cape Coral Metropolitan Statistical Area (MSA), unincorporated areas of Lehigh Acres, Buckingham, North Fort Myers, South Fort Myers, and East Fort Myers constitute the bulk of the population in the western portion of the Caloosahatchee Basin (see ***Table 2-4*** in ***Section 2*** on population estimates by county). Urban growth in Lee County has the potential to impact the region's environmental and water resources. Drainage of wetlands caused by urban expansion, loss of natural surface water storage areas, and contamination from urban land use are the major water related issues in the urban areas. Growth in this part of the basin generally follows the I-75 corridor, with the greatest portion of the population being located west of S-79. The majority of projected urban growth in this part of the basin is located to the east of I-75 toward the S-79 and contains a mixture of single family/multifamily dwellings, commercial and industrial facilities, some mining operations and preserves/wetlands. ***Figure 3-1*** presents a map of the 2050 future land use conditions in the C-43 study area. ***Figure 3-2*** presents a map showing changes between existing (2000) conditions and future without project conditions. ***Table*** 3-5 shows changes to land use for the 2025 and 2050 conditions.

There are a number of areas where urban development, agriculture, and/or proposed conservation areas compete for the same land. While these competing areas are not large compared to the entire area being modeled, they are significant. There were two most likely scenarios that were determined to be applicable to the C-43 study area. The first of these scenarios corresponds to land use in 2025, the second to land use in 2050. The first scenario has agriculture out-competing or "trumping" new low-density residential urban use, agriculture develops in areas proposed for conservation (not existing conservation lands, however), and marginal urban land has not developed yet. The second scenario, or 2050 conditions, also has agriculture trumping new low-density residential urban, agriculture is allowed to develop in areas proposed for conservation, but marginal urban land has now developed. ***Figure 3-1***, ***Figure*** 3-2***,*** and ***Table 3-5*** show the projected difference between 2000 and 2050 land use. General characterizations of the study area can be determined and forecasts that in the future, urban lands and agriculture will increase in acreage, resulting in a decrease in natural areas. Within the C-43 study area, urban lands are expected to increase from 47,000 acres in 2000 to 114,000 acres in 2025 and 127,000 acres in 2050. Sugar cane is expected to increase to 116,000 acres in 2025 and decline slightly to 113,000 acres in 2050. Acreages for citrus are 118,000 in 2025 and 110,000 in 2050. Vegetable crops and sod production are expected to increase by 10,000 acres by 2025. Given the high probability that urbanization will meet or exceed the counties' current future-growth plans within the next 20 years, it may be difficult for the agricultural community to meet its 2025 goals.

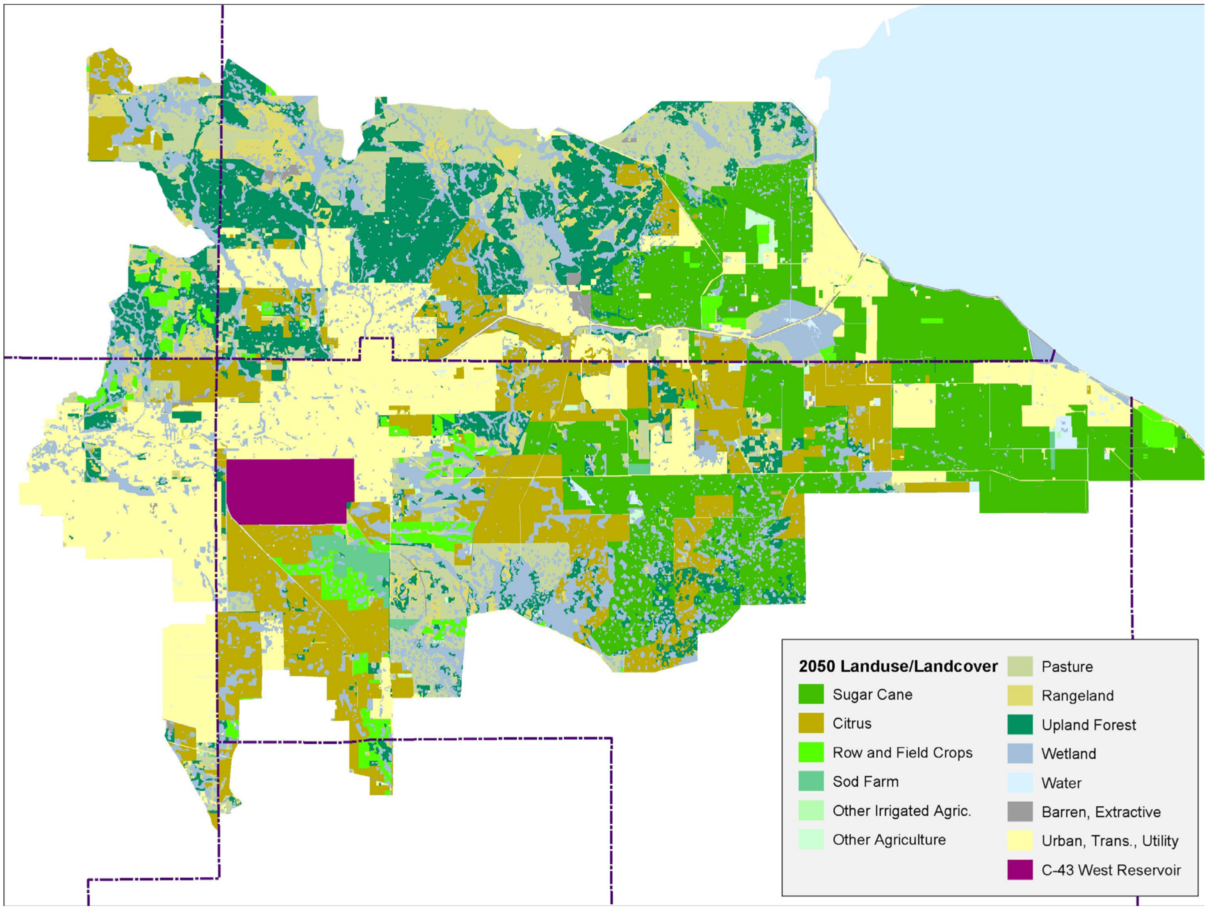

FIGURE 3-1: PROJECTED 2050 LAND USE

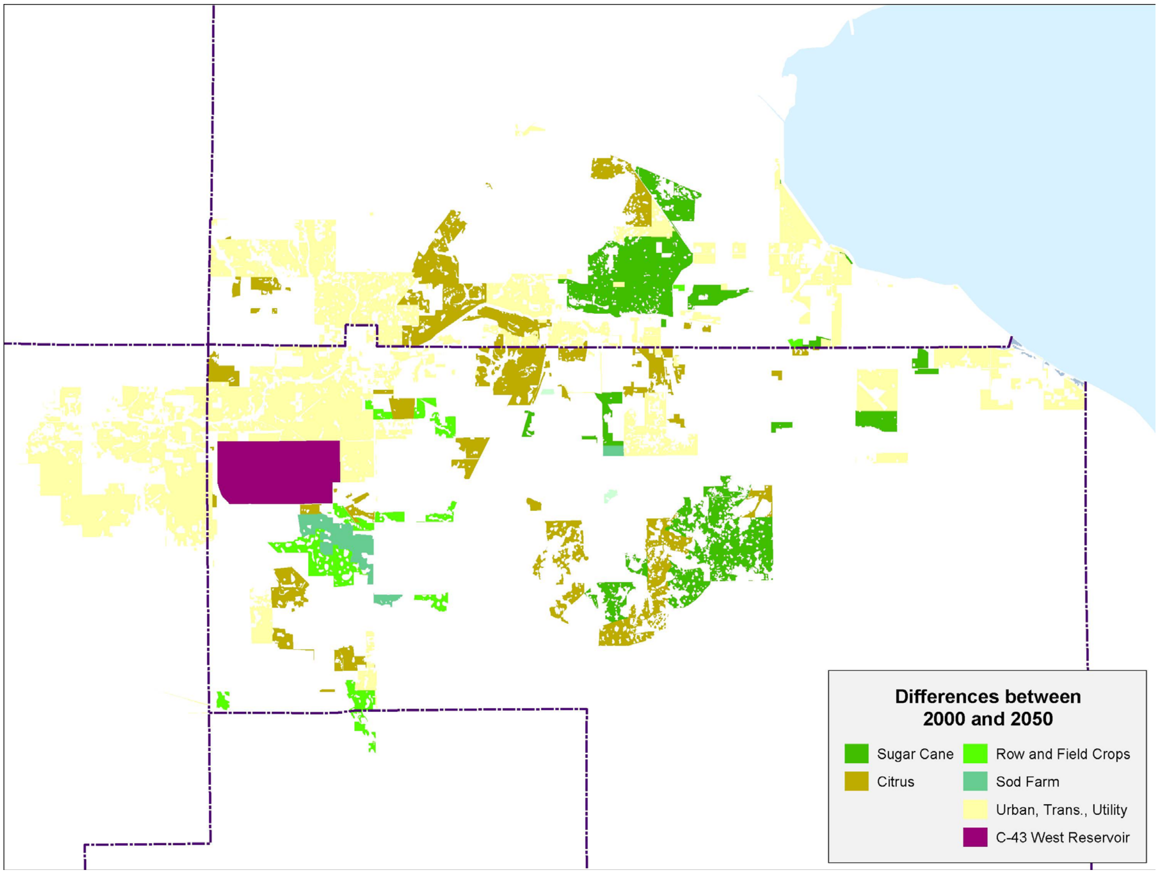

FIGURE 3-2: DIFFERENCES BETWEEN 2000 AND 2050 LAND USE

TABLE 3-5: PROJECTED DIFFERENCE BETWEEN 2000 AND 2050 LAND USE

	2000 LAND USE	2025 LAND USE	Change from 2000 to 2025	2050 LAND USE	Change from 2000 to 2050	Change from 2025 to 2050
	(Acres)					
Sugar Cane	101,513	116,105	14,592	112,970	**11,457**	(3,135)
Citrus	99,855	118,469	18,614	110,037	**10,182**	(8,432)
Row Crops, Field Crops	11,026	17,557	6,531	16,506	**5,480**	(1,051)
Improved Pasture	101,170	38,691	-62,479	38,691	**-62,479**	0
Unimproved and Woodland Pasture	28,344	16,493	-11,851	16,493	**-11,851**	0
Other Irrigated Agriculture	508	474	-34	174	**-334**	(300)
Sod	482	4,024	3,542	4,008	**3,526**	(16)
Other Agriculture	5,220	2,284	-2,936	2,098	**-3,122**	(186)
Urban, Trans., Comm., and Util.*	46,800	113,553	66,753	126,671	**79,871**	13,118
Low Density Residential	13,443	54,779	41,335	33,509	20,066	(21,269)
Medium Density Residential	4,704	31,633	26,929	61,160	56,456	29,527
High Density Residential	193	1,792	1,599	6,616	6,423	4,824
Range	31,898	20,651	-11,247	20,651	**-11,247**	(0)
Upland Forest	96,265	76,259	-20,006	76,259	**-20,006**	0
Water	5,447	5,356	-91	5,356	**-91**	(0)
Wetland	96,056	96,188	132	96,188	**132**	(0)
Barren, Extractive	6,635	5,115	-1,520	5,115	**-1,520**	(0)
TOTAL	631,218	631,218	0	631,218	**0**	0

*Residential acreage figures are included in the urban acreage total

3.16 MUNICIPAL AND INDUSTRIAL WATER SUPPLY

The Restudy recommended the development of a feasibility study to identify southwest Florida water resource conditions, and to develop potential solutions to any problems that may be identified. This municipal and industrial (M&I) water use forecast is part of the overall SWFFS, and includes Lee County, most of Collier and Hendry counties, and portions of Charlotte, Glades and Monroe counties, which encompass the Caloosahatchee River Basin and the C-43 study area. The water demand projections for the SWFFS do not exactly coincide with the C-43 study area. Collier County is not included in the C-43 study area. The water use sectors for which forecasts were developed include public and self-supply domestic (residential), commercial, industrial, government, and unaccounted-for water loss. Water use in agriculture, mining, and power generation were not addressed as part of the M&I forecast, but are addressed under a separate agricultural water demands section. The purpose of the M&I water use forecast is to estimate existing water use and to develop water use projections for the SWFFS area.

An M&I forecast is required as input to modeling efforts which serve as the basis for planning and optimally designing the Caloosahatchee River (C-43) West Basin Storage Reservoir for both existing and future planning conditions. The planning horizon extends to the year 2050. Water use is estimated from the present to 2050 for natural area environmental purposes, agricultural irrigation purposes, M&I use, and other purposes.

The M&I water use forecasts were developed using the IWR-MAIN Water Demand Management Suite. The IWR-MAIN software allows water use forecasts to be developed based on existing water use patterns and existing or forecast socioeconomic parameters and then allows the impact of water conservation measures on those water uses to be evaluated. To maintain consistency with the water use forecasts developed for the Initial CERP Update (ICU), the water use models developed for the western portion of the study area in the ICU analysis will be used in this analysis. In the ICU, residential water use was forecast using a multiplicative forecast model and nonresidential water use was forecast using a constant use rate model.

Golf course irrigation requirements were based on a model developed by SFWMD and previously used in projecting water use in the Lower West Coast Water Supply Plan (LWC WSP). The SFWMD model consisted of using multiple regression analysis to project future golf course acreage as a function of projected population, and then applying irrigation requirements to those acreages based on the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) model. Irrigation requirements from AFSIRS, based on a representative irrigation system/rainfall station/soil type combination for each county, were then applied to the projected golf course acreage to develop projected golf course irrigation requirements.

Consistent population projections are critical to the development of M&I water use because they are used to directly project housing and employment statistics, the main drivers of the IWR-MAIN water use models. The population projections from 2000 to 2050 were based on population projections produced by the University of Florida, BEBR. BEBR generates low, medium, and high sets of population projections for each county in Florida for 2005 through 2030. The medium population projections are believed by BEBR to most likely provide an accurate forecast of future county populations. The high and low population projections were developed to address uncertainty based on past population forecast error.

Three population projection scenarios were developed for this analysis. The BEBR medium projections were the basis for the medium or most-likely scenario for all counties, and the BEBR high and low population projections were the basis for the high and low scenarios, respectively. In order to develop projections to 2050, the growth rate exhibited in the national population projections from 2030 to 2050 was applied to the projected 2030 BEBR population for each county.

The IWR-MAIN models were calibrated to local water use patterns using the most recent data available (2000), then used to estimate water use for 2000 and project water use, in five-year intervals, to 2050. Four sets of forecasts were developed. Three were based on differing population projection scenarios, and one was based on one-in-ten year drought conditions. Projection of future water use included the implementation of all reasonable conservation measures.

According to the USGS, in 2000 estimates of annual water withdrawals (***Table* 3-6*)*** total public-supply water use for the region is estimated at 72 MGD and from the IWR-MAIN model (***Table 3-6***) the total M&I water use is estimated at 115 MGD. The addition of 681 MGD of agricultural water use increases total water demand for the region to approximately 796 MGD. Agricultural water use accounts for 86 percent of the total use; public-supply water use, nine percent; and recreational self-supply, about four percent.

TABLE 3-6: USGS ESTIMATED TOTAL WATER USE (MGD), FOR SELECTED COUNTIES, 2000, EXCLUDING MINING AND POWER GENERATION

	Municipal and Industrial							
		Self-Supply						
County	Public Supply	Domestic	Commercial	Industrial	Recreation	Sub Total	Agriculture	**Grand Total**
Charlotte	14.21	3.55	0.11	0	3.48	21.35	47.19	**68.54**
Glades	0.55	0.61	0.04	0	0.42	1.62	69.02	**70.64**
Hendry	4.72	1.67	0.21	0.51	1.09	8.2	503.91	**512.11**
Lee	52.37	8.86	0.46	0.09	22.66	84.4	60.51	**144.95**
Total	**71.85**	**14.69**	**0.82**	**0.6**	**27.65**	**115.57**	**680.63**	**796.24**

On the county-level, the largest total water user in the study area in 2000 was Hendry County, mainly because of agricultural water use. Hendry County used a total of 512 MGD, or 64 percent, of the total regional water use. Of this amount, 504 MGD (or 98 percent) was agricultural use and 4.7 MGD was public-supply M&I water use. Lee County's total water use was 145 MGD, the second highest in the study area, with public-supply water use accounting for 52 MGD or 36 percent. Lee County had the highest self-supply domestic water use in the region at 8.9 MGD. Lee County also had high recreational water use, with 22.7 MGD.

Table 3-7 represents the conservation-adjusted, most likely population scenario, water use forecast and the percent of total water use associated with each county or county area in the study area, for 2000, 2025, and 2050. Lee County accounted for 90.7 percent of all M&I water use in the study area in 2000, and will account for 90.4 percent of all water use by 2050. The population of Lee County is projected to increase by 97 percent over the same time period. The Glades County Area generates the smallest use, at slightly more than two percent of the total regional water use over all time periods. Due to the small population in the Charlotte County portion of the study area, the water use totals for Charlotte County are incorporated into those of Glades County and therefore the USGS 2000 baseline totals do not exactly equal the IWR-MAIN 2000 totals.

TABLE 3-7: C-43 STUDY AREA, M&I CONSERVATION-ADJUSTED WATER USE AND DISTRIBUTION, BY COUNTY AREA MOST-LIKELY POPULATION SCENARIO, 2000, 2025, AND 2050

	2000		2025		2050	
Area	MGD	Percent of Total	MGD	Percent of Total	MGD	Percent of Total
Lee County	92.7	90.7 %	129.5	90.4 %	148.0	90.4 %
Glades County Area	2.4	2.4 %	4.0	2.8 %	4.5	2.8 %
Hendry County Area	7.1	6.9 %	9.7	6.8 %	11.2	6.8 %
Total	**102.2**	**100.0%**	**143.2**	**100.0%**	**163.7**	**100.0%**

3.16.1 Agricultural Water Demand

The SFWMD calculated agricultural water demands as part of the CWMP in April 2000. These water demand calculations are the most current demands available for the C-43 study area and are a sufficient base point for demonstrating future demands and trends for the planning horizon.

The Southwest Florida Regional Planning Council (SWFRPC) has estimated that total agricultural acreage will increase between three percent and seven percent between 1995 and 2020 while citrus acreage will increase between 54 and 81 percent and sugar cane between 62 and 190 percent. The increase in citrus and sugar cane acreage is due in a large part to conversion of existing irrigated acreage that is in other crop types to citrus and sugar cane. Based upon representation from the agricultural industry and Citrus Administrative Committee (CAC) discussion and concurrence, 2020 citrus acreage of 112,500 and sugar cane acreage of 125,000 were modeled. This represented a reduction from the SWFRPC estimate but an increase from the SFWMD District-Wide Water Supply Assessment (DWSA) completed by the SFWMD in July 1998.

The acreage for citrus and sugar cane in the 1995 CWMP does not exactly coincide with the land use update presented in this section. Upon adoption of the new land use figures, the agriculture water demand figures will be updated. A scientific procedure that considered existing land use, ownership, suitability for crop use, and proximity to existing agricultural lands was used to adjust the 1995 land use map to the 2020 land use projections. An explanation summarizing the steps involved in development of the 2020 land use coverage is included in the Land Use section of the CWMP. Based on the 2020 land use map, the MIKESHE model was used to estimate future agricultural demands.

The MIKESHE model developed for the CWMP was used to estimate the future demands by incorporating the 2020 land use information and modifying irrigated areas within the model to match the new land use. The MIKESHE model used an eight-year period (1988-1995) to simulate demand. The selected period represents a combination of wet, dry, and average years representative of variations within the Caloosahatchee Basin. The resulting demands for the 2020 Base Case using the MIKESHE methodology therefore represents probable demands based on 2020 land use and hydrologic data corresponding to an eight-year period. The resulting demands for the entire planning area, including both the Lake Okeechobee Service Area (LOSA) and non-LOSA portions of the basin, were obtained.

Table 3-8 summarizes the simulated 2020 irrigation demand for major agricultural land use categories for the CWMP area based on the MIKESHE model

TABLE 3-8: SUMMARY OF 2020 WATER USE DEMAND BASED ON THE MIKESHE FOR MAJOR AGRICULTURAL LAND USE CATEGORIES.

Crop	Water Use (1,000 acre-feet/year)
Citrus	242
Sugar cane	181
Vegetables	27
Total	450

Irrigation demands are expected to increase approximately 55 percent in the Caloosahatchee Basin between 1995 and 2020, according to the CWMP. No projected increases in irrigated acreages between 2020 and 2050 are expected, and there may potentially be a slight decline. It is expected that 2050 demands will approximate 2020 demands of 450,000 acre feet annually. After completion of the 2025 and 2050 land use projections, these new acreage figures will be modeled and new estimates of agricultural water demand will be presented.

3.17 NOISE

Noise in south Florida is expected to increase due to increased populations and urbanization. Noise levels within the project site should not change significantly in the future without project condition.

3.18 RECREATION AND AESTHETIC RESOURCES

The Florida State Comprehensive Outdoor Recreation Plan (SCORP) is the best source of information on recreation demand and supply at the state and regional scales. It divides the state into 11 planning regions, each with clusters of counties. Region 9 is the planning region that encompasses the study area and includes the following counties: Charlotte, Collier, Glades, Hendry, Lee, and Sarasota.

Recreation demands were developed for the SCORP through surveys of residents and tourists. The State of Florida's Division of Recreation and Parks conducts periodic surveys of resident and tourist participation in recreation activities to estimate outdoor recreation in Florida. The recreation participation information was derived from the 2000 surveys conducted by the University of Florida, Department of Recreation, Parks, and Tourism. Participation in outdoor recreation activities is expressed in terms of user-occasions, which occur each time an individual participates in a single outdoor recreation activity. The number of user-occasions was calculated for each planning region as well as the entire state by type of activity. Demand was estimated for 1997, 2000, 2005 and 2010 by applying the per capita participation rates to population projections.

Table 3-9 presents 1997 and projected 2010 user-occasion demands for selected recreation activities. Activities selected were those that could potentially be affected by the hydrologic changes or ecological changes associated with the alternative restoration plans. The table includes user-occasions as well as facility/resource needs. The region is expected to have significant increases in demands for the selected recreation activities with a commensurate need to increase development of the regions' recreation resources and facilities.

TABLE 3-9: DEMAND AND FACILITY NEEDS (1997 AND 2010) FOR SELECTED RECREATION ACTIVITIES IN SOUTHWEST FLORIDA (SCORP REGION 9)

Activity	Units	Demand (user-occasions)		Resources / Facility Needs	
		1997	2010	1997	2010
Hunting	Acres	108,131	139,247	0	0
RV / Trailer Camping	Camp Sites	1,501,713	2,386127	0	0
Tent Camping	Camp Sites	155,069	204,538	0	0
Hiking	Miles	1,299,375	2,011,069	223	517
Freshwater Fishing	Feet	543,125	779,561	0	0
Nature Study	Miles	2,146,713	3,073,615	10.87	56.8
Bicycle Riding	Miles	11,761,917	16,675,164	771.33	1,177.08

Source: Florida Department of Environmental Protection, 2000.

In summary, the Southwest Region (Region 9) ecosystems support a significant amount of outdoor recreation. A large portion of the expenditures comes from tourists. As can be seen from ***Table 3-9***, recreation activities for which there is an existing and increasing supply shortage include hiking, bicycle riding and nature study. With continued development and growth in southwest Florida, recreational demands are anticipated to increase and the current level of recreational opportunities will be insufficient.

The aesthetics of the proposed project site will be unchanged in the future without project condition. Surrounding areas will reflect a mixture of unchanged agricultural views as well as an increase in urbanization and population growth in some areas.

3.18.1 Commercial and Recreational Fishing Resources

Altered freshwater releases to the Caloosahatchee Estuary from Lake Okeechobee and the Caloosahatchee watershed have stressed estuarine ecosystems due to excessive salinity fluctuations, critically low benthic oxygen levels, increased turbidity that blocks sunlight to seagrass communities, algae blooms and subsequent declines in dissolved oxygen. These detrimental environmental effects can lead to commercial and recreational fishing impacts. The challenge in estimating the economic effects on commercial and recreational fishing in the Caloosahatchee Estuary is complicated by the inability to quantify the decrease in fish numbers and accurately measure the decrease in fish yields. It is reasonable to assume that as fish populations decrease due to degraded conditions in the estuary, the supply of fish will decrease, restrictions will be placed on certain species of fish, and greater distances will have to be traveled for commercial fishing vessels who in turn will realize smaller catches, all leading to a decrease in economic activity associated with commercial and recreational fishing.

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SECTION 4
IDENTIFICATION OF PROBLEMS AND OPPORTUNITIES

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4.0 IDENTIFICATION OF PROBLEMS AND OPPORTUNITIES

4.1 STATEMENT OF PROBLEMS AND OPPORTUNITIES

To focus on water resources problems and opportunities in the C-43 Canal (Caloosahatchee River) basin to be addressed with this project, the project delivery team (PDT) began with the project components and purposes for the C-43 Canal basin as described in the 1999 Central & Southern Florida Comprehensive Review Study. The CERP Programmatic Regulations Draft Guidance Memoranda (GM) #1 and #2 (USACE 2004) instruct PDTs to focus on specific issues and problems identified in the Comprehensive Plan related to a given project component, and to update project-specific concerns as needed based on more current or improved information. The PDT therefore began by examining the problems and opportunities identified in the Comprehensive Plan for the Caloosahatchee River and its estuary, but also undertook a more detailed analysis of problems and opportunities in the study area in response to more recent questions and concerns expressed by the resource agencies and the public. This section describes the problems and opportunities identified in the study area and the planning goals and objectives developed by the PDT for the project.

While this section outlines the problems and opportunities identified by the PDT for the entire basin, it should be noted that the project has been split into two separate PIRs. The first of these two PIRs (Caloosahatchee River (C-43) West Basin Storage Reservoir project) will focuses on reaffirming that project goals and objectives can be achieved by constructing and operating an above-ground reservoir on lands already acquired for this purpose (Berry Groves).

4.1.1 Public Concerns

An integral component of the identification of problems and opportunities is an understanding of the public's concerns (USACE 1999). Public workshops were conducted early in the planning process for this project in order to gather public input and to document public concerns related to the problems, needs, and opportunities within the Caloosahatchee River watershed. Numerous presentations to public groups were conducted, including Lee, Collier, Hendry and Glades counties; the cities of LaBelle, Moore Haven, and Clewiston; local agencies; agricultural organizations; civic groups; business groups; clubs and neighborhood organizations.

In February of 2001 and 2002, representatives from the USACE and the SFWMD conducted two workshops/public meetings with various groups and individuals to provide a brief overview of the process for development of a PIR for the Caloosahatchee River (C-43) West Basin Reservoir Project and to obtain an understanding of the public's concerns and issues. The public meetings were held in LaBelle, Florida at the Hendry County Extension Service Building on

February 26, 2001 and at the LaBelle Civic Center on February 28, 2002. Approximately 35 people attended the meeting in 2001 and approximately 35 people attended the meeting in 2002. Information collected at these meetings was used to help inform the plan formulation process.

In addition to the earlier meetings, a NEPA scoping letter was sent out in March 2003 requesting input from the public and federal, state, and local government agencies. A public scoping meeting was subsequently held in LaBelle on May 1, 2003. By this time the team had completed some initial plan formulation and screening. The public was updated on the progress and status of the project to that point. Meetings were also held in the spring of 2003 with various stakeholders including recreational interests, agricultural interests, and local policy makers.

Table 4-1 outlines the public concerns that were brought to the PDT's attention through written correspondence, phone calls, and public meetings.

TABLE 4-1: PUBLIC COMMENTS AND HOW THEY WERE ADDRESSED

Issue Category	Public Comment-Issue, Problem, or Opportunity	Response/Action taken
Ecological	Health of the estuary	Main purpose/objective of study
	Fish health and abundance for commercial and recreational uses	Performance measures will be used to evaluated the different plan alternatives ability to improve estuarine conditions for improving fish health
	Water quality	Water quality of reservoir(s) to be evaluated as to not cause or contribute to water quality problems; also addressed in later study
	Wildlife health and abundance	Ecological performance measures
	Dredging of oxbows	Being accomplished by several other projects
	Use of water stored in reservoir	Water reservations and effects on water supply studied as part of project assurances analyses; Draft operating manual will accompany PIR
	Water allocation concerns	Water reservation studies will be completed
Ecological	Water level on the river	Project objective to deliver a more consistent water flow to estuary, which would result in a more consistent water level
	Littoral zone around reservoir to promote fishing and fish habitat	Included around seepage canal

Issue Category	Public Comment-Issue, Problem, or Opportunity	Response/Action taken
	Lake Hicpochee for natural area restoration	Lake Hicpochee will be considered for natural area restoration under later study
	Exotic/invasive plant control	Other projects are addressing this issue; proper procedures will be used to minimize this problem during construction
	Recreation and restoration as opposing uses	Restoration is the main purpose of this study, so restoration will not be sacrificed for recreational opportunities. However, recreation will be considered wherever it is viable and applicable trade-offs displayed.
Economic	Economic impacts	Socioeconomic analysis
	Tourism	Healthier estuary will promote tourism
	Water supply	Effects on water supply studied as part of project assurances analyses
	Cost of project	Cost estimates in PIR; part of alternative screening; addressed through cost effectiveness and incremental cost analyses
	Loss of tax base in Hendry County	Project will analyze impacts resulting from a reduction of agriculture land and its effect on county tax base.
	Concern that cost will outweigh benefits	Cost effectiveness/ incremental cost analyses will be performed to justify costs
	Loss of Highway 80 property for development	The State has located the reservoir a significant distance from Highway 80 so that development will not be hindered.
Engineering	Flood control	Modeling of alternatives to ensure no harm
	Questions on ASR	Separate study–see ASR pilot project Draft PIR/EIS
	Drainage problems in basin	Not a project purpose–will recommend to the SWFFS
	Suggest deeper reservoir	Geotechnical studies were conducted to determine appropriate maximum depths
	Visual aesthetics – high levee is not conducive to visual enjoyment	Due to the soils, aquifers, and topography, high embankments cannot be avoided

Issue Category	Public Comment-Issue, Problem, or Opportunity	Response/Action taken
	Water loss due to evaporation	ASRs (part of a later study) are envisioned to complement the reservoir(s), and will decrease total loss to evaporation
Other	Hurricane evacuation: route/safety issues	A meeting was held to develop safety standards for all CERP projects; local evacuation planning is not included as part of this PIR, but evacuation plans/procedures are considered in the project operating manual.
Recreation	Recreational opportunities	CERP recreation plan: Project has considered recreational opportunities compatible with restoration objectives;
	Active recreation opportunities (baseball fields, playgrounds, etc.)	Recreation plan is attached; passive recreation is most appropriate for this site.
	"Watchable" wildlife areas	These were incorporated into the Recreation Plan for the selected alternative plan (SAP)

4.1.2 Ecological Problems and Opportunities

Natural resource specialists agree that the remaining ecosystems in south Florida no longer exhibit the functions and diversity that characterized the pre-drainage system, and that key measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that even the current, unacceptable ecological conditions can be sustained into the future (USACE, 1999).

The Caloosahatchee watershed has some ecological problems that are unique to the basin, as well as environmental problems that can also be found elsewhere in south Florida. Agricultural industry growth, urban development and the associated water management practices that accompany these activities have created undesirable conditions in the river and estuary. These problems are predicted to be magnified in the future. Some of the identified problems affecting the Caloosahatchee Basin are:

- Extreme changes in salinity in the Caloosahatchee Estuary due to either excessive or insufficient freshwater discharges over the W.P. Franklin Lock and Dam (the S-79 structure), which demarcates the division between the freshwater and tidal portions of the Caloosahatchee River.

- Loss of freshwater and marine SAV, due to salinity imbalances in the estuary.
- Truncation of estuarine extent and function due to the physical constraint of S-79 (the structure effectively blocks tidal flows upstream of that point).
- Major changes in riverine, drainage, and seepage characteristics due to excavation of 25-foot deep navigational channel in C-43.
- Reduction of oysters and blue crab habitat areas due to low salinity conditions in the lower estuary.
- Water quality problems in the river and estuary that are the result of pollutant laden (particularly nutrients) runoff from within the basin.
- Other water quality problems, including low dissolved oxygen (DO), high metals, high coliform bacteria, and diminished biological integrity.
- Increased occurrences of phytoplankton algal blooms and fish with lesions in the Caloosahatchee Estuary (FDEP2003).
- Loss of spatial extent of wetlands and associated uplands in the Caloosahatchee Basin.
- Availability of and competition for water supply for environmental, agricultural, and urban needs during dry periods.

To understand the full extent of these problems and to formulate potential solutions, it is necessary to first understand the changes that have occurred in the river and estuary.

Since the turn of the twentieth century, land reclamation, flood damage reduction and water management projects (consisting of complex networks of canals, structures and levees) have drastically altered the wetland ecosystem and hydrologic regime that once existed in the Caloosahatchee watershed. The manmade connection between Lake Okeechobee and the Caloosahatchee River (originally created in the late 1800s) has disrupted the natural pattern (quantity and timing) of freshwater flow into the Caloosahatchee Estuary. Problems in the estuary have been compounded due to the addition of water control structures on the river, the network of channelized tributaries and drainage canals in the basin connecting to the river, and associated water demands and flood protection requirements of urban and agricultural users.

The W.P. Franklin Lock and Dam structure (S-79) is the beginning of the tidal Caloosahatchee Estuary, and maintains higher water levels upstream of the structure while acting as a barrier to salinity and tidal action, which historically extended upriver as far as Fort Denaud and LaBelle (Sackett 1988). Construction of S-79 together with C-43 improvements have allowed for better conveyance of basin storm water discharge along with regulatory releases from Lake Okeechobee downstream to the estuary. This has created unnatural hydrologic and salinity regimes, and periodically causes extremely adverse effects on estuarine health and productivity. This also adversely affects the local economy, as a significant amount of economic activity in the study area is associated with tourism and recreational and commercial fishing and related services.

Benefits obtained from the construction of the S-79 structure include the prevention of salinity intrusion into drinking water supplies upstream during dry, low flow periods. It also allowed the construction of a potable water supply intake facility upstream of the structure (the Lee County drinking water facility). In the dry season (approximately November–May), releases through S-79 are occasionally initiated to support environmental needs downstream by maintaining minimum flows.

Although S-79 has been instrumental for supporting and protecting this water supply, it has been detrimental for many estuarine organisms that historically could proceed further upstream in the dry season to find the optimum salinity and habitat. During the dry season when discharges are not occurring due to restrictions in water availability, very low or no freshwater inflow to the estuary can occur, resulting in a salinity wedge moving upstream into the upper-most reaches of the estuary, threatening fresh-water dependent species such as *Vallisneria* (tape grass), and shifting the competitive advantage to larger predatory marine fish species and adult (as opposed to juvenile) life stages. This disruption at the base trophic levels threatens the future viability of the estuarine ecosystem. Primary ecological functions (such as forage and nursery habitat) disrupted by such extreme changes in salinity do not rebound readily when more desirable salinity levels are restored, and may take several uninterrupted annual cycles to fully recover.

The amount of water available for the estuarine organisms during the dry season is constrained by at least two factors. First, the Caloosahatchee Basin has a significant amount of agriculture that depends upon surface water (and some groundwater) for its water supply. Many of the canals that discharge to the Caloosahatchee River in the wet season are used for irrigation water supply in the dry season. Second, there are several public water supplies in the basin, one of which is the Lee County drinking water facility, that rely upon surface water from the Caloosahatchee River. The net effect of increasing demands for agricultural and municipal water supply is a reduction in the amount of fresh water available to be delivered to the estuary to maintain viable ecological conditions.

Water from Lake Okeechobee has historically been released to supply water for urban and agricultural uses in the basin. The current approved LORS WSE provides for the regulation of Lake Okeechobee's freshwater discharges as a multipurpose water resource affecting the timing and volume of water available to the estuary. With the WSE regulation schedule, some water is supplied to maintain minimum flows to the estuary when lake levels are high enough to provide those minimum flows while not endangering water supply demands elsewhere in the C&SF system. However, the historical and most predominant type of releases from Lake Okeechobee continues to be for lowering the lake when levels are too high. These regulatory releases, which can be very large and often occur in addition to basin runoff, are extremely detrimental to estuarine health. During the wet season releases (approximately June–October), the estuary can receive freshwater flows in excess of 10,000 cfs measured at S-79, significantly exceeding the historically-occurring volumes of freshwater and essentially flushing the estuary of saltwater and water column organisms, such as plankton.

To improve the problems created by high water levels in Lake Okeechobee, the USACE has also initiated a separate study to prepare a revision to the LORS. However, it should be noted that a revision to the LORS cannot by itself significantly reduce the harmful affects of excessive lake discharges and basin runoff on the Caloosahatchee Estuary. Additional storage is needed to enable management of Lake Okeechobee to minimize the frequency and severity of such harmful events.

Estuarine manifestations of the combined effects of water quantity, quality, and timing problems include the reduction and/or losses in such valued ecosystem components as SAV, oysters, and blue crab, as well as periodic declines in plankton and soft bottom benthic invertebrates. Restoring the flows and achieving hydrologic targets to maintain desirable salinity levels remains the overwhelming and overriding environmental priority within the Caloosahatchee River Basin.

4.1.3 Water Quality Problems and Opportunities

The 1999 Central and Southern Florida Project Comprehensive Review Study Final Feasibility Report and Programmatic Environmental Impact Statement (the "Restudy") reported that 14 water body segments in the Caloosahatchee River Basin and downstream coastal waters were impaired or potentially impaired, according to the FDEP in 1998. Water quality parameters of concern included excessive nutrients, coliform bacteria, biochemical oxygen demand, and depressed levels of dissolved oxygen. The Restudy report estimated that water quality conditions in the upper (eastern) and central portions of the Caloosahatchee watershed would remain unchanged through 2050, while water quality in the downstream and coastal portions would decline as a result of increased population growth and agricultural development.

The Restudy report identified the purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project as capturing Caloosahatchee Basin runoff and releases from Lake Okeechobee. The project was formulated to provide water supply benefits, some flood attenuation, environmental water supply deliveries to the Caloosahatchee Estuary, and water quality benefits to reduce salinity and nutrient impacts of runoff to the estuary. It was assumed that the project might also provide significant water quality improvements depending on the location of the project and pollutant loading conditions in the watershed. According to CERP guidance memorandum-GM 23.01 "Water Quality Considerations for the PIR Phase," the Caloosahatchee River (C-43) West Basin Storage Reservoir Project falls in Category B, which means the project should be designed to achieve water quality improvements.

Because of water quality problems within the basin that were identified during the Restudy, as well as the purposes the project was designed to meet, the C-43 project team collected additional, updated water quality information for this PIR. According to the FDEP's 2003 Caloosahatchee Basin Status Report, the same water quality parameters of concern were identified for the basin as were identified in the Restudy report. In addition to problems associated with extremes in salinity levels, excessive nutrients (expressed as high chlorophyll-a concentrations), depressed levels of DO, and elevated coliform bacteria levels have been identified as problematic within the estuary. The extent of and research associated with these problems, as well as the over-arching problem of excessive salinity variations in the estuary, are discussed in the following paragraphs.

Water quality within the Caloosahatchee watershed is influenced by fresh water inflows from Lake Okeechobee, non-point pollution in local basin runoff, as well as point sources such as wastewater treatment plant discharges. Due to the geology of the region, there is also a direct interaction between the surface water and groundwater, which can affect the dissolved oxygen and iron concentrations in the surface water column. The upper Caloosahatchee River watershed from the Moore Haven Lock and Dam (S-77) to the Lee/Hendry county line has been classified by the State of Florida as a Class III water body in accordance with 62-302 Florida Administrative Code. The Class III designation establishes specific water quality standards that are intended to protect and sustain the natural attributes necessary for these waters to meet their intended use (recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife). The surface water directly upstream of S-79 east to the Lee/Hendry county line is designated as a Class I water body and must meet the standards required for use as a potable water supply (see ***Table 4-2*** for surface water classification status of Caloosahatchee River).

TABLE 4-2: SURFACE WATER CLASSIFICATION FOR CALOOSAHATCHEE RIVER

Water Class	Location
Class I Water: Caloosahatchee River	East Lee County line to SFWMD structure S-79 (Franklin Lock & Dam Spillway)
Class III Water: Caloosahatchee River	SFWMD structure S-77 (Moore Haven Lock & Spillway) at Lake Okeechobee to Lee/Hendry County line.

Several ecological functions of the Caloosahatchee Estuary are directly affected by water quality. The water quality problems negatively impacting ecological resources are primarily related to excessive variations in freshwater inflow and salinity as well as increased nutrient loads and color that result from excessive freshwater discharges in the wet season.

Water quality within this study area has been significantly altered due to the construction of the three locks and dams, excavation of the riverbed to 25 feet, increases in both urban and agricultural land use, and by the construction of an extensive network of canals and drainage ditches to accommodate this level of development. These hydrologic alterations have resulted in discharges of unnaturally large quantities of freshwater runoff into the river and eventually into the downstream receiving estuarine systems. Extensive documented research on the tidal portion of the Caloosahatchee River has shown that salinity changes in the estuary are the result of either low to no flows or too high flows of freshwater being discharged at the S-79 structure. Together, extreme flows and changes in salinity are by far the largest problem affecting the ecologic health of the estuary.

4.1.3.1 Salinity

It has long been established that freshwater inflow dynamics and salinity are major determinants of the distribution of estuarine species and those species' life stages, especially regarding their location and association with favorable habitat for rearing, protection and settlement (Gunter 1961; Pearcy and Richards 1962; Kinne 1966; Remane and Schlieper 1971; Bulger et al. 1993). Therefore, the ability of each estuary to function as a nursery differs according to its biological features, physical configuration, and inflow volume, magnitude and timing. Research by the SFWMD on the tidal Caloosahatchee began in the mid-1980s to determine the proper timing and volume of water required to support valued ecosystem components (i.e., such key estuarine species as oysters and SAV, such as *Vallisneria* spp.) and general biotic indicators (plankton and benthic invertebrates). Since the predominant source of freshwater to the tidal

Caloosahatchee (especially in the wet season) is water through the S-79 (70 percent of total flow), the research focused on issues of timing and volume of water through this structure; however, the latest models and methods do take into account the other major sources of freshwater discharged to the tidal Caloosahatchee from the "tidal" watershed. The SFWMD has focused on development of optimum S-79 flow ranges and delivery patterns for the estuary (Chamberlain and Doering, 1998b; Doering, 2002; Volety et al., 2003). As part of the state-mandated minimum flows and levels (MFLs) process, the SFWMD initially determined that a minimum dry season discharge at S-79 of 300 cfs (monthly average flow) is required to provide salinity conditions capable of supporting *Vallisneria*; however, the minimum flow target has been revised upwards to 450 cfs based on more recent scientific research by SFWMD staff. *Vallisneria* in the upper estuary is still recovering from the last drought and could suffer additional harm as the MFL requirements continue to be unmet (***Figure 4-1***).

Also as part of this research, maximum freshwater inflow limits (set at mean monthly values of 2,800 cfs and 4,500 cfs depending on frequency) and a frequency distribution of flows have been recommended that support valued ecosystem components and promote estuarine ecological benefits (Chamberlain et al. 1995, Chamberlain and Doering 1998b, Doering et al 2002, SFWMD 2003). It is these recommended flows that were used initially to determine CERP storage requirements and infrastructure changes in the Caloosahatchee Basin and Lake Okeechobee during the Restudy. These minimum and maximum flow targets have also been adopted for this PIR.

Based on the above biotic and water quality research, restoring the flows and achieving the hydrologic targets is an environmental priority within the Caloosahatchee River Basin. The estuary will remain at risk as long the quantity and timing of freshwater flows into the estuary remains unchanged. If water management practices are not changed, large releases will continue to have far reaching salinity and water quality impacts that may even influence Florida Bay (Rudnick et al. 1999).

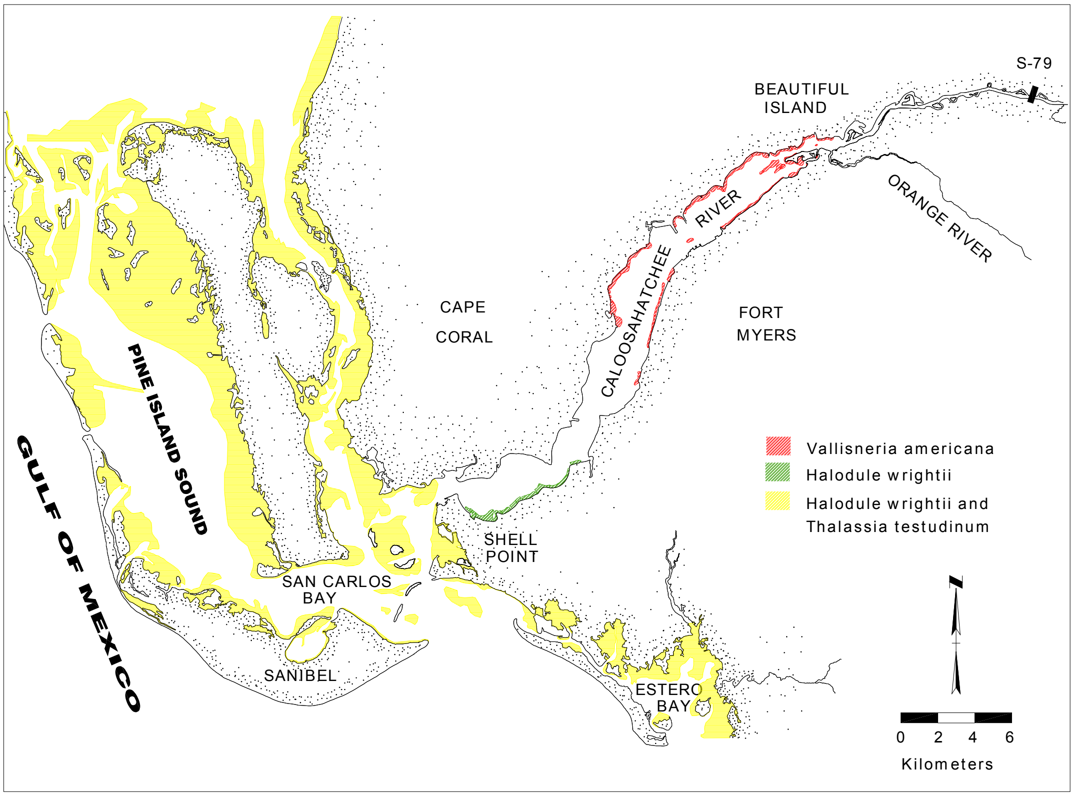


FIGURE 4-1: SUBMERGED AQUATIC VEGETATION IN THE CALOOSAHATCHEE ESTUARY

The excessive and unnatural variation in discharge and salinity that now occurs in the Caloosahatchee Estuary is due in large part to the man-made connection between Lake Okeechobee and the construction of C-43 Canal, the S-79 structure, and the network of secondary canals in the Caloosahatchee Basin (Chamberlain and Doering 1998a). Even before the S-79 was installed in 1965, a study was conducted by the University of Miami (under contract to the USACE) to determine the effects of the Lake Okeechobee releases on the St. Lucie and the Caloosahatchee estuaries (University of Miami, 1954). This study found significantly more sediment and salinity problems in the St. Lucie Canal than in the Caloosahatchee River, but the study did concluded that salinity was reduced as far downstream on the Caloosahatchee River as San Carlos Bay (downstream of Shell Point) when large releases from Lake Okeechobee occurred. According to the study, "These conditions are sufficiently severe during conditions at or near maximum release to cause temporary movements of marine life from the lower river, the southern part of Matlacha Pass, and sections of San Carlos Bay.

These conditions are also severe enough to cause the death of some forms unable to move from these areas (University of Miami, 1954)."

Subsequent biological field sampling of plants and fish by Phillips and Springer (1960), as well as Gunter and Hall (1962), before the S-79 structure was built also reported impacts on biota related to freshwater releases that extended into San Carlos Bay.

The Caloosahatchee River is the predominant source of freshwater discharges to the estuary. Bierman (1993) determined that over 90 percent of the variance in salinity in the estuary was related to discharges from S-79. The primary research on the tidal Caloosahatchee has focused on assessing the biological and water quality impacts from S-79 discharges, in order to determine optimum flow ranges, salinity, and water quality. Ideally, an estuary should provide a complete range in salinity from zero parts per thousands (ppt) (freshwater) to 35 ppt (ocean water). The long-term mean discharge through S-79 falls between approximately 300 cfs and 3,000 cfs. However, daily and monthly average inflows often exceed this long term average, with changes in salinity caused by either too little or too much freshwater being discharged over S-79. Studies conducted by the SFWMD on the Caloosahatchee Estuary indicate that discharges in excess of 2800 cfs from S-79 has caused most of the estuary above Shell Point to become oligohaline (low salinity between zero and five ppt) and inflows that commonly exceed 4,500 cfs adversely reduce salinity and water quality not only in the estuary, but also in the San Carlos Bay area and outer embayments (Chamberlain and Doering 1998a, Doering and Chamberlain 1998). During the dry season, lack of freshwater availability and subsequent low to no flow conditions can upset the salinity balance in the upper estuary and threaten the associated species, which depend on a minimum of freshwater inflow to maintain the low salinity zone that has been spatially reduced because the placement of the S-79 structure that truncated this zone (Doering et al. 2002, SFWMD 2002).

4.1.3.2 Nutrients

Although the salinity regime in the tidal Caloosahatchee has been the primary focus of much of the research, the SFWMD, FDEP, USGS and other agencies have also been examining other water quality issues in the basin and estuary. Work done by FDEP's Watershed Management Program has documented water quality impairments in the basin for several parameters and, in particular, for nutrients.

Urban and agricultural development within the drainage basin typically results in an increase in runoff and nutrient loads delivered to the downstream estuary. If excessive, the additional nutrients can cause a decrease in critical water quality when subsequent increases in phytoplankton (algae) production cause a depletion of dissolved oxygen and a reduction in light penetration. Decreased light penetration can result in declines in SAV abundance since some of the estuary bottom that presents favorable conditions for SAV no longer obtains enough light to sustain these plants. The sediment in areas no longer supporting SAV can become mobile and increase water column turbidity which further impacts SAV viability. Excessive nutrients also trigger a thick growth of epiphytes, which can block the sunlight before it can reach the surface of the seagrass (Murray et al. 1999). In fact, in some estuaries, nutrient input has such an effect that relatively minor changes in water quality can lead to sharp reductions in the productivity of seagrasses which can lead to broad habitat changes (Livingston 1984).

Fortunately, within the Caloosahatchee Estuary, salinity swings rather than excessive nutrient loads have been identified as the primary limiting factor for SAV viability. McPherson et al. (1990) in their study of phytoplankton productivity in Charlotte Harbor determined there are three regions of productivity within an estuary that are characterized primarily by salinity and associated water quality parameters from freshwater. These regions are: (1) low salinity areas typical of the upper estuary or where high flows lowered salinity to less than approximately 10-15 ppt; (2) moderate to high salinity areas near the mouth of the major rivers or in Matlacha Pass; and (3) high salinity near the marine influence of passes to the Gulf of Mexico, well away from the influence of freshwater runoff (e.g., in Pine Island Sound). Increased phytoplankton productivity occurs when early spring temperature, light availability, and supportive water quality conditions co-occur. Typically, in Region 1, the highly-colored water from dissolved organic matter in freshwater runoff limits availability of light and is the determining factor controlling phytoplankton production and chlorophyll biomass, even when sufficient nutrients and temperature co-occur. A short residence time related to high flows also limits production. SAV (*Vallisneria* spp.) in this region of the estuary is inhibited during the wet season (high freshwater inflows) by colored water that reduces light availability. During the dry season (low freshwater inflows), low temperature and high salinity inhibit SAV.

In Region 2, nutrient-rich colored water is diluted by seawater so that the availability of light has increased and stimulates phytoplankton productivity. It is in this region of the Caloosahatchee Estuary (middle to lower estuary, western San Carlos Bay, and southern Matlacha Pass) that Chamberlain and Doering (2003) reported good statistical correlations between nutrient loading and chlorophyll concentrations. However, research by SFWMD indicates that SAV growth in shallower areas is predominately influenced by salinity, while SAV at deeper depths are impacted by a combination of salinity and light availability (Chamberlain and Doering 1997). In this region, the amount of influence on water clarity from colored water versus chlorophyll biomass depends on the magnitude of flow and is currently being analyzed

In Region 3, even though water clarity is high, chlorophyll levels are typically low, primarily because nutrients are limited due to the distance from freshwater runoff and proximity to marine water. In this region of the estuary, SAV biomass and canopy height are high and typically extend to two meters depth.

4.1.3.3 Nutrients Impacts to the Caloosahatchee

Currently, nutrient standards for the State of Florida are narrative (non quantitative); therefore a surrogate standard for chlorophyll-a has been set at above 11 micrograms per liter (ug/l) (mg/m3) for estuaries and above 20 ug/l for freshwater. In the latest FDEP impaired water analysis for the Caloosahatchee, seven segments of the tidal Caloosahatchee River were found to be potentially impaired for nutrients. Chlorophyll-a is used as a measure of nutrient imbalance since Florida surface water quality standards do not include numerical criteria for nutrients such as nitrogen and phosphorus.

The watershed downstream of the S-79 structure that contributes directly to the tidal Caloosahatchee River is primarily urban (Cape Coral and Fort Myers). Although some of this urban area pre-dates the 1979 state rule regarding the prevention of the pollution of state waters from stormwater runoff (62-25 Florida Administrative Code), much of it was developed after this rule went into place. Although urban areas can be significant sources of nutrients and pollutants, the impact from this urban area appears to be relatively minor compared to the proportion of nutrient loads delivered to the Caloosahatchee Estuary through S-79 inflows. A study by ERD (2003) found that, discharge from S-79 contributes from 90 percent to 95 percent of the mean annual mass of total nitrogen (TN) and total phosphorus (TP) to the tidal Caloosahatchee River (for this report, the USACE has estimated that S-79 contributes more than 75 percent of the nutrient loads). The next largest contributor to the tidal Caloosahatchee River was the Orange River with 1.1 percent to 3.8 percent of the annual mass of TN and TP.

As stated above, approximately 75 to 90 percent of the nitrogen and phosphorus load sent to the Caloosahatchee Estuary comes from sources upstream of S-79. To address questions regarding the effect of reservoirs on water quality, specifically nutrients, FDEP contracted with Tetra Tech (and subcontractors Janicki Environmental and Soil and Water Engineering Technology, Inc.) to examine the potential nutrient impairment problem in the estuary. The study developed regression equations to describe two relationships: 1) between chlorophyll-a concentration and nitrogen loading and 2) between chlorophyll-a concentration and phosphorus loading. Due to the naturally occurring high levels of phosphorus in the watershed, the indication was that nitrogen was the limiting nutrient, which is consistent with the other studies identified earlier. Thus, of the two regression equations, this study determined that the nitrogen/chlorophyll-a relationship was the best means of predicting nutrient impairment (or phytoplankton algal blooms) in the estuary. The report has identified three preliminary targets for TN loading to the estuary from releases at S-79 in order to achieve a chlorophyll-a concentration limit of 11 ug/l:

1. Maximum annual load less than 3,000 tons/year, where annual load ~ (wet season monthly load x 5) + (dry season monthly load x 7)
2. Dry season monthly load less than 190 tons/month, and
3. Wet season monthly load less than 350 tons/month.

The estimated annual TN load at S-79 is approximately 2600 tons/year at present. During the wet season an average of approximately 310 tons/month is discharged at S-79 while during the dry season an average of approximately 150 tons/month of TN is discharged at S-79. On an average basis, therefore, the nitrogen loads delivered through S-79 fall within the State's nutrient targets (i.e., TN loads associated with acceptable chlorophyll-a concentrations). The amount of nutrient loading to the estuary is mostly dependent on the magnitude of freshwater inflow (Chamberlain and Doering 2003).

During the 1996-2002 time period, the suggested annual TN target load has been exceeded three times. The exceedence years were 1998, 1999 and 2002. A dry season TN target exceedence occurred in 1998 when dry season flows from the C-43 basin along its eastern boundary with Lake Okeechobee were approximately three times higher in 1998 than the average for 1996 to 2002, probably reflecting a large controlled release from Lake Okeechobee. Wet season exceedences occurred in 1999 and 2002. These were the highest wet season flows observed at S-79 between 1996 and 2002. It should be noted that between 1996 and 2002, many of the years analyzed were wet years, resulting in high loads.

Additional documentation of the extent of the nitrogen problem in the estuary comes from research conducted as part of the Initial CERP Update (ICU). For the ICU, 22 years of TN concentrations collected just upstream of S-79 were used to calculate the average monthly concentrations at S-79 for each of 12 months. Then TN loading for each month of the 36-year period of record for CERP was calculated by multiplying each month's discharge by the average monthly TN concentration for that month. For each 36-year scenario, the number of years in which the annual TN load at S-79 exceeded 3000 tons (the load limit meeting the FDEP's estuarine standard) was calculated. Nitrogen loads were exceeded in ten of 36 years for the 2000 Base scenario (i.e., existing conditions), nine years for the 2050 Base scenario (future without project conditions), one year for the

CERP0 scenario (CERP as defined in the Restudy), and 1 year for CERP1 (updated CERP as defined in the ICU).

Similarly, ***Table 4-3*** below depicts analysis from the ICU showing results of seasonal, rather than annual TN loading. The number of months in which TN loading exceeded critical seasonal loads of 350 tons/month during the wet season and 190 tons/month during the dry season (wet season defined as June–October, dry season as November–May) are shown.

TABLE 4-3: NUMBER OF MONTHS OF TN SEASONAL LOAD EXCEEDANCES IN THE CALOOSAHATCHEE ESTUARY

Scenario	2000 Base	2050 Base	CERP0	CERP1
Wet Season	60	48	8	8
Dry Season	45	36	9	8

Under existing conditions (2000 Base) and future without conditions (2050 Base), critical seasonal loads were exceeded 28 percent (2000 Base) and 22 percent (2050 Base) during the wet season and exceeded 21 percent (2000 Base) and 17 percent (2050 Base) during the dry season. As will be discussed in greater depth under the evaluation of C-43 alternatives, TN loads under existing and future without project conditions exceed critical seasonal loads four to five times more frequently in the dry season and six to seven times more frequently in the wet season than infrastructure alternatives related to CERP0 and CERP1 (***Table 4-3***). This analysis conducted for the ICU thus demonstrates that nitrogen loadings exceeding the estuary's targets, while not a frequent problem, do occur, but are likely to be greatly improved by implementation of the Caloosahatchee River (C-43) West Basin Storage Reservoir project as described in CERP.

4.1.3.4 Nutrient Reduction Opportunities

Nutrient loads to the estuary can be reduced through treatment in stormwater treatment areas (STAs) or through the widespread adoption of best management programs (BMPs) by farmers, land developers, and urban residents. Lower nutrient loads will result in improved estuary habitat through increased light penetration and increased dissolved oxygen concentrations. The implementation of BMPs to control nutrient loads, while quite useful in the case of the Caloosahatchee Estuary, has not been considered as a central element of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project strategy. Because achievement of water quality standards is a responsibility resting primarily upon individual states, the underlying assumption of the project team has been that the State of Florida will implement state and local water quality programs necessary to achieve appropriate load reductions through actions by the FDEP, Florida Department of Agriculture and Consumer Services (FDACS), and SFWMD.

However, the Caloosahatchee River (C-43) West Basin Storage Reservoir itself can potentially reduce and alter the timing of nutrient loads through the construction and operation of storage reservoirs. The reservoir is expected to reduce nutrient loading (particularly nitrogen) through settling and nutrient uptake.

4.1.4 Economic and Social Well-Being Problems and Opportunities

As a result of the C&SF Project, by providing flood protection and an available supply of drinking water, the population of south Florida has grown from approximately 900,000 as reported in 1950 to a population of over 5.5 million in 1995. By the year 2050, the population of south Florida is projected to grow to 11.6 million. Lee County (including Fort Myers, Cape Coral, Sanibel and Captiva Islands, Bonita Springs, and surrounding areas) has one of the fastest growing populations in both south Florida and in the state. The increased growth in population in Lee County can be attributed to net in migration and not as a result of high birth rates for this area. The coastal areas in the study area have become highly urbanized. As a result, this urbanization has caused development to move eastward into areas that were once agricultural or undeveloped.

The Governor's Commission for a Sustainable South Florida identified agriculture and tourism as "critical industries" for maintaining the economy in the southern part of the state. In the project area, agriculture is a major industry. A rapidly increasing human population demanding more developable lands and advancing agricultural development now threaten the relatively pristine natural areas. The tourism industry is also dependent upon the region's ability to sustain its economy and its quality of life through management of its resources. Agriculture and tourism depend on a system that can provide vital water supply needs and flood protection without harming the natural system upon which tourism, recreational activities, and associated services depend.

In response to the proposed modification to the LORS, the City of Sanibel commented in an October 2006 letter to the USACE:

"Sanibel Island's economy and its way of life depend upon the health of the Caloosahatchee River and Estuary. The Estuary provides essential habitat for fish populations that are central to the region's economy and recreational fishing economies. The City of Sanibel is particularly dependent on the health of the Caloosahatchee Estuary, as tourism generated by the diverse estuarine ecosystem in which it is located is central to the Island's economy."

Similarly, the City of Fort Myers also commented in 2006:

"The Caloosahatchee River and the estuary must be protected. The local economy is reliant on these waters through both the tourism industry and the fishing industry. We cannot afford to lose this most precious environmental and economic resource to the damaging effects of increased water releases from Lake Okeechobee."

Competition for regional water resources has intensified with the increase in population and agriculture industry growth. This places a strain on existing resources, which will eventually surpass the readily available sources. When the needs of the natural system are then factored in, demands become greater and conflicts among competing water users will become even more severe. While most people recognize the need for a healthy ecosystem to support the region's economy and jobs, many people are concerned that restoration projects will displace farms and other businesses, limit development, reduce available water supply and reduce job opportunities. By contrast, continued degradation of the south Florida ecosystem will adversely affect the tourism and recreational industry that are important to the regional economy.

4.1.4.1 Water Supply

While providing additional water supply for urban and agricultural users represents a potential opportunity to be addressed by the Caloosahatchee River (C-43) West Basin Storage Reservoir, providing water supply to meet the environmental needs of the estuary during dry periods is one of the primary purposes of this project. Upon meeting flow targets at the S-79 structure necessary for ecosystem restoration in the Caloosahatchee Estuary, any additional water stored by the Caloosahatchee River (C-43) West Basin Storage Reservoir could be delivered to the C-43 Canal and would be available for other water related needs.

Water supply and flood control benefits of the Caloosahatchee River (C-43) West Basin Storage Reservoir implementation will be classified as incidental. Increases to flood damage reduction benefits and water supply benefits will not be further analyzed as part of this study; however, a later PIR will investigate opportunities to increase the quantity of water available for municipal, agricultural, and other environmental interests in the basin. Analysis of area water supply is being conducted by the SFWMD in a report entitled Lower West Coast Water Supply Plan (LWCWSP) Update.

4.1.4.2 Flood Damage Reduction

While flood damage reduction is not the primary intent of this project, the evaluation of alternatives will include an analysis of their effects on the current level of flood protection. The project will not compromise that existing level of protection, and although it was not a specific goal of the study to increase the level of protection, some incidental benefits may be achieved.

4.2 PLANNING GOALS, OBJECTIVE AND CONSTRAINTS

4.2.1 Project Goals and Objectives

The Restudy assessed some but not all of the water resource problems and issues within the Caloosahatchee River Basin. The Restudy purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir is to capture Caloosahatchee Basin runoff and releases from Lake Okeechobee as a means to meet water demands (moderate extreme damaging high and low flows) for ecosystem restoration within the Caloosahatchee Estuary, with some benefits to municipal and agricultural water supply. However, since this project is focused on reaffirming a plan to construct and operate a reservoir with approximately 160,000 ac-ft of storage, the primary goal of this project is to produce a plan that, when implemented, will meet the ecosystem restoration objectives of the Caloosahatchee Estuary. Opportunities for providing additional water to meet municipal and agricultural needs for water supply will be investigated under a subsequent study.

Based on a consideration of the Restudy purpose for the project and problems and opportunities in the study area, specific planning objectives to meet the goal of enhancing ecological values are listed below:

Goal: Enhance ecological values by restoring ecosystem function in the Caloosahatchee River and Estuary

Objectives:

- Improve the quantity, timing, and distribution of freshwater flows to the Caloosahatchee Estuary.
- Improve water quality in the Caloosahatchee Estuary by reducing nutrient inflows from the Caloosahatchee Basin.
- Improve salinity balance in the Caloosahatchee Estuary for estuarine organisms. Reduce the spatial extent and duration of occurrences of extreme low and high salinities.
- Improve the spatial extent and functional quality of habitat for estuarine biota.
- Increase plant and animal diversity and abundance, particularly increasing the spatial extent of SAV. Increase seagrass and oyster production through improved salinity regime.
- Increase spatial extent and quality of wetlands in watershed.
- Increase suitable habitat for oysters and seagrasses in estuary.

Specific planning objectives to meet the goal of restoring economic values and social well-being are listed below:

Goal: Enhance economic values and social well being

Objectives:

- Conserve and protect water resources to ensure sustainability of economic and natural resources.
- Ensure availability of ground and surface water supplies for environmental resources while protecting existing legal sources of water for agricultural and urban uses.
- Maintain existing level of service for flood protection in the project area.
- Provide recreational, tourism, and environmental education opportunities.

Table 4-4 shows the CERP goals and project specific goals and objectives.

TABLE 4-4: CERP AND PROJECT GOALS AND OBJECTIVES

CERP Goals and Objectives	Project Goals and Objectives
Enhance Ecological Values	
Increase the total spatial extent of natural areas	• Improve the spatial extent and functional quality of habitat for estuarine biota. • Increase spatial extent and quality of wetlands in watershed
Improve habitat and functional quality	• Improve the quantity, timing, and distribution of freshwater flows to the Caloosahatchee Estuary by capturing runoff from the Caloosahatchee Basin and Lake Okeechobee releases. • Improve salinity balance in the Caloosahatchee Estuary for estuarine organisms. Reduce the spatial extent and duration of occurrences of extreme low and high salinities. • Improve water quality in the Caloosahatchee Estuary by reducing nutrient inflows from the Caloosahatchee Basin. Increase plant and animal diversity and abundance, particularly increasing the spatial extent of SAV. Increase seagrass and oyster production through improved salinity regime. • Increase suitable habitat for oysters and

CERP Goals and Objectives	Project Goals and Objectives
	seagrasses in estuary.
Improve native plant and animal species abundance and diversity	• Increase plant and animal diversity and abundance, particularly increasing the spatial extent of SAV.
Enhance Economic Values and Social Well Being	
Reduce Flood Damages (agricultural/urban)	
Provide recreational and navigation opportunities	• Increased recreational opportunities are directly related to improved habitat function and quality objectives.
Protect cultural and archaeological resources and values	

4.2.2 Constraints

The C&SF Project has supported agricultural and urban development in the Caloosahatchee Basin through a variety of benefits such as water supply, flood protection, drainage control, navigation, and recreation opportunities. This economic development has, however, adversely affected ecosystem functions and values in the study area, including reductions in the spatial extent and functional quality of wetland, riverine, estuarine, and marine habitats and decreases in native animals, fish, and plant populations. While alternative plans are formulated to achieve restoration of these functions and values, to be considered for implementation, plans must also avoid violating planning constraints. All CERP projects are constrained by WRDA 2000 provisions such as avoiding the elimination or transfer of existing legal sources of water unless a new source of comparable quantity and quality is available and maintaining existing levels of service for flood protection. In addition, all USACE projects are constrained by legal requirements that seek to minimize, for example, impacts to cultural resources or impacts to threatened and endangered species or their habitats.

Planning constraints specific to the Caloosahatchee River (C-43) West Basin Storage Reservoir project include:

- Avoid or minimize impacts to navigation.
- Avoid contributing to the degradation of water quality in the estuary or any of the contributing water bodies within the basin.
- Minimize impacts that will adversely affect the tourism or recreational industries which are critical to the regional economy.

4.3 PROJECT EVALUATION CRITERIA AND EVALUATION METHODS AND MODELS

Alternatives were evaluated based on their ability to meet specific evaluation criteria and performance targets, which relate directly to the goals and objectives identified in this report. A key criterion for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is the need to capture and retain excess basin stormwater runoff and to capture excess flows discharged from Lake Okeechobee into the Caloosahatchee Estuary. The goal of the Caloosahatchee River (C-43) West Basin Storage Reservoir is to capture this excess water at times of peak or high flows and retain it for release at a later time when an increase in the freshwater flows are needed to maintain desirable salinity levels in the estuarine system. Reservoir operations were optimized to first address the environmental needs of the Caloosahatchee Estuary.

4.3.1 Hydrologic Performance Measures

The hydrologic performance measure was derived from relationships between the distribution, abundance, growth and survival of estuarine organisms and changes in salinity or freshwater discharge. Salinity tolerances of submerged grasses were initially used to identify an optimum S-79 freshwater inflow range of 300-2800 cfs (Chamberlain et al. 1995; Chamberlain and Doering 1995; Doering et al. 1999, 2001, and 2002; Doering and Chamberlain 2000; and Kraemer et al. 1999). Flows greater than 2800 cfs depress salinity in the lower estuary and threaten the marine shoal grass (*Halodule wrightii*) typical of this region (Chamberlain and Doering 1998b; and Doering et al. 2002), while flows that approach 4500 cfs have similar adverse impacts downstream in San Carlos Bay (Chamberlain and Doering 1995). Research has shown that the optimum flows for SAV are beneficial to other organisms as well.

A steady-state salinity model (Scarlatos 1988; Bierman 1993) and a statistical model of salinity (SFWMD 2000) were used to estimate mean monthly flows from S-79 that would establish a desirable salinity range in the geographic (historical) locations of SAV, without adverse impacts to benthic invertebrates, ichthyoplankton, and zooplankton (Chamberlain et al. 1995, 1999, 2001; Chamberlain and Doering 1998b; Doering et al. 2002; and Volety et al. 2003). An upgraded, fully hydrodynamic model has been developed and is under refinement. An early version of this model was used to verify and improve estimates of inflow requirements based on model prediction of salinity distribution in the estuary. For the Caloosahatchee Estuary, a mean monthly inflow of at least 300 cfs is needed from S-79 to ensure that the 30-day moving average salinity at Fort Myers (Yacht Basin) is less than ten ppt (< 10 ppt) (target maximum salinity for healthy *Vallisneria americana*) and single day maximum salinity (daily average) does not exceed 20 ppt (Doering et al. 1999, 2001, and 2002, Kraemer et al. 1999).

These MFL salinity criteria were initially designed to protect *Vallisneria americana* (tape grass) upstream of Fort Myers, but are also beneficial for other organisms that utilize this low salinity region of the estuary (Chamberlain and Doering 1998b; and SFWMD 2000 and 2002). For tape grass, this estimated MFL depends on about 200 cfs of additional flow from the tidal basin tributaries downstream of S-79. However, violations of the salinity criteria commonly occur during dryer than normal periods in the dry season when tidal tributary flows are less than 200 cfs (< 200 cfs). Additional field and laboratory research (Hunt and Doering 2005) indicates that tape grass is more sensitive to water quality conditions related to high salinity during low flows, as well as poor water clarity during excessive discharges. The last major drought constituted significant harm to the tape grass beds, which have still not fully recovered after four years. Therefore, a minimum flow of 300 from S-79 is not enough. A greater frequency of flows are needed from S-79 that are closer to a minimum of 450-500 cfs to achieve the required salinity goals associated with the MFL and prevent MFL salinity violations during these very dry conditions. Hydrologic performance measures for discharge at S-79 and MFL salinity criteria are summarized in the table below (***Table 4-5***).

TABLE 4-5: CERP PERFORMANCE MEASURES FOR FRESHWATER DISCHARGE AT S-79 AND MFL SALINITY CRITERIA AT FORT MYERS, FL

Freshwater Discharge At S-79	
Low Flow for Estuary (mean monthly)	Number of months < 450 cfs
High Flow for Estuary (mean monthly)	Number of months > 2800 cfs Number of months > 4500 cfs
Low Flow Duration	Frequency of consecutive months < 450 cfs
High Flow Duration	Frequency of consecutive months > 2800 cfs Frequency of consecutive months > 4500 cfs
Minimum Flow and Level (MFL) at Fort Myers, FL (Yacht Basin salinity sensor)	
Salinity Criteria (daily average)	Shall not exceed 20 ppt more than once in 2 years
Salinity Criteria (30-day moving average)	Shall not exceed 10 ppt more than once in 2 years

4.3.1.1 Flow Distribution Target for the Estuary

Environmental investigations done in the Caloosahatchee Estuary by the SFWMD in the 1980s and 1990s led to the initial establishment of freshwater inflow targets (average monthly flows through S-79), based on key biota, such as the freshwater-low salinity plant, *Vallisneria americana*, in the upstream portion of the estuary. As part of this analysis, the SFWMD made the initial attempts to define a preferred distribution of flows from S-79 that would best support the estuary's biotic resources. This effort began by evaluating the inflows that had occurred during the 25-year period 1966-1990 after installation of S-79. These flows were obviously skewed toward the very low end of the range (***Figure 4-2***), which routinely threatened the low salinity zone of the estuary where the submerged plant *Vallisneria* provides important habitat when allowed to flourish.

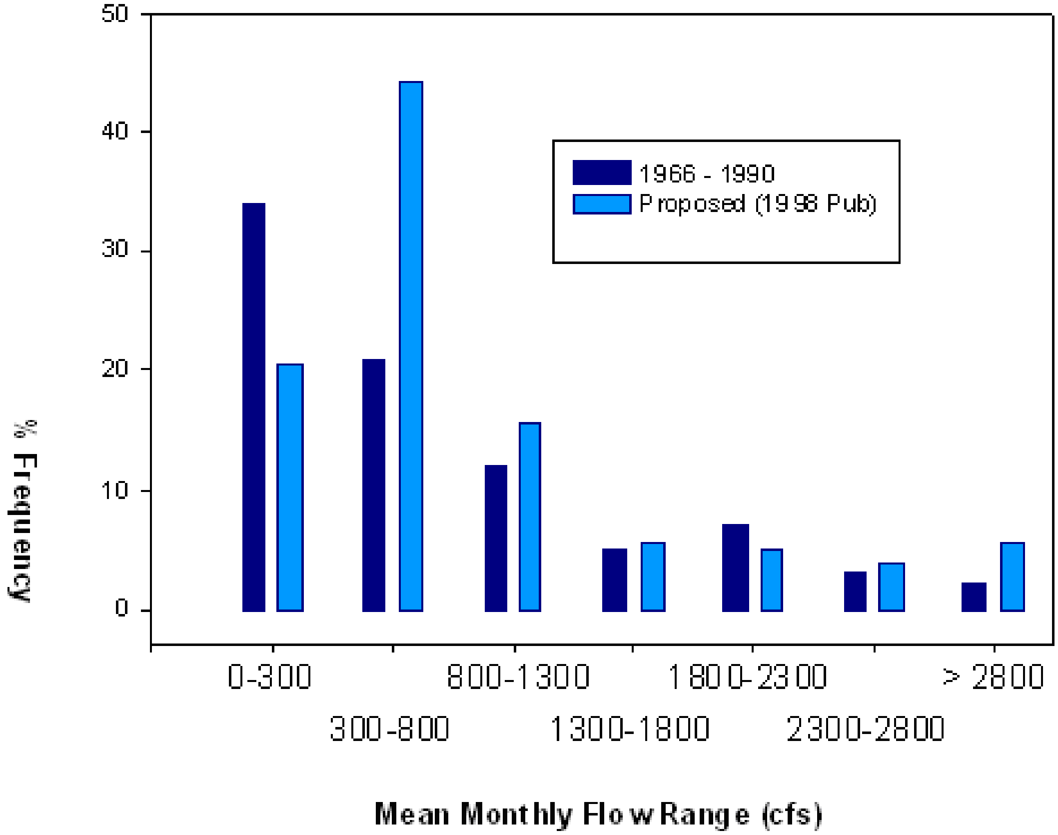
A distribution of inflows that has the greatest frequency range from 300 to 1,500 cfs, with a peak between 300-800 cfs was initially determined to be the most beneficial to the range of species evaluated. However, the SFWMD also recognized that a percentage of flows outside the preferred range (violations) may be an important component of the natural variability inherent in the estuary. An optimization program was employed as a first attempt to define the percent of acceptable violations (Labadie 1995: Otero et al 1995). The desired inflow ranges (limits for biota) were input variables to the model, along with the natural periodicity of violations of the upper and lower limits (estimated from the 1966-1990 historic data). For the Caloosahatchee, 20.5 percent violation of the low flow limit created inflows that emulated the natural variability established from the rainfall during 1966-1990. In addition to natural variation, this original frequency distribution generated by the model revealed that (1) the appropriate initial inflows limits were attained (300-2,800 cfs); and (2) the greatest frequency of inflows were within the range from 300-1,300 cfs, with a peak of inflows between 300-800 cfs. This original frequency distribution was reported and published as provisional (Chamberlain and Doering 1998), with the intent to update it as more information became available about the salinity requirements of key biota.

Instead of the original 1966-1990 base data set, more recent modeling efforts use a 2000 base condition (***Figure 4-3***), which have approximately 51 percent of the flows falling below 300 cfs (45% <150 cfs). Additional field and laboratory research since the Chamberlain and Doering (1998) publication indicates that *Vallisneria* is more sensitive to water quality conditions related to high salinity during low flows, as well as poor water clarity during excessive discharges. The last major drought constituted significant harm to the *Vallisneria* beds, which have still not fully recovered after four years.

Subsequent hydrologic modeling work (related to the Restudy, the Caloosahatchee Water Management Plan, and the development of MFL criteria) provided at least two new flow distributions that have fewer low flow violations than the original 20.5 percent and will better protect *Vallisneria*. The flow distribution known as EST02 was based on improving minimum flow deliveries at S-79. It allows fewer violations of flows below 300 cfs (seven percent) and is the best available estimate of pre-development freshwater deliveries to the estuary.

Both the earliest flow distribution estimates and EST02 assumed an average 200 cfs would be contributed by tidal basin inflows downstream of S-79, which would be adequate for meeting the *Vallisneria* salinity limits and MFL criteria. Most recently, estimates of tidal tributary inflows were added to the modeling effort to better assess total estuarine inflows related to salinity distribution targets. Assuming that 200 cfs will be contributed by the tidal basin will not achieve the MFL requirements. Also, permanent alterations have occurred in the estuary and watershed, such as the installation of S-79, which truncated the salinity gradient, preventing upstream migration of low salinity water during the dry season, thus eliminating the dry season oligohaline low salinity zone that historically existed. Therefore, a flow distribution that provides flows below 450 cfs at S-79 will not achieve the protection defined in the MFL (SFWMD 2000 and 2002) rule.

EST05 is similar to EST02, except that mean monthly inflows at S-79 are maintained above 450 cfs. Most of the EST05 flows from S-79 (75 percent) are in the ideal range of 450-800 cfs and almost all the remaining inflows are in the 800 to 2800 cfs range at S-79. Therefore, EST05 provides a slightly higher level of protection (against high salinity) in the upper estuary than other time series. This proposed frequency distribution has an estimated estuary delivery volume demand of ~524,000 ac-ft/yr and will maintain a full estuarine salinity gradient that is not unnaturally compressed.



Percent frequency of mean monthly flows from S-79 for: (a) 1966 – 1990, and (b) initially proposed during 1998 publication.

FIGURE 4-2: PERCENT FREQUENCY OF MEAN MONTHLY FLOWS FOR 1966 THROUGH 1990

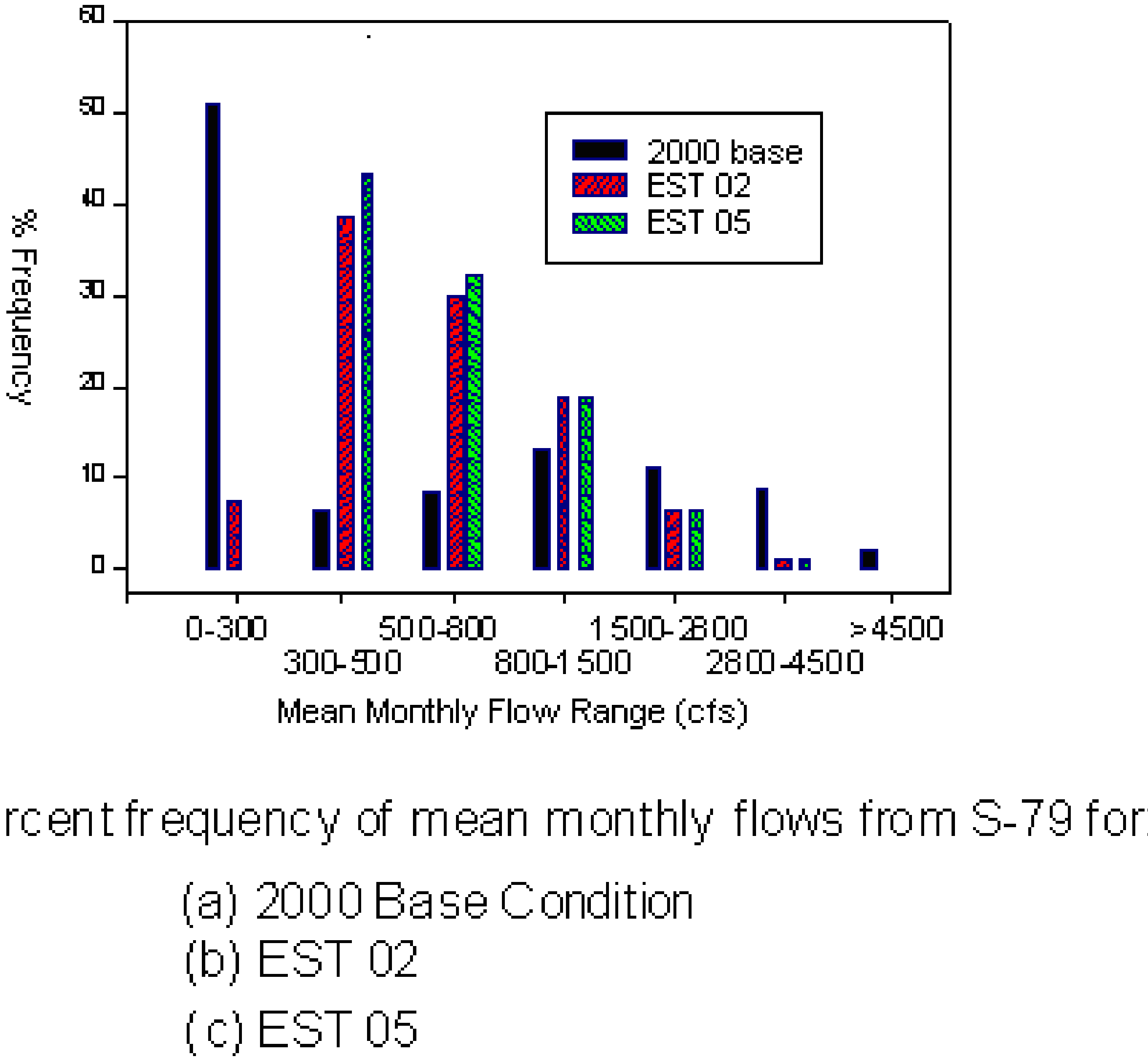


FIGURE 4-3: PERCENT FREQUENCY OF MEAN MONTHLY FLOWS (EST 02, EST 05 FLOW DISTRIBUTIONS)

In order to better achieve the CERP project and MFL restoration goals, scientists on the Caloosahatchee River (C-43 West Basin Storage Reservoir project team selected the EST05 flow distribution (***Table 4-6***) as the restoration target. It provides no allowances for monthly average discharges from S-79 less than 450 cfs. However, salinity violations are allowed under the MFL rule once every two years for the moving monthly average and daily salinity criteria. Therefore, the West Basin Storage Reservoir can still achieve estuarine protection and restoration success if the final selected alternative has flow occurrences beyond the distribution limits, including those below 450 cfs. The degree of achievement will be in part demonstrated by comparing performance measure targets and habitat units (Hus) between base conditions and the alternative.

TABLE 4-6: FREQUENCY DISTRIBUTION OF FLOWS FROM S-79 ASSOCIATED WITH EST05 (WITHOUT TIDAL BASIN CONTRIBUTION)

Discharge Range (cfs) From S-79	Percent Distribution Of Flows From S-79
0 to 450	0%
450 to 500	42.8%
500 to 800	31.7%
800 to1500	19.2%
1500 to 2800	5.6%
2800 to 4500	0.7%
>4500	0%

4.3.2 Ecological Performance Measures

Estuarine ecosystem improvements will be measured as improvements to the salinity regime and water quality achieved in the river and estuary. These improvements will be measured by performance measures developed for six key indicator species:

- SAV (tape grass and seagrass)
- Oyster
- Blue crab
- Zooplankton
- Spotted seatrout

Performance measures have been established for the above biological resources in the Caloosahatchee Estuary (values are provisional and may be adjusted upon new evaluation of historic and current research efforts). These current ecological targets and supportive salinity requirements include the following:

1. SAV
   a) Tape grass–A permanent presence of tape grass beds (above the Fort Myers U.S. 41 Highway Bridges) that improve water quality and provide viable habitat for other organisms. Requires maintaining a 30-day moving average salinity < 10 ppt during the dry season at the Fort Myers continuous salinity sensor (near the surface at the Fort Myers Yacht Basin), such that tape grass in the Beautiful Island area does not decrease below 20 percent coverage and blade length is > 10 cm. Daily average salinity shall not exceed 20 ppt at Fort Myers more than

once every two years, and neither shall the 30-day moving average salinity of 10 ppt (MFL Rule: SFWMD 2000);

b) Seagrass–Return of viable seagrass that has been lost in the lower Caloosahatchee River (Iona Cove Region) and return of the 38 percent of seagrass lost in San Carlos Bay since 1982 (Harris et al. 1983). Limit the occurrence of average monthly salinity <15 ppt at the Cape Coral Bridge sensor, so salinity > 20 ppt is promoted in Iona Cove (Bierman 1993), which is supportive of minimum seagrass density (coverage > 30 percent at one meter water depth and average blade length > 10 cm). Maintain an average monthly salinity > 25 ppt, as measured at the Sanibel Causeway Bridge near-surface continuous sensor, so that historical seagrass density and coverage in the San Carlos Bay area (as determined from previous surveys, hydroacoustic monitoring, and aerial photography) is protected and restored to a previous condition (at least circa Harris et al. 1983), which includes reestablishment of continuous coverage at deeper depths in the San Carlos Bay area between Shell Point and the Sanibel Causeway.

2. Fauna

a) Oysters–A five fold increase in area coverage to approximately 100 acres and possibly 400 acres with placement of suitable substrate. Maintain daily salinity at Piney Point > 5 ppt to prevent high mortality. Consistently provide the preferred salinity of 14-28 ppt that supports the recruitment, survival, and growth of juvenile oysters upstream of Shell Point during March–October (juvenile oyster growth > 2.5 mm a month; recruitment > 3 spats per substrate shell a month; and mortality < 20 percent per month-values are based on information interpreted from Volety et al. 2003).

b)Plankton–Improve the nursery function of the estuary and better support each generation of fish recruited by improving food supply (zooplankton available). Zooplankton density spikes currently occur. Increase by 30-40 percent the occurrences of spikes that double or triple zooplankton density. Significantly reduce the occurrence (>10 percent) the frequency of total wash-out of fish eggs from the estuarine area upstream of Shell Point that result from high flows (Chamberlain and Doering 1998b; Chamberlain et al. 1999 and 2001, and SFWMD 2002)

c) Blue Crabs–Substantially (significantly) increase the blue crab population and commercial landing (catch per unit effort). Expect increase (return) of landings to 1-3 million pounds annually (assuming that fishing effort does not substantially increase or decrease).

d) Spotted seatrout-Substantially (significantly) increase the population and catch per unit effort.

Several prominent species have been identified for long-term monitoring and environmental assessment because they constitute important habitat in the Caloosahatchee, San Carlos Bay, Matlacha Pass and Pine Island Sound. In addition to tape grass that serves as an indicator of estuarine health in the upper estuary, these are oysters and marine seagrasses that represent the more downstream, seaward portions of the system. ***Table 4-7*** outlines each species chosen by the study team as a performance measure, the variables used in the habitat suitability index (HSI) for that species, and the preferred flow range identified by SFWMD research to be ideal for the Caloosahatchee estuary (Chamberlain and Doering 1998). The preferred flow ranges tend to fall in the same range as the target flow rates as outlined in EST05. Once the selected alternative plan (SAP) is identified, the ecological benefits to the Caloosahatchee estuary that accrue from achieving flow targets at S-79 will be quantified.

The ecological model which will be used to quantify benefits of the SAP relies on the HSIs to determine what conditions will make an area more suitable for each species. Each species identified as a performance measure is dependent on factors (such as flow, salinity, and temperature) that make up the variables of the HSI for that species. By plugging in each of these variables to the ecological model, a spatially explicit benefit output will be developed. Therefore, it is evident that improving the ecological conditions would be a direct result of modifying the flows. Flow will also affect other variables, most noticeably salinity. The ecological model, using the HSIs, will indicate those areas that will be most supportive of each species as a result of each alternative. The model will be able to quantify the benefits that will be provided under the chosen plan, and compare those to existing and future without project conditions.

TABLE 4-7: ECOLOGICAL PERFORMANCE MEASURES

Species	Variables in HSI	Preferred Flow Range (cfs)
SAV	Light, salinity, temperature, flow	Halodule <800 Halodule/Thalassia <2800
Oyster	Salinity, temperature, depth, substrate, flow	500-2000
Blue Crab	Substrate, salinity, temperature, flow	300-800
Zooplankton	Salinity, flow	150-600
Spotted Seatrout	Salinity, temperature, seagrass cover, proximity to seagrasses and drop offs, flow	300-1300 (general fish requirement)
Vallisneria	Previous condition, salinity, temperature, light availability	~800- 1500

4.3.3 Water Quality Evaluation Criteria

A secondary goal of the project is to improve water quality in the river and estuary. This can be accomplished by: (1) reducing high flows during the wet season, capturing, storing, and partially treating this water, then releasing it in a more environmentally sensitive manner that is beneficial to estuarine resources during the dry season; and (2) eliminating regulatory (non discretionary) discharges from Lake Okeechobee to the Caloosahatchee Estuary.

In addition, an evaluation of project-related water quality impacts is necessary to determine if the alternative plan under consideration would meet the FDEP's requirement that the project not contribute to the degradation of water quality and also to determine any benefits the project might create by improving water quality conditions both upstream and downstream of the S-79. The primary means of assessing the water quality benefits of the project will be to determine the net change in annual average nitrogen and phosphorus loads at S-79. An increase or decrease in nutrient loading will affect other water quality constituents such as dissolved oxygen, light penetration, and chlorophyll which are all critical to the quality of the estuary habitat that lies downstream of S-79.

Regional and sub-regional models will be used to simulate historical, current, and predicted flows to the estuary with and without the Caloosahatchee River (C-43) West Basin Storage Reservoir and CERP features for each alternative considered. Output (flows) from the above model runs in conjunction with water quality analyses will be used to assess the extent of project effects on water quality.

SECTION 5
FORMULATION OF ALTERNATIVE PLANS

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5.0 FORMULATION OF ALTERNATIVE PLANS

This section describes the plan formulation and evaluation process necessary to achieve the goals and purposes of the project and maximize the achievement of the system-wide benefits of the Plan. The Caloosahatchee River (C-43) West Basin Storage Reservoir project is an integral part of the Comprehensive Everglades Restoration Plan (CERP). The main purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to provide for the retention and management of excess water within the natural system that is lost to tide (to the ocean), then release it back into the natural system when needed to help moderate extreme salinity changes in the estuary which are detrimental to estuarine communities. Captured excess water is made up of regulatory releases from Lake Okeechobee, basin runoff from storm events passing through the Caloosahatchee Watershed, and irrigation runoff from agricultural fields.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project is needed primarily to perform two functions: (1) reduce high-volume flows to the Caloosahatchee Estuary during the wet season by capturing and storing excess surface water runoff and (2) supplement water for the natural system by increasing the availably of water to be delivered to the estuary during the dry season. Thus, a project in the lower Caloosahatchee River Watershed will increase the amount of water made available for the restoration of the Caloosahatchee Estuary.

5.1 PRIOR FORMULATION

The plan formulation and evaluation process employed during the Restudy utilized a base set of management measures identified during the reconnaissance phase of the study from which comprehensive plan alternatives were formulated in a "building block" fashion to achieve desired objectives. To address problems in the Caloosahatchee River Watershed, the Restudy recommended plan, Alternative D-13R, called for the use of above-ground reservoir(s) with a total storage capacity of approximately 160,000 ac-ft to capture excess water being lost to tide, then return this water back to the Caloosahatchee Estuary during low flow conditions Captured water in the reservoir(s) would then be released during dry periods to provide the desirable flow volumes through the S-79 structure to achieve the appropriate salinity envelope in the Caloosahatchee Estuary, thereby restoring the salinity balance to promote estuarine restoration (refer to Section 1 for more detail information on the evaluation of the project).

In 1997, significant amendments were made to the Florida Water Resources Act of 1972 (Chapter 373, Florida Statutes) regarding regional water supply planning. These changes required the SFWMD to prepare a District-wide Water Supply Assessment (DWSA) and to prepare water supply plans for regions that were anticipated to have the potential of demand outstripping available supply by the year 2020. In 1998, the SFWMD began a water supply planning initiative to ensure prudent management of south Florida's water resources. As a result of this initiative, the SFWMD released in 2000 the Caloosahatchee Water Management Plan (CWMP) whose findings determined that the improved management of surface water through storage containment, could increase freshwater availability in the region and reduce potential impacts resulting from water use.

In building alternative plans, the Restudy PDT considered cost effective means to achieving the desired output. The conclusion drawn in the Restudy determined that above ground water storage provided the most cost effective alternative for freshwater attenuation (CERP, Volume 1; Section 7.2). Additionally, this same conclusion was also reached in the Caloosahatchee Water Management Plan (CWMP). Both the Restudy and the CWMP concluded that above ground water storage areas are the most cost affective and appropriate method for capturing and storing excess water in the Caloosahatchee River Basin project area resulting from regulatory releases from Lake Okeechobee and freshwater runoff.

5.2 PLAN FORMULATION RATIONALE

Draft Programmatic Regulations Guidance Memoranda (GM) #1 (Project Implementation Reports) and GM #2 (Formulation and Evaluation of Alternatives Developed for Project Implementation Reports) instruct project teams to affirm and optimize the component identified in the Restudy unless conditions or planning objectives have changed or if the component no longer meets the purposes outlined in the Restudy. Additionally, for projects where the non-Federal sponsor has already acquired lands, formulation of alternative plans using other sites will be minimized if the intended project purposes can be achieved and no more cost-effective sites are identified during formulation. Additional management measures to address the new circumstances should be developed and screening should occur based on the project's evaluation criteria and performance measures.

The plan formulation for this project focuses on first reaffirming that above-ground storage reservoirs in the Caloosahatchee River (C-43) Basin continue to meet the goals, objectives, and purposes for the project as described in the Restudy (Refer to Section 1 for more detail on Reaffirmation versus Reformulation). The project team then optimized the reservoir reviewing smaller and larger alternatives (including increased/decreased footprints, increased/decreased depths, varying infrastructural features such as numbers of pumps and pumps sizes and different cell configurations) in addition to the State's Acceler8 alternative referred to as the C-43 West Storage Reservoir. This project implementation report (PIR) will also identify any additional unmet needs in the study and a process to address them.

Once a TSP is identified through system-wide formulation analysis, a next-added incremental (NAI) analysis evaluates the effects, or outputs, of the TSP as the next project added to the group of already approved CERP projects. This analysis helps illuminate the beneficial effects of the selected alternative plan (SAP) contributions without regard to future CERP projects as well as the importance of the project in the sequence of implementing CERP and dependence of other CERP projects on the project under evaluation. This analysis also helps to ascertain whether sufficient benefits attributable to the SAP can justify the cost, if no additional CERP projects (other than those already existing or authorized) are implemented.

Studies conducted for this report will confirm that the problems, opportunities, objectives, and constraints remain consistent with the Plan; the existing and future without project conditions identified in the Plan remain consistent; and the plan as described in the Restudy remains a viable alternative.

In addition the PDT considered the recent recommendations of the National Research Council (NRC) during the formulation of alternative plans and ultimately in the final selection of the TSP. The NRC has reviewed the first five years of work on CERP. Starting in 2004, 12 science and engineering experts studied CERP's progress and, after two years of study, issued their findings: *Progress Toward Restoring the Everglades: The First Biennial Review, 2006*. Biennial evaluations will continue through the 30-year lifetime of CERP. The NRC recognizes that Everglades' restoration is a complex undertaking with many scientific uncertainties, which can slow the rate of progress. They concluded that if the construction of a restoration project is delayed until all scientific uncertainties are eliminated, there will be many negative consequences including: continued decline of the Everglades ecosystem, lagging public support, and increased project costs. The NRC identified an approach referred to as Incremental Adaptive Restoration where an incremental approach using steps that are large enough to provide some restoration benefits now while addressing critical scientific uncertainties and to take actions that promote learning that can guide the remainder of the project design. Constructing projects using a phased approach will enable assessments of benefits and impacts to the environment as each phase is constructed. Remaining phases will then be adapted to optimize performance based on actual findings from the earlier phases.

The primary purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to provide water supply to meet environmental needs, with surplus water being used as a potential opportunity to meet additional water supply demands for urban and agricultural users in the area. Additionally, Stakeholders in the basin have expectations that the Caloosahatchee River (C 43) Basin project will address water quantity problems while providing water quality improvement features. The ability of the project to address these needs is affected by at least two factors:

- Agriculture in the area depends upon surface water and groundwater for water supply to meet irrigation needs, especially in the East Caloosahatchee River (upper) basin; and
- Several public water supplies sources in the basin rely on surface water withdrawals from the Caloosahatchee River (C-43 Canal) to meet urban water demands.

Taking into consideration all of the issues, constraints and expectations for this project, formulating and evaluating larger-scale alternatives that take into consideration all of the issues and problems in the basin while trying to meet the public's expectation for the project will be technically complex due to modeling requirements, requiring additional time to conduct the analysis of the watershed. Additionally, cost estimates for potential solutions will be costly and considerably over the Caloosahatchee River (C-43) Basin Storage Reservoir cost estimate from the Restudy. The basin-wide approach to restoration in the Caloosahatchee Basin remains consistent with the approach and issues identified in the Restudy, but require further investigation, will be more complex and time consuming, and will taking longer periods of time to complete and implement. The Caloosahatchee Estuary is in need of immediate help and cannot wait until a holistic approach is developed to address all of the issues of the entire basin.

In order to address these changing conditions and other issues and concerns that have arisen since the Restudy analysis of the project, it is recommended that the project use an Incremental Adaptive Restoration approach in which the basin study is divided in to two separate PIRs. This first PIR, the Caloosahatchee River (C-43) West Basin Storage Reservoir, will address the most immediate needs of the estuary, while ensuring that it is fully compatible and consistent with the CERP. A subsequent PIR will then provide a more comprehensive solution to the broader needs of the entire basin.

5.3 PLAN FORMULATION

The Restudy identified that above ground storage is the most cost effective means for capturing, storing and distributing excess water in the Caloosahatchee Watershed. The Restudy also realized that further in-depth analysis would result in project refinements, resulting in a more realistic and implementable design.

The refinement of the Restudy Plan for the Caloosahatchee River Watershed is known as the Caloosahatchee River (C-43) West Basin Storage Reservoir. The first major step of the plan formulation process for this project consists of reaffirming an above ground impoundment or storage reservoir with associated features such as a pumping station and seepage management system meets the goals and objectives as outlined in the Restudy. The refinement of the Restudy Plan is known as Alternative 3. To complete the plan formulation analysis, alternative plans with different storage volumes and pump sizes were then compared to determine cost-effectiveness and implementability of the selected plan.

5.3.1 Management Measures for Reaffirmation

Both structural and non-structural management measures were developed to ensure the achievement of an overall CERP goal that the proposed project would provide environmental restoration benefits as outlined in the Restudy.

In developing an initial set of management measures for the Caloosahatchee River (C-43) West Basin Storage Reservoir, the team looked at both structural and non-structural management measures. ***Table 5-1*** provides a description of management measures considered and how they could meet the planning objectives.

In order to develop and select a plan that will reasonably maximize ecosystem restoration benefits while addressing the water supply issues and opportunities in the basin, restoration of estuarine and riverine health were sought by improving hydrologic conditions. This could be done by evaluating two objectives: 1) providing additional water to augment low or no flows over S-79 during the dry season/dry periods, and 2) reducing damaging peak flows by providing adequate storage during high flow conditions.

Informal methods of analysis were used in the development of the screening process for initially selecting management measures. This consisted of an interactive process used to identify the significant differences between the management measures, to evaluate each measure utilizing best professional judgment, and to narrow down the number of measures to those that achieved the planning objectives and goals of the project (while taking into consideration constraints and environmental needs and requirements).

TABLE 5-1: DESCRIPTION OF MANAGEMENT MEASURES CONSIDERED FOR THE PROJECT

Management Measures Type	Management Measure Name	Description	Comments
Structural	Above Ground Reservoir Storage Areas	Large water storage areas surrounded by perimeter levees constructed from excavating soil from the interior of the reservoir adjacent to the levee locations. Would allow storage of water during extreme high runoff periods for release during low flow periods.	**Advantages:** Cost effective way of storing water, can be a secondary source of agricultural and urban water supply. **Disadvantages:** As the dry season's end approaches, water levels in the reservoir may drop to near the existing ground surface. **Water Quality**: Potential to improve water quality of water stored in the reservoirs somewhat through settling. Could also be combined with implementation of an STA to provide additional treatment. **Increased Habitat:** Improving habitat quality in the river and estuary by better meeting flow and associated salinity targets.
Structural	Restoration of Natural Areas	Natural areas that capture and provide natural storage & retention of stormwater runoff.	**Advantages:** Introduces an opportunity to re-hydrate and restore historic wetland and lacustrine areas and upland areas that have been altered due to urban and agricultural encroachments. **Disadvantages:** Few locations available to provide natural storage. Introductions of large amounts of water could be detrimental to the health of the existing wetlands by altering hydro-periods. **Water Quality:** Reduces the amount of stormwater reaching the canal systems, river, and estuary through the natural retention of stormwater runoff **Increased Habitat:** Improving habitat quality in the estuary, also increasing spatial extent of watershed wetlands and lake habitats.
Structural	Stormwater Treatment Areas (STAs)	Shallow water bodies created through the construction of small levees, generally ranging from one to three feet in depth. Divide vegetated cells (in which the water depth and rate flow can be controlled) are designed to uptake nutrients and remove suspended sediments from the water column.	**Advantages:** Designed and built to capture and treat stormwater runoff from the drainage basin, then release it back to the receiving water body **Disadvantages:** Due to the naturally occurring high levels of phosphorus in the watershed, nitrogen, rather than phosphorus, was the limiting nutrient, and high nitrogen loads were responsible for the elevated chlorophyll-a concentrations in the

Management Measures Type	Management Measure Name	Description	Comments
			Caloosahatchee Estuary. STAs recently constructed in South Florida have been designed to optimize phosphorus removal, but are not as effective at the removal of nitrogen. **Water Quality:** Vegetated STAs are designed to remove at least 80% of the incoming phosphorus load in water captured by the reservoirs **Increased Habitat:** Increased acreage for fish and wildlife. STAs often provide excellent areas for many migratory and threatened and endangered bird species.
Structural	Backpumping with Stormwater Treatment (STAs)	When a series of conditions are met, a series of pump stations could backpump excess water from reservoir(s) and from the Caloosahatchee River (C-43) Basin, to Lake Okeechobee after treatment through a STAs	**Advantages:** Unused water captured in reservoir(s) could be treated and returned to Lake Okeechobee. **Disadvantages:** Potentially insufficient water supply to meet all future environmental, agricultural, and urban demands in Caloosahatchee River (C-43) Basin. Series of conditions must be met before water can be sent to Lake Okeechobee. **Water Quality:** Stormwater treatment could address to small degree phosphorus loading in Lake Okeechobee **Increased Habitat:** Increased acreage for fish and wildlife. STAs often provide excellent areas for many migratory and threatened and endangered bird species.
Structural	Aquifer Storage and Recovery (ASR)	Water pumped from the storage reservoir into an ASR well for storage (at a specific capacity) in the aquifer.	**Advantages:** Provide additional water through subsurface storage to meet water needs in the Caloosahatchee River (C-43) Basin (44 ASRs) wells within the Caloosahatchee Basin, each having an injection or withdrawal capacity of five million gallons per day). It was assumed for the Restudy that the recovery efficiency would be 70% of water injected. **Disadvantages:** Water needed for ASR would be pumped from reservoir. Lack of information on the specific water quality characteristics of water to be injected, the specific water quality characteristics and the amount of water recovered from the aquifer, and the water quality

Management Measures Type	Management Measure Name	Description	Comments
			characteristics of water within the receiving aquifer. **Water Quality:** Chlorination for pre-treatment of water taken from reservoir prior to injection, and aeration for post-treatment of water recovered from ASR well prior to release. **Increased Habitat:** Improve habitat quality in the river and estuary by better meeting flow and associated salinity targets.
Structural	Oxbow Restoration	A crescent shape lake that forms in an abandoned meandering river channel, when the course of the river changes over a period of time, sedimentation builds up and closes the bend off from the river.	**Advantages:** 35 of these oxbows located along the Caloosahatchee River from the S-79 structure to the City of LaBelle. Could provide habitat within the river. **Disadvantages:** Water quality is poor in all of the oxbows; all have dissolved oxygen problems due to decaying vegetation and sediment buildup. Oxbows offer little storage value. **Water Quality:** Provides no water quality advantages. **Increased Habitat:** Increase wetland habitat. Could provide both riverine and wetland habitat improvements for many fish and wildlife species.
Nonstructural	Operation of Reservoirs	Focus on the capture and release of basin runoff through the timing of releases from the reservoir(s) that will alter the timing and quantity of nutrients delivered to the estuary through S-79 Structure.	**Advantages:** Depending upon the design and operation of the reservoir system, settling and some biological uptake will remove between 20% and 30% of the TN load captured by the reservoirs. **Disadvantages:** Will alter the timing and quantity of nutrients delivered as a result of changing discharge rates to the estuary. **Water Quality:** A nutrient loading analysis of reservoir operations conducted by FDEP determined that with an available storage of 228,000 acre-feet of storage, the project would capture approximately 500 tons/year of TN. **Increased Habitat:** Improving habitat quality in the river and estuary by better meeting flow and associated salinity targets.
Nonstructural	Best Management Practices (BMPs)**	The focus of the BMP effort is to reduce the pollutant load for a variety of water quality	**Advantages:** FDACS BMP program adopts BMPs developed by growers through workshops as the most

Management Measures Type	Management Measure Name	Description	Comments
		constituents contained in runoff from all major agricultural commodity groups (i.e., citrus, sugarcane, cattle, and row crops) and from urban land uses.	effective and practicable on-location means to improve water quality from agricultural discharges. Benefits of participation include a mechanism for "presumption of compliance" with state water quality standards and a waiver of liability. **Disadvantages:** Participation is self-implementing in that a grower chooses to participate. **Water Quality:** Reduction in nutrient and pollutant content of runoff from all major agricultural commodity groups through self imposed practices. SFWMD will expand its Urban BMP Program into the urban areas within the next year. The concept behind the BMP program is to identify and establish effective measures to prevent polluted stormwater from entering the receiving water bodies. **Increased Habitat:** Could benefit system by reducing algae blooms and other adverse affects of poor water quality.

**Note: The BMP programs described above are considered as part of the future without project conditions for the West Basin Storage Reservoir project and will not be considered as management measures in the formulation of alternative plans.

After a thorough review of the different structural and nonstructural management measures developed for the project, all but two were screened out based on the screening criteria described above. The results of the screening are shown in ***Table 5-2***. Above ground storage reservoirs (structural management measure) and operation of above ground storage reservoirs (non-structural management measures) were the selected features that the team determined were best able to meet the planning goals and objectives, opportunities, constraints, and environmental needs of the project.

TABLE 5-2: SCREENING OF POTENTIAL MEASURES FOR USE IN THIS PROJECT

Measure	Selection for First PIR	Reason
Above Ground Reservoir Storage Areas	Yes	Primary focus of Caloosahatchee River (C-43) West Basin Storage Reservoir project is to evaluate various reservoir storage areas.
Restoration of Natural Areas	No	This measure was deferred for further consideration in later study
STAs	No	This measure was deferred for further consideration in later study. STAs may not be needed. STAs most effectively treat phosphorus, and nitrogen loading is key issue in the basin.
Backpumping with Stormwater Treatment	No	This measure was deferred to later study. However, this option is less likely, since current modeling shows insufficient water supply to meet all future demands.
Aquifer Storage and Recovery	No	This measure was deferred to later study.
Oxbow Restoration	No	This measure is currently being evaluated as part of a Continuing Authorities Program - Section 206 study. Areas not addressed by the 206 study were deferred to a later study or separate SWFFS
Operation of Reservoirs	Yes	Primary focus of Caloosahatchee River (C-43) West Basin Storage Reservoir project is to evaluate various reservoir storage areas, and operational approaches
BMPs	No	Considered part of the future without project condition - will not be considered a measure in the formulation of alternative plans

5.3.2 Summary of Reaffirmation of Management Measures

The above analysis of management measures reaffirmed that above ground reservoir storage areas and operations of reservoirs meet the goals and objectives as outlined in the Restudy. These management measures will now be further optimized to meet those goals and objectives in a cost effective manner.

5.3.3 Project Siting Analysis

After screening of management measures concluded that above ground reservoir storage areas and operations of reservoirs meet the CERP-wide and project specific goals and objectives, an alternative site analysis was conducted to determine the most feasible and productive location. Previous studies such as the CWMP examined areas in existence that could be utilized for the proposed project.

Originally, an in-depth site analysis was performed for both the Eastern Caloosahatchee River (upper) basin and Western Caloosahatchee River (lower) basin to identify potential reservoir sites prior to the splitting of the project into two PIRs, see Plan Formulation Appendix for complete Siting Analysis. The siting criteria used to rank the potential reservoir sites included threatened and endangered species, wetlands, cultural resources, basin locations, effects to natural tributaries, potential seepage and flooding, and compatibility with enterprise zone. Sites with significant wetlands were eliminated from this level 1 screening.

For the West Caloosahatchee Basin, seven sites were further investigated as possible locations for placement of storage reservoirs. The seven sites included lands currently in agriculture i.e., citrus, pasture, etc. and were therefore similar with respect to type and quality of wetlands present. As a result of the in-depth screening analysis, six of the seven sites were eliminated either due to impacts to threatened or endangered species or due to geotechnical concerns with seepage rates of the soils on site. Based on this analysis a site referred to as the "Berry Groves" site was selected (***Figure 5-1***), since it represented the most promising site given the location, land use, geology, and soils (see Appendix F for more information on siting analysis).

Based on the findings of the Restudy and CWMP, which both require a storage reservoir in the Caloosahatchee River (C-43) Basin, the SFWMD determined the best location to use both State and Federal funds to acquire property in the Caloosahatchee River (C-43) Basin. The Federal funds used for this project were appropriated to the Department of Interior (DOI) and a Grant Agreement entitled Everglades Watershed Restoration-Grant Number LWCF-1 was executed to acquire south Florida ecosystem restoration project lands in the Caloosahatchee River (C-43) Basin. The Florida Division of State Lands in cooperation with the SFWMD staff reached an agreement that allowed the SFWMD to acquire the Berry Groves property as a key component for Everglades restoration (February 2000). To date the State of Florida has purchased a total of 12,372 acres in the immediate area in anticipation of reservoir construction with Federal funding provided by the DOI at a total of approximately $32,800,000, a portion of which will be credited to the Federal government towards the acquisition of lands for this project. It was determined that the currently identified site was the most practicable location for the proposed project without incurring exorbitant costs of purchasing lands in the basin. Additionally, where the non-Federal sponsor has already acquired lands, formulation of plans using other sites will be minimized if the intended project purposes can be achieved and no more cost effective land sites are identified in plan formulation.

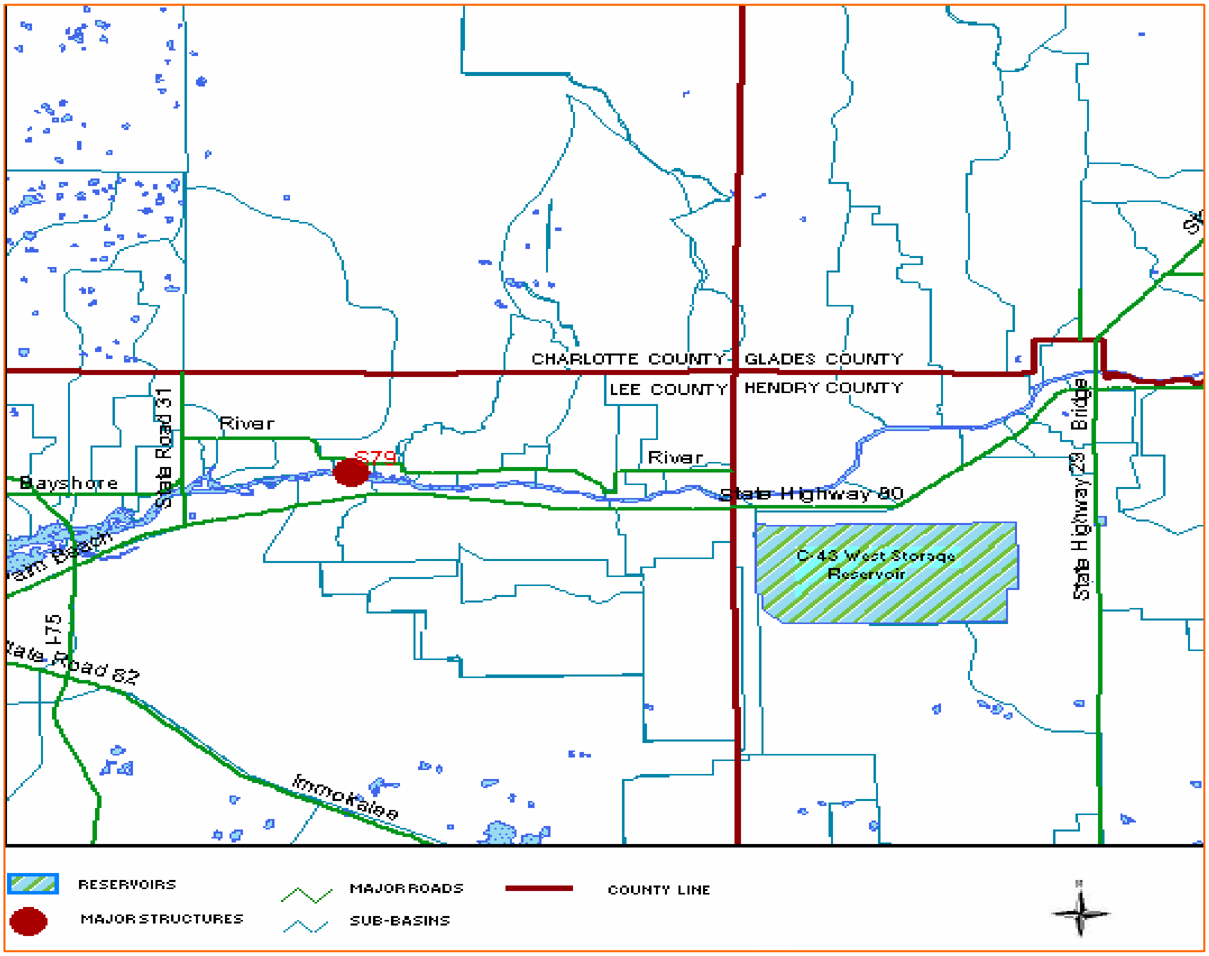


FIGURE 5-1: LOCATION OF THE BERRY GROVES SITE

5.3.4 Screening of Final Array of Alternatives

With the reaffirmation of the management measures (above ground reservoir storage areas and operations) identified in the Restudy and the selection of a cost effective site for its implementation, the PDT focused on the optimization of the management measures in identifying a cost effective and implementable alternative. The alternatives noted below were subjected to a screening process described in ***Section 5.3.1***. Also included within all these analyses was the "No Action" Alternative.

The alternative described in the Restudy used the Everglades Screening Model to identify approximately 160,000 acre-feet of storage volume as the targeted amount of storage necessary to capture wet season flows and to meet dry season minimum flows in order to provide desired salinity levels in the Caloosahatchee Estuary. The project team used the Restudy alternative (construction of above ground storage reservoirs totaling approximately 160,000 ac-ft) as a starting point for the basis of developing project alternatives.

5.3.4.1 Alternative 1

Alternative 1 is the No Action Plan, which is also the Future Without Project Condition described in ***Section 3*** of this report. This alternative was developed from the existing hydrology with modifications for anticipated changes in the watershed due to land use changes, water supply changes, water quality changes, and changes caused by other water resource projects in the watershed.

5.3.4.2 Alternative 2 (100,000 ac-ft Reservoir with 1,500 cfs Pumping Capacity)

Alternative 2 was developed as a smaller restoration alternative for the Western Caloosahatchee River (lower) Basin. This alternative is consistent with the CERP recommendation for a reservoir in this area, but it should be noted that this alternative's total storage volume of 100,000 ac-ft is significantly reduced from the 160,000 ac-ft of storage CERP estimated would be needed in this sub-region.

Alternative 2 is a two-cell reservoir with a "normal pool" storage capacity of 100,000 ac-ft (***Figure 5-2*** shows the configuration of this alternative and is applicable to the other alternatives). The design details of this alternative are outlined in ***existing on-site*** material and have a low permeability core. A graded filter is to be provided on the exterior side of the dam to direct seepage. Soil cement protection would be included on the interior side of all reservoir slope faces. A freeboard of 15 feet was used based on detailed analysis of wind and wave height run-up.

Table 5-3. The two-cell design was selected based on the fact that an internal embankment reduces wind set-up and wave-run up helping to reduce the embankment size and cost and it also allows for independent dewatering for unscheduled maintenance if necessary. The reservoir design includes a pump station (1,500 cfs capacity) to pump water from the C-43 Canal through the Townsend Canal to fill the reservoir. While a two pump station design was considered, the single pump station option was found to be most cost effective. Locating the pump station in the northwest corner minimizes improvements necessary for the Townsend Canal.

The water surface elevation of 35 ft North American Vertical Datum of 1988 (NAVD88) at “normal pool” is constant within the cells, with the depths ranging from 10-15 feet based on the elevation of the existing land surface. Dam heights for Alternative 2 will range from 29-34 feet. The maximum water depths and dam heights will occur in Cell 1, due to lower land surface elevations. The exterior and interior dams are to have a top width of 15 feet. The side slopes are 3 Horizontal: 1 Vertical (3H:1V). The exterior dams are to be constructed from

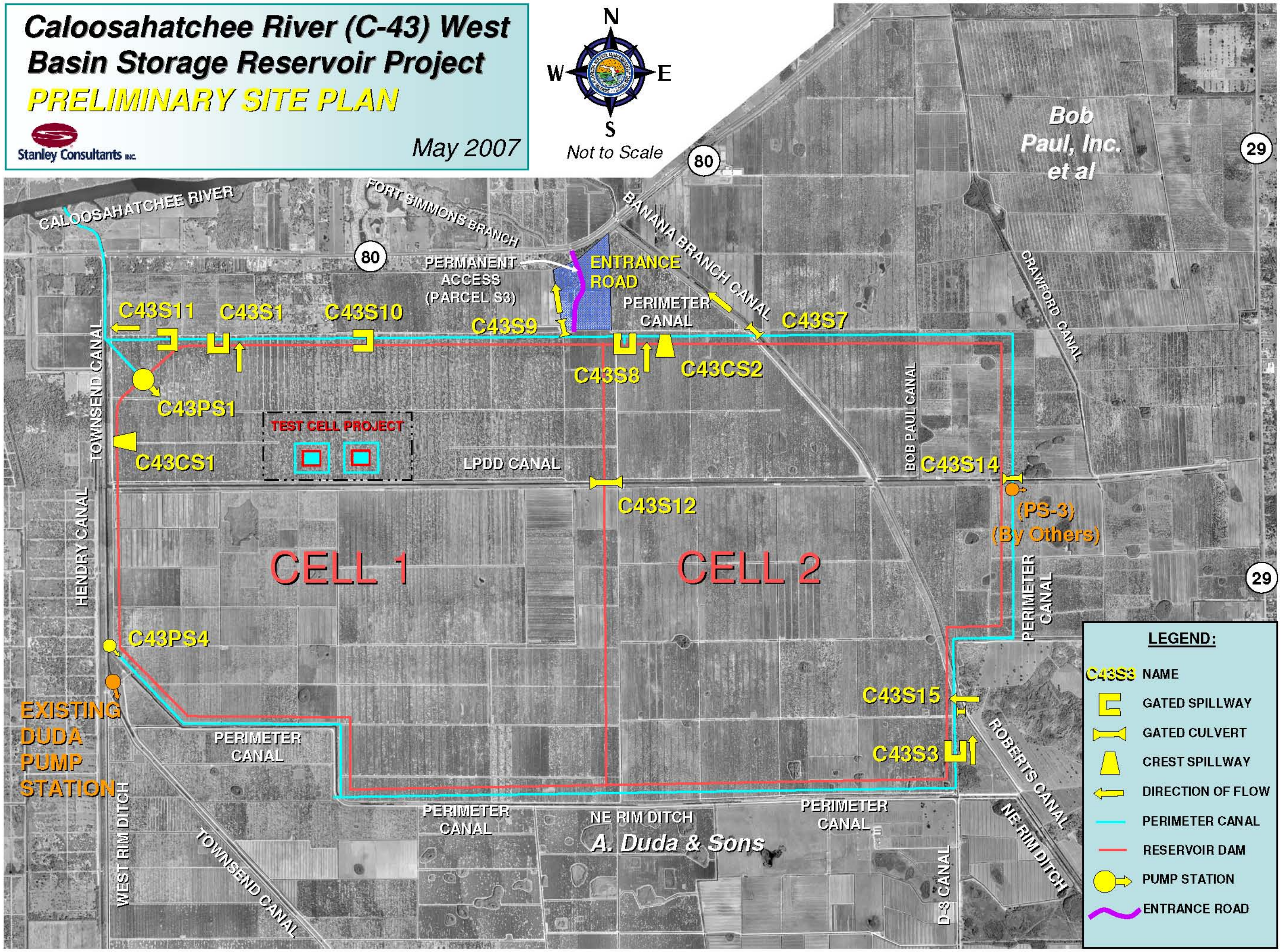


FIGURE 5-2: TYPICAL ALTERNATIVE SITE PLAN

existing on-site material and have a low permeability core. A graded filter is to be provided on the exterior side of the dam to direct seepage. Soil cement protection would be included on the interior side of all reservoir slope faces. A freeboard of 15 feet was used based on detailed analysis of wind and wave height run-up.

TABLE 5-3: ALTERNATIVE 2 DESIGN SUMMARY

Design Parameters	Parameter Values
Storage Volume (ac-ft)	100,000
Storage Area/Reservoir (acres)	9,220
Project Footprint-Staging, O&M, etc. (acres)	10,500
Normal Pool Elevation/ Average Pool Depth	35 ft NAVD88/ 10-15 ft
Dam Elevation/Dam Height	54 ft NAVD88/29-34 ft
Total Fill Rate–Pump Capacity (cfs)	1,500
Time to Fill (days)	33

A perimeter canal (seepage canal) is provided on the south, east, and north sides of the reservoir. The existing Townsend Canal will act as a seepage canal on the west side of the reservoir. In addition to seepage collection, the perimeter canal will also convey discharges from the reservoir; convey surface runoff from the south and east of the reservoir including improved drainage for SR 29; provide flows to the Crawford Canal, Banana Branch and Fort Simmons Branch; and maintain the surface water elevation in the expanded northeast rim ditch that provides irrigation for the A. Duda and Sons (Duda) citrus operations, located to the south of the reservoir. A 17-foot cutoff wall along the perimeter of the dam embankment has also been included.

Improvements to the Townsend Canal are based on the necessary capacity to meet maximum pumping requirements to fill the reservoir. Pre-storm and post-storm event flows have been simulated to evaluate flows in the Townsend Canal and other local canals and tributaries. Storm event flows in the Townsend Canal will be decreased over existing conditions with the construction and operation of the reservoir.

Each cell in the alternative is designed to discharge independently through separate discharge structures. Cell 1 discharges via S-1 into the Townsend Canal. Cell 2 discharges via S-8 into the perimeter canal. These structures will be designed for incremental operation allowing required flows to be released to the Caloosahatchee River (C-43 Canal) during periods of low flow. These structures could also serve as design storm control structures for releases prior to and during a storm event. The storm releases must be balanced with the targeted maximum flow allowed over S-79, which is 4,500 cfs. An emergency spillway with a crest elevation based on retaining the 25-year, 72-hour storm

event is to be provided within each cell's discharge structure. The 25-year, 72-hour storm captured in the reservoir would be a "control release" after the storm event in order to restore the water surface to the normal pool elevation while not exceeding the maximum flow of 4,500 cfs at S-79. The final design of the emergency spillway(s) will be in accordance with the requirements of Design Criteria Memorandum 3 (DCM-3).
Within the reservoir, structure S-12 hydraulically connects the reservoir cells and is designed to be gated so that either cell can be "isolated" for operational or maintenance purposes. A number of other culverts, weirs, and spillways are included to operate the reservoir and maintain appropriate water levels in existing canals and the perimeter canals.

5.3.4.3 Alternative 3 (A and B)–170,000 ac-ft Reservoir with 1,500 cfs Pumping Capacity

This alternative comes closest to approximating the Restudy-recommended volume of approximately 160,000 ac-ft for the West Basin storage reservoir and is the size evaluated and recommended in the Acceler8 planning process. Alternative 3 is a two-cell reservoir with a "normal pool" storage capacity of 170,000 acre-feet. The reservoir design includes a pump station with 1,500 cfs capacity to pump water from the Townsend Canal to fill the reservoir. The site layout would remain unchanged. This alternative was subdivided into a Alternatives 3A and 3B for evaluation purposes. The key distinction between Alternatives 3A and 3B is the operational methodology related to filling and draining the reservoir, rather than any structural differences. In general, Alternative 3A, the original plan identified by the State's Accler8 program attempts to maintain very specific flow rates at S-79 at all times while Alternative 3B attempts to meet the dynamic flow targets supplied by the ecological sub team (EST05).

Further in the formulation process these two alternatives were merged to fully meet the goals and purposes as identified in this report. For Alternatives 3A and 3B, the water surface elevation would be 42 feet at "normal pool" (NAVD88), with the average depth ranging from 17-19 feet. Dam heights for Alternatives 3A and 3B range from 32 -37 feet. The maximum water depths and dam heights will occur in Cell 1 due to lower land surface elevations in that cell. The exterior and interior dams are to have a top width of 14 feet. The side slopes are 3 Horizontal to 1 Vertical (3H:1V). The exterior dams are to be constructed from existing on-site material and have a low permeability core. A graded filter is to be provided on the exterior side of the dam to direct seepage. Soil cement protection would be included on the interior side of all reservoir slope faces. A freeboard of 15 feet was used based on detailed analysis of wind and wave height run-up. The design details of this alternative are outlined in ***Table 5-4***.

TABLE 5-4: ALTERNATIVE 3A AND 3B - DESIGN SUMMARY

Design Parameters	Parameter Values
Storage Volume (ac-ft)	170,000
Storage Area/Reservoir (acres)	9,220
Project Footprint Staging, O&M, etc. (acres)	10,500
Normal Pool Elevation/ Average Pool Depth	42 ft NAVD88/17-19 ft
Dam Elevation/Dam Height	57ft (NAVD88)/32-37 ft
Total Fill Rate–Pump Capacity (cfs)	1,500 cfs
Time to Fill (days)	57

The perimeter canal, improvements to the Townsend Canal, and construction of culverts, weirs, and spillways is essentially unchanged from Alternative 2. Because this alternative has a larger storage volume yet maintains the same pumping capacity, the amount of time required to fill the reservoir is approximately 24 days longer.

5.3.4.4 Alternative 3C–170,000 ac-ft Reservoir with 3,800 cfs Pumping Capacity

Alternative 3C is very similar to Alternatives 3A and 3B. The only difference is a larger pumping capacity and the associated modified reservoir operations to optimize storage performance with greater pumping flexibility. Alternative 3C is a two-cell reservoir with a "normal pool" storage capacity of 170,000 acre-feet. The reservoir design includes a pump station (3,800 cfs pumping capacity) to pump water from the Townsend Canal to fill the reservoir. The water surface elevation of 42 feet (NAVD88) at "normal pool" is the same for both cells, with depths ranging from 17-19 feet. Other structural elements would be the same as described in the previous Alternative 3B.

The inclusion of the larger pump allows for greater operational flexibility. In particular, the reservoir can be filled approximately 34 days faster than under Alternatives 3A and 3B and ten days faster than Alternative 2. This allows the reservoir to capture more water during the relatively short duration high flow events. Within this alternative there is uncertainty regarding the amount of retrofitting that may be required to the Townsend Canal and roadways. These uncertainties would not be known until additional engineering and design could be completed in the planning, engineering and design phase. For the purposes of this analysis it was assumed that no additional retrofitting would be required. The design details of this alternative are outlined in ***Table 5-5***.

TABLE 5-5: ALTERNATIVE 3C - DESIGN SUMMARY

Design Parameters	Parameter Values
Storage Volume (ac-ft)	170,000
Storage Area/Reservoir (acres)	9,220
Project Footprint-Staging, O&M, etc. (acres)	10,500
Normal Pool Elevation/ Average. Pool Depth	42 ft NAVD88/17-19 ft
Dam Elevation/Dam Height	57 ft NAVD88/32-37 ft
Total Fill Rate–Pump Capacity (cfs)	3,800 cfs
Time to Fill (days)	23

5.3.4.5 Alternative 4A–220,000 ac-ft Reservoir with 3,800 cfs Pump

Alternative 4A is a two-cell reservoir with a "normal pool" storage capacity of 220,000 ac-ft with dam heights of 41-46 feet and water depths of 22-27 feet at "normal pool." The pump station capacity is 3,800 cfs. The reservoir location and other associated features are the same as Alternative 3C.

The major difference is that by increasing the storage capacity and maintaining the same foot print normal pool elevations and levee elevations would be approximately five feet higher. In addition, by maintaining the same pump capacity as Alternative 3C approximately six additional days would be required to fill the reservoir. The design details of this alternative are outlined in ***Table*** 5-6**.** The selection of the upper bound 220,000 acre-feet reservoir matches findings of the SFWMD CWMP that recommended a storage reservoir with a capacity of 220,000 ac-ft located in the Western Caloosahatchee River (lower) basin at Berry Groves. The CWMP concluded that a 220,000 ac-ft reservoir would provide for environmental restoration of the Caloosahatchee Estuary.

TABLE 5-6: ALTERNATIVE 4A - DESIGN SUMMARY

Design Parameters	Parameter Values
Storage Volume (ac-ft)	220,000
Storage Area/Reservoir (acres)	9,220
Project Footprint-Staging, O&M, etc. (acres)	10,500
Normal Pool Elevation/Average Pool Depth	47 ft NAVD88/22-27 ft
Dam Elevation/Dam Height	66 ft NAVD88/ 41-46 ft
Total Fill Rate–Pump Capacity (cfs)	3,800
Time to Fill (days)	29

5.3.4.6 Alternative 4B–220,000 ac-ft Reservoir on Expanded Footprint with 3,800 cfs Pumping Capacity

Alternative 4B maintains the same storage volume as Alternative 4A; however, an approximately 5,610 acre larger footprint would be utilized allowing for an approximately eight foot lower dam height and pool elevation. Alternative 4B would also be a two-cell reservoir with 220,000 ac-ft of storage. Dam heights would range from 32-37 feet and water depths from 14-19 feet at “normal pool.” The pump station location and capacity is the same as Alternative 3C and 4A. The exact locations of other culverts, weirs, and spillways would be similar to Alternative 4A. The general site plan and design details can be found in ***Figure*** 5-3 and ***Table 5-7*** respectively.

Although Alternative 4B was carried into the final array of alternatives, it was screened from further consideration at this point. Alternative 4B provides the same level of ecosystem output as Alternative 4A, however, the cost estimates indicated that while construction costs would be lower, total land costs would increase by approximately $150 million resulting in a roughly $80 million higher cost. The real estate costs for the additional land area associated with Alternative 4B were estimated to be considerably higher than previous purchases based on increasing development pressures in the area. In addition, the larger surface area of this alternative would result in greater evapotranspiration of water. Based on these findings, Alternative 4B was removed from further consideration.

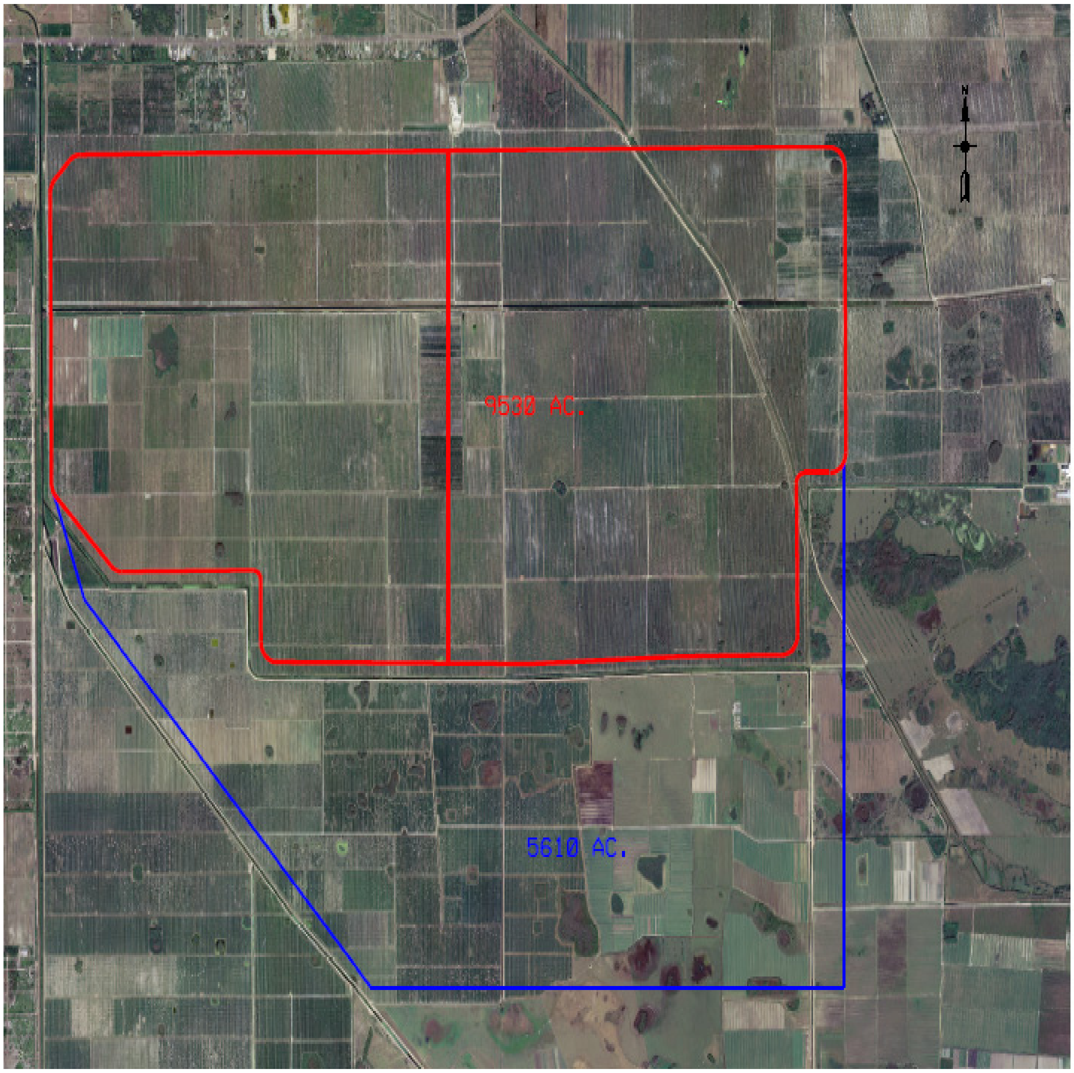


FIGURE 5-3: ALTERNATIVE 4B SITE PLAN

TABLE 5-7: ALTERNATIVE 4B - DESIGN SUMMARY

Design Parameters	Parameter Values
Storage Volume (ac-ft)	220,000
Storage Area/Reservoir Footprint (acres)	15,140/16,610
Project Footprint-Staging, O&M, etc. (acres)	18,910
Normal Pool Elevation/ Average Pool Depth	39 ft NAVD88/14-19 ft
Dam Elevation/Dam Height	57 ft NAVD88/32-37 ft
Total Fill Rate–Pump Capacity (cfs)	3,800
Time to Fill (days)	29

5.3.5 Summary of Final Array of Alternative Plans

The final array of alternatives consists of seven alternative plans, including the No Action Alternative and variations on three reservoir capacities of 100,000, 170,000 and 220,000 ac-ft. Alternative 4B would require the purchase of approximately 5,610 additional acres to support an expanded footprint and lower dam heights. This array of alternatives would serve the needs of the Caloosahatchee River (C-43) Basin through the creation of a single reservoir in a location that would capture water from Lake Okeechobee and basin runoff from a majority of the Caloosahatchee River (C-43) Basin. The Berry Groves location also provides for efficient and flexible management of the stored water. The final array of alternatives is summarized in ***Table 5-8***.

TABLE 5-8: SUMMARY OF FINAL ARRAY OF ALTERNATIVES

Alternative 1	No Action (Future-Without Project)
Alternative 2	100,000 ac-ft reservoir, 29-34 feet dam, 10-15 feet average pool depth, and 1,500 cfs pump capacity
Alternative 3A	170,000 ac-ft reservoir, 32-37 feet dam, 17-19 feet average pool depth, and 1,500 cfs pump capacity • Restudy/Acceler8 design and operations
Alternative 3B	170,000 ac-ft reservoir, 32-37 feet dam, 17-19 feet average pool depth, and 1,500 cfs pump capacity • Restudy/Acceler8 design with alternate operations
Alternative 3C	170,000 ac-ft reservoir, 32-37 feet dam, 17-19 feet average pool depth, and 3,800 cfs pump capacity • Restudy design with larger pump
Alternative 4A	220,000 ac-ft reservoir, 41-46 feet dam, 22-27 feet average pool depth, and 3,800 cfs pump capacity
Alternative 4B	220,000 ac-ft reservoir, (expanded footprint) 32-37 feet dam, 14-19 feet average pool depth, and 3,800 cfs pump capacity

Note: Range in height is due to site elevations which vary by approximately 5 feet over the reservoir area.

5.3.6 Alternatives within the Jurisdiction of the Lead Agency

The Caloosahatchee River (C-43) West Basin Storage Reservoir project contains one component that is a part of the CERP, and is authorized in WRDA 2000. The measures considered in this study fall within the jurisdiction of the USACE and its sponsor the SFWMD. The implementation of this plan by the Federal government is being led by the USACE along with its non-Federal partner, the SFWMD. All alternatives being evaluated for the Caloosahatchee River (C-43)

West Basin Storage Reservoir project are consistent with CERP and within the USACE's jurisdiction. No measures considered were outside the jurisdiction of the USACE or its sponsor.

5.3.7 Evaluation of the Final Array of Alternatives

The next step was to evaluate the final array of alternatives using ecological output measured in habitat units (HUs) and costs. The following sections summarize the tools used for this evaluation and how they were used.

5.3.7.1 Analytical Tools Used to Evaluate the Final Array of Alternatives

In formulating and evaluating project alternatives, operational effects of proposed management measures on the existing ecosystem must be considered. To do this, computer simulation models and spreadsheets were used to evaluate the proposed operational criteria for each alternative in terms of its hydrologic influences on potentially affected natural areas.

A description and interpretation of all model results, including a review of the reliability and accuracy of the assumptions and data used in the model as well as risks and uncertainties associated with their use, is provided in ***Appendix A***.

5.3.7.1.1 South Florida Water Management Model

The most commonly used integrated model in South Florida is the South Florida Water Management Model (SFWMM). The model simulates the hydrology and the management of the water resources system from Lake Okeechobee in the north to Florida Bay in the south, covering an area of 7,600 square mile with a mesh of 3.2 km (2 miles) by 3.2 km (2 miles) cells. The SFWMM incorporates current or proposed water management protocols and operational rules and has the ability to simulate water management practices and policies that affect urban, agricultural, and environmental water uses in south Florida in one of its major strengths. Since the boundary of the SFWMM does not extend into the Caloosahatchee River (C-43) West Basin Storage Reservoir project area, the SFWMM model can only provide boundary conditions at the point where Lake Okeechobee discharges into the Caloosahatchee River (C-43 Canal), at Structure S-77. Therefore, a sub-regional model will be needed to simulate the hydraulics and hydrology of the project area.

5.3.7.1.2 MIKESHE Model

For this PIR, hydrologic indicators and hydraulic models were used to evaluate potential affects that could occur in the watershed for average wet season water levels (July 1 to October 1), average dry season water levels (April 1 to May 15), and hydroperiods. The MIKESHE modeling platform was used to develop sub-regional models of the Caloosahatchee River (C-43) Basin to simulate the hydraulics and hydrology for purposes of showing hydrographs and stage duration curves, water level fluctuations and hydroperiods for selected indicator regions within natural areas associated with each of the alternative plans. These modeling results provide a comparison between Pre-Development, Existing (2000) conditions, 2050 Without Project conditions, and With Project conditions for each of the proposed alternatives for the system-wide analysis (with CERP) to identify the SAP.

5.3.7.1.3 Spreadsheet Analyses

The intent of this project is to help maintain desirable salinity levels in the Caloosahatchee Estuary System as measured by flows calculated for the S-79 structure. As an additional verification of modeling results used in selection of the SAP, a spreadsheet analysis will calculate flow data for the S-79 structure for use in a Next Added Increment (NAI) analysis of each alternative to verify environmental benefits achieved by each plan evaluated.

The source of Caloosahatchee River (C-43 Canal) flow data for the spreadsheet analyses for the Existing Conditions Baseline (2000) and Future Without Project Condition (2050 with no-CERP projects in place) is derived from South Florida Water Management Model (SFWMM) version 5.4.2 base model simulation 2000RD, for the Existing Conditions Baseline and 2050RD model simulation for the year 2050 with no CERP projects in place. Listed below are key assumptions utilized in these analyses, and which are consistent with this conceptual intent.

- The spreadsheet will take into consideration the evapotranspiration (ET) losses from the reservoir due to evaporation. The mass balance terms for the reservoir are reservoir inflow, reservoir releases, reservoir seepage (assumed to be zero based on results of the C-43 Test Cell Pilot Project– July 2006), ET losses (based on area volume relationship), and reservoir direct precipitation.
- No agricultural or urban water supply deliveries will be supplied by the reservoir. These demands continue to be supplied from Lake Okeechobee or existing groundwater sources.
- The eastern Caloosahatchee Basin (east of the S-78 structure) will not be affected by the project.
- With the exception of changing flows to the Caloosahatchee Estuary downstream of S-79, there will be no impacts on the Western Caloosahatchee Basin.

5.3.7.2 Hydrologic Modeling Evaluation of Alternatives

As previously discussed, the reservoir's design utilizes the selected site to its fullest capacity in order to capture the greatest volume of water needed to meet the flow targets (EST05) just downstream of S-79 at the start of the Caloosahatchee Estuary. To determine the appropriate size and performance of the reservoir at the area known as the Berry Groves, hydrologic data was compiled and analyzed to determine if the reservoir was designed to meet the flow and salinity targets.

Average daily flows between January 1988 and June 1999 were approximately 500 cfs. Low flows of 0 cfs and flows as high as 17,283 cfs were recorded during the same period (CWMP, April 2000). Therefore, in order to mimic natural fluctuations in flows to the estuary, other flow ranges and their frequency of occurrence needed to be determined. To do this, the SFWMD evaluated average monthly flow data for a period of 36 years (1965 to 1999), and developed the following flow distributions (EST05) shown in ***Table 5-9***.

TABLE 5-9: TARGET FLOW DISTRIBUTION FOR EST05

S-79 Freshwater Discharge (Mean monthly flow range)	Frequency -Mean Monthly Flow (36 Year Period of Record)
Number of months < 450 cfs	0.0%
Number of months between 450 cfs and 1500 cfs	74.5%
Number of months between 1500 cfs and 2800 cfs	24.8%
Number of months > 2800 cfs	0.07%
Number of months > 4500 cfs	0.0%

For each of the alternatives evaluated for this project, comparisons were made between the flow frequency distribution performance of the alternative and the target frequency distribution of the combined monthly and weekly average freshwater inflows through S-79 from the watershed and Lake Okeechobee for the nine year period of record (9 years out of the 36 year period of record containing three wet, three dry and three normal years on record).

The resulting flow frequency distributions from the analysis of Alternatives 1, 2, 3A, 3B, 3C and 4A were compared against the EST05 target distribution to determine the top performing plan. Based on this analysis, all alternatives show an increase in hydrologic performance. As the size of the project increases the performance also increases. Of the alternatives analyzed, Alternatives 3C and 4A came closest to matching the EST05 flow frequency distribution at S-79 (providing the desired number of months where the flows at S-79 were in the 450 cfs to 2800 cfs flow range) as they are the largest projects. These results are reflected in ***Table 5-10***.

The result of the analysis for each alternative was to show either an increase or decrease in the number of events where the mean monthly flows at S-79 were either above, below or within the flow envelope as compared to the future without project condition (***Table 5-10***).

TABLE 5-10: SUMMARY OF MEAN MONTHLY FLOW EVENTS AT S-79 WITHIN DIFFERENT FLOW RANGES

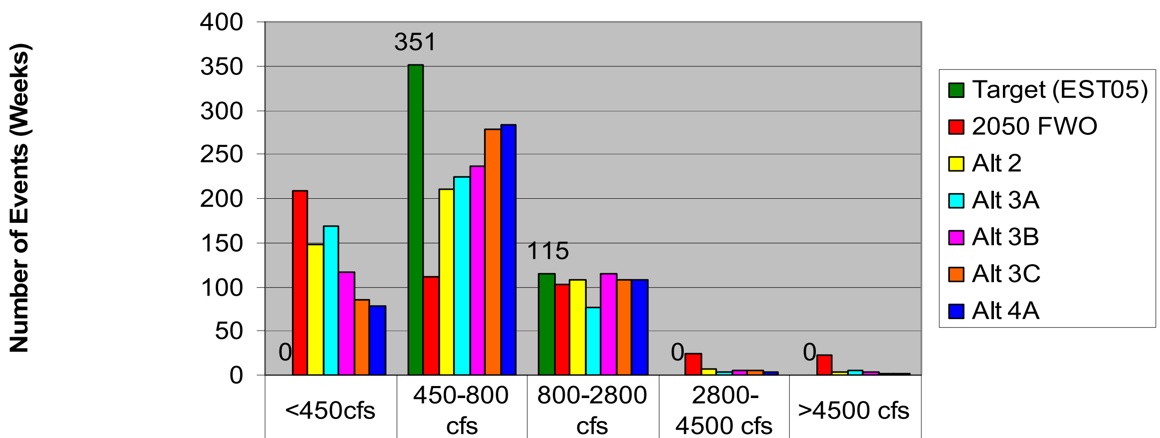
Alternative	Number of Months <450 cfs	Number of Months 450 – 800 cfs	Number of Months 800 – 2800 cfs	Number of Months 2800 – 4500 cfs	Number of Months >4500 cfs
Target (EST05)	0	79	29	0	0
2050FWO	43	27	28	7	3
Alternative 2 (2050)	33	46	27	2	0
Alternative 3A (2050)	33	56	17	2	0
Alternative 3B (2050)	30	26	49	3	0
Alternative 3C (2050)	19	60	29	0	0
Alternative 4A (2050)	19	60	29	0	0

It is anticipated that project benefits will see additional lifts in benefits over those currently predicted using available ecologic and hydrologic models.

5.3.7.3 Evaluating the Ecological Significance of Hydrologic Change

Because all of the species indicators are also somewhat dampened by the effect of averaging over months, seasons, and spatially, it was determined that it would be beneficial to have at least one benefit stream that depicts a more accurate picture of how well each alternative is matching the hydrologic target flow at S-79. EST05 is the hydrologic target used for a suite of estuarine organisms but, because it represents a time series/flow range necessary for an ecological balance within the estuary, it may not reflect the optimal hydrology for any one species.

As stated above, species indicators were dampened by the effect of averaging over months, seasons, and spatially. In reviewing the flow data for each alternative, it was determined that by looking at the monthly values of flows over S-79 for each alternative, not all of the flow events that were greater than 2,800 cfs were being captured due that the averaging of data for monthly periods. Extreme short duration events that occurred over a few days rather than an entire month were not being accounted for in the habitat analysis. Additionally, weekly data were available which did capture these shorter duration extreme events so the results are not as diluted as the monthly averages. The alternatives were then evaluated based on mean weekly flows through the S-79 structure. Using this method, the relative ranking of alternative performance remained unchanged across alternatives. Alternative 3C and Alternative 4A again provide the best performance at 84 percent of the period of record respectively (***Table 5-11***). Percentages used for calculating HUs were then calculated based upon weekly averages as to how well each alternative came close to matching the EST05 frequency distribution at S-79. These analyses are summarized in ***Figure 5-4*** and ***Table 5-11***. What these evaluations continue to show is that as storage and pump size are increased, the resulting benefits also increase.



	<450cfs	450-800 cfs	800-2800 cfs	2800-4500 cfs	>4500 cfs
Target (EST05)	0	351	115	0	0
2050 FWO	209	111	102	24	22
Alt 2	148	210	108	7	4
Alt 3A	168	224	76	4	5
Alt 3B	117	236	114	6	4
Alt 3C	85	278	107	5	2
Alt 4A	79	284	108	4	2

Flow Ranges (cfs)

FIGURE 5-4: MEAN WEEKLY DISTRIBUTION OF FLOWS FROM S-79

TABLE 5-11: PERCENT MATCH TO TARGET (EST05) AT S-79 FOR MEAN WEEKLY FLOWS

Alternative	450-800 cfs	800-2800 cfs	%POR in Desired Envelope
Target	75.0%	24.6%	99.6%
2050FWO	23.7%	21.8%	45.5%
Alt2	44.9%	23.1%	67.9%
Alt3A	47.9%	16.2%	64.1%
Alt3B	50.4%	24.4%	74.8%
Alt3C	59.4%	22.9%	82.3%
Alt4A	60.7%	23.1%	83.8%

5.3.7.4 Ecological Benefits Evaluation of the Final Array of Alternatives–System-Wide Perspective

In practice, USACE's ecosystem restoration studies typically measure the ecosystem benefits of alternative plans in terms of physical dimensions (number of acres of wetlands, for example), or population counts (number of wading birds, for example), or various habitat-based scores ("habitat unit (HUs) based on the USFWS's Habitat Evaluation Procedures, or [HEP], for example). The next step was to evaluate the final array of alternatives using ecologic output measured in HUs and costs

The purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to develop a plan that will help moderate flows: i.e., reduce flows during high flow periods and augment flows during low flow periods. Therefore, in order to present benefits of each plan, the impacts must be determined during those critical flow events. Once benefits are determined for each of the final alternatives, they will be compared to determine the differences between plans for basis of selection of the tentatively selected plan (TSP). Benefits of each plan are measured in terms of HUs. A HU is a measure of how a particular species responds to changes in its environment as a result of contributions of a particular plan. More detailed information on the calculation of HUs for this project can be found in ***Appendix C***. Species selected for evaluation (focal species) are ecologically, recreationally or economically important and have a well established linkage to stressors of management interest. They may also make good focal species because they engage the public in caring about the outcome of restoration projects. To measure the responses of these indicator species to the different alternatives, Habitat Suitability Indices (HSI) models were developed by choosing specific life stages of particular species with the most limited, restricted, or tightest range of suitable conditions, to capture the highest sensitivities of the organisms to the environmental changes associated with the planned restoration activities. The intent of the habitat suitability model is not to simulate the life-cycles of the species. Rather, it is to estimate the number of HUs to serve as a relative basis for comparing management alternatives. HSI models were developed with each stressor variable portrayed spatially and temporally across the study area at scales appropriate to the organism or community being portrayed. The HSI models have been incorporated into a Geographic Information System (GIS) to portray responses spatially and temporally to facilitate policy decisions. That is, the model describes a response surface of habitat suitability values that vary spatially according to stressor levels throughout the estuary and temporally according to temporal patterns in stressor variables (see ***Appendix C***).

The project team originally decided to use seven species–eastern oysters, blue crabs, *Vallisneria,* seagrass (*Halodule and Thalassia)*, spotted seatrout, decapod larvae, and zooplankton. Once all models were run on all alternatives, the team decided to narrow the full analysis to three species–oysters, *Vallisneria* and seagrass. It was useful to run all of the species models, as they affirmed that all species showed an improvement over base conditions. However, it was determined that some species would be dropped for purposes of quantification for the final analysis because:

- they were less sensitive to changes between alternatives
- they were redundant and added little additional value
- the team decided to focus on habitats rather than individual species

The chosen species also cover a full range of both temporal and spatial attributes. Oysters are found in the middle estuary and are impacted by both wet and dry season flows. Seagrass are found in the lower Caloosahatchee River Estuary and are most impacted by the wet season flows. *Vallisneria* is found in the upper Caloosahatchee River Estuary and is most impacted by the dry season flows. Benefits were calculated using the appropriate period of record to reflect when species are most affected. Wet years analyzed include 1979, 1982, and 1983. Dry years include 1980, 1981 and 1985. The wet season was defined as July through November and the dry season was defined as December through May. June was not included, because for some years June is dry and for some years it is wet, therefore it causes inconsistency in the benefits calculations. However, in practice benefits will be realized in June based on the current recommended operations.

This project is expected to primarily benefit the Caloosahatchee Estuary. However, because CERP projects are required to be selected and justified based on their system-wide benefits, the following analysis conducted for the plan selection process is based on a system approach in which the Caloosahatchee River (C-43) West Basin Storage Reservoir project benefits would coincide with the rest of CERP being constructed. For system formulation analyses, the environmental evaluations were based on five attributes:

1) Average HSI for oyster–based on all seasons of dry years and all seasons of wet years
2) Average HSI for *Vallisneria*–based on dry seasons of dry years
3) Average HSI for seagrass–based on wet seasons of wet years
4) Extreme Events–Average HSI of oyster, *Vallisneria*, and seagrass during the three driest months and three wettest months in the period of record.
5) EST05–This attribute reflects the percentage of weeks each alternative matches our target flow (EST05). EST05 is a time series of flow developed to maximize beneficial conditions for a suite of organisms in the Caloosahatchee River Estuary. EST05 was adopted as the system-wide performance measure for the Caloosahatchee Estuary (NE-03) by the RECOVER team.

Upon review of the data, there is little value in averaging all habitat suitability index (HSIs) for all seasons of all years. The purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to help moderate flows; reducing flows during high flow periods and augmenting flows during low flow periods. Therefore, in order to present benefits, the impact must be determined during those periods of time. Thus the benefits were calculated using the appropriate seasons to reflect when species are most impacted. Wet years analyzed include 1979, 1982, and 1983. Dry years include 1980, 1981, and 1985. The wet season was defined as June through November. The dry season was defined as December through May.

5.3.7.4.1 HSI Assumptions

The following is a list of assumptions for the HSI models:

- Linear relationship between the index and individual habitat parameter
- Positive relationship between the index and habitat carrying capacity
- Time scales are appropriate to capture change
- Spatial scale appropriate to capture change
- Variables strongly correlates with habitat quality and can be quantified by the model
- Habitat quality for selected species is a good indicator of habitat quality for other estuarine species
- Input data used to create HSI curves are reliable
- Where local data is lacking, data from other regions/estuaries are applied to models

5.3.7.4.2 HSI Background

The forecasting model used to evaluate alternatives for the Caloosahatchee River (C-43) West Basin Storage Reservoir project consisted of a set of stressor-response (habitat suitability) models for individual species. These Habitat

Suitability Indices (HSI) models were developed from scientific literature, expert knowledge, and available field data. The HSIs portray each stressor variable spatially and temporally across the study area at a scale appropriate to the organism or community being portrayed. HSI models were incorporated into a Geographic Information System (GIS) to describe responses spatially and temporally for the selection of restoration alternatives for each project.

Each HSI model describes a response surface of habitat suitability values between 0 (unsuitable) and 1 (most suitable) that varies spatially according to stressor levels throughout the estuary and temporally according to temporal patterns in stressor variables. Much of the temporal variation is a result of temporal cycling of important stressor inputs, such as salinity. The models calculate habitat suitability monthly as the weighted geometric mean of the environmental variables identified as important for each model. The geometric mean is derived from the product of the variables rather than the sum (as in the arithmetic mean), and has the appropriate property that if any of the individual variables are unsuitable for species success (i.e., the value of the variable is zero) then the entire index goes to zero. This HSI value was then multiplied by the area within each grid cell and the grid cell values added to calculate habitat units for each species. ***Figure 5-5*** represents how the various HSI's were combined to generate habitat unit scores and support the cost effectiveness/ incremental cost analysis (CE/ICA) effort.

Scoring each of the attributes above resulted in a quality index number (HSI or percent) for each alternative. Those quality index numbers were then combined using a Habitat Unit Combination Method (HUCM) in order to arrive at one total HU number for each alternative. ***Figure 5-5*** outlines the process for the environmental analysis.

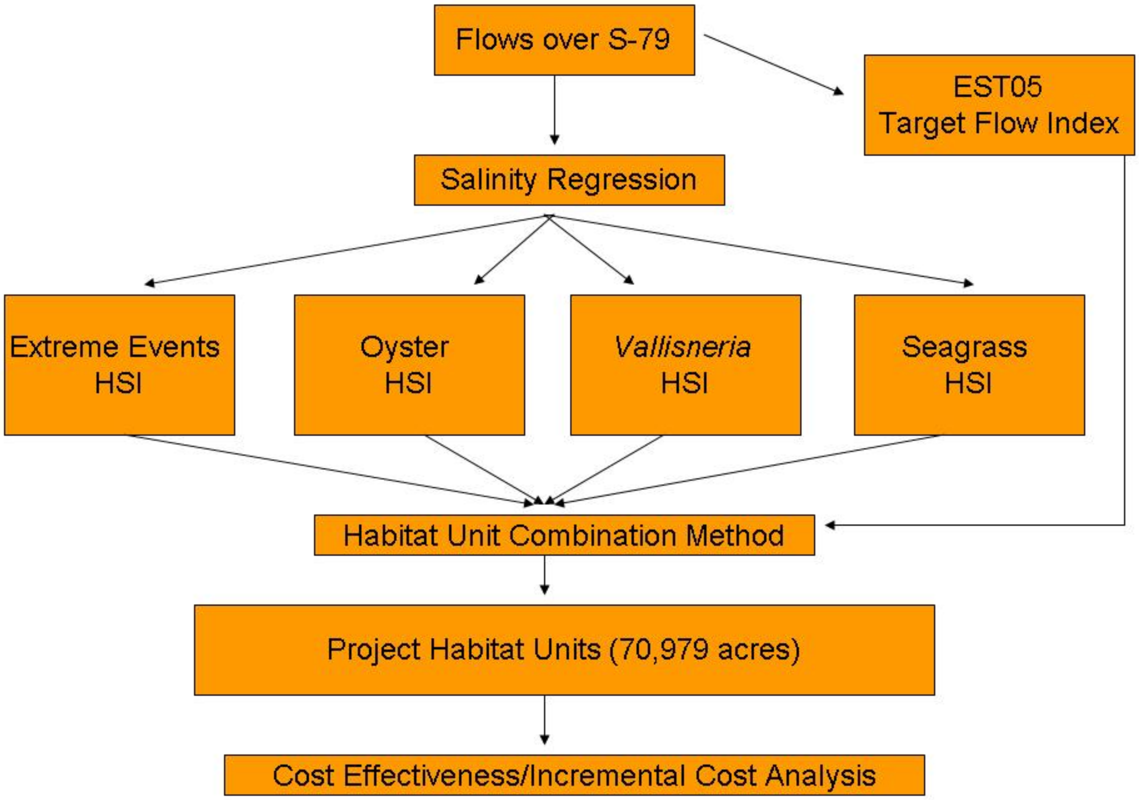


FIGURE 5-5: FLOW CHART FOR THE ENVIRONMENTAL ANALYSIS PROCESS

Table 5-12 summarizes the five attributes and quality index calculations for the 2000 base case, 2050 future without project, and each of the alternatives.

TABLE 5-12: TOTAL HABITAT UNIT CALCULATIONS FOR SYSTEM FORMULATION

Condition	**Oyster**	***Vallisneria***	**Seagrass**	**Extreme Event**	**EST 05**
2000 Base (Existing)	.48	.16	.51	.28	.38
2050 Future Without Project	.52	.20	.54	.30	.43
Alternative 2	.60	.31	.59	.42	.64
Alternative 3B	.60	.33	.59	.43	.70
Alternative 3C	.61	.35	.59	.45	.80
Alternative 4A	.61	.35	.59	.45	.79

5.3.7.5 Water Quality Analysis of Final Array of Alternatives

Under the conservative assumption that no water quality treatment occurs in the reservoir, the project alternatives in the system formulation condition (which include the rest of CERP) will reduce TP and TN loads at S-79 by approximately 28% to 34% in comparison to the future without condition. This reduction in nutrient loads at S-79 is largely the result of the reduction in discharges from Lake Okeechobee. All of the selected alternatives will cause a shift in nutrient load from the wet season to the dry season; however, all of the alternatives will decrease the frequency in which the monthly TN load exceeds the dry season, wet season, and annual targets established by DEP (dry-season 190 tons/month, wet-season 350 tons/month, annual 3,000 tons/month).

While it is possible that nitrogen fixation within the reservoir will result in short-term increases in TN loading to S-79, the average annual TN load at S-79 will be reduced. Each of the alternatives results in an improvement in overall average water quality conditions at S-79 as well as downstream in the estuary. Given the uncertainty in the threshold chlorophyll-a concentration required for the restoration of the ecological function of the estuary, the degree to which the reservoir project will improve downstream water quality is unknown at this time. Based on the evidence presented here, it appears that the project will not cause or contribute to water quality degradation under future conditions.

5.3.7.6 Planning Level Cost Estimates of Final Array of Alternatives

The cost estimate for the alternatives includes construction, lands, easements, right-of-ways, relocation, and disposal (LERRD), pre-construction, engineering and design (PED) costs, and construction management. Data for initial construction/implementation, land acquisition, monitoring, and periodically recurring costs for operation, maintenance, repair, replacement, and rehabilitation (O&MRR&R), have been developed through engineering design and cost estimation, and real estate appraisal efforts (See Appendix B: Cost Estimates for details of data development for cost estimates).

For purposes of this report and analysis, national economic development (NED) costs, as defined by USACE, are expressed in October 2006 price levels, and are based on costs estimated to be incurred over a 40 year period of analysis. Costs of a plan represent the value of goods and services required to implement and operate and maintain the selected plan. These costs are included in ***Table 5-13*** and were used in the cost effectiveness analysis of the alternatives. Based on additional engineering and design that would be performed in the planning, engineering and design phase, Alternative 3C may require modifications to the Townsend Canal and a major road downstream of the impoundments. For this purposes of this planning level cost estimate these costs were not included.

The costs in this section of the main report are updated, detailed costs and are not exactly equivalent to the costs that were utilized in the Economic Appendix cost/effectiveness and incremental costs analysis (CE/ICA). These updated costs were used, due to more detailed cost estimates becoming available, which warranted further justification of the original CE/ICA that was used for plan formulation and selection as can be noted in Appendix E. The result of this analysis verifies the conclusions of the original CE/ICA and the results seen in ***Table 5-18*** are consistent for both CE/ICA evaluations.

TABLE 5-13: COST OF FINAL ARRAY OF ALTERNATIVES (ROUNDED TO THE NEAREST 10,000)

	Alternative 2	Alternative 3B	Alternative 3C	Alternative 4A
Cost Component*				
Construction	$319,200,000	$355,170,000	$395,100,000	$425,500,000
S/A	$25,500,000	$27,000,000	$31,600,000	$34,000,000
PED	$31,900,000	$44,660,000	$39,500,000	$42,500,000
Lands	$80,420,000	$80,420,000	$80,420,000	$80,420,000
Initial Cost	$457,020,000	$507,240,000	$546,620,000	$582,420,000
Interest During Construction				
Construction	$33,600,000	$39,400,000	$42,000,000	$45,000,000
Lands	$13,500,000	$13,500,000	$13,000,000	$13,000,000
Total IDC	$47,100,000	$59,900,000	$55,000,000	$58,000,000
Total Project Investment	$504,120,000	$560,140,000	$601,620,000	$640,420,000
Average Annual Cost				
Interest & Amortization	$28,900,000	$32,100,000	$34,500,000	$36,700,000
Operation & Maintenance	$3,000,000	$3,000,000	$3,930,000	$3,930,000
Total Average Annual Cost	$31,900,000	$35,100,000	$38,430,000	$40,630,000

*Note – Final Costs of Selected Alternative Plan will be revised based on additional engineering and design
NED cost do not include Recreation Cost for Plan Formulation

5.3.7.7 Cost-Effectiveness/Incremental Cost Analyses for Final Array of Alternatives

Cost effectiveness analysis begins with a comparison of the costs and outputs of alternative plans to identify the least cost plan for every level of output considered. Alternative plans are compared to identify those that would produce greater levels of output at the same cost, or at a lesser cost, as other alternative plans. Alternative plans identified through this comparison are the cost effective alternative plans. Next, through incremental cost analysis, the cost effective alternative plans are compared to identify the most economically efficient alternative plans. Cost effective plans are compared by examining the additional (incremental) costs for the additional (incremental) amounts of output produced by successively larger cost effective plans. The plans with the lowest incremental costs per unit of output for successively larger levels of output are the "Best Buy" plans. The results of these calculations and comparisons of costs and outputs between alternative plans provide a basis for addressing whether the additional outputs are worth the costs incurred to achieve them.

The final arrays of alternative plans for this project consisted of an aboveground reservoir (a single management measure) of varying storage volumes and pump sizes. All other management measures were screened from further consideration as a result of prior studies. Since all of the plans in the final array of alternative plans consisted of the same cost effective management measure, an incremental cost analysis was performed to determine the incremental costs of the benefits produced by the remaining four structural plans. Incremental cost analysis of the system-wide effects of the final array of plans was performed using IWR Plan software for the remaining alternative plans.

This analysis is based on and follows guidance from the USACE's Institute for Water Resources publication, Evaluation of Environmental Investment Procedures Manual, Interim: Cost Effectiveness and Incremental Analyses, May 1995, IWR Report #95-R-1. Costs are based initially on a rough order of magnitude (ROM) and include PED and construction costs, interest during construction, as well as O&M costs after construction.

5.3.7.8 Average Annual Benefits

The analysis of ecological response times for large, diverse ecosystems is extremely difficult to calculate. For example, when analyzing an estuarine system, certain attributes will have to be examined when predicting the response to changes in salinity. While some species will generally provide responses within a year of salinity change towards normal conditions, others will respond fairly quickly, but are difficult to measure due to changing conditions. To account for this, a linear approach to predict ecological response time was used and it resulted in:

- 80% of the benefits would be realized by three years from start of construction,
- 90% within five years after that,
- 100% of the lift would be realized within ten years of construction.

If nothing was done to improve the conditions in the estuary, the project team determined that eventually the ecosystem would stabilize in a severely degraded condition.

In ecosystem restoration projects, cost effectiveness and incremental cost analyses require a comparison of average annual costs and average annual benefits. In an ecosystem restoration project, the analyses compare the alternative plans' average annual costs against the appropriate average annual HU estimates. ***Table 5-14*** summarizes the four alternatives and their respective project HU lift totals. The average annual outputs were calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2050). Costs used for CE/ICA and outputs used for CE/ICA are displayed in ***Table 5-15***.

TABLE 5-14: HABITAT UNIT LIFT, SYSTEM FORMULATION

Alternative	Average Annual Project Habitat Units
Alternative 2	10,628
Alternative 3B	12,809
Alternative 3C	16,397
Alternative 4A	15,907

Note that the output values shown reflect the differences between without project and with project on an average annual basis (i.e., ecological "lift" provided by each of the alternatives). For increases in oyster population under the future with project condition, recycled and fossil oyster shell and stabilizing mesh (where needed) could be used to establish suitable substrate for oyster recruitment (Oyster Reef Construction). Although this oyster reef restoration is not a part of the recommended plan, a description is included in this document as a recommendation for enhanced restoration of the estuary. A full description of the oyster reef restoration plan can be found in ***Appendix C*** (C.8 Oyster Reef Restoration Plan). ***Figure 5-6*** graphically represents a plot of the average annual benefits for the combined habitat streams for the future with and future with-out conditions. Any year on the graph can be picked to represent the HUs created in any particular period. The analysis used a 40 year period for benefit annualization, with the base year (first year benefits) beginning to accrue in 2010. Each alternative that took longer periods for benefits to begin accruing, had their costs annualized over 39 years and the 2010 present worth of the annualization calculated. In order to account for discrepancies in the annual benefit period of analysis, the benefits were annualized over 40 years (which is consistent with the cost annualization); with a year of zero lift being included in the average. The average annual HUs lift is then calculated as subtracting the future without project HUs from the future with project HUs for each year and averaging over the life of the project, which in this case is 40 years.

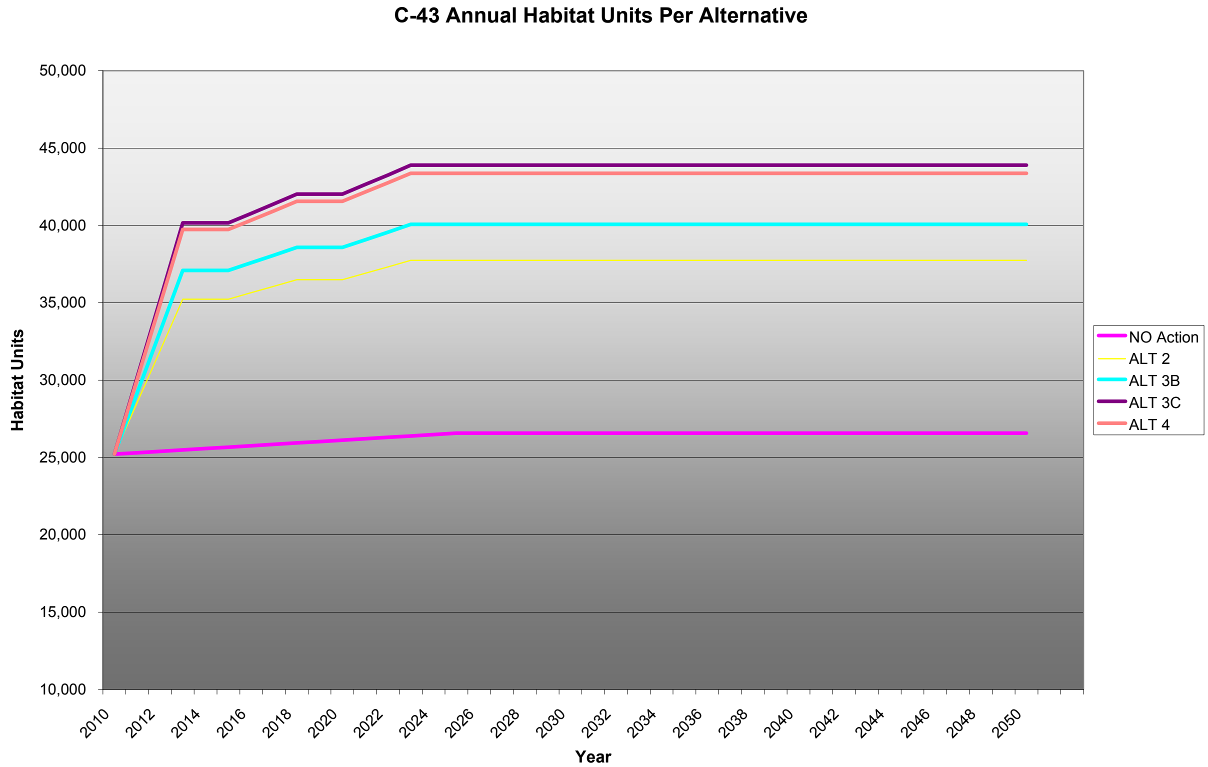


FIGURE 5-6: ANNUAL HABITAT UNIT LIFT

TABLE 5-15: COSTS AND OUTPUTS USED IN COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES

	Alternative 2	Alternative 3B	Alternative 3C	Alternative 4A
Annual Cost	**$31,900,000**	**$35,100,000**	**$38,400,000**	**$40,600,000**
Average Annual Habitat Units	**10,628**	**12,809**	**16,397**	**15,907**

Note: Values assume system benefits (ecosystem outputs that would accrue to the Caloosahatchee River (C 43) West Basin Storage Reservoir study area if rest of CERP is constructed). Values for Alternatives are Differences Between "Without" Plan and "With" Plan (on an average annual basis)

5.3.7.9 Cost Effectiveness Analysis

Cost effectiveness and incremental cost analyses (CE/ICA) were conducted for each of the Caloosahatchee River (C-43) West Basin Storage Reservoir alternative plans. The analyses compared the alternative plans' average annual costs against the appropriate average annual HU estimates. The average annual outputs were calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2050). CE/ICA was performed using a combination of the following five metrics to represent various ecosystem outputs of the C--43 alternatives:

- *Vallisneria*
- Oyster
- Seagrass
- EST05
- Extreme Event

The total cost of CERP is not included in this CE/ICA. The cost of the balance of the CERP features, those not included in the West Basin Storage alternatives, is the same for all the alternatives. As such, including it in this analysis does not bring any additional insight or differentiation between alternatives. For this analysis, the difference between the alternatives can be shown through a display of the outputs and costs of each alternative without the cost of the "other CERP" features.

All of the environmental outputs were calculated on an average annual basis to account for the fact that several years may be required for full attainment of the functional capacities to be realized. This was performed for the expected future with and without project HUs, which were used to calculate the average annual benefits for each ecosystem output. A summary of the average annual lift calculations and average annual costs used in the CE/ICA analysis are provided in ***Table 5-16***, ***Table 5-17***, and ***Table 5-18*** show that for Alternatives 2, 3B and 3C; are all cost effective alternatives. Alternative 3C provides the greatest habitat lift of all the alternatives, and this alternative also has the lowest average cost per unit of output.

TABLE 5-16: RESULTS OF COST EFFECTIVENESS ANALYSIS

Alternatives	Average Annual Cost ($1,000)	Output	Average Cost Per Output	Cost Effective?
Without Plan	$0	0	N/A	
Alternative 2	$31,900	10,628	$3,002	YES
Alternative 3B	$35,100	12,809	$2,740	YES
Alternative 3C	$38,400	16,397	$2,344	YES
Alternative 4A	$40,600	15,907	$2,554	NO

Note: Freshwater Wetland Habitat Units (HU). All plans and cost effective plan arrayed by increasing output for each output category.

5.3.7.10 Incremental Cost Analysis

Typically, cost effective plans are arrayed by increasing outputs to clearly demonstrate changes in costs (i.e., increments of cost) and in outputs (i.e., increments of output). For comparison purposes, each cost effective alternative plan is compared to the without plan condition to determine which of the alternative plans has the lowest incremental costs per unit of output of all plans. This plan is then considered the National Ecosystem Restoration (NER) plan. After the NER plan is identified, all larger cost effective plans are compared to the NER plan in terms of increases in (increments of) cost and increases in (increments of) output. The alternative plan with the lowest incremental cost per unit of output (for all cost effective plans larger than the NER plan) is then considered the second best buy plan. ***Table 5-17*** presents the results of the ICA of the different alternative plans for the Caloosahatchee River (C-43) West Storage Reservoir project (for the respective ecological zones). The results of the analysis show that there is only one best buy plan for the Caloosahatchee River (C-43) West Basin Storage Reservoir project. From the analysis of incremental cost for all of the alternatives, Alternative 3C provides the greatest HU lift while having the lowest cost per unit of output and is considered the NER plan for the project.

TABLE 5-17: RESULTS OF INCREMENTAL COST ANALYSIS–COST EFFECTIVE AND BEST BUY PLANS ARRAYED BY INCREASING OUTPUT

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output	Best Buy?
(Habitat Units)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alt 3C	$38,400	16,397	$2,344	$38,400	16,397	$2,344	Best Buy

While the CE/ICA of the various alternatives in obtaining habitat outputs is the primary evaluation technique in the selection of the NER plan. Engineering Circular (EC) 1105-2-409 states that in regards to plan selection: Any alternative plan may be selected and recommended for implementation if it has, on balance, net beneficial effects after considering all plan effects, beneficial and adverse, in the four Principles and Guidelines (P&G) evaluation accounts: NED, Environmental Quality (EQ), Regional Economic Development (RED), and other social effects (OSE).

This section provides a full discussion and display of the beneficial and adverse effects of each plan, and a comparison of costs and effects among plans as well as cumulative effects.

5.3.7.11 National Economic Development (NED)

NED benefits are defined as increases in the economic value of the goods and services that result directly from a project. These are benefits that occur as a direct result of the project but are national in perspective.

The P&G states: "the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (NED plan) is to be selected (paragraph 1.10.2)." There is no similar rule for plan selection where outputs are not measured in dollars, as in the case of ecosystem restoration analyses. While the CE/ICA does not provide a discrete decision rule for plan selection, it does provide the types of information to support an informed decision regarding ecosystem restoration (see ***Table 5-18***). Information about the acceptability, completeness, efficiency and effectiveness can also provide valuable support in making an informed decision in answering the question: "Is it worth it?"

TABLE 5-18: SUMMARY OF ALTERNATIVE PLANS

Alternative 2	**Alternative 3B**	**Alternative 3C**	**Alternative 4A**
Cost Effective	Cost Effective	Cost Effective and Best Buy	Not Cost Effective

Using the P&G evaluation criteria, the final array of alternatives were evaluated for:

- Acceptability: the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public. The alternatives are evaluated for compatibility with existing laws, regulations, and public policies
- Completeness: the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.
- Efficiency: the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment

- Effectiveness: the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities

Each plan (except the No Action Alternative), was rated on a scale of 0 to 2 on the ability of each plan to meet the specified criteria (0 = does not meet; 1 = partially meets; 2 = fully meets) (***Table 5-19***).

TABLE 5-19: P&G EVALUATION CRITERIA

	Alternative 2	Alternative 3B	Alternative 3C	Alternative 4A
Acceptability	1	2	1	1
Completeness	1	1	1	1
Efficiency	1	1	2	0
Effectiveness	1	2	2	1

5.4 SELECTION OF THE FINAL PLAN

This section of the report began with a brief overview of the findings of the NRC that stated that they recognize that Everglades' restoration is a complex undertaking with many scientific uncertainties, which can slow the rate of progress. The NRC concluded that if the construction of a restoration project is delayed until all scientific uncertainties are eliminated, there will be many negative consequences including: continued decline of the Everglades ecosystem, lagging public support, and increased project costs. The NRC identified an approach referred to Incremental Adaptive Restoration where an incremental approach using steps that are large enough to provide some restoration benefits now while address critical scientific uncertainties and to take actions that promote learning that can guide the remainder of the project design. Constructing projects using the suggested NRC phased approach will enable assessments of benefits and impacts to the environment as each phase is constructed. Remaining phases will then be adapted to optimize performance based on actual findings from the earlier phases.

While utilizing a basin-wide approach to plan formulation remains consistent with the Restudy, formulation of comprehensive restoration plans for the entire Caloosahatchee River Watershed will necessitate further investigations of the basin, is more complex, and will require more time to complete the study and implement a recommended plan. The Caloosahatchee Estuary cannot wait on a larger study to address all basin wide issues; the estuary is in need of immediate action now if restoration efforts are to be successful.

To address the immediate issues of the estuary, an Incremental Adaptive Restoration approach (as suggested by the NRC) in which the basin study is divided in to two separate PIRs is recommended. The first PIR (the Caloosahatchee River (C-43) West Basin Storage Reservoir project) will address the most immediate needs of the estuary, reaffirm the reservoir component in the Comprehensive Review Study, and ensure that it is fully compatible and consistent with the CERP. To address the overall needs and issues of the Caloosahatchee River Watershed, a subsequent PIR will address a more complete solution to the broader needs of the entire basin.

This first PIR focuses on the formulation and evaluation of a reservoir located in the lower West Caloosahatchee River basin to address the immediate restoration needs of the Caloosahatchee River Estuary. Through the formulation process, Alternative 3C is identified as the NER plan and is also identified as the Best Buy Plan in the CE/ICA analysis of project alternatives.. Although identified as the NER and Best Buy Plan, Alternative 3C does carry with it greater uncertainty, such as the potential to require more extensive modification to numerous structures downstream of the reservoir,, resulting in possible additional costs and time delays to the project. Delays in implementing the project will ultimately result in a loss of time for the estuary to realize potential ecological benefits. Alternative 3B is a variation of Alternative 3C, with the only difference between plans being the major pump station size (Alternative 3B uses a 1500 cfs pump while Alternative 3C uses a 3800 cfs pump). Alternative 3B is a cost effective plan, it is implementable, it achieves estuarine benefits, it does not carry as much uncertainty as Alternative 3C, and it received a high score based on the P&G selection criteria. While Alternative 3B is not a Best Buy Plan it ultimately may become one if Alternative 3C should require more extensive modifications to downstream features in order to meet project objectives.

Alternative 3B is recommended for implementation, rather than Alternative 3C (identified as the NER alternative plan). Alternative 3B meets the policy criteria established in Corps of Engineers guidance for planning in a collaboration environment[1]. This guidance provides that any alternative plan can be selected "if it has, on balance, net beneficial effects after considering all plan effects, beneficial and adverse…" Alternative 3B is clearly of less scope and cost than Alternative 3C, reduces uncertainty and financial risk to the government, and meets the Administration's policies for high priority outputs. Because Alternative 3B is an increment of Alternative 3C, this plan also supports adaptive implementation recommendations established by the National Academy of Science. The study considered various scales of reservoir storage and identified no alternative smaller than 3B which was more economical. For these reasons Alternative 3B is the recommended plan, and no ASA (CW) waiver is required.

[1] EC 1105-2-409 "Planning in a Collaborative Environment"

Therefore, the recommendation is to select Alternative 3B as the SAP (preferred plan) and adaptively monitor and manage implementation of the project.

As part of the second PIR for the Caloosahatchee River Watershed, the PDT will evaluate if additional pump capacity is required and the feasibility of making modifications to the 1500 cfs pump station. The design of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project does take into consideration the potential future addition of pumps to provide additional pumping capacity if it is determined necessary in the second PIR analysis. Additional pumps can be added to the pumping station but would require additional construction (building on to the pump station) to accommodate the new additional pumps. A new operations plan would also be needed to account for the additional pumping capacity. The addition of pumps would allow the reservoir to capture additional flows from the Caloosahatchee River and to be filled in a shorter period of time, but it would not add any additional volume for water storage.

This decision will be based on real time data collection and engineering and ecological analysis and adaptive management while the SAP is functioning and benefits are being realized in and around the estuary.

5.4.1.1 Next Added Increment Plan Selection Verification

The intent of a system-wide analysis is to demonstrate how an alternative plan will function in conjunction with all CERP projects in place. However, potential benefits achievable by each alternative plan may not be realized due to differences in water budgets resulting from the implementation of additional CERP projects that have the Lake Okeechobee Regulation Schedule (LORS) shifting water away from the Caloosahatchee River (C-43) Basin in order to meet the demands of these projects under the system-wide analysis. To verify additional environmental benefits achievable by each plan, a NAI analysis was performed on all of the alternatives.

The NAI analysis does not include other CERP projects; therefore additional benefits achievable by each plan are more than likely resulting from the differences in additional water being released into the Caloosahatchee River (C-43) Basin under a water budget that is not influenced by CERP. A NAI analysis yields greater HUs and shows a larger lift in HUs calculated for each alternative over those calculated in the system-wide analysis. Additionally the NAI analysis can provide a better representation of the ranking of alternatives, thereby providing a validation of the plan rankings based on MIKESHE modeling results used in the selection of the SAP.

To validate the plan selection and address concerns with the MIKESHE modeling results, a spreadsheet analysis will calculate flow data for the S-79 structure for use in conducting a NAI analysis of each alternative (see

Engineering ***Appendix A*** for a detail discussion of the spreadsheet analysis used in the NAI analysis). The HSI models calculated HU for each alternative utilizing flow results from the spreadsheet analysis. ***Table 5-20*** and ***Table 5-21*** show the results of the HU benefit analysis of the different alternatives along with the system-wide analysis results providing a comparison of achievable HU lift from the NAI and system-wide analysis to validate selection of the SAP.

TABLE 5-20: TOTAL HABITAT UNIT CALCULATIONS FOR NAI FORMULATION

Metrics	2000	2050	ALT 2	ALT 3B	ALT 3C	ALT 4A
Vallisneria	0.03	0.08	0.58	0.60	0.59	0.59
Seagrasses	0.49	0.51	0.52	0.52	0.52	0.52
Oysters	0.52	0.52	0.23	0.23	0.33	0.34
Extreme Events	0.22	0.24	0.24	0.24	0.26	0.27
EST05	0.20	0.21	0.65	0.71	0.76	0.78

TABLE 5-21: SUMMARY OF NAI AND SYSTEM-WIDE AVERAGE ANNUAL HABIT UNITS LIFT FOR EACH ALTERNATIVE EVALUATED

Alternative	System-wide AAHU lift (MIKESHE)	NAI AAHU lift (spreadsheet)
2	10,628	13,624
3B	12,809	15,297
3C	16,397	17,694
4A	15,907	18,410

As would be expected, under the NAI analysis, alternatives increase in benefit as the pump size and reservoir capacity increases.

Increased Benefits

The NAI analysis demonstrates that there are increased benefits for all of the alternatives, compared to system formulation. This is mainly due to the change in flows that the basin will be receiving from Lake Okeechobee in the system formulation condition compared to the NAI condition. In the system-wide formulation analysis, the basin will be receiving reduced flows, sometimes occurring during periods when the estuary demands increased freshwater flows. However, under the NAI analysis, there are fewer competing demands on Lake Okeechobee water, resulting in more lake water being made available to the Caloosahatchee Basin.

Alternative 3C versus Alternative 4A

In the system formulation, Alternative 3C provided more habitat units than Alternative 4A. This is counterintuitive to the assumption that a larger reservoir should provide more benefits. The NAI analysis using spreadsheet data does reflect Alternative 4A providing more benefits than Alternative 3C. In this case, issues with water budgets in the MIKESHE model may not realistically reflect the reservoir benefits. The NAI analysis is a better representation of the relative ranking of alternatives.

Alternative 3B versus Alternative 3C in the NAI Analysis

The relative difference in benefits between Alternatives 3B and 3C is less in the NAI analysis than in system formulation analysis. If there is more water in the Caloosahatchee Basin in the NAI, as stated above, all alternatives will perform better in the dry season. The dry season is where the reservoir feature provides most of its benefits, and these benefits during the dry season do not depend on pump size, since the pump is not used to release water to the estuary. Alternatives 3B and 3C are the same size reservoir, so they would provide roughly the same benefits during the dry season. In the wet season under NAI, the relative difference in benefits may be less than system formulation because there is so much more water available in NAI, that the larger pump of Alternative 3C still does not have much of a beneficial impact. There would be more flows that would be greatly over the target than in the system formulation scenario. So the added benefits of the larger pump in Alternative 3C would be less under NAI wet season than system formulation wet season. .

5.5 DISCUSSION OF MAJOR RISKS AND UNCERTAINTY

The primary focus areas for the risk and uncertainty evaluation are engineering and real estate considerations, modeling, and ecological response. This assessment includes evaluations of engineering and construction issues, such as project and construction scheduling, construction cost estimates, land availability, and technology. In addition, the reliability and accuracy of the assumptions and tools used to forecast with- and future without project conditions are evaluated. Finally, project performance and ecological response is discussed.

5.5.1 Engineering and Real Estate Risks and Uncertainty

The risk and uncertainty associated with the construction and operation of these features of the proposed project should be minimal. All features have been designed and constructed through established and applied technology. No experimental design was necessary for any component of the proposed impoundment. Additionally, both the USACE and the SFWMD have extensive and reputable credibility in the design, construction and O&M of the proposed features from previous water resources planning efforts.

A cutoff wall along the perimeter of the dam embankment is being considered and will be further investigated as the project proceeds to design. For estimating purposes, a 17-foot cutoff wall was included. These features use standard technology and should pose minimal risk.

Soil cement protection was included for armoring. This will be further investigated as the team proceeds with the design. Armoring generally uses standard technology and should pose minimal risk.

A freeboard of approximately 15 feet was used in preparing the rough order of magnitude cost estimates. This value for freeboard was developed by Acceler8 and presented in their March 2006 Draft Technical Memorandum detailing their design assumptions and calculations for freeboard. Based on interagency review (USACE, SFWMD, USFWS, USEPA, USGS, FDEP, FFWCC, Hendry County, and Lee County) of the draft memorandum, it is expected that the final freeboard design will be somewhat less than the initial 13-foot assumption. The freeboard design will be further refined in accordance with applicable CERP DCM. These DCMs were developed to provide consistent working level guidance for impoundment design by the Acceler8 teams. The DCMs consolidate and incorporate design criteria from various agency regulations and guidelines including USACE, U.S. Bureau of Reclamation, Federal Energy Regulatory Commission, Florida Building Code, and the American Society of Civil Engineers. The DCMs do not supersede USACE's regulations. Freeboard designed in compliance with the DCMs, and thusly USACE regulations, should result in minimal risk of embankment failure due to overtopping (refer to DCM-2 for additional detail).

Through the Caloosahatchee Watershed plan, lands necessary for the construction and O&M of the West Basin Storage Reservoir have already been acquired by the SFWMD using funds appropriated to the DOI in Section 390 of the Federal Agricultural Improvement and Reform Act of 1996 together with State funds. As such, there is no uncertainty associated with land availability and acquisition.

A summary of project features and associated risks and uncertainties is provided in ***Table 5-22***.

TABLE 5-22: RISKS AND UNCERTAINTIES

Feature	Risk	Uncertainty
Reservoirs • Armoring • Cutoff Walls • Freeboard	Minimum	Minimum- established and applied technology
Pump Stations	Minimum	Minimum- established and applied technology
Spillways • Emergency Overflow • Vertical Lifts	Minimum	Minimum- established and applied technology
Drawdown Structures	Minimum	Minimum established and applied technology
Culverts	Minimum	Minimum established and applied technology
Canals	Minimum	Minimum- established and applied technology
Earthwork • Filling canals • Plugging culverts	Minimum	Minimum-established and applied technology
Manatee Barrier	Minimum	Minimum- established and applied technology

5.5.2 Modeling Risks and Uncertainty

5.5.2.1 Hydrologic Modeling

To formulate, evaluate, assess and adaptively manage the CERP and individual CERP projects, regional hydrologic simulation models, such as the SFWMM and the Natural Systems Model (NSM) are utilized by project teams and RECOVER. Both models use two-mile (2 mile by 2 mile) square grids with resolution based on available spatially distributed data. These models have been peer reviewed and represent the best available science. They are considered reliable for current decision-making processes (and have been used repeatedly to support decision-making). However, these models depict general hydrologic conditions that are assumed to be representative throughout the individual four-square mile area (2,560-acre) grid cells that comprise the model. Therefore, the models may not be fine enough in their resolution to simulate minor hydrologic changes that would result from variations in topography, soils, and vegetation within the grid cells, but which may be significant in terms of ecological response. The SFWMM was developed during the late 1970s and early 1980s and has served as the primary regional simulation model in south Florida for nearly two decades.

New initiatives such as the Everglades Restoration and Water Supply Planning have placed new demands for information on regional simulation models. This has led to the development of the next generation of the 2x2 model referred to as the Regional System Model (RSM). The RSM is the next generation SFWMM developed using recent advances in computer technology-in particular, GIS, databases, and object-oriented model development. The RSM makes use of the more realistic, accurate, and efficient numerical algorithms to simulate hydrology and water management in south Florida. It uses a variable mesh structure capable of simulating the region at differing spatial resolutions. It is expected that the RSM will eventually replace the existing SFWMM, although years of development and testing will be needed before RSM becomes fully operational for the entire system.

While the hydrologic models can illustrate effects of alternative plans in relationship to hydrologic targets, it is often difficult to discern the ecological magnitude of the relative differences between alternatives (e.g., a small slope change in a stage duration curve). Furthermore, the simulation models are not sensitive to small changes in hydrology at the cell boundaries. As such, the effects of individual projects may be negligible or may not even be discernable using the regional modeling tool, particularly when their influence on the regional water management system is relatively small. This particular problem creates a lack of scientific certainty with respect to the spatial extent of a project's effects.

The uncertainties in using these models to predict reservoir function relate to the use of historical data, including:

1. Failure of the reservoir to be filled by the time of commissioning.
2. Mean flows in the watershed below what has been predicted/simulated.
3. Clustering of wet and dry years, especially the occurrence of a prolonged dry period.
4. Faster reservoir sedimentation than expected.

The risks due to this project are:

1. Risk to downstream settlement and environmental resources due to dam breach.
2. Higher than expected downstream damages during release of major floods due to infrastructure encroachment on flood plains.

The regional hydrologic simulation model is designed for regional, long-term applications. Although scalable, performance constraints may impose practical limits on the time and space scales. This regional model is not intended for local-scale decision-making support. Even if the hydrologic model shows differences in alternative plans in relationship to hydrologic targets, it is often difficult to discern the ecological magnitude of the relative differences between alternatives. Also, the relative size difference between the reservoir and the affected areas (Caloosahatchee Estuary) is such that even large changes in volume of water stored within the reservoir cannot be easily seen when water is spread over such a large area. To minimize these risks, the project team will use a sub-regional model to determine seepage rates and the probability of spillover. The reservoir operations manual will include management measures such as:

1. Developing a reservoir regulation schedule
2. Creating flood storage prior to predicted storm
3. Design of outlet structures to handle release water after a major storm in preparation for a subsequent storm

5.5.2.2 Modeling of the Various Alternative Plans

The MIKESHE modeling platform was used to develop a subregional model to simulate the hydraulics and hydrology of the Caloosahatchee River (C-43) Basin in order to simulate the integral connection between groundwater and surface water interaction within the basin for existing and future conditions. For formulation purposes, the hydrologic outputs from the modeling analysis of the final array of alternatives are useful for determining and comparing the effects of alternative plans for plan selection.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project was formulated to keep water in the regional system without adversely affecting existing legal uses of water. Excess water is captured and stored in the reservoir for later releases for meeting estuarine demands. The volume of water that could be retained by a reservoir for delivery to the estuary is likely limited to the volume of damaging Lake Okeechobee releases that can be captured and pumped to the reservoir and the volume of excess runoff captured by the reservoir from the Caloosahatchee River (C-43) Basin (largely agricultural and un-developed lands with some urban areas intermixed). To evaluate the performance of different reservoir sizes, modeling output data of the with project conditions (obtained from the MIKESHE/MIKE 11 analysis of the alternatives modeled) was compared to the CERP system-wide performance measure "NE-3" (Caloosahatchee salinity envelope (EST05)) to determine which alternative plan came closest to achieving the hydrologic performance targets set for the project.

In order to characterize the risk and uncertainty issues that are inherent in developing a model to simulate a natural and/or managed system, an assessment of the risk and uncertainty specific to the modeling of existing condition, future without condition and the final array of alternatives for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project must be considered. These assessments included a review of the reliability and accuracy of the assumptions and data used in the MIKESHE/MIKE 11 modeling platform to simulate existing conditions and for forecasting the future with and without project conditions. During a review of the sub-regional modeling results for all of the alternatives, several issues became apparent resulting in a level of uncertainty in calculating habitat units for the alternatives.

Analysis of the modeling results indicated a significant water budget discrepancy. It was determined that the source of this water budget error was in the MIKESHE irrigation routines. Within a given MIKESHE model, the irrigated areas are discretized into “irrigation command areas” which represent individual farms or groups of farms that draw from an individual source of water. These sources of water can be withdrawals from locations within a surface water canal, withdrawals from groundwater wells, or water introduced from an external source. This external source could represent water from sources outside or below the model domain (a deep aquifer), from a feature not modeled at all such as a water reclamation facility, or as in the case of this MIKESHE model application, it was used to represent irrigation demands that are unmet by the surface and groundwater systems. Within the irrigation module, this external source is treated as an infinite source of water. Each irrigation command area can also use multiple sources within each time step and a prioritized list is developed for each irrigated area based on currently permitted or projected irrigation operations. For example, a given command area can try to get its water from a canal source, then if the quantity of water available from that source is insufficient, then that command area will go to the next source which could be another surface water location or a groundwater source. If all preceding sources of water are insufficient, then the irrigation command area will receive the remaining unmet balance of its demand from the infinite external source.

In the development of the Freshwater Caloosahatchee MIKESHE model, it was decided to allow all the irrigated areas to use this infinite external source as a final source of water as a method of quantifying “demands not met” or the shortage in the amount of water that is required by an irrigation command area. It was anticipated that this quantity of water would be very small in relation to the remainder of the irrigation volumes and insignificant in relation to the total model water budget.

Upon analysis of the model outputs, specifically the irrigation outputs, it was discovered that this volume of water coming from external sources was significantly greater than anticipated. The quantity of water coming from external sources also varied significantly among the various model runs. The average-annual volume of water coming from external sources ranges from 125,100 ac-ft for the 2000 without-project run to 260,500 ac-ft for one of the with-project runs. For some model runs this equates to more than half of the total irrigation volume coming from an artificial external source of water. When compared to the volumes of the reservoirs being tested, this is a significant error in the water budget.

After consultation with the developer of the MIKESHE code, the Danish Hydraulic Institute, it was determined that there was a limitation in the conceptualization of the irrigation routines. Essentially, the model grossly underestimated the available volume of water from existing sources of water such as canals and groundwater and prematurely resorted to the theoretically infinite external water source. At times when sufficient irrigation water was available in the canals, the model pulled in water from external water sources, producing this significant water budget error.

While this water budget error produces some level of risk and uncertainty, it is not anticipated that there will be a change to the ranking of environmental benefits for the alternatives. It is still reasonable to assume that alternatives with larger component features (pumps and reservoir sizes) will perform better than alternatives with smaller components. In the wet season, a larger pump will always be able to shave off more damaging flows than a smaller pump and a larger reservoir will always provide more storage volume than a smaller reservoir. That extra water that is stored in the wet season will always translate to a larger source of water carried over into the dry season.

This water budget error could also affect the various alternatives differently, changing the relative differences in project benefits between alternatives. As a result, it is possible that the final quantity of habitat units for each alternative will change (increase or decrease). This means that there could be changes in the number of habitat units achieved by each alternative as a result of the water budget error, but the ranking of the order of plans based on the number of habitat units achieved will remain the same.

Although there is a level of risk and uncertainty associated with the modeling results, for purposes of plan selection, the modeling data developed to date will be used in selecting the recommended plan for the project (SAP). Additionally, the CERP Programmatic Regulations require the evaluation of a tentatively selected plan (TSP) using a “next-added increment” (NAI) analysis to helps illuminate the amount of benefits the plan contributes without regard to future CERP projects prior to the selection of the SAP. The TSP must also demonstrate that it does not negatively impact existing levels of flood protection (saving clause) to meet the intent of the level of service analysis for flood protection contained in the WRDA 2000, the CERP Programmatic Regulations as well as Florida State law regarding the implementation of CERP. To minimize the risks and uncertainties resulting from the issues with the MIKESHE/MIKE11 modeling platform, the project team will use alternative methods for showing TSP compliance with CERP Programmatic Regulations, WRDA 2000 and Florida State law. A separate spread sheet analysis which utilizes modeling output from the SFWMM regional hydrologic simulation model will be used in the NAI analysis of the TSP. To demonstrate compliance with saving clause requirements concerning flood levels, a revised MIKESHE/MIKE11 model will look at the localized areas around the reservoir to demonstrate that the project does not have an impact to flood levels on lands adjacent to the reservoir.

5.5.3 Ecological Response Risks and Uncertainty

5.5.3.1 Evaluating the Ecological Significance of Hydrologic Change

Hydrologic performance measures are useful for determining and comparing the effects of alternative plans. However, to determine a plan's outputs for purposes of depicting NER benefits, the assumption is made that the hydrologic performance measures fully characterize all of the attributes of ecosystem functions, since the analytical tool for system-wide effects is a hydrologic simulation model. This assumption results in some uncertainty with respect to the evaluation of system-wide ecological responses because not all ecological attributes can be simply reduced to hydrologic terms. However, to reduce some levels of uncertainty, the hydrologic performance measures have been related to certain ecological attributes by the ecological sub-team.

Additional uncertainty exists in the correlation between small hydrologic changes seen in the outputs of a regional model, and the ecological significance of those changes. The hydrologic change in a model grid cell, indicator region, or geographic sub-region that may result from individual projects is typically small in relative magnitude. Therefore, there is uncertainty in predicting the extent of system-wide change in ecological attributes due to relatively small differences in the hydrologic changes associated with incremental implementation of individual CERP projects.

Hydrologic performance measures illustrate the degree of attainment of specific hydrologic targets in specific areas (e.g., releases at the S-79 structure). However, the significance of change in a hydrologic performance measure with respect to the ecological attribute to which the performance measure applies is uncertain, especially when evaluating the effects of individual CERP projects. This is because the hydrologic change in a model grid cell, indicator region, or environmental sub-region that may result from individual projects is typically small in relative magnitude. Although target conditions are usually established for hydrologic performance measures, scientists on project teams usually have difficulty determining the meaningfulness of the relatively small differences between plans, including base conditions indicative of the degree of attainment of target condition. Typically, a more-or-less-is-better analysis is performed, and can be expressed as a percentage of the degree of attainment of the target. However, when the effects of all plans are relatively equal, it can be difficult to state the meaningfulness (in terms of the ecological response of the attributes affected by the performance measures) of relatively small differences between plans (e.g., 60, 61, and 63 percent attainment). Therefore, there is some uncertainty in predicting the extent of system-wide change in ecological attributes due to relatively small differences in the hydrologic changes associated with incremental implementation of individual CERP projects.

5.5.3.2 Spatial Extent of System-Wide Effects of Alternative Plans

While the hydrologic models used for CERP project plan formulation and evaluation may effectively demonstrate meaningful changes between alternatives in hydrologic performance measures and where those changes occur (in terms of the model's four-square mile grid cells), describing ecological responses to those hydrologic changes over precise areas has proven to be difficult for many projects which are "invisible" to the hydrologic model. For example, a species may be sensitive to topographic, vegetation, and soil conditions, which would in turn affect habitat quality. Thus, determining the differences in the spatial extent of effects resulting from each alternative plan in an array of plans (for a given ecological attribute) has proven to be difficult to estimate with scientifically defensible certainty. This in turn makes the estimation of the spatial extent of the benefit units uncertain.

Determining the individual variable spatial response to hydrologic change of each attribute that is evaluated during plan formulation is also uncertain. Each of the Conceptual Ecologic Models (CEM) that are the basis for the system-wide hydrologic performance measures encompass multiple ecological attributes (for example, oysters, *Vallisneria*, and seagrass are all attributes of the Caloosahatchee CEM). Each attribute may vary independently in the spatial extent of response to differences in hydrology. These variations in area make the assignment of "spatial extent" affected by an alternative plan all the more difficult to determine. If "areas affected" for each attribute were simply summed, the issue of double-counting HUs could arise as multiple attributes could overlap in the same area affected by multiple projects, and thus the same benefit units could be counted more than once. Similarly, without fully understanding how each attribute responds independently to variations in hydrology (and without a sensitive enough hydrologic modeling tool to depict the spatial extent of the attribute response), it is equally likely that not enough benefit units (expressed as HUs) would be counted, thereby understating the beneficial effects of plans.

5.5.3.3 Ecological Response Time Risks and Uncertainty

There are no existing models that can be utilized to predict ecological response time. Although ecological response can be fairly well predicted for smaller restoration projects, it is difficult to address the effects of such a large restoration project as the Caloosahatchee River (C-43) West Basin Storage Reservoir project. Therefore, the natural system sub-team utilized current scientific knowledge and best professional judgment to predict responses within the natural system.

5.5.4 Adaptive Management

Adaptive management (AM) consists of an active strategy for dealing with the considerable uncertainties that characterize management of large natural ecosystems, which are complex and difficult to predict. The overall purpose of AM is to maximize the chance of success and includes methods, such as proactive approaches to dealing with uncertainties, the use of modern ecosystem science and scientific practices, active collaboration, and the use of open, inclusive, and integrative processes.

Five key principles help implement this approach to adaptive management (AM):

1. Anticipate future uncertainties and contingencies
2. Employ science-based approaches to build knowledge
3. Design robust projects that can be adapted to changing conditions
4. Build a shared understanding through collaboration and conflict resolution
5. Reconcile competing objectives to benefit both nature and society

The Caloosahatchee River (C-43) West Basin Storage Reservoir project is a component of the CERP, which consists of sixty-eight (68) major components. The uncertainty associated with a program of this magnitude was recognized during the Restudy, which led Congress to address the necessity of AM in the WRDA 2000.

As such, a fundamental implementation principle for CERP is to utilize adaptive assessment and management in order to continually refine and improve the performance of CERP projects so that planned benefits are attained. Incremental revisions of optimal project designs and project operations throughout the planning and implementation process will lead to improved performances. The use of the adaptive assessment policy minimizes the effects of uncertainty with respect to the effects of CERP projects on the natural system and other water-related needs of the region related to the design and implementation of the CERP.

The measurement of benefits attributable to CERP projects must consider individual outputs as well as system-wide interdependencies among projects. This evaluation methodology applies to hydrologically linked projects that operate optimally in a synergistic fashion. Therefore, until other CERP projects are implemented, some benefits may not be realized. Moreover, interim and long-term impacts will be largely determined by implementation of CERP components and operational strategies. Regional evaluations will be used to improve information necessary to predict and assess shortfalls attributable to sequencing issues versus shortfalls in performance.

The project team considered the uncertainty in the estimation of HU values for the various alternatives and how would ecological outputs respond over time, and how do continued high Lake Okeechobee inflows and runoff volumes affect outputs over time. Consideration of “if” and “when” other CERP components were constructed were also considered in the estimate of ecological outputs, demonstrating the sensitivity of Caloosahatchee Estuary outputs to the construction of other CERP components.

As part of the AM process, careful flow monitoring will occur to evaluate the ability of any implemented features to meet the performance measures. In addition, biological response data will be collected for use in further refining the performance measures, project operations, and system understanding. The NAI analysis showed that essentially all of the estuary outputs would still be produced by the Caloosahatchee River (C-43) West Basin Storage Reservoir project even if other CERP projects were never constructed. This same analysis also indicated that no other alternative performed more cost effectively than the recommended alternative (Alternative 3B) when other CERP project were not constructed. Furthermore, cost effectiveness analysis indicated that the various alternatives were sufficiently separate and distinct so that relatively large changes in either cost or output would be required before an alternative would appear to be the superior.

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SECTION 6
ENVIRONMENTAL EFFECTS

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6.0 ENVIRONMENTAL EFFECTS

6.1 SUMMARY OF EFFECTS

Table 6-1 is a summary of the environmental effects of the final array of alternatives. More detailed descriptions of these effects can be found in the remainder of this section.

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TABLE 6-1: IMPACT TABLE

Resource	"No Action"	Alt. 2	Alt. 3B	Alt. 3C	Alt. 4A
Physical Landscape	No impact	Dam height of 29-34 feet; no impact to aquifers, surficial sands removed for embankments; loss of ~10,500 acres of unique farmland	Dam height of 32-37 feet; no impact to aquifers, surficial sands removed for embankments; loss of ~10,500 acres of unique farmland	Dam height of 32-37 feet; no impact to aquifers, surficial sands removed for embankments; loss of ~10,500 acres of unique farmland	Dam height of 41-46 feet,;. no impact to aquifers, surficial sands removed for embankments; loss of ~10,500 acres of unique farmland
Hydrology	45.5% of flows in desired envelope; Continued extreme flow events to the estuary	67.9% of flows in desired envelope; Rerouting of local canals; perimeter canal will serve to maintain groundwater levels in vicinity of reservoir;	74.8% of flows in desired envelope; Rerouting of local canals; perimeter canal will serve to maintain groundwater levels in vicinity of reservoir	82.3% of flows in desired envelope; Rerouting of local canals; perimeter canal will serve to maintain groundwater levels in vicinity of reservoir	83.8% of flows in desired envelope; Rerouting of local canals; perimeter canal will serve to maintain groundwater levels in vicinity of reservoir
Water Management	Large volume releases to Caloosahatchee River continue; it is also likely that harmful low flows in the dry season would continue.	82% reduction in weekly high flows >4500 cfs; Changes in local canal operations; changes to S-79 operations to maximize reservoir usage for estuarine benefits; 100,000 ac/ft of storage	82% reduction in weekly high flows >4500 cfs; Changes in local canal operations; changes to S-79 operations to maximize reservoir usage for estuarine benefits; 170,000 ac/ft of storage	91% reduction in weekly high flows >4500 cfs; Changes in local canal operations; changes to S-79 operations to maximize reservoir usage for estuarine benefits; 170,000 ac/ft of storage	91% reduction in weekly high flows >4500 cfs; Changes in local canal operations; changes to S-79 operations to maximize reservoir usage for estuarine benefits; 220,000 ac/ft of storage
Water Supply	Existing water supply conditions would be maintained	There will be no elimination or transfer as a result of this project on existing legal sources; transfer of source for the Bob Paul property	There will be no elimination or transfer as a result of this project on existing legal sources; transfer of source for the Bob Paul property	There will be no elimination or transfer as a result of this project on existing legal sources; transfer of source for the Bob Paul property	There will be no elimination or transfer as a result of this project on existing legal sources; transfer of source for the Bob Paul property
Flood Protection	Existing levels of flood protection would be maintained.	There will be no adverse affects on existing levels of service for flood protection in the vicinity of the reservoir.	There will be no adverse affects on existing levels of service for flood protection in the vicinity of the reservoir.	There will be no adverse affects on existing levels of service for flood protection in the vicinity of the reservoir.	There will be no adverse affects on existing levels of service for flood protection in the vicinity of the reservoir.
Water Quality	Nutrient loads to the estuary will likely increase by 10% or more if no BMPs or nutrient TMDLs are implemented in the Caloosahatchee basin. If nutrient reduction	Reduction in TP loads at S-79 by approximately 30% in comparison to the FWO condition; Reduction in TN loads at S-79 by approximately 29% in comparison to the FWO condition. The load	Reduction in TP loads at S-79 by approximately 29% in comparison to the FWO condition; Reduction in TN loads at S-79 by approximately 28% in comparison to the FWO condition. The load	Reduction in TP loads at S-79 by approximately 32% in comparison to the FWO condition; Reduction in TN loads at S-79 by approximately 31% in comparison to the FWO condition. The load	Reduction in TP loads at S-79 by approximately 34% in comparison to the FWO condition; Reduction in TN loads at S-79 by approximately 32% in comparison to the FWO condition. The load reductions are due for the most part to

	programs are successful, the 2050 Future Without nutrient loads may decrease by more than 30% as compared to the existing condition.	reductions are due for the most part to reduced flows from Lake Okeechobee that result from other project elements of the CERP program.	reductions are due for the most part to reduced flows from Lake Okeechobee that result from other project elements of the CERP program.	reductions are due for the most part to reduced flows from Lake Okeechobee that result from other project elements of the CERP program.	reduced flows from Lake Okeechobee that result from other project elements of the CERP program.
Sediment Quality	Sediment quality in the estuary is expected to continue to slowly degrade.	The reduction in sediment load will be on the order of 5% to 10% relative to existing without project conditions and approximately 30% relative to future without project conditions.	The reduction in sediment load will be on the order of 5% to 10% relative to existing without project conditions and approximately 30% relative to future without project conditions.	The reduction in sediment load will be on the order of 5% to 10% relative to existing without project conditions and approximately 30% relative to future without project conditions.	The reduction in sediment load will be on the order of 5% to 10% relative to existing without project conditions and approximately 30% relative to future without project conditions.
Plant Communities	Very little change from existing conditions	Construction will largely replace existing plant communities with aquatic habitat (water-covered reservoir areas) or maintained uplands (embankments, roads, berms); 7,970 acres of citrus trees will be removed and burned	Construction will largely replace existing plant communities with aquatic habitat (water-covered reservoir areas) or maintained uplands (embankments, roads, berms); 7,970 acres of citrus trees will be removed and burned	Construction will largely replace existing plant communities with aquatic habitat (water-covered reservoir areas) or maintained uplands (embankments, roads, berms); 7,970 acres of citrus trees will be removed and burned	Construction will largely replace existing plant communities with aquatic habitat (water-covered reservoir areas) or maintained uplands (embankments, roads, berms); 7,970 acres of citrus trees will be removed and burned
Wetlands	The 125 acres of wetlands scattered throughout the project site would likely remain; expansion of citrus operations could result in direct removal of some of these wetlands areas.	Loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding	Loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding	Loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding	Loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding
Fish and Wildlife	Continues to provide limited fish and wildlife habitat.	The reservoir will likely harbor fish typical of nearby canals. Amphibians and aquatic reptiles including frogs, turtles, snakes, and alligators will use the reservoir; limited foraging habitat for osprey, bald	The reservoir will likely harbor fish typical of nearby canals. Amphibians and aquatic reptiles including frogs, turtles, snakes, and alligators will use the reservoir; limited foraging habitat for osprey, bald eagle, terns, cormorant, and	The reservoir will likely harbor fish typical of nearby canals. Amphibians and aquatic reptiles including frogs, turtles, snakes, and alligators will use the reservoir; limited foraging habitat for osprey, bald eagle, terns, cormorant, and	The reservoir will likely harbor fish typical of nearby canals. Amphibians and aquatic reptiles including frogs, turtles, snakes, and alligators will use the reservoir; limited foraging habitat for osprey, bald eagle, terns, cormorant, and other aquatic birds that feed on fish

		eagle, terns, cormorant, and other aquatic birds that feed on fish	other aquatic birds that feed on fish	other aquatic birds that feed on fish	
Federal and State Listed Species	No immediate impacts to threatened or endangered species	Beneficial impacts to many T&E species. Impacts to most species would be same under all alternatives because the footprint is identical. The project may adversely affect the eastern indigo snake, Audubon's crested caracara, and the Florida panther	Beneficial impacts to many T&E species. USACE determined the project may adversely affect the eastern indigo snake, Audubon's crested caracara, and the Florida panther	Beneficial impacts to many T&E species. The project may adversely affect the eastern indigo snake, Audubon's crested caracara, and the Florida panther	Beneficial impacts to many T&E species. The project may adversely affect the eastern indigo snake, Audubon's crested caracara, and the Florida panther
Essential Fish Habitat	Essential fish habitat (EFH) in the Caloosahatchee estuary would continue to be adversely impacted by extreme high and low flows to the Caloosahatchee Estuary	Average Annual Habitat Unit Lift: 10628. AAHUs are based on estuarine species and a good indicator of improvement to EFH. This reservoir is expected to vastly improve the extent and health of essential fish habitat.	Average Annual Habitat Unit Lift: 12809 AAHUs are based on estuarine species and a good indicator of improvement to EFH. This reservoir is expected to vastly improve the extent and health of essential fish habitat. The USACE has determined that implementation of the project would not have an adverse impact on EFH or federally managed fisheries.	Average Annual Habitat Unit Lift: 16397 AAHUs are based on estuarine species and a good indicator of improvement to EFH. This reservoir is expected to vastly improve the extent and health of essential fish habitat.	Average Annual Habitat Unit Lift: 15907 AAHUs are based on estuarine species and a good indicator of improvement to EFH. This reservoir is expected to vastly improve the extent and health of essential fish habitat.
Estuarine Resources	Habitat Suitability Model results: Oyster HSI: .52 *Vallisneria* HSI: .20 Seagrass HSI: .54 Extreme Event: .30	Habitat Suitability Model results: Oyster HSI: .60 *Vallisneria* HSI:.31 Seagrass HSI:.59 Extreme Event: .42 Improved estuarine environment	Habitat Suitability Model Results: Oyster HSI: .60 *Vallisneria* HSI:.33 Seagrass HSI:.59 Extreme Event: .43 Improved estuarine environment	Habitat Suitability Model Results: Oyster HSI: .61 *Vallisneria* HSI:.35 Seagrass HSI:.59 Extreme Event: .45 Improved estuarine environment	Habitat Suitability Model Results: Oyster HSI: .61 *Vallisneria* HSI:.35 Seagrass HSI:.59 Extreme Event: .45 Improved estuarine environment
Land Use	SFWMD could continue to lease the lands for citrus production, sell the lands, or consider	All alternatives include the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir within the same	All alternatives include the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir within the same	All alternatives include the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir within the same	All alternatives include the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir within the same project

	another project; however, approval from DOI would be required	project footprint.	project footprint.	project footprint.	footprint.
Air Quality	Air quality is expected to be slightly degraded (due to regional increased populations and urbanization) while still complying with air quality standards.	Construction activities would temporarily increase dust within the proposed project area; The operation of pumps and other equipment associated with the proposed action may have some impact upon local air quality, primarily in the form of elevated particulates, nitrogen oxides, and volatile organic compounds.	Construction activities would temporarily increase dust within the proposed project area; The operation of pumps and other equipment associated with the proposed action may have some impact upon local air quality, primarily in the form of elevated particulates, nitrogen oxides, and volatile organic compounds.	Construction activities would temporarily increase dust within the proposed project area; The operation of pumps and other equipment associated with the proposed action may have some impact upon local air quality, primarily in the form of elevated particulates, nitrogen oxides, and volatile organic compounds. Larger pumps would result in a marginal increase in the air quality impacts.	Construction activities would temporarily increase dust within the proposed project area; The operation of pumps and other equipment associated with the proposed action may have some impact upon local air quality, primarily in the form of elevated particulates, nitrogen oxides, and volatile organic compounds. Larger pumps would have more impact. Larger pumps would result in a marginal increase in the air quality impacts.
Noise	No impact	Diesel pump PS-1 would be a 1500 cfs pump. Housing of pump station would minimize noise effects.	Diesel pump PS-1 would be a 1500 cfs pump. Housing of pump station would minimize noise effects.	With a larger pump station, more pumps would be needed which could result in more noise; however, housing of the pump station will minimize noise effects.	With a larger pump station, more pumps would be needed which could result in more noise; however, housing of the pump station will minimize noise effects.
HTRW	Site will pose only a typical HTRW risk to the environment similar to other citrus operations	Over 50 point source sites with potential HTRW contamination were identified. Most if not all of these potential contamination sites have either been remediated or further investigated to characterize the sites and prepare remediation plans.	Over 50 point source sites with potential HTRW contamination were identified. Most if not all of these potential contamination sites have either been remediated or further investigated to characterize the sites and prepare remediation plans.	Over 50 point source sites with potential HTRW contamination were identified. Most if not all of these potential contamination sites have either been remediated or further investigated to characterize the sites and prepare remediation plans.	Over 50 point source sites with potential HTRW contamination were identified. Most if not all of these potential contamination sites have either been remediated or further investigated to characterize the sites and prepare remediation plans.
Cultural Resources	The existing cultural resource site that may be potentially eligible for listing in the National Register of Historic Places would likely be adversely affected by expansion of the existing citrus	Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were	Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were determined to lack integrity	Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were determined to lack integrity	Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were determined to lack integrity and

	operations	determined to lack integrity and determined not eligible for listing on the National Register of Historic Places, the prehistoric archeological site (8HB129) is located near the edge of the proposed project and will be avoided by project design.	and determined not eligible for listing on the National Register of Historic Places, the prehistoric archeological site (8HB129) is located near the edge of the proposed project and will be avoided by project design.	and determined not eligible for listing on the National Register of Historic Places, the prehistoric archeological site (8HB129) is located near the edge of the proposed project and will be avoided by project design.	determined not eligible for listing on the National Register of Historic Places, the prehistoric archeological site (8HB129) is located near the edge of the proposed project and will be avoided by project design.
Socioeconics	Under "no action", no regional impact will be realized from project expenditures. The local economy would continue to realize revenue stemming from the continued agricultural operation of the property	Although the expenditures for the various alternative plans are quite large, and are expected to result in fairly large, regional economic impacts, these impacts are very small, relative to the regional economy in which they will take place (on the order of less than one percent).	Although the expenditures for the various alternative plans are quite large, and are expected to result in fairly large, regional economic impacts, these impacts are very small, relative to the regional economy in which they will take place (on the order of less than one percent).	Although the expenditures for the various alternative plans are quite large, and are expected to result in fairly large, regional economic impacts, these impacts are very small, relative to the regional economy in which they will take place (on the order of less than one percent).	Although the expenditures for the various alternative plans are quite large, and are expected to result in fairly large, regional economic impacts, these impacts are very small, relative to the regional economy in which they will take place (on the order of less than one percent).
Aesthetics	No impact	Dams (dam elevation of 54 feet) will be an abrupt landscape transition; The top of the enclosing levees, however, will provide wide panoramas of the Caloosahatchee River landscape, and should also offer good observation points	Dams (dam elevation of 57 feet) will be an abrupt landscape transition; The top of the enclosing levees, however, will provide wide panoramas of the Caloosahatchee River landscape, and should also offer good observation points	Dams (dam elevation of 57 feet) will be an abrupt landscape transition; The top of the enclosing levees, however, will provide wide panoramas of the Caloosahatchee River landscape, and should also offer good observation points	Dams (dam elevation of 66 feet) will be an abrupt landscape transition; The top of the enclosing levees, however, will provide wide panoramas of the Caloosahatchee River landscape, and should also offer good observation points
Recreation	No impact	Wildlife viewing, boating, hiking, and horseback riding provide recreation benefits.	Wildlife viewing, boating, hiking, and horseback riding provide recreation benefits.	Wildlife viewing, boating, hiking, and horseback riding provide recreation benefits.	Wildlife viewing, boating, hiking, and horseback riding provide recreation benefits.

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6.2 SUMMARY OF AFFECTED RESOURCES

Under the No Action Alternative, the Caloosahatchee Estuary would continue to be degraded due to excessive high and low flows. These episodes of abnormal flushing and hypersalinity would continue to adversely affect the overall health of the estuary. The project site would likely continue to operate as a citrus grove.

The project alternatives (Alternatives 2, 3B, 3C, and 4A) would all cause similar effects on resources within the project footprint and immediately adjacent to the project site since they utilize the same project footprint. ***Therefore some of the resources in this chapter are impacted by all four alternatives equally***. The difference among alternatives, in the cases where they do differ, would be of magnitude rather than type of impact, as the alternatives represent a graduated series of reservoir storage, pump size, and embankment heights from smallest (Alternative 2) to largest (Alternative 4A) while the location and footprint size of all alternatives is nearly the same.

The most significant beneficial effects of the proposed project would be achieved in the Caloosahatchee Estuary. Generally, estuary benefits would increase directly as storage/pumpage volume increases. All alternatives provide a significant benefit to the estuary. All alternatives can store water during the wet season for release when needed during the low flow periods. Removal of the highest peak flows and supplementing the low flow periods to the estuary will improve the salinity regime and result in a healthier estuarine environment.

Flows in the lower Caloosahatchee River will be improved during dry periods, when water is available in the reservoir for release into the river. These releases can supplement releases from Lake Okeechobee and avoid conversion of the upper estuary to a fully saline environment, which is detrimental to the growth of *Vallisneria,* a plant species of brackish water SAV. The majority of benefits accrued by this project would be a result of this supplement during the dry season. The project will provide limited benefits attributable to catching and storing high flow events during unusually wet years, when the storage capacity of Lake Okeechobee may not be enough to avoid high volume discharges of fresh water to the estuary, causing blow-outs or flushing of brackish water loving species.

None of these alternatives are capable of completely resolving the problems of the Caloosahatchee Estuary and Caloosahatchee River (C-43) Basin. None of the alternatives provide enough storage or pumping capacity to truly alleviate all extreme events. However, they all move towards restoration of the estuary by lowering the number and severity of extreme events and they all provide significant improvement to the health of the estuary. Based on a salinity model, the area within the Caloosahatchee Estuary system beneficially affected by the project conservatively encompasses 70,979 acres in the Caloosahatchee River, San Carlos Bay, and a portion of Pine Island Sound, although in all likelihood the area beneficially affected by project implementation will be much larger, including portions of Pine Island Sound, Estero Bay, and the Gulf of Mexico. These acres are within the navigable waters of the United States and within the navigational servitude of the United States.

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6.3 PHYSICAL LANDSCAPE

6.3.1 No Action Alternative

The No Action Alternative would not change the proposed reservoir site's operation as a citrus grove, nor would it affect other aspects of the physical landscape.

6.3.2 Alternatives 2, 3B, 3C, and 4A

With the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir under all alternatives, topography within the proposed project area would change significantly due to construction of the embankment and excavation of the perimeter canal. Impacts are anticipated to be similar with all of the reservoir alternatives; however, since the alternatives share the same footprint, increasing the reservoir storage capacity also increases the dam height. This in turn necessitates additional excavation of materials to form the larger, higher embankment. These elevations are significantly different and represent a significant change to the existing landscape. The dam elevations are listed below:

- Alternative 2: 54 feet
- Alternative 3b: 57 feet
- Alternative 3c: 57 feet
- Alternative 4A: 66 feet

Groundwater modeling completed for project assurances has predicted there will be no impact to the surficial aquifer. All of the deeper aquifers are below a confining layer; therefore no impact is expected to the lower aquifers.

Surficial sands (approximately upper three feet) in the footprint of the perimeter canal and portions of the reservoir would be removed on site for use as construction material for embankments. Excavation of the perimeter canal would result in removal of surficial sands, sandy clay material, and limestone. Material unsuitable for use in the embankments would be spread over the interior of the reservoir. The underlying regional geology would not be affected.

After the citrus trees are removed from the site, the areas formerly covered by citrus trees would be disced (one pass using a disc with a diameter of at least twelve inches). Exterior areas (near the embankments) would be excavated for embankment materials. Internal areas that are not covered by citrus trees (such as wetlands, canals, ditches, roads) may be left unaltered.

The soils on the project site are classified as unique farmland by the NRCS. Coordination was completed with U.S. Department of Agriculture (USDA)/NRCS and a determination was made that 13,300 acres of unique farmland would irretrievably be lost through conversion of the project site to an open water reservoir. Further design refinements reduced the potentially affected area to about 10,500 acres, which was confirmed with NRCS. This is a little less than five percent of the unique farmland in the county to be converted. Refer to the Pertinent Correspondence Annex B, correspondence with NRCS for details.

The project site includes 267 acres impacted by construction of reservoir test cells. These test cells would be incorporated into the interior reservoir. Portions of the embankments of both test cells would be breached with mounds of embankments left in place.

6.4 HYDROLOGY

6.4.1 No Action Alternative

The No Action Alternative does not improve hydrologic conditions in the Caloosahatchee Estuary and may lead to further estuarine habitat degradation. Extreme events of high flow periods during the wet season and low flow periods during the dry season would continue to occur.

6.4.2 Alternatives 2, 3B, 3C, and 4A

All of the alternatives improve hydrologic conditions by varying degrees dependent upon project components in the Caloosahatchee Estuary. Alternative 2 provides the least benefit, with Alternative 3B providing more and Alternatives 3C and 4A providing the most benefit. In general, the larger the alternative (both pump size and reservoir storage capacity), the more benefit the alternative provides to the estuary. A larger pump allows more flexibility in operations and is able to capture more of the high volume flows, while a larger capacity reservoir stores more water to augment flows in the dry season and allows more of the large flows to be stored in the wet season. The difference in ability of each alternative to match the desired flow envelope is significant. All alternatives would reduce damaging Lake Okeechobee releases of large volume flows to the estuary through the S-79 by capturing some of these flows in the reservoir. This water would then be available to supplement flows during the dry season when minimal flows for estuarine health can often not be met. The table below summarizes the percentage of time each alternative matches the desired envelope within the preferred flow target (EST05) (***Table 6-2***):

TABLE 6-2: PERCENTAGE OF TIME EACH ALTERNATIVE MATCHES THE DESIRED ENVELOPE WITHIN THE PREFERRED FLOW TARGET (EST05):

Alternative	% Flows in Desired Envelope
2050 FWO	45.5%
Alt 2	67.9%
Alt 3B	74.8%
Alt 3C	82.3%
Alt 4A	83.8%

Within and immediately surrounding the proposed project site there would be some minor impacts to hydrology. The Roberts Canal would be re-routed around the reservoir through the perimeter canal. This would result in the Banana Branch Canal (north of the reservoir) and Ft. Simmons Branch receiving its flows from the perimeter canal. When cell two of the reservoir is dry, pump station four will be used to pump out of cell one and around the perimeter canal in order to maintain levels in the Banana Branch Canal.

The Roberts Canal would serve as a water source for the perimeter canal. The local reservoir MIKESHE Modeling (for the SAP, Alternative 3B) groundwater level analysis included the Okaloacoochee Slough (***Annex C Figure 1***, Location 7). The model results show that with the project there would be no difference to existing conditions (***Annex C, Figure 2-G***). The project footprint, project operations, and project purpose would be the same with all of the reservoir alternatives; therefore, Alternatives 2, 3C, and 4 are not anticipated to adversely affect water levels in the Okaloacoochee Slough. However, under all of the alternatives, monitoring would be required to ensure that no impacts to existing groundwater levels occur.

Currently groundwater seeps from the project site north towards the river. All of the reservoir alternatives include a slurry wall within the embankment to effectively prevent this seepage. Due to a higher embankment under Alternative 4A, it may not be possible to construct a continuous slurry wall that could extend from the subsurface clay layer to the top of the embankment. Alternative seepage control would be necessary for Alternative 4A. Once constructed the perimeter canal will provide this groundwater flow to the areas north of the project. In order to minimize the disturbance to the natural groundwater flow, the perimeter canal will be kept at levels adequate to maintain existing levels of groundwater in the area.

Another potential hydrologic change may occur as a result of removing the siltation structure at the union of the Townsend Canal and Caloosahatchee River. This structure is being removed in order to increase flow velocities. However, the removal of this structure will allow free flow to occur between the Townsend and Caloosahatchee River and would result in the northern portion of the Townsend Canal being at the same stage as the river. This is not expected to cause any negative impacts but is noted since it will change hydrology in the immediate area.

6.5 WATER MANAGEMENT

6.5.1 No Action Alternative

Lake Okeechobee releases would continue as dictated by the current LORS. Without additional water storage in the Caloosahatchee River (C-43) Basin there will be insufficient capacity in Lake Okeechobee to retain storage during the wettest months or years without large volume releases to both Caloosahatchee River and St. Lucie estuaries, and it is likely that large pulse releases would continue to affect the estuary at least during extreme years. In addition, it is likely that harmful low flows in the dry season would also continue. Additional demands on Lake Okeechobee may decrease the magnitude of large pulses being released. However, increased watershed runoff due to an increase in urban areas would likely result in continued events which may effect the estuarine habitat.

6.5.2 Alternatives 2, 3B, 3C, and 4A

The proposed Caloosahatchee River (C43) West Basin Storage Reservoir in all alternatives would be designed as a storage area which could receive water from the following sources:

- Caloosahatchee River (C-43 Canal) water via Townsend Canal
- Drainage water from southwest of the reservoir via Townsend Canal
- Drainage water from southeast of the reservoir via Roberts Canal

Management measures included as part of all alternatives include canal improvements, culverts and culvert enlargements, pumping stations, inlet and outlet structures, levees, and seepage canal. These all serve to divert water to the reservoir in times of high flow and release water from the reservoir in times when the estuary would benefit from additional flows. Water can only go into and out of the reservoir via the perimeter canal

If there is more drainage coming from the Roberts Canal during the wet season than the Banana Branch, Fort Simmons Branch, and Townsend Canal can take, and the reservoir pump station is on at that time, these flows may be “indirectly"

picked up by the reservoir when the reservoir has capacity. The same holds true for the drainage from the Townsend Canal back to the Caloosahatchee River. If the reservoir pump station was on at the same time, this flow would be picked up along with the water pulled in from the Caloosahatchee River.
The storage capacities and pump sizes of the alternatives are outlined below:

- Alternative 2 100,000 ac/ft, 1500 cfs pump
- Alternative 3B 170,000 ac/ft, 1500 cfs pump
- Alternative 3C 170,000 ac/ft, 3800 cfs pump
- Alternative 4A 220,000 ac/ft, 3800 cfs pump

The reservoirs with the larger storage capacity would allow the water managers greater flexibility in operations, due to the ability to both capture and release more often. This is a significant improvement over the no action alternative. This flexibility is apparent in the reduction of weekly average flow events >4500 cfs over S-79 compared to the No Action Alternative:

- Alternative 2 82% reduction
- Alternative 3B 82% reduction
- Alternative 3C 91% reduction
- Alternative 4A 91% reduction

The S-79 gate would be operated to mimic EST05, which is a time series of flow derived from biological indicators in the Caloosahatchee Estuary (see Section C.6 in the Environmental Appendix.). Operations of this gate are currently and will continue to be discussed on a weekly basis between the SFWMD and USACE to discuss the state of the estuary and what flows would be most appropriate.

The existing water management system in the Caloosahatchee River (C-43) basin will be modified by the proposed reservoir to enhance water storage. The LORS may be adjusted to take advantage of additional off-lake water storage capacity as it is constructed and becomes operational.

It is possible that this reservoir may extend periods of full storage capacity as well as little to no storage capacity being used. The basic operational scenario is as follows (See ***Annex D***):

- Beginning of dry season– conservatively release water from reservoir
- End of dry season– aggressively release water from reservoir
- Beginning of wet season conservatively pump water into reservoir
- End of wet season aggressively pump water into reservoir

These operational constraints will be balanced with the needs of the estuary in order to best manage the water in the basin.

6.6 WATER SUPPLY

6.6.1 "No Action" Alternative

Lake Okeechobee releases would continue as dictated by the current LORS. Without additional water storage in the Caloosahatchee River (C-43) Basin there will be insufficient capacity in Lake Okeechobee to retain storage during the wettest months or years without large volume releases to both Caloosahatchee and St. Lucie estuaries, and it is likely that large volume releases would continue during wet years. In addition, it is likely that insufficient low flows in the dry season would also continue. Additional demands on Lake Okeechobee may decrease the magnitude of high volume releases. However, increased watershed runoff due to an increase in urban areas would likely result in continued events which may affect the estuary in some cases.

Existing water supply conditions would be maintained. Undesirable low flows and insufficient water for lower watershed operations will continue to occur during some very dry years.

6.6.2 Alternative 3B

The operations for this project focus on reducing high volume flows from S-79 and provide supplemental flows across S-79 to the Caloosahatchee Estuary to achieve restoration targets. Sources of water to meet agricultural and urban demand in the Caloosahatchee Basin will remain the same as before the project. Sources of water for the Seminole and Miccosukee Tribes and Everglades National Park (ENP) are influenced by the regional water management system (C&SF Project, including Lake Okeechobee), and will not be affected by this project. Therefore, there will be no elimination as a result of this project on existing legal sources of supply for:

- Agricultural or urban water supply
- Allocation or entitlement to the Seminole Indian Tribe of Florida under Section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e)
- Water supply for Miccosukee Tribe of Florida
- Water supply for ENP
- Water supply for fish and wildlife

With the project in place, portions of the Roberts Canal and Header Canal will become part of the project footprint. To continue to provide an irrigation source to the Bob Paul property, which currently pumps irrigation water from the Header Canal and the Crawford Canal, pump station #3 was included in the reservoir perimeter canal to pump water to the east down the remaining Header canal assuring the same volume of water is available compared to existing conditions. This will result in a partial transfer of water. The Crawford Canal will still be available to the Bob Paul property and is not affected by the project.

6.6.3 Alternatives 2, 3C, and 4A

The project footprint for Alternatives 2, 3C and 4 will remain the same with only embankment height and pump size changes as described in Section 5.4.1. While the updated system-wide spread sheet analysis and local reservoir level MIKESHE model was applied to the TSP and to date has not been applied to the alternatives, operations and project purpose remain the same as described in the TSP. Therefore, it is expected that sources of water to meet agricultural and urban demand in the Caloosahatchee Basin will remain the same as before the project. Sources of water for the Seminole and Miccosukee Tribes and ENP are influenced by the regional water management system (C&SF Project, including Lake Okeechobee), and will not be affected by this project. Therefore, there will be no elimination or transfer as a result of this project on existing legal sources of supply for:

- Agricultural or urban water supply
- Allocation or entitlement to the Seminole Indian Tribe of Florida under Section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e)
- Water supply for Miccosukee Tribe of Florida
- Water supply for ENP
- Water supply for fish and wildlife

6.7 FLOOD PROTECTION

6.7.1 No Action Alternative

With the No Action Alternative existing water supply conditions would be maintained. Undesirable low flows and insufficient water for lower watershed operations will continue to occur during some very dry years.

Existing levels of flood protection would be maintained. There will be no significant impact on flood protection for any alternative.

6.7.2 Alternative 3B

The intent of the level of service analysis for flood protection, required by WRDA 2000 and the CERP Programmatic Regulations as well as Florida State law regarding the implementation of CERP, is to ensure that CERP components do not negatively impact existing levels of flood protection.

The operations of this project will not change the operations of the Caloosahatchee River (C-43) Canal based on the key assumptions outlined in the Federal Assurances and Savings Clause Analysis, Section 8.4. Therefore, there will be no system-wide effects on flood protection as a result of the project.

The MIKESHE model was used to evaluate flood protection by evaluating groundwater levels to determine if they were altered due to reservoir operations. A significant change in groundwater levels could signify a potential impact to flood protection. The results from the local reservoir-level MIKESHE modeling indicate a boundary slurry wall within the embankment will prevent seepage out of the reservoir and impacts to groundwater levels. In addition, optimization of the operating levels of the seepage canals and canal structures surrounding the reservoir will maintain existing groundwater levels adjacent to the project.

Of the eleven locations evaluated using the MIKESHE model, the only location where simulated groundwater elevations increased compared to the without-project conditions was north of the project. Simulated "with project" groundwater elevations increased slightly compared to the "without project" condition. The greatest difference was during the dry period (e.g., 1981) not the wet periods. This minor effect can be addressed through further optimization of perimeter canal control structure operations for the project. The remaining ten locations show practically no differences in groundwater elevations.

Therefore, there will be no adverse affects on existing levels of service for flood protection in the vicinity of the reservoir.

6.7.3 Alternative 2, 3C, and 4A

As described above, the project footprint for Alternatives 2, 3C and 4 will remain the same with only embankment height and pump size changes as described in Section 5.4.1. The cut-off slurry wall included in the SAP embankment to attenuate seepage will also be included in the alternative embankments for Alternative 2 and 3C. Due to construction equipment constraints and embankment height, a continuous slurry wall would not be practicable under Alternative 4A; however, alternate seepage control methodologies would be investigated. While the local reservoir level MIKESHE model groundwater analysis was applied to the SAP and to date has not been applied to the alternatives, operations and project purpose remain the same as described in the SAP.

Therefore, it is anticipated there will be no adverse affects on existing levels of service to flood protection in the vicinity of the reservoir.

6.8 WATER QUALITY

6.8.1 No Action Alternative

Future water quality conditions in the basin will be strongly influenced by future land use, the operation schedule of Lake Okeechobee, and the implementation of BMPs to control nutrient discharges. In the immediate vicinity of the project, the Townsend Canal will likely continue to be impaired for copper as long as citrus is cultivated on the project lands. Since the 2050 population will be substantially greater than the year 2000 population, the quantity of treated wastewater effluent discharged to the estuary will increase. However, with the expected implementation of TMDLs for the discharge of nutrients into the estuary, it is reasonable to expect that by 2050 most existing wastewater treatment plants and all future plants will incorporate tertiary treatment process to remove nutrients. If the TMDL program is effective, the 2050 nutrient loads from wastewater effluent will be similar to or less than the present nutrient loads.

Future water quality conditions will depend upon the overall change in nutrient loads delivered to the estuary from upstream of S-79 as well as below this structure. Nutrient loads to the estuary will likely increase by ten percent or more if no BMPs or nutrient TMDLs are implemented in the Caloosahatchee Basin. If the implementation of BMPs substantially reduces non-point source nutrient loads, discharges from Lake Okeechobee are significantly reduced, and tertiary wastewater treatment is implemented basin wide, the 2050 Future Without nutrient loads may decrease by more than 30 percent as compared to the existing condition. This scenario would result in fewer violations of water quality standards at least for nutrients and coliforms. The number of water bodies in the basin listed as impaired for other pollutants such as heavy metals is likely to increase as the basin becomes more developed.

6.8.2 Alternatives 2, 3B, 3C, and 4A

Under the conservative assumption that no water quality treatment occurs in the reservoir, the project alternatives would show the following reduction in TP and TN loads at S-79 in comparison to the future without condition (***Table 6-3***).

TABLE 6-3: REDUCTION IN TP AND TN LOADS AT S-79 IN COMPARISON TO THE FWO CONDITION

Alternative	TP% Reduction	TN% Reduction
FWO 2050	0	0
Alt. 2	30%	29%
Alt. 3B	29%	28%
Alt. 3C	32%	31%
Alt. 4A	34%	32%

The difference in load reduction between alternatives is not significant. Although the size of the reservoir and the pump have some influence on the S-79 pollutant load, the reduction in nutrient loads at S-79 is largely the result of the reduction in discharges from Lake Okeechobee. In other words, the majority of load reduction shown in ***Table 6-3*** will result from project elements of CERP other than the C-43 Basin Storage Reservoir project itself. All of the selected alternatives will cause a shift in nutrient load from the wet season to the dry season; however, all of the alternatives will decrease the frequency in which the monthly TN load exceeds the dry season, wet season, and annual targets established by the FDEP (dry-season 190 tons/month, wet-season 350 tons/month, annual 3,000 tons/month). While it is possible that nitrogen fixation within the reservoir will result in short-term increases in TN loading to S-79, the average annual TN load at S-79 will be reduced. Given the uncertainty in the threshold chlorophyll-a concentration required for the restoration of the ecological function of the estuary, the degree to which the reservoir project will improve downstream water quality is unknown at this time. However, each of the alternatives results in an improvement in overall average water quality conditions at S-79 as well as downstream in the estuary.

Section 303(d) of the CWA requires states to develop a list of waters not meeting water quality standards or not supporting their designated uses. Those waters not meeting water quality standards are designated as "impaired". TMDLs are required for the waters determined to be impaired. A summary of the current list of impaired water bodies in the Caloosahatchee Basin is included in the existing conditions section of this report. Using the current list as a baseline, the impact of the project on future compliance with state water quality standards can be estimated. Under the with project condition, the Townsend Canal will likely no longer be impaired for copper and lead since the much of the farmland in this sub-basin will be within the reservoir footprint. Several of the downstream estuary bodies that are presently impaired for nutrients will likely no longer be impaired since the project will significantly decrease nutrient loads to the estuary. Estuary water bodies that are currently impaired for heavy metals will likely continue to be impaired for these pollutants since this contamination is a result of the urbanization of the estuary sub-basin. Similarly, impairments of sub-basin water bodies not directly affected by S-79 discharges will not be influenced by the construction of the project. Based on the evidence presented here, it appears that the project will not cause or contribute to water quality degradation and will likely reduce the number of and intensity of violations of water quality standards.

6.9 SEDIMENT QUALITY

6.9.1 No Action Alternative

Under the No Action Alternative, the sediment quality in the estuary is expected to continue to slowly degrade. The conversion of farms and pastures to urban developments over the next 50 years will increase the concentrations of heavy metals and hydrocarbons in stormwater runoff. Many of these pollutants will become entrained in the estuary sediments despite the requirement to include stormwater treatment facilities in all new developments. Unless additional stormwater control such as retrofitting existing development is implemented, the rate at which the estuary sediments degrade may increase somewhat since the overall quantity of stormwater and sediment load to the estuary will increase.

6.9.2 Alternatives 2, 3B, 3C, and 4A

The with project total load of sediments transported to the estuary from the freshwater Caloosahatchee sub-basin will be reduced relative to future without conditions since some fraction of the available sediment load will be retained within the reservoir. Additionally, since construction of the reservoir will reduce the total area of farmed land by some 10,500 acres, sediment transport associated with farming this acreage will also no longer be transported to the estuary. The reduction in sediment load will be on the order of five percent to ten percent relative to existing without project conditions and approximately 30 percent relative to future without project conditions. The difference between alternatives would be minimal. This reduction in sediment delivered to the estuary should result in a slight improvement in sediment quality relative to without project conditions. However, since urbanization of the basin will continue over the next 50 years, non-project related anthropogenic impacts will likely result in the continued degradation of estuary sediment quality over time.

6.10 PLANT COMMUNITIES

The impacts described below are applicable to plant communities within the project site. Estuarine plant communities (such as SAV) are addressed in Section 6.12.4, Estuarine Resources. *Plant communities would be impacted by all four alternatives equally.*

6.10.1 No Action Alternative

The lands within the project area would be developed consistent with surrounding land use patterns. The surrounding areas are predicted to be in agricultural production, as at present, in 2050. If the site remained a citrus grove, there would be very little change to the plant communities under the No Action Alternative. There may be a slight change in the density and distribution of exotic species along the perimeters and canals. The areas in production are controlled for noxious species. However, along the canals and perimeter there is a variety of exotic species. These may change due to biological control of existing noxious plants as well as the introduction of new exotic species into the south Florida ecosystem.

6.10.2 Alternatives 2, 3B, 3C, and 4A

Under all alternatives, an above ground reservoir with associated seepage canals and embankments would be constructed. Most existing plant cover within the project footprint would be removed. This is a significant impact to existing plant communities and would be equally significant among all alternatives.

Preparation for construction of the reservoir includes the removal and burning of all citrus trees within the project footprint. The total area of tree removal is approximately 7,970 acres. Only trees located in the cultivated citrus areas of the project will be removed. No other trees or vegetation within the project area will be removed. The remaining vegetation, including vegetation found in irrigation and drainage ditches, swales, canals, jurisdictional wetlands, and areas noted as contaminated soils within the project footprint will not be removed.

In general, construction will largely replace existing plant communities with aquatic habitat (water-covered reservoir areas) or maintained uplands (embankments, roads, berms). The construction of the reservoir and seepage canal may provide some deepwater refugia and/or littoral habitat for use by fish and amphibian species when the reservoir is drawn down. The operational plan for the reservoir, in order to meet the project objectives, constrains the ability of the project site (either reservoir or seepage canal) to be optimized for management as habitat for fish and wildlife. The reservoir would likely experience wide-ranging depth and duration fluctuations throughout the year ranging from complete dry down to full capacity i.e., 15-25 feet above soil surface, on an annual basis. This would potentially impact the survival of any wetland species and provide limited benefits to opportunistic plants that could adapt to such environmental dynamics.

The interior of the reservoir will lack much productive littoral zone because of the necessity to construct relatively steep sides to maximize water storage capacity. The design for the perimeter canals, however, includes littoral areas in the corners and along some of the banks.

Exotic plant species are not expected to be a problem under any of the alternatives, as appropriate construction and maintenance procedures would be established to deter and control exotic establishment at the project site.

6.11 WETLANDS

6.11.1 No Action Alternative

If the project site remained a citrus grove, the 125 acres of wetlands scattered throughout the project site would likely remain. (An additional 6.39 acres of wetlands present within the project site were previously impacted by discharge of fill material during construction of the C-43 Test Cell Project.) The function and value of the existing wetlands would continue to deteriorate due to infestation by exotic plant species and due to reduced hydroperiod from agricultural operations. Additionally, expansion of citrus operations could result in direct removal of some of these wetlands areas.

6.11.2 Alternatives 2, 3B, 3C, and 4A

Construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir will result in the loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding. This includes the total acreage of a wetland on the eastern portion of the project that will be bifurcated and partially impacted by construction activities. This acreage does not include wetlands previously impacted by the C-43 Test Cell Project. *This loss would be the same for all reservoir alternatives since the project footprint is nearly identical.* Operation of the reservoir to meet the project water storage and release objectives constrains its management for wetland function and habitat. Therefore, it is assumed that all wetlands within the project area will be eliminated. Currently, the design for the reservoir perimeter canals includes approximately 109 acres of littoral areas in the corners and along some of the banks.

E.O. 11990, Protection of Wetlands, was created to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. The area proposed for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project is mostly farmland with a few disturbed wetlands. The reservoir design will include areas of littoral shelf along the seepage canal. This littoral shelf will create some new habitat which will help to minimize the impact of the loss of wetlands due to construction of the reservoir. There will be no mitigation for wetlands as a result of the federal project. Overall, CERP projects are expected to have a net positive lift of wetland function. The C&SF Project Comprehensive Review Study ("Yellow Book") states in Section 9.6 that "…construction features of the Comprehensive Plan will be designed to first avoid and then minimize unavoidable impacts to wetlands or other aquatic sites and natural upland habitats. Unavoidable impacts to these habitats are expected to be offset by the ecological improvement throughout the south Florida ecosystem that results from the overall restoration achieved by the Comprehensive Plan. Accordingly, separate compensatory mitigation features are not included in the recommended Comprehensive Plan for these impacts." The state's Accler8 program may have separate wetland mitigation requirements for this project as a result of their permitting process. A wetland rapid assessment procedure (WRAP) was performed in 2004 to determine impacts of wetland function related to the proposed project. Additional information on wetlands can be found in the Final CAR in *Annex A*.

6.12 FISH AND WILDLIFE RESOURCES

This section will discuss the fish and wildlife impacts at the reservoir footprint, as well as all threatened and endangered species impacts. Impacts to the estuarine fish and wildlife resources are addressed in Section 6.12.4. *Impacts to fish and wildlife resources at the project site would be impacted by all four alternatives equally.* There will be significant, mostly beneficial, impacts to fish and wildlife resources.

6.12.1 No Action Alternative

The agricultural operation associated with the No Action Alternative would continue to provide some level of fish and wildlife resources, similar to existing conditions.

6.12.2 Alternatives 2, 3B, 3C, and 4A

Small areas of existing open water habitat would be lost under the construction footprint. Once the reservoir is filled aquatic (open water) habitat will substantially increase. The open water reservoir will likely harbor fish typical of nearby canals. Water would be conveyed to the reservoir by these canals which also act as conduits for the introduction of many aquatic organisms, including fish. Due to the operation of the pumps there will likely be some entrainment and impingement of fish and other aquatic organisms. The larger pumps (alternatives 3C and 4A) will likely increase the impingement and entrainment impacts. Species that will likely inhabit the reservoir include: largemouth bass, black crappie, red ear sunfish, shad, bluegill, and mosquitofish, among others. A high population of invertebrates is not expected, due largely to a lack of emergent vegetation. Shallow water fish bedding and rearing habitat will be limited to the margins of the reservoir. The design of the reservoir perimeter canal, however, includes littoral areas for fish and wildlife use.

Amphibians and aquatic reptiles including frogs, turtles, snakes, and alligators will likely inhabit the deepwater reservoir. Limited emergent vegetation in the reservoir will also affect these organisms by reducing available forage, cover, and reproductive habitat. The reservoir will likely create limited foraging habitat for osprey, bald eagle, terns, cormorant, and other aquatic birds that feed on fish. Ducks may also use the reservoir, but low cover of submergent and emergent vegetation may limit the habitat value. Mammals in the reservoir will likely be limited to river otter.

Flooding a large area may create insect or rodent problems. If such problems occur, the SFWMD operations and maintenance staff will address these issues on an as-needed basis.

Additionally, the project site contains 899.59 acres of primary, secondary, and tertiary ditches. (Construction of the test cells has resulted in loss of 26.03 acres of tertiary ditches not included in this acreage). Ditches underlying the footprint of the open water portion of the reservoir will provide deepwater refugia to aquatic invertebrates, fish, and wading birds during periods when the rest of the reservoir is dry.

Prior to flooding of the reservoir, portions of the test cells embankments will be demolished in a few locations leaving some embankment mounds in place for wildlife when the reservoir is full.

Threatened and endangered species would be impacted by all four alternatives equally unless otherwise noted.

6.13 FEDERAL AND STATE LISTED SPECIES

6.13.1 No Action Alternative

Under the No Action Alternative, there would be no immediate impacts to threatened or endangered species. Use of the site by federal and state listed species would continue. Under the "No Action" Alternative including future without, continued degradation of marine seagrasses and *Vallisneria sp*. in the estuary would be harmful to the survival of the endangered West Indian Manatee.

6.13.2 Alternatives 2, 3B, 3C, and 4A

The USFWS has been an active member of the project team for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project and has provided guidance through informal consultation during plan formulation and evaluation. The USFWS provided a Biological Opinion on November 30, 2005, for construction of the Caloosahatchee River (C-43) West Basin Storage reservoir test cells, an area of approximately 267 acres. This area is not included in the ongoing Section 7 evaluation for the reservoir since consultation has been completed; therefore, the 267 acres associated with the test cells are not discussed in this section.

The USACE Regulatory Division's January 10, 2007, letters to the USFWS and NMFS transmitted the Final Biological Assessment for the Caloosahatchee River (C-43) West Basin Storage Reservoir (see Annex A). These documents describe the potential effects of the proposed Caloosahatchee River (C-43) West Basin Storage Reservoir project on federally listed threatened and endangered species. The USACE determined that the Caloosahatchee River (C-43) West Basin Storage Reservoir Project would not affect the bald eagle (de-listed effective August 8, 2007), Florida scrub jay, Florida grasshopper sparrow, red cockaded woodpecker, Okeechobee gourd, or the beautiful pawpaw because they do not occur within or adjacent to reservoir footprint, nor would there be direct or indirect impacts to those species. The USACE determined that the proposed project may affect, but is not likely to adversely affect the smalltooth sawfish, wood stork, West Indian manatee, Everglade snail kite, American crocodile, piping plover, or the green, hawksbill, leatherback, Kemp's ridley or loggerhead sea turtles. The American crocodile, piping plover, or the green, leatherback, Kemp's ridley and loggerhead sea turtles do not occur within or adjacent to the reservoir footprint and indirect effects resulting from operation of the reservoir are expected to be negligible, discountable or beneficial to those species. Additionally, wintering piping plover critical habitat will not be adversely modified by the proposed project. Additionally, the USACE determined the project may adversely affect the eastern indigo snake, Audubon's crested caracara, and the Florida panther and requested initiation of formal consultation for these species in the January 10, 2007 letter. Formal consultation for all species was completed per a Biological Opinion (BO) transmitted from the USFWS to the USACE dated July 20, 2007. A copy of the BO is located in *Annex A*.

The following is a summary of the effects on the remaining federally-listed species not already discussed in this section. These impacts are considered significant (although largely beneficial) but would be similar for all alternatives.

6.13.2.1 Wood Stork

The Caloosahatchee River (C-43) West Basin Storage Reservoir project area is within the CFA of three wood stork rookeries as discussed in Section 2.8.7.2. Construction of the reservoir will result in the loss of approximately 785 acres of potential wood stork foraging habitat within the reservoir footprint. This includes wetlands and secondary and tertiary drainage canals. The proposed project would improve salinity conditions during the dry season for 4,130 acres of *Vallisneria* beds in the upper Caloosahatchee estuary. Two of the wood stork rookeries are located on mangrove islands within the upper estuary and would directly benefit from the proposed project. Additionally, the proposed project is not expected to alter the hydroperiod of freshwater wetlands outside of the project footprint but within the wood stork CFAs as recommended in the USFWS' Habitat Management Guidelines for the Wood Stork in the Southeast

Region. The reservoir may intermittently provide foraging habitat for wood storks during the dry season if/when water releases for the estuary are great enough to create optimal shallow-water foraging areas with concentrated prey in the reservoir. Thus, the USACE has made the determination that construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir may affect, but is not likely to adversely affect, the wood stork.

6.13.2.2 Everglade Snail Kite

No known snail kite nesting locations are documented within or adjacent to the reservoir site, and no designated critical habitat occurs within or adjacent to the project area. Snail kites have a specific diet comprised almost entirely of apple snails. Snail kite use of the site is low at present with apple snails having been documented only in the larger canals near the test cell project. Citrus operations in the project area and elsewhere have routinely applied heavy copper treatments as a fungicide for many years, resulting in extensive copper contamination in the soil. Potential copper risk to the endangered snail kite may occur due to copper accumulation in the kite's primary food item, the apple snail (URS 2003). Copper concentrations in the soils within the project area range from 13.1 to 169.0 mg/kg (URS Corporation 2003). Approximately nine percent of the sample concentrations within the project area exceed the interim effects level of 85 mg/kg agreed upon by the USFWS and SFWMD until a study to evaluate that value for the snail kite is completed. Those areas will be remediated before project construction. Construction of the reservoir would infrequently provide habitat for the snail kite as water levels would experience wide-ranging depth and duration fluctuations from complete dry down to 15 - 25 feet above soil surface, potentially impacting the survival of most wetland species. However, such widely fluctuating water levels are unlikely to provide suitable habitat for apple snails, and thus snail kite use is not expected. However, the perimeter canal may provide wetland vegetation for survival of apple snails in littoral areas created from uneven edges. The perimeter canal could potentially attract or increase usage of snail kites, providing foraging habitat but this use would be dependent on the presence of apple snails and appropriate perching sites. The USACE has therefore determined the project may affect, but is not likely to adversely effect, the Everglade snail kite and its' critical habitat.

6.13.2.3 West Indian Manatee

Manatees are known to use major inland freshwater waterways and canals, including the Caloosahatchee River from Lake Okeechobee to the Gulf of Mexico (i.e., Glades, Hendry, and Lee Counties). They are highly mobile and may be found in all waters accessible to them, including the Townsend Canal on the western side of the project footprint. When water levels are high in the Caloosahatchee River, manatees are capable of passing over the existing weir or through a flap gate into the Townsend Canal and have been observed at the Berry Groves main pump station. However, manatees cannot access the main distribution canal (i.e., Header Canal) on the project site due to differences in elevation.

The Townsend Canal will serve as the intake canal for the reservoir. The weir will be removed, portions of the canal will be widened and armored, and two new pump stations will be constructed. In order to reduce the likelihood of thermal stress to manatees (due to warmer water from the reservoir being released into cooler canal and river water), the weir will be replaced with a structure that serves either as a permanent barrier or a seasonal barrier which restricts manatee access to the Townsend Canal only during the winter season (November 1 through March 31). A monitoring plan (described in the BO) will also be implemented when needed during the winter months. Thus, manatees in the river may continue to have seasonal access to the Townsend Canal where the two reservoir intake pump stations (i.e., C-43PS-1 and C-43PS-4) will be located. However, both intake pumps will include bar screens and trash rake systems that will prevent manatees from becoming trapped in the intake pipes as well as from entering the reservoir through C-43PS-1 or the perimeter canal through C-43PS-4, and reduce the likelihood of injury to manatees by the rake systems. The USFWS' manatee requirements for culverts, *Guidelines for Culverts Located in Manatee-Accessible CERP Projects* (USFWS 2006) and the *Standard Manatee Conditions for In-Water Work* (FWC 2005) will be followed. Manatee access to the pump intake will be blocked. Manatees feed on a variety of emergent, submergent, and floating vegetation. With implementation of the project, food sources for the manatee in the lower river and estuary will improve. Section 6.1.13.2 includes a discussion of estuarine resources that will improve as a result of the project. Therefore, the USACE has determined that the project "may affect but is not likely to adversely affect" the manatee.

6.13.2.4 Florida Panther

The proposed reservoir is within the current range of the Florida panther and will result in the conversion of approximately 10,335 acres of habitat suitable for use by the panther for foraging and dispersal to open water habitat. This acreage includes uplands i.e., agricultural lands, agricultural roads and embankments, as well as wetlands within the project area. (This acreage does not include suitable panther habitat within the test cells project area.) The project site is located within the Florida panther consultation area according to the USFWS' *Final Interim Standard Local Operating Procedures for Endangered Species for the Florida Panther* (USFWS 2000) and overlaps with the Florida panther "Primary", "Secondary", and "Other Habitat Zones" as defined in the report *How Much Is Enough? Landscape-scale Conservation for the Florida Panther* (Kautz et al. 2006) and in the *CERP Landscape Level Project Planning/Siting Map for Panther Conservation* (USFWS and FWC 2004:

Figure 15). A Biological Assessment (BA) including a panther cumulative impact analysis for a 25-mile radius action area around the project was prepared in December 2006, in order to evaluate the effects of the project on the Florida panther (See Annex A for a copy of the BA). Based on the BA, the USACE determined that the Caloosahatchee River (C-43) West Basin Storage Reservoir Project "may affect" the Florida panther and requested initiation of formal consultation with the USFWS on January 10, 2007.

In February 2007, the USACE and USFWS implemented a revised Panther Key and Panther Focus Area Map for use in determining effects to the Florida panther. In June 2007, the USACE and SFWMD provided the USFWS with an updated panther cumulative impact analysis based on the new information. On July 23, 2007, the USFWS terminated formal consultation for the Florida panther with a Biological Opinion (BO). The USFWS is using a system-wide approach for assessing impacts and benefits to panther habitat associated with the CERP Band 1/Acceler8 Projects. This includes maintaining a panther habitat mitigation ledger that shows individual projects that cause some habitat loss may be offset by habitat gains or improvements attributable to another project. The direct and indirect loss of 10,335 ac of panther habitat associated with this project as well as direct and indirect loss of panther habitat associated with other CERP Band 1/Acceler8 Projects will be offset through the preservation and restoration of approximately 102,129 ac of lands associated with implementation of the CERP Band 1/Acceler8 Projects (primarily Picayune Strand Restoration Project). This includes 63,099 ac, 5,290 ac, and 33,740 ac of habitat used by the panther within the Primary, Secondary, and Other Zones, respectively, to benefit the Florida panther and its prey. These lands, most of which have already been acquired for CERP, are located in the core area of occupied habitat. Acquisition of these lands for CERP has resulted in preservation of important lands that may otherwise be used for development. The majority of these lands are adjacent to other large tracts of natural and preserved lands (e.g., Picayune Strand State Forest), and are consistent with the USFWS' goal to locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

The USFWS does not anticipate construction of this project will result in the direct mortality or injury of any Florida panthers. The USFWS does however, anticipate indirect take of the panther in the form of harm and harassment because of potential increases in interspecific aggression within the 25-mile radius action area. Based on their analysis, the USFWS believes this level of take is not likely to jeopardize the continued existence of the Florida panther. The complete habitat loss and other project effects including the panther mitigation ledger are addressed in the biological opinion (BO) prepared by the USFWS (*Annex A*).

6.13.2.5 Eastern Indigo Snake

Specific information on the status of the eastern indigo snake within the project area is not available. However, indigo snakes are known to occur in the Caloosahatchee River Basin in low densities and are known to occur along roads and the banks of larger ditches and canals in citrus groves, particularly if burrows (e.g., tortoise, armadillo, small mammal, and/or land crab), debris piles, or other shelter are in close proximity. The network of ditches and canals also provide prey items. Therefore, the USACE assumes that eastern indigo snakes occupy the site, and are more prevalent where habitat and prey items are more plentiful. Potential impacts to indigo snakes may occur due to project-related activities including citrus tree removal and burning, habitat destruction and degradation, earthmoving, construction of the reservoir and associated structures and canals, and operation and maintenance of the project. This action may cause individuals to leave the area, abandon den sites, and miss foraging and/or mating opportunities. Snakes fleeing the area could be more vulnerable to predation. Potential direct impacts to the eastern indigo or its habitat include direct injury or mortality and loss of available habitat for foraging, breeding, and dispersing.

The USFWS' *Standard Indigo Snake Protection Conditions* will be implemented during construction to minimize potential adverse effects to indigo snakes (USFWS 2002). Those measures include: 1) providing indigo snake educational materials to construction employees prior to project initiation; 2) if a live indigo snake is found, construction activities will cease until the snake has left the project area on its' own accord and the location of sightings will be reported to the USFWS; and, 3) if a dead indigo snake is found, the snake will be frozen as soon as possible and the USFWS will be contacted immediately for further instructions. With these conservation measures in place the USACE determined the proposed reservoir project "may adversely affect" the eastern indigo snake and by letter dated January 10, 2007, requested initiation of formal consultation with the USFWS. The USFWS terminated consultation with a BO on July 23, 2007. Terms and conditions of the consultation require a slow initial hydration rate for the reservoir in order to allow the snakes sufficient time to move to other habitats. Subsequent rehydration after the first extended drydown event will be monitored and the rate will be re-evaluated based on results of that monitoring. The USFWS anticipates that the direct permanent loss of approximately 10,264 ac of eastern indigo snake habitat will occur through conversion of citrus grove to reservoir and associated embankments, canals, and other infrastructure. The USFWS anticipates up to 54 eastern indigo snakes will be taken incidental to the initial project construction and operations. Complete details of the habitat loss and other project effects are addressed in the BO prepared by the USFWS (*Annex A*).

6.13.2.6 Audubon's Crested Caracara

The reservoir footprint occurs with the secondary (6,600-foot radius from the nest tree) protection zones of two known caracara nest sites. Caracara have been observed foraging in the southeast portion of the project footprint that overlaps with the secondary zone of one nest. However, no construction activities or habitat loss would occur within the primary zone (985-foot radius from the nest tree) of either nest. Since it is anticipated that construction within the secondary zone would occur all year round including during the nesting season, the USACE determined that the proposed project "may adversely affect" the crested caracara and requested initiation of formal consultation with the USFWS by letter dated January 10. 2007. The USFWS terminated consultation with a BO on July 23, 2007. Terms and conditions of the consultation require that the Caracara pairs proximate to the C-43 site will be monitored during land cover conversion and construction of reservoirs associated with this project. The USFWS anticipates that the proposed action will incidentally take the federally listed caracara, though the level of incidental take may be difficult to detect and quantify. The USFWS anticipates that up to two adult pairs of caracaras could be taken as a result of this proposed action. This incidental take for adult birds is expected to be in the form of harassment. No direct killing or injuring of adult caracaras is anticipated. The USFWS also anticipates that disturbance may cause the loss of productivity (eggs or young) associated with up to two caracara nest sites for up to five consecutive breeding seasons. The USFWS anticipates that up to six caracara eggs or young (a maximum of three per nest) could be incidentally taken per year during the construction of the project. This take would be in the form of mortality. The complete habitat loss and other project effects are addressed in the BO prepared by the USFWS (*Annex A*).

6.13.3 Essential Fish Habitat

6.13.3.1 No Action Alternative

Under the No Action Alternative, essential fish habitat (EFH) would continue to be adversely impacted by extreme high and low flows to the Caloosahatchee Estuary. Decline of marine and estuarine grasses would continue as a result of alterations in the salinity regime and the unsuitable timing of the freshwater discharges from the S-79 structure.

6.13.3.2 Alternatives 2, 3B, 3C, and 4A

The intent of the Caloosahatchee River (C-43) West Basin Storage Reservoir project is to improve the quantity and timing of flows to the Caloosahatchee Estuary by reducing high flows during the wet season and augmenting low flows during the dry season. This reservoir is expected to vastly improve the extent and health of EFH predicted for the "without project" condition. Reducing salinity and nutrient fluctuations caused by large, pulsed freshwater flows would improve seagrass and mangrove habitat conditions in the downstream estuaries. With these improvements in water quality, the appropriate conditions for sensitive estuarine biota, such as species dependent on this habitat for egg, larval, and juvenile stages, are anticipated to benefit or rebound. These impacts are largely beneficial and are significant, and do vary in degree of improvement between alternatives.

The NMFS website (http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/) lists the Caloosahatchee Estuary as EFH for juvenile Brown shrimp (*Penaeus aztecus*), juvenile Gray snapper (*Lutjanus griseus*), juvenile Pink shrimp (*Penaeus duorarum*), adult and juvenile Red drum, (*Sciaenops ocellatus*), adult and juvenile Spanish mackerel (*Scomberomorus maculatus*), and juvenile Stone crab (*Menippe mercenaria*).

All of the construction features of the alternatives are well upstream of EFH and any juvenile or adult habitat for the listed species. Standard BMPs to reduce erosion and downstream turbidity will be included in the construction specifications. Construction should have no impact on EFH in the Caloosahatchee Estuary. The USACE requested that NMFS review the draft EIS and concur with the determination stated as required by the Magnuson-Stevens Fisheries Conservation and Management Act. The USACE has determined that implementation of the project would not have an adverse impact on EFH or federally managed fisheries. The NMFS agreed with this determination per an email dated 30 May 2007.

6.13.4 Estuarine Resources

6.13.4.1 No Action Alternative

Under the No Action Alternative, the estuarine habitat would continue to be degraded as described in the existing conditions due to altered freshwater inflows and extreme variation in salinity levels, and eutrophication. Some areas of habitat may be so badly degraded that it would no longer serve as suitable habitat for important estuarine species.

6.13.4.2 Alternatives 2, 3B, 3C, and 4A

All alternatives would improve the estuarine environment. These impacts are largely beneficial and are significant, and do vary in degree of improvement between alternatives. As already described, the larger alternatives and pumps (Alternative 3C and 4A) provide the largest benefit to the estuary, as they are able to capture more of the high flows as well as hold more water in storage to augment the low flows. Specifically, salinity at Ft. Myers would be expected to fluctuate less than at present, and less than under the smaller alternatives.

Vallisneria sp. would be expected to increase in density and spatial extent. Most importantly, *Vallisneria*.cover would be more consistent year to year. Under existing conditions, the *Vallisneria* is in an almost constant state of recovery. This reservoir may stabilize conditions enough to allow the *Vallisneria* to establish and maintain consistent beds in the estuary. Oysters are currently limited in their recruitment due to high flow events. The reservoir would allow oysters to better maintain their populations and reduce the loss of live oysters and spat. This would also be expected to increase their spatial cover. Marine seagrasses would also be expected to increase in density and spatial extent. These gains would be seen both horizontally and vertically. The vertical improvement (grasses present at deeper depths) would be due to the increased clarity of the water. This improvement to seagrasses would be most beneficial in the San Carlos Bay area and upstream of Shell Point.

6.14 LAND USE

6.14.1 No Action Alternative

The SFWMD owns most of the lands within the 10,700 acre project site. (Currently the SFWMD is exchanging 541.31 acres north of the reservoir boundary for the 600.1 acres of Bryan Paul Property.) The project lands are commonly referred to as Berry Groves and were purchased in 1999 using DOI's Federal funds and State funds for Everglades restoration purposes. The DOI, USACE, FDEP, and the SFWMD are parties to a Framework Agreement under which all interim uses of lands acquired with these funds must be consistent with the ultimate use of the property in a Congressionally authorized federal project for Everglades restoration. Under the No Action Alternative the SFWMD could continue to lease the lands for citrus production, sell the lands, or consider another project; however, approval from DOI would be required.

6.14.2 Alternatives 2, 3B, 3C, and 4A

All alternatives include the construction of the Caloosahatchee River (C-43) West Basin Storage Reservoir within the same project footprint. As stated above, the lands were purchased for Everglades restoration. Implementation on any of the alternatives would be consistent with the Framework Agreement. This is a significant impact to land use and would be comparable across all alternatives.

6.15 AIR QUALITY

6.15.1 No Action Alternative

The air quality for this area is considered good and the region attains all National Ambient Air Quality Standards. In the future under the No Action Alternative, air quality is expected to be slightly degraded (due to regional increased populations and urbanization) while still complying with air quality standards.

6.15.2 Alternatives 2, 3B, 3C, and 4A

Construction activities associated with implementing all alternatives would temporarily increase dust within the proposed project area. BMPs to control dust would be implemented during construction. All alternatives include the burning of citrus trees which may necessitate a local or state burning permit which the contractor would coordinate. Impacts to air quality are not expected to be significant and would not be significantly different across alternatives.

The operation of pumps and other equipment associated with the proposed action may have some impact upon local air quality, primarily in the form of elevated particulates, nitrogen oxides, and volatile organic compounds. Reservoir pumps and associated equipment would be powered by diesel engines or additional electric power with appropriate backup generators. The larger pumps associated with Alternatives 3C and 4 would result in a marginal increase in air quality impacts compared to the smaller pumps in Alternatives 2 and 3B.

Every Federally funded project must be consistent with state plans for implementing the provisions of the Clean Air Act Amendments (State Implementation Plans). This project is in conformance with the State Implementation Plan because it would not cause violations of the National Ambient Air Quality Standards.

6.16 NOISE

6.16.1 No Action Alternative

Within the major natural areas of south Florida, external sources of noise are limited and of low occurrence. With the No Action Alternative, noise is expected to be similar to the existing condition, which is mostly limited to agricultural machinery and a 300 cfs pump station that is exposed.

6.16.2 Alternatives 2, 3B, 3C, and 4A

Noise impacts associated with all alternatives would not increase over what presently exists within the project area. Noise impacts would not be significant and would be similar across all alternatives. Temporary increases in noise levels would be expected during construction of any of the alternatives; however, this would be limited to the immediate area of construction. This noise would mostly consist of typical construction equipment which generates an average of 80-88 dBA at 50 ft. This impact should be minimal as the area within and surrounding the construction is mostly rural. The estimated construction timeline (during which construction noise impacts would occur) is 38 months. Although all of the reservoir alternatives include construction of two pump stations, PS-4 and PS-1, both pump stations would be housed to minimize noise. PS-4 is an electrical 195 cfs pump station that would be used only for filling the perimeter canal and therefore would not operate as frequently as PS-1. PS-4 is the same for all of the reservoir alternatives. PS-1 is a larger pump station with diesel pumps that would be used to fill and empty the reservoir. PS-1 would be of 1500 cfs capacity for Alternatives 2 and 3B and 3800 cfs capacity under Alternatives 3C and 4A. With a larger pump station under these latter alternatives, more pumps would be needed which could result in more noise; however, housing of the pump station will minimize noise effects.

6.17 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

6.17.1 No Action Alternative

The four major land parcels acquired for the project are the Berry Groves tract, Bryan Paul tract, the MG Enterpise, LLC (aka Winthrop) property, and the Griffin property. Over the last six years, the SFWMD has performed multiple Environmental Site Assessments as well as worked to remediate most of the point source contamination sites. (A description of the findings of the assessments and the remediation efforts completed to date are found in the existing conditions portion of this report.) At present, most of this land is leased to agricultural operators who continue to cultivate the thousands of acres of citrus groves located on the properties. If the reservoir project is not constructed, it is likely that the SFWMD will either continue to lease the land to citrus farmers or sell the land to willing buyers. With no reservoir on the site, the potential for bioaccumulation of copper or other toxic substances from contaminated site soils is much less since this usually occurs when the soils are submerged. If the properties continue to be to be used as working groves, the application of pesticides will continue into the future. New point source contamination sites on the properties will likely occur. However, these new sites may be contaminated to a lesser extent than in the past given modern environmental management practices. Overall, since the future without condition would not include a reservoir on the site, the properties will pose only a typical HTRW risk to the environment similar to other citrus operations.

6.17.2 Alternatives 2, 3B, 3C, and 4A

The HTRW impacts of all of the project alternatives are essentially identical since they all use the same real estate footprint. In general, all project related HTRW audits and remediation plans have been coordinated with state (FDEP) and federal (USFWS) agencies when necessary. The existing conditions portion of this document includes a summary of the Phase I/II Environmental Site

Assessment studies done on the four properties acquired for the reservoir project. In the course of these studies, over 50 point source sites with potential HTRW contamination were identified. At this time, most if not all of these potential contamination sites have been either remediated or further investigated to characterize the sites and prepare remediation plans. The project's non-Federal sponsor, SFWMD, has made a commitment to the USACE and USFWS that after it takes control of the properties from the present lessees and begins construction of the reservoir, all of the outstanding point source remediation efforts will be completed. In addition to the point source contamination sites, the SFWMD also identified distributed soil contamination in portions of the cultivated areas on all of the acquired properties. The remediation of the cultivated soil sites involves the placement of these soils into the core of the reservoir dam. This will isolate the contaminated soils from benthic organisms that serve as food for higher level organisms and thus reduce the potential for bioaccumulation of contaminants by fish and wildlife. In accordance with USACE policy, costs incurred by the non-Federal partner to characterize and remediate environmental contamination will not be cost-shared.

The USFWS has reviewed all of the SFWMD's remediation plans and indicated that they believe that the efforts will sufficiently reduce the risk of harm to fish and wildlife in those areas where the remediation will be performed. The USFWS has also stated that moderate levels of copper and other contamination of the cultivated areas are believed not to pose a direct threat to species of concern; however, they believe that an indirect effect may occur since widespread low-level soil contamination may reduce the population of benthic organisms upon which the species of concern normally feed.

Despite the diligent work performed by the SFWMD and USFWS to reduce the risk to environmental resources, it is possible that once the reservoir is built, bioaccumulation of soil contaminants does result in harm to one or more species of interest. If this does happen, additional remediation efforts, such as more extensive removal of the reservoir bottom sediments, could be done to further reduce the exposure of benthic organisms to near surface soil contamination at the end of a dry season. The cost of additional remediation, if necessary, would be the responsibility of the non-Federal sponsor. If such remediation is necessary, this remediation effort may be scheduled in one cell at a time, possibly during the late dry season, thereby keeping the reservoir somewhat operational.

6.18 CULTURAL RESOURCES

6.18.1 No Action Alternative

Under the No Action Alternative, the project site would continue to be an active citrus grove. Therefore, the existing cultural resource site that may be potentially eligible for listing in the National Register of Historic Places would likely be adversely affected by expansion of the existing citrus operations.

6.18.2 Alternatives 2, 3B, 3C, and 4A

Cultural resources would be impacted by all four alternatives equally. Cultural resources impacts are not considered significant for this project. Cultural resource surveys have been conducted for the Caloosahatchee River (C-43) West Basin Storage Reservoir. Three isolated prehistoric artifacts, one isolated historic artifact, one prehistoric archeological site (8HN129), and four modified historic buildings were identified. All except the prehistoric archeological site were determined to lack integrity and determined not eligible for listing on the National Register of Historic Places, the prehistoric archeological site (8HB129) is located near the edge of the proposed project and will be avoided by project design. The USACE has determined that the project will not affect historic properties eligible for listing on the National Register of Historic Places. The Florida State Historic Preservation Officer (SHPO) concurred with this determination (Florida State Department of Historic Preservation numbers 2004-8676 and 2006-07757). This determination and concurrence is the same for all alternatives since they utilize the same project footprint. The project has been reviewed by the SHPO and complies with the requirements of Section 106 of the National Historic Preservation Act.

6.19 SOCIOECONOMICS-REGIONAL ECONOMIC IMPACTS

The purpose of this section is to estimate the regional economic consequences of the project. The main impacts on the regional economy as a result of implementation of the project are expected to result from expenditures on construction and real estate.

6.19.1 No Action Alternative

In the event that the C-43 reservoir is not constructed, no regional impact will be realized from project expenditures. The local economy would continue to realize revenue stemming from the continued agricultural of the property.

6.19.2 Alternatives 2, 3B, 3C, and 4A

Although the expenditures for the various alternative plans are quite large, and are expected to result in fairly large, regional economic impacts, these impacts are very small, relative to the regional economy in which they will take place (on the order of less than one percent).

Expenditures on project construction, non-construction and real estate, represent an influx of money into the local economy. Spending has a ripple, or multiplier, effect throughout the economy that can be estimated using multipliers that have been calculated using IMPLAN®. IMPLAN multipliers have been used to estimate the impacts on employment, earnings and output (sales) during the estimated three year construction period. The results of the expenditures resulting from construction of the SAP are presented in the table below. If the construction costs of the other alternatives are greater, the regional impacts will be greater, likewise it they are smaller, the impacts will be smaller.

At first glance the figures in ***Table 6-4*** look like enormous impacts resulting from the spending required to implement the project. However, these effects generally represent a very small percentage of the total economic activity in this region.

TABLE 6-4: OVERALL REGIONAL ECONOMIC IMPACTS

Alternative	Impacts			Project Costs
	Output	Earnings	Employment	
3B	$306,400,000	$79,990,000	2,258	$507,240,000

The construction of a reservoir of this size is not a one-year injection into the regional economy, but will be broken up over a number of years. The effects of the annual spending on the regional economy will prove even less significant than viewing the expenditures in total. Since the impacts are likely to occur in varying magnitude over time, the summary effects given in ***Table 6-4*** represent the upper limit if all these impacts were to occur simultaneously. In reality, the impacts of construction last only as long as those activities are carried out. The impacts represent the effects resulting from expenditures during project implementation that is expected to last three years beginning in 2008.

Table 6-5 contains the labor employment and earnings for Florida's South Region. The gross state product (GSP) for Florida is presented for a comparison to the output (sales) created by the construction projects.

When comparing the impacts of construction, as shown in ***Table 6-4*** to the actual total figures for the south region and state, it is important to recognize that the latest earnings data available were from 2000 census data. These figures have increased since 2000, but are considered sufficient for this analysis.

It can be seen that the impact on the region from the construction of the alternatives would be similar. There would be no major long-term impact and the short-term impacts would be insignificant compared to the economy of south Florida.

TABLE 6-5: REGIONAL AND STATE TOTALS

Region	**Earnings (2003) ($millions)**	**Employment (2000)**	**Output (2003)*** ($millions)**
Southwest Region	$320,000	9,391,709	**$910,000**
Florida	$ 10,000	357,914	**$30,000**

6.20 OTHER SOCIAL EFFECTS

The purpose of this section is to examine the social and community consequences of the project.

6.20.1 No Action Alternative

In the event that the reservoir is not constructed, the project footprint and immediate surrounding area is expected to remain a predominantly agricultural community, with earnings lower and unemployment slightly higher than that of the Florida in general. The overall outlook of the areas economic future is positive and an increase in population and residential development can be expected, while maintaining a rural community.

6.20.2 Alternatives 2, 3B, 3C, and 4A

The OSE account considers the effects of alternative plans in areas that are not already contained in the NED and RRED accounts. The categories of effects contained within the OSE account include:

- Urban and community impacts
- Life, health, and safety factors
- Displacement
- Long-term productivity
- Energy requirements and energy conservation

The alternative plans could result in both beneficial and adverse OSE within the study area. The alternative plans could have positive or adverse OSE impacts on the study area associated with (1) plan implementation, including land acquisition, project construction, and O&M activities, and (2) operation of the modified C&SF system. As in the case of the NED effects, the OSE account is

concerned with the net effects of the alternative plans (i.e., the differences between the with- and without-project future conditions).
Some of the potential OSE impacts would occur primarily at the regional scale, and others would have more localized effects. At both scales, there may be some individuals and communities that are positively affected by the alternative plans, some that are adversely affected, and many that are not affected at all. Relative to the size of the regional or local economies, the OSE effects may be minimal. However, if these effects occur predominantly within a limited geographic area, or affect a relatively small or vulnerable population, then the impacts can be disproportionately large. Therefore, the purposes of OSE analysis include not only determining the total magnitude of potential impacts, but also identifying the population (and its characteristics) that would be affected by any proposed action.

Some of the categories of effects typically included in the OSE account do not pertain to the alternative restoration plans. For example, the alternative plans are not expected to affect energy use or energy conservation in the study area.

An urban and community impact is the principal category of potential OSE impacts associated with the alternative restoration plans. This category of impacts includes effects on income distribution, employment distribution, population distribution and composition, and quality of community life. Regional income effects and fiscal impacts were discussed in the RED analysis. In addition, the impacts of agricultural water supply and M&I water supply were discussed in detail in earlier sections. The OSE assessment of urban and community impacts considers both the potential for exposure to the effects of the alternative restoration plans and the degree of vulnerability to potential impacts. Exposure refers to whether an individual or community is subject to the other social effects of the alternative plans. Vulnerability refers to the ability of that individual or community to respond or adjust to those effects.

Potential urban and community impacts of the alternative restoration plans could result from: (1) land acquisition and potential relocation of populations for reservoir and other project construction features, (2) reduced agricultural activity associated with taking the impoundment lands out of cultivation, and (3) construction activity associated with plan implementation. In general, construction activity is considered to have positive impacts. At the local scale, construction and O&M activities associated with the alternative restoration plans can have positive effects to local residents and communities by providing jobs, increasing local wages, increasing local sales, increasing tax revenues, increasing tourism and generally benefiting the local economy.

There are a variety of social and economic factors that are important determinants of an individual's or community's ability to cope with adversity.

One of the most important economic factors in the ability of individuals and groups to respond is the number of employment alternatives available locally. The ability to find another job depends on the education and training of the work force as well as the needs of local economic concerns, such as other farms, agricultural-related services, or some other local business. The socio-economic makeup of the community is also an important consideration of the ability of individuals and the community at large to cope with the adverse effects of large-scale agricultural land conversion. Some groups in society are recognized as having less opportunity to respond to adversity. These groups include ethnic and racial minorities, the elderly, and the poor.

The surrounding counties have a wide range of ethnic compositions, proportions of elderly population, unemployment rates, and per capita incomes. These socio-economic characteristics suggest that the rural counties of the study area – those that are expected to provide locations for new storage reservoirs – are areas that are least able to accommodate the associated economic and social effects on local communities. However, in these rural areas the affected populations should be relatively small.

6.21 AESTHETIC EFFECTS

6.21.1 No Action Alternative

The aesthetics of the project site would remain basically unchanged under the No Action Alternative.

6.21.2 Alternatives 2, 3B, 3C, and 4A

Aesthetic effects refer generally to impacts on the visual qualities of the environment. The area proposed for the Caloosahatchee River (C-43) Basin Storage Reservoir project is now overwhelmingly flat, rural and agricultural, with a mixture of pastures, citrus groves and other crops. The land slope is very gradual; thus long-distance viewsheds are hard to observe. The high walls of a large reservoir will present an abrupt landscape transition, which may initially be a visual shock. This will be a significant impact to aesthetics of the area and will be significantly different across alternatives due to the progressive dam elevations. The top of the enclosing levees, however, will provide wide panoramas of the Caloosahatchee River landscape, and should also offer good observation points for the surroundings. This man-made viewshed could be a good observation point for bird watching over the surrounding countryside. The main aesthetic difference between the alternatives will be in the dam elevations which are listed below:

- Alternative 2 54 feet
- Alternative 3B 57 feet

- Alternative 3C 57 feet
- Alternative 4A 66 feet

6.22 RECREATION

6.22.1 No Action Alternative

The No Action Alternative would not result in an improvement nor degradation of recreation resources. The continued operation of a citrus grove would not provide any additional recreational opportunities to the region.

6.22.2 Alternatives 2, 3B, 3C, and 4A

All of the alternatives would offer comparable recreational opportunities. These beneficial recreation impacts are considered significant. The recreation plan in ***Appendix G*** outlines wildlife viewing and hiking along the perimeter of the reservoir. Boating within the reservoir is also included in the plan. These recreational opportunities would help to fill the deficit in recreational facilities expected due to high population growth in south Florida. It is important to note, however, that recreation must be a secondary benefit of the reservoir. The reservoir must be operated to benefit the estuary in order to obtain the benefits outlined in this document. There will be times when the reservoir is predominantly dry. During those times boating may be limited or not possible within the reservoir. If the reservoir were to be operated to allow boating at all times, benefits being claimed by this project would be lost.

6.23 CUMULATIVE IMPACTS

Cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)."

The Caloosahatchee River (C-43) West Basin Storage Reservoir will increase water storage in the Caloosahatchee River (C-43) Basin resulting in long-term benefits for the estuary. This storage function is essential to the overall restoration of the Caloosahatchee estuary. This project along with other CERP projects would cause some adverse consequences to agricultural land use, permanently removing thousands of acres from agricultural production. These impacts may be felt locally and/or regionally as the economic base derived from agriculture is incrementally reduced relative to other sectors of the economy.

There will be some loss of wetlands on the site. 125 acres of wetlands were identified on the proposed project site. (This acreage does not include a small wetland area within the project site that has already been impacted by construction of the C-43 Test Cell Project.) Most of the existing wetlands have been impacted by surrounding agricultural activities, including reduced hydroperiod, ditching, and exotic plant species infestation. These relatively low-functioning wetlands would be converted to open water habitat. However, the overall benefit to the estuarine system which consists primarily of high value mangrove wetlands, coastal marshes, tidal flats, and aquatic and estuarine habitats such as streams, ponds, bays and SAV beds would be greater than the local wetland loss.

Other CERP projects which might directly affect this basin include the SWFFS and a subsequent Caloosahatchee River (C-43) Basin study. The SWFFS is currently in the PIR development stage and includes many alternatives in this watershed. The subsequent Caloosahatchee River (C-43) Basin study, at the time of this writing, is not yet in the PIR development stage but is planned to begin in late 2007. This subsequent study will evaluate building additional storage features in the eastern portion of the basin. These features might result in removal of additional lands from agricultural production. However, additional storage in the basin would also result in a greater ability to control flows to the estuary, potentially improving conditions in both the wet and the dry season. Indicator species such as oysters and SAV as well as species such as manatees which feed on the SAV and wading birds which forage on the estuarine fisheries would benefit. The cumulative effect of these projects in the Caloosahatchee River (C-43) Basin would be a great reduction in the large damaging flows during the wet season as well as augmentation of the low flows during the dry season.

Other state and local projects may have impacts on this basin. Immediately adjacent to and east of the reservoir, the SFWMD may work with Hendry County to provide some additional flood alleviation to SR 29, which captures drainage from a basin area east of SR 29. A series of culverts, located in the LaBelle Private Drainage District (LPDD) Canal to direct water away from the SR 29 west ditch towards the perimeter canal, may potentially be constructed. This initiative is not a part of the Caloosahatchee River (C-43) West Basin Storage Reservoir project, but may in the future be hydraulically linked to the C-43 reservoir project's perimeter canal. The impacts to the drainage area east of SR 29 would need to be determined and analyzed. The SR 29 west ditch flood alleviation project would be separately coordinated with the USACE and FDEP through permitting.

In early 2007 the Florida Legislature passed Senate Bill 392, The Northern Everglades and Estuaries Protection Program, which expands the Lake Okeechobee Protection Act to include protection and restoration of the Lake Okeechobee watershed and the Caloosahatchee and St. Lucie rivers and estuaries. This program includes development of a technical plan to identify the storage and water quality treatment requirements for the Lake Okeechobee watershed by February 1, 2008. This plan is currently scheduled to include development of the Caloosahatchee and St. Lucie Rivers Watershed Protection Plans to identify watershed storage projects and water quality targets by January 1, 2009. The Caloosahatchee and St. Lucie River Watershed Protection Programs will include goals for salinity envelopes and freshwater inflow targets for each estuary. The goals of the program are to :

- Meet Lake Okeechobee Watershed Total Maximum Daily Loads
- Manage Lake Okeechobee levels within an ecologically desirable range
- Manage flows to meet desirable salinity ranges for the St. Lucie and Caloosahatchee Estuaries.
- Identify opportunities for alternative surface water supply sources in the watershed

This program has potential to benefit the watershed and would help to maximize the benefit of the reservoir by developing a comprehensive watershed plan for storage as well as water quality.

In addition to the above projects, many of the storage features of the CERP would affect the water levels in Lake Okeechobee, which will in turn affect how much water is released to the estuary. This could represent both positive and/or negative impacts. Reducing the water levels in Lake Okeechobee would be an improvement during the wet season by reducing the damaging high flows to the estuary. However, lower lake levels might also result in less water available to release during the dry season. Ideally the storage reservoirs would then have water available to release to the estuary.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project is a proposed part of the CERP. Large areas north of Lake Okeechobee, within the EAA, around the lake, in the Caloosahatchee River (C-43) Basin, and on the Upper East Coast will be used to increase water storage for the overall gain and long-term benefit of the regional system. This will result in the conversion of lands to reservoirs. This will cause some adverse consequences to agricultural land uses permanently removing tens of thousands of acres from agricultural production. These impacts may be felt locally and/or regionally as the economic base derived from agriculture is incrementally reduced relative to other sectors of the economy. As these water storage features occur disparately across the landscape within different hydrologic basins, and as distinct units rather than multiple features within a single watershed, they will not likely result in a significantly detrimental cumulative effect. These project features will provide important storage functions and are essential to the overall restoration of the freshwater marshes and the estuaries of the area. The CERP contains 68 components that total approximately 217,000 acres of new reservoirs and wetlands-based water treatment areas. This plan increases the supply of fresh water for the Everglades and south Florida ecosystem and improves the quantity, quality, timing, and delivery of water to the natural system.

A number of operational components have also been identified in the CERP and will, in most cases, occur in conjunction with related construction features. The operational features in the CERP include: a modified LORS; environmental water supply deliveries to the Caloosahatchee and St. Lucie estuaries; modifications to the regulation schedules for WCAs 2A, 2B, 3A, 3B, and the current rainfall delivery formula for ENP; modified Holey Land Wildlife Management Area Operations Plan; Modified Rotenberger Wildlife Management Area Operations Plan; a modification for coastal wellfield operations in the Lower East Coast ; Lower East Coast utility water conservation; and operational modifications to the southern portion of L-31N and C-111. These features will result in significant environmental benefits to the CERP project area.

6.24 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of the proposed project will include features considered permanent, which may be deemed irreversible. This would include construction of the reservoir, embankment, and perimeter canal. Resources committed would include state and Federal funding to purchase lands (project lands have already been acquired with state and Federal funds) and labor, energy and project materials to build, operate, and maintain the project. Limited fish and wildlife habitat on project lands will be converted to open water habitat.

6.25 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

6.25.1 Land Use

Existing citrus groves would be permanently altered to construct the reservoir and associated features.

6.25.2 Wetlands

Although the project site is a producing citrus grove, it contains 125 acres of remaining wetlands. These wetlands are of low to moderate quality with limited function and value due to their reduced hydroperiod, infestation by exotic plant species, and location in the landscape i.e., separation from other habitats and corridors). Implementation of the project would permanently alter wetlands within the footprint of the project features.

6.25.3 Water Quality

Temporary increases in turbidity of local waters within allowable limits are expected during construction. Precautions to limit turbidity will be employed.

6.25.4 Air Quality

Fugitive dust from vehicular traffic and earth moving during construction will be unavoidable but insignificant overall.

6.25.5 Soils

The disruption of soils is expected to result from construction activities. The conversion of prime farmland to an open water habitat is anticipated to be significant and irretrievable.

6.25.6 Wildlife

Localized short-term disturbance to fish and wildlife are expected from construction activities of the plan components.

6.25.7 Threatened and Endangered Species

Short-term disturbance to fish and wildlife are expected from construction activities of the plan components. Precaution measures and construction conditions to limit impacts to threatened and endangered species will be implemented.

6.26 RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

While regional conditions will improve, short-term or localized problems will undoubtedly occur. Although overall restoration of the Everglades ecosystem is expected to improve habitat for nesting wading birds regionally over time, the transition period might adversely affect regional wading bird populations. Proper sequencing of project features should mitigate impacts to existing wildlife resources expected to be impacted by restoration activities within their vicinity. Further assessment and monitoring will be critical to recovery of ecosystem attributes and maintaining a viable fish and wildlife population during the implementation of CERP.

6.27 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

The proposed action is consistent with the overall goals and objectives of the CERP. It is expected that the proposed action will be consistent with Federal, State, and local plans and objectives.

6.28 SIGNIFICANCE OF HABITAT

The significance of the habitat for this project is clearly identified below using the categories and criteria defined in Section 3.4.3 of Principles and Guidelines and in paragraph 16.b of Engineering Pamphlet (EP) 1165-2-502. Significance of the benefited area (Caloosahatchee Estuary, San Carlos Bay, Pine Island Sound, and Matlacha Pass) is identified by the following:

- Plans and constitutions, laws, directives, resolutions, gubernatorial directives, and other policy statements of States with jurisdiction in the planning area.
    - Matlacha Pass and Pine Island Sound are designated as aquatic preserves by the Florida Department of Environmental Protection
    - Caloosahatchee Water Management Plan (April 2000)
    - Lower West Coast Water Supply Plan 2005-2006 Update
    - Minimum Flows for Caloosahatchee River (Chapter 40E-8, Florida Administrative Code)
- Endangered Species Act of 1973, as amended, Pub. L. 93-205; 16 U.S.C. 1531, et seq.
    - Threatened and endangered species found in the Caloosahatchee Estuary and other benefited areas include the West Indian manatee, smalltooth sawfish and five species of sea turtles
- Estuary Protection Act, Pub. L. 90-454; 16 U.S.C. 1221, et seq.
- Marine Mammal Protection Act of 1972, Pub. L. 92-522; 16 U.S.C. 1361, et seq
    - The West Indian Manatee could benefit immensely from increased aquatic vegetation which is its main source of food
    - Benefits area includes San Carlos Bay Federal Manatee refuge
- Migratory Bird Treaties and other international agreements listed in the Endangered Species Act of 1973, as amended, Section 2(a)(4).
    - The South Florida ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North America and winter in the tropics of the Caribbean and South America.
- Significance based on public recognition means that some segment of the general public recognizes the importance of an EQ resource or attribute. Public recognition may take the form of controversy, support, conflict, or opposition and may be expressed formally (as in official letters) or informally.

  - This project has received intense public and local government support. There has been long-term and intense interest in the degraded state of the Caloosahatchee estuary and interest in improving its condition. Please see the inventory of public concerns and dPIR comment matrix in Annex B for further information.
  - American Rivers listed the Caloosahatchee River in the top 10 endangered rivers in US
- Effects on the resources in terms of differences between estimated future without- and with plan conditions
  - The selected alternative plan improves flows to the estuary during both the wet and dry season, but is especially good at meeting the dry season demands of the estuary. This results in a forecasted significant improvement of many ecosystem indicators such as oysters, crab, submerged aquatic vegetation, and fisheries.
- Other relevant information concerning duration, frequency, location, magnitude, and other characteristics, such as reversibility, retrievability, and the relationships to long-term productivity (P&G).
  - Please see Sections 6.23 – 6.28 for a discussion of these factors

In summation, the significance of the project is demonstrated by a combination of applicable policy, technical attributes and public interest as outlined above.

6.29 UNCERTAIN, UNIQUE OR UNKNOWN RISKS

The risk and uncertainty associated with the construction and operation of these features of the proposed project should be minimal. All features have been designed and constructed through established and applied technology. No experimental design was necessary for any component of the proposed impoundment. Additionally, both the USACE and the SFWMD have extensive and reputable credibility in the design, construction and O&M of the proposed features from previous water resources planning efforts.

A cutoff wall along the perimeter of the dam embankment is being considered and will be further investigated as the project proceeds to design. For estimating purposes, a 42-47 foot cutoff wall was included. These use standard technology and should pose minimal risk.

Soil cement protection was included for armoring. This will be further investigated as the team proceeds with the design. Armoring generally uses standard technology and should pose minimal risk.

A freeboard of approximately 17 feet was used in preparing the ROM cost estimates. The freeboard design will be further refined in accordance with applicable CERP DCM. These DCMs were developed to provide consistent working level guidance for impoundment design by the Acceler8 teams. The

DCMs consolidate and incorporate design criteria from various agency regulations and guidelines including USACE, U.S. Bureau of Reclamation, Federal Energy Regulatory Commission, Florida Building Code, and the American Society of Civil Engineers. The DCMs do not supersede USACE. Freeboard designed in compliance with the DCMs, and thusly USACE regulations, should result in minimal risk of embankment failure due to overtopping (refer to DCM-2 for additional detail).

AM consists of an active strategy for dealing with the considerable uncertainties that characterize management of large natural ecosystems, which are complex and difficult to predict. The overall purpose of AM is to maximize the chance of success and includes methods, such as proactive approaches to dealing with uncertainties, the use of modern ecosystem science and scientific practices, active collaboration, and the use of open, inclusive, and integrative processes.

Five key principles help implement this approach to AM:

1. Anticipate future uncertainties and contingencies
2. Employ science-based approaches to build knowledge
3. Design robust projects that can be adapted to changing conditions
4. Build a shared understanding through collaboration and conflict resolution
5. Reconcile competing objectives to benefit both nature and society

The C-43 project is a component of the CERP, which consists of sixty-eight (68) major components. The uncertainty associated with a program of this magnitude was recognized during the Restudy, which led Congress to address the necessity of AM in the WRDA 2000.

As such, a fundamental implementation principle for CERP is to utilize adaptive assessment and management in order to continually refine and improve the performance of CERP projects so that planned benefits are attained. Incremental revisions of optimal project designs and project operations throughout the planning and implementation process will lead to improved performances. The use of the adaptive assessment policy minimizes the effects of uncertainty with respect to the effects of CERP projects on the natural system and other water-related needs of the region related to the design and implementation of the CERP.

6.30 ENVIRONMENTAL JUSTICE

In accordance with E.O. 12898, USACE has made achieving environmental justice part of its mission. While the President's E.O. on Environmental Justice made this directive explicit, it is implicit in NEPA and in planning regulations that USACE and SFWMD planners must conduct an objective evaluation of all project objectives in terms of their social and economic performance. This is accomplished by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. In public outreach efforts to date, only one potential environmental justice issue has been identified: the loss of jobs for low income and minority workers as a result of acquiring agricultural land for the construction of the reservoir. The expected loss in employment will occur to seasonal and/or temporary migrant workers, and as can be noted in the future land use section agricultural acreage in the surrounding study area and counties is expected to increase. The Caloosahatchee River (C-43) West Basin Storage Reservoir Project PIR and EIS is an opportunity to somewhat alleviate this potential problem by providing jobs within and during construction of the project, some of which could provide seasonal and temporary employment. To address this issue the SFWMD is conducting training programs to allow local individuals to acquire the skills needed to construct the reservoirs. In addition, it is anticipated that adjacent lands will continue to support agricultural operations.

In order to keep all members of the public updated, the SFWMD will be providing regular updates to the County Commission which are open to the public. In addition, meetings with stakeholders will be held on an as needed basis.

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SECTION 7
THE SELECTED ALTERNATIVE PLAN

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7.0 THE SELECTED ALTERNATIVE PLAN (SAP)

The Caloosahatchee River (C-43) West Basin Storage Reservoir project is planned and designed primarily to restore the 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 fresh water to the estuary during dry periods. These two primary functions help to moderate unnatural changes in salinity which is extremely detrimental to estuarine communities.

Detailed design of the Caloosahatchee River (C-43) West Basin Storage Reservoir project will be accomplished by the SFWMD as part of the State of Florida's Acceler8 program. Design information and details will be coordinated and reviewed by the USACE pursuant to the Design Agreement between USACE and SFWMD dated May 12, 2000. Activities during the construction phase will be in accordance with the Acceler8 program and will be the responsibility of the SFWMD.

The State of Florida's "Acceler8" program was developed for the purpose of accelerating design and construction of a number of critical restoration projects consistent with the Comprehensive Everglades Restoration Plan (CERP) prior to one or more of the following: administration approval, Congressional committee resolution, Congressional authorization, or Federal construction funding. The SFWMD proposes to initiate construction of the C-43 West Reservoir/Acceler8 Project prior to implementation of the Federal Caloosahatchee River (C-43) West Basin Storage Reservoir project.

7.1 DESCRIPTION OF PLAN COMPONENTS

Through the formulation of alternative plans described in Section 5.0, Alternative 3B was identified as the Selected Alternative Plan (SAP) for the Caloosahatchee River (C-43) West Basin Storage Reservoir project. The SAP was further refined based on additional engineering and design and described in this section of the report. The SAP provides approximately 170,000 ac-ft of above-ground storage volume in a two-cell reservoir with normal pool depths when the reservoir is full varying from 15 feet at the southeast corner to 25 feet at the northwest corner. Major features of the project include external and internal embankments, canals, two pump stations, internal control and outflow water control structures, 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.

Once the SAP was identified more detailed design (i.e. surveys and real estate) was completed. The final design details necessary for the plan to be authorized are described in this section with additional detail provided in ***Appendix A***. The additional engineering and design analysis that was completed does not effect the plan formulation as the cost changes and project refinements would be applied proportionally to all projects. The total benefits derived by the plan does not change based on these additional refinements.

The following is a general description of the location and design of SAP features. For a detailed description of project features refer to ***Appendix A***.

7.1.1 General Plan Description

The SAP, as shown in ***Figure 7-1,*** consists of a two-cell reservoir with a "normal pool" storage capacity of 170,000 ac-ft. This SAP comes closest to approximating the Restudy Caloosahatchee River (C-43) West Basin Storage Reservoir recommended volume of approximately 160,000 ac-ft of storage and is the size evaluated and currently being designed by the SFWMD under their Acceler8 program. The project footprint for the SAP encompasses approximately 10,700 acres, of which approximately 10,480 acres are required in fee, approximately 20 acres will be perpetual easements, and approximately 200 acres will be used on a temporary basis for staging area. The project consists of major features and components to include a two-cell reservoir with armoring, cutoff walls, and embankments. Other features are pump stations, spillways with emergency overflow and vertical lifts, drawdown structures, culverts, canals, earthwork artificial habitat creation, and recreational features. The reservoir design includes a pump station with 1,500 cfs capacity to pump water from the Townsend Canal to fill the reservoir.

The existing Townsend Canal, located along the west perimeter of the reservoir, will serve as the west perimeter canal. The existing disposal mounds along the east side of the Townsend Canal will be removed as part of the project. A drainage culvert will be located on the east perimeter canal connecting the LPDD Canal (also known as the Header Canal), which will maintain historical drainage from the Paul property east of the project. Improvements to or the relocation of the existing weir structure located at the mouth of the Townsend Canal are included. Work to that structure will be done within an existing easement.

The Selected Alternative Plan has a water surface elevation of 42 feet at "normal pool" (NAVD88), with the average depth ranging from 17-19 feet. Dam (embankment) heights for the SAP range from 32-37 feet (top of dam is at elevation 57 ft (NAVD88)). The maximum water depths and dam heights will occur in Cell 1 due to lower land surface elevations in that cell. The exterior and interior dams are to have a crest width of 14 feet. The side slopes are 3 Horizontal to 1 Vertical (3H:1V). The exterior dams are to be constructed from existing on-site material and have a low permeability core. A graded filter is to be provided on the exterior side of the dam to direct seepage. Soil cement protection would be included on the interior side of all reservoir slope faces. A freeboard of 15 feet was used based on detailed analysis of wind and wave height run-up.

A perimeter canal (seepage canal) is provided on the south, east, and north sides of the reservoir. The existing Townsend Canal will act as a seepage canal on the west side of the reservoir. In addition to seepage collection, the perimeter canal will also convey discharges from the reservoir; convey surface runoff from the south and east of the reservoir including drainage for SR29; provide flows to the Crawford Canal, Banana Branch and Fort Simmons Branch; and maintain the surface water elevation in the expanded northeast rim ditch that provides irrigation for the A. Duda and Sons (Duda) citrus operations, located to the south of the reservoir. A cutoff wall (approximate total height of 47 feet) along the perimeter of the dam embankment has also been included in the reservoir design.

Improvements to the Townsend Canal are based on the necessary capacity to meet maximum pumping requirements to fill the reservoir. Pre-storm and post-storm event flows have been simulated to evaluate flows in the Townsend Canal and other local canals and tributaries. Storm event flows in the Townsend Canal will be decreased over existing conditions with the construction and operation of the reservoir.

Each cell is designed to discharge independently through separate discharge structures. Cell 1 will discharge via the S-1 structure into the Townsend Canal. Cell 2 will discharge via S-8 structure into the perimeter canal. These structures will be designed for incremental operation allowing required flows to be released to the Caloosahatchee River (C-43 Canal) during periods of low flow. These structures could also serve as design storm control structures for releases prior to and during a storm event. The storm releases must be balanced with the targeted maximum flow allowed over S-79, which is 4,500 cfs. An emergency spillway with a crest elevation based on retaining the 25-year, 72-hour storm event is to be provided within each cell's discharge structure. The 25-year, 72-hour storm captured in the reservoir would be a "control release" after the storm event in order to restore the water surface to the normal pool elevation while not exceeding the maximum flow of 4,500 cfs at S-79. The final design of the emergency spillway(s) will be in accordance with the requirements of Design Criteria Memorandum 3 (DCM-3).

Within the reservoir, structure S-12 will hydraulically connect the two reservoir cells and is designed to be gated so that either cell can be "isolated" for operational or maintenance (O&M) purposes. A number of other culverts, weirs, and spillways are included to operate the reservoir and maintain appropriate water levels in existing canals and the perimeter canals.

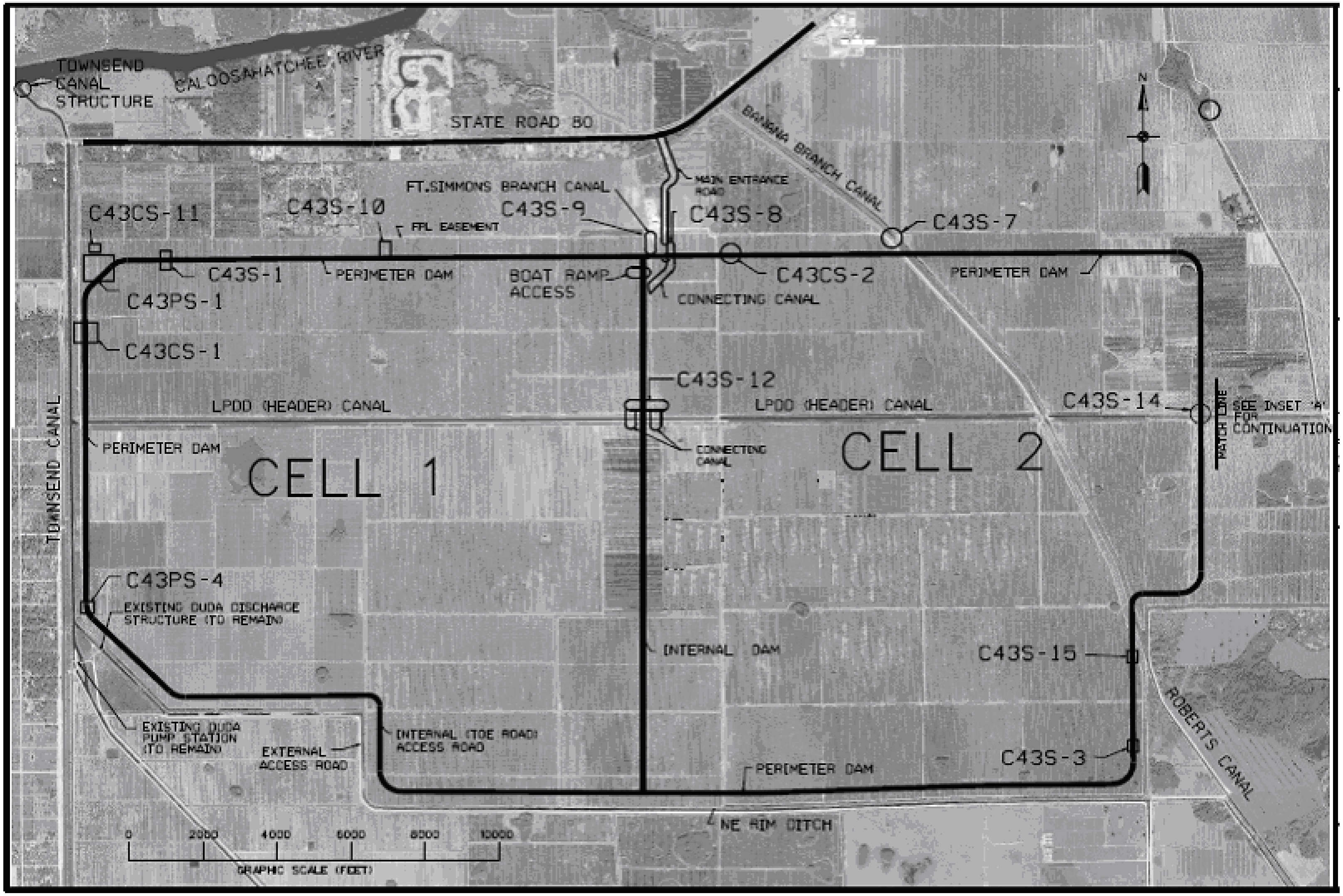

FIGURE 7-1: THE SELECTED ALTERNATIVE PLAN

7.1.2 Major Project Components

7.1.2.1 Reservoir

The reservoir is an earthen impoundment consisting of approximately 9,220 acres of interior storage that is to be constructed above the existing ground. It will consist of an approximate 170,000 ac-ft two-cell reservoir. Water will be pumped from the Caloosahatchee River (C-43 Canal) and into the reservoir by utilizing the existing Townsend Canal and a new pump station (C43PS-1) located in the northwest corner of the project.

Water will be discharged from the reservoir through gravity discharge structures in each cell that discharge into a perimeter canal. Both flows into and out of the reservoir will be controlled by monitoring flows at S-79.

7.1.2.2 Intake Canal

The existing Townsend Canal will serve as intake canal. The West Storage Reservoir (WSR) has been designed so that during storm events flows in the Townsend Canal will not exceed the "pre-existing" condition. Therefore, there will be no negative impacts to the Townsend Canal, SR 80 bridges, or the existing flap gate weir structure. However, two additional flap gates will be installed in the weir structure to provide capacity for pumping rates of 1500 cfs at C43PS-1.

The perimeter canal will serve as a seepage canal and as a means of conveying both surface storm water runoff and off site flows entering the project. The perimeter canal design includes littoral shelves along the exterior slope that are intended to promote wetland vegetation, fisheries, and recreation activities.

7.1.2.3 Embankments (Dams)

The perimeter embankment will have an external geometry that includes a 14-foot wide crest and 3 horizontal to 1 vertical sideslopes. Crest elevations have been established at +57 feet NAVD88 for both Cell 1 and Cell 2. The embankment will be constructed largely of random fill, but will also include a low permeability soil-bentonite wall, an internal drain, and upstream slope protection. The soil-bentonite wall will extend from an elevation that is five feet above the normal pool elevation to five feet below the top of a clay layer which underlies the project site at depths generally in the range of 20 to 25 feet below existing surface grades. A few structures pass through the perimeter embankment. At these locations, the above ground portion of the soil-bentonite wall will be replaced with select fill. A roughly 100-foot wide bench will be raised above the existing ground surface immediately downstream of the perimeter embankment. A perimeter canal is to be located on the outside of the bench.

The separator dam between Cells 1 and 2 will be a homogenous embankment with a crest elevation of +50 feet NAVD88. It will not include any soil-bentonite wall or internal drain. The separator dam will be covered on both sides with soil-cement. The components of the embankments are described in more detail in the following sections.

7.1.2.4 Pumping Station C43PS-1

It will consist of a steel and reinforced concrete structure that will house the main pumps and pumping motors for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project. The structure will be located adjacent to the downstream side of the dam and will have plan dimensions of approximately 200 feet (parallel with the dam) by 100 feet (measured at the intake level). It will have a base slab elevation on the intake side of the structure of -16 feet with respect to the North American Vertical Datum of 1988 (NAVD88). The structure bottom will step up to elevation +10 feet NAVD88 for a distance of about 30 feet in the area between the intake bay and the toe of the dam. The existing surrounding grades at the site of the proposed construction are approximately +16 to +17 feet NAVD88.

7.1.2.5 Pumping Station C43PS-4

C43PS4 will provide water to the perimeter canal during dry periods when water cannot be released from Cell 2 of the reservoir due to low Reservoir water levels. C43P-S4 will maintain the water level in the perimeter canal, provide water to the Paul property, and supply water to the Banana Branch and Ft. Simmons Branch.

It will consist of a steel and reinforced concrete structure that will include a "can" type intake. The structure will be located adjacent to the top of bank of the Townsend Canal and will have plan dimensions of approximately 55 feet by 45 feet. It will have a separate intake bay that will have a top of slab elevation of -12 feet with respect to the NAVD88. The intake pipes will consist of three 48-inch diameter steel pipes that connect the intake bay with the vertical cans. Invert elevations for these pipes will be approximately elevation -10 feet NAVD88. The bottom of the can structures will be elevation -20.4 feet NAVD88. Surface water levels in the Townsend Canal are expected to range between +3 and -3 feet NAVD88. The pumping station floor level will be elevation +10 feet NAVD88, and will step up to elevation +19 feet NAVD88 in the discharge bay. The existing surrounding grades at the site of the proposed construction are approximately +22 to +23 feet NAVD88.

7.1.2.6 Culvert Structure C43S-7

This culvert structure will provide a hydraulic connection between the perimeter canal and the Banana Branch Canal. It will consist of a 222-foot long double barrel concrete box culvert that rests upon a combined footing with bottom width of approximately 26 feet. The culvert will have an invert elevation of +10 feet with respect to the NAVD88. The normal water level on the perimeter canal side of the structure will be +19 feet NAVD88. Finished grades above the culvert are expected to be about +22 to +23 feet NAVD88.

7.1.2.7 Culvert Structure C43S-9

This culvert structure will provide a hydraulic connection between the perimeter canal and the Fort Simmons Branch. It will consist of a 102-foot long double barrel concrete box culvert that rests upon a combined footing with bottom width of approximately 26 feet. The culvert will have an invert elevation of +14 feet with respect to the NAVD88. The normal water level on the perimeter canal side of the structure will be +19 feet NAVD88. Finished grades above the culvert are expected to be about +21 to +22 feet NAVD88.

7.1.2.8 Culvert Structure C43S-14

This culvert structure will provide a hydraulic connection between the perimeter canal and the Header Canal. It will consist of a 97-foot long single barrel concrete box culvert that rests upon a footing with bottom width of approximately 15 feet. The culvert will have an invert elevation of +15 feet with respect to the NAVD88. The normal water level on the perimeter canal side of the structure will be +19 feet NAVD88. Finished grades above the culvert are expected to be about +28 to +29 feet NAVD88.

7.1.2.9 Culvert Structure C43S-15

This culvert structure will provide a hydraulic connection between the perimeter canal and the Roberts Canal. It will consist of an 86-foot long double barrel concrete box culvert that rests upon a combined footing with bottom width of approximately 26 feet. The culvert will have an invert elevation of +14 feet with respect to the NAVD88. The normal water level on the perimeter canal side of the structure will be +19 feet NAVD88. Finished grades above the culvert are expected to be about +26 to +27 feet NAVD88.

7.1.2.10 Gated Culvert Structure C43S-3

This structure will consist of a gated dual culvert that will be situated in the perimeter canal and will control the water levels in the canal. It will have base dimensions of 65 feet (parallel with the canal) by 25 feet (across the canal). The structure will bottom new elevation +11.5 feet with respect to the NAVD88. A concrete tremie seal will be placed between the structure bottom level and elevation +6.5 feet NAVD88. The ground surface elevation in the project vicinity is estimated to be +26 feet NAVD88. Surface water levels across the structure will be +23 and +19 feet NAVD88 on the upstream and downstream sides of the structure, respectively. Steel sheet piling will be used to construct wingwalls as needed. A seepage cutoff wall will be set below the upstream edge of the structure. The bottom of the cutoff wall is currently designed at elevation -1.5 feet NAVD88.

7.1.2.11 Gated Spillway Structure C43S-10

This structure will consist of a gated spillway that will be situated in the perimeter canal and will control the water levels in the canal. It will have a base slab that has plan dimensions of 64 feet (parallel with the canal) by 55 feet (across the canal). The structure will bottom near elevation +2 feet with respect to the NAVD88. A concrete tremie seal will be placed between the structure bottom level and elevation -3 feet NAVD88. The ground surface elevation in the project vicinity is estimated to be +20 feet NAVD88. Surface water levels across the structure will be +19 and +15 feet NAVD88 on the upstream and downstream sides of the structure, respectively. Steel sheet piling will be used to construct wingwalls and seepage cutoff walls. A seepage cutoff wall will be set below the upstream edge of the structure. The bottom of the cutoff wall is designed to be approximately elevation -8 feet NAVD88.

7.1.2.12 Gated Spillway Structure C43S-11

This structure will consist of a gated spillway that will be situated in the perimeter canal and will control the water levels in the canal. It will have a base slab that has plan dimensions of 75 feet (parallel with the canal) by 62 feet (across the canal). The structure will bottom near elevation -8 feet with respect to the NAVD88. A concrete tremie seal will be placed between the structure bottom level and elevation -13 feet NAVD88. The ground surface elevation in the project vicinity is estimated to be +17 feet NAVD88. Surface water levels across the structure will be +15 and +3 feet NAVD88 on the upstream and downstream sides of the structure, respectively. Steel sheet piling will be used to construct wingwalls and seepage cutoff walls. A seepage cutoff wall will be set below the upstream edge of the structure. The bottom of the cutoff wall is designed to be approximately elevation -18 feet NAVD88.

7.1.2.13 Cell 1 Main Outlet Structure C43S-1

Structure C43S-1 refers to the main operational outlet from Cell 1 to the perimeter canal. It will consist of twin concrete conduits, which will be constructed essentially at existing grade, and will be buried beneath the perimeter dam and oriented perpendicular to the dam. The conduits will each be ten feet wide and six feet high. The outlet will include an intake structure located on the upstream side of the dam, consisting of a concrete box supported on a reinforced concrete mat foundation. The top of the box has been established at elevation +44 feet with respect to the NAVD88. The existing ground elevation in the vicinity of the intake box is estimated to be +17 feet NAVD88. The crest of the dam will have an elevation of +57 feet: NAVD88. Operational and emergency gates will be located within a control building near the center of the dam. The control works will also be supported on a reinforced concrete mat foundation. The outlet works will discharge to an impact stilling basin located on the downstream side of the dam. The stilling basin will be approximately 26 feet wide and have an invert elevation of +5 feet NAVD88. This portion of the facility will also be supported on a reinforced concrete mat foundation. The downstream water surface elevation at this structure is designed at +15 feet NAVD88.

7.1.2.14 Cell 2 Main Outlet Structure C43S-8

Structure C43S-8 refers to the main operational outlet from Cell 2 to the perimeter canal. It will consist of twin concrete conduits, which will be constructed essentially at existing grade, and will be buried beneath the perimeter dam and oriented perpendicular to the dam. The box culverts will each be ten feet wide and six feet high. The outlet will include an intake structure located on the upstream side of the dam, consisting of a concrete box supported on a reinforced concrete mat foundation. The top of the box has been established at elevation +29 feet with respect to the NAVD88. The existing ground elevation in the vicinity of the intake box is estimated to be +20 feet NAVD88. The crest of the dam will have an elevation of +57 feet NAVD88. Operational and emergency gates will be located within a control building near the center of the dam. The control works will also be supported on a reinforced concrete mat foundation. The outlet works will discharge to an impact stilling basin located on the downstream side of the dam. The stilling basin will be approximately 26 feet wide and have an invert elevation of +9 feet NAVD88. This portion of the facility will also be supported on a reinforced concrete mat foundation. The downstream water surface elevation at this structure is designed at +19 feet NAVD88.

7.1.2.15 Balancing Outlet Structure C43S-12

Structure C43S-12 refers to the operational hydraulic connection between Cells 1 and 2. It will consist of triple concrete conduits, which will be constructed essentially at existing grade, and will be buried beneath the internal dam and oriented perpendicular to the dam. The box culverts will each be ten feet wide and six feet high, and will be supported on a reinforced concrete mat foundation. The existing ground elevation in the vicinity of the spillway is estimated to be

+21 feet with respect to the NAVD88. The top of the internal dam is expected to have a crest elevation of +50 feet NAVD88.

7.1.2.16 Crest Spillway Structure C43CS-1

Crest Spillway Structure C43CS-l refers to the service spillway from Cell 1 to the Townsend Canal. It will consist of a concrete conduit, which will be constructed across the perimeter dam and oriented perpendicular to the dam. The conduit will be 12 feet wide. The invert elevation for the conduit will be set at elevation +38 feet with respect to the NAVD88. A concrete weir will be set at elevation +42 feet NAVD88. The existing ground elevation in the vicinity of the spillway is estimated to be +17 feet NAVD88. The crest of the dam will have an elevation of +57 feet NAVD88. The spillway will discharge down a concrete lined channel to a stilling basin located on the downstream side of the dam. The stilling basin will be approximately 12 feet wide and have an invert elevation of -feet NAVD88. This portion of the facility will also be supported on a reinforced concrete mat foundation. The downstream water surface elevation at this structure is designed at +3 feet NAVD88.

7.1.2.17 Crest Spillway Structure C43CS-2

Crest Spillway Structure C43CS-2 refers to the service spillway from Cell 2 to the perimeter canal. It wi11 consist of a concrete conduit, which will be constructed across the perimeter dam and oriented perpendicular to the dam. The conduit will be 12 feet wide. The invert elevation for the conduit will be set at elevation +38 feet with respect to the NAVD88. A concrete weir will be set at elevation +42 feet NAVD88. The existing ground elevation in the vicinity of the spillway is estimated to be +21 feet NAVD88. The crest of the dam will have an elevation of +57 feet NAVD88. The spillway will discharge down a concrete lined channel to a stilling basin located on the downstream side of the dam. The stilling basin will be approximately 12 feet wide and have an invert elevation of +7 feet NAVD88. This portion of the facility will also be supported on a reinforced concrete mat foundation. The downstream water surface elevation at this structure is designed at +19 feet NAVD88.

7.2 RECREATION FEATURES

The study area for the recreation benefit analysis for this project includes the counties of Lee, Collier, Hendry, Glades and portions of Charlotte county; approximately the same geographical extent as Region 9 of Florida Statewide Comprehensive Outdoor Recreation Plan (SCORP). The 2000 SCORP identifies the proposed project area as part of Region 9 comprised of Charlotte, Collier, Lee, Sarasota, Glades and Hendry counties. Recreation deficits identified by the SCORP for this region include; bicycle riding, tent camping, hiking, nature study and saltwater beach activities. Subsequent FWC and FDEP, letters included as

Addendums I and II in Recreation Appendix H demonstrate need for motor boat ramps. A statewide need assessment through 2010 identifies these deficits and the unit need for each (i.e. miles of trail and camp sites); is provided in SCORP 2000.

Some existing recreational facilities within the Caloosahatchee Basin provide opportunity to hike, boat, fish and camp. Existing recreation facilities near the project site include Ortona Lock Recreation Area, Caloosahatchee Regional Park, and WP Franklin Lock Recreational Area that are used by residents and tourists alike. The Caloosahatchee is used as a boating corridor between the east and west coasts of Florida. Boat traffic is moderately heavy with boating and fishing occurring on the river. The banks of the Caloosahatchee are too steep to be useful for bank fishing. Access for boat launch is provided at the three USACE lock structures located along the river. The FWC provides ramps at Wayside Park in Hendry County and at the intersection of SR 80 and Highland, east of Ft. Myers, in Lee County. All are well used.

The recreation activities proposed for the Caloosahatchee River (C-43) West Basin Storage Reservoir project include: nature study, multi-use trail atop the levee, equestrian use, boat and bank fishing, canoeing/kayaking, motor boating and hunting which will fit with the project purposes as managed by the SFWMD. A major recreation attraction of the Caloosahatchee River (C-43) West Basin Storage Reservoir project will be an approximately 12-mile multi-purpose trail loop atop the levee constructed as part of the project. Recreation facilities proposed include: parking and toilet facilities (clivas multrum waterless vault toilets), information kiosk, canoe/kayak launch facility, a shade structure, traffic-control fencing and a pedestrian footbridge bridge over the perimeter canal to provide public access to the reservoir.

Two handicapped accessible, double-lane public motor boat ramps would be provided; one into each of the two reservoir cells. Vehicle access will be provided via the single-lane bridge over S-10. The ramps are proposed within the reservoirs on the north levee. A paved two-lane public road will provide vehicular access to a one-lane bridge across the perimeter canal. A two-lane crushed shell road up the levee and to the ramps is proposed. Boat traffic control buoys would keep boaters clear of the reservoir structures. Signage would post warnings. The canoe/kayak launch facility would be on the perimeter canal.

Littoral areas are proposed at the corners of the seepage canal as part of the project and would provide ideal bank fishing locations outside the levee perimeter. The Florida Fish & Wildlife Conservation Commission (FWC) has endorsed the littoral shelf concept for habitat benefit and potential water quality benefits. Shades trees are proposed on the outside area of the north rim canal adjacent to parking areas. Ample public parking will be developed outside of the north levee and perimeter canal in the general area of the construction staging location.

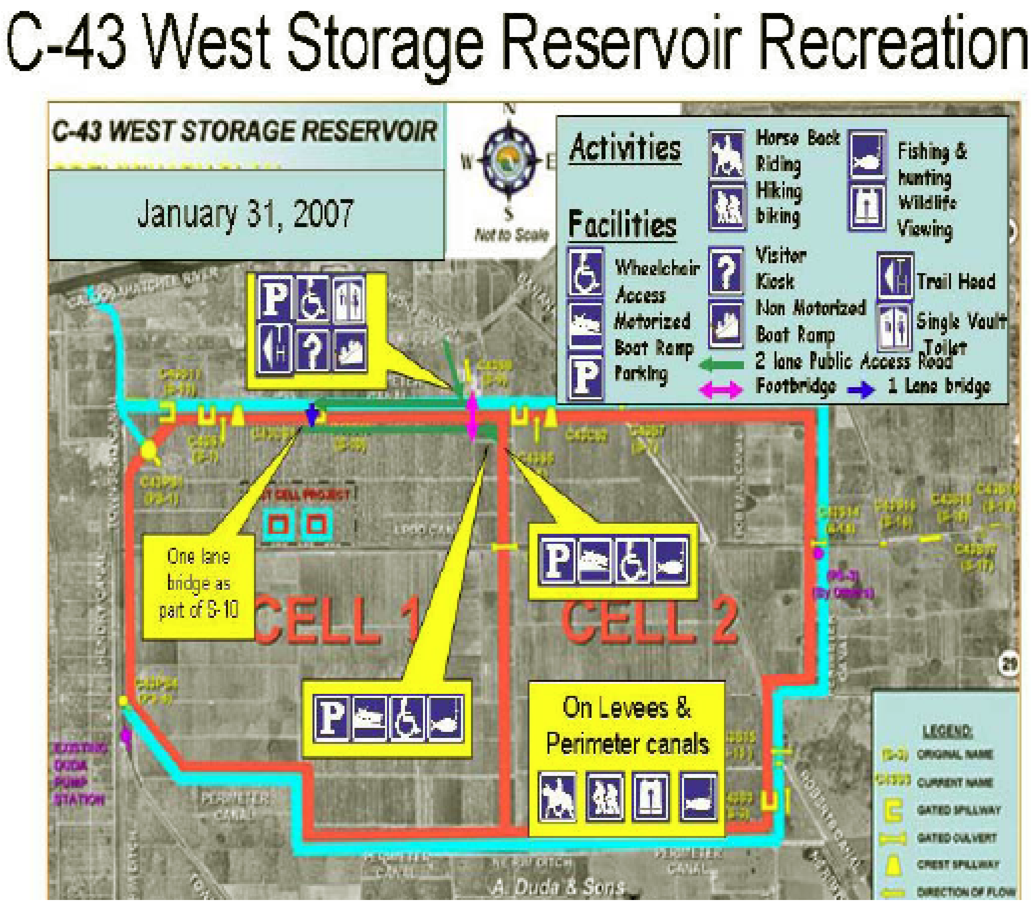

FIGURE 7-2: CONCEPTUAL RECREATION PLAN

7.2.1 Recreational Costs

The costs for proposed recreation features would be $2,519,000. An additional ten percent for PED, and an additional eight percent for construction supervision and administration bring the estimated total costs for recreation to $2,972,000.

The justification of incurring additional costs for recreation features is derived by utilizing a benefit to cost ratio. The tangible economic justification of the proposed project can be ascertained by comparing the equivalent average annual charges with the estimate of the equivalent average annual benefits, which would be realized over the period of analysis. These average annual recreation benefits and costs are summarized in (***Table 7-1***).

Engineering Regulation (ER) 1105-2-100 (The Planning Guidance Notebook) provides economic evaluation procedures to be used in all Federal water resources planning studies. The guidelines specified in the ER 1105-2-100 dated 22 April 2000 were observed in preparing this cost analysis. The Federally mandated project evaluation interest rate of 4 7/8 percent, an economic period of analysis of 40 years and current prices were used to evaluate economic feasibility.

TABLE 7-1: SUMMARY OF RECREATION COSTS AND BENEFITS (OCTOBER 2006 PRICE LEVEL)

Recreation Construction Costs	**$2,519,000**
PED & S/A (18%)	$453,000
Total Recreation Construction	**$2,972,000**
Construction Duration	12 months
Interest During Construction Costs	$72,000
Total Recreation Investment	**$3,044,000**
Period of Analysis	40 years
Annualized Cost	$174,000
OMRR&R	$25,000
Total Annual Costs	**$199,000**
Annual Benefits	
User Day Value	$6.79
Daily Use	145
Annual Use	52,925
Average Annual Benefit	**$359,000**

The benefit to cost ratio for the proposed recreation features is approximately 1.80, with net annual benefits equaling approximately $160,000. Therefore the Caloosahatchee River (C-43) West Basin Storage Reservoir project recreation sites are economically justified. ***Appendix H*** describes in greater detail the recreation plan and associated benefits and costs.

7.3 COST ESTIMATES

Table 7-2 includes a breakdown of the cost of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project including construction, lands and damages, ecosystem restoration elements, Pre-Construction Engineering and Design (PED) costs, recreation and interest during construction. Costs are estimated at October 2006 price levels and rounded to the nearest $10,000.

TABLE 7-2: PROJECT COSTS FOR THE SELECTED ALTERNATIVE PLAN (OCTOBER 2006 PRICE LEVEL)
(Initial cost rounded to the nearest $10,000)

Ecosystem Restoration Elements	TOTAL
Construction	
Demolition	$70,000
Mobilization/Demobilization	$11,240,000
Relocations	$1,050,000
Site Work	$4,040,000
Reservoir (embankments, slurry wall, drains, soil cement, perimeter canal, spillways, structures, etc.)	$250,660,000
Pumping Plants	$72,820,000
Main Outlet Structures	$8,250,000
Townsend Canal Improvements	$2,000,000
Recreation	$2,520,000
Manatee Protection Structure	$2,520,000
Sub-Total Construction Cost	**$355,170,000**
Non-Construction	
Lands and Damages	$80,420,000
Planning, Engineering, and Design	$44,650,000
Construction Management	$27,000,000
Sub-Total Non-Construction Cost	**$152,070,000**
TOTAL INITIAL COST	**$507,240,000**

*The costs shown above are updated, detailed costs and are not exactly equivalent to the costs that were utilized in the Economic Appendix.

Table 7-3 includes a comparison of Yellow Book, project first cost and fully funded estimate in October 2006 price levels.

TABLE 7-3: COMPARISON OF YELLOW BOOK AND SELECTED ALTERNATIVE PLAN FIRST COST FOR CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR PROJECT (OCT 2006 PRICE LEVEL)

Component	Yellow Book	Project First Cost	Fully Funded Cost
Caloosahatchee River (C-43) West Basin Storage Reservoir	$400,000,000	$507,240,000	$565,700,000

Based on the engineering and design of the SAP for this study, the average annual cost for the SAP (Alternative 3B), is $35,100,000 that result in total average annual habitat units (HUs) of 12,809 and average annual net benefits for recreation of $160,000. The average annual cost per the combined average annual HUs generated by the project is $ 2,740.

7.4 DESIGN AND CONSTRUCTION CONSIDERATIONS

7.4.1 Engineering and Design

PED activities will be in accordance with USACE and SFWMD requirements. Preliminary design activities, which include survey and geotechnical investigations as well as cultural resources compliance, commenced in early 2004. Under the State's Acceler8 program, the SFWMD prepared a Basis of Design Report for the Caloosahatchee River (C-43) West Basin Storage Reservoir project (otherwise known in Acceler8 as the C-43 West Storage Reservoir). The Basis of Design Report includes all engineering assumptions and conceptual designs for each of the projects features. Upon reviewing the Basis of Design Report, the SFWMD will prepare initial, intermediate and final plans and specifications for construction contract award. All design work will be coordinated and reviewed with the USACE to meet USACE standards and regulations.

7.4.2 Construction and Implementation of the Plan

The non-Federal sponsor is exploring alternative project delivery methods to expedite implementation of the through the Acceler8 program. Such delivery methods may include the formation of a public-private partnership in which the non-Federal sponsor enters into an agreement or agreements with a private or not-for-profit entity for the provision of services that may include designing, building, operating or financing these components. It may also involve the non-Federal sponsor initiating construction activities prior to executing a Project Cooperation Agreement (PAC). Expedited implementation of the

Caloosahatchee River (C-43) West Basin Storage Reservoir project is in the best interest of the Federal government because it will provide early restoration benefits, potential cost savings, and reduced cash flow demands. Credit for such work is subject to the Secretary of the Army determining that the work performed was for a reasonable cost, necessary and integral to the authorized CERP project, and that the construction is consistent with applicable USACE construction standards and applicable Federal law. The non-Federal sponsor is aware that it will not receive credit for those costs unless the Congress approves the granting of the credit in law by the authorization of the Caloosahatchee River (C-43) West Basin Storage Reservoir project and the Secretary of the Army later determines the work is necessary and integral to the authorized Caloosahatchee River (C-43) West Basin Storage Reservoir project.

7.5 LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS, AND DISPOSALS (LERRD) CONSIDERATIONS

Section 601 of the WRDA of 2000 and USACE policy requires that the non-Federal sponsor will obtain and provide certification of all LERRDs necessary for project implementation.

7.5.1 Real Estate Requirements

The lands required for the recommended plan are based on an analysis of the lands needed for construction, and operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project. The real estate component of the recommended plan is tentative in nature for planning purposes only. Both the final real property acquisition lines and the real estate cost estimates provided herein and in ***Appendix D*** are subject to change. More detail on the real estate requirements for the recommended plan is discussed in ***Appendix D***.

7.5.2 Land Acquisition

Within the Caloosahatchee River (C-43) West Basin Storage Reservoir Project, comprised of approximately 10,700 acres, which consists of approximately 10,480 acres are required in fee, approximately 20 acres will be perpetual easements and approximately 200 acres will be used on a temporary basis for staging areas. Approximately 7,080 acres of the 10,700 acres within the project footprint were acquired under a Federal grant using a combination of State and Federal funds.

7.5.2.1 Department of Interior Grant Number LWCF-1, Addendum 3, Land and Water Conservation Act Funds

In June 1999, the DOI and SFWMD executed a grant agreement entitled Everglades Watershed Restoration-Grant Number LWCF-1, in which DOI provided $38,900,000 in Federal funds to the SFWMD for the acquisition of land in the East Coast Buffer/Water Preserve Areas and Southern Corkscrew Regional Ecosystem Watershed Project. SFWMD matched the Federal share with a State share of $38,900,000, making the total expenditures on land acquisition at $77,800,000. This grant contained language to allow SFWMD to manage these acquired lands during an interim period defined as "...the period of time: 1) commencing a) with respect to Grant Lands, the date of purchase or date of possession under condemnation, as appropriate, and b) with respect to Match Lands, the effective date of the Grant Agreement as defined below, and 2) ending a) sixty (60) days prior to the issuance of a notice to proceed with construction phase of the District/Corps Caloosahatchee River (C-43) West Basin Storage Reservoir PIR project, at which time the Grant Land or Match Land is deemed to be 'Incorporated into a District/Corps project', or b) on the date of receipt by Interior of written notice from the Corps or the District that the particular Grant Land or Match Land is not to be included within a District/Corps project, or c) such other date agreed to by Interior and the District." …. "Upon incorporation of each Grant Land or Match Land into a District/Corps Project, such Grant Land or Match Land shall be managed in accordance with Corps approved water management and control plans and operation and maintenance manuals for the project so long as the project remains authorized."

This grant was amended in December 1999 to add an additional $13,900,000 from each of the parties bringing the total to $105,600,000. The grant was amended again in April 2000 to add an additional $18,900,000 from each of the parties bringing the total to $143,000,000. This additional $38,900,000 was to be used to purchase the Berry Groves property (C-43) West Basin Storage Reservoir Project). The DOI's additional $18,900,000 in funding came from Land and Water Conservation Funds provided to the DOI by Congress. The last amendment to this grant was executed in June 2001 with each party contributing an additional $5,974,000 bringing the total State and Federal funding under the grant to $155,348,000. Not all the lands covered in this grant agreement are within the footprint of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

A total of $$27,567,669 in Federal funds was utilized to acquire approximately 7,080 acres, within the 10,700 acres within the project footprint, which will be credited to the Federal government.- These costs include both the land acquisition cost as well as the cost of any improvements and a major portion of SFWMD's administrative costs for the acquisition of the lands. This amount may be increased or decreased based on a more detailed analysis during the crediting review process after approval of the project, execution of a PCA and certification of the land.

A thorough discussion of this act, the Federal Grant, and its effects on this project are located in ***Appendix D***.

7.5.3 Hazardous, Toxic and Radioactive Waste

The existing conditions section of this document (**Section 2**) includes a summary of the Phase I/II Environmental Site Assessment (ESA) studies done on the five properties acquired (totaling approximately 12,372 acres) or being acquired (totaling approximately 600 acres) for the reservoir project. These are the Berry Groves tract composed of approximately 9,000 acres, the Bryan Paul Grove tract composed of approximately 600 acres, which has not been acquired, the MG Enterprises LLC property composed of approximately 2,399 acres, and the Griffin property, composed of approximately 954 acres. In the course of these studies, over 50 point source sites with potential HTRW contamination were identified. At this time, most if not all of these potential contamination sites have been either remediated or further investigated to characterize the sites and prepare remediation plans. The project sponsor, the SFWMD, has made a commitment to the USACE and USFWS that after it takes control of the properties from the present lessees and begins construction of the reservoir, all of the outstanding point source remediation efforts will be completed. In addition to the point source contamination sites, the SFWMD also identified distributed soil contamination in portions of the cultivated areas on all of the acquired properties. The remediation of the cultivated soil sites involves the placement of these soils into the core of the reservoir dam. This will isolate the contaminated soils from benthic organisms that serve as food for higher level organisms and thus reduce the potential for bioaccumulation of contaminants by fish and wildlife. In accordance with USACE policy, costs incurred by the non-Federal partner to characterize and remediate environmental contamination will not be cost-shared.

The USFWS has reviewed all of the SFWMD's remediation plans and indicated that they believe that the efforts will sufficiently reduce the risk of harm to fish and wildlife in those areas where the remediation will be performed. The USFWS has also stated that moderate levels of copper and other contamination of the cultivated areas are believed to not pose a direct threat to species of concern; however, they believe that an indirect effect may occur since widespread low-level soil contamination may reduce the population of benthic organisms upon which the species of concern normally feed.

Despite the diligent work performed by the SFWMD and USFWS to reduce the risk to environmental resources, it is possible that once the reservoir is built bioaccumulation of soil contaminants will result in harm to one or more species of interest. If this does happen, additional remediation efforts, such as more extensive removal of the reservoir bottom sediments could be performed to further reduce the exposure of benthic organisms to near surface soil contamination. The cost of additional remediation, if necessary, would be the responsibility of the non-Federal sponsor. If such remediation is necessary, it may be schedule in one cell at a time, possibly during the late dry season, thereby keeping the reservoir somewhat operational. In accordance with Corps policy, costs incurred by the non-Federal sponsor to characterize and remediate environmental contamination will not be cost-shared.

A summary of the proposed SFWMD remediation efforts and USFWS opinions for each property are included below.

7.5.3.1 Berry Groves Property

The most environmentally significant soil contamination was found on the Berry Groves property which had elevated levels of copper contamination distributed over a large fraction of the approximately 9,000 acres. As part of an Environmental Risk Assessment (ERA) study, the SFWMD estimated an interim screening concentration for risk to the snail kite to be 85 mg/kg. After extensive grid based testing, the SFWMD identified approximately 300 acres of groves located within the footprint of the planned reservoir that exceed the interim screening concentration of 85 mg/kg. The copper contaminated grids cells (50 acres in size) are identified as the entirety of numbers 124, 125, 134, 135, 143, and the southern half of 56 and 58. In addition to these heavily copper contaminated grid cells, the geometric mean copper concentration in the Berry Groves property was calculated to be 51.9 mg/kg. This exceeds the threshold effects concentration (TEC) 32 mg/kg for benthic organisms.

To remediate the 300 acres of the Berry Groves property that exceed the interim screening criteria, the SFWMD proposed that one foot of topsoil be scraped and placed within the core of the reservoir levee as construction progresses. The intent is to isolate these soils from benthic organisms that typically live in sediments within one to two feet of the sediment/water interface. Since benthic organisms would not typically be present in the core of the levee, the potential for bioaccumulation of copper by these organisms and the later biomagnification of these contaminants by higher tropic levels will be much less than if the soils are left in place.

The USFWS reviewed the SFWMD's plan to place the contaminated soils from the 300 acres into the core of the levee and they agreed that this will reduce the copper concentrations in the affected grids to below the interim screening value for risk to the snail kite. However, the USFWS also believes that while remediating the 300 acres with the highest levels of copper concentration will likely protect the snail kite, the property-wide average copper concentration of 45 mg/kg will still exceed the TEC of 35 mg/kg for benthic organisms. The USFWS concludes that direct impacts to the snail kite are not likely, but indirect impacts are likely since the food base for the snail kite will be reduced as a result of the elevated property-wide copper concentration.

7.5.3.2 Griffin Property

Five areas of potential concern including the cultivated areas, canal sediments, maintenance area/chemical barn, fertilizer mix/load area, and burn area were identified in the Phase I/II ESA studies. The investigation of the cultivated areas indicated that though there is evidence of residual pesticide contamination, the detected concentrations of persistent pesticides were not above the levels of concern. Aldicarb was detected at a concentration above the site-specific Florida Sediment Quality Assessment Guidelines (SQAG); however, this was not of great concern because discontinuing its use would likely result in much lower residual concentrations since this pesticide readily degrades.

The Phase II audit recommended that remediation be performed at the maintenance/chemical barn area and the burn area. The remediation plan for the maintenance area/chemical barn area requires the excavation and proper disposal of 140 tons of soil that is contaminated with petroleum products. Two groundwater monitoring wells will be installed at this site. Samples from the monitoring wells will be analyzed for petroleum products, organophosphorous pesticides, lead, arsenic, copper, and zinc. The remediation plan for the burn area requires the excavation and proper disposal of 50 tons of soil. One groundwater monitoring well will be installed at this site. Samples from this well will be analyzed for copper.

Based on a review of the Phase I/II ESAs and proposed remediation efforts, the USFWS indicated in a letter to the SFWMD (dated October 12, 2004) that incorporation of the Griffin property into the reservoir project would not pose a threat to listed species.

7.5.3.3 MG Enterprises LLC, also known as the Winthrop Property

Five areas of potential concern including the cultivated areas, canal sediments, two agricultural maintenance areas and the exploratory oil/gas well were identified in the Phase I/II ESA studies. The investigation of the cultivated areas indicated that though there is evidence of residual aldrin contamination in one sample, the risk to avian species was not significant. Aldicarb was also detected above levels of concern; however, the cessation of its use was considered by the SFWMD to be an adequate remediation method since this compound readily degrades.

Of the point source contamination sites, the two maintenance areas were identified as requiring remediation. The remediation plan for Maintenance Area A requires the excavation of approximately 300 tons of topsoil that is contaminated with pesticide residue and petroleum products. Contaminated soils will be disposed of offsite. Clean fill will be placed and at least two monitoring wells will be installed to monitor for contamination of the surficial aquifer by petroleum products, pesticides, copper, lead, and zinc. The remediation plan for Maintenance Area B requires the excavation and proper disposal of 300 tons of contaminated soil. Clean fill will be placed and two monitoring wells will be installed to monitor for contamination of the surficial aquifer by petroleum products, and lead.

The USFWS, in a July 14, 2003 letter, indicated that the proposed remediation methods for the aldicarb and paraquat on the cultivated areas and the soil removal at the maintenance area should reduce the risk to benthic organisms from exposure to the detected contaminants. After review of the ESA studies the USFWS agreed (letter to Robert Kukleski, SFWMD, dated July 1, 2004) that the risk presented by aldrin contamination was not significant.

7.5.3.4 Bryan Paul Property

In a summary of the Phase I/II ESA studies, the SFWMD (internal memo dated August 24, 2004, from Robert Taylor to Ruth Clements) identified ten remediation actions that would have to occur to make the Bryan Paul property suitable for use in the reservoir project. The identified actions are cleanups at the nursery barn, C-1 mix station, graded area, auxiliary tank area, cultivated citrus area, burn area, and canal sediment sampling site. Tasks included removing the well/septic tank and the above ground storage tanks (ASTs). The total projected cost of these actions was $565,000. Of this amount approximately $90,000 could be attributed to actions required if the future land use of the property was agricultural or residential. The remaining expense is necessary only if the future land use would be water storage or natural use.

The most expensive remediation action required on this property is the removal and disposal of two feet of top soil from approximately 20 acres of cultivated land. This soil is contaminated with chlordane. The SFWMD has proposed that this soil be excavated and placed within the core of the reservoir's dam. In a letter to the SFWMD dated August 9, 2006, the USFWS states that it agrees with the SFWMD's proposed cleanup target level of 18 ug/kg. The USFWS also concurs that placing the contaminated soils within the reservoir dam is an appropriate remediation technique.

7.5.4 Relocation Assistance

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (Public Law [PL] 91-646), relocation assistance is required to be provided to affected residents and business. Information provided by SFWMD indicates that there is no relocation or displaces. Upon certification of the LERRD, SFWMD will be required to demonstrate compliance with the requirements of PL 91-646 including that landowners have been properly advised of their rights under the program and that which evidence appropriate benefit determinations. To include:

- Number of persons, farms, and businesses displaced.
- Estimate of all PL 91-646, Title II costs and contingencies.
- Discuss/describe availability of replacement housing and any need for last resort housing benefits.

Based on current information, it appears that there were no relocation assistance payments made or required.

7.6 OPERATIONS AND MAINTENANCE CONSIDERATIONS

The SAP will be operated in a manner consistent with the original design intent for the Caloosahatchee River (C-43) West Basin Storage Reservoir project components included in the 1999 Comprehensive Review Study Report. In very brief summary, the Caloosahatchee River (C-43) West Basin Storage Reservoir project will be operated to capture regulatory releases from Lake Okeechobee (via pumping station) and to collect and store basin runoff from the lower southwestern Caloosahatchee River Basin currently discharged to the Caloosahatchee River (C-43 Canal) through existing canal systems and natural drainage ways. The reservoir will be operated to collect and store water during the wet season, then release the water when needed during the dry season to meet estuarine demands by helping to maintain a minimum flow of 450 cfs at S-79. Since the reservoir's perimeter canal serves as a means of conveying both surface storm water runoff and off site flows entering the project several canals discharge to and from the reservoir's perimeter. Additional details about project operations are included in ***Annex D*** (Draft Operating Manual).

7.6.1 Operations and Maintenance Costs

Annual operations and maintenance (O&M) costs were estimated for the construction features of the recommended plan for Caloosahatchee River (C-43) West Basin Storage Reservoir Project. The O&M costs were determined by extrapolation from operational costs histories supplied by the SFWMD using industry standard cost data and data from past and projected cost trends. O&M activities include such items as mowing, erosion control, pump maintenance, levee road maintenance, and building maintenance. The annual (OMRR&R) costs are estimated to be $3,000,000 (rounded to the nearest $10,000), which includes ecologic and water quality monitoring associated with the project level Adaptive Program described in ***Annex D***. Recreation OMRR&R costs have been estimated at approximately $25,000. The non-Federal sponsor is responsible for 100 percent of the OMRR&R recreation costs.

7.6.2 Monitoring and Adaptive Management Costs

The estimated cost for water quality during the initial year is $610,000, which would be construction funded. The estimated cost for water quality monitoring during operations of the project is $604,000 per year, which would be OMRR&R funded. The water quality monitoring plan is included in Annex D. The Ecological monitoring plan (also in Annex D) includes recommendations for salinity, oysters, SAV, fish, and estuarine water quality. This ecological monitoring plan is not recommended for funding by this project. It has been recommended to RECOVER for funding as part of the Monitoring and Assessment Plan (MAP). Most of the ecological monitoring recommended for the Caloosahatchee Estuary is already currently recommended by the MAP. A hydrologic monitoring plan is also included in Annex D which includes recommendations for monitoring of reservoir water level, flow, groundwater, weather, and structures. This cost is included in the OMRR&R estimate cited above in 7.6.1.

7.7 PLAN ACCOMPLISHMENTS

The SAP affirmed that an above-ground storage reservoir (including pump stations and water control structures) and associated conveyance can meet the needs of the Caloosahatchee Estuary at the right time, and is a cost-effective solution to achieving system-wide benefits in Caloosahatchee River, estuary and the south Florida ecosystem. In addition, the plan helps achieves the benefits of the project as previously developed for CERP.

The SAP includes a key component that was identified in the Restudy and helps to promote a salinity balance in the Caloosahatchee Estuary that will provide for vegetation, fish and wildlife habitat restoration functions that are critical to the continual health and development of the estuary. The additional water injected into the estuary's natural system areas are key aspects of restoration planning for the Caloosahatchee Estuary. The Caloosahatchee Estuary is part of south Florida's fragile ecosystem and has long been recommended as a management measure to achieve restoration objectives. Based on a salinity model, the area within the Caloosahatchee Estuary system beneficially affected by the project conservatively encompasses at least 71,000 acres in the Caloosahatchee River, San Carlos Bay, and a portion of Pine Island Sound, although in all likelihood the area beneficially affected by project implementation will be much larger, including portions of Pine Island Sound, Estero Bay, and the Gulf of Mexico. These acres are within the navigable waters of the United States and within the navigational servitude of the United States.

Two planning goals and seven planning objectives have been established for CERP projects through the Restudy. The two planning goals are: (1) enhance ecological values and (2) enhance economic values and social well-being. The

SAP for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project positively contributes to both of these goals and all seven of the objectives originally established for these two underlying planning goals.

7.7.1 Relationship of Other Projects in CERP to Caloosahatchee River (C-43) West Basin Storage Reservoir Project

The intent of Caloosahatchee River (C-43) West Basin Storage Reservoir Project is to meet the immediate needs of the Caloosahatchee Estuary and thereby show ecosystem restoration benefits in the estuary. Construction and implementation of the reservoir and the subsequent achievement of estuarine benefits are not dependent on CERP being in place. The implementation or non-implementation of CERP will not diminish benefits achieved by the Caloosahatchee River (C-43) West Basin Storage Reservoir. The need for additional storage to prevent harmful discharges to the natural system and improve the timing and quality of water delivered to the natural system is well-established as a basic premise of the CERP.

7.7.2 Project Justification: Next-Added Increment

7.7.2.1 Next–Added increment Analysis

Section 385.26 of the CERP Programmatic Regulations requires the development of a series of programmatic guidance memoranda (GM) that includes guidance for performing plan formulation and evaluation process and next-added incremental (NAI) justification. The CERP Programmatic Regulations requires a NAI evaluation of the Tentatively Selected Plan (TSP) as is defined in the CERP Programmatic regulations as “the next project to be added to a system of projects that includes only those projects that have been approved according to general provision of law or specific authorization of Congress and likely to be implemented by the time the project being evaluated is completed.” The NAI analysis evaluates the effects, or outputs, of the TSP as the next project to be added to the group of already approved CERP projects. This analysis helps illuminate the amount of benefits the SAP contributes without regard to future CERP projects. It also helps to ascertain whether sufficient benefits would accrue to the SAP to justify the cost if no additional CERP projects (other than those already existing or authorized) were implemented. In the case of this analysis no other CERP projects are assumed to exist for the purposes of the NAI analysis.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project aims to 1) reduce harmful discharges to the Caloosahatchee Estuary by capturing some high flow releases from Lake Okeechobee and basin runoff from the lower West Caloosahatchee River Basin during the wet season, 2) storing the water till needed in a reservoir and 3) provide incidental water deliveries to supplement river flows over S-79 to Caloosahatchee Estuary during the dry season, thereby reducing stress on the natural system due to low flows which allowed increased salinity levels to occur in the estuary. The SAP affirmed that a reservoir and discharging to better meet the needs of the basins at the right time, together is a cost-effective solution to achieving system-wide benefits in the south Florida ecosystem. In addition, the plan achieves the benefits of the project as previously developed for the CERP.

Alternative 3C was identified as the NER plan that provides the maximum net environmental benefits on a system-wide basis. Alternative 3B, which is a variant of Alternative 3C, is a cost effective plan that will provide environmental benefits on a system-wide basis, has a lower project cost, is a part of an incremental adaptive restoration approach and is justifiable alternative. The project is justified by its beneficial effect on seagrass habitat, an important indicator of estuarine ecosystem function. The NAI condition produces more total benefits than seen in the system-wide analysis.

The system-wide formulation was conducted to determine the input for the CE/ICA and assist in the selection of the recommended plan. An additional analysis was also conducted to use in justifying and describing the benefits of the Caloosahatchee River (C-43) West Basin Storage Reservoir as a stand-alone project without the system-wide benefits attributed to other CERP projects, otherwise known as the NAI analysis. This analysis was completed for all the alternatives that were evaluated under the system formulation. This was done to demonstrate that all alternatives would have similar benefit outputs during the NAI as they do with the system-wide formulation analysis.

An identical method was used for the NAI as was used for the system formulation. As described in the system formulation analysis, five attributes were studied to determine system response. Oysters, *Vallisneria*, seagrasses, extreme events and EST05 were all measured and compared to 2050 in order to determine the benefit lift for the TSP (***Table 7-4***). This methodology is described in the environmental benefits evaluation section.

Although the NAI and system formulation analysis are listed below, this is not a valid comparison due to different sources of data for the two analyses. Therefore, even though the HSIs are similar, the total project average annual HUs are based on different 2050 model conditions, resulting in a larger lift for the NAI analysis. The NAI analysis reflects 28 percent more benefits than the system-wide formulation. There are several variables which could explain the higher benefits with the NAI approach. The first and most influential of these results from the rest of CERP's impact on the overall water budget provided to the Caloosahatchee River (C-43) basin. The system-wide analysis has a lower water budget than the NAI analysis, leading to diminished dry season conditions. The other variances may stem from differing models being utilized for the benefit analysis. The system-wide analysis utilized the MIKESHE model and the NAI run utilized spreadsheet flow models, which utilized flows from the SFWMM and is further described in ***Section 8*** and ***Appendix A***.

TABLE 7-4: COMPARISON OF NAI AND SYTEM FORMULATION SCORES

Alternative	Oyster	*Vallisneria*	Seagrasses	Extreme Events	EST05	Total Project Average Annual Habitat Units
3B – System-wide	.60	.33	.59	.43	.70	12,809
3B – NAI	.23	.60	.52	.24	.71	15,297

7.7.2.2 Next–Added increment Analysis Conclusions

Both the system formulation and the NAI evaluations of Alternative 3B (SAP) demonstrate significant ecological benefits due to implementation of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

It was determined through this analysis that there are benefits associated with the NAI analyses completed for the West Basin Storage Reservoir Project. Overall, the project design is consistent with attaining project goals and objectives. Operational flexibility will lead to increased benefits by further minimizing potential high flows to the estuary as well as by minimizing discharges (and associated sediment loads).

In comparing the NAI benefits with the system-wide analysis it can be noted that there is a perception of more benefits realized in the NAI analysis. There were approximately 12, 809 average annual HUs calculated for the system-wide analysis compared to the 15,300 average annual HUs in the NAI analysis. In reality the NAI and system-wide HSI scores are relatively close. ***Table 7-5*** presents a summary of the raw HSI scores for both the NAI and system-wide calculations.

TABLE 7-5: SUMMARY OF RAW HSI SCORES

	SYSTEM WIDE FORMULATION			NAI ANALYSIS		
	2000	2050	ALT 3B	2000	2050	ALT 3B
Vallisneria	0.16	0.20	0.33	0.03	0.08	0.60
Seagrasses	0.51	0.54	0.59	0.49	0.51	0.52
Oysters	0.48	0.52	0.60	0.52	0.52	0.23
Extreme Events	0.28	0.30	0.43	0.22	0.24	0.24
EST05	0.38	0.43	0.70	0.20	0.21	0.71

The Caloosahatchee River (C-43) West Basin Storage Reservoir project NAI analysis demonstrates that as a stand-alone project, all of the benefits achieved in the system-wide formulation process were met or exceeded. The NAI analysis yields a greater average annual HU lift than the system-wide analysis. The reason behind the additional benefits calculated during the NAI analysis is due to different water budgets afforded to the model for both the system-wide and NAI computations, stemming from demands on Lake Okeechobee. The variables in the water budget reflect additional demands from CERP features located outside the Caloosahatchee River (C-43) West Basin Storage Reservoir study area. This additional water being supplied to other CERP features in the system-wide analysis leads to a lower potential benefit to the study area. This does not imply that the West Basin Storage Reservoir is operating less efficiently as part of the CERP system, but instead illustrates difficulties in comparing model results when the boundary conditions are not consistent.

The system-wide analysis does not capture all of the benefits that are being provided to the other CERP features by limiting the water available to the Caloosahatchee River (C-43) West Basin Storage Reservoir study area, and mainly aims to capture the direct benefits to the study area. Due to the nature of the models and uncertainty in the independent CERP features included in the system-wide analysis it was not practicable to characterize all of the benefits. If all of the benefits to the other conceptual CERP features were characterized, it is fully expected that the cumulative system-wide benefit analysis would exceed the cumulative NAI benefits.

Total system-wide analysis includes each of the projects that are affected by the water budget changes reflected in the modeling. The NAI analysis does not include these other projects shifting water from the Caloosahatchee River (C-43) West Basin Storage Reservoir study area, so it is likely that the additional benefits calculated in the NAI analysis result from the difference in the water budget in the system-wide and NAI analysis, and are not directly related to the features in the NAI analysis.

The conclusion from this analysis is that as a stand-alone project the Caloosahatchee River (C-43) West Basin Storage Reservoir will be efficient and effective at meeting the goals and objectives of the project. The risk of being unable to obtain project benefits is expected to be minimal.

7.8 CONTRIBUTION TO ACHIEVEMENT OF INTERIM GOALS AND TARGETS

Section 601(h)(3)(C)(III) of the WRDA 2000 (PL 106-541) required the CERP Programmatic Regulations to include the “establishment of interim goals to provide a means by which the restoration success of the Plan may be evaluated throughout the implementation process." Section 385.38 of the CERP Programmatic Regulations (33 CFR Part 385) further describes the intent and the underlying principles for establishing interim goals and a process for developing them. Section 385.39 of the CERP Programmatic Regulations also established the requirement to develop interim targets to measure progress toward meeting the other water-related needs of the south Florida region, and describes the intent, underlying principles, and the process for establishing interim targets.

Consistent with the processes for developing interim goals and targets required in the CERP Programmatic Regulations, RECOVER issued a final report containing recommendations for interim goals and targets on February 17, 2005. The RECOVER report was then utilized to develop the Interim Goals and Interim Targets Agreements and will be updated after the final PIR is completed and when the agreements are finalized.

For the purposes of this PIR the project delivery team (PDT) utilized the RECOVER report to evaluate the progress towards the interim goals and interim targets. Interim goals for evaluating progress toward the restoration of the south Florida ecosystem are recommended for the Northern Estuaries, Lake Okeechobee, the Everglades, and the Southern Estuaries. Interim targets for water supply and flood protection are also recommended.

7.8.1 Progress toward Interim Goals

Although the Caloosahatchee River (C-43) West Basin Storage Reservoir project will create minor hydrologic and ecosystem response effects throughout a large portion of the south Florida ecosystem due to the interconnectedness of the regional water management system, the magnitude of the project's contribution toward restoration objectives for the Northern Estuaries, Lake Okeechobee, and the Southern Estuaries is relatively insignificant when considered with other components which were specifically included in the Plan to beneficially affect those areas. However, the Caloosahatchee River (C-43) West Basin Storage Reservoir Project's effects on fish and wildlife habitat functions in the Northern Estuaries, specifically the Caloosahatchee Estuary, are quite significant. Accordingly, this applies to the project's effects on the twelve "Everglades Restoration Indicators" listed in RECOVER's Interim Goals and Interim Targets report, which in general are indicators of effects on hydrology, water quality, and biological response. The interim goal indicators for the Everglades included in RECOVER's February 17, 2005 report are listed in ***Table 7-6.***

TABLE 7-6: EVERGLADES INTERIM GOAL INDICATORS

No.	***Indicator***
1.1	American Oysters in Northern Estuaries
1.2	Submerged Aquatic Vegetation in Northern Estuaries
3.1	Water Volume
3.2	Sheet Flow in Natural Areas
3.3	Hydropattern
3.4	System-Wide Spatial Extent of Habitat

In general, the Caloosahatchee River (C-43) West Basin Storage Reservoir project will result in improvement in ecosystem function and will create a substantial incremental contribution toward the achievement of the interim goals for ecosystem restoration in the Northern Estuaries. The project's contributions toward the achievement of interim goals for the restoration of the south Florida ecosystem are assessed by evaluating the effects on the above-listed indicators. Although not all of the indicators were quantitatively assessed using hydrologic-based performance measures during plan formulation and evaluation work, a qualitative assessment was performed for all of the Everglades interim goals indicators. Due to the magnitude of hydrologic change necessary to meaningfully affect some of the indicators and the actual hydrologic effects predicted to result from implementation of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project, it is not expected that the project will affect all of the indicators equally. Detailed information about the performance measures and methodologies used to evaluate and compare alternative plans can be found in ***Appendix C*** (Environmental Information). ***Table 7-7*** is a summary of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project's effects on Northern Estuaries indicators.

TABLE 7-7: PROJECT EFFECTS ON EVERGLADES INTERIM GOALS AND INDICATORS

No.	***Indicator***	***Project Effects***
1.1	American Oysters In Northern Estuaries	The reduction in number and duration of high flow events reduces low salinities and creates favorable conditions for oyster recruitment that will lead to increased diversity and abundance of estuarine fauna. The reduction in low flow events reduces high salinities and will benefit oyster populations by killing predators, reducing disease and diminishing predation pressure on oyster spat allowing greater recruitment.
1.2	Submerged Aquatic Vegetation in Northern Estuaries	The reduction in the number and duration of high flow events reduces low salinities and creates favorable conditions for more extensive seagrass beds including shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*) that are an important habitat for a variety of estuarine invertebrate and vertebrate species, including some commercially and recreationally important fishes. The reduction in low flow events reduces high salinities and will lead to more extensive tape grass (*Vallisneria americana*) beds and greater ecological function.
3.1	Water Volume	170,000 ac-ft of storage capacity.
3.2	Sheet Flow in Natural Areas	No change; project does not include removal of barriers to sheet flow.
3.3	Hydropattern	The reduction in the number and duration of extreme high and low flow events will improve quantity, timing and distribution of freshwater flows to Caloosahatchee Estuary which will lead to increased diversity and abundance of estuarine flora and fauna.
3.4	System-Wide Spatial Extent of Habitat	The reduction in extreme high and low flow events will significantly benefit the valued ecosystem components such as tape grass (*Vallisneria americana*), shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*) manatee grass (*Syringodium filiforme*) and the American oyster (*Crassostrea virginica*) which are crucial to maintaining the ecological structure and function of the estuary by providing food, living space and foraging sites for other naturally occurring estuarine species.

7.8.2 Progress toward Interim Targets

To evaluate project effects on progress toward meeting CERP objectives for other water-related needs of south Florida, eight interim target indicators were recommended by RECOVER in the February 17, 2005 report. The interim targets were developed using the Yellow Book version of the 2x2 model run which limited some of the information to certain geographic areas. The only performance measures available for flood control were for the southern Dade area so there is not an interim target to compare to in the Caloosahatchee River (C-43) West Basin Storage Reservoir project area. The severity and duration of water restrictions when drought levels exceed a one-in-ten condition need to be reviewed to determine the full extent of predicted water supply impacts in the

Caloosahatchee River (C-43) basin. To perform a review based on supply-side management, raw or post-processed data that will allow the determination of monthly demand volume, number of days per month with cutbacks (demands not met), and volume of cutbacks (demand not met) per each month is required. Since this data is not readily available from MIKESHE output, annual average volumes were evaluated. The average annual volumes will not allow for a determination of differences in alternative performance regarding water supply deliveries. However, of the eight indicators, the Caloosahatchee River (C-43) West Basin Storage Reservoir project is expected to improve surface water annual average volumes deliveries to agricultural users in the Caloosahatchee East and Caloosahatchee West basins. The project is expected to slightly increase groundwater average annual volumes agricultural demand over the 2050WO in the Caloosahatchee East Basin without significantly affecting performance. Detailed information about the project's effects on sources of water for supply, aquifer protection and flood damage reduction can be found in ***Annex C***. ***Table 7-8*** is a summary of the Caloosahatchee River (C-43) West Basin Storage Reservoir Project's effects on applicable interim targets indicators.

TABLE 7-8: PROJECT EFFECTS ON INTERIM TARGETS INDICATORS

No.	*Indicator*	*Project Effects*
5.1	Water Volume	Effects unknown due to absence of adequate evaluation tools.
5.2	Water Supply for Lower East Coast Service Area	Not applicable to this geographic area
5.3	Water Supply for Lake Okeechobee Service Area	Effects unknown due to absence of adequate evaluation tools.
5.4	Protect Biscayne Aquifer from Saltwater Intrusion	Not applicable to this geographic area.
5.5	Protect Southern Portion of Biscayne Aquifer from Saltwater Intrusion	Not applicable to this geographic area
5.6	Flood Control: Root Zone Groundwater Levels in South Miami-Dade Agricultural Area East of L-1N	Not applicable to this geographic area
5.7	Flood Control: Groundwater Stages for Miami-Dade, Broward, Palm Beach, and Seminole Tribe Surface Water Management Basins	Not applicable to this geographic area
5.8	Flood Control: Flood Water Removal Rate for Everglades Agricultural Area (EAA)	Not applicable to this geographic area

7.9 SUMMARY OF ECONOMIC, ENVIRONMENTAL, AND OTHER SOCIAL EFFECTS

7.9.1 Other Social Effects

The Caloosahatchee River (C-43) West Basin Storage Reservoir Project alternative restoration plans could result in beneficial and adverse Other Social Effects (OSE) within the study area. As is evident throughout this appendix, a variety of positive and adverse NED impacts on water supply, flood damage reduction and recreation are expected to result from the reservoir construction. Similarly, the alternative restoration plans could have positive or adverse OSE impacts on the study area associated with (1) plan implementation, including land acquisition, project construction, and O&M activities, and (2) operation of the modified C&SF system. As in the case of the NED effects, the OSE account is concerned with the net effects of the alternative plans (i.e., the differences between the with- and without-project future conditions).

Some of the potential OSE impacts would occur primarily at the regional scale, and others would have more localized effects. At both scales, there may be some individuals and communities that are positively affected by project implementation, some that are adversely affected, and many that are not affected at all. Relative to the size of the regional or local economies, the OSE effects may be minimal. However, if these effects occur predominantly within a limited geographic area, or affect a relatively small or vulnerable population, then the impacts can be disproportionately large. Therefore, the purposes of

OSE analysis include not only determining the total magnitude of potential impacts, but also identifying the population (and its characteristics) that would be affected by any proposed action.

Some of the categories of effects typically included in the OSE account do not pertain to the alternative restoration plans. For example, the alternative plans are not expected to affect energy use or energy conservation in the study area. As will be noted, other categories of potential OSE impacts have been addressed and can be found in ***Appendix G***.

7.9.2 Environmental Justice

Executive Order (E.O.) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires the Federal government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects of its activities on minority and low-income populations. E.O. 12898, Environmental Justice, states that the proposed action would not result in adverse human health or environmental effects. Any impacts of the action would not be disproportionate towards any minority or low-income population. The activity does not (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. The activity would not impact "subsistence consumption of fish and wildlife." It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental actions. It also requires Federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns, and the communication of associated risks to the public.

The Caloosahatchee River (C-43) West Basin Storage Reservoir project will provide benefits to quality of life by improving the natural environment in which we live. The project improves flows to the estuary. This is achieved through a reservoir which is located in a rural area so that negative impacts are minimized for all communities. The project is a Congressionally approved project funded with Federal and State dollars to make improvements to hydrology for people and the environment.

In public outreach efforts to date, only one potential environmental justice issue has been identified: the loss of jobs for low income and minority workers as a result of acquiring agricultural land for the construction of the reservoir. The expected loss in employment will occur to seasonal and/or temporary migrant workers, and as can be noted in the future land use section agricultural acreage in the surrounding study area and counties is expected to increase. The Caloosahatchee River (C-43) West Basin Storage Reservoir Project PIR and EIS is an opportunity to somewhat alleviate this potential problem by providing jobs within and during construction of the project, some of which could provide seasonal and temporary employment. To address this issue the SFWMD is conducting training programs to allow local individuals to acquire the skills needed to construct the reservoirs. In addition, it is anticipated that adjacent lands will continue to support agricultural operations.

The reservoir does not present any environmental impacts that are high, adverse and disproportionate to low income, minority or Tribal populations. Through the public participation process of the outreach and NEPA scoping no high and adverse impacts became known. There was sufficient public input to feel confident that scoping was successful and that the breadth of the potential impacts were communicated and understood by the public. Thus this NEPA process has found no evidence of high, adverse and disproportionate impacts.

The reservoir site is located based upon hydrologic characteristics, land availability and interconnection to existing canals and structures to optimize operations. Furthermore, in the consideration of the project site, urban areas are avoided to eliminate the negative impacts typically associated with site location of large projects. Through "willing seller agreements" a variety of land rights have been or will be acquired that allow the use of land for the resulting improvements to the human quality of life and the intended environmental benefits intended by the impoundment.

These environmental benefits provide quality of life improvements to all people and primarily to people in the communities within the study area. By the nature of design, this operating procedure will maintain if not improve flood damage reduction. This will improve the quality of human life by providing increased wildlife activity; a special bonus for those who appreciate seeing increases in fish and bird populations. This logically translates to the increased benefits in enjoyment, aesthetics, and economics for recreational activities.

7.10 SIGNIFICANCE OF HABITAT

The Selected Alternative Plan is consistent with each of the USACE "Environmental Operating Principles" particularly with respect to the south Florida ecosystem-wide approach for plan formulation, evaluation, and selection, and a holistic consideration of water resources needs and solutions to water resources problems in the study area.

Principle One: **Strive to achieve environmental sustainability**. An environment maintained in a healthy, diverse condition is necessary to support life.

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and richness that defined the pre-drainage system. These measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that the current, degraded ecological conditions can be sustained in the future.

The SAP contributes to the restoration of the Caloosahatchee Estuary by capturing high-volume flows released from Lake Okeechobee and basin run-off and storing this excess water to provide flows during the dry season to provide supplemental flows over S-79 to maintain correct salinity balance in the estuary.

Principle Two: **Recognize the interdependence of life and the physical environment.** Proactively consider environmental consequences of USACE programs and act accordingly in all appropriate circumstances.

Life within the Caloosahatchee Basin is dependent on the river as a source to meet drinking water and irrigation needs. The USACE currently manages Lake Okeechobee as well as the Caloosahatchee River (C-43). As a result of conditions within the lake and the lake infrastructure, large regulatory releases are required to maintain lake levels within acceptable safety parameters.

The Caloosahatchee River (C-43) West Basin Storage Reservoir will provide immediate benefits to the Caloosahatchee Estuary, a part of the South Florida Everglades Ecosystem. The damaging estuarine effects of basin run-off and water releases from Lake Okeechobee will be reduced. Untimely discharges of fresh water to the estuaries would be partially equalized, leading to more natural salinity levels and the recovery of the estuarine ecosystem in the project area. By maintaining salinity balance and preventing salinity intrusion, the SAP will reduce the need for desalinization technologies. Any additional water made available through this project could be used for incidental benefits for water supply.

The SAP footprint is located on an active orange grove which provides employment in the local community. This loss in jobs will be offset by the construction opportunities in relation to implementing the project as well as related recreation.

Principle Three: **Seek balance and synergy** among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

Caloosahatchee River (C-43) West Basin Storage Reservoir was designed to meet the needs of competing municipal, agricultural, and environmental water supply in the basin. Every effort was made to provide for a beneficial effect in the adjacent natural system and also to ensure that the proposed project would not impact the current water supply needs. The proposed Reservoir would provide additional resources for the human environment through improved recreation within the Reservoir itself. The Caloosahatchee River (C-43) West Basin Storage Reservoir will have no negative effect on water resources for urban utilities, agricultural or flood damage reduction.

Principle Four: **Continue to accept corporate responsibility and accountability** under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

The Caloosahatchee River (C-43) West Basin Storage Reservoir PIR complies with all applicable laws such as the NEPA, Clean Water Act, Endangered Species Act, and all other applicable legislation. The proposed Reservoir will enhance both ecologic values and also economic values and social well-being.

Public safety concerns were raised in regards to possible flooding and damage to the SR 80 Bridge (main evacuation route for Lee County) and surrounding area homes and businesses. These concerns were addressed by designing the reservoir embankments to USACE dam safety standards.

Principle Five: **Seek ways and means to assess and mitigate cumulative impacts to the environment;** bring systems approaches to the full life cycle of our processes and work.

The Caloosahatchee River (C-43) West Basin Storage Reservoir is one of 68 different projects as part of the CERP. Congress approved the CERP as the "framework for modifications and operational changes to the C&SF 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 (WRDA 2000). As such, the primary purpose of the CERP is the restoration of the Everglades ecosystem, including specific safeguards to ensure that the benefits to the natural system are achieved and maintained, while providing for other water-related needs of the south Florida region. By doing this, the USACE is able to avoid and minimize any potential project impacts that may occur as a result of the implementation of any project.

Potential impacts to the natural system have been assessed as part of the PIR process and considered in the plan selection. Specifically, NEPA consultation was performed for the Eastern Indigo Snake, Audubon's Crested Cara Cara and the East Indian Manatee. Guidelines for fill rates, operations and control structures have been established to minimize impacts to these species. In addition, a system wide monitoring plan of the natural environment will be in place to continue to assess all impacts, and used along with adaptive management of the project and other CERP components, in order to maximize benefits to the system while identifying and limiting any negative effects.

Principle Six: **Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.**

As part of the Adaptive Management strategy for the CERP, three sub-teams from RECOVER meet monthly to discuss ways to improve the overall effects of the CERP program. The three RECOVER teams are the Planning, Evaluation, and Assessment teams. These three teams collectively are composed of many individuals with separate disciplines in order to integrate their specific knowledge of science, economics, and sociology. The teams evaluate the different environmental effects that are expected to occur as a result of CERP implementation, and also assess possible impacts to any areas that can be beneficially adjusted through Adaptive Management. RECOVER reviewed the proposed Caloosahatchee River (C-43) West Basin Storage Reservoir PIR as it was being developed and provided input as to how the project could best be implemented and operated.

Additionally, extensive modeling was performed to mimic the natural system in the project area, both hydrologically and ecologically, in order to better understand how the system will function with the SAP in place.

Principle Seven: **Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems that also protect and enhance the environment.**

The USACE fully addressed and considered all public comments concerning the proposed Caloosahatchee River (C-43) West Basin Storage Reservoir. Comments were received from state and federal agencies as well as non-governmental agencies, tribal interests, and the general public. As part of the NEPA process, the USACE sent out a scoping notice to provide information to the public and/or other agencies in order to encourage participation and receive comments about the proposed project. Further public input was encouraged through public meetings, stakeholder meetings, and Regional Project Delivery Team meetings. Changes to the report were made where applicable; as an example, changes were made to the final in response to comments provided by Lee County during the public review period for the draft PIR. These changes included adding information about the Northern Everglades and Estuary Protection Act to the final PIR, this information can be found on page 1-17 of this report.

The Selected Alternative Plan is consistent with the USACE's 12 Actions for Change. The "12 Actions for Change" can be grouped into three overarching themes: Effectively implement a comprehensive systems approach; communication; and reliable public service professionalism. Below is a summary of the grouped actions for change, and how the Caloosahatchee River (C-43) West Basin Storage Reservoir is consistent with those actions.

Effectively Implement a Comprehensive Systems Approach: Comprehensively design, construct, maintain and update engineered systems to be more robust, with full stakeholder participation.

1. Employ integrated, comprehensive and systems-based approach
2. Employ risk-based concepts in planning, design, construction, operations, and major maintenance
3. Continuously reassess and update policy for program development, planning guidance, design and construction standards
4. Employ dynamic independent review
5. Employ adaptive planning and engineering systems
6. Focus on sustainability
7. Review and inspect completed works
8. Assess and modify organizational behavior

In order to effectively implement a comprehensive systems approach the Selected Alternative Plan was formulated to optimize system-wide benefits to further CERP goals and objectives. The Selected Alternative Plan minimized risk in several ways. First, reservoir design complies with the Design Criteria Memoranda, developed jointly by USACE and the South Florida Water Management District, and USACE dam safety criteria. Test cells were constructed by the project's non-Federal sponsor at the project site in order to assess reservoir site characteristics, embankment design, reservoir cell operation, and overwash scenarios. The information gathered from test cell construction and operation has minimized risk of proposed construction methods, as well as reservoir operation. The project delivery team reviewed CERP program guidance and applied lessons learned from other projects to this project. Independent review was conducted at the programmatic level by the National Academy of Sciences/National Research Council. Lessons learned from those programmatic reviews were applied in the planning and design of the Selected Alternative Plan. In addition, external ITR was conducted at key milestone points throughout the planning and decision document preparation process. The SAP includes program-level adaptive assessment and ecological monitoring that will study the long-term system-wide contributions of the SAP. It also includes project-specific water quality monitoring, as well as operational monitoring to ensure the reservoir functions as planned and does not cause or contribute to water quality degradation.

<u>Communication</u>: Effective and transparent communication with the public, and within the USACE, about risk and reliability.

9. Effectively communicate risk
10. Establish public involvement risk reduction strategies

Information has been provided regularly via public notices PDT meeting and summaries, newsletters, internet, and other methods. Risk reduction strategies have been communicated through utilizing the above methods as well as by gathering the input of the public through public meetings and by public review of the draft PIR.

Risk and uncertainty analyses have been documented throughout the PIR. Risk and uncertainty were also discussed at public meetings as well as at PDT meetings.

<u>Reliable Public Service Professionalism</u>: Improve the state of the art and the USACE' dedication to a competent, capable workforce on a continuing basis. Make the commitment to being a "learning organization" a reality.

11. Manage and enhance technical expertise and professionalism
12. Invest in research

SAJ, SFWMD and SFWMD consultants have extensive expertise in dam and reservoir construction in South Florida, pump station construction and operation, and other technologies used in this project.

Project level investments were made in creating the habitat suitability index model which provided a new methodology for evaluating and ranking ecosystem benefits resulting from the different project alternatives. Additionally, the construction and operations of the test cells have provided important lessons learned which have been implemented in the reservoir design.

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SECTION 8
PLAN IMPLEMENTATION

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8.0 PLAN IMPLEMENTATION

8.1 DIVISION OF IMPLEMENTATION RESPONSIBILITIES

The SFWMD proposes to initiate construction on the Caloosahatchee River (C-43) West Basin Storage Reservoir project (also referred to as the "C-43 West Storage Reservoir" under Acceler8) project as part of the State's Acceler8 plan prior to implementation of the Federal project. The USACE is proceeding with two separate and independent but related actions: the planning evaluation of the Federal project and the regulatory evaluation of the SFWMD's application for a Section 404 (Clean Water Act) permit for the proposed project, both of which are described in this Final PIR/EIS. The Caloosahatchee River (C-43) West Reservoir (Acceler8 project) is consistent with the plan recommend in this document. The purposes of the Federal recommended plan identified in this Final PIR and the Acceler8 project are consistent. Therefore, it is anticipated that the Final PIR/EIS will also serve as the basis for the Regulatory Division's NEPA evaluation of the SFWMD's proposed Acceler8 project.

8.1.1 Schedule

Availability of a Final PIR/EIS is scheduled for July 2007. Once the public review period of the Final PIR/EIS is complete and comments are addressed the Record of Decision (ROD) will be signed in and a fully executed Project Cooperation Agreement (PCA) will follow (A separate ROD on the Section 404 permit application will be signed by the Jacksonville District Commander for SFWMD's proposed action.). SFWMD commenced engineering design in late 2003 under the Acceler8 program with survey and subsurface geotechnical investigations. It is anticipated that full scale construction on the Caloosahatchee River (C-43) West Storage Reservoir by the SFWMD will begin in 2008, pending issuance of all permits and authorizations. The Assistant Secretary of the Army for Civil Works (ASA[CW]) cannot consider awarding credit for the SFWMD design and construction work until the recommended project is authorized and funds are appropriated by Congress

8.1.2 Preconstruction Engineering and Design

Detailed design of the C-43 West Reservoir is currently being conducted by the SFWMD with coordination and review by the USACE under the Acceler8 program. All detailed design and construction will be coordinated with the USACE. Crediting for work performed by the SFWMD will be subject to project authorization and adherence to USACE design standards and regulations. Lands, Easements, Right-of-ways, Relocations and Disposal (LERRDs) will be the responsibility of the SFWMD.

8.1.3 Implementation of Project Operations

A Project Operating Manual has been prepared and is included in ***Annex D*** of this PIR. Modifications of the Project Operating Manual may occur as operational experience and knowledge is gained. An Interim Operating Manual will be completed during the Detailed Design phase of the project to allow for use during the construction phase. The Interim Operating Manual will incorporate any modifications to the Operating Manual resulting from the Detailed Design phase. The USACE and SFWMD will share in the responsibilities for conducting water management operations during the Operational Testing and Monitoring phase. Following completion of the Operational Testing and Monitoring phase, a Final Project Operating Manual will be prepared for the Operations and Maintenance (O&M) phase of the project.

8.2 COST SHARING

The total first cost of the project, including the value of LERRDs and pre-construction engineering and design costs will be shared equally between the Federal government and the non-Federal sponsor and is described in ***Table 8-1***. The non-Federal sponsor will provide cash or manage a portion of construction as necessary to meet its 50 percent share of the total first cost of the project to be balanced according to Section 601 of WRDA 2000 to maintain a 50/50 cost share as measured cumulatively for the entire CERP Program. Section 601 of the WRDA of 2000 and USACE policy requires that the non-Federal sponsor must obtain and provide certification of LERRDs necessary for project implementation.

TABLE 8-1: COST APPORTIONMENT TABLE FOR THE CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR (OCTOBER 2006 PRICE LEVEL ROUNDED TO THE NEAREST $10,000)

Item	Non-Federal Cost	Federal Cost	Total Cost
PED	$ 22,330,000	$ 22,330,000	$ 44,650,000
Lands & Damages*	$ 52,490,000	$ 27,930,000	$ 80,420,000
Construction Management**	$ 13,500,000	$ 13,500,000	$ 27,000,000
Construction Total	$165,300,000	$189,860,000	$355,170,000
Total	**$253,620,000**	**$ 253,620,000**	**$507,240,000**

Note: Total costs shown are consistent with costs shown through out the report. Due to rounding to the nearest $10,000, numbers may not total correctly.
*Federal costs include Federal funds provided via Grant Agreement entitled Everglades Watershed Restoration-Grant Number LWCF-1 and future estimated administrative expenses of the Federal Government associated with crediting and project implementation.
**Non-Federal Cost for construction total is less than Federal Cost since consideration is given for cost already provided by the Non-Federal Sponsor.

8.2.1 Cost Sharing of Construction and Land Costs for Restoration Features

Section 601 of the WRDA of 2000 and USACE policy requires that the non-Federal sponsor will provide LERRD.

The total first cost of the restoration features of the project, including the value of LERRD and pre-construction engineering and design costs, will be shared equally between the Federal government and the non-Federal sponsor. The non-Federal sponsor will provide cash or manage a portion of construction as necessary to meet its 50 percent share of the total first cost of the project to be balanced according to Section 601 of WRDA 2000.

8.2.2 Cost Sharing of Monitoring

A project monitoring plan, including water quality, hydrometeorological, and ecosystem monitoring has been prepared and is included in ***Annex D*** of this PIR. Water quality and hydrometeorological monitoring will be cost-shared during the construction and O&M phases of the project in accordance with Section 601(b)(2) of WRDA 2000 and USACE policy for cost-sharing of operational monitoring. Ecosystem monitoring will be performed as part of the CERP Adaptive Assessment and Management program implemented by RECOVER. Regional data collected as part of the monitoring program is critical to the refinement of the features and operation of the selected alternative plan by providing the basis for modifications to design and operational criteria as needed.

8.2.3 Cost Sharing of Operations and Maintenance

Section 601(e)(4) of the WRDA 2000 specifies that the O&M of authorized projects of the CERP would be cost shared equally by the Federal government and the non-Federal sponsor. Consistent with the provisions of section 601(e)(4) of the WRDA of 2000 and given the multi-objective nature of the features in this plan, it is appropriate for the Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) associated with this plan to be shared equally between the Federal government and the non-Federal local sponsor. OMRR&R costs associated with recreation features of the plan will be funded 100 percent by the non-Federal local sponsor. Note that the proposed one-lane bridge and boat ramps will be used by operations staff to access the reservoir and are necessary with or without recreation features.

8.3 PROJECT DESIGN

8.3.1 Application of the Design Criteria Memorandums for Hazard Potential Classifications of Impoundments

USACE Engineering Regulation typically provides rules and policies that engineers must follow to correlate their design parameters and decisions to for approval. USACE Engineering Manuals typically provide general guidance in formulations and procedures that can be followed to complete design efforts for typical projects. Therefore, these general based publications allow unique project factors to be considered to optimize designs on a case-by-case basis. The design of impoundments in south Florida is thought to be unique in that the impoundments are not classic cross-stream dams, but include 360° perimeter embankments where each foot of increase in embankment height adds significantly to the cost of the project, especially as normal pool depths for these impoundments are relatively deep (for C-43 West Basin Reservoir, between 17 and 19 feet). Another unique factor for south Florida reservoirs is the high design wind speed that is considered "reasonable" to be applied on the Probable Maximum Flood surcharged pool for High Hazard Potential Classification (HPC) impoundments. These factors led to a series of discussions between the USACE, Jacksonville District and the SFWMD that resulted in the Design Criteria Memorandums (DCMs) that provide selected and USACE approved design formulations and procedures for impoundments in south Florida that adhere to USACE and State of Florida engineering regulations. The following final DCMs were followed in the design of the Caloosahatchee (C-43) West Basin Storage Reservoir:

- DCM-1 Hazard Potential Classification
- DCM-2 Wind and Precipitation Design Criteria for Freeboard
- DCM-3 Spillway Capacity and Reservoir Drawdown Criteria
- DCM-4 Minimum Dimensions of Dams and Embankments

Other draft DCMs were used in the design of other features of the project, some associated with the impoundments, others not. Each DCM lists USACE, State of Florida, or literature references for all supporting data, procedures, and guidance that were used to complete the documentation(s).

DCM-2 produced as a non-binding guidance agreement for the project team's design use, four cases for completing a sensitivity analysis in selection of the embankment design. As a default for all reservoirs with a HPC, Case 1 (scenario that includes the Probable Maximum Flood (resulting from routing the Inflow Design Flood using the Probable Maximum Precipitation event) in combination with the 100-year return frequency wind speed) was the selected condition for design as it claims the more conservative design.

8.4 PROJECT OPERATIONS

8.4.1 Existing Operations

In the Caloosahatchee Drainage Basin, excess water in the eastern basin resulting from Lake Okeechobee releases (at S-77) and basin runoff drains to the west by way of the Caloosahatchee River (C-43 Canal). Releases from the eastern Caloosahatchee basin are then made at S-78 (which serves as the basin divide between the East and West Caloosahatchee River basins) where inflow along the river is passed into the West Caloosahatchee River Basin. Excess stormwater in the western basin also drains to the Caloosahatchee River (C-43 Canal) and along with the inflow from the East Caloosahatchee River (upper) basin is then discharged to the Caloosahatchee Estuary from S-79.

S-77, S-78, and S-79 are operated based on the Water Control Plan for Lake Okeechobee and Everglades Agricultural Area (EAA) (USACE, July 2000). Within the current approved Lake Okeechobee Regulation Schedule (WSE) is an "Operational Guidelines Decision Tree" used for deciding when and how much water can be discharged from Lake Okeechobee to the Caloosahatchee River. The range of water released to the Caloosahatchee River in the decision tree is from "up to maximum discharge" in the case where the lake is in Zone A of the regulation schedule, and "no discharge to tidewater" when the lake is in Zone D and the tributary conditions are dry. The operational flexibility of the WSE schedule allows for adjustments to be made in the timing and magnitude of Lake Okeechobee regulatory discharges based on conditions in the lake and in tributary basins, and on extended meteorological and climate outlooks.

8.4.2 Initial Operating Regime

The Initial Operating Regime is a depiction of the operational conditions that would exist when project operations would commence. For this PIR, initial operating regime baseline assumptions include a consideration of land use and water supply demands in the study area assumed for 2010, operations of the C&SF Project at the time that the selected alternative plan (SAP) is identified, the effect of non-CERP activities with approved operating manuals (if any), and authorized CERP projects with approved operating manuals (none at this point in time). The selected plan features and operations are incorporated into the initial operating regime baseline to prepare the Draft Project Operating Manual consistent with project objectives.

The conceptual intent of the project is that the excess runoff and discharges from Lake Okeechobee in the Caloosahatchee River (C-43 Canal) will be diverted to the reservoir. Water will be released from the reservoir back to the Caloosahatchee River (C-43 Canal) to maintain desirable salinity levels in the Caloosahatchee Estuary as measured by flow at the S-79 (W.P. Franklin Lock and Dam) structure. Project operations will be dependent upon the stage in the Caloosahatchee River, Lake Okeechobee, the conditions at S-77, S-78, S-79, and the estuary. All of these locations are affected primarily by seasonal and short-term hydrologic and climatic conditions.

After the initial filling of the reservoir and operational testing and verification is complete, initial operating regime project operations will be a function of conditions of flows measured at the S-79 structure. When flows at the S-79 structure are less than 450 cfs, the C43S-1 structure (the main reservoir outflow structure located in Cell 1) will be opened to allow releases from the reservoir. When the flows at S-79 are greater than 450 cfs, releases from the reservoir will end. When excess flows are present in the basin and there is capacity in the reservoir, the C43PS-1 (1,500 cfs pump station) will begin pumping into the reservoir.

Annex D ("Draft Project Operating Manual and Monitoring Plan") contains additional detailed information on operations of all of the project structures.

8.4.3 Initial Operating Regime Local Water Supply Operations

The project is within the LaBelle Private Drainage District (LPDD) service area. The LPDD has historically served both the Berry Groves property (project site) and the Bob Paul property by pumping water from the Townsend Canal to the Header Canal. Irrigation water will continue to be supplied to the Bob Paul property. The existing Berry Groves No. 1 and No. 2 pump stations will remain in operation until project features including C43PS-4, a 150 cfs water supply pump station) and the perimeter canal are constructed and operational testing and verification is complete. The Crawford Canal will still be available to the Bob Paul property for drainage and is not affected by the project.

8.4.4 Future Operations

To depict conditions that are likely to exist in the future for analytical purposes and for purposes of describing future project operations, a next-added increment (NAI) baseline condition is prepared, including projected future (2050) land use and water supply demands and the effects of non-CERP activities. The selected plan features and operations are incorporated into the NAI baseline for inclusion in the Project Operating Manual to ensure that future operations will be consistent with the benefits that justify the project.

For project operations purposes, the conceptual intent of the project applies to both the initial operating regime and NAI operations. For this project, the only significant assumed difference between the initial operating regime and NAI conditions is water supply deliveries to the Caloosahatchee River (C-43 Canal) basin from Lake Okeechobee. As demand for water supply in the basin increases in the future, additional water could be released from Lake Okeechobee (if available, and based on other C&SF project operations requirements) to meet those demands. However, such water supply releases from Lake Okeechobee would not effect reservoir operations, since filling of the reservoir is based on excess basin flows, and releases from the reservoir are based on maintaining desirable flows at the S-79 structure.

Similar to the initial operating regime, future project operations will be based on flow at the S-79 structure. When flows at S-79 are less than 450 cfs, the C43S-1 structure (the main reservoir outflow structure located in Cell 1) will be opened to allow releases from the reservoir. When the flows at S-79 are greater than 450 cfs, releases from the reservoir will end. When excess flows are present in the basin and there is capacity in the reservoir, the C43PS-1 (1,500 cfs pump station) will begin pumping into the reservoir.

8.4.5 Future Local Water Supply Operations

To maintain water supply to the Bob Paul properties, deliveries will be made via the C43PS-4 structure into the perimeter canal surrounding the reservoir.

8.5 PROJECT ASSURANCES

8.5.1 Level of Service for Flood Protection

Each PIR is required to include an analysis of the project's impacts on levels of service for flood protection that existed on the date of enactment of WRDA 2000, December 2000, and in accordance with applicable law. If a project is expected to result in an impact on the existing levels of service for flood protection, the PIR will modify operations or re-design the project, consider further acquisitions and or formulate other alternatives to address the potential impact. The analysis to determine if there was an impact on existing levels of service for flood protection was conducted on both the system-wide and project level scales.

8.5.1.1 System-wide

The operations of this project will not change the operations of the Caloosahatchee River (C-43 Canal) based on the key assumptions outlined in ***Annex C***. Therefore, there will be no system-wide effects on flood protection as a result of the project.

8.5.1.2 Project Level

Based on an analysis of effects on local groundwater using the local reservoir MIKESHE model as outlined in ***Annex C***, there will be no significant and adverse reduction to existing levels of service for flood protection in the vicinity of the reservoir. In addition, results of the C-43 Test Cell Pilot Project described in ***Annex C*** support this conclusion. Furthermore, the canal stages and groundwater levels adjacent to the reservoir would be maintained by adjusting the operations of the perimeter canal water levels and its structures as explained in the project operating manual.

8.5.2 Effects on Existing Legal Sources for Water Supply

Each PIR is required to determine if existing legal sources of water are to be eliminated or transferred as a result of project implementation. If a project is expected to result in an elimination or transfer of an existing legal source of water, the PIR shall include an implementation plan that ensures a new source of water of comparable quantity and quality is available to replace the source that is being transferred or eliminated. The analysis to determine if there is an elimination or transfer of existing legal sources was conducted on both the system-wide and project level scales.

8.5.2.1 System-wide

The only system-wide basin affected by the project will be the Western Caloosahatchee Basin and Estuary. The operations of this project, as described in ***Annex C***, will result in no changes in the operations of the Caloosahatchee River (C-43 Canal) or to the source of water to meet agricultural and urban water supply. Therefore, there will be no system-wide effects that eliminate or transfer of existing legal sources of water as a result of this project.

8.5.2.2 Project Level

The project will transfer an existing legal source of water for agricultural water supply on lands adjacent to the project site from a portion of the existing Header Canal within the project's footprint to the perimeter canal surrounding the reservoir. However, the new source (water in the perimeter canal) will be comparable in volume of water available and water quality to the existing conditions. Upon completion of construction, operational testing and monitoring will occur to ensure that the reservoir and structures designed to deliver water from the reservoir to existing agricultural uses will function as intended. The Project Operating Manual includes project operations to ensure that agricultural water supply deliveries will be provided.

8.5.3 Identification of Water Made Available for the Natural System and Water for Other Water-Related Needs

Each project implementation report is required to identify the quantity, timing, and distribution of water to be dedicated and managed for the natural system, the amount of water to be reserved or allocated for the natural system by the

State of Florida, and water made available for other water-related needs of the region.

8.5.3.1 Identification of Water Made Available and Water for Other Water-Related Needs

The Caloosahatchee River (C-43) West Basin Storage Reservoir project was designed to store excess, high-volume flows in the basin (as measured by flows at the S-79 control structure) and to release water to supplement periods of low flows to improve salinity levels towards estuary restoration targets. To achieve the project purpose, all water made available by the project is for the natural system to attain the benefits of the project. Therefore, there will be no water made available for other water-related needs of the region by the project. Unmet municipal, agricultural and natural system needs for water supply will be further investigated in the second PIR to be initiated upon completion of this first PIR.

8.5.3.2 Identification of Water to be Reserved or Allocated for the Natural System

The volume of water to be reserved or allocated by the State of Florida is based on the Initial Operating Regime condition. As shown in ***Annex C***, section C.3.2.3, the 10th, 50th and 90th percentile average annual volumes of additional water for the natural system simulated in the initial operating regime condition were calculated to be approximately 159,485 ac-ft/year, 105,990 ac-ft/year and 27,619 ac-ft/year, respectively. These volumes will be reserved or allocated for the natural system to achieve the benefits of the project.

8.5.4 State and Federal Assurances

The overarching objective of the Comprehensive Everglades Restoration Plan ("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. The Federal Government and the State of Florida are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to achieve and maintain the benefits to the natural system described in the Plan. As envisioned in WRDA 2000 and the Programmatic Regulations, each PIR will identify this appropriate quantity, quality, timing, and distribution of water for the natural system.

The following language sets forth these commitments:

> "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. The Federal Government and the non-Federal sponsor are committed to the

protection of the appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation, and protection of the natural system as defined in WRDA 2000, for so long as the project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and purposes of CERP, as the Plan is defined in the programmatic regulations. The non-Federal sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:

1. Ensure, through appropriate and legally enforceable means under Federal law, that the quantity, quality, timing, and distribution of existing water that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report is available to the natural system, will be available at the time the Project Cooperation Agreement for the project is executed and will remain available for so long as the Project remains authorized.

2a. Prior to the execution of the Project Cooperation Agreement, reserve or allocate for the natural system the necessary amount of water that will be made available by the project that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report.

2b. After the Project Cooperation Agreement is signed and the project becomes operational, make such revisions under Florida law to this reservation or allocation of water that the Federal Government and the non-Federal sponsor determines, as a result of changed circumstances or new information, is beneficial for the natural system.

3. For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any revision in the reservation of water or other legally enforceable means of protecting water be proposed by the non-Federal sponsor, so that the Federal Government can assure itself that the changed reservation or legally enforceable means of protecting water conform with the non-Federal sponsor's commitments under paragraphs 1 and 2. Any change to a reservation or allocation of water made available by the project shall require an amendment to the Project Cooperation Agreement.

8.6 PROJECT MONITORING PLAN

The SAP includes water quality, hydrologic, and environmental monitoring activities to ensure that the intended purposes of the project will be achieved through long-term operations.

Water quality and hydrologic monitoring activities are described in detail in ***Annex D*** ("Draft Project Operating Manual and Monitoring Plans"). Water quality monitoring involves sample collection and analysis for baseline, startup, and operational phases of the project. Water quality parameters to be monitored include physical parameters (i.e., temperature and dissolved oxygen concentration), turbidity, nutrients, and organochlorine compounds. Hydrologic monitoring includes measurements of stage and elevation (groundwater) and flow at water control structures. Project environmental monitoring includes monitoring of nuisance exotic vegetation within the reservoir and the perimeter canal around the reservoir.

A project-specific ecological monitoring plan was also prepared, focusing on estuarine performance measures. Ecological monitoring is recommended to be implemented as part of RECOVER's system-wide Monitoring and Assessment Plan (MAP) efforts and incorporated into the adaptive management (AM) strategy for south Florida ecosystem restoration.

8.7 COMPLIANCE WITH ENVIRONMENTAL LAWS, STATUTES, AND EXECUTIVE ORDERS

For more complete information on all coordination please see Section 9 Summary of Coordination.

TABLE 8-2: COMPLIANCE WITH ENVIRONMENTAL LAWS, STATUTES, AND EXECUTIVE ORDERS

Law, Regulation, or Policy	Status C, P, NC	Status	Compliance
Clean Air Act	C	PIR/EIS will be coordinated with USEPA. Air emissions permit may be required for large diesel pumps; normally applied for during PED phase	Compliance with Section 309 of the CAA will occur with the coordination and review of the PIR/EIS by EPA.
Clean Water Act	P	WQC will be required; NPDES permit will be required ; WQ evaluation completed and included in this PIR/EIS; 404b evaluation included in Annex F	Full compliance upon issuance of the WQC and NPDES permits by the state – before operation of reservoir; as well as review of the Final PIR by State agencies

Law, Regulation, or Policy	Status C, P, NC	Status	Compliance
Coastal Zone Management Act	C	Based on a review of the March 2003 scoping notice and comments provided by the state reviewing agencies, as well as the dPIR, the state has determined that, at this stage, the project is consistent with the Florida Coastal Management Program. CZM consistency review included in Annex F.	Additional consistency review by the state will occur during coordination of the final PIR/EIS.
National Environmental Policy Act (NEPA)	P	NOI published; scoping meetings held; draft PIR/EIS NOA in Federal Register April 27, 2007	Full compliance upon coordination of the final PIR/EIS, public outreach activities completed and signing of the ROD.
Fish and Wildlife Coordination Act	C	Funds transferred annually to FWS; PALs received; Draft CAR received in March 2007; Final CAR received July 2007 and included in Annex A. FWS active team participant; has provided info on fish and wildlife elements on project and been lead on field documentation.	Coordination complete.
Farmland Protection Policy Act	C	Form AD-1006 to NRCS in November 2006, returned to the USACE in January 2007 and re-submitted in March 2007.	Coordination complete.
Endangered Species Act	C	USACE submitted a BA and letter dated 10 January 2007 to USFWS requesting formal consultation on Eastern Indigo Snake, Florida panther, and Audubon's Crested Caracara. Formal consultation is complete. NMFS concurred with Corps' determination for sea turtles and smalltooth sawfish.	Coordination complete.
Magnuson-Stevens Fishery Conservation and Management Act	C	EFH present in Caloosahatchee River. NMFS concurred with Corps EFH evaluation.	Coordination complete.
National Historic Preservation Act	C	Coordination with SHPO has occurred and the Section 106 Process is complete. A determination of no historic properties affected has been made.	Coordination is complete.

Law, Regulation, or Policy	Status C, P, NC	Status	Compliance
RECRA, CERCLA, other HTRW laws	P	Caloosahatchee River (C-43) West Basin Storage Reservoir surveys completed – received recommendation letter from FWS Spring 2006.	Full compliance before construction. WMD responsible for ensuring present lessee provides final assurances.
Coastal Barrier Resources Act and Coastal Barrier Improvement Act	C	The Coastal Barrier Resources on Sanibel Island are being coordinated with USFWS. The project is expected to benefit these resources and is therefore consistent with the Act.	Coordination complete.
Marine Mammal Protection Act	C	The West Indian Manatee does occur in the Caloosahatchee River and associated canals. Incorporation of the safeguards used to protect T&E species during construction and operation would protect any marine mammals in the area. No take of Marine Mammals is expected.	The project is in compliance with the intent of this act.
Marine Protection, Research, and Sanctuaries Act	C	The Caloosahatchee River (C-43) West Basin Storage Reservoir does not involve any ocean dumping nor does it establish a marine sanctuary. The project is in compliance with this act.	The project is in compliance with the intent of this Act.
Estuary Protection Act of 1968	C	The main purpose of this project is to improve flows and salinity to the estuary. The project is in compliance with this act.	The project is in compliance with the intent of this Act.
Anadromous Fish Conservation Act	P	Anadromous fish species are not expected to be adversely affected by this project. The NMFS concurred with the Corps evaluation in the dPIR.	Coordination complete.

Law, Regulation, or Policy	Status C, P, NC	Status	Compliance
Migratory Bird Treaty Act and Migratory Bird Conservation Act	C	Few adverse impacts are expected to migratory birds. The restoration of the estuary should also increase available forage species such as amphibians, fish, and aquatic invertebrates for wading birds. Littoral zones created in the seepage canals may also benefit migratory birds.	Coordination complete.
Wild and Scenic River Act of 1968	C	No designated Wild and Scenic River reaches would be affected by project related activities	The project is in compliance with this Act.
Federal Water Project Recreation Act	C	The recreation plan for the project is included in Appendix H. The project is in compliance with this act.	The project is in compliance with the intent of this Act.
Submerged Lands Act of 1953	C	This project does not occur on submerged lands of the state of Florida.	The project is in compliance with the intent of this Act.
Rivers and Harbors Act of 1899	C	The proposed work would not obstruct navigable waters of the United States.	The project is in compliance with this Act.
E.O. 11988 Floodplain Management	C	The purpose of the EO is to discourage Federally induced development in floodplains. Commitment of lands to reservoirs will preclude such development. In addition, existing flood levels will not be significantly or adversely impacted.	The project is in compliance with this E.O.
EO 11990 Protection of Wetlands	C	The area proposed for the C-43 BSRP is mostly farmland with a few disturbed wetlands. The reservoir design will include areas of littoral shelf along the seepage canal. Construction of the Caloosahatchee River (C-43) West Storage Reservoir will result in the loss of 125 acres of wetlands through discharge of dredge or fill material, excavation, and/or flooding. However, CERP projects are expected to have a net positive lift of wetland function.	This project is in compliance with this EO.

Law, Regulation, or Policy	Status C, P, NC	Status	Compliance
EO 12898 Environmental Justice	C	This E.O. requires consideration of, and avoidance of disproportionately adverse effects on, minority and low-income populations. No such impacts were identified during project scoping. Minimal adverse impacts are expected.	This project is in compliance with this EO.
EO 13089 Coral Reef Protection	C	This project will not adversely impact coral reefs or coral reef resources.	This project is in compliance with this EO.
EO 13112 Invasive Species	C	The project will follow all feasible and prudent measures to minimize the risk of introducing new invasive species. An analysis of invasive species potential impacts is included in Sections 3 and 6.	This project is in compliance with this EO.

C= compliance; P=pending; NC=non compliance

8.8 COMPLIANCE WITH FLORIDA STATUTES

The State of Florida has enacted several laws pertaining to implementation of CERP projects. These include amendments to section 373.026 (8), F.S., which establishes a requirement for the SFWMD to submit a report for review and approval by the FDEP prior to formal submission of a request for authorization from Congress and prior to receiving an appropriation of state funds for construction and other implementation activities (except the purchase of lands from willing sellers); enactment of Section 373.1501, Florida Statue (F.S.), which establishes the intent of the Florida Legislature with respect to the CERP and the criteria for FDEP approval and the procedures to be followed by the SFWMD and FDEP for submitting and reviewing requests for approval; the enactment of Section 373.1502, which establishes permitting requirements and a process for the submittal, review, and issuance of certain regulatory permits for CERP projects; and the enactment of Sections 373.470, and 373.472 F.S. establishing the "Save Our Everglades Trust Fund," funding and reporting requirements, and procedures for distributions from the trust fund. The SFWMD's report addressing the criteria for approval listed in Section 373.1501, F.S. is included in ***Annex C***.

In addition to the above-described statutory requirements, other sections of Chapters 373 (Water Resources) and 403 (Environmental Control) of the F.S. include requirements that may apply to various aspects of CERP project planning and implementation. In particular, Chapter 403 and the administrative laws adopted in accordance with Chapters 373 and 403 contain the requirements for facilities that involve the discharge or potential discharge of pollutants to surface and ground waters and the discharge of air pollutants, including facilities regulated under the Federal Clean Water and Safe Drinking Water Acts and the Federal Clean Air Act. Based on the information contained in the PIR, the selected plan complies with the applicable provisions of F.S. A detailed explanation of how the project complies with the applicable requirements for CERP projects contained in the F.S. can be found in ***Annex C***.

8.8.1 Permits, Entitlements and Certifications

In as much as construction activities on the Caloosahatchee River (C-43) West Reservoir are scheduled to begin in 2008 in accordance with the schedule for the State of Florida's Accler8 program, the SFWMD will be responsible for obtaining permits issued by the Regulatory Division of the USACE under the authority of Section 404 (discharge of dredged or fill material into waters) of the Clean Water Act (CWA) and any corresponding permits required by the State of Florida in accordance with Chapters 373 and 403 of the F.S.

SFWMD will also be responsible for obtaining the Section 401 (CWA) water quality certification or waiver of water quality certification, as appropriate, from the State of Florida. Typically, water quality certification is obtained through the State of Florida's regulatory program established under the authority of Chapter 373, F.S.

Section 402 National Pollutant Discharge Elimination System (NPDES) permits required under the CWA may be required for the construction (non-point source runoff) of project features. This program has been delegated by the U.S. Environmental Protection Agency (USEPA) for implementation to the State of Florida (FDEP). NPDES permits for construction of project features under the Acceler8 program prior to Federal approval and authorization of the Calooshatchee (C-43) West Basin Storage Reservoir project will be the responsibility of SFWMD. At this time, a NPDES permit will not be required for the operation of Caloosahatchee River (C-43) West Basin Storage Reservoir Project features, as the project does not involve treatment or the discharge of pollutant.

Depending upon the schedule for obtaining Federal review and approval of the project, the USACE will obtain the necessary permits to construct and perform initial operational testing and verification of remaining project features. The cost and schedule for obtaining the necessary permits are included in the project management plan.

8.8.2 Compliance with Applicable Water Quality Standards and Permitting Requirements

The Caloosahatchee River (C-43) West Basin Storage Reservoir project selected plan complies with water quality standards applicable to the project and adjacent waters. The selected plan's features are located in and adjacent to waters designated as Class III by the State of Florida. In accordance with Florida Administrative Code (F.A.C.) Rule 62-302 ("Surface Water Quality Standards"), the use classification of Class III waters is "Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife." In addition to the minimum and general criteria for surface waters found in Section 62-302.500(1), there are numerous water quality criteria for specific parameters for Class III waters listed in Section 62-302.530, F.A.C. Although the selected plan for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is not expected to affect most of the parameters listed in this rule, certain parameters (e.g., turbidity, certain metals, dissolved oxygen and nutrients) listed in the criteria may be affected by construction and operations activities.

In general, any short-term impacts to water quality associated with construction of the selected plan will be ameliorated by construction sequencing, best management practices (BMPs) for erosion and sedimentation control and monitoring during construction. Longer-term impacts to water quality associated with the operation of project features will be addressed through operational monitoring and AM actions, if potentially adverse affects are observed or predicted.

The selected plan is expected to significantly improve water quality in the study area, especially in the Townsend, Banana Branch and Ft. Simmons canals, by diverting nutrient-laden discharges from the existing canals and drainage basin and routing it through the reservoir. The diversion and storage of canal water in the reservoir and the sequestration and settling of pollutants associated with storage should also improve water quality in canals conveying source water from the reservoir. To the extent that releasing water out of the reservoir may result in the mobilization of water-borne pollutants or pollutants bound in impoundment sediments, operational protocols are included in the operations plan (see ***Annex D***, "Draft Operating Manual") to prevent the release of water not meeting Class III criteria to adjacent surface waters. Water quality in the reservoir is expected to meet Class III criteria, primarily as a result of the water quality improvement functions attributable to the reservoir; however, the Caloosahatchee River (C-43) West Basin Storage Reservoir project is not designed nor will it be operated specifically for the improvement of water quality. Upon completion of construction and initiation of operations, water quality and hydrology will be monitored to determine whether project design and operational objectives are being achieved.

8.9 ENVIRONMENTAL COMMITMENTS

The USACE, the non-Federal sponsor (SFWMD), and contractors commit to avoiding, minimizing, or mitigating for adverse effects during construction activities by taking the following actions:

1. Employ BMPs with regard to erosion and turbidity control. Prior to construction, the construction team should examine all areas of proposed erosion/turbidity control in the field, and make adjustments to the plan specified in the plan control device as warranted by actual field conditions at the time of construction.

2. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. The contractor will be required to prepare a spill prevention plan.

3. Demolition debris would be transported to a landfill or otherwise disposed of in accordance with Federal, State, and local requirements. Concrete or paving materials would be disposed of in accordance with Federal, State, and local requirements.

4. Inform contractor personnel of the potential presence of threatened and endangered species in the project area, the need for precautionary measures and the Endangered Species Act prohibition on taking listed species.

5. Any measures or restrictions resulting from Section 7 consultation shall be implemented.

6. The USACE and the SFWMD agree to maintain an open and cooperative informal consultation process with the USFWS and FWC throughout the design, construction, and operation of this restoration project.

7. To protect cultural resources, conditions stipulated by the State Historic Preservation Office (SHPO) will be followed. Language will be included in construction contract specifications outlining the steps to be taken in the event that undiscovered historical properties or unmarked human burials are encountered. An informational training session, developed by a professional archaeologist, will be conducted for the contractor's personnel to explain what kinds of archaeological/cultural materials might be encountered during construction of the impoundment, and the steps to be taken in the event these materials are encountered. A professional archaeologist will conduct periodic monitoring of the project area during ground disturbing activities to determine if activities are impacting unanticipated cultural resources.

8. As required under WRDA 2000, the PDT has identified water to be reserved for ecosystem restoration. This is addressed in ***Annex C*** of this report.

9. As likewise required under WRDA 2000, the SAP has been evaluated in the light of its potential effects on existing legal sources of water and the level of service for flood protection. This is addressed in ***Annex C*** of this report.

10. Compliance with the State of Florida's requirements for approval of CERP projects is also addressed in ***Annex C***.

8.10 VIEWS OF NON-FEDERAL SPONSOR

The non-Federal sponsor (SFWMD) supports the Caloosahatchee River (C-43) West Basin Storage Reservoir project, and has initiated design and construction efforts through the State of Florida's Acceler8 program.

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SECTION 9
SUMMARY OF COOPERATING AGENCIES, COORDINATION, PUBLIC VIEWS, AND COMMENTS

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9.0 PROJECT COORDINATION

9.1 COOPERATING AGENCIES

An official letter inviting USFWS, USEPA, ENP, FFWCC and FDEP to be cooperating agencies (as defined by NEPA) was sent in September 2006. These agencies were chosen because of their special expertise in the area. The selection of these agencies to be invited as cooperating agencies does not exclude any other agencies from full participation in the project.

None of these agencies agreed to be a cooperating agency. The USFWS sent a letter dated October 6, 2006 declining the offer. The reason given for declining the offer was "The Service must balance its role as a study team member with its statutory responsibilities to independently review this proposed action under the Fish and Wildlife Coordination Act and Endangered Species Act."

None of the other agencies replied.

9.2 SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

This NEPA document is an integrated PIR and EIS (PIR/EIS). Early in project planning, a letter notifying interested parties, tribes, and Federal and state agencies was mailed to scope for potential issues or project suggestions. Comments received were evaluated and incorporated into the project planning as appropriate. Please see the NEPA ***Annex B*** for additional information on scoping and comments received. In addition, an interagency team was assembled to prepare and evaluate plans that could be implemented for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project. The interagency team includes local (Lee County, Hendry County), state (FFWCC, FDEP, SFWMD), and Federal (USACE, USFWS, USEPA, USGS) representatives.

9.3 SCOPING FOR THE CALOOSAHATCHEE RIVER (C-43) BASIN STORAGE RESERVOIR

In compliance with the NEPA, the Caloosahatchee River (C-43) West Basin Storage Reservoir project initiated a scoping process in early 2002. An initial scoping meeting was held in February/March of 2002, with a follow-up scoping meeting held on May 1, 2003. Following this meeting, a letter was sent to Federal, State, and local stakeholders requesting their assistance in identifying the extent of significant issues to be addressed in this study. A public meeting was held on February 28, 2002 to specifically identify critical fish and wildlife habitat and any threatened or endangered species that may be within the project area or affected by the activities of the project.

Once it was determined that an EIS would be necessary for this project, a Notice of Intent (NOI) to prepare a draft EIS was published in the Federal Register on 28 March 2003. A NEPA scoping letter was sent to Federal, State, and local stakeholders, including those who had earlier expressed an interest in this project. A public meeting, identified in the scoping letter, was held on May 1, 2003 to ensure continued public involvement. This meeting was recorded and all issues identified were noted and reviewed.

9.4 SCHEDULING COORDINATION WITH OTHER AGENCIES

Other agencies were integrally involved in scheduling efforts for both the PIR and PED stages. This is especially true of the SFWMD, through the Acceler8 program and continued scheduling coordination for that effort. USFWS has also been closely involved in order to ensure that all of their statutory requirements for review of the project can be completed. In addition, permitting agencies such as the Florida Department of Environmental Protection have been contacted to ensure that all permits can be coordinated in a timely and consistent manner. Other agencies and organizations were updated on schedules at periodic PDT meetings which were open to agencies and the public.

9.5 OTHER REQUIRED COORDINATION

Compliance with environmental laws is summarized below. The project is currently in compliance with all applicable laws. None of the coordination to date has indicated that the project will have compliance issues in implementing any of the proposed alternatives.

9.6 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

A NOI to prepare a draft EIS for the Caloosahatchee River (C-43) West Basin Storage Reservoir project was published in the Federal Register on March 28, 2003. A scoping letter describing the project objectives and array of alternatives was mailed on 18 March 2003, to Federal, State, and local agencies, Native American Tribes, private organizations, and other interested parties to solicit their views, comments, and information about resources, study objectives, alternatives, and important features within the study area. Comments received were reviewed and incorporated in project planning. This draft PIR/EIS served as the environmental coordination with many agencies. A Notice of Availability was published in the Federal Register on 27 April 2007 when this document was released for public and agency review. Comments received were addressed and are included in ***Annex B***.

9.7 ENDANGERED SPECIES ACT OF 1973

The USACE sent a letter to the USFWS dated January 10, 2007 requesting formal coordination for this project due to potentially adverse impacts to the Florida panther, Eastern indigo snake, and Audubon's crested caracara. A biological assessment (BA) was drafted by the SFWMD contractor, reviewed and edited by the USACE, and submitted by the USACE to the USFWS and NMFS. NMFS concurred with the USACE's determination of "may affect but is not likely to adversely affect" sea turtles or smalltooth sawfish by letter dated March 28, 2007. The USFWS concurred with the Corps' determinations in a biological opinion dated July 20, 2007 (***Annex A***). The USFWS has been an active participant throughout the planning process and continues to coordinate closely with the USACE. The following letters have been provided by the USFWS and are included in ***Annex A***:

- Planning Aid Letters dated August 13, 2003 and March 29, 2005
- Scoping comments dated June 10, 2003
- List of threatened and endangered species in the study area dated April 11, 2002

9.8 FISH AND WILDLIFE COORDINATION ACT OF 1958

The central objective of the Fish and Wildlife Coordination Act (FWCA) is to allow for equal consideration of wildlife resources. Transfer funds have been made available to the USFWS in order to participate in team meetings and workshops scheduled in conjunction with the USACE's planning, implementation, and evaluation process. Funding has also been provided for the USFWS to conduct surveys and investigations necessary to determine impacts of the C-43 project on wildlife resources and to make recommendations to the USACE on measures to prevent loss of or damage to wildlife resources. Recommendations for optimizing opportunities related to the conservation and enhancement of fish and wildlife resources have been provided through the submittal of PALs listed above. A final CAR has been prepared and is included in this PIR in ***Annex A***. Additionally, the FWC has been an active participant on this project and have provided a scoping letter dated June 10, 2003 and comments on the draft PIR dated June 8, 2007.

9.9 NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA) (PL 89-665, THE ARCHEOLOGY AND HISTORIC PRESERVATION ACT (PL 93-291), AND EXECUTIVE ORDER 11593)

The USACE has reviewed information regarding historical properties that might be affected by the C-43 project, in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL89-665), as amended in 2000; its implementing regulations (36 CFR Part 800) and the Archaeological and

Historic Preservation Act of 1974 (PL93-291), as amended. A Phase I survey has been completed on all sections of the C-43 West Reservoir site.

Coordination with the SHPO has occurred and the Section 106 process is complete. In consultation with the Florida SHPO (Florida SHPO numbers 2004-8676 and 2006-07757) a determination of no historic properties affected has been made. This project is in compliance with the National Historic Preservation Act.

9.10 CLEAN WATER ACT OF 1972

A Section 404(b)(1) evaluation is included in ***Annex F***. The Water Quality Certification (WQC) will be met by the Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit. A NPDES permit will be required and water quality will be evaluated to ensure equal or improved discharge from the reservoir. Prior to constructing the project, the USACE or the local sponsor must obtain water quality certification from FDEP in order to comply with Section 401 of the CWA. The project must be shown to not cause or contribute to violations of state water quality standards. The assessment of water quality impacts prepared for this document indicates that the project will not cause or contribute to violations of state water quality standards. Presently, the local sponsor has applied for and will obtain a 404 permit and a Section 401 Water Quality Certificate from the FDEP to construct and operate the project. It is anticipated that these permits will be issued and the project will comply with these sections of the CWA.

9.11 CLEAN AIR ACT OF 1972

Section 176(c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA state implementation plans for geographical areas designated as “non-attainment” and “maintenance” areas under the CAA. This project is not located within a “nonattainment” area since there are none of these within the State of Florida. If CAA permits are required for large diesel pumps, the required permits will be obtained during the PED phase. A NOI was issued March 28, 2003 and a scoping letter was sent March 18, 2003. This project will be coordinated with the USEPA for compliance with Section 309 of the Act and with local agencies as a matter of comity. The potential to adversely affect the air quality of nearby residences is expected to be low since the diesel engines that drive the intake pumps will meet the latest USEPA emissions requirements for non-road engines that burn ultra-low sulfur diesel. Additionally, the facility is located in a sparsely populated area of Hendry County where the closest private residence is slightly more than ½ mile from the pump station and where there are no more than 20 houses within 1 mile of the proposed pump station.

9.12 COASTAL ZONE MANAGEMENT ACT OF 1972

Based on a review of the March 18, 2003 scoping notice and comments provided by the state reviewing agencies, the State determined that the project was consistent with the Florida Coastal Management Program. The State later reviewed the draft PIR and stated in a letter dated June 11, 2007 that “the state has determined that, at this stage, the proposed activities are consistent with the Florida Coastal Management Program (FCMP)”.

9.13 FARMLAND PROTECTION POLICY ACT OF 1981

USACE submitted form AD-1006 to the NRCS in accordance with the Act. The form was returned to USACE for evaluation and resubmitted by letter dated March 2, 2007. There will be an unavoidable loss of unique farmland which comprises approximately five percent of this type of farmland in Hendry County. Although this is a significant loss, there were several factors which contributed to the selection of this site. The SFWMD has previously purchased the land, making it cost-effective. More importantly, the team was not able to find a contiguous parcel of non-agricultural land in the appropriate location and condition for this reservoir. Therefore the alternatives were limited to agricultural areas. Consultation with NRCS is complete and the project is in compliance with the Farmland Protection Policy Act of 1981.

9.14 WILD AND SCENIC RIVER ACT OF 1968

No designated wild and scenic river reaches would be affected by project related activities.

9.15 MARINE MAMMAL PROTECTION ACT OF 1972

The West Indian manatee does occur in the Caloosahatchee River as well as the Townsend Canal. As a result of consultation between the USFWS, USACE, SFWMD, and FFWCC, a manatee barrier will be placed at the intersection of the Townsend Canal and Caloosahatchee River to protect manatees from any potential harm due to project operations. Incorporation of safeguards used to protect threatened and endangered species during construction and operation would protect the manatee and other marine mammals in the area. The MMPA prohibits, with certain exceptions, the take of marine mammals in United States waters and by United States citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. This project is not expected to result in the “take” of any West Indian manatees.

9.16 ESTUARY PROTECTION ACT OF 1968

The main purpose of this project is to improve flows and salinity to the estuary. The project is in compliance with this Act.

9.17 FEDERAL WATER PROJECT RECREATION ACT

The recreation plan for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project was developed in coordination with the CERP Master Recreation Plan. Details of this plan can be found in the Recreation Appendix. This project is in full compliance with this Act.

9.18 FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

The intent of this project is to improve estuarine conditions and will therefore improve fisheries. NMFS reviewed the draft EIS and stated in an email dated 30 May 2007 that "NOAA's National Marine Fisheries Service, Southeast Region, Habitat Conservation Division, has reviewed the Department of the Army permit application listed below. We anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore, do not object to issuance of the permit." The permit application referred to used this draft EIS as the NEPA document, and therefore NMFS has found the project to be in compliance with this Act.

9.19 SUBMERGED LANDS ACT OF 1953

The project does not occur on submerged lands of the state of Florida. The project is in compliance with this Act.

9.20 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

The coastal barrier resources on Sanibel Island are being coordinated with the USFWS. The project is expected to benefit these resources and is therefore consistent with the Act.

9.21 RIVERS AND HARBORS ACT OF 1899

The proposed work would not obstruct navigable waters of the United States. The project is in compliance with this Act.

9.22 ANADROMOUS FISH CONSERVATION ACT

Anadromous fish species are not expected to be adversely affected by this project. NMFS reviewed the draft EIS and stated in an email dated 30 May 2007 that "NOAA's National Marine Fisheries Service, Southeast Region, Habitat

Conservation Division, has reviewed the Department of the Army permit application listed below. We anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore, do not object to issuance of the permit." The permit application referred to used this draft EIS as the NEPA document, and therefore NMFS has found the project to be in compliance with this Act.

9.23 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

The project site may be used by migratory birds that could be affected by project activities. Appropriate surveys will be conducted prior to construction. Construction will not take place during nesting seasons in the event migratory bird nest sites are discovered. Also, with the construction of the reservoir, habitat buffer, and littoral shelves, as well as its location adjacent to natural areas, it is anticipated that migratory birds, especially wading birds, would benefit from additional foraging areas provided by the project. The restoration of the estuary should also increase available forage species such as amphibians, fish and aquatic invertebrates for wading birds. The project is in compliance with these acts.

9.24 MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

The Caloosahatchee River (C-43) West Basin Storage Reservoir project does not involve any ocean dumping nor does it establish a marine sanctuary. The project is in compliance with this act.

9.25 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

Phase I and II Environmental Site Assessment work was completed on the site in December of 1999. These investigations identified 40 potential contamination sites within the project boundaries (***Table 9-1***). Seventeen (17) of the 40 sites were designated as requiring no further action because further investigation determined that contamination was not present at levels requiring remedial action. Fifteen (15) of the sites have been identified as presenting a contingent HTRW risk because contamination has been identified and quantified but remediation has either not begun or been completed. An additional five sites have been identified as requiring remediation; however, these sites have not been completely characterized such that a remediation program has been initiated as of March 2006.

The 40 contaminated sites discussed above can be generally categorized as "point source" contamination sites in which the contamination is relatively contained within an area of a few acres or less. The SFWMD is currently working with the present lessees to ensure that the remaining contaminated sites are remediated prior to the surrender of the lands to the SFWMD.

The HTRW investigations performed to date have identified a number of point source contaminated sites as well as elevated levels of copper in the cultivated soils. Most of the contamination at the point source sites has been delineated and much of it remediated. The remaining sites are expected to be remediated prior to certification of the lands and are not likely to cause a project delay. The copper contamination issue poses a greater risk to the success of the project. At this time, the SFWMD and the USFWS are working together to identify copper hotspots as well as studying potential remediation techniques. Preliminary studies indicate that it is likely that a combination of several remediation techniques will result in an acceptable level of environmental risk to benthic invertebrates, fish, and birds. Proof of the effectiveness of the proposed remediation techniques will have to be submitted to the USACE and the USFWS as part of the 404 permit application process. The FDEP and the USEPA will participate in the environmental risk assessment review through the 404 WQC, and State Environmental Resource Permitting processes.

Until the USFWS has reviewed the results of a revised Phase III audit/Environmental Risk Assessment and the USFWS is satisfied that environmental risk is acceptable, the USACE will not be able to certify the lands for the project purpose nor will the 404 permit for the accelerated project be issued. In other words, the non-Federal sponsor will not be able to build the facility until the USFWS determines that proposed remediation techniques are sufficient. Since the SFWMD has accelerated the construction of the reservoir and proposed remediation techniques appear to be affective, there is only a small risk that the resolution of the copper contamination issue will delay the certification of the project lands as part of the federal project.

TABLE 9-1: LIST OF ACTIVE AND INACTIVE HTRW SITES ON C-43 BASIN PROJECT LANDS

No.	Area of Concern	Environmental Concern	Corrective Action	Risk	Within Reservoir Footprint
TRACT NO. GX-100-001: JACK BERRY					
1	Pole Barns A&B	None identified	NFA	No	--
3	Landfill	None identified	NFA	No	--
4	Former Landfill	None identified	NFA	No	--
5	Former Airstrip	None identified	NFA	No	--
6	Shooting Range	None identified	NFA	No	--
7	Former Spray Field	None identified	NFA	No	--
8	Bone Yard	None identified	NFA	No	--
9	Irrigation Pump Stations	None identified	NFA	No	--
10	Building C, Machine Shop	None Identified, impacted soil	Excavation and off-site disposal	Yes	No
11	Former Nursery	None identified	NFA	No	--
12	Current Airstrip	None identified	NFA	No	--
13	Former UST	Petroleum	Enter in Abandoned Tank Program	Contingent, no impact once clean up is completed	No
14	Building G, Chemical Barn	None identified	NFA	No	-
15	Building E, Maintenance Shop/Fuel Island	Petroleum	Impacted Soil, excavation and off-site disposal	Yes	No
16	Building F vehicle repair	Haz-Solvent based impacted solid-excavation and offsite disposal	Yes		No
17	Equipment Washing Area	Haz-Solvent based	Impacted soil-excavate and off site disposal	Yes	No
18	Wastewater treatment ponds	Hazardous	Impacted soil-excavate and off-site disposal	NO. Clean up completed	--
TRACT NO. GX-100-001: GRIFFIN BROTHERS PROPERTY					
19	Agricultural lands	Metals and Pesticides	Paraquat cease immediately, aldicarb cease one year prior to flooding	Contingent-no impacts if paraquat and aldicarb cease	Yes
20	Canal sediments	Low levels Copper and Penata-chlorophenol	NFA	No	--
21	Maintenance area / chemical barn	Soil impacted-agrochemicals and petroleum	133 tons of impacted soil-excavation and off-site disposal	Contingent, no impact once cleanup is completed	Yes

No.	Area of Concern	Environmental Concern	Corrective Action	Risk	Within Reservoir Footprint
22	Burn area	Soil impacts-copper	121 tons of impacted soils-excavation and off-site disposal	Contingent, no impact once cleanup is completed	Yes
23	Fertilizer mix/load area	Soil impacts-zinc	38 tons of impacted soils-excavation and off-site disposal	Contingent, no impact once cleanup is completed	Yes
24	pump stations	None identified	NFA	No	--
25	Solid waste	None identified	Remove piles of solid waste	Mp	--
TRACT NO. GX-100-005: WINTHROP CITRUS GROVES					
26	Citrus Grove crop area	Metal and pesticides	Paraquat cease immediately, aldicarb cease one year prior to flooding	Contingent, no impact once cleanup is completed	Yes
27	Canal sediments	Low levels of copper	NFA	no	--
28	Agriculture maintenance area	Metals and pesticides	Paraquat cease immediately, aldicarb cease 1 year prior	Contingent, no impacts if paraquat and aldicarb cease	Yes
29	Exploratory oil and Gas well	None identified	NFA	No	--
30	solid waste	None identified	NFA	No	--
31	Maintenance Area A	Petroleum and pesticides	653 tons of impacted soil-excavate and off-site disposal	Contingent, no impacts once cleanup is complete	Yes
32	Maintenance Area B	Petroleum	694 tons of impacted soil, excavate and off-site disposal	Contingent, no impact once clean up is completed	Yes
TRACT NO. GX-100-009: BRYAN PAUL CITRUS INC.					
33	Pump Station	Visible presence of contamination	Soils excavation adjacent to the main pump station and former pump station	Contingent, no impact once clean up is completed	Probable
34	Former Nursery Barn	Arsenic, cadmium, chloropyrifos and malathion	Soil to be excavated and off-site disposal	Contingent, no impact once clean up is completed	Probable
35	Mix station	Metals and petroleum	Impacts to soils - excavate and dispose of soils near structure, groundwater contamination - perform groundwater treatment	Contingent - no impacts once soil excavation and groundwater treatment is completed and 1 year of GW monitoring is done	Probable

No.	Area of Concern	Environmental Concern	Corrective Action	Risk	Within Reservoir Footprint
36	Auxiliary tank area	Metals	Impacted soils-excavation and disposal	Contingent no impact once cleanup is complete	Probable
37	Graded area solid waste	None identified	Solid waste present, scrape and remove waste	no	Probable
38	Burn area	Metals	Removal ash material and excavate and dispose	Contingent no impact once cleanup is complete	Probable
39	Cultivated area	Chlordane	13 acres high level contamination Options: excavate, cover with clean fill, soil inversion	yes	Probable
40	Canal Sediments	Metals	Excavate ash from bank of canal and sediments within the canal adjacent to burn area	Contingent no impact once clean up is complete	Probable

NFA-No further Action
-- Designation not made as no further action required

9.26 TOXIC SUBSTANCES CONTROL ACT OF 1976

The most prevalent chemicals known to have been applied to project area soil are fertilizers, pesticides and herbicides. However, the Toxic Substances Control Act exempts pesticides from its regulations. Extensive HTRW efforts have been undertaken on the site to identify, delineate and remediate contaminated areas. However, until the USFWS has reviewed the results of a revised Phase III audit and ERA to be performed after remediation and the USFWS is satisfied that environmental risk is acceptable, the USACE will not be able to certify the lands for the project purpose.

9.27 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

EFH is present in the Caloosahatchee Estuary. This habitat is discussed in this section under Existing Conditions as well as Effects of the Selected Plan. National Oceanic and Atmospheric Administration (NOAA) agreed to accept the Draft EIS as the EFH assessment. NMFS reviewed the draft EIS and stated in an email dated 30 May 2007 that “NOAA's National Marine Fisheries Service, Southeast Region, Habitat Conservation Division, has reviewed the Department of the Army permit application listed below. We anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore, do not object to issuance of the permit.” The permit application referred to used this draft EIS as the NEPA document, therefore NMFS has found the project to be in compliance with this Act.

9.28 EO 11990, PROTECTION OF WETLANDS

The area proposed for the Caloosahatchee River (C-43) West Basin Storage Reservoir Project is mostly farmland with a few disturbed wetlands. The reservoir design will include areas of littoral shelf along the seepage canal. These littoral shelves will help to offset the loss of wetlands due to project construction. There will be no wetland mitigation for the federal project. Overall, CERP projects are expected to have a net positive lift of wetland function. However, the state Acceler8 program may have wetland mitigation requirements as a result of the permitting process. A WRAP was performed in 2004 to determine impacts of wetland function related to the proposed project. Details of the WRAP can be found in the final CAR in ***Annex A.*** This project is in compliance with this EO.

9.29 EO 13186 RESPONSIBILITIES OF FEDERAL AGENCIES TO PROTECT MIGRATORY BIRDS

The project has been coordinated with the USFWS concerning migratory birds. The project is expected to benefit migratory birds by improved habitat and increased availability of forage species (amphibians, fish, and aquatic invertebrates) for wading birds. The project is in compliance with this EO.

9.30 EO 11988, FLOOD PLAIN MANAGEMENT

The purpose of the EO is to discourage Federally induced development in floodplains. Commitment of lands to reservoirs will preclude such development. In addition, existing flood levels will not be significantly or adversely impacted. This project is in compliance with this EO.

9.31 EO 12898, ENVIRONMENTAL JUSTICE

This EO requires consideration and avoidance of disproportionately adverse effects on minority and low-income populations. No such area was identified during project scoping. In order to better communicate with minority populations in the area, a Spanish translator has been provided at public meetings. There will be no displacement of homes by this reservoir. Subsistence fishing is expected to improve due to an overall lift in habitat quality resulting in more abundant fisheries. In public outreach efforts to date, only one potential environmental justice issue has been identified. The loss of jobs for low income and minority workers as a result of acquiring agricultural land for the construction of the reservoir would be a potential issue. However, to offset this issue, the SFWMD is conducting training programs to allow local individuals to acquire the skills needed to construct the reservoirs. Adverse impacts have been considered and minimized to the extent practicable. The project is in compliance with the EO.

9.32 EO 13089, CORAL REEF PROTECTION

This project will not adversely impact coral reefs or coral reef resources; therefore, the project is in compliance with this EO.

9.33 EO 13112, INVASIVE SPECIES

The existing and future problem of invasive species growing within the C-43 West Reservoir site has been considered during the planning process. An evaluation of exotic species was included in Existing Conditions, Future Without Project Conditions, and Effected Environment. All feasible and prudent measures to minimize risk of introducing new invasive species will be followed. The CERP also includes further studies of means and methods to reduce the influence of exotic invasive plant species. The project is in compliance with this EO.

9.34 STATUS OF COORDINATION AND COOPERATION WITH OTHER AGENCIES

This project has been developed with strong cooperation from the USFWS, USDA, NRCS, USEPA, NOAA, USGS, FFWCC and FDEP. The SFWMD is a cost-sharing partner in the study and had been a fully active participant in the formulation of this project and creation of the project report. USEPA, USFWS, and USGS have staffers located in the Planning sections of USACE, Jacksonville Division; these staffers aid in interagency coordination for CERP projects. There has also been local participation in the project from Lee and Hendry counties.

An official letter inviting USFWS, USEPA, ENP, FWC and FDEP to be cooperating agencies (as defined by NEPA) was sent in September 2006. These agencies were chosen because of their special expertise in the area. The selection of these agencies to be invited as cooperating agencies does not exclude any other agencies from full participation in the project. Although none of these agencies decided to become a participating agency, their input will continue to be valued and solicited for the project.

9.34.1 CERP Partnerships and Cooperating Agencies

For the purposes of the Caloosahatchee River (C-43) West Basin Storage Reservoir project and the preparation of this report, the lead agency is the USACE Jacksonville District, and the SFWMD is the non-Federal cost-sharing partner. As part of the CERP partnership, the SFWMD has several roles as defined in the following Florida Statutes (F.S):

- F.S. 373.470 (3)(c) requires the completion of a PIR prior to the SFWMD entering into a PCA with the USACE;
- F.S. 373.026 (8)(b) requires the SFWMD to submit a PIR to the FDEP for approval prior to the allocation of funds for the construction of CERP projects; and
- F.S. 373.1501(5) requires the SFWMD to analyze and evaluate water supply, water quality, flood protection, threatened and endangered species, and other natural system and habitat needs and to determine that components of the Plan are feasible, efficient, cost-effective, and consistent with the purposes of the CERP.

USEPA, USFWS, and USGS have staffers located in the USACE, Jacksonville District; these staffers aid in interagency coordination for CERP projects. There has also been local participation in the project from Lee and Hendry counties.

9.35 REVIEW OF THE DRAFT CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR PROJECT

A Notice of Availability of the Draft PIR/EIS was published in the Federal Register on April 27, 2007. The Draft PIR/EIS was sent to local, state, and Federal agencies, private interest groups, and interested public for review and comment in accordance with the Council on Environmental Quality's NEPA regulations and related USACE guidance. Public libraries in the project area were provided copies to maintain in the reference section of the libraries for public review. The Draft PIR/EIS was also posted on www.evergladesplan.org for web viewing. The comment period ended on June 11, 2007. Comments received during the review were considered in preparing the final study documents.

9.35.1 Comments Received and Responses

Many comments were received in response to the Draft PIR/EIS. A matrix of the comments and responses, as well as copies of the correspondence, is provided in ***Annex B***.

9.35.2 List of Agencies, Organizations and Persons to Whom Copies of the Draft PIR/EIS were Sent

The following agencies, groups, and individuals were sent copies of the Draft PIR/EIS:

Native American Tribes
Miccosukee Tribe of Indians of Florida
Seminole Tribe of Florida
Muscogee (Creek) Nation of Oklahoma
Seminole Nation of Oklahoma
Poarch Creek Indian Nation

Federal Agencies
Advisory Council on Historic Preservation
Federal Emergency Management Agency
Council on Environmental Quality
U.S. Environmental Protection Agency
U.S. Department of Agriculture
- Forestry Service
- Natural Resources Conservation Service

U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
  - Florida Keys National Marine Sanctuary
  - National Marine Fisheries Service

U.S. Department of Energy
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
- Bureau of Indian Affairs
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- National Park Service
- Office of Environmental Policy and Compliance

U.S. Department of Justice
U.S. Coast Guard
U.S. Department of Transportation
- Federal Highway Administration

U.S. Public Health Service

State Agencies
Office of the Governor
Florida House of Representatives, Environmental Protection Committee
Florida Coastal Management Program
Florida Department of Agriculture and Consumer Services
Florida Department of Community Affairs
Florida Department of Environmental Protection
Florida State Clearinghouse
Florida Fish and Wildlife Conservation Commission
Florida Department of Transportation
Florida Division of Forestry
Florida Division of Historical Resources–SHPO

Florida Division of State Lands
South Florida Water Management District
Florida Geological Survey

Regional Governments
Central Florida Regional Planning Council
South Florida Regional Planning Council

County Governments
Lee County
Hendry County
Glades County
Charlotte County

Municipalities
City of LaBelle
City of Fort. Myers
City of Clewiston
City of Moore Haven
City of Cape Coral
City of Bonita Springs

Groups
Arthur R. Marshall Foundation
Audubon Society
Caribbean Conservation Corporation
Defenders of Wildlife
Dredging Contractors of America
Environmental Defense Fund
Everglades Coordinating Council
Everglades Foundation
Florida Audubon Society
Florida Defenders of the Environment
Florida Wildlife Federation
Friends of Florida
Friends of the Everglades
Izaak Walton League of America, Inc.
League of Women Voters
National Audubon Society
National Parks and Conservation Association
National Resources Defense Council
National Sierra Club
National Wildlife Federation
Reefkeeper International
Save the Manatee Club

Sierra Club
The Nature Conservancy
The Wilderness Society
World Wildlife Fund

Individuals
A list of individuals who received the Draft PIR/EIS is on file in the Jacksonville District of the USACE at the address shown on the cover page of this document.

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SECTION 10
RECOMMENDATIONS

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10.0 DISTRICT ENGINEER'S RECOMMENDATION

The Caloosahatchee River (C-43) West Basin Storage Reservoir project will provide an above-ground storage reservoir (including pump stations and water control structures) and associated conveyance canals as a cost-effective solution to achieving estuarine restoration benefits in the Caloosahatchee Estuary, which is integral to achieving system-wide benefits in the south Florida ecosystem. The Project will help reduce wet season high volume flows from Lake Okeechobee and contributing basin runoff from the lower West Caloosahatchee River Basin by capturing and storing a portion of these flows in the reservoir. Then during the dry season when water levels are at their lowest, water will be released from the reservoir to the Caloosahatchee River (C-43 Canal) to promote a healthy salinity balance in the estuary, thereby reducing saltwater migration into the freshwater portion of the estuary. In addition, the plan achieves the benefits of the Project as previously developed for the CERP.

This Project is integral to achieving restoration in the Caloosahatchee Estuary and plays an important role in meeting the CERP system-wide ecosystem restoration goals and objectives and other water-related needs of the region. Fish and wildlife habitat benefits of the Caloosahatchee River (C-43) West Basin Storage Reservoir project includes improving the timing of water deliveries to the estuary thereby providing a salinity range suitable for a healthy ecosystem and reestablishment of natural hydropatterns within existing natural areas, improvement in seagrass beds in the estuary, and increase habitat for the eastern oyster, blue crab, and other fish and marine organisms. The Project is expected to produce a total of 12,809 average annual habitat units (HUs). Further, this Project is a critical building block upon which a subsequent study will be able to evaluate and achieve broader ecosystem restoration objectives in the Caloosahatchee River Watershed (includes the East Caloosahatchee River (upper) and West Caloosahatchee River (lower) fresh water river basin and the tidal basin).

I find that the Caloosahatchee River (C-43) West Basin Storage Reservoir project, located in western Hendry County, is an integral part of CERP. The Caloosahatchee River (C-43) West Basin Storage Reservoir project Recommended Plan features a reservoir with a storage capability of 170,000 ac-ft, a normal pool storage depth between 15 and 25 feet with a footprint of approximately 10,700 acres (of which approximately 10,480 acres are required in fee, approximately 20 acres will be perpetual easements, and approximately 200 acres will be used on a temporary basis for staging area).. The reservoir includes an individual inflow pump station of 1500 cfs capacity, discharge structures, emergency overflow spillways, and seepage control canals with associated structures. The reservoir may also provide opportunities to increase flood damage reduction capabilities through operational changes to the C&SF Project and local drainage systems. However, these opportunities are considered incidental and are not claimed as benefits. Additionally, the reservoir may provide some water quality improvements in the Townsend, Banana Branch and Ft. Simmons Branch canals and other areas. Again, these opportunities are considered incidental and are not claimed as benefits.

Therefore, I recommend that the Caloosahatchee River (C-43) West Basin Storage Reservoir project as described in the section of the report entitled "The Selected Plan", with such modifications that may be deemed advisable at the discretion of the Chief of Engineers, be authorized for construction. The total estimated first cost for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is $570,480,000 (October 2009 price level).The total first cost for the Caloosahatchee River (C-43) West Basin Storage Reservoir project includes recreation features totaling $2,930,000. The estimated total annual cost of OMRR&R of the ecosystem restoration elements is $3,100,000 with an estimated Federal annual OMRR&R cost of $1,550,000 and an estimated non-Federal OMRR&R cost of $1,550,000. The estimated cost for OMRR&R of the recreation elements is $25,000 which is 100 percent non-Federal.

The above recommendations are made with the provision that the non-Federal sponsor and the Secretary of the Army shall enter into a binding agreement defining the terms and conditions of cooperation for implementing the Project, and that the non-Federal sponsor agrees to perform the following items of local cooperation:

a. Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the Water Resources Development Act of 2000 as amended including authority to perform design and construction of project features consistent with Federal law and regulation.

b. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations that the Government and the Non-Federal Sponsor jointly determine to be necessary for the construction, operation, maintenance, repair, replacement and rehabilitation of the Project and valuation will be in accordance with the Master Agreement.

c. Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other projects.

d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the non-Federal sponsor owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project;

e. Assume responsibility for operating, maintaining, repairing, replacing, and rehabilitating (OMRR&R) the Project or completed functional portions of the Project, including mitigation features, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Cost sharing for OMRR&R will be in accordance with Section 601 of WRDA 2000 as amended;

f. The non-Federal Sponsor shall operate, maintain, repair, replace and rehabilitate the recreation features of the Project with responsibility for 100 percent of the cost;

g. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

h. Unless otherwise provided for in the statutory authorization for this Project, comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the Project or separable element;

i. Hold and save the Government free from all damages arising from construction, operation, maintenance, repair, replacement and rehabilitation of the Project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;

j. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as will properly reflect total project costs and comply with the provisions of the Master Agreement;

k. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the Project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;

l. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-ways that the Government determines necessary for construction, operation, maintenance, repair, replacement and rehabilitation;

m. As between the Government and the non-Federal Sponsor, the non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA;

n. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

p. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708[revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)];

q. Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with the Florida State Historic Preservation Officer, and as necessary, the Advisory Council on Historic Preservation, prior to construction as part of the preconstruction engineering and design phase of the project;

r. Provide 50 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to the Project that are in excess of one percent of the total amount authorized to be appropriated for the Project;

s. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized and in accordance with Section 601 (e)(3) of the WRDA of 2000, as amended, and in accordance with the Master Agreement;

t. The Non-Federal Sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority.

1. Not less than once each year the Non-Federal Sponsor shall inform affected interests of the extent of protection afforded by the Project.

2. The Non-Federal Sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood

plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

3. The Non-Federal Sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a PPA for the Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the Project. As required by Section 402, as amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the Project. The Non-Federal Sponsor shall provide an information copy of the plan to the Government upon its preparation.

4. The Non-Federal Sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the Project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, that could reduce the level of protection the Project affords, hinder operation or maintenance of the Project, or interfere with the Project's proper function.

u. 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. The Federal Government and the non-Federal sponsor are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation, and protection of the natural system as defined in Section 601 of WRDA 2000, for so long as the project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and objectives of the CERP, as the Plan is defined in the Programmatic Regulations. The non-Federal sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:

1. Ensure, through appropriate and legally enforceable means under Florida law, that the quantity, quality, timing, and distribution of existing water that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report is available and beneficial to the natural system, will be available at the time the Project Partnership Agreement for the project is executed and will remain available for so long as the Project remains authorized.

2. (a) Prior to the execution of the Project Partnership Agreement, reserve or allocate for the natural system the necessary amount of water that will be made available by the project that the Federal Government and the non-Federal sponsor have determined in this Project Implementation Report.

   (b) After the Project Partnership Agreement is signed and the project becomes operational, make such revisions under Florida law to this reservation or allocation of water that the non-Federal sponsor determines, as a result of changed circumstances or new information, is necessary for the natural system.

3. For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any revision in the reservation of water or other legally enforceable means of protecting water be proposed by the non-Federal sponsor, so that the Federal Government can assure itself that the changed reservation or legally enforceable means of protecting water conform with the non-Federal sponsor's commitments under paragraphs 1 and 2. Any change to a reservation of water made available by the project shall require an amendment to the Project Partnership Agreement.

Section 601(e)(5)(B) of the WRDA 2000 authorizes the Secretary of the Army to provide credit to the non-Federal sponsor for work completed by it during the period of construction pursuant to a PCA and a determination by the Secretary that the work is integral to the CERP. As part of its initiative for early implementation of certain expedited CERP projects, formerly known as the "Acceler8 Program", the non-Federal sponsor has stated that it may construct portions of the Caloosahatchee River (C-43) West Basin Storage Reservoir project consistent with this report, in advance of Congressional authorization and the signing of a PCA. The non-Federal sponsor is exploring alternative project delivery methods to expedite implementation of the Project. Such delivery methods may include public-private partnerships in which the non-Federal sponsor contracts with a private or not-for-profit entity for services that may include designing, building, operating or financing these components. I believe that it would be in the public interest for this Project to be implemented expeditiously due to the early benefits to the surrounding habitat, as well as hydrologic benefits to Federal lands and estuaries in other portions of the south Florida ecosystem. Therefore, I recommend that should the non-Federal sponsor construct portions of the Caloosahatchee River (C-43) West Basin Storage Reservoir project prior to the execution of a PAC for this Project, the non-Federal sponsor be credited for such construction costs at the time the PAC for the Caloosahatchee River (C-43) West Basin Storage Reservoir project is executed. Such credit would be applied toward the non-Federal sponsor's share of the costs associated with the implementation of the CERP as authorized by Section 601(e)(5)(C) of WRDA 2000, shall not include cash reimbursements, and shall be subject to: a) the authorization of the Caloosahatchee River (C-43) West Basin Storage Reservoir project by law; b) a determination by the Secretary of the Army that the activities are integral to the CERP restoration project; c) a certification by the District Engineer that the costs are reasonable, allowable, necessary, auditable, and allocable; and d) a certification by the District Engineer that the activities have been implemented in accordance with USACE design and construction standards and applicable Federal and State laws.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding.

However, prior to transmittal to the Congress, the Sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Alfred A. Pantano
Colonel, Corps of Engineers
District Engineer

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SECTION 11
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SECTION 13
GLOSSARY OF TERMS AND ACRONYMS

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13.0 GLOSSARY OF TERMS AND ACRONYMS

13.1 GLOSSARY OF TERMS

A

Acre — Area of land equal to 43,560 square feet. In S.I. metric system, one acre is equal to 4,046.9 square meters or 2.471 hectares.

Acre-foot — The quantity of water required to cover 1 acre to a depth of 1 foot. Equal to 43,560 cubic feet (1,233.5 cubic meters).

Activity – A specific project task that requires resources and time to complete.

Adaptive Assessment – A process for learning and incorporating new information into the planning and evaluation phases of the restoration program. This process ensures that the scientific information produced for this effort is converted into products that are continuously used in management decision-making.

Adverse Impact – The detrimental effect of an environmental change relative to desired or baseline conditions.

Affected Environment — Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as a result of a proposed human action.

Air Quality — Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.

Aquatic – Consisting of, relating to or being in water; living or growing in, on or near the water; or taking place in or on the water.

Aquifer – An underground geologic formation, a bed or layer of earth, gravel or porous stone, that yields water or in which water can be stored.

Aquifer Storage and Recovery (ASR) – The practice of pumping freshwater, which has been treated to drinking water standards, approximately 1,000 feet underground where it is stored in a confined aquifer and can be recovered later. The pumped freshwater displaces, or pushes away, the brackish water of the Upper Floridan Aquifer, resulting in an underground reservoir of freshwater.

Authorization — An act by the Congress of the United States, which authorizes use of public funds to carry out a prescribed action.

B

Baseline – The initial approved plan for schedule, cost or performance management, plus or minus approved changes, to which deviations will be compared as the project proceeds.

Basin (or Caloosahatchee River Basin) - All the land drained by a river and its branches.

Best Management Practices (BMPs) – The best available land, industrial and waste management techniques or processes that reduce pollutant loading from land use or industry, or which optimize water use.

Bioaccumulation - If the input of a toxic substance to an organism is greater than the rate at which the substance is lost, the organism is said to be bioaccumulating that substance. Thus, the longer the biological half-life of the substance the greater the risk of chronic poisoning, even if environmental levels of the toxin are very low.

Bioconcentration - If the input of a toxic substance to an organism is greater than the rate at which the substance is lost, the organism is said to be bioaccumulating that substance. Thus, the longer the biological half-life of the substance the greater the risk of chronic poisoning, even if environmental levels of the toxin are very low.

Biota - The total collection of organisms of a geographic region or a time period, from local geographic scales and instantaneous temporal scales all the way up to whole-planet and whole-timescale spatiotemporal scales. The biota of the Earth lives in the biosphere.

Borrow Canal – Canal or ditches where material excavated is used for earthen construction nearby. Also, typically denotes a canal with no conveyance or water routing purpose.

C

Canal – A human-made waterway that is used for draining or irrigating land or for navigation by boat.

Central and Southern Florida Project (C&SF) – A multi-purpose project, first authorized by Congress in 1948, which provides flood control, water supply protection, water quality protection and natural resource protection.

Channel — Natural or artificial watercourse, with a definite bed and banks to confine and conduct continuously or periodically flowing water.

Comprehensive Everglades Restoration Plan (CERP) – The plan for the restoration of the greater Everglades and to meet water supply and flood protection needs in the urban and agricultural regions of south Florida.

Comprehensive Plan – See Comprehensive Everglades Restoration Plan.

Control Structure – A human-created structure that regulates the flow of waters or the level of waters.

Conveyance Capacity — The rate at which water can be transported by a canal, aqueduct, or ditch. In this document, conveyance capacity is generally measured in cubic feet per second (cfs).

Cost-Benefit Analysis – An analysis, often stated as a ratio, used to evaluate a proposed course of action.

Cost Effectiveness Analysis – An analysis, used in ecosystem restoration planning studies, in which comparison of the costs and non-monetary outputs of alternative plans to identify the least cost plan for every level of output considered. Alternative plans are compared to identify those that would produce greater levels of output at the same cost, or at a lesser cost, as other alternative plans.

Critical Habitat – A description, which may be contained in a Biological Opinion, of the specific areas with physical or biological features essential to the conservation of a listed species and which may require special management considerations or protection; these areas have been legally designated via Federal Register notices.

Cubic feet per second (cfs) — A measure of the volume rate of water movement. As a rate of streamflow, a cubic foot of water passing a reference section in 1 second of time. One cubic foot per second equals 0.0283 meter /second (7.48 gallons per minute). One cubic foot per second flowing for 24 hours produces approximately 2 acre-feet.

Culvert – A concrete, metal or plastic pipe that transports water.

D

Dam - A barrier across flowing water that obstructs, directs or slows down the flow, often creating a reservoir, lake or impoundment.

Discharge – The rate of water movement as volume per unit time, usually expressed as cubic feet per second.

Dissolved Oxygen (D.O.) – The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Dry Season — Hydrologically, for south Florida, the months associated with a lower incident of rainfall, November through May.

Duration – The period of time over which a task occurs, in contrast to effort, which is the amount of labor hours a task requires; duration establishes the schedule for a project, and effort establishes the labor costs.

E

Ecology – The science of the relationships between organisms and their environments, also called bionomics; or the relationship between organisms and their environment.

Ecosystem — A functional group of animal and plant species that operate in a unique setting that is mostly self-contained.

Effectiveness – A measure of the quality of attainment in meeting objectives; this is distinguished from efficiency, which is measured by the volume of output achieved for the input used.

Effluent - An outflowing of water from a natural body of water, or from a man-made structure.

Embankment - An outflowing of water from a natural body of water, or from a man-made structure or to prevent or direct flooding by water.

Endangered Species — Any species or subspecies of bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion of its range. Federally endangered species are officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Enhancement — Measures which develop or improve the quality or quantity of existing conditions or resources beyond a condition or level that would have occurred without an action; i.e., beyond compensation.

Environmental and Economic Equity (EEE) – A program-level activity, referred to in early phases of the program as Socioeconomic and Environmental Justice.

Environmental Consequences — The impacts to the Affected Environment that are expected from implementation of a given alternative.

Environmental Impact Statement (EIS) — An analysis required by the National Environmental Policy Act for all major federal actions, which evaluates the environmental risks of alternative actions.

Estuary – A semi-enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. Estuaries are often associated with high rates of biological productivity.

Evaluate – To appraise or determine the value of information, options or resources being provided to a project.

Evapotranspiration (ET) - The sum of evaporation and plant transpiration. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and waterbodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapour through stomata in its leaves. Evapotranspiration is an important part of the water cycle.

Exotic species — Introduced species not native to the place where they are found.

F

Feasibility Study — The second phase of a project. The purpose is to describe and evaluate alternative plans and fully describe recommended project.

Federally Endangered Species — An endangered species which is officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Flood Control Storage Capacity – Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream (compare with reservoir storage capacity).

Flow — The volume of water passing a given point per unit of time.

- **Instream flow requirements** — Amount of water flowing through a stream course needed to sustain instream values.
- **Minimum flow** — Lowest flow in a specified period of time.
- **Peak flow**—Maximum instantaneous flow in a specified period of time.

G

Geospatial Data - Information, which includes, but is not limited to surveys, maps, aerial photography, aerial imagery, and biological, ecological and hydrological modeling coverages.

Goal – Something to be achieved. Goals can be established for outcomes (results) or outputs (efforts).

Groundwater — Water stored underground in pore spaces between rocks and in other alluvial materials and in fractures of hard rock occurring in the saturated zone.

Groundwater Level — Refers to the water level in a well, and is defined as a measure of the hydraulic head in the aquifer system.

Groundwater Pumping — Quantity of water extracted from groundwater storage.

Groundwater Seepage — Groundwater flow in response to a hydraulic gradient.

Groundwater Table — The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

H

Habitat — Area where a plant or animal lives.

Hectare – A unit of measure in the metric system equal to 10,000 square meters or 2.47 acres.

Hydraulic Gradient – Denotes slope of watercourse, above or below ground water level. Typically, defines energy loss or consumption in the conveyance process.

Hydraulic Head (Lift) – Denotes relative comparison of water stages for gravity flow. Pump stations generally provide lift or increase water level elevations.

Hydrologic Condition — The state of an area pertaining to the amount and form of water present. For example, saturated ground (water table at surface), lake stage and river flow rate.

Hydrologic Response — An observed decrease or increase of water in a particular area.

Hydrology – The scientific study of the properties, distribution and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydropattern — Refers to depth as well as hydroperiod is hydropattern. Hydropatterns are best understood by a graphic depiction of water level (above as well as below the ground) through annual cycles.

Hydroperiod — For non-tidal wetlands, the average annual duration of flooding is called the hydroperiod, which is based only on the presence of surface water and not its depth.

I

Impoundment – An obstruction, such as a dam and reservoir,

Independent Technical Review Team – A group autonomous of the Project Team established to conduct reviews to ensure that design products are consistent with established criteria, guidance, procedures and policies.

Indicator Species — Organism, species, or community which indicates presence of certain environmental conditions.

In situ - A Latin phrase meaning in the original place. It is used in many different contexts

Invertebrate – A small animal that does not have a backbone, examples include crayfish, insects and mollusks, which can be indicators of ecosystem status.

L

Lag – The amount of time after one task is started or completed before the next task can be started or completed.

Lake Okeechobee Regulation Schedule (LORS)

- Manage Lake Okeechobee at optimal lake levels to allow recovery of the Lake's environment and natural resources.
- Reduce high regulatory releases to the Caloosahatchee and St. Lucie estuaries so that the health of the estuaries are not compromised.

- Continue to provide flood control, water supply, navigation and recreation water resource needs.
- Ensure public health and safety.

Land Classification — An economic classification of variations in land reflecting its ability to sustain long-term agricultural production.

Levee – A human-created embankment that controls or confines water.

Littoral Zone — The shore of land surrounding a water body that is characterized by periodic inundation or partial saturation by water level. Typically defined by species of vegetation found.

Local Sponsor – The South Florida Water Management District.

Lock and Dam - A lock is a particular type of device for raising or lowering boats between stretches of water at different levels. The distinguishing feature of a lock is a fixed chamber whose water level can be varied; whereas in a boat lift or canal inclined plane, it is the chamber itself which moves.

M

Macrophytes – Visible plants found in aquatic environments, including sawgrass, sedges and lilies.

Marl - Calcium carbonate or lime-rich muds or mudstones which contain variable amounts of clays and calcite or aragonite. The term is most often used to describe lacustrine (lake) sediments but may also be used for marine deposits.

Marsh — An area of low-lying wetland.

Master Program Management Plan (MPMP) – A document which describes the framework and processes to be used by the USACE and the SFWMD for managing and monitoring implementation of the Comprehensive Everglades Restoration Plan.

MIKESHE - An integrated surface water/ground water model, which includes a module for estimating supplemental irrigation requirements based upon land use, soil type, crop type, rainfall, and evapotranspiration.

Mitigation – To make less severe; to alleviate, diminish or lessen; one or all of the following may comprise mitigation: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating or restoring the affected environment; (4) reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action; and (5) compensating for an impact by replacing or providing substitute resources or environments.

Model — A tool used to mathematically represent a process which could be based upon empirical or mathematical functions. Models can be computer programs, spreadsheets, or statistical analyses.

Monitoring – The capture, analysis and reporting of project performance, usually as compared to plan.

N

National Environmental Policy Act (NEPA) - United States environmental law that was signed into law on January 1, 1970 by U.S. President Richard Nixon. (Although enacted on January 1, 1970, its "short title" is "National Environmental Policy Act of 1969.")

Nutrients - A chemical element or compound used in an organism's metabolism or physiology. Six nutrient groups exist and are broadly classified into those providing energy, and those used as components in the body or cellular structures.

O

Objective – A goal expressed in specific, directly measurable terms.

Off-peak – Less than peak design flow rate during storm runoff producing events.

Outreach - Proactive communication and productive involvement with the public to best meet the water resource needs of South Florida.

Oxbow - A bend in a river, similar to the shape of the wooden yoke of an ox.

Oxygen Demand — The biological or chemical demand of dissolved oxygen in water. Required by biological processes for respiration.

P

Performance Measure – A desired result stated in quantifiable terms to allow for an assessment of how well the desired result has been achieved.

Periphyton – The biological community of microscopic plants and animals attached to surfaces in aquatic environments, for example algae.

Phosphorus (P) — Element or nutrient required for energy production in living organisms. Distributed into the environment mostly as phosphates by agricultural runoff (fertilizer) and life cycles. Frequently the limiting factor for growth of microbes and plants.

Pollutants - Many of the compounds which are dangerous to the environment can also be harmful to humans in the long-term range and come from mineral and fossil sources or are produced by humans themselves.

Potable - Water of sufficient quality to serve as drinking water is termed potable water whether it is used as such or not.

Program – A group of related projects managed in a coordinated manner; programs usually include an element of on-going activity.

Program Management – A structure and set of strategies to be used during the implementation phase, which build upon the interagency partnership, implementation guidelines and successful strategies developed during the Restudy's feasibility planning phase.

Programmatic Environmental Impact Statement (PEIS) – An environmental impact statement prepared prior to a Federal agency's decision regarding a major program, plan or policy, which usually is broad in scope and followed by subsequently more narrowly focused National Environmental Policy Act compliance documents.

Programmatic Regulations – Section 601(h) of WRDA 2000 states that the overarching purpose of the Comprehensive Plan is the restoration, preservation and protection of the south Florida ecosystem while providing for the other water related needs of the region, including water supply and flood protection. The purpose of the regulations is to ensure that the goals and objectives of CERP are achieved. The regulations will contain: (1) processes for the development of Project Implementation Reports, Project Cooperation Agreements and operating manuals that ensure the goals and objectives of the plan are achieved; (2) processes that ensure new scientific, technical, or other information such as that developed through adaptive management is integrated into the implementation of the plan; and (3) processes to establish interim goals to provide a means by which the restoration success of the plan may be evaluated throughout the implementation process.

Project – A sequence of tasks with a beginning and an end that uses time and resources to produce specific results. Each project has a specific, desired outcome, a deadline or target completion date and a budget that limits the amount of resources that can be used to complete the project.

Project Area – The entire C-43 Basin.

Project Cooperation Agreement (PCA) – A document that describes the roles and responsibilities of the USACE and SFWMD for real estate acquisition, construction, construction management and operations and maintenance.

Project Team – An interdisciplinary group formed from the resources of the implementing agencies, which develops the products necessary to deliver the project.

Project Duration – The time it takes to complete an entire project from starting the first task to finishing the last task.

Project Implementation Report (PIR) – A decision document that will bridge the gap between the conceptual design contained in the Comprehensive Plan and the detailed design necessary to proceed to construction.

Project Management – A discipline of combining systems, techniques and people to complete a project within established goals of time, budget and quality.

Project Manager – A person who takes overall responsibility for coordinating a project to ensure the desired result comes in on time and within budget.

Project Phase – A collection of logically related project activities, usually culminating in the completion of a major deliverable.

Proposed Action — Plan that a Federal agency intends to implement or undertake and which is the subject of an environmental analysis. Usually, but not always, the proposed action is the agency's preferred alternative for a project. The proposed action and all reasonable alternatives are evaluated against the no action alternative.

Public Involvement — Process of obtaining citizen input into each stage of the development of planning documents. Required as a major input into any EIS.

Public Outreach – A program-level activity with the objectives of keeping the public informed of the status of the overall program and key issues associated with restoration implementation and providing effective mechanisms for public participation in the restoration plan development.

Pump Station – A human constructed structure that uses pumps to transfer water from one location to another.

Q

Quality Assurance (QA) – The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Quality Control (QC) – The process of monitoring specific project results to determine if they comply with relevant quality standards, and identifying means of eliminating causes of unsatisfactory performance.

R

Recharge — The processes of water filling the voids in an aquifer, which causes the piezometric head or water table to rise in elevation.

Reconnaissance Study — The first phase of a project. It has four phases (1) to define problem, (2) asses sponsor's level of interest and support, (3) decide to progress to feasibility phase based on Federal interest, (4) estimate time and money to complete feasibility study.

Record of Decision — Concise, public, legal document which identifies and publicly and officially discloses the responsible official's decision on the alternative selected for implementation. It is prepared following completion of an Environmental Impact Statement.

Refugia - Refers to locations of isolated or relict populations of once widespread animal or plant species.

Regional Water Supply Plan — Detailed water supply plan developed by the District under Ch. 373.0361, F.S.

Reservoir — Artificially impounded body of water.

Reservoir Storage Capacity — Reservoir capacity normally usable for storage and regulation of reservoir inflows to meet established reservoir operating requirements.

> **Flood control storage capacity** — Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream.

Restoration – The recovery of a natural system's vitality and biological and hydrological integrity to the extent that the health and ecological functions are self-sustaining over time.

Restoration Coordination and Verification (RECOVER) – A program-level activity whose role is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan.

Restudy – The Central and South Florida Project Comprehensive Review Study, authorized by the Water Resources Development Act of 1992, which examined the Central and Southern Project to determine the feasibility of modifying the project to restore the south Florida ecosystem and provide for other water-related needs of the region, and which resulted in The Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, which was transmitted to Congress on July 1, 1999.

Risk Analysis – An evaluation of the feasibility or probability that the outcome of a project or policy will be the desired one; usually conducted to compare alternative scenarios, action plans or policies.

Run off – Unfiltered water that reaches streams, lakes sounds, and oceans by means of flowing across impervious surfaces. These surfaces include roads, parking lots, driveways and roofs.

S

Salinity - The saltiness or dissolved salt content of a body of water

Scoping — The process of defining the scope of a study, primarily with respect to the issues, geographic area, and alternatives to be considered. The term is typically used in association with environmental documents prepared under the National Environmental Policy Act.

Scrub – A community dominated by pinewoods with a thick understory of oaks and saw palmetto, and which occupies well-drained, nutrient-poor sandy soils.

Seepage — Water that escapes control through levees, canals or other holding or conveyance systems.

Sheet Flow – Water movement as a broad front with shallow, uniform depth.

Slough – A depression associated with swamps and marshlands as part of a bayou, inlet or backwater; contains areas of slightly deeper water and a slow current; can be thought of as the broad, shallow rivers of the Everglades.

South Florida Ecosystem – An area consisting of the lands and waters within the boundary of the South Florida Water Management District, including the Everglades, the Florida Keys and the contiguous near-shore coastal waters of South Florida.

South Florida Water Management Model (SFWMM) - An integrated surface water groundwater model that simulates the hydrology and associated water management schemes in the majority of South Florida using climatic data from January 1, 1965, through December 31, 1995. The model simulates the major components of the hydrologic cycle and the current and numerous proposed water management control structures and associated operating rules. It also simulates current and proposed water shortage policies for the different subregions in the system.

Spatial Extent – Area that is continuous without non-integrating internal barriers or land usage.

Spillway — Overflow structure of a dam.

Stakeholders – People or organizations having a personal or enterprise interest in the results of a project, who may or may not be involved in completing the actual work on that project.

Stormwater – Surface water resulting from rainfall that does not percolate into the ground or evaporate.

Subspecies - The rank immediately subordinate to a species. It is equivalent to "race" in the biological (i.e. not social) sense

Substrate - The earthy material that exists in the bottom of a marine habitat, like dirt, rocks, sand, or gravel

Success Indicator – A subset of performance measures selected as a good representation of overall performance.

Surficial Aquifer – An aquifer that is closest to the surface and is unconfined; the water level of a surficial aquifer is typically associated with the groundwater table of an area.

Sustainability – The state of having met the needs of the present without endangering the ability of future generations to be able to meet their own needs.

Swamp – A generally wet, wooded area where standing water occurs for at least part of the year.

T

Threatened Species — Legal status afforded to plant or animals species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Tiering — Procedure which allows an agency to avoid duplication of paperwork through incorporation by reference of the general discussions and relevant specific discussions from an environmental impact statement (EIS) of broader scope into a subsequent EIS of narrower scope.

Trade-Off – Allowing one aspect of a project to change, usually for the worse, in return for another aspect of the project getting better.

Tributary — A stream feeding into a larger stream, canal or waterbody.

W

Water Budget – An account of all water inflows, outflows and change in storage for a pre-specified period of time.

Water Column Turbidity – The measure of the cloudiness or opacity in the appearance of a water sample. Turbidity in natural waters is caused by the presence of suspended solids or colloidal particles. Turbidity measurement provides an indication of the clarity of water and water quality.

Water Conservation Areas (WCAs) – Marshland areas that were designed for use as storage to prevent flooding, to irrigate agriculture and recharge well fields and as input for agricultural and urban runoff; the Water Conservation Areas WCA-1, WCA-2A, WCA-2B, WCA-3A and WCA-3B comprise five surface water management basins in the Everglades; bounded by the Everglades Agricultural Area on the north and the Everglades National Park basin on the south, the WCAs are confined by levees and water control structures that regulate the inflows and outflows to each one of them.

Water Resource Development Act 2000 (WRDA 2000) – WRDA is legislation which provides for the conservation and development of water and related resources and authorizes the Secretary of the Army to construct various projects for improvements to rivers and harbors of the United States, and for other purposes deemed appropriated by the U.S. Congress and the President of the United States.

Watershed – A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

Water Quality - The physical, chemical and biological characteristics of water. The primary bases for such characterization are parameters which relate to drinking water, safety of human contact and for health of ecosystems.

Wetlands – Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wet Season – Hydrologically, for south Florida, the months associated with a higher than average incident of rainfall, June through October.

Wildlife Corridor – A relatively wide pathway used by animals to transverse from one habitat arena to another.

Wildlife Habitat – An area that provides a water supply and vegetative habitat for wildlife.

Y

Yellow Book – See “Restudy”

13.2 GLOSSARY OF ACRONYMS

>	greater than
<	less than

A

ac-ft	acre-feet
AFB	Alternative Formulation Briefing
ASA(CW)	Assistant Secretary of the Army for Civil Works
ASR	Aquifer Storage and Recovery
AST	Aboveground Storage Tanks
ASTMS	American Society for Testing and Materials Standard Price

B

BA	Biological Assessment
BCNP	Big Cypress National Park
BEBR	Florida Bureau of Economic and Business Resources
BMP	Best Management Practice
BODR	Basis of Design Report

C

C	Canal
C&SF	Central and Southern Florida
CE/ICA	Cost Effectiveness/Incremental Coat Analysis
CERP	Comprehensive Everglades Restoration Plan
CERPRA	Comprehensive Everglades Restoration Plan Regulation Act
CESAJ	U.S. Army Corps of Engineers, Jacksonville District
CFA	Core Foraging Area
CFR	Code of Federal Regulation
cfs	Cubic Feet per Second
cm	centimeter
CWA	Clean Water Act
CWMP	Caloosahatchee Water Management Plan
CZMA	Coastal Zone Management Act

D

DCM	Design Criteria Memorandum
DO	Dissolved Oxygen
DOI	Department of the Interior
DWSA	SFWMD District-Wide Water Supply Assessment

E

EAA	Everglades Agricultural Area
ECT	Environmental Consulting & Technology, Inc
EFH	Essential Fish Habitat

EIS	Environmental Impact Statement
ENP	Everglades National Park
EO	Executive Order
EPPC	Exotic Pest Plant Council
EQ	Environmental Quality
ER	Engineering Regulation
ERA	Environmental Risk Assessment
ESA	Endangered Species Act
ESA	Environmental Site Assessment

F

FAS	Floridan Aquifer System
FCRB	Freshwater Caloosahatchee River Basin
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FLUCCS	Florida Land Use/Land Cover Classification System
FLUCFCS	Florida Land Use, Cover and Forms Classification System
FNAI	Florida Natural Areas Inventory
FP&L	Florida Power & Light
F.S.	Florida Statutes
FSA	Florida Statistical Abstract
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year

G

GCTL	Groundwater Cleanup Target Levels
GIS	Geographic Information System
GM	Guidance Memorandum

H

HHD	Herbert Hoover Dike
HSI	Habitat Suitability Indices
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HTRW	Hazardous, Toxic, and Radioactive Wastes
HU	Habitat Unit

I

IAS	Intermediate Aquifer System
ICU	Initial CERP Update
ITR	Independent Technical Review
IWR	Institute for Water Resources

K

kac-ft	1000 acre feet
km	kilometer

L

L	Levee
LERRD	Lands, Easements, Right-of-Ways, Relocation, Disposal
LORSS	Lake Okeechobee Regulation Schedule Study
LOSA	Lake Okeechobee Demand Service Area
LWC	Lower West Coast
LWCWSP	Lower West Coast Water Supply Plan

M

M&I	Municipal and Industrial
MCACES	Microcomputer Aided Cost Engineering System
MERIT	Multi-species/Ecosystem Recovery Implementation Team
MFL	Minimum Flow and Levels
MGD	Million gallons per day
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
MIS-10	Master Implementation Schedule
MISP	Master Implementation Sequencing Plan
MPMP	Master Program Management Plan

N

NAI	Next-Added Increment
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NGVD	National Geodetic Vertical Datum
NLBSA	North Lake Belt Storage Area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge

O

OMRR&R	Operation, Maintenance, Repair, Rehabilitation, Replacement
O&M	Operations and Maintenance
OSE	Other Social Effects

P

P&G	Principles and Guidelines
PAHs	Polyaromatic Hydrocarbons
PAL	Planning Aid Letter
PCA	Project Cooperation Agreement
PCP	Pentacholorophenol
PCX	Planning Center of Expertise
PDT	Project Delivery Team
PEC	Probable Effect Concentration
PED	Planning, Engineering and Design
PEIS	Programmatic Environmental Impact Statement
PEL	Probable Effects Level
PGM	Project Guidance Memorandum
PIR	Project Implementation Report
PM	Performance Measure
ppb	Parts per billion
ppt	Parts per thousand
PWS	Public Water Supply

R

RDD	Rapid Draw Down
RECOVER	Restoration Coordination and Verification
RED	Regional Economic Development
Restudy	C&SF Project Comprehensive Review Study
ROD	Record of Decision
ROW	Right of Way

S

S	Structure
SAD	South Atlantic Division
SAS	Surficial Aquifer System
SAV	Submerged Aquatic Vegetation
SCORP	Florida State Comprehensive Outdoor Recreation Plan
SCTL	Soil Cleanup Target Levels
SFRWPC	South Florida Regional Water Planning Council
SFWMD	South Florida Water Management District
SFWMM	South Florida Water Management Model
SHPO	State Historic Preservation Officer
SLERA	Screening Level Ecological Risk Assessment
SLOPES	Standard Local Operating Procedures for Endangered Species
SQAG	Sediment Quality Assessment Guidelines
SR	State Road
STA	Stormwater Treatment Area
SWFFS	Southwest Florida Feasibility Study

SWFRPC	Southwest Florida Regional Planning Council

T

TEC	Threshold Effects Concentration
TMDL	Total Maximum Daily Loads
TN	Total Nitrogen
TP	Total Phosphorus
TRPH	Total Recoverable Petroleum Hydrocarbons
TSP	Tentatively Selected Plan

U

ug/L	micrograms per liter
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

V

VEC	Valued Ecosystem Components

W

WCA	Water Conservation Area
WQ	Water Quality
WQC	Water Quality Certification
WRDA	Water Resources Development Act
WSE `	Water Supply/Environmental
WY	Water Year

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SECTION 14
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