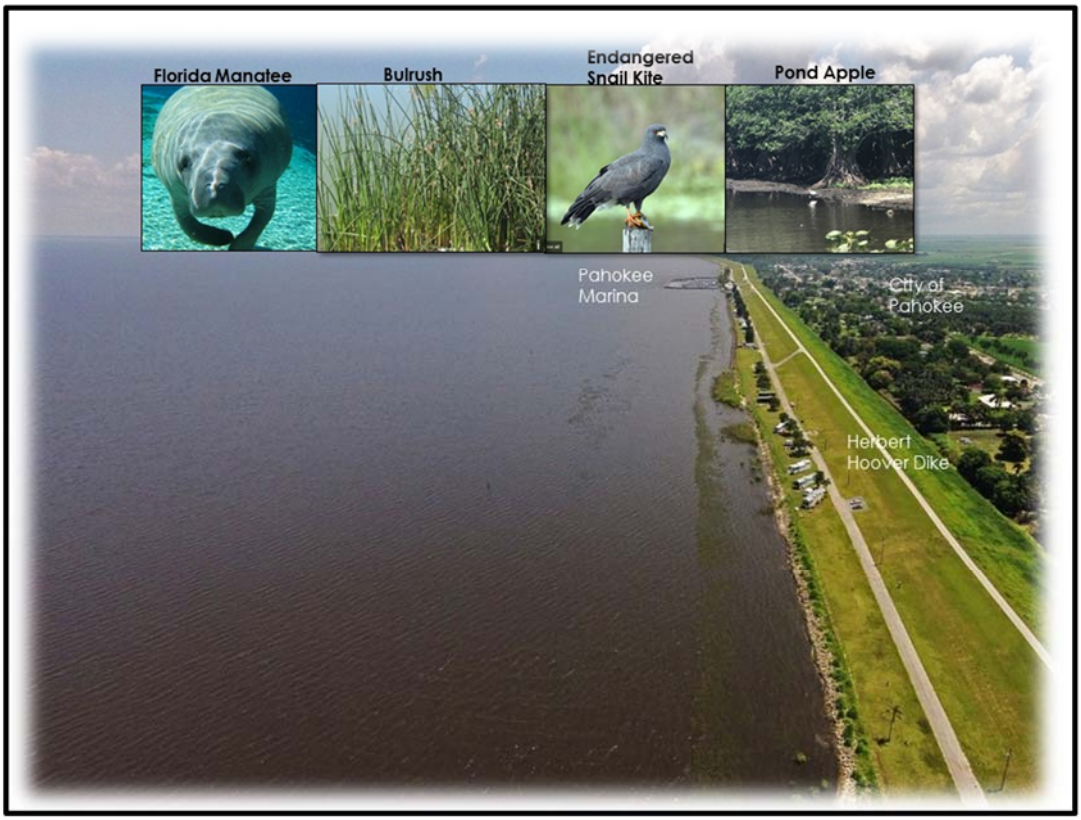
FINAL INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

PAHOKEE RESTORATION CONTINUING AUTHORITIES PROGRAM, SECTION 1135 PROJECT



JULY 2018

US Army Corps of Engineers ®
Jacksonville District

US Army Corps of Engineers
JACKSONVILLE DISTRICT

FINDING OF NO SIGNIFICANT IMPACT

PAHOKEE, PALM BEACH COUNTY, FLORIDA
CONTINUING AUTHORITIES PROGRAM SECTION 1135 PROJECT
INTEGRATED FEASIBILITY STUDY AND ENVIRONMENTAL ASSESSMENT

The U.S. Army Corps of Engineers, Jacksonville District (USACE) has conducted an environmental assessment in accordance with the National Environmental Policy Act of 1969, as amended. USACE assessed the effects of the following actions in the Final Integrated Feasibility Report and Environmental Assessment (IFR/EA), dated May 2018, for the Pahokee Restoration Section 1135 Continuing Authorities Program (CAP) project in Pahokee, Palm Beach County, Florida. The final recommendation is contained in the IFR/EA and is incorporated herein by reference. The Recommended Plan consists of the following:

- A low profile island will be constructed at an elevation of 11.0-feet (ft) North Atlantic Vertical Datum of 1988 (NAVD 88);
- A high profile island will also be constructed, which includes a terraced island with a lower elevation of 11.0-ft NAVD 88 and a higher elevation of 13.0-ft NAVD 88;
- Both islands will consist of an interior mix of sand and finer silt sediment, surrounded by a sand berm for stability;
- Both islands will include riprap armoring on the outer, lakeward slopes.

In addition to the "no action" alternative, a final array of seven alternatives with varying levels of benefits and costs were evaluated, including the Recommended Plan. Alternative 5 was the best-buy plan with the lowest incremental cost per increased unit of output. Thus, based on the cost effective/incremental cost analysis, as well as the planning criteria, Alternative 5 is the National Ecosystem Restoration Plan which is cost effective and meets project objectives, as well as displays benefits under each of the four USACE Principles and Guidelines (P&G) accounts, and meets the P&G screening criteria of being complete, effective, efficient, and acceptable. There is not a locally preferred plan.

All practicable means to avoid and minimize adverse environmental effects have been incorporated into the recommended plan. Environmental commitments as detailed in the IFR/EA will be implemented to minimize impacts.

Pursuant to the Clean Water Act of 1972, as amended, any discharge of dredged or fill material associated with the Recommended Plan will be compliant with Section 404(b)(1)

Guidelines (40 CFR Part 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in the Environmental Appendix D2 of the IFR/EA.

The Florida Department of Environmental Protection (DEP) has concluded that the proposed project is consistent with the Florida Coastal Zone Management Program and its associated statutes. A water quality certification pursuant to Section 401 of the Clean Water Act will be obtained from DEP prior to construction. All conditions of the water quality certification will be implemented in order to minimize adverse impacts to water quality.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, coordination with the U.S. Fish and Wildlife Service has been completed.

Pursuant to Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, consultation with the Florida State Historic Preservation Officer and the Tribes is ongoing. The Recommended Plan will be in compliance with the goals of this Act upon completion of coordination of the undertaking.

Public review of the draft IFR/EA was completed on March 3, 2018. All comments submitted during the public comment period were responded to in the Final IFR/EA.

Technical, environmental, economic, and cost-effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resource Council's 1983 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in the evaluation of the alternatives. Based on the analysis provided in the Final IFR/EA, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not significantly affect the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date: 14 AUG 2018

Jason A. Kirk, P.E.
Colonel, U.S. Army
District Commander

HOW TO USE THIS DOCUMENT

This report is written in a condensed and streamlined manner, appropriate for Continuing Authorities Program (CAP) projects. As such, this report can be used as a summary of the technical appendices for a broad level overview of the project. The technical appendices are to be used as references for detailed project information. The executive summary of the report is offered as a two-sided graphic representation, which can also be pulled out of the report as a stand-alone reference. It should be noted that the designs in this report are at a conceptual feasibility level of design. Further refinements to the design features, as well as optimized methods of construction, will take place during the Design and Implementation (D&I) phase.

Additionally, informational foldouts REF-1 (Existing Conditions) and REF-2 (the Tentatively Selected Plan) are provided at the end of the report to be used while reading the document to serve as reference maps with key points and landmarks.

Organization of this report follows Exhibit G-7 (Feasibility Report Content) provided in Appendix G of ER 1105-2-100 (30 June 2004), documenting the iterative **U.S. Army Corps of Engineers (USACE) Plan Formulation Process.** The planning process consists of six major steps:

(1) Specification of problems and opportunities
(2) Inventory, forecast and analysis of existing conditions within the study area
(3) Formulation of alternative plans
(4) Evaluation of the effects of the alternative plans
(5) Comparison of the alternative plans
(6) Selection of the National Environmental Restoration (NER) Plan based upon the comparison of the alternative plans.

The report describes the planning process as it progresses through the four integrated environments that shape an ecosystem restoration project: the **built environment** (upland development, etc.); the **natural environment** (species of concern and their habitat); the **physical environment** (historic hydrologic conditions and current conditions), and the **economic environment**. Concerns relative to plan formulation and National Environmental Policy Act (NEPA) review are summarized and encapsulated in the discussions of these four main environments.

The recommended format of an **Environmental Assessment (EA)** is provided in 40 CFR §1502.10 and has been integrated into the Feasibility Report. The basic table of contents for the report outlines how the EA format has been integrated into the planning process to develop a Recommended Plan which meets the requirements of both USACE Plan Formulation Policy and NEPA.

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GRAPHIC EXECUTIVE SUMMARY PAGE 1

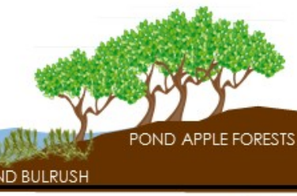
PROJECT SPONSOR: PALM BEACH COUNTY, FLORIDA

INTRODUCTION & HISTORIC CONDITIONS

STUDY AREA: Lake Okeechobee in the vicinity of the city of Pahokee, Palm Beach County, Florida.

AUTHORITY: Section 1135, Water Resources Development Act of 1986, as amended, providing for restoration measures where construction or operation of a USACE project has contributed to the degradation of the environment.

HISTORIC CONDITIONS: The southeastern edge of Lake Okeechobee transitioned gradually into the water, where thick pond apple forests and other native upland species grew along its ridge, functioning as a natural breakwater, weir, and filtering system during the occasional flooding of the lake into the Everglades River of Grass. This former upland and emergent habitat provided for rookeries and nurseries for species such as great egrets, wood storks, great blue herons, snail kites, apple snails, and otters.



CLEAR WATER COLUMN

SAND

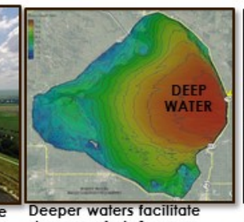
EXISTING & FUTURE WITHOUT-PROJECT CONDITIONS

Current conditions are expected to continue into the future without-project condition. Federal construction of Herbert Hoover Dike and regulation of lake levels for flood risk mitigation, water supply, and other purposes facilitated the loss of historic vegetation resulting in:

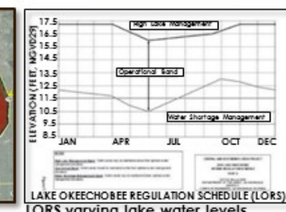
- Reduced habitat for avian, land, and aquatic species requiring in-lake, emergent, and upland areas
- Deeper lake levels in the southeastern area of the lake
- Loss of the historic wind break exposing the lake bottom to the effects of strong winds and waves
- Silt from the lake bottom, stirred by wind and waves, decreasing water quality
- Fluctuating lake levels; often too high or too low

These unfavorable conditions hinder the regeneration of needed vegetation and habitat.

Lack of vegetation/habitat along Lake Okeechobee's southeastern shoreline



Deeper waters facilitate stronger winds & waves



LORS varying lake water levels (targeting between 12.5-15.5 feet NGDV29

Excess silt accumulation, inhibiting littoral zone vegetation

STEEP LAKE BANK

SILT AND MUCK BOTTOM/LOSS OF SAND

OBJECTIVES

Reduce effects of wind and waves on lake bottom

Create emergent and upland vegetation

Create habitat for fisheries and birds

Improve natural lake bottom conditions (localized)

Maintain or improve ecotourism

MEASURES AND BENEFITS (refer to illustration of island and littoral options below)

TARGET SPECIES

LOW PROFILE MEASURES

- Emergent: Spike rush and Bulrush
- Some Pond Apple trees

HIGH PROFILE MEASURES

- Terraced effect with more Pond Apple trees and more emergent (Spike rush and Bulrush) vegetation

BENEFITS FROM VEGETATION SPECIES

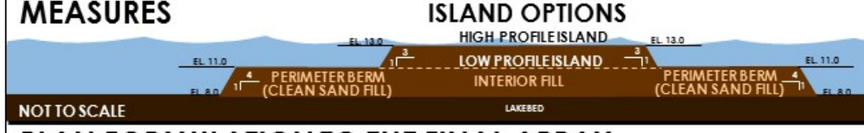
- Emergent (Spike rush and Bulrush): Fisheries, food for birds, and incidental water quality improvement
- Upland (Pond Apple trees): Nesting birds, shelter for land animals, and the potential to support listed species such as the Snail Kite and Okeechobee Gourd

ADDITIONAL BENEFITS OF LAND CONSTRUCTION

- Recreation opportunities (birding, boating, fishing)
- Removal of some silt for use in project potentially uncovers sandy lake bottom in some adjacent areas
- Natural wind/wave break to reduce turbidity (island construction)
- Some wind/wave attenuation to create protected habitat (littoral shelf construction)

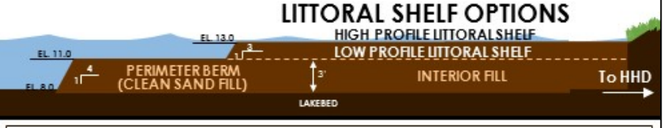
MEASURES

ISLAND OPTIONS



ISLAND'S APPROXIMATE DISTANCE FROM SHORELINE: AVERAGE OF 950 FEET (LAKESIDE OF LAKE OKEECHOBEE NAVIGATION CHANNEL ROUTE 2)

LITTORAL SHELF OPTIONS



NOT TO SCALE

PLAN FORMULATION TO THE FINAL ARRAY

1 MEASURES
16 structural measures and 2 non-structural measures

2 SCREENING
Objectives, Constraints, P&G Accounts

SCORE >12 CARRIED FORWARD

3 RESULTS
5 primary measures carried forward + 4 as supporting design features

MEASURES CARRIED FORWARD

PRIMARY	SUPPORTING
1. Island LP	1. Silt from lake
2. Island HP	2. Terraces
3. Littoral shelf LP	3. Limestone
4. Littoral shelf HP	4. Shallow exposed rock (Rock spine)
5. Living shoreline	

4 ALTERNATIVES
Measures combined and expanded into 587 variations:

- Dimensions
- Armor type
- With Preliminary Cost
- With Cost/Acres

5 SCREENING CRITERIA

- Cost<$12.5M
- Cost/Acre

Results:

- 4 stand alone (alternatives with one primary measure)
- 2 combinations (alternatives with two primary measures)

FINAL ARRAY OF ALTERNATIVES

Please refer to the plan diagrams in page 2 of this Executive Summary for conceptual descriptions of island dimensions.

ALTERNATIVE 1: Low profile island: 700 feet wide x 3000 feet long

ALTERNATIVE 2: Low profile littoral shelf: 400 feet wide x 3000 feet long

ALTERNATIVE 3: High profile island: 800 feet wide x1500 feet long

ALTERNATIVE 4: High profile littoral shelf: 400 feet wide x 3000 feet long

ALTERNATIVE 5 (TSP)*: High profile island: 500 feet x 1000 feet long + low profile island: 500 feet wide x 1500 feet long

ALTERNATIVE 6: Low profile island: 500 feet wide x 1500 feet long + low profile littoral shelf: 400 feet wide x 1500 feet long

*The most cost-effective alternative that meets all USACE planning criteria, is carried forward as the Recommended Plan).

PAHOKEE RESTORATION 1135 CONTINUING AUTHORITIES PROGRAM PROJECT

GRAPHIC EXECUTIVE SUMMARY PAGE 2

PROJECT SPONSOR: PALM BEACH COUNTY, FLORIDA

THE RECOMMENDED PLAN: ALTERNATIVE 5 HIGH AND LOW PROFILE ISLANDS

CONCEPTUAL SITE LOCATION

The Recommended Plan is Alternative 5, which includes construction of two islands in Lake Okeechobee:

- Low-profile island
  - Built at an elevation of 11.0 feet NAVD 88/12.3 feet NGVD29
  - Constructed of a mix of sand and finer silt sediment and surrounded by a sand berm for stability
  - The outer slopes will be armored with riprap
  - Use of silt from the project area can help improve turbidity there by dredging and sequestering some of the fine silt sediments
- High-profile island
  - Built as a terraced island with a lower elevation of 11.0 feet NAVD 88/12.3 feet NGVD29 and a higher elevation of 13.0 feet NAVD 88/14.3 feet NGVD29
  - Constructed of a mix of sand and finer silt sediment, surrounded by a sand berm for stability
  - The outer slopes would be armored with riprap.

Both islands will be planted with pond apples in the inner silt/sand mix, and will be planted with emergent vegetation (Bulrush and Spike rush) on the sand outer rims. Design features and construction methods will be refined during the Design and Implementation (D&I) phase.

DESIGN FEATURES

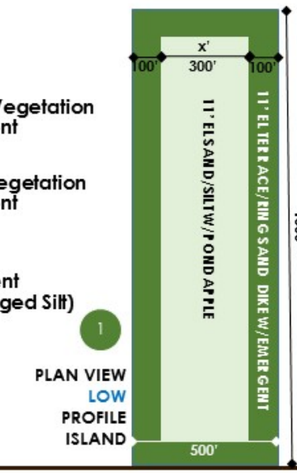
FILL

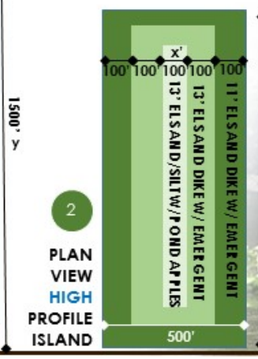
- Perimeter Sand Berm with Emergent Vegetation (Florida Department of the Environment Permitted Upland Mined Sand)
- Elevated Sand Berm with Emergent Vegetation (Florida Department of the Environment Permitted Upland Mined Sand)
- Interior Fill with Pond Apple Trees (Florida Department of the Environment Permitted Upland Mined Sand + Dredged Silt)

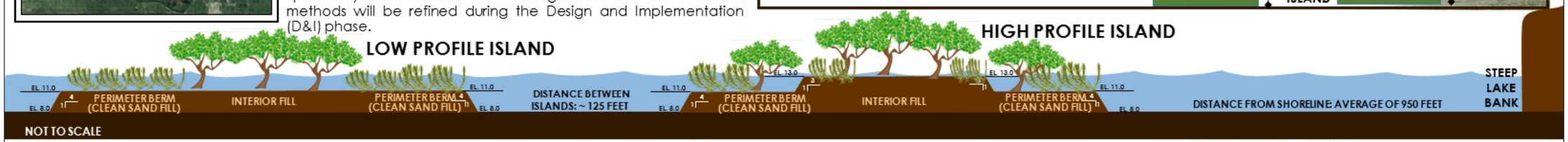
ARMORING

Rock revetment (lake side)

Note: Island setback from navigation Route 2 is 200 feet.







RECOMMENDED PLAN

DIRECT AND ANCILLARY BENEFITS

Direct project benefits:

- Vegetation and habitat for birds and aquatic species
- Reduction of wave/wind energy
- Reduction in the amount of silt in the lake system
- Recreation

Ancillary project benefits:

- Reduction of wind and wave energy in the lakebed between the islands and the shoreline, setting up the potential for additional emergent and submerged vegetation beyond the islands
- Incidental localized water quality improvements (reduced turbidity and nutrient uptake by plants)
- Potential to restore the once sandy lakeshore bed in some areas by dredging silt for use in the project
- Potential habitat for threatened and endangered avian species, such as the Snail Kite and Wood Stork
- Upland Pond apple trees also have the potential to host the threatened Lake Okeechobee Gourd

Images (left to right): Florida Manatee; Endangered Snail Kite; Bulrush; Pond Apple Tree.

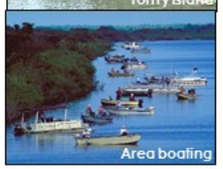
THE FOUR P&G ACCOUNTS

This plan meets all of the project objectives, as well as the national objectives under the P&G accounts:

- **National Ecosystem Restoration (NER):** Results in a cost-effective means to meet all objectives, providing the best buy of all the alternatives at an average incremental cost of $4,100 (using average annual screening level costs) and provides net average benefits of 18.48 Habitat Units.
- **Environmental Quality (EQ):** Provides diversity of emergent and upland species, is able to withstand varying water stages, and provides 28.70 acres of created habitat. This area would serve as habitat and attracters for birds and other land and aquatic animals.
- **Other Social Effects (OSE):** Brings increased aesthetic value and recreational opportunities to the community.
- **Regional Economic Development (RED):** Offers opportunities for improved ecotourism and regional commercial fishing.

Foraging along Torry Island

Torry Island



Area boating

RESIDUAL RISK

ADAPTIVE MANAGEMENT AND MONITORING

This plan was designed with resilience and long-term sustainability as goals, minimizing residual risk:

- The perimeter sand berm and armoring are designed to help reduce wind and wave energy - preventing erosion of the islands - as will vegetation once it matures.
- Pond apple trees and emergent vegetation can tolerate variable levels of water stages. Torry Island Pond apple trees, to the south of the project site along Lake Okeechobee, are at similar elevations and continue to be successful.
- Proactive measures to ensure vegetation success will be written into plans and specifications to include size, maturity, and required depth of planting.
- Post-construction monitoring period: five years.
  - The Adaptive Management and Monitoring Plan outlines modifications, if needed, to achieve project success (cost shared between Federal/non-federal)
  - Modifications after the five-year monitoring period, due to O&M or changed conditions, will be the responsibility of the non-federal sponsor.

COST SHARING

PROJECT COST (FY18 Price Levels): $12 M

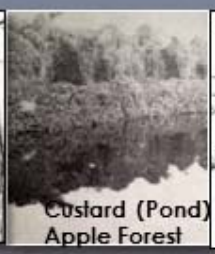
Construction: 75% Federal; 25% non-federal

Monitoring/Adaptive Management (5 years): 75% Federal; 25% non-federal

Adaptive Management post-monitoring: 100% non-federal sponsor cost

PAHOKEE RESTORATION 1135 CONTINUING AUTHORITIES PROGRAM PROJECT

MILITARY MAP 1800S ILLUSTRATING EXTENT OF LAKE OKEECHOBEE



HISTORIC LAKE & VEGETATION

1924 WAR LEVEE PERMIT PLANS - PAHOKEE

1935 LEVEE CONSTRUCTION - PAHOKEE

CURRENT DAY HERBERT HOOVER DIKE - PAHOKEE

1 Introduction

1 INTRODUCTION

Please refer to the Executive Summary and informational foldout REF-1 (located at the end of this report).

1.1 STUDY AUTHORITY

The authority for this project is Section 1135 of the Water Resources Development Act of 1986, as amended.

Section 1135 projects are part of a larger Continuing Authorities Program (CAP) under which the Secretary of the Army, acting through the Chief of Engineers, is authorized to plan, design, and implement certain types of water resources projects without additional project-specific authorization. The Section 1135 authority allows U.S. Army Corps of Engineers (USACE) to carry out projects for improving the quality of the environment when it is determined that such modifications are feasible and consistent with the authorized project purpose and will improve the quality of the environment in the public interest. This project is eligible in accordance with Engineer Regulation 1105-2-100, Appendix F, paragraph F-32.b(2), which states that restoration projects may be undertaken at those locations where the construction or operation of an existing USACE project has contributed to the degradation of the quality of the environment. These projects do not need to modify an existing USACE project. Section 1135 authority is designed to address environmental degradation associated with an existing USACE project. The existing USACE project in this case is Herbert Hoover Dike, where the natural ecosystem in the vicinity of the City of Pahokee has experienced degradation since construction of the dike.

USACE carried out this feasibility study in a manner consistent with the USACE Environmental Operating Principles (EOPs). The principles are consistent with the National Environmental Policy Act (NEPA), the Army's Environmental Strategy with its four pillars (prevention, compliance, restoration, and conservation), and other environmental statutes that govern USACE activities. Finally, the implementation framework proposed as part of the study seeks to work collaboratively, fully engaging individuals, agencies, and local groups in identifying, planning, and implementing ecosystem restoration efforts.

1.2 STUDY SPONSOR

The non-Federal sponsor is Palm Beach County, Florida. A Feasibility Cost Sharing Agreement (FCSA) was executed on December 19, 2016.

The study area is in the vicinity of the City of Pahokee, along the southeastern shore of Lake Okeechobee in Palm Beach County, Florida, approximately 100 miles north of Miami. The Congressional Delegation is Senator Bill Nelson, Democrat, Senator Marco Rubio, Republican, and Congressman Alcee L. Hastings, Republican, 20th Congressional District, U.S. House of Representatives.

1.3 STUDY PURPOSE AND NEED

PURPOSE: Restore historical vegetation and habitat along a portion of the southeastern Lake Okeechobee shoreline which has been degraded due to the USACE Herbert Hoover Dike project.

NEED: Deep lake levels, wind, and wave activity in Lake Okeechobee near the Pahokee shoreline maintains turbid water conditions and inhibits the ability of emergent vegetation to root and establish a littoral and buffer zone. Storm events exacerbate already poor conditions.

Photos and documentation suggest that thick native pond apple forests (previously called custard apples) grew along the southern and southeastern rim of the lake, providing important habitat, breakwaters, sediment traps, and filtration systems. The shape of the lake itself was wider, rounder, and longer in the southern and southeastern portions than it is today, suggesting a gradual transition of water from the lake to the Everglades. This former upland and emergent habitat provided for rookeries and nurseries for species such as great egrets, wood storks, great blue herons, snail kites, apple snails, and otters. This area functioned as a natural breakwater, weir, and filtering system during the occasional flooding of the lake into the Everglades.

In the early 1900's, the lake levels were higher than they are today; roughly 19-22 feet mean low water, Punta Rasa datum.[1] The pond apple forest was also at this same elevation and approximately 1 to 1.5 miles thick and 30 miles long along the southern and eastern shoreline, according to literature (McVoy, 2011 and Will, 1968). Some sources say this pond apple forest and the hammocks behind it may have been on a slightly elevated sand ridge (Will, 1968).

In 1910, local settlers in the area began filing permits for water control features and small levees in the area. In 1924, USACE issued a permit to bring the lake levels down to 15 feet mean low water, Punta Rasa datum, for drainage purposes, and build up the smaller local levees to a crest elevation of 22 feet, mean low water, Punta Rasa datum.[2] This action by the Federal government was an important and defining start of the changes to the landscape and hydrology of the area. Drawing down the lake by such an extreme amount left the pond apples and hammock vegetation, which were used to growing in Lake Okeechobee's waters, suddenly high and very dry. Without the constant source of water, they began their decline.

[1] Lake Okeechobee datum was approximately within 1.4 feet of Mean Low Water, Punta Rasa.
[2] War Permit

Figure 1-1. Historic Conditions in the Pahokee area.

The infamous catastrophic hurricanes of 1926/1928 claimed thousands of lives, which lead to the congressional approval of more Federal actions in South Florida for the primary purposes of flood control and navigation in the Rivers and Harbors Act of 1930 (Public Law (P.L.) 71-520). In 1932-1937, the 22-foot crest elevation levees south of Pahokee were raised to 34-foot crest elevations along the entire southern rim of Lake Okeechobee, in the general location of the dry remains of the pond apple forest. Hurricanes and floods again caused damages to the people and area in 1947/1948, leading to the authorization of Central and Southern Florida Project in the Flood Control Act of 1948 (P.L. 80-858). In 1960, the southern levee was joined by a northern levee, effectively encircling the entire lake, and officially took its name as the Herbert Hoover Dike. All of the Federal actions described were taken for much needed flood control but contributed to the degraded ecosystem that exists today in the Pahokee area, along the southeastern shore of Lake Okeechobee.

1.4 FEDERAL PROJECTS IN THE VICINITY

The following Federal projects as described below are all in the vicinity of Pahokee.

Herbert Hoover Dike

Herbert Hoover Dike is a component of the C&SF Project which was designed to reduce impacts from flooding as a result of high lake levels, consisting of a 143-mile earthen dam that surrounds Lake Okeechobee. Local associated features in the project vicinity are:

- Contracts C-10 and C-12; currently scheduled for completion in 2020.
- Contract C-2; currently scheduled for completion in August 2018.
- Contract C-12A; currently scheduled for 2020.
- Contract C-3; currently scheduled for completion in August 2018.
- Contract C-4A; currently scheduled for completion in May 2018.

Lake Okeechobee Waterway (OWW) Route 1 and 2

The OWW, a component of the C&SF Project, extends from the St. Lucie Lock in Martin County southward and westward through Martin and Palm Beach Counties to the Palm Beach/Hendry County line. It includes the St. Lucie Canal, Route 1 (or Cross-Lake Canal), and Route 2 (Rim Canal). The OWW was originally federally authorized and constructed under the Caloosahatchee River and Lake Okeechobee Drainage Project of the Rivers and Harbors Act of 1930, and then later under the Central and Southern Florida Flood Control Project of the Rivers and Harbors Act of 1948. The OWW is used in the community for recreational boating and is maintained at the following depths: 8 feet from the Atlantic Intracoastal Waterway near Stuart, Florida via Okeechobee Lake Route 1 to Fort Myers, Florida; 10 feet from Fort Myers to Punta Rassa; 12 feet from Punta Rassa to the Gulf of Mexico; 6 feet for Route 2 along the south shore of Lake Okeechobee from Port Mayaca westward to Clewiston. The current non-Federal sponsor is the Florida Inland Navigation District (FIND).

Lake Okeechobee Regulation Schedule

Levels within the lake are currently regulated under the 2008 Lake Okeechobee Regulation Schedule (LORS). LORS is the result of a two-year study on water management and lake levels that included significant public involvement. The LORS was developed to balance the performance of multiple project purposes while preserving public health and safety. One of the primary goals of LORS is to maintain a lake level between 12.5 and 15.5 feet. LORS includes a seasonally-adjusted schedule to help guide water management decisions.

Lake Okeechobee Restoration Watershed Study

The Lake Okeechobee Watershed Restoration Project (LOWRP) is developing alternatives that will capture, store, and redistribute water entering the north part of Lake Okeechobee to improve lake stage levels, improve discharges to the Caloosahatchee and St. Lucie estuaries, restore/create wetland habitats, and reestablish connections among natural areas that have become spatially and/or hydrologically fragmented. If implemented, these actions will help restore more natural water deliveries, promote the

improved health and functionality of wetland and upland areas, and increase the quantity and quality of habitat available for native wildlife and vegetation.

Kissimmee River Restoration (KRR)

The Kissimmee Basin forms the headwaters of Lake Okeechobee and the Everglades. Once the Kissimmee River Restoration (KRR) Project is constructed and the headwaters schedule is implemented, it will return flow to 44 miles of the river's historic channel and restore about 40 square miles of river/floodplain ecosystem. The floodplain will be able to store excess water upstream, helping to offset some flows into Lake Okeechobee. This restoration project is currently estimated to be complete by 2020.

1.5 PRIOR STUDIES

The following reports are pertinent to the project area, in terms of background information and alternatives considered by other agencies and entities. Many other sources of literature used for this report can be found in the references section of this report.

- Pahokee Restoration, Florida, Section 1135 Federal Interest Determination (FID), approved June 23, 2016. This report outlined problems and opportunities in the Pahokee area, describing conditions prior to the construction of Herbert Hoover Dike. Based on the information compiled in the FID, the report concluded that there is sufficient Federal interest in proceeding to a feasibility level of study for Pahokee Restoration under the Section 1135 authority, to be cost shared with the non-Federal sponsor.

- Prototypical Eco-Island Study on Lake Okeechobee for the City of Pahokee, Florida. (July 1, 2008). Gentile Holloway O'Mahoney and Associates, Landscape Architecture, Planning and Environmental Consulting. This report offers study and design recommendations for the location, construction methods, establishment of native habitats and ecosystems, along with recreational opportunities and preliminary construction budgets for the creation of Lake Okeechobee Eco-Islands.

2 Existing and Future

Without Project Conditions

2 EXISTING AND FUTURE WITHOUT-PROJECT CONDITIONS

This chapter describes the physical features (conditions), environmental resources (affected environment), and socio-economic environment that could be affected if none of the alternatives were implemented. This chapter, in conjunction with the description of the "no-action" alternative, forms the baseline conditions for determining the impacts of the proposed action and reasonable alternatives.

Please refer to the Graphic Executive Summary located at the beginning of this report and informational foldout REF Map 1 (located at the end of this report).

2.1 GENERAL ENVIRONMENTAL EFFECTS

The City of Pahokee, Florida is located on the southeastern shoreline of Lake Okeechobee in Palm Beach County. The study area is 4,000 feet wide, spanning approximately 31,000 feet of shoreline along Lake Okeechobee.

As mentioned in Chapter 1, the Federal actions taken including construction of existing flood control features were taken for much needed flood control but contributed to the degraded ecosystem that exists today in the Pahokee area.

Without action, any improvements towards restoration of the ecosystem which once existed in this area cannot be achieved. Without a natural or manmade barrier, this area will continue to experience negative impacts from strong wind and wave patterns, creating turbid conditions and silt accumulation where aquatic vegetation – and therefore an ecosystem - cannot survive. Water stages will continue to vary greatly, but new submerged or emergent aquatic vegetation that attempts to grow on the bottom of the lake will be uprooted by rising water stages. Without a plan, physical influences will continue to exacerbate the existing conditions, impairing the local environmental resources upon which this community depends, negatively impacting the local and regional economy, and contributing to degradation in the larger extent of the Everglades system.

2.2 PHYSICAL ENVIRONMENT

This section describes the physical conditions that are relevant to the decision to be made. It does not describe the entire existing physical environment, but only that pertinent to forming the baseline conditions to determine the impacts of the proposed action and reasonable alternatives.

2.2.1 HYDROLOGY

EXISTING CONDITIONS

Lake Okeechobee is part of the massive C&SF multi-purpose system, which stretches from just south of Orlando to Florida Bay and serves 8.1 million people. USACE manages Lake Okeechobee water levels with the goal of balancing flood control, public safety, navigation, water supply, and ecological health. Operational decisions – i.e. whether to retain or release water in the massive lake – are based on a

regulation schedule, LORS, and the best available science and data. Under the 2008 LORS, the lake water level is maintained between 12.5 feet and 15.5 feet NGVD29 and maintains stages below 17.25 feet NGVD29 to protect the lake ecology and the integrity of the aging Herbert Hoover Dike that surrounds the lake. More detailed information on the hydrology can be found in section 4.1.2 of **APPENDIX A (Engineering)**.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Conditions in the physical environment for the hydrologic system will most likely continue to be the same in the future. Although LORS will change, any adjustments will include consideration of the Lake Okeechobee performance measures. Dramatic changes that would force lake levels outside of the target stage range could have severe detrimental effects to the existing lake ecology.

2.2.2 SEDIMENTS

EXISTING CONDITIONS

The materials encountered within Lake Okeechobee, near Pahokee, Florida, consist of sands and silts, peat, and limestone rock fragments; however the surficial sediments are primarily supersaturated silts and silty sands. Sands are characterized as poorly graded to silty sands, with some pebble-sized rock and shell fragments. Silty material also contains shell fragments. Some clay is also found occurring with silt. While the visual classification of the soils show large deposits of clay material, laboratory testing indicate that this material is predominantly silt and organic material. More detailed information on sediments can be found in section 5.0 of **APPENDIX A (Engineering)**.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

It is assumed that without this project, the shoreline will continue to erode and recede due to wind and waves which are amplified during storms and hurricane events. In addition, silty sediments would continue to accumulate in the area, inhibiting vegetation growth.

2.2.3 SEA LEVEL CHANGE

EXISTING CONDITIONS

Lake Okeechobee is an inland water body with controlled water levels based on LORS. More detailed information on sea level change can be found in section 4.1.2 of **APPENDIX A (Engineering)**.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

The no-action alternative would have no effect on sea level change in the project area.

2.2.4 CLIMATE

EXISTING CONDITIONS

APPENDIX A (Engineering) describes the climate in Pahokee, Florida as a mild, and generally warm and temperate climate characterized by an annual average temperature of 73°F and approximately 75% humidity. The warmest month is August, with an average maximum temperature of 91.2°F, and the coolest month is January, with an average maximum temperature of 74.1°F. The rainy season spans from

May through October. June is the wettest month, with an average monthly precipitation of over 7.6 inches, and December is the driest month, with an average monthly precipitation of approximately 2 inches (https://en.climate-data.org). More detailed information on climate can be found in section 4.4.1 of **APPENDIX A (Engineering)**.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Although there is significant uncertainty in warming and precipitation trends, the no-action alternative is not likely to have any effect on the project area's climate.

2.3 BUILT ENVIRONMENT

2.3.1 RESIDENTIAL AND COMMERCIAL STRUCTURES

EXISTING CONDITIONS

Four main built features exist near or adjacent to the study area: the Pahokee Marina, the Palm Beach County Glades Airport, Torry Island Campground, and Herbert Hoover Dike. The Pahokee Marina was built by the City of Pahokee in 2009, and is used by the community for the marina and conference room capabilities. A road over Herbert Hoover Dike provides access. Torry Island Campground and Marina is located along the southern shores of Lake Okeechobee and is a privately owned campground with recreational opportunities for camping, fishing, boating, and birding. The Palm Beach County Glades Airport covers an area of 243 acres, and, due to relatively low traffic, it is one of five South Florida airports that is used for instrument training by student pilots. Herbert Hoover Dike is a 143-mile earth dike that surrounds Lake Okeechobee and is built to an elevation of 35-40 feet. More information regarding the population growth of the City of Pahokee as it relates to residential structures can be found in section 2.5.

FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

In the future without project condition, the built features as described above will continue to function as intended and residential structures will likely continue to be constructed at similar rates.

2.4 NATURAL ENVIRONMENT

This section describes the environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect, or that would be affected by, the alternatives if they were implemented.

2.4.1 VEGETATION

EXISTING CONDITIONS

The project area is characterized by upland vegetation, sharp drop offs into the lake, and little to no emergent or submerged aquatic vegetation. Submerged aquatic vegetation does not grow in this area of the lake due to depths in the lake being deeper than the photic zone, as well as the high wave and wind energy and turbidity near the shoreline. There is not a littoral zone or any other natural feature(s) to act as a barrier to strong wind and wave influences. Just south of the project area is Torry Island, which represents a goal for the Pahokee area. Torry Island is fortunate to have remnant elevated islands at

approximately 12 foot elevation, which have been successfully reforested with pond apples due to local efforts combined with grants, as well as South Florida Water Management District (SFWMD) plantings in 2005 and 2011.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

No significant change is expected to occur to vegetation if the Recommended Plan is not implemented; however, ongoing shoreline erosion will continue to reduce the already limited amount of habitat available for vegetation growth.

2.4.2 FISH AND WILDLIFE RESOURCES (OTHER THAN ENDANGERED SPECIES)

EXISTING CONDITIONS

BENTHOS

Sedimentary habitats support a variety of invertebrates and demersal fishes. Invertebrate species in the project area include infaunal and epifaunal species represented primarily by annelid worms, gastropods, bivalves, etc. Demersal feeding fishes prey on most of these species.

FISHERIES

Lake Okeechobee is nationally recognized as supporting high quality fisheries for black crappie and largemouth bass (FWC 2017).

MIGRATORY BIRDS

A number of birds may occur in and around the project area, including a number of species considered birds of conservation concern by the Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§703-712). In the past 10 years, 78 species of birds have been sighted at the Pahokee Marina, including black skimmer, wood storks, and various species of terns and herons (eBird.org 2018).

OTHER WILDLIFE

Other wildlife typically found in the project area include small mammals such as squirrels, rabbits, and raccoons, as well as reptiles and amphibians, such as frogs, lizards, and alligators.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

No significant change is expected to occur to fish and wildlife if the Recommended Plan is not implemented; however, continued shoreline erosion may reduce the available habitat used by fish and wildlife.

2.4.3 THREATENED, ENDANGERED, AND PROTECTED SPECIES

EXISTING CONDITIONS

Based on preliminary coordination, USACE believes that the following species have the potential to be in or near the project area, and, thus, must be considered as part of the design and construction:

- Eastern indigo snake (*Drymarchon corais couperi*);
- Florida panther (*Puma* (felis) *concolor coryi*);
- West Indian (Florida) manatee (*Trichechus manatus*);
- Everglade snail kite (*Rostrhamus sociabilis plumbeus*);

- Florida bonneted bat (*Eumops floridanus*);
- Audubon's crested caracara (*Polyborus plancus audubonii*);
- Wood stork (*Mycteria americana*);
- Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*);
- Migratory birds.

In addition, designated critical habitat (DCH) for the Florida population of the Everglade snail kite and the entire population of the Florida manatee exists within the project area's vicinity. Descriptions of the species, DCH, and their potential presence in the project area are located in **APPENDIX E (Pertinent Correspondence)** in USACE consultation documents to USFWS.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

No significant change is expected to occur to threatened, endangered, and protected species if the Recommended Plan is not implemented; however, continued shoreline erosion may reduce the amount of habitat available for use by listed species.

2.4.3.1 AIR QUALITY

EXISTING CONDITIONS

The Conformity Rule in the Clean Air Act (CAA) (42 U.S.C. §7506(c)) requires Federal actions to conform to an approved state implementation plan (SIP) designed to achieve or maintain an attainment designation for air pollutants as defined by the National Ambient Air Quality Standard (NAAQS). The NAAQS were designed to protect public health and welfare. The criteria pollutants include carbon monoxide (CO), ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter (PM2.5 and PM10), VOC, and lead (Pb). The General Conformity Rule (40 CFR Parts 51 and 93) implements these requirements for actions occurring in air quality nonattainment areas.

The project is located in the Air Quality Control Region (AQCR) known as Southeast Florida Intrastate AQCR (40 CFR §81.49). The project area is in attainment for all of the NAAQS.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Air quality conditions would remain the same if the Recommended Plan is not implemented.

2.4.4 WATER QUALITY

EXISTING CONDITIONS

Lake Okeechobee is Florida's largest body of fresh water. The lake supports fisheries, provides flood control protection, and also serves as a reservoir for potable and irrigation water in South Florida. Rainfall contributes 30% of the lake water whereas the remaining 70% is from major tributaries, canals, and runoff (FWC 2017). High water levels are maintained during the dry season (October – May) and lower water levels are maintained during June through September. Freshwater in-flows to Lake Okeechobee from the Kissimmee River have resulted in increased amounts of silty sediments. Lake nutrient levels also increased over the past thirty years. These sediments, when disturbed by wind and wave energy, become resuspended in the water, resulting in turbid water and ecologically undesirable conditions. In 1998, Lake

Okeechobee was added to the State of Florida's Clean Water Act Section 303(d) (33 U.S.C. §1313(d)) impaired waters list due to the high levels of phosphorus.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Water quality conditions would continue to degrade if the Recommended Plan is not implemented. Silty sediments would continue to accumulate and become resuspended into the water column during periods of high wave energy.

2.4.5 NOISE

EXISTING CONDITIONS

Noise in the project area is created by sources commonly found in natural and human environments. Natural sources of ambient noise include weather, e.g. rain and thunder, waves and surf, and wildlife. Anthropogenic noise could include commercial and residential vehicles and vessels. The underwater acoustic environment is likely dominated by noise from vessels traversing the lagoon, however natural sources such as weather, water movement, and wildlife would also contribute to underwater ambient noise.

FUTURE-WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Noise levels in the project area would likely remain the same if the Recommended Plan is not implemented.

2.4.6 CULTURAL RESOURCES

EXISTING CONDITIONS

Cultural resources are defined by the National Historic Preservation Act (54 U.S.C. §300101 *et. seq*) (NHPA) as prehistoric and historic sites, structures, districts, or any other physical evidence of human activity considered important to a culture, a subculture, or a community for scientific, traditional, religious, or any other reason. Several Federal laws and regulations protect these resources, including the NHPA, the Archaeological and Historic Preservation Act of 1974 (54 U.S.C. §312505 *et. seq*), and the Archaeological Resources Protection Act of 1979 (16 U.S.C. §§470aa-470mm). Additionally, NEPA requires that Federal agencies consider the "unique characteristics of the geographic area such as proximity to historic or cultural resources, and the degree to which the [proposed] action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places." (40 CFR §1508.27(b)(8)).

Based on a literature assessment and search of the Florida Master Site File (FMSF), two potential project areas (see Figure 4-2) were reviewed by staff archaeologists of USACE, Jacksonville District. One prehistoric site and several and historic resources were found to be recorded within approximately one mile of the two proposed project development locations. All of these resources are terrestrial and located within approximately 1,500 feet of Lake Okeechobee shoreline. No submerged cultural resources surveys have been conducted within one mile of the potential project areas and no submerged archaeological sites have been recorded.

The prehistoric site is assigned Smithsonian trinomial 8PB16177 and contains 19 Belle Glade Plain, two St. Johns Plain, and five Sand Tempered Plain pottery sherds. Burnt faunal remains were also recovered from the site. These materials indicate a midden deposit that is typically associated with larger sites; therefore, there exists a high potential in the area's vicinity for recovering additional diagnostic artifacts and undisturbed cultural features (Davenport & Green 2013). The site, while adversely impacted by development, may still be eligible for inclusion in the National Register of Historic Places (NRHP) under *Criteria D*.

The historic resources recorded at the FSMF include the Herbert Hoover Dike, Old Pioneer Park, the Old Pioneer Park Cemetery, and the many historic residences neighboring Lake Okeechobee southwest of the City of Pahokee. The Herbert Hoover Dike (8PB02028) encircles Lake Okeechobee. It is composed of sand, shell, and rock and was constructed from 1930 to 1938. The dike is eligible for inclusion in the NRHP based upon its significance in community planning and development, engineering, agriculture, and conservation. The dike is the largest civil engineering structure in South Florida, averaging 34 feet in height, and designed to control waters in and around Lake Okeechobee. Old Pioneer Park (8PB14957) and Old Pioneer Park Cemetery (8PB15052) are part of a locally well-known public space established as part of Pahokee's early twentieth-century cityscape (Stallings et al 2011). No evidence has been found regarding the park's construction date; however, interviews with residents and city officials suggest that the park was either established as a memorial for Pahokee's earliest settlers or the victims of the 1928 hurricane (Stallings et al 2011). The historic residences located east of the Herbert Hoover Dike, a few of which have been recommended as eligible for inclusion in the NRHP, were primarily built in the 1930s and 1940s.

USACE initiated consultation with the State Historic Preservation Office (SHPO) and other interested parties on December 22, 2017 regarding the two potential project areas and the need for a submerged cultural resources remote sensing survey. Consultation will continue through completion of the project.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

No significant change is expected to occur if the Recommended Plan is not implemented.

2.4.7 NATIVE AMERICANS

EXISTING CONDITIONS

Archaeological site 8PB16177 is the only prehistoric terrestrial site recorded within one mile of the potential project areas; however, there is a moderate to high probability that additional prehistoric resources will be encountered in and around Lake Okeechobee. These resources include prehistoric campsites, shell middens, and burial mounds. No portion of this project affects Native American properties. Consultation with appropriate Federally-recognized tribes is ongoing and will be completed prior to project implementation. Pursuant to Section 106 of the National Historic Preservation Act (NHPA) regarding the USACE's Trust Responsibilities to Federally-recognized Native American tribes, and in consideration of the Burial Resources Agreement between USACE and the Seminole Tribe of Florida, the USACE initiated consultation with the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, the Seminole Nation of Oklahoma, and the Thlopthlocco Tribal Town through a letter dated December 22, 2017 concerning the two potential project areas and the need for a submerged cultural resources remote sensing survey.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

No significant change is expected to occur if the Recommended Plan is not implemented.

2.4.8 AESTHETIC RESOURCES

EXISTING CONDITIONS

The Herbert Hoover Dike surrounds Lake Okeechobee. The project area is characterized by upland vegetation, sharp drop offs into the lake, and little to no emergent or submerged aquatic vegetation. The upland and aquatic habitat in the area is scarce. The water in the area is noticeably turbid. There is no littoral zone or any other natural feature(s) to act as a barrier to strong wind and wave influences. Shoreline erosion is visible in the vicinity.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

There would be no significant change to the aesthetics in the project area without the implementation of the Recommended Plan. The shoreline will likely continue to erode and silty sediments will continue to accumulate in the project area.

2.4.9 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

EXISTING CONDITIONS

The project footprint has no known HTRW problems (Superfund listings, state records, etc.) but the City of Pahokee has several minor pending petroleum cleanup sites (e.g. gas stations, as noted on the Florida Department of Environmental Protection (FDEP) Waste Cleanup Contamination Locator Map). These sites are not expected to have any impact to the proposed project footprint. Any fill required for this project will be sourced only from clean, HTRW-free areas. Since the project footprint is within a lake bed, any concern with past residential or industrial use is eliminated.

South and Central Florida have relatively high natural background levels of arsenic in various parts of the state; above residential limits (2.1 mg/kg soil) and, in some cases, above industrial limits (12mg/kg soil). Pristine marsh soil cores in the Everglades have yielded results as high as 50 mg/kg.

Parts of Lake Okeechobee are likely to have some areas with the sediments above the residential limits for arsenic. These levels are not the result of any past industrial activity in or around the lake, but are due to the natural geology of the area. Levels above residential limits are commonly found in the Miami area and within the Everglades National Park (e.g. Tamiami Trail Modifications). Limits are based on daily consumption of a small amount of soil throughout an entire year.

Any sediments moved within the lake to construct this project would be capped with clean fill. The islands created by this project would also reduce resuspension of sediments by dampening wave energy. This would tend to reduce resuspension of the lake sediments into the water column which would help dampen nutrient spikes in the project area resulting from wind/wave action.

There is no history of industrial discharges into or around Lake Okeechobee. The main concern with Lake Okeechobee sediments is the relatively high levels of legacy nutrients introduced into the lake by agricultural activities.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

HTRW conditions would remain the same if the Recommended Plan is not implemented.

2.5 SOCIO-ECONOMIC ENVIRONMENT

2.5.1 LOCAL ECONOMY AND DEMOGRAPHICS

EXISTING CONDITIONS

Incorporated in 1922, the City of Pahokee covers an area of 5.4 miles. According to U.S. Census data, the population of Pahokee in 2010 was 5,649 and is estimated to have grown 7.9% to 6,094 by 2016.

According to the American Community Survey (ACS) for the year 2016, the sectors employing the highest percent of the Pahokee population are agriculture (18.7%), educational services, health care and social assistance (15.7%), and recreation, accommodation, and food services (14.1%). The unemployment rate for the area is 27.1%. The following table (Table 2-1) demonstrates some wage and income data for Pahokee and compares it to the entire State of Florida, as well as the United States as a whole.

Table 2-1. Pahokee Wage and Income Data.

American Community Survey Data (2012 – 2016)	Pahokee	All of Florida	All of U.S.
Median Earnings for Workers	$ 24,130	$ 28,148	$ 31,334
Median Household Income	$ 27,907	$ 48,900	$ 55,322
Percent of Population Below Poverty Threshold	26.3%	11.7%	11.0%

Specific to the project area, there is a local marina which contributes to the recreation potential in the area. Launches from the marina provide opportunities for wildlife viewing, as well as fishing within Lake Okeechobee.

Demographic information for Pahokee was obtained through the Census Bureau's 2010 Decennial Census Survey. The breakdown can be seen in Table 2-2.

Table 2-2: Pahokee Demographic Information (2010 Decennial Census)

	Pahokee City	
Demographic	**Number**	**Percent**
Population	5,649	100.0%
White	1,630	28.9%
Black or African American	3,170	56.1%
American Indian and Alaska Native	18	0.3%
Asian	17	0.3%
Native Hawaiian and Other Pacific Islander	7	0.1%
Some Other Race	643	11.4%
Two or More Races	164	2.9%

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Based on Census Bureau data, the annual estimated population growth is 1.1% and this modest growth is expected to maintain in the future without-project. It is also anticipated that there will not be any increases in the quality of recreation opportunities in the absence of a project.

2.5.2 LAND USE

EXISTING CONDITIONS

The existing conditions of the study area represent a southeastern segment of Lake Okeechobee with deteriorated historic vegetation and habitat. Current lake conditions of deeper water, wind and wave impact, and increased turbidity during storms have created conditions difficult for reestablishing native vegetation.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

Conditions will continue to degrade in the absence of a project. Native vegetation will not be able to reestablish and decreases in available habitat are anticipated.

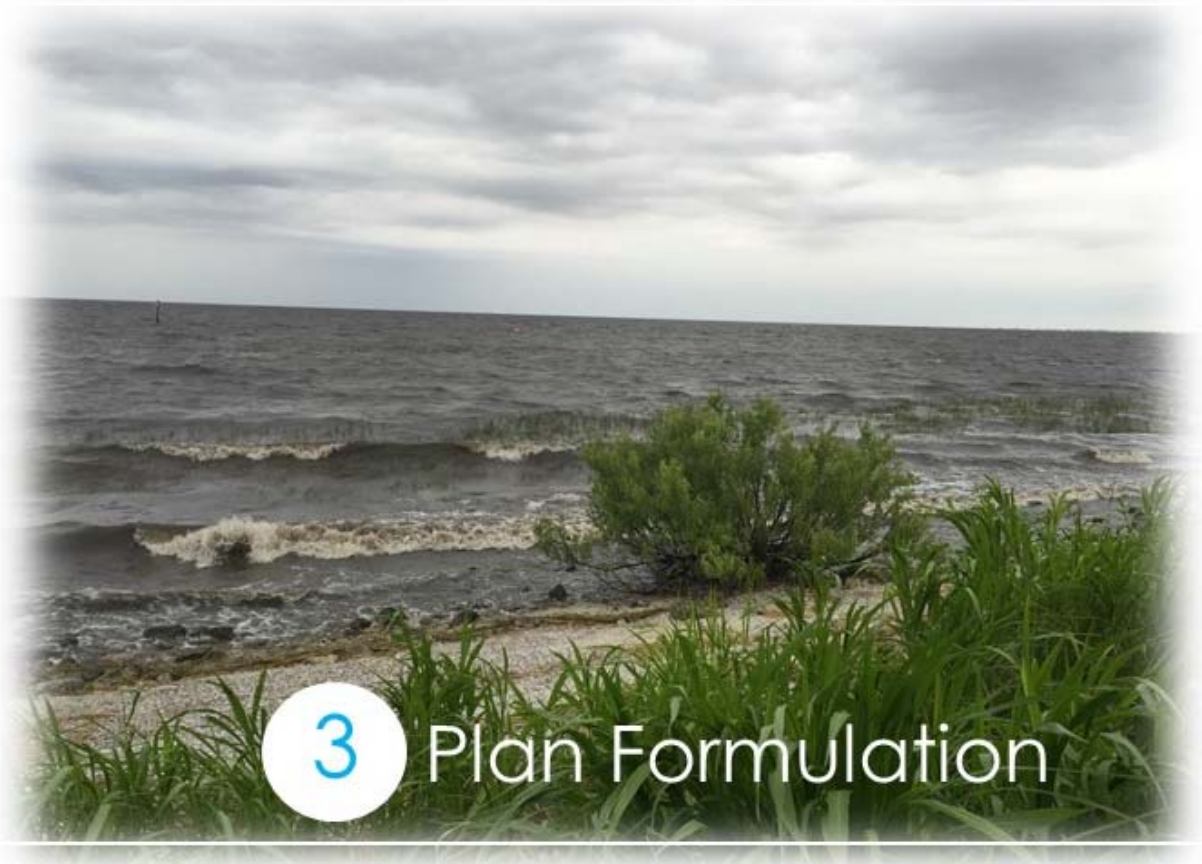
2.5.3 RECREATION

EXISTING CONDITIONS

The primary sources of recreation include operation of the local marina, where visitors are able to launch boats, kayaks, and paddle boards, etc. In addition, visitors are able to engage in wildlife viewing, fishing, and swimming. Just south of the project site is Torry Island Campground, where visitors are able to camp in recreational vehicles or tents. The Lake Okeechobee Scenic Trail was designated as part of the Florida National Scenic Trail in 1993 and consists of an approximately 110-mile trail encircling the lake. More than half the trail is paved and the remainder is a gravel roadway on top of the 35-foot high dike. The trail can be used by the community and visitors for walking, hiking, rollerblading, bicycling, and horseback riding.

FUTURE WITHOUT-PROJECT CONDITIONS (NO-ACTION ALTERNATIVE)

The amounts of recreation and eco-tourism will slightly increase in this area.



3 Plan Formulation

3 PLAN FORMULATION

Please refer to the Executive Summary, as well as informational foldouts REF-1 and REF-2 (located at the end of this report).

3.1 PROBLEMS AND OPPORTUNITIES

The purpose of this feasibility study is to develop an implementable and acceptable plan to change the future condition and address specific problems and opportunities in the study area. Problems and opportunities have been identified by USACE in several ways, including previous USACE studies, reports by private contractors for the City of Pahokee, information from Palm Beach County, Florida, and other related reports from state and Federal environmental agencies.

3.1.1 PROBLEMS, OPPORTUNITIES, OBJECTIVES AND CONSTRAINTS

Problems & Opportunities	
Problems	Loss of historic vegetation and habitat
	Strong wind & waves create conditions unfavorable to new growth
	Deeper water in this portion of Lake Okeechobee inhibit plan use of light needed for photosynthesis and growth
	Silt on lake floor continues to inhibit growth, and often buries new growth during turbid waters
Opportunities	Create favorable conditions for submerged and emergent aquatic vegetation, similar to what exists near Torry Island (in the southern vicinity of the lake)
	Increase fisheries habitat
	Potentially incorporate beneficial use of dredged material from dredging the Lake Okeechobee Waterway Route 2
	Promote eco-tourism/recreational interests
	Use Regional Sediment Management (RSM)
	Incorporate sustainable practices to reduce long-term maintenance by using natural lake dynamic processes
	Incidental, localized improvements to water quality
Objectives & Constraints	
Objectives	
Objective 1	Create an area suitable for vegetation, with associated habitat, of at least 1 acre
Objective 2	Create habitat for aquatic species & birds within 5 years
Objective 3	Reduce effects of wind & waves to lake bottom
Objective 4	Maintain or improve ecotourism
Objective 5	Improve natural lake bottom conditions (localized)
Constraints	Avoid conflict with state and Federal regulations, as stated in Federal law, United States Army Corps of Engineers regulations, and executive orders.

Federal Environmental Objectives & Environmental Operating Principles in Plan Formulation

USACE strives to balance the environmental and development needs of the nation in full compliance with the National Environmental Policy Act (NEPA) and other authorities provided by Congress and the Executive Branch. Public participation is encouraged early in the planning process to help define problems and environmental concerns relative to the study. Therefore, significant environmental resources and values that would likely be impacted, favorably as well as adversely, by an alternative under consideration are identified early in the planning process. All plans are formulated to avoid to the fullest extent practicable any adverse impact on significant resources. Significant adverse impacts that cannot be avoided are mitigated as required by Section 906(d) of WRDA 1986.

Additionally, the feasibility study was carried out in a manner consistent with the USACE Environmental Operating Principles (EOPs).

THE FOUR USACE Principle and Guidelines (P&G) ACCOUNTS

The Federal process incorporates four accounts to facilitate evaluation and display of alternative plans. These are National Economic Development (NED)/National Ecosystem Restoration (NER), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE).

- NER: Displays contributions, our outputs, and increases in the net quantity and/or quality of desired ecosystem resources. This category is generally NED in other mission areas which do not relate to restoration.
- EQ: Displays non-monetary effects on significant natural and cultural resources
- RED: Registers changes in distribution of regional economic activity that result from each alternative plan.
- OSE: Registers plan effects from perspectives that are relevant to the planning process, but not captured in the other three accounts.

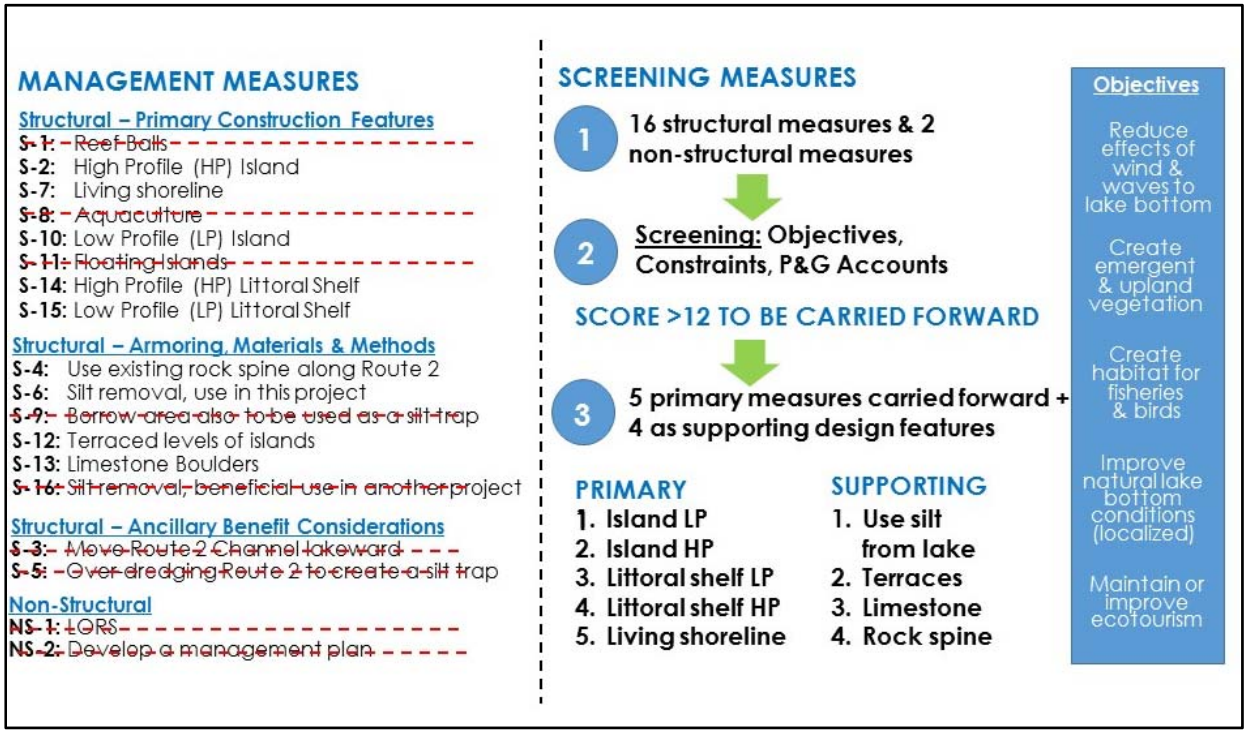
3.1.2 SUMMARY OF MANAGEMENT MEASURES

The initial process of screening measures is shown in Figure 3-1. Management measures were brainstormed with USACE and Palm Beach County to meet some or all of the project objectives. These included 16 structural and two non-structural measures. Each measure was then scored on its ability to meet objectives, avoid constraints, and qualify under the four USACE Principles & Guidelines (P&G) accounts (NED/NER, EQ, RED, OSE).[3] A score of 12 or more illustrated meeting over half of the criteria and showed that a measure was important to be carried forward for further consideration.

Nine measures had scores of 11 or less, and were not carried forward (shown with a red strikeout in Figure 3-1Table 3-1) as they did not represent measures that would address the objectives and four P&G criteria as fully as the other measures did, when compared and evaluated. The nine remaining measures had scores of 12 or more and were carried forward and classified as primary measures and supporting measures.

[3] The recreation objective is intended for incidental recreational benefits, appropriate in scope and scale to the project and would be compatible with the project primary purpose, per ER 1105-2-100.

Figure 3-1. Summary of Management Measures and Screening Process.



The following overarching management measures were carried forward after initial screening and labeled as primary measures:

- **S-2: High Profile (HP) Islands** – This type of island would be at a higher elevation and, depending on the stages in Lake Okeechobee, could be more elevated from the water during certain times of the year.
- **S-7: Living shoreline** – This measure would provide protection and restoration of habitat along the shoreline through natural and strategic placement of sand fill, stone, and plants.
- **S-10: Low Profile (LP) Islands** - This type of island would be at a lower elevation and, depending on the stages in Lake Okeechobee, could be more submerged during certain times of the year.
- **S-14: High Profile (HP) Littoral Shelf** - This type of littoral shelf would be at a higher elevation and, depending on the stages in Lake Okeechobee, could be more elevated from the water during certain times of the year.
- **S-15: Low Profile (LP) Littoral Shelf** - This type of littoral shelf would be at a lower elevation and, depending on the stages in Lake Okeechobee, could be more submerged during certain times of the year.

Measures which can be combined with the above listed measures were labeled as supporting measures and carried forward as ways to reduce cost or gain project efficiencies:

- **S-6: Silt Removal** – This measure would remove excess silt in areas of high density and could be used, when appropriate, towards construction of an island, littoral shelf, or living shoreline. While there would be temporary turbidity impacts to water quality during the dredging and construction of the project, this measure is beneficial in that removing the silt from the lake bottom allows

more light penetration and less turbidity, which will help lake aquatic species. This material has high nutrients which, if used in a contained system, will help establish vegetation.

- **S-12: Terraced levels of islands to accommodate varying lake levels** – This measure would incorporate varying levels of relief for islands or a littoral shelf, to incorporate greater variety of species which could be established through different lake stages.
- **S-13: Limestone Boulders** - This measure could be incorporated into islands, a littoral shelf, or a living shoreline for stability and also could provide additional attracters for fish.

Measures which can decrease cost in terms of location:

- **S-4: Use existing shallow exposed rock (higher elevation) outcropping in lake bed**[4] – This measure would take advantage of the higher elevation in portions of Route 2 to decrease the required volumes of material. It could be applied to the island measures.

Measures that are independent of the others and could be recommended for future projects or studies to add additional benefits to the project and community:

- **S-3: Move Route 2 Channel lakeward** – Conversations with the sponsor, and anecdotal stories from the community about boaters unable to use portions of Route 2 for recreational navigation due to shallow depths, led to the development of this measure. Relocating buoy markers to deeper water lakeward would allow more flexibility for future projects and would additionally allow Route 2 to potentially become more useable by the community. The existing shallow portions of Route 2 already serve as a sediment trap and could continue to provide that function. This is recommended as a potential future action to be investigated under a different authority.

- **S-5: Over-dredging Route 2 to create a silt trap** – Conversations with the sponsor, and anecdotal stories from the community about boaters unable to use portions of Route 2 for recreational navigation due to shallow depths, led to the development of this measure. This idea could work with S-3 or independently; it would recommend overdredging Route 2 during the next maintenance event to plan for it to act as a sediment trap and allow for longer durations between maintenance events to benefit both the environment, in terms of reducing excess silt on the lake bottom, and the community, for recreational use.

ENVIRONMENTAL BENEFITS OF MEASURES CARRIED FORWARD

The benefits of the measures are summarized in Figure 3-2. Low profile islands and littoral shelves, where low profile in this case would mean a land feature that would be submerged frequently, provide emergent vegetation on the outer banks and upland vegetation, generally in the centers. High profile islands and littoral shelves, which would be elevated and submerged less frequently, would provide a terraced level of both low and high elevation, across a broader range of water levels, and would provide a greater range of habitat.

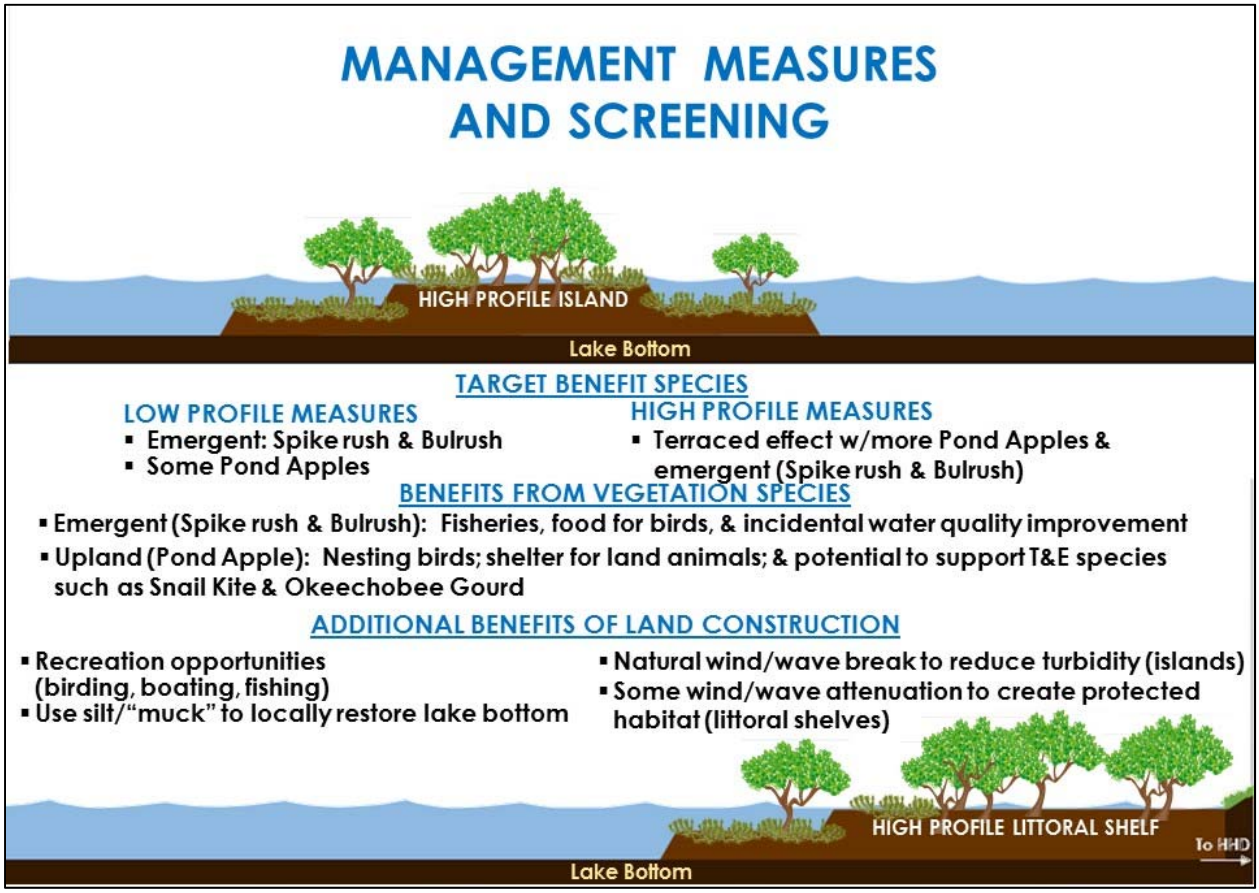
Emergent species such as spike rush and bulrush are important for fisheries, provide food sources for birds, and a filtering effect for incidental water quality benefits. Pond apples provide sturdy habitat for

[4] A natural shallow exposed limestone within the lakebed.

nesting birds and shelter from wind and waves for upland animals. The pond apple fruit also provides an important food source for a variety of wildlife, including birds and alligators. Although the rock armoring is an engineered feature incorporated into the project for structural stability and erosion protection, the reduction in wave energy and resuspended sediments in the area immediately adjacent to the landward side of the islands may be more attractive to fish. In addition, the rock could serve as potential nursery habitat for juvenile fish.

The creation of this area provides recreational opportunities for the communities. The incorporation of silt from the lake in the design removes silt from the lake bottom where it is dredged, taking some excess out of the system and using it beneficially as a nutrient source for vegetation. The creation of land in the lake, specifically for the island measures, creates a natural wind/wave break, reducing the negative effects of storms to aquatic life in the area between the island and the shoreline. Littoral shelves, particularly the outer edges, would provide some protection in wind/wave attenuation to shelter vegetation and habitat farther inland on them. Armoring such as locally obtained limestone rock, or revetment, further would add to the resiliency of these land creation measures.

Figure 3-2. How the primary measures carried forward meet the project objectives.



3.2 PLAN FORMULATION AND EVALUATION OF ALTERNATIVES

DATUMS PRESENTED IN THIS REPORT

There are two datums referenced in this report – North American Vertical Datum 1988 (NAVD88) and National Geodetic Vertical Datum 1929 (NGVD29). The reason is that most Lake Okeechobee water stage datums, historically through current, use NGVD29. However, more current projects generally use NAVD88 as a reference datum. Therefore, to offer a crosswalk to the reader, both datums are used. 1.3 feet can be added to NAVD88 to arrive at the equivalent datum in NGVD29.

3.2.1 ALTERNATIVES CONSIDERED – INITIAL ARRAY

USACE created an initial array using the five measures of high profile islands, low profile islands, living shoreline, high profile littoral shelf, and low profile littoral shelf as stand-alone alternatives and combinations of other measures (silt, terraces, limestone). The proposed elevations of the islands and littoral shelves were targeted at 11 and 13 feet NAVD88/12.3 and 14.3 feet NGVD29 to provide habitat of varying reliefs at a reasonable cost within the ranges of the 2008 Lake Okeechobee Regulation Schedule (LORS), which is held between 11.2 to 14.2 feet NAVD88/12.5 to 15.5 feet NGVD29. Other existing habitat at nearby Torry Island is at 12 feet NAVD88 and was used as a successful reference point.

- **NO ACTION:** The no-action alternative is always considered and carried forward as a requirement of NEPA and it forms the basis of comparison and evaluation of alternatives.
- **ALTERNATIVE 1: High profile Islands** - This type of island would be at a higher elevation (13 feet NAVD88/14.3 NGVD29) and, depending on the stages in Lake Okeechobee, could be more elevated from the water during certain times of the year. Variations in terraces, silt use, and limestone can be considered. The potential rock spine location can be considered for savings in volume requirements.
- **ALTERNATIVE 2: Living shoreline** - This measure would provide protection and restoration of habitat along the shoreline through natural and strategic placement of sand fill, stone, and plants. Variations in terraces, silt use, and limestone can be considered.
- **ALTERNATIVE 3: Low profile Islands** - This type of island would be at a lower elevation (11 feet NAVD88/12.3 NGVD29) and, depending on the stages in Lake Okeechobee, could be less elevated from the water during certain times of the year. Variations in terraces, silt use, and limestone can be considered. The potential rock spine location can be considered for savings in volume requirements.
- **ALTERNATIVE 4: High profile Littoral Shelf** - This type of littoral shelf would be at a higher elevation (13 feet NAVD88/14.3 NGVD29) and, depending on the stages in Lake Okeechobee, could be more elevated from the water during certain times of the year. Variations in terraces, silt use, and limestone can be considered.
- **ALTERNATIVE 5: Low profile Littoral Shelf** - This type of littoral shelf would be at a lower elevation (11 feet NAVD88/12.3 NGVD29) and, depending on the stages in Lake Okeechobee, could be less elevated from the water during certain times of the year. Variations in terraces, silt use, and limestone can be considered.

3.2.2 INTERMEDIATE ARRAY

Following the initial array, USACE created an intermediate array for a total of 24 variations, which included varying crest and toe elevations, as well as design types 1, 2, and 3, representing a stone toe, sand toe, and stone revetment respectively; shown in Table 3-1. This array was then expanded further into 587 variations, with different dimensions of widths (100 to 300 feet) and along-shore lengths (500 to 3,000 feet) for each group of alternatives. USACE also analyzed the living shoreline alternative.

Table 3-1. Simplified table showing the variables considered for each alternative.

Alternative	Design Type	Elevation (ft) (NAVD88)	Toe (ft)
Littoral Shelf, low profile	Type 1,2,3	11	6 or 8
Littoral Shelf, high profile	Type 1,2,3	13	6 or 8
Island, low profile	Type 1,2,3	11	6 or 8
Island, high profile	Type 1,2,3	13	6 or 8

Preliminary costs and acreages were calculated by USACE and then used for screening purposes. Criteria for stand-alone alternatives was set that costs must be under $12.5 million and that the most cost effective cost per acre for each category would be chosen, to be used as a proxy for habitat unit and cost effectiveness.[5] The criteria for combination alternatives was that costs must be under $6 million and that the most cost effective cost per acre for each category would be chosen. None of the living shoreline alternatives met the criteria and were therefore screened out.

3.2.3 FINAL ARRAY

The resulting final array of alternatives that met the criteria as described above is shown in Table 3-2 and additionally meets USACE planning criteria in terms of being complete, effective, efficient, and acceptable; each are also technically feasible, operationally flexible, and will provide environmental benefits. These evaluations are shown in Table 3-6 and discussed in Section 3.2.3.1.

In this phase, USACE refined the cost of each alternative. Cost assumptions at this stage included 2017 bathymetry surveys, revealing both the rock spine at a higher elevation, as well as a deep trench located off the shoreline. While the rock spine reduced required volumes needed for the island alternatives, the trench increased required volumes for the littoral shelf alternatives. The variable "x'" marks the location

[5] CAP 1135 projects are limited to $10M Federal and $3.3M non-Federal. Using a cost limit as a screening tool would help ensure that in addition to meeting other criteria, only cost-effective alternatives that could feasibly be appropriated within their programs would be carried forward. On the same note, combinations of alternatives were limited to $6M each, assuming that two combined would be estimated roughly at $12M.

of the silt and sand fill, where upland vegetation such as pond apples would grow, while the actual "x" is a larger dimension for stability purposes, where emergent vegetation could grow on versions of the alternatives with a perimeter sand berm, but not stone or rock revetment. "Y" is the length of the island. All alternatives assumed that material would be a mix of dredged silt from lake and upland sand from a nearby FDEP permitted mine. Costs also assume planting of both upland (pond apples) and emergent species (bulrush, spike rush).

At this point, USACE discussed risks and tradeoffs with the non-Federal sponsor. Alternative 3, in particular, was the only alternative that has a perimeter sand berm as erosion protection. The non-Federal sponsor and team developed Alternative 3a as a suitable variation of Alternative 3 in terms of reduction of long–term potential maintenance for the non-Federal sponsor, due to the high energy wave environment.

Table 3-2. Final Array of Alternatives (FY18 price level).

ALT	FINAL ARRAY	TYPE	EL (NAVD88)[6]	X' (FT)	X (FT)	Y' (FT)	COST
1	Low profile island	Stone	11	300	500	3000	$16,100,000
2	Low profile shelf	Rock Revetment	11	300	400	3000	$15,525,000
3	High profile island	Sand toe	13	200	800	1500	$11,940,000
3a	High profile island	Rock Revetment	13	200	600	1500	$11,030,000
4	High profile shelf	Rock Revetment	13	100	300	3000	$13,245,000
5	Low profile island + high profile island	Rock Revetment & Stone	11, 13	300, 100	500, 500	1500, 1000	$11,255,000
6	Low profile island + low profile shelf	Rock Revetment	11, 11	300, 300	500, 400	1500, 1500	$22,885,000

A habitat suitability index was assigned to each of the main categories of vegetation established for each alternative (emerged vegetation (EV) and upland), which was then applied to acreage to determine habitat benefits for each alternative. USACE conducted a Cost Effective Incremental Cost Analysis (CE/ICA)

[6] Add 1.3 feet to convert to NGVD29

to determine the alternative with the highest net benefits to be identified as the National Ecosystem Restoration (NER) plan.

3.2.3.1 HABITAT BENEFITS ANALYSIS

To facilitate the selection of a preferred alternative, and to ensure that the Federal government is investing funds in the most cost effective plans, USACE requires that the benefits be quantified so that relative levels of habitat benefit (output) can be compared to the costs. Although approval of planning models under EC 1105-2-412 is not required for CAP projects (Civil Works Policy Memorandum #1 [January 19, 2011]), the principles to ensure quality continue to be necessary. Models and analysis must be compliant with USACE policy, theoretically sound, computationally accurate, and transparent. The variables developed for this model are based upon data in the literature of species habitat requirements and preferences and are inherently based on best professional judgment.

The Pahokee Restoration 1135 CAP project planning model was specifically developed to evaluate project alternative benefits within the project area. The primary areas to be evaluated in the project area include newly created eco-islands within Lake Okeechobee, as well as the immediately surrounding environment, which includes aquatic and terrestrial habitat, plants, fish, and wildlife. The planning model was developed by the Jacksonville District with input from U.S. Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission (FWC), the non-Federal sponsor (Palm Beach County), and Restoration, Coordination, and Verification (RECOVER), a multi-agency team tasked with applying scientific and technical information to support the goals and purposes of the Comprehensive Everglades Restoration Plan (CERP). RECOVER is comprised of USACE, SFWMD, National Park Service, USFWS, U.S. Environmental Protection Agency (USEPA), U.S. Geological Survey, NOAA (National Oceanic and Atmospheric Administration), FDEP, Florida Department of Agriculture and Consumer Services, FWC , Seminole Tribe of Florida, and the Miccosukee Tribe of Indians of Florida. Members of the project delivery team include scientists and engineers with experience working in South Florida environmental systems, ecology, hydrology, engineering, and planning. The planning model is explained in detail in **APPENDIX D-1 (Habitat Unit Analysis)** and has been reviewed by subject matter experts on Lake Okeechobee flora and fauna.

Habitat unit scores were produced by multiplying the HSI scores by the total acreage of suitable habitat created (see **Table 3-3**):

Table 3-3. Calculated habitat units for project alternatives.

Alternative	Total HU	Total Acreage	Emergent Vegetation			Pond Apples		
			HSI	Acreage	HU	HSI	Acreage	HU
1	15.84	34.44	0.4	13.77	5.51	0.5	20.66	10.33
2	15.84	27.55	0.5	6.89	3.44	0.6	20.66	12.40
3	20.66	27.55	0.7	20.66	14.46	0.9	6.89	6.20
3a	15.84	20.66	0.7	13.77	9.64	0.9	6.89	6.20
4	14.32	16.85	0.7	8.43	5.90	1	8.43	8.43
5	18.48	28.70	0.6	16.07	9.64	0.7	12.63	8.84
6	17.56	30.99	0.5	10.33	5.17	0.6	20.66	12.40

The habitat unit values are used in the cost effectiveness and incremental cost analysis, which is described in the following section.

3.2.3.2 COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS (CE/ICA) FOR THE FINAL ARRAY OF ALTERNATIVES

The final evaluation of measures and alternative plans includes a CE/ICA consistent with USACE guidance. The CE/ICA is an evaluation tool which considers and identifies the relationship between changes in cost and changes in quantified, but not monetized, habitat benefits. The evaluation is used to identify the most cost-effective alternative plans to reach various levels of restoration output and to provide information on whether different (increasing) levels of restoration are worth the added cost. The CE/ICA is a planning tool to help identify cost effective (CE) plans which provide a certain level habitat output at the least cost. The results provide an array of alternatives which undergo a tradeoff analysis and are evaluated based on a plan's acceptability, completeness, effectiveness, and efficiency.

As **Table 3-4** demonstrates, in ascending order of cost, Alternatives 3, 3a, and 5 were the only cost effective plans. The results of the CE/ICA are demonstrated in **Table 3-5**. All annualized costs are based on the Fiscal Year (FY) 18 discount rate of 2.75% and a period of analysis of 50 years. An incremental analysis was necessary to demonstrate the increased cost per unit of output in going from the no action plan to each of the cost-effective alternatives. As shown in **Table 3-5** and **Figure 3-3**, Alternative 5 is the best-buy plan with the lowest incremental cost per increased unit of output. Thus, based on the CE/ICA, as well as the planning criteria, Alternative 5 is the NER which is cost effective and meets project objectives, as well as displays benefits under each of the four P&G accounts, and meets the P&G screening criteria of being complete, effective, efficient, and acceptable, as discussed in the following section.

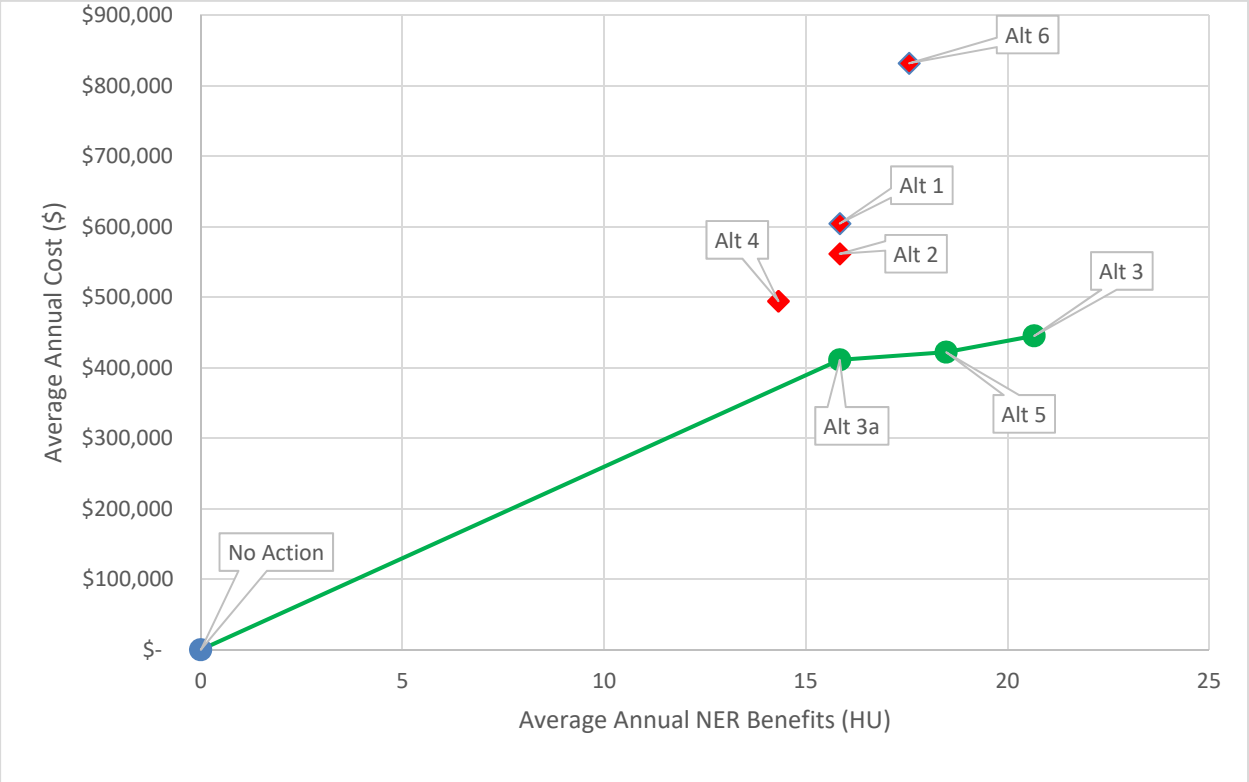
Table 3-4. Cost effective analysis for the final array of alternatives.

Alternative	Preliminary Cost (FY18)	Average Annual Cost (n=50, i=2.75%)	Average Annual NER Benefits	Cost Effective
No Action Plan	**$ -**	**$ -**	**N/A**	**N/A**
Alternative 3a - High-Profile Island	**$ 11,030,000**	**$ 411,346**	**15.84**	**YES**
Alternative 5 - Low-Profile Island + High-Profile Island	**$ 11,255,000**	**$ 422,124**	**18.48**	**YES**
Alternative 3 - High Profile Island	**$ 11,940,000**	**$ 445,283**	**20.66**	**YES**
Alternative 4 - High Profile Littoral Shelf	$ 13,250,000	$ 494,698	14.32	NO
Alternative 2 - Low-Profile Littoral Shelf	$ 14,965,000	$ 561,908	15.84	NO
Alternative 1 - Low-Profile Island	$ 16,160,000	$ 604,715	15.84	NO
Alternative 6 - Low-Profile Island + Low-Profile Littoral Shelf	$ 22,060,000	$ 832,086	17.56	NO

Table 3-5. Incremental Cost Analysis for final array of alternatives.

Alternative	Preliminary Cost (FY18)	Average Annual Cost (n=50, i=2.75%)	Average Annual NER Benefits	Average Cost/HU	Incremental Cost	Incremental Output	Incremental Cost/Unit Output
No Action Plan	**$ -**	**$ -**		**$ -**	**$ -**	**0**	**$ -**
Alternative 3a - High-Profile Island	**$ 11,030,000**	**$ 411,346**	**15.84**	**$ 25,969**	**$ 411,346**	**15.84**	**$ 25,969**
Alternative 5 - Low-Profile Island + High-Profile Island	**$ 11,255,000**	**$ 422,124**	**18.48**	**$ 22,842**	**$ 10,779**	**2.64**	**$ 4,083**
Alternative 3 - High Profile Island	**$ 11,940,000**	**$ 445,283**	**20.66**	**$ 21,553**	**$ 23,158**	**2.18**	**$ 10,623**

Figure 3-3. Graph showing cost effectiveness across the final array.



3.2.3.3 ISSUES AND BASIS FOR CHOICE

Table 3-6 lists factors considered in the plan formulation process and summarizes the major features and consequences of the no-action alternative (future without-project) as compared to other plans in the final array of alternatives. **Table 3-7** lists the environmental factors, benefits, and consequences of the no-action plan and the final array of alternatives in comparison to each other. The best performing plan is identified for each environmental factor.

ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION & ALTERNATIVES CARRIED FORWARD FOR DETAILED EVALUATION

The no-action alternative, as well as Alternatives 1, 2, 3, 3a, 4, and 6 were screened out from further analysis due to not fully meeting all of the evaluation criteria of objectives, constraints, P&G four accounts, and P&G screening criteria, as shown in Table 3-6. While most of the alternatives have similar outputs in each category under evaluation, Alternative 5 most fully meets the criteria in its entirety and is identified as the NER plan. In terms of effects under NEPA, effects are similar for all alternatives, except for minor differences in magnitude of effect; therefore, Alternative 5 is carried forward for detailed analysis throughout the remainder of the report and is, additionally, carried forward as the Recommended Plan.

Table 3-6. Summary of Plan Formulation Evaluation for the Final Array.

1. Alternatives	No Action (Future Without-Project)	Alt 1 - Low Profile Islands	Alt 2 -Low Profile Shelf	Alt 3 - High Profile Island (sand berm)	Alt 3a - High Profile Island (revetment)	Alt 4 -High Profile Shelf	Alt 5 - Low Profile Island + High Profile Island	Alt 6 - Low Profile Island + Low Profile Shelf
2. Impact Assessment (4 P&G Accounts)								
A. National Ecosystem Restoration (NER)	O - There is currently not an existing habitat in this area.	O - This plan was not cost effective in the final array.	O - This plan was not cost effective in the final array.	P - This plan was cost effective in the final array.	P - This plan was cost effective in the final array.	O - This plan was not cost effective in the final array.	F - This plan was the the most effective in the final array.	O - This plan was not cost effective in the final array.
B. Environmental Quality (EQ)	O - There is currently not any EV or upland species in this area and would not be established in the future.	F- EV and some upland could attract a variety of species.	F- EV and some upland could attract a variety of species.	F- EV and upland could attract a variety of species.	F- EV and upland could attract a variety of species.	F- EV and upland could attract a variety of species.	F- EV and upland, especially with two different reliefs, could attract a variety of species.	F- EV and some upland could attract a variety of species.
C. Regional Economic Development (RED)	P - There is currently some tourism assoicated with the Pahokee Marina for fishing, boating, and hiking on the LOST trail; however, it is minimal in this area and would not increase in the future.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.	P - Some project related tourism, recreation, ecotourism could stimulate local economy. Two islands adds more potential economic opportunities.	P - Some project related tourism, recreation, ecotourism could stimulate local economy.
D. Other Social Effects (OSE)	O - This area has little to no aesthetic qualities and 26.3% percent of the individuals in Pahokee are considered below the poverty level. These characterizations could continue in the future.	P - An island could be a recreational spot for the community, for fishing, boating, birding, etc.	P - Additional habitat creation could be a recreational spot for the community, for fishing, birding, etc.	P - An island could be a recreational spot for the community, for fishing, boating, birding, etc.	P - An island could be a recreational spot for the community, for fishing, boating, birding, etc.	P - Additional habitat creation could be a recreational spot for the community, for fishing, birding, etc.	F - Two islands could be a recreational spot for the community, for fishing, boating, birding, etc.	P - Additional habitat creation could be a recreational spot for the community, for fishing, boating birding, etc.
3. Plan Evaluation								
A. Contribution to Planning Objectives								
(1) Reduce effects of wind/waves during tropical storms and storm events	O - There is currently not a land/barrier to act as a wind/wave break and would likely not be one in the future.	F- An island would act as a wind & wave break, to protect the area behind it, in terms on silt and sediment turbidity, and a protected habitat on the shoreward side of the island and to some degree in the water.	F - This would create a natural barrier to wind and erosion along the shoreline.	F- An island would act as a wind & wave break, to protect the area behind it, in terms on silt and sediment turbidity, and a protected habitat on the shoreward side of the island and to some degree in the water.	F- An island would act as a wind & wave break, to protect the area behind it, in terms on silt and sediment turbidity, and a protected habitat on the shoreward side of the island and to some degree in the water.	F - This would create a natural barrier to wind and erosion along the shoreline.	F- An island would act as a wind & wave break, to protect the area behind it, in terms on silt and sediment turbidity, and a protected habitat on the shoreward side of the island and to some degree in the water. The low profile island in front of the high profile adds additional wave break benefits.	F - This would create a natural barrier to wind and erosion along the shoreline. The low profile island would also create more favorable conditions in the waters behind it.
(2) Create an area suitable for vegetation, with associated habitat, of at least 1 acre	O - There is currently not any vegetation in the area and likely there would be no improvements in the future.	F- EV and some upland growth could occur.	F - EV and some upland growth could occur	F- EV and upland growth could occur.	F- EV and upland growth could occur.	F - EV and upland growth could occur	F- EV and upland growth could occur at a variety of reliefs.	F - EV and some upland growth could occur
(3) Create habitat for fisheries and birds within 5 years	O - There are minimal birds and fishing in this area and would likely be on increase in use in the future.	F- Could attract variety of species, and islands would addprovide additional protection to some avian species.	P - Land would encourage EV and upland. Fish would be attracted to EV, which would then attract and support birds.	F- Could attract variety of species, and islands would addprovide additional protection to some avian species.	F- Could attract variety of species, and islands would addprovide additional protection to some avian species.	O - Land would encourage EV and upland. Fish would be attracted to EV, which would then attract and support birds.	F- Could attract variety of species, and islands would addprovide additional protection to some avian species.	P - Land would encourage EV and up land. Fish would be attracted to EV, which would then attract and support birds.
(4) Maintain or improve ecotourism	P - There is currently some tourism assoicated with the Pahokee Marina for fishing, boating, and hiking on the LOST trail; however, it is minimal in this area and would not increase in the future.	F - Potential to increase ecotourism, depending on what is done.	P - Potential for increased ecotourism or better quality of ecotourism, possibly not as fully as islands would.	F - Potential to increase ecotourism, depending on what is done.	F- Potential to increase ecotourism, depending on what is done.	P - Potential for increased ecotourism or better quality of ecotourism, possibly not as fully as islands would.	F - Potential to increase ecotourism, depending on what is done.	P - Potential for increased ecotourism or better quality of ecotourism, possibly not as fully as islands would.
(5) Improve natural lake bottom conditions in the project or adjacent area within 5 yrs	O - Lake bottom would continue to experience high siltation.	P - Meets for local improvements and potential temporary effects.	P - Meets for local improvements and potential temporary effect.	P - Meets for local improvements and potential temporary effect.	P - Meets for local improvements and potential temporary effects.	P - Meets for local improvements and potential temporary effects.	P - Meets for local improvements and potential temporary effect.	P - Meets for local improvements and potential temporary effect.
B. Response to Planning Constraints								
(1) Avoid conflict with state and Federal regulations, as stated in Federal law, USACE regulations and Executive Orders.	F- Fully meets	F- Fully meets	F- Fully meets	F- Fully meets	F- Fully meets	F- Fully meets	F- Fully meets	F- Fully meets
C. Response to Evaluation Criteria								
(1) Completeness	O - This is not complete.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.	F - This plan is complete and would achieve benefits.
(2) Effectiveness	O - This is not effective; non of the project objectives would be met.	P - This plan acheives benefits, but is not the most cost-effective plan.	P - This plan acheives benefits, but is not the most cost-effective plan.	P - This plan acheives benefits, but is not the most cost-effective plan.	P - This plan acheives benefits, but is not the most cost-effective plan.	P - This plan acheives benefits, but is not the most cost-effective plan.	F - This plan acheives benefits,and is the most cost-effective plan.	P - This plan acheives benefits, but is not the most cost-effective plan.
(3) Efficiency	O - This is not efficient; no cost would be imposed but no improvements would be gained.	P - This plan is is partially effiecient at meeting project objectives.	P - This plan is is partially effiecient at meeting project objectives.	P - This plan is is partially effiecient at meeting project objectives.	P - This plan is is partially effiecient at meeting project objectives.	P - This plan is is partially effiecient at meeting project objectives.	F - This plan more fully meets project objectives compared to the other plans.	P - This plan is is partially effiecient at meeting project objectives.
(4) Acceptability	O - This would not be acceptable to the community.	F - This plan would likely be acceptable to the community.	P- This plan would likely be acceptable to the community.	F - This plan would likely be very acceptable to the community (perhaps more so than simply low profile island).	F - This plan would likely be very acceptable to the community (perhaps more so than simply low profile island).	P- This plan would likely be acceptable to the community.	F - This plan would likely be very acceptable to the community, especially with two islands.	P- This plan would likely be acceptable to the community.
O = Does not meet; P = Partially meets; F = Fully meets								

Table 3-7. Summary of the environmental evaluation of the final array of alternatives and the no-action plan.

Environmental Assessment	No-action Alt	Alt 1	Alt 2	Alt 3	Alt 3a	Alt 4	Alt 5	Alt 6
General Environmental Effects (Refer to sections 2.1 and 5.1)	No significant change is expected to occur.	None of the alternatives are likely to result in a significant change to the project area's general setting; however, construction of any of the alternatives will provide the existing shoreline with protection from winds, waves, and storm events. Based on this single metric, Alts 1 through 6 perform equally.						
Physical Environment (Hydrology, sediments, sea level change, climate) (Refer to sections 2.2 and 5.2)	Hydrologic conditions may be influenced by changes to LORS and/or other projects in the region. Silty sediments would continue to accumulate and inhibit vegetation growth.	None of the alternatives would result in a significant change to the project area's hydrology, sea level rise/change, or climate. All of the alternatives will result in minor improvements to the project area's sediments. Creation of the shelf and island alternatives include construction on some portion of the lakebed and dredging of silty sediments from within the lake near the project vicinity. The material removed from the lake will be mixed with clean sand and used as fill for the interior portion of the island or shelf. Removal of silty sediments from the lakebed and construction of islands or shelves on the existing silty sediments will reduce the amount of silty sediments that would re-enter the water column during periods of high wind and/or wave energy. All alternatives would assist to trap sediments from the water column and reduce negative effects associated with wind and wave erosion. Based on this single metric, Alts 1 through 6 perform equally.						
Built Environment (Residential and commercial structures) (Refer to sections 2.3 and 5.3)	Built features and structures would likely continue to function as intended.	None of the alternatives would result in a significant change to the project area's built environment. There would be no change to current efforts to the rehabilitated HHD, Lake Okeechobee water levels, nor the schedule that governs water supply and flood risk management discharges. Based on this single metric, Alts 1 through 6 perform equally.						
Vegetation (Refer to sections 2.4.1 and 5.4.1)	Ongoing accumulation of silty sediments in the lake bed and damages to the shoreline from wind and wave energy during storm events would continue to reduce the limited habitat available for vegetation growth.	All of the alternatives include the creation of habitat viable for the planting of cornerstone species (i.e., pond apples and emergent vegetation). Alts 1, 2, 6, and one component of Alt 5 are low profile islands or shelves. Vegetation planted at the 11' elevation (NVGD88) would be more often inundated and perimeter vegetation would be most susceptible to taking the brunt of wind and wave energy. Alts 3, 3a, 4, and 5 include a low and high profile shelf or island. The high profile terrace would be less often inundated and better protected from wave energy due to the lower terrace absorbing the brunt of the effects. Shelf alternatives (Alts 2, 4, and one component of Alt 6) would tie into the existing shoreline, which would allow for the migration and expansion of planted vegetation. Island alternatives (Alts 1, 3, 3a, 5, and one component of Alt 6) would not have this benefit. Alt 6, which consists of both a low profile shelf and island, would provide greater wetland plant species diversity due to various inundation regimes and individual species requirements. Based on this single metric, Alt 5 provides vegetation with the best elevation diversity but limits the acreage and ability to migrate. Alt 6 provides the best opportunity for vegetation growth but is also at risk of higher inundation periods and wind and wave energy.						
Fish and Wildlife Resources (Other than Endangered Species) (Benthos, Fisheries, Migratory Birds, Other Wildlife) (Refer to sections 2.4.2 and 5.4.2)	Ongoing accumulation of silty sediments in the lake bed and damages to the shoreline from wind and wave energy during storm events would continue to reduce the available habitat used by fish and wildlife.	High profile alternatives (Alts 3, 3a, and 4) include upper terraces that would provide better habitat for birds, mammals, and some reptiles due to less inundation; however, the upper terrace may be more difficult for other species to access. Low profile alternatives (Alts 1, 2, and 6) would more often be inundated and susceptible to wind and wave energy but fairly easy for a variety of species to access (e.g. turtles, alligators). Island alternatives (Alts 1, 3, 3a, and 5), would have more opportunity for species to access the project due to the natural perimeter. In addition, the island alternatives act as a breakwater. The reduced wind and wave activity would result in less resuspension of sediment and therefore improved water quality which could attract more fish to the project area. Islands are also ideal habitat for birds due to lower predation opportunities. Shelf alternatives (Alts 2, 4, and one component of Alt 6) have the added benefit of being linked to shoreline, which allows easy access to the project for animals using shoreline habitat. Based on this single metric, Alt 6 is the best plan as it provides the widest variety of habitat and improved water quality for fish and wildlife in the project area.						

Threatened, Endangered, and Protected Species (Everglade snail kite, Florida bonneted bat, Audubon's crested caracara, wood stork, Okeechobee gourd, Eastern indigo snake, Florida panther, West Indian (Florida) manatee) (Refer to sections 2.4.3 and 5.4.3)	Ongoing accumulation of silty sediments in the lake bed and damages to the shoreline from wind and wave energy during storm events would continue to reduce the available habitat used by threatened, endangered, and protected species.	All of the alternatives may create habitat that could benefit the Everglade snail kite, wood stork, and the Okeechobee gourd. High profile alternatives (Alts 3, 3a, and 4) include upper terraces that would provide better nesting habitat for birds due to less inundation. In addition, if the Okeechobee gourd populates the project site, it would be better protected from wind and wave effects under Alts 3, 3a, and 4. Low profile alternatives (Alts 1, 2, and 6) would also provide habitat for these species, however, the project would be more frequently inundated and susceptible to wind and wave energy. Island alternatives (Alts 1, 3, 3a, and 5) act as a breakwater. The reduced wind and wave activity would result in less resuspension of sediment and therefore, improved water quality which could attract more fish to the project area, increasing the amount of foraging opportunities for birds. Islands are also ideal habitat for nesting and foraging due to lower predation opportunities. Shelf alternatives (Alts 2, 4, and one component of Alt 6) are linked to shoreline, which may allow for the easier migration and population of the Okeechobee gourd into the project area. Based on this single metric, Alt 5 is the best plan for threatened, endangered, and protected species as it provides improved habitat for nesting and foraging opportunities.
Air Quality (Refer to sections 2.4.4 and 5.4.4)	Air quality conditions would likely remain the same.	None of the alternatives would result in a significant change to the project area's air quality. Implementation of any alternative would have short term, temporary effects due to construction equipment. However, after completion of construction, air quality would return to ambient conditions. Based on this single metric, Alts 1 through 6 perform equally.
Water Quality (Refer to sections 2.4.5 and 5.4.5)	Water quality conditions would likely continue to degrade. Silty sediments would continue to accumulate and become resuspended in the water column during periods of high wave and/or wind energy.	All alternatives include the dredging of silty sediments from within the lake near the project vicinity. The material removed from the lake will be mixed with clean sand and used as fill for the interior portion of the island or shelf. The island alternatives (Alts 1, 3, 3a, 5, and one component of 6) have an additional benefit as they would act as a breakwater and reduce the wind and wave energy behind the island. The reduction of wind and wave energy would result in less resuspension of sediment and therefore improved water quality. Based on this single metric, Alt 5 is the best plan since there are two islands being constructed.
Noise (Refer to sections 2.4.6 and 5.4.6)	No significant change is expected to occur.	All of the alternatives would result in minor, short-term, and local increases in noise production during the construction phase of the project due to the use of heavy machinery. All noise impacts would cease with completion of construction. Based on this single metric, Alts 1 through 6 perform equally.
Cultural Resources (Refer to sections 2.4.7 and 5.4.7)	No significant change is expected to occur.	Following identification of the area of potential affect, a submerged remote sensing survey of the potential project area(s) will be completed during the Design and Implementation (D&I) phase of the project. Consultation is ongoing with the Florida SHPO and will be concluded prior to project implementation. Based on this single metric, Alts 1 through 6 perform equally.
Native Americans (Refer to sections 2.4.8 and 5.4.8)	No significant change is expected to occur.	No portion of the alternatives affect Native American-owned lands, reservation lands, or Traditional Cultural Properties; however, Native American groups have lived throughout the region in the past and their descendants continue to live within the State of Florida and throughout the United States. Consultation is ongoing with Native American tribes having ancestral ties to this region and will be completed prior to project implementation. Based on this single metric, Alts 1 through 6 perform equally.
Aesthetic Resources (Refer to sections 2.4.9 and 5.4.9)	No significant change is expected to occur.	All of the alternatives would result in an improved shoreline viewshed. Alts 1, 3, 3a, and 5 would be improved with in-lake vegetated islands whereas Alts 2 and 4 would improve the viewshed by constructing a littoral shelf over the existing shoreline. Alt 6 incorporates both an in-lake island and littoral shelf. Based on this single metric, Alt 6 is the best plan as it provides the best aesthetic value in the project area by improving the existing viewshed with a vegetated island and the shelf component would restore the shoreline.
HTRW (Refer to sections 2.4.10 and 5.4.10)	No significant change is expected to occur.	None of the alternatives would result in a change to the project area's existing HTRW conditions. Based on this single metric, Alts 1 through 6 perform equally.
Socio-economic Environment (Local economy and demographics, land use, recreation) (Refer to sections 2.5 and 5.5)	No significant change is expected to occur.	None of the alternatives would result in a significant change to the project area's socio-economic environment. Recreation benefits are incidental to the project, but implementation of any of the alternatives will likely increase the recreation quality, which could result in a modest growth in the area's ecotourism. Based on this single metric, Alts 1 through 6 perform equally.

4 The Recommended Plan

4 THE RECOMMENDED PLAN

Please refer to the Graphic Executive Summary at the beginning of this report and informational foldout REF-2 (located at the end of this report).

4.1 BENEFITS OF THE RECOMMENDED PLAN

This project meets not only all of the project objectives, but also provides positive effects under the four accounts as outlined in the USACE Principles & Guidelines (P&G). First, under National Ecosystem Restoration (NER), the plan is a cost effective means to meet all objectives. It results in a cost-effective means to meet all objectives, provides the best buy of all the alternatives at an average incremental cost of $4,100 (using average annual screening level costs) and provides net average benefits of 18.48 habitat units.

Under Environmental Quality (EQ), this plan provides diversity of emergent and upland species (pond apples, bulrush, and spike rush), is able to withstand varying water stages, and provides 28.70 actual created acres. This area would serve as habitat and attracters for birds and other land and aquatic animals, such as otters, alligators, and fish. Under Other Social Effects (OSE), this plan would provide increased aesthetic value and recreational opportunities to the community. Under Regional Economic Development (RED), there could be opportunities for improved ecotourism and regional commercial fishing.

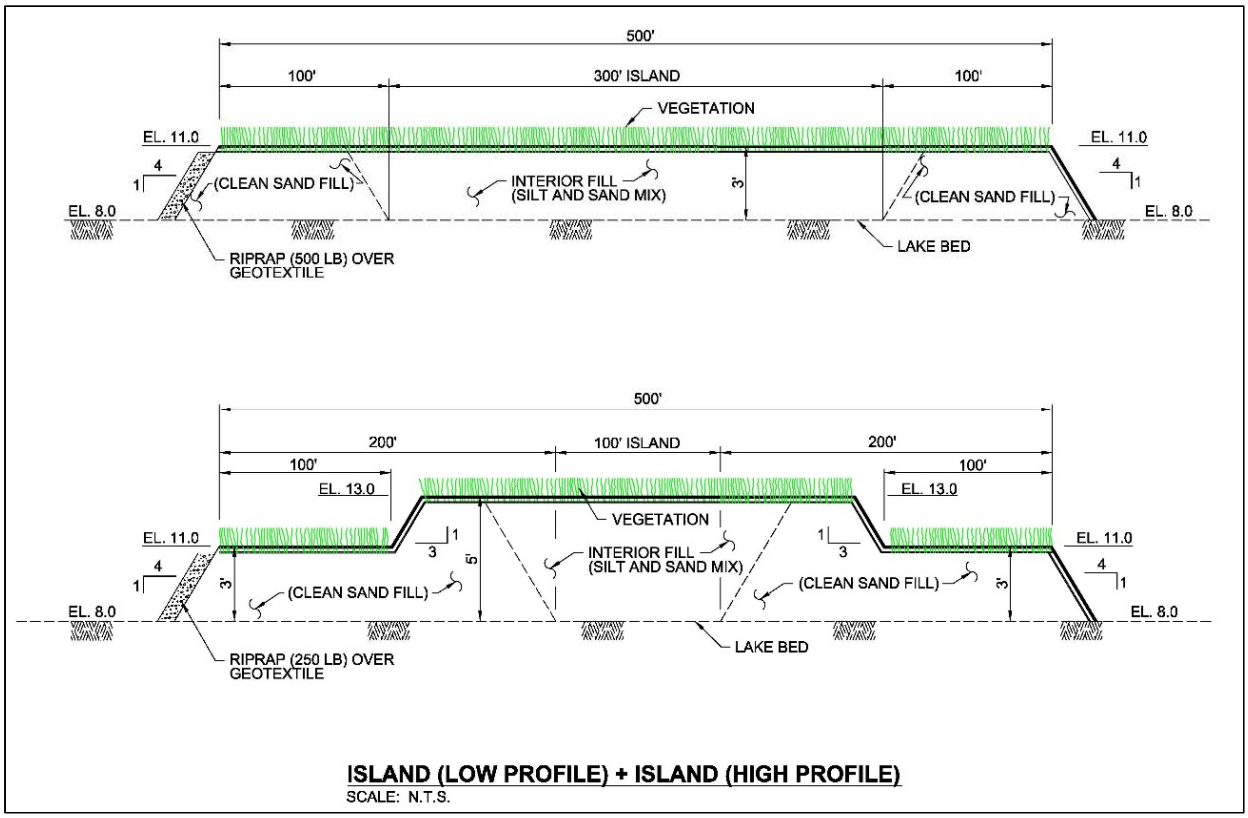
This project provides direct benefits in terms of vegetation and habitat for birds and aquatic species, reduction in wave/wind energy in the immediate area where the islands are constructed, reducing the amount of silt in the lake system, and improving recreation. It also provides other benefits such as reduction of wind and wave energy in the lakebed between the island and the shoreline, which could create conditions favorable for other aquatic life; incidental localized water quality improvement due to the plants using nutrients in the water, as well as taking silt out of the system to reduce turbidity, and the potential to restore sandy lakeshore bed in some areas through dredging of excess silt on the lake bed. This plan also has potential to provide habitat to threatened and endangered avian species, such as the Snail Kite and Wood Stork. The upland pond apples trees also have the potential to host the threatened Lake Okeechobee Gourd. Although the rock armoring is an engineered feature incorporated into the project for structural stability and erosion protection, the reduction in wave energy and resuspended sediments in the area immediately adjacent to the landward side of the islands may be attractive to fish. In addition, the rock could serve as potential nursery habitat for juvenile fish.

4.2 GENERAL DESCRIPTION

The Recommended Plan is Alternative 5, which will include construction of two islands - a low profile island constructed at an elevation of 11.0-ft NAVD88/12.3-ft NGVD29, and a high profile island with a lower elevation of 11.0-ft NAVD88/12.3-ft NGVD29 with a higher terraced elevation of 13-ft NAVD88/14.3-ft NGVD29. Both islands would be constructed of a mix of sand and finer silt sediment in

the center, surrounded by a sand berm for stability. The lakeward slope of each would be armored with riprap for additional protection against erosion. The cross section of both islands is shown in **Figure** 4-1, and the conceptual position of the islands relative to one another within the lake is shown in **REF-2** (located at the end of this report), which is subject to change. It should be noted that the designs in this report are at a conceptual feasibility level of design. Further refinements to the design and optimized methods of construction would take place during the Design and Implementation (D&I) phase.

Figure 4-1. West-East Cross Section of Alternative 5 – Low and High Profile Island - the Recommended Plan.



4.3 DESIGN AND CONSTRUCTION CONSIDERATIONS

4.3.1 ENGINEERING ANALYSIS

APPENDIX A (Engineering) provides the full detail of the analysis, but is summarized in this section. The site fill volumes were determined by estimating quantities based on Lake Okeechobee lake bed elevation, using 2017 bathymetry surveys and island dimensions. It is estimated that the following quantities of each material will be used: 122,000 cubic yards of sand, 31,000 cubic yards of silt, and 5,000 cubic yards of rock.

Coastal design and geotechnical analyses determined the optimal side slopes for the design of the islands. Side slopes of 1V on 3H above the water provide the most optimal slopes for wave energy dissipation and the most stable side slopes below the water is 1V on 4H.

4.3.2 PLAN IMPLEMENTATION REQUIREMENTS

The following data will be collected and methodologies analyzed during the Design and Implementation (D&I) Phase:

- Value Engineering (VE) study;
- Design level hydrographic data;
- Sediment probes to characterize the silt, including thickness and settle-ability;
- Construction access in shallow waters; and
- Sand placement technique to minimize silt displacement.

The team and non-Federal sponsor will conduct a Value Engineering (VE) Study at the beginning of the D&I Phase (see Value Management Plan in **APPENDIX A (Engineering), Attachment 3**). During the VE study, the team will analyze and determine the most optimized design aspects, such as island position and placement relative to each other; as well as the most efficient methods of dredging and construction in the wet. Current uncertainties related to unknown silt settling rates, unknown location and quantity of silt, and barge access to the construction site were taken into account in the cost risk register.

Plans and specifications during D&I will include requirements for plant species, maturity size, and depth of planting for success of vegetation establishment.

1. Current assumptions to date include: Construction sequencing of the islands in order to minimize displacement of the fill material.
2. Storage of stone and sand in a public park or parking lot may require temporary closure of these facilities for safety.
3. Runoff and erosion control measures during construction will minimize erosion of the slopes of the newly constructed components, as well as the fill material in the storage area.

Current constraints to date include: Material will not be excavated between the shore and the Route 2 navigation channel for dam safety reasons.

NON-FEDERAL RESPONSIBILITIES

Palm Beach County, Florida is the non-Federal sponsor for the project and proposes to provide an up-front cash and in-kind contributions for the construction costs of the proposed project. The non-Federal sponsor shall provide lands, easements, and rights-of-way, and a portion of the administrative costs associated with land requirements, as well as assume responsibility for all costs related to operation, maintenance, repair, rehabilitation, and replacement of project features.

FEDERAL RESPONSIBILITIES

USACE is responsible for budgeting for the Federal share of future Federal construction projects. Federal funding is subject to the budgetary constraints inherent in the formation of the national civil works budget in a given fiscal year. USACE would perform the necessary design needed prior to construction. USACE would obtain water quality certification, coordinate with the state as required by the Coastal Zone

Management Act, and construct the project. Cost sharing of D&I is subject to the availability of appropriations.

IN-KIND CONTRIBUTIONS

The non-Federal Sponsor plans to provide in-kind contributions, subject to the appropriate review and approval of such contributions.

PROJECT PARTNERSHIP AGREEMENT

USACE does not anticipate deviating from the Model Agreement for Section 1135 - Continuing Authorities Program Project Modifications for Improvement of the Environment, dated June 21, 2017.

SPONSOR'S VIEWS

The non-Federal sponsor fully supports the Recommended Plan.

REAL ESTATE REQUIREMENTS

APPENDIX C (Real Estate) contains more details of real estate requirements for the Recommended Plan. USACE identified a construction staging area north of Pahokee Marina, located on the shore of Lake Okeechobee. The Okeechobee Waterway perpetual easement tracts obtained for Herbert Hoover Dike will cover the temporary work area easement needed for construction of the Recommended Plan. Access to the staging area will not require exclusive use of the identified access route. USACE has not identified any relocations, alterations, vacations or abandonments of utilities, structures, facilities, cemeteries, or towns within the proposed construction limits of the Recommended Plan. The project will occur on submerged lands of the State of Florida.

PERMITS

This project will be performed in compliance with the State of Florida's water quality standards. An application for a water quality certification will be submitted to the FDEP. The "General Permit to U.S. Army Corps of Engineers for Environmental Restoration or Enhancement Activities" (Fla. Admin. Code r. 62- 330.630) applies to this project. In compliance with the Coastal Zone Management Act (CZMA) (16 U.S.C. §1451 *et. seq*.), **APPENDIX E (Pertinent Correspondence)** includes a Federal Consistency Determination (FCD), which received preliminary approval by the State of Florida on April 2, 2018. USACE will obtain all permits and approvals prior to the start of construction.

4.4 DETAILED COST ESTIMATE AND COST APPORTIONMENT

The following construction equipment and techniques were assumed when calculating cost estimates:

- Sand will be excavated from an upland mine and transported to the Pahokee Marina staging area via truck.
- A scow barge with 3,000 CY capacity will be used to transport material from shore to site.
- Two hydraulic excavators and two clamshells will be used for offloading the sand from the barge.
- A dozer and a grader will be used for grading.
- One 14" cutter section pipeline dredge will be used to dredge and place silt.

Pahokee CAP Section 1135		
Summary of Project Cost (FY18 Price Levels)		
WBS Code	**Item**	***Project First Cost**
31	Construction	$9,931,000
06	Monitoring	$91,000
18	Cultural Resource Investigations	$69,000
30	Design and Implementation[7]	$1,157,000
31	Construction Management	$716,000
01	Real Estate	$41,000
	Total	**$12,005,000**
	*Costs Include contingency of 27.6%	

Pahokee CAP Section 1135					
Summary of Project Cost (FY18 Price Levels)					
Item	Federal Cost Share	Federal Cost	Non-Federal Cost Share	Non-Federal Cost	Project First Cost
Implementation Cost Share	75%	$9,004,000	25%	$3,001,000	$12,005,000
Non-Federal LERRD Contribution*				-41,000	
Non-Federal Cash Contribution				$2,960,000	
Note: Dollar values are rounded. *01 (Lands and damages) costs are all administrative costs and are credited back to the non-Federal sponsor as LERRD costs.					

4.5 RISK AND UNCERTAINTY

Even with implementation of the Recommended Plan, some residual risk remains. Criteria for success of the plan and adaptive options to implement as needed are discussed briefly below in Section 4.7 and in **APPENDIX D-3 (Monitoring and Adaptive Management Plan)**.

4.6 SEA LEVEL CHANGE CONSIDERATIONS

ER 1100-2-8162, *Incorporating Sea Level Change (SLC) in Civil Works Programs*, provides regulations and guidance for incorporating the direct and indirect physical effects of projected future sea level change to

[7] The WBS (work breakdown structure) code 30 category also includes $40,000 for Real Estate oversight during D&I. Altogether, the $40,000 in category 30 and $40,000 in category 01 add up to the $80,000 shown in the Real Estate plan. This line item also includes $332,000 for potential Adaptive Management to be cost-shared within the 5-year monitoring period.

USACE Civil Works projects. Lake Okeechobee is an inland water body directly controlled by mean sea level; therefore, the standard SLC analysis covered in this guidance does not apply. However, the impacts of higher lake levels would have similar impacts to the project. In the event of extended higher lake levels, this can be addressed similar to the adaptive management process and measures, described below.

4.7 MONITORING & ADAPTIVE MANAGEMENT PLAN

This plan was designed with resilience and long-term sustainability in mind. The perimeter sand berm and armoring will prevent erosion of the islands and help to reduce wind and wave energy, as will vegetation once it is mature. Pond apples and emergent vegetation are able to tolerate variable levels of water stages. Pond apples planted in 2005 and 2011 on nearby Torry Island by other agencies have been successful. Proactive measures to ensure vegetation success will be written into plans and specifications to include size, maturity, and required depth of planting.

APPENDIX D-3 (Monitoring and Adaptive Management Plan) contains the combined monitoring and adaptive management plan for the project. Monitoring lasts for the first five years after construction completion to measure the success of vegetation establishment. If project success is not met during the first five years, adaptive management may be used and could be cost shared between the Federal and non-Federal sponsor, as identified in the adaptive management plan. It is assumed that adaptive management should not be needed after the five-year monitoring period is complete. However, measures to address operation and maintenance or to address changed site conditions after the five-year monitoring period would be a non-Federal response responsibility and cost.

5 Effects of the Recommended Plan

5 EFFECTS OF THE RECOMMENDED PLAN

This section is the scientific and analytic evaluation of effects that would result from implementing the Recommended Plan. Section 2 includes the effects resulting from the "no-action alternative," or the "Future Without-Project Conditions." The following section includes anticipated changes to the existing environment including direct, indirect, and cumulative effects as a result of the Recommended Plan, or the "Future With-Project Conditions."

The terms "impact" and "effect" are used interchangeably in this chapter. Impacts may be discussed as positive or negative and/or significant or minor, as appropriate to the condition or resource. Positive impacts occur when an action results in a beneficial change to the resource, whereas negative impacts occur when an action results in a detrimental change to the resource. Significant impacts occur when an action substantially changes or affects the resource. A minor impact occurs when an action causes impact, but the resource is not substantially changed. Impacts are also discussed as temporary, as well as short and long-term, and are associated with relative time frames as the direct result of the action. In this case, temporary refers to an impact only during the period of construction. Short-term describes the impact as continuing for 1-3 years post construction, whereas long-term describes impacts that are permanent or would be expected to remain for many years. This chapter is organized by resource area following the same sequence as in Chapter 2.

5.1 GENERAL ENVIRONMENTAL EFFECTS

Implementation of the Recommended Plan will not impact the overall general conditions at the project site. The constructed project will provide protection from winds, waves, and storm events to the shoreline landward of the eco-islands.

5.2 PHYSICAL ENVIRONMENT

The Recommended Plan will not change the project area's hydrology and will have no impact on the project area's sea level or sea level rise. The project itself is adaptable to higher than current lake water levels to ensure that it continues to function as intended during its service life. No effect is anticipated to the project area's climate although minimal amounts of greenhouse gases (GHG) would be created during construction of the proposed project. The release of GHG emissions will cease with completion of construction. The planting of pond apples and emergent vegetation may aid in the natural carbon capture and/or carbon sequestration processes. Construction of the TSP will result in minor improvements to the project area's sediments. Island creation will occur on a portion of the lakebed and includes dredging silty sediments from within the lake near the project vicinity. The material removed from the lake will be mixed with clean sand and used as fill for the interior portion of the island. Removal of silty sediments from the lakebed and construction of the islands on the existing silty sediments will reduce the amount of silty sediments that could become resuspended in the water column during periods of high wind and/or wave energy. (Reference **APPENDIX A (Engineering)** for further information on the physical environment and the required climate change analysis.)

5.3 BUILT ENVIRONMENT

Construction of the Recommended Plan will have no effect on nearby residential and commercial structures. In addition, there would be no change to current efforts to the rehabilitated HHD, Lake

Okeechobee water levels, nor the schedule that governs water supply and flood risk management discharges. Although the project will attract wildlife and birds, it is not expected to affect air traffic or navigation due to the project site being located approximately two miles from the Palm Beach County Glades Airport and the HHD obstructing a clear path between the two sites.

5.4 NATURAL ENVIRONMENT

5.4.1 VEGETATION

FUTURE WITH-PROJECT CONDITIONS

Eco-island creation will result in approximately 12 acres of pond apples and 16 acres of emergent vegetation. In addition, the eco-islands will serve as a breakwater to the nearby shoreline. The reduction in wave and wind forces will promote the reestablishment of shoreline vegetation, which will add to the biodiversity of the area. Invasive species will likely attempt to colonize the eco-islands while native species are being planted and established. Annual monitoring will ensure that native and planted species are thriving. Since CAP projects do not include an operations and maintenance component, the non-Federal sponsor will ultimately be responsible for invasive species control following project completion.

5.4.2 FISH AND WILDLIFE RESOURCES (OTHER THAN ENDANGERED SPECIES)

FUTURE WITH-PROJECT CONDITIONS

Implementation of the Recommended Plan is expected to improve freshwater habitat conditions in the project area. The Recommended Plan supports the project's purpose to reestablish and protect the biodiversity of the freshwater fauna and flora within the Lake Okeechobee in the project area. There may be temporary impacts to fish and wildlife during construction; however, these impacts are expected to be minor and cease with the completion of construction. USACE will incorporate minimization measures into the plans and specifications to reduce and/or offset effects.

BENTHOS

Construction activities may result in temporary increases in turbidity and sedimentation, burial of benthic species, and displacement of fishes that could adversely impact local foraging opportunities; however, those effects are minimal given the short-duration of activities and widespread availability of equivalent habitat (Wenger et al. 2016). The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §801 *et. seq.*) requires Federal agencies to consult with National Marine Fisheries Service (NMFS) on activities that may adversely affect essential fish habitat (EFH). This project takes place entirely within Lake Okeechobee, a freshwater lake, and will not affect any EFH outside of the lake. As there is no effect to EFH, consultation with NMFS is not required.

FISHERIES

Implementation of the Recommended Plan will create better habitat foraging and nursery habitat for the fish present in Lake Okeechobee. This will result in a long-term, positive benefit to the fisheries currently present in Lake Okeechobee. Although the rock armoring is an engineered feature incorporated into the project for structural stability and erosion protection, an incidental benefit of the rock armoring is the creation of potential nursery habitat for juvenile fish. Additionally, the area immediately adjacent to the landward side of the islands may have an increased presence of fish due to the reduction of wave energy and resuspended sediments.

MIGRATORY BIRDS

Migratory birds may pass through and use areas in or adjacent to the project area. There may be some interruption of foraging and resting activities for birds due to construction activities. This effect would be short-term and limited to the immediate area of construction activities. There is sufficient habitat that can be used by displaced birds during construction. Temporary displacement and noise related to use of heavy construction equipment could disturb nesting and foraging birds at the sand mining site. USACE, in conjunction with the USFWS and FWC, developed guidelines to avoid and monitor potential effects to shorebirds. USACE developed a suite of contractual specifications for contractors to implement during construction where migratory birds may be present. The contractor will keep all dredging and construction activities under surveillance, management, and control to prevent effects to migratory birds. The contractor may be held responsible for harming or harassing the birds, their eggs, or their nests present in the site as a result of the construction activities.

OTHER WILDLIFE

Implementation of the TSP may result in short-term interruption to foraging and resting activities of other wildlife in the project area. This effect would be temporary and limited to the construction activities area. Truck haul operations will occur on urban roads, which is likely already avoided by wildlife. In addition, wildlife will be able to relocate during construction operations to avoid any physical impacts. There is sufficient habitat in the area that can be used by displaced species during construction.

5.4.3 THREATENED, ENDANGERED, AND PROTECTED SPECIES

FUTURE WITH-PROJECT CONDITIONS

In order to comply with Section 7 of the Endangered Species Act (ESA) (16 U.S.C. §1536), USACE initiated ESA consultation with USFWS in January 2018. USACE determined that the proposed project will have no effect to the following species:

- Everglade snail kite (*Rostrhamus sociabilis plumbeus*);
- Florida bonneted bat (*Eumops floridanus*);
- Audubon's crested caracara (*Polyborus plancus audubonii*);
- Wood stork (*Mycteria americana*);
- Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*).

USACE requested concurrence from USFWS that the proposed project may affect, but is not likely to adversely affect (MANLAA), the following species:

- Eastern indigo snake (*Drymarchon corais couperi*);
- Florida panther (*Puma* (=felis) *concolor coryi*);
- West Indian (Florida) manatee (*Trichechus manatus*).

On May 2, 2018, USFWS concurred with the USACE MANLAA to the above listed species.

Components of construction activity for the Recommended Plan will occur within areas where Florida manatees and/or Eastern indigo snakes could be present; however, by utilizing the 2011 Standard Manatee Conditions for In-Water Work and the 2013 Standard Protection Measures for the Eastern Indigo Snake, potential effects to these species can be minimized. Although eco-island construction activities will occur in-water, mining of the sand and transit from the sand mine to the project site may occur in areas where Florida panthers may be present. The following measures will be included in the plans and

specifications and will be taken during construction activities and transit between the sand mine and project site to ensure the safety of Florida panthers that may be in the vicinity:

- If a female Florida panther or Texas cougar is suspected of denning within 1 km (or approximately 3000 feet) of construction activities, construction activities within 1 km of the den site will be suspended for the two-month denning period, or until denning is complete.
- The Contractor agrees to immediately notify the Project Manager upon locating a dead, injured, or sick Florida panther specimen. Care should be taken in handling sick or injured specimens to ensure effective treatment and care, or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured Florida panthers, or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by USFWS Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Everglade snail kite DCH and Florida manatee DCH do not exist within the project site or sand mining transit route, therefore, USACE has determined construction activities associated with this project will have no effect to DCH. Due to the planting of emergent vegetation and pond apples, this project may result in a long-term benefit to the Everglade snail kite DCH. More detailed information on potential effects to listed species and efforts to eliminate and/or avoid impacts can be found in Section 7 ESA consultation documents, which are located in **APPENDIX E (Pertinent Correspondence)**.

5.4.4 AIR QUALITY

FUTURE WITH-PROJECT CONDITIONS

Minor, temporary reduction of air quality will occur due to emissions from in-water construction activities and sand mining operations; however, the impacts to air quality are anticipated to be localized and negligible, lasting only until construction is complete. The project will not construct any new sources of air pollution. The contractor will be required to comply with applicable air pollution standards of the State of Florida and all Federal emission and performance laws and standards, including the USEPA NAAQS.

5.4.5 WATER QUALITY

FUTURE WITH-PROJECT CONDITIONS

There are potential short-term negative localized impacts from resuspended sediment due to excavation. Turbidity controls (such as floating turbidity curtains, etc.) will be part of the construction process. Long term, this project, once completed, will reduce resuspension of sediments in the project area. Additionally, there could be minor, temporary impacts to water quality, mainly turbidity during in-water construction at the project site. Construction equipment may release negligible amounts of pollutants into the water, including oils and grease. Best management practices (BMPs) will be used to limit the possibility of negatively effecting water quality. Detailed pollution control plans will be developed during the design phase. The completed project features, which include capping sediments, and the islands, which are wave energy attenuation features, will act to reduce resuspension of sediment, which will, for this localized area, tend to reduce water column nutrient levels cause by the resuspension of sediments.

DREDGING

Dredging operations will create a minor temporary reduction of water quality in the vicinity of construction by increased turbidity levels. Elevated turbidity levels would occur within the mixing zone in

dredging areas. Turbidity directly due to dredging is expected to return to ambient levels within a short time period. Dredging can be performed hydraulically or mechanically. Hydraulic dredging allows for sediment resuspension at the point of material removal only (at the cutterhead) since sediments are suctioned from the bottom and are not directly in contact with the middle or upper part of the water column. The concentration of resuspended sediments the dredging activity will create is a function of dredge type and sediment properties (Collins 1995). Compared to other dredges, cutterhead dredges remove sediment with only limited amounts of resuspension extending beyond the immediate vicinity of the dredge (USACE 1986).

Mechanical dredging could also be used for this project. This method allows for sediment resuspension at vertical points in the water column from the bottom to above the water surface. Resuspension of the material into the water column can happen as the bucket impacts the bottom, closes, and is pulled off the bottom through the water column and breaks the water surface. Generally, resuspension of sediment is higher using mechanical clamshell (bucket) dredges than hydraulic dredges but can be minimized through operational controls. Clamshell dredges can be used in smaller navigation channels due to increased maneuverability.

ECO-ISLANDS CONSTRUCTION

Construction of the eco-islands will be sequenced in order to minimize settling or displacement of the fill material. Final details for BMPs will be determined during the permitting and contracting process. The contractor will be given criteria to determine and achieve acceptable means and methods. BMPs will be incorporated into the construction method to minimize impacts to water quality. The project will obtain a water quality certification from FDEP and will be required to meet Florida water quality standards. Additionally, in compliance with the CZMA, USACE received preliminary approval on the project's FCD from the State of Florida in an email dated April 2, 2018.

5.4.6 NOISE

FUTURE WITH-PROJECT CONDITIONS

The Recommended Plan would result in minor, short term, local increases in noise production during the construction phase of the project. The noise would result from the use of heavy machinery. Construction crews would be required to comply with all applicable laws regarding noise, including any potential time of day restrictions and maximum decibel levels. All noise impacts associated with the Recommended Plan would cease with completion of construction.

5.4.7 CULTURAL RESOURCES

FUTURE WITH-PROJECT CONDITIONS

On December 22, 2017, in accordance with Section 106 of the NHPA (54 U.S.C. §306108) and its implementing regulations (36 CFR Part 800), USACE consulted with the SHPO and appropriate Federally-recognized tribes regarding the USACE's determination of a need for a submerged cultural resources survey of the potential project areas. This determination was based on the absence of any previous submerged cultural resources surveys in the vicinity of the potential project areas and the moderate probability that significant cultural resources may be present. The submerged remote sensing survey of these potential project areas will be completed during the D&I phase of the Pahokee Restoration project following the identification of the area of potential effect. USACE consultation letters to SHPO and the Federally-recognized tribes regarding the subject can be found in **APPENDIX E (Pertinent**

Correspondence). Consultation is ongoing with the Florida SHPO and appropriate Federally-recognized tribes and will be concluded prior to project implementation.

5.4.8 NATIVE AMERICANS

FUTURE WITH-PROJECT CONDITIONS

No portion of this project affects Native American-owned lands, reservation lands, or Traditional Cultural Properties. However, Native American groups have lived throughout the region in the past and their descendants continue to live within the State of Florida and throughout the United States. Pursuant to Section 106 of the NHPA regarding the USACE's Trust Responsibilities to Federally-recognized Native American tribes, and in consideration of the Burial Resources Agreement between USACE and the Seminole Tribe of Florida, USACE initiated consultation with the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, the Seminole Nation of Oklahoma, and the Thlopthlocco Tribal Town through a letter dated December 22, 2017 concerning the two potential project areas and the need for a submerged cultural resources remote sensing survey. Consultation is ongoing with Native American tribes having ancestral ties to this region and will be completed prior to project implementation.

5.4.9 AESTHETIC RESOURCES

FUTURE WITH-PROJECT CONDITIONS

The presence of heavy equipment that would be used during construction is likely uncommon and members of the public may consider such equipment to be "unsightly". Construction of the eco-islands is a permanent change to the shoreline aesthetics. The shoreline viewshed will be improved by the vegetated islands, which will have eventual use by wildlife. Construction operations may temporarily impede or restrict boat traffic within the project vicinity due to the presence of the construction equipment. All impacts associated with the Recommended Plan would cease with completion of construction.

5.4.10 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

FUTURE WITH-PROJECT CONDITIONS

No change to the existing HTRW conditions will occur as a result of construction of the Recommended Plan. USACE will not introduce any new sources of contaminants or hazardous waste to the area due to this project.

5.5 SOCIO-ECONOMIC ENVIRONMENT

5.5.1 LOCAL ECONOMY AND DEMOGRAPHICS

FUTURE WITH-PROJECT CONDITIONS

There is no evidence currently available to suggest a major impact to the socio-economic conditions of Pahokee in the future resulting from the project. It is likely the recreation will increase in quality and as a result there may be some modest growth in ecotourism in the area.

5.5.2 LAND USE

FUTURE WITH-PROJECT CONDITIONS

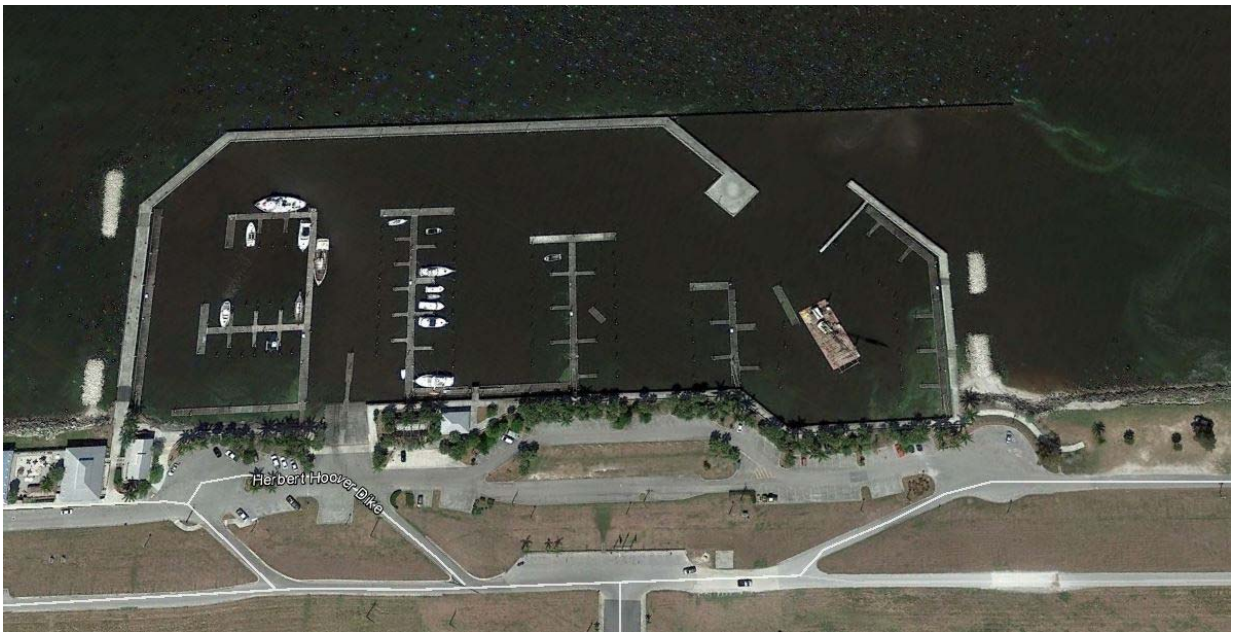
Project conditions will allow native vegetation to reestablish in the lake. The way in which the land is used will not vary from the existing condition, but those engaging in recreation in the project area are expected to see increased quality from the recreational activities.

5.5.3 RECREATION

FUTURE WITH-PROJECT CONDITIONS

As mentioned above, the increase in quality of the project area will increase the quality of the recreation experience to visitors of the area. Recreation benefits are incidental to the construction of the project and were, therefore, not used in plan formulation. At this time, there is no desire from the non-Federal sponsor to construct any recreation features in the project area and thus benefits were not calculated in order to economically justify any construction events but were instead calculated to demonstrate an added benefit of constructing the Recommended Plan in the study area. The primary source of recreation benefits is based on the continued operation of the local marina, displayed in **Figure 5-1.** From this marina, visitors are able to launch boats, kayaks, and paddle boards, etc. Visitors are able to engage in wildlife viewing, fishing, swimming, and various other activities which will be enhanced by the construction of the Recommended Plan.

Figure 5-1. Pahokee Marina showing available docks for recreational boating and associated activities.



The Recommended Plan will not increase the *availability* or *quantity* of recreation in the project area, but will instead increase the *quality* of recreation already occurring. Because of this, recreation benefits were calculated using the Unit Day Value method, as described in EGM 18-03 (November 20, 2017) and in Appendix E of ER 1105-2-100 (April 22, 2000). The Unit Day Value (UDV) method estimates a user's willingness to pay for a given recreational opportunity; i.e. a dollar amount the recreational experience would be worth to them were they required to pay. This value is estimated via a series of criteria applied

to the various recreation facilities and opportunities provided by the project; criteria gauging the overall quality of the experience, availability, carrying capacity, accessibility, and environmental factors. Each criterion can be assigned a score selected from one-of-five possible ranges which represents rating from low to high. These point values are summed together and applied a dollar value based on the current UDV guidance. The current unit-day values, provided by USACE Economic Guidance Memo #18-03, *Unit Day Values for Recreation, FY 2018,* are presented in
Table 5-1**.** Linear interpolation was used to estimate the dollar value of point scores between ranges. So, for example, a point score of 2 in General Recreation corresponds with a dollar value of $4.20. The recreation point values assigned to Pahokee vary by year. They are summarized in **Table 5-2**.

Table 5-1. Current Unit Day Values for Recreation (FY18).

Point Values	General Recreation Values
0	$ 4.05
10	$ 4.81
20	$ 5.32
30	$ 6.08
40	$ 7.59
50	$ 8.61
60	$ 9.37
70	$ 9.87
80	$ 10.89
90	$ 11.64
100	$ 12.15

Table 5-2. Total Unit Day Point Scores Applied to the Pahokee Study Area.

Year	Without-Project	With-Project
2020	34	36
2025	34	37
2030	33	39
2040	33	40
2050	32	41
2060	32	41
2065	32	41

The point assignments are based on qualitative criteria; they depend on best professional judgment (i.e. "judgment criteria"). For this study the points were assigned based on team field visit photographs and videos, as well as Google Earth map imagery. The differences in the assigned point scores vary for each category depending on the relevant recreation facilities. The following list briefly explains the logic behind

the judgment criteria applied to Pahokee and **Table 5-3** summarizes the point comparison roughly halfway through the period of analysis (2050). [8]

- **Recreation Experience:** The recreation experience in the Pahokee study area was assigned a point score of 9 in the existing condition and a score of 7 in the future without-project condition, which corresponds to "Several general recreation activities". The marina and surrounding area offer visitors the opportunity to experience several general activities, including swimming, fishing, and wildlife viewing. Though there will be no change in the general activities available, the quality of those activities will degrade throughout the future without–project condition. The value in the future with-project condition is assigned a 10 since the project will not create any additional recreation experiences but will improve upon the quality of those experiences.
- **Environmental Quality:** Throughout the study in the existing condition and the future without-project condition, the environmental quality was assigned a score of 3 as there exist some factors which lower quality to a minor degree. In the future without-project condition, the point score increased throughout the period of analysis with anticipation that the area will reach above average aesthetic quality with any limiting factors easily rectified. In 2050, the point score is 9.

Table 5-3. Criteria Score Comparison in Year 2050.

Criteria	Point Scale	Unit Day Point Value – Without-Project	Unit Day Point Value – With-Project
Recreation Experience	0-30	7	10
Availability of Opportunity	0-18	3	3
Carrying Capacity	0-14	8	8
Accessibility	0-18	11	11
Environmental Quality	0-20	3	9

After assigning point scores and dollar values, these values must be assigned to expected recreation visits over the period of analysis. Site-specific visitation numbers were not readily available for use in this study, so an estimate was applied. Due to budget and schedule constraints, existing information was leveraged to determine potential visitation to the area and marina use. The County of Palm Beach provided the team with a visitor profile dashboard from the "Discover The Palm Beaches" publication which has tracked visitation to the county over several years. Data from the publication indicated that from the year 2007 to 2016, visitation has grown on average 4%. There is no specific data relating to Pahokee within the dashboard but there is data indicating that 2% of overall visitation occurs in the city of Belle Glade, FL, which is approximately 12 miles away from the study area. USACE analysis conservatively assumed that 25% of Belle Glade visitation could be used as a proxy for visitation to the study area and adjacent marina. However, there is limited parking near the Pahokee Marina and this parking was used to constrain visitation. Based on Google Earth imagery, 75 distinct parking spots were counted in the immediate vicinity of the marina. Assuming a maximum capacity of four people per vehicle and no vehicle turnover,

[8] Only judgment criteria in which point values are anticipated to change between the FWOP and FWP are discussed.

the maximum daily capacity of the marina is 300 visitors, or 109,500 annually[9]. Based on the above mentioned growth rate of 4%, it is estimated that Pahokee marina does not reach constrained visitation until the year 2044. Based on visitation and UDV estimates, and using the FY18 discount rate of 2.75%, the recreation benefits resulting from the recommended project are $80,082 in average annual terms.

5.6 CUMULATIVE EFFECTS

Cumulative effects are defined in 40 CFR §1508.7 as those effects that result from "the incremental effect 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. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."

Past, present, and reasonably foreseeable actions and plans are summarized below in **Table 5-4**. Past Federal actions in the area of the project site are discussed in section one of this report. Other actions, such as restoration activities just south of the project area in Torry and Ritta Islands, have been completed by state agencies, Palm Beach County, and private organizations. It is expected that the general public and state and local governments could have permitted activities in or around the project area. Federal activities are evaluated under NEPA directly for each project. Other projects that take place in-water or that would impact wetlands would be evaluated under a permit issued by USACE Regulatory Division.

In general, as more restoration projects are completed in this area, the projects will provide protection to the shoreline and the creation of suitable habitat for species to naturally recruit and self-propagate. Over time, a natural linkage between projects may occur, which will increase suitable habitat for plant species and foraging opportunities for birds and other wildlife. The construction of this project's eco-islands, when considered with past projects in the area and potential future projects, has a long term positive cumulative impact on the environmental conditions of the project area. A summary of cumulative effects on environmental factors from past, present, and reasonably foreseeable actions and plans is provided in **Table 5-5**.

Table 5-4. Past, present, and reasonably foreseeable actions and plans affecting the project area.

Past Actions/Authorized Plans*	Current Actions and Operating Plans*	Reasonably Foreseeable Future Actions and Plans*
- Herbert Hoover Dike - Lake Okeechobee Waterway Routes 1 and 2 - Torry Island and Ritta Island restoration projects (completed by state agencies, local governments, and private entities)	- LORS 2008	- LORS will be replaced by a revised regulation schedule in 2024-2025 - Lake Okeechobee Watershed Restoration Project (LOWRP) - Kissimmee River Restoration (KRR) - State and local government and/or private entity restoration efforts

*Refer to section 1.4 for more details on Federal projects in the vicinity.

[9] It is common to assume vehicle turnover when constraining beach visitation using parking. However, for marina use where visitors will be engaged in more time intensive activities (i.e. boating, kayaking, and fishing) it is conservatively assumed that a single user will occupy a space for the duration of a visitor day.

Table 5-5. Summary of cumulative effects.

Hydrology	
Past Actions	Construction of Herbert Hoover Dike has affected hydrology within the lake.
Present Actions	Federal and state agencies are coordinating on how best to improve hydrology in the project area.
Recommended Plan	The Recommended Plan will have no effect on the project area's hydrology.
Future Actions	Revision of LORS will include consideration of Lake Okeechobee performance measures. Changes to LORS is unlikely to result in severe detrimental effects to the existing lake ecology.
Cumulative Effect	While the Lake Okeechobee hydrology is not likely to be restored to historic proportions by projects within the lake, projects constructed in this region of Florida may ultimately improve the hydrology within the lake system.
Threatened and Endangered Species	
Past Actions	Water management practices and urbanization have resulted in the degradation of existing habitat function and direct habitat loss leading to negative population trends of threatened and endangered species.
Present Actions	Projects implemented maintain threatened and endangered species presence within the area. Restoration projects maintain or improve the available habitat for threatened and endangered species.
Recommended Plan	Effect determinations are included in section 5.4.3. The Recommended Plan will result in the creation of habitat that can be used by threatened and endangered species.
Future Actions	Projects implemented would maintain threatened and endangered species within the area. It is anticipated that restoration projects would maintain or improve the available habitat for threatened and endangered species.
Cumulative Effect	Habitat improvement, monitoring and management of threatened and endangered species are anticipated to allow populations to be maintained. Improvement of degraded populations is expected to be facilitated by the restoration and enhancement of suitable habitat through efforts to restore more natural hydrologic conditions within the project area.
Fish and Wildlife Resources	
Past Actions	Water management practices have resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions through the food web, including effects on wading birds, large predatory fishes, reptiles and mammals.
Present Actions	Ongoing efforts have been made by Federal and state agencies to implement projects to improve hydrology within the project area to restore habitat conditions for fish and wildlife resources.
Recommended Plan	Implementation of the Recommended Plan will result in improved water quality and habitat available for use by fish and wildlife resources in the project area.
Future Actions	Some level of improvement to fish and wildlife resources is expected to occur as a result of implementation of projects with the capability of improving water quality, erosion, and vegetation in the project area.
Cumulative Effect	Habitat improvement efforts are anticipated to benefit fish and wildlife resources.
Vegetation and Wetlands	

Past Actions	Conversion of wetlands to agriculture and urban development has reduced the spatial extent and quality of wetland resources.
Present Actions	Efforts are being taken by state and Federal regulatory agencies to reduce wetland losses.
Recommended Plan	The Recommended Plan will result in the creation of emergent vegetation islands. Reduced wind and wave activity will improve adjacent shoreline conditions and enable vegetation growth.
Future Actions	Some level of improvement to vegetative communities is expected to occur as a result of the implementation of restoration projects.
Cumulative Effect	While the spatial extent of natural plant communities would not be restored to historic proportions, the quality of vegetative communities would be improved.
Cultural Resources and Native Americans	
Past Actions	Previous cultural resources studies and coordination with State and Tribal agencies indicated that there is a high potential for the presence of submerged cultural resources.
Present Actions	Federal, State, and Tribal agencies are coordinating the identification of historic properties and culturally significant sites.
Recommended Plan	The Recommended Plan will be subject to a submerged cultural resources survey to identify historic properties located within the area of potential effects.
Future Actions	Project design and implementation will avoid, minimize, or mitigate all effects to historic properties that may be identified as a result of the cultural resources survey.
Cumulative Effect	Cumulative effects to historic properties and culturally significant sites may potentially be adverse if not avoided. Avoidance of historic properties or cultural significant sites during project implementation is recommended to reduce cumulative effects.
Water Quality	
Past Actions	Water quality has been degraded from urban, suburban, commercial, industrial, recreational and agricultural development.
Present Actions	Construction of Federal and state projects can temporarily elevate localized levels of suspended solids and turbidity.
Recommended Plan	Water quality will be temporarily effected during project construction. Water quality will be locally improved by the implementation of the Recommended Plan.
Future Actions	Projects implemented would maintain and meet regulated water quality standards within the area. It is anticipated that restoration projects would maintain or improve the water quality.
Cumulative Effect	While anthropogenic effects on water quality are unlikely to be eliminated, water quality is expected to continue to improve. USACE and Palm Beach County are committed to ensuring that project implementation will not result in violations of water quality standards.

5.7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.7.1 IRRETRIEVABLE

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction. Construction of the eco-islands will result in the permanent loss of the non-motile benthic

community at the site of the islands' footprints; however, over time, organisms migrating from adjacent habitat will recolonize the benthic environment at the eco-islands.

5.7.2 IRREVERSIBLE

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment would be the mining of a mineral resource. The energy and fuel used during construction would be an irreversible commitment of resources.

5.8 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Impacts from the construction activities to mobile marine organisms, such as fish, are expected to be insignificant and temporary as these organisms are able to relocate and avoid direct physical effects. While construction of the eco-islands will impact the non-motile benthic community, these impacts would cease with the completion of construction. Benthic repopulation within the affected areas will occur by organisms migrating from adjacent habitat. These effects are expected to be short-term and minor in nature.

6 Environmental Compliance

6 ENVIRONMENTAL COMPLIANCE

6.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) (42 U.S.C. §4321 *ET. SEQ.*)

Under the requirements of Section 102 of NEPA, this proposed project constitutes a major Federal action and an Environmental Assessment (EA) is therefore required. This EA, integrated with the feasibility report, has been prepared pursuant to NEPA and its implementing regulations. A Notice of Availability for the integrated report and Finding of No Significant Impact (FONSI) was coordinated with pertinent agencies and interested stakeholders for review and comment. The project is in compliance with NEPA.

6.1.1 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

USACE provided a Notice of Availability of the draft IFR/EA and FONSI for 30 days. USACE posted the draft IFR/EA, FONSI, and associated appendices to the Jacksonville District's environmental website and provided it to the following agencies and interested parties for a 30-day comment period, which ended on March 3, 2018. Recipients include:

Federal Agencies
NMFS, USEPA, USFWS, U.S. Coast Guard, and Federal Aviation Administration

Tribal Nations
Miccosukee Tribe of Indians of Florida, Seminole Tribe of Florida, Poarch Band of Indians, Muscogee (Creek) Nation, Kialegee Tribal Town, Alabama-Quassarte Tribal Town, Thlopthlocco Tribal Town, and the Seminole Nation of Oklahoma

State Agencies
FWC, FDEP, Florida State Clearinghouse, and SHPO

Local Agencies
City of Pahokee and Palm Beach County

Non-Governmental Organizations
Save the Manatee Club, Audubon Florida, Florida Wildlife Federation, Sierra Club, Fish and Wildlife Foundation of Florida, Florida Biodiversity Project, the Wildlife Society, and the Nature Conservancy

6.1.2 COMMENTS RECEIVED AND USACE RESPONSES ON THE DRAFT IFRA/EA

Comments received during the 30 days agency review and public comment period were incorporated into the final IFR/EA. A list of the comments received, and USACE responses, are included as **APPENDIX D-4 (National Environmental Policy Act (NEPA) Public and Agency Comments and USACE Responses**).

6.2 ENVIRONMENTAL COMMITMENTS

USACE and its contractors commit to avoiding and minimizing for adverse effects during construction activities by including the following commitments in the contract specifications:

PROTECTION OF FISH AND WILDLIFE RESOURCES

Contractors will keep construction activities under surveillance, management, and control to minimize interference with and disturbance and damage to fish and wildlife. Species that require specific attention, along with measures for their protection, will be listed in the Contractor's Environmental Protection Plan (EPP) prior to the beginning of construction operation.

ENDANGERED SPECIES PROTECTION

Contractors will keep construction activities under surveillance, management, and control to minimize interference with and disturbance and damage to fish and wildlife. USACE will include the USFWS 2011 Standard Manatee Conditions for In-Water Work and the 2013 Standard Protection Measures for the Eastern Indigo Snake in the project specifications. The Contractor will also include protection criteria for species requiring specific attention and federally listed endangered and threatened species protections in their EPP.

WATER QUALITY

USACE and its contractor will prevent oil, fuel, or other hazardous substances from entering the air or water. This will be accomplished by design and procedural controls. All wastes and refuse generated by project construction would be removed and properly disposed. Contractors will implement a spill contingency plan for hazardous, toxic, or petroleum material.

CULTURAL RESOURCES

An unexpected cultural resources finds clause will be included in the project specifications. In the event that any archaeological resource is uncovered during construction activities, all activities will be halted immediately within the area. Once reported, USACE staff will initiate coordination with the appropriate Federal, tribal, and state agencies to determine if archaeological investigation is required. Additional work in the area of the discovery will be suspended at the site until compliance with all Federal and state regulations is successfully completed and USACE staff members provide further directive.

PROTECTION OF MIGRATORY BIRDS

USACE will incorporate the standard migratory bird protection protocols into the project plans and specifications and will require contractors to abide by those requirements.

6.3 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

6.3.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) (42 U.S.C. §4321 *ET. SEQ.*)

The project is in compliance with NEPA as noted by the discussion in Section 6.1 above.

6.3.2 ENDANGERED SPECIES ACT OF 1973 (16 U.S.C. §1531 *ET. SEQ.*)

For species under the jurisdiction of the USFWS, USACE initiated consultation in accordance with Section 7 of the ESA in January 2018. On May 2, 2018, USFWS concurred with the USACE MANLAA determination for the Eastern indigo snake, Florida panther, and the West Indian (Florida) manatee. USACE will comply with all substantive and procedural requirements of the Act before and during construction. This project is fully coordinated under the ESA and is in full compliance with the Act. Copies of relevant correspondence are located in **APPENDIX E (Pertinent Coordination)**.

6.3.3 FISH AND WILDLIFE COORDINATION ACT (16 U.S.C. §§661-665; 665A; 666; 666A-666C)

A memorandum for the record was submitted in January 2018 to USFWS documenting an agreement between USACE and USFWS to use the NEPA review and ESA consultation processes to complete coordination responsibilities under the Fish and Wildlife Coordination Act. This agreement will avoid duplicate analysis and documentation as authorized under 40 CFR §§1500.4(k), 1502.25, and 1506.4 and is consistent with the Presidential Executive Order for Improving Regulation and Regulatory Review, released January 18, 2011. USFWS signed the memorandum for the record on May 2, 2018. The project is in compliance with the Act.

6.3.4 NATIONAL HISTORIC PRESERVATION ACT (54 U.S.C. §300101 *ET. SEQ.*)

Consultation with the SHPO and the appropriate Federally-recognized tribes was initiated on December 22, 2017 in accordance with the NHPA and as part of the requirements and consultation processes contained within the NHPA implementing regulations of 36 CFR Part 800 (**APPENDIX E**). This project shall be in compliance with the Archeological Resources Protection Act (16 U.S.C. §§470aa-470mm), the Abandoned Shipwreck Act (43 U.S.C. §§2101-2106), American Indian Religious Freedom Act (42 U.S.C. §§1996 and 1996a), Executive Orders (E.O. 11593, 13007, & 13175), and the Presidential Memo of 1994 on Government to Government Relations. Consultation with the Florida SHPO, appropriate Federally-recognized tribes, and other interested parties has been initiated and is ongoing. The Recommended Plan will be in compliance with the goals of this Act upon completion of coordination of the undertaking.

6.3.5 CLEAN WATER ACT OF 1972, SECTION 401 AND SECTION 404(b) (33 U.S.C. §1341 *ET. SEQ*. and 33 U.S.C. §1344(b) *ET. SEQ.*)

Dredging and dredged material placement within Lake Okeechobee is covered by CWA Sections 401 and 404(b). **APPENDIX D-2** includes a Section 404(b)(1) (33 U.S.C. §1344(b)) evaluation and discharges into the waters of the U.S. Additionally, USACE coordinated the project with the State of Florida via the issuance of a water quality certification and concurrence on the project's FCD (as required by CZMA), which received preliminary approval by the State of Florida on April 2, 2018. The project is in full compliance with this Act.

6.3.6 CLEAN AIR ACT (42 U.S.C. §7401 *ET. SEQ.*)

The short-term effects from construction equipment associated with the project will not significantly affect air quality. Air quality permits are not required for this project. Palm Beach County is designated as an attainment area for Federal air quality standards under the CAA. Because the project is located within an attainment area, USEPA's General Conformity Rule to implement Section 176(c) of the CAA (42 U.S.C. §7506(c)) does not apply and a conformity determination is not required.

6.3.7 COASTAL ZONE MANAGEMENT ACT (16 U.S.C. §1451 *ET. SEQ.*)

In compliance with the CZMA, USACE submitted a FCD to the State of Florida on February 1, 2018, during the public noticing of the draft IFR/EA. In an email dated April 2, 2018, the State provided preliminary approval that the proposed project is consistent with the Florida Coastal Management Program. In accordance with Section 373.428, Florida Statutes, final concurrence is determined during the

environmental permitting process. This project is in compliance with the Act.

6.3.8 FARMLAND PROTECTION POLICY ACT (7 U.S.C. §4201 *ET. SEQ.*)

This project will not affect any prime or unique farmland. This Act is not applicable.

6.3.9 WILD AND SCENIC RIVER ACT (28 U.S.C. §1271 *ET. SEQ.*)

This project will not affect any designated wild and scenic river reaches. This Act is not applicable.

6.3.10 MARINE MAMMAL PROTECTION ACT (16 U.S.C. §1361 *ET. SEQ.*)

USACE will incorporate the safeguards of the 2011 Standard Manatee Conditions for In-Water Work used to protect any manatees present in the project area. These safeguards are included in the project plans and specifications and will be implemented by the contractor during construction. Therefore, this project is in compliance with the Act.

6.3.11 ESTUARY PROTECTION ACT (16 U.S.C. §§1221-26)

This project will not affect any designated Estuary of National Significance. This Act is not applicable.

6.3.12 FEDERAL WATER PROJECT RECREATION ACT

The principles of the Federal Water Project Recreation Act (16 U.S.C. §460l-12 *et. seq.*) require USACE to give full consideration to any opportunity for the project to add or improve outdoor recreation and/or fish and wildlife enhancement. Recreational resources and opportunities are considered and discussed in this report. This project is in compliance with the Act.

6.3.13 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (16 U.S.C. §801 *ET. SEQ.*)

The proposed project will occur in a freshwater lake. No fish species travel between the freshwater lake and saltwater water bodies; therefore, the proposed project will have no adverse effects on EFH and does not require coordination with NMFS. This project is in compliance with the Act.

6.3.14 SUBMERGED LANDS ACT (43 U.S.C. § 1312 *ET. SEQ.*)

The project will occur on submerged lands of the State of Florida. USACE will coordinate the project with the state via the issuance of a water quality certification, as well as through the review process for the IFR/EA and CZMA FCD, which received preliminary approval by the State of Florida on April 2, 2018. This project is in compliance with the Act.

6.3.15 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT (16 U.S.C. §3501 *ET. SEQ.*)

There are no designated coastal barrier resources in the project area that would be affected by this project. These Acts are not applicable.

6.3.16 RIVERS AND HARBORS ACT OF 1899, SECTION 10 (33 U.S.C. §401 *ET. SEQ.*)

The proposed work will obstruct navigable waters of the U.S. by constructing eco-islands in previously open water; however, the eco-islands will not prevent public access to navigable waters in and around the project area. USACE does not permit itself for civil works projects. In consideration of applicable factors listed in 33 CFR section 320.4, USACE has determined the project is not contrary to public interest. As such, the activity discussed in this IFR/EA is in compliance with the Act.

6.3.17 ANADROMOUS FISH CONSERVATION ACT (16 U.S.C. §§757A-757G)

This project will have no effect on anadromous fish species. The project is in compliance with this Act.

6.18 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT (16 U.S.C. §§715-715D, 715E, 715F-715R)

The project plans and specifications will include migratory bird protection measures for construction activities. Appropriate buffers will be placed around any nests if they occur in the construction activity areas. Construction of the eco-islands will create long-term, positive benefits as the project will result in foraging habitat for birds. The project is in compliance with these Acts.

6.3.18 MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT (33 U.S.C. §1401 *ET. SEQ.*)

Ocean disposal is not a component of this project; therefore, this Act is not applicable.

6.3.19 UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT (42 U.S.C. §4601 *ET. SEQ.*)

The purpose of this Act is to ensure that owners of real property to be acquired for Federal and Federally assisted projects are treated fairly and consistently and that persons displaced as a direct result of such acquisition will not suffer disproportionate injuries as a result of projects designed for the benefit of the public as a whole. This project will not acquire property. Therefore, this Act is not applicable.

6.3.20 E.O. 11990, PROTECTION OF WETLANDS

This project will create wetlands within Lake Okeechobee. Construction of the proposed project will provide protection to the nearby shoreline, which will reduce erosion and silt settlement, thereby encouraging repopulation of shoreline vegetation from species in adjacent habitats. This project is in

compliance with the goals of this Order.

6.3.21 E.O. 11988, FLOOD PLAIN MANAGEMENT

To comply with E.O. 11988, the policy of USACE is to formulate projects that, to the extent possible, avoid or minimize adverse effects associated with the use of the floodplain and avoid inducing development in the floodplain unless there is no practicable alternative. USACE concludes that the proposed project will not result in harm to people, property, and floodplain values, will not induce development in the floodplain, and the project is in the public interest. The project is in compliance with the Order.

6.3.22 E.O. 12898, ENVIRONMENTAL JUSTICE

This E.O. mandates that each Federal agency make environmental justice (EJ) part of the agency mission and to address, as appropriate, disproportionately high and adverse human health or environmental effects of the programs and policies on minority and low-income populations. Significance thresholds that may be used to evaluate the effects of a proposed action related to EJ are not specifically outlined. However, Council on Environmental Quality (CEQ) guidance requires an evaluation of a proposed action's effect on the human environment and USACE must comply with Executive Order 12898. USACE has determined that a proposed action or its alternatives would result in significant effects related to EJ if the proposed action or an alternative would disproportionately adversely affect an EJ community through its effects on:

- Environmental conditions such as quality of air, water, and other environmental media; degradation of aesthetics, loss of open space, and nuisance concerns such as odor, noise, and dust;
- Human health such as exposure of EJ populations to pathogens;
- Public welfare in terms of social conditions such as reduced access to certain amenities like hospitals, safe drinking water, public transportation, etc.; and
- Public welfare in terms of economic conditions such as changes in employment, income, and the cost of housing, etc.

USACE conducted an evaluation of EJ impacts using a two-step process: as a first step, the study area was evaluated to determine whether it contains a concentration of minority and/or low-income populations. Following that evaluation, in the second step, USACE determined whether the proposed action would result in the types of effects listed above in a disproportionately, high adverse manner on these populations.

As defined in Executive Order 12898 and the CEQ guidance, a minority population occurs where one or both of the following conditions are met within a given geographic area:

- The American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic population of the

affected area exceeds 50 percent; or

- The minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

For this study, the geographic location used in determining demographics was the entire City of Pahokee based on the Census Bureau's 2010 census. Based on this, as shown in **Table 2-2** (**section 2.5 Socio-Economic Environment**), the aggregate minority population is 71.1 percent of the total population in Pahokee. Therefore, aggregate population percentages exceed 50 percent, so the study area does contain a high concentration of minority population.

Executive Order 12898 does not provide criteria to determine if an affected area consists of a low-income population. For the purpose of this assessment, the CEQ criterion for defining a minority population has been adapted to identify whether or not the population in an affected area constitutes a low-income population. An affected geographic area is considered to consist of a low-income population (i.e. below the poverty level for purposes of this analysis) where the percentage of low-income persons:

- is at least 50 percent of the total population; or
- is meaningfully greater than the low-income population percentage in the general population or other appropriate unit of geographic analysis.

As shown in **Table 2-1** (**Section 2.5 Socio-Economic Environment**), based on the American Community Surveys, 26.3% of the individuals in Pahokee are considered below the poverty level. Since this is more than double the percentage of population below poverty threshold in both the State of Florida and all of the United States, Pahokee meets the second criteria, and thus contains a high concentration of low-income population. In summary, the study area which comprises Pahokee constitutes an EJ community.

This project will not cause any disproportionate and adverse effects to minority or low income populations. The project will result in temporary impacts related to noise, air quality, water quality, and use of the project staging area during construction of the project. These temporary effects would cease with construction completion and are not considered to be adverse effects. The project will result in long-term positive effects to Pahokee's environmental conditions and public welfare through the creation of new habitat and the improvement of existing habitat and water quality. Benefits of the project are summarized in **Section 4.1, Benefits of the Recommended Plan** and are also discussed in detail throughout **Chapter 5, Effects of the Recommended Plan**. The project is in compliance with the Order.

6.3.23 E.O. 13045, DISPARATE RISKS INVOLVING CHILDREN

The E.O. mandates that each Federal agency make it a high priority to identify and assess environmental

health and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. As the preferred alternative does not affect children disproportionately from other members of the population, the preferred alternative would not increase any environmental health or safety risks to children. The project is in compliance with the Order.

6.3.24 E.O. 13089, CORAL REEF PROTECTION

This E.O. may apply to coastal projects, especially those which might directly or indirectly impact coral reefs. There are no coral reefs or hardbottoms within the project footprint or project vicinity; therefore, this E.O. is not applicable.

6.3.25 E.O. 13112, INVASIVE SPECIES

The Recommended Plan will require the mobilization of dredge equipment from other geographical regions. Dredge equipment has the potential to transport species from one region to another, introducing them to new habitats where they are able to out-compete native species. The benefits of the Recommended Plan outweigh the risks associated with the very slight potential for introducing non-native species to this region. Although no new invasive species will be introduced as a result of this project, invasive species currently present in the area will attempt to colonize the project site. USACE will identify protection and control measures to incorporate into the project's plans to control the spread of invasive species. Since CAP projects do not include an operations and maintenance component, the NFS is ultimately responsible for invasive species control following project completion. The project is in compliance with the Order.

6.3.26 E.O. 13186, MIGRATORY BIRDS

This E.O. requires, among other things, a Memorandum of Understanding (MOU) between the Federal Agency and the USFWS concerning migratory birds. Neither the Department of Defense MOU nor the USACE's Draft MOU clearly address migratory birds on lands not owned or controlled by USACE. For many USACE civil works projects, the real estate interests are provided by the non-Federal sponsor. Control and ownership of the project lands remain with a non-Federal interest. Measures to avoid the destruction of migratory birds and their eggs or hatchlings are described in a section above on the MBTA. USACE will include standard migratory bird protection requirements in the project plans and specifications and will require the contractor to abide by those requirements. Construction of the eco-islands will have a long term, positive effect as it will create foraging habitat for birds in the project vicinity. The project is in compliance with the Order.

7 Recommendations

7 RECOMMENDATIONS

I have given consideration to all significant aspects in the overall public interest, including engineering feasibility, economic, social, cost and risk analysis, and environmental effects. The Recommended Plan described in this final report is in the public's interest and provides the optimum solution for ecosystem restoration within the study area that can be developed within the framework of the formulation concepts. Implementation of the Recommended Plan for the Pahokee 1135 Project is recommended at this time, with such modification as the discretion of the Commander, South Atlantic Division, U.S. Army Corps of Engineers (SAD), deems advisable.

The Recommended Plan is described in the previous chapters. The plan provides a cost effective means towards restoration of an ecosystem, with a net average benefit of 18.48 habitat units at a cost of $12 million. It will promote diversity of emergent and upland species able to withstand varying water stages, and provides 28.70 actual created acres. This area would serve as habitat and attracters for birds and other land and aquatic animals, such as otters, alligators and fish. This plan would provide increased aesthetic value and recreational opportunities to the community.

7.1 DRAFT ITEMS OF LOCAL COOPERATION

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with Federal laws and policies, including but not limited to:

a. Provide 25 percent of total construction costs, as further specified below:

   1. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material as determined by the Federal Government to be required or to be necessary for the construction, operation, and maintenance of the project;
   2. Provide, during construction, any additional contributions necessary to make its total contribution equal to 25 percent of total project costs;

b. Provide, during construction, 100 percent of any project costs that exceed the Federal limit of $10,000,000;

c. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal sponsor's obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project;

d. 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 project, hinder operation and maintenance of the project, or interfere with the project's proper function;

a. Shall not use project lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project;

f. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. §§4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

g. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal Government;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local Governments at 32 CFR §33.20;

k. 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));

l. Perform, or ensure performance of, 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 U.S.C. §§9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction or operation and maintenance of the project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Government provides the non-Federal sponsor with prior specific direction in which case the non-Federal sponsor shall perform such investigation in accordance with such written direction;

m. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, rehabilitation, or replacement of the project;

n. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

o. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. §§1962d-5b) and Section 101(e) of the WRDA 86, Public Law 99-662, as amended (33 U.S.C. §2211(e)), which provide 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;

p. Provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation that are in excess of 1% of the total amount authorized to be appropriated for the project in accordance with the cost sharing provisions of the agreement.

q. Provide documentation that the completed work was identified in the Project Management Plan as needed for project, in order for the non-Federal sponsor to be afforded credit for eligible design/construction work performed after execution of the Project Partnership Agreement toward the non-Federal sponsor's required cash contribution

7.2 DISCLAIMER

The recommendations contained herein reflect the information available at this time and current departmental policies governing the formulation of individual projects. They do not reflect the program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher level reviews within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to a higher authority as proposals for project modification and/or implementation funding. The recommendations herein for the provision of a CAP Section 1135 project for the Pahokee Restoration Project do not include any provisions for work which would result in any new Federal expenditures or financial assistance prohibited by the Coastal Barrier Resources Act; nor were funds obligated in past years for this project for purposes prohibited by this Act.

Jason A. Kirk
Colonel, U.S. Army
District Engineer

7.2 DISCLAIMER

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Jason A. Kirk
Colonel, U.S. Army
District Engineer

8 References and Index

8 ACRONYMS AND REFERENCES

8.1 ACRONYMS

AAEQ	Average Annual Equivalent
AQCR	Air Quality Control Region
BMP	Best Management Practice
CAA	Clean Air Act
CAP	Continuing Authorities Program
CE/ICA	Cost Effective/Incremental Cost Analysis
CZMA	Coastal Zone Management Act
D&I	Design and Implementation
DCH	Designated Critical Habitat
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPP	Environmental Protection Plan
ER	Engineering Regulation
ESA	Endangered Species Act
FY	Fiscal Year
EA	Environmental Assessment
EV	Emerged Vegetation
FCD	Federal Consistency Determination
FID	Federal Interest Determination
FIND	Florida Inland Navigation District
FONSI	Finding of No Significant Impact
FWC	Florida Fish and Wildlife Conservation Commission
GHG	Greenhouse Gases
HHD	Herbert Hoover Dike
HS	Habitat Suitability Index
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
IFR/EA	Integrated Feasibility Report/Environmental Assessment
LORS	Lake Okeechobee Regulation Schedule
LORWP	Lake Okeechobee Restoration Watershed Project
NAAQS	National Ambient Air Quality Standards
NAVD 88	North Atlantic Vertical Datum, 1988
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration Plan
NFS	Non-Federal sponsor

NGVD 29	National Geodetic Vertical Datum, 1929
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
OWW	Lake Okeechobee Waterway
PBC	Palm Beach County
PPA	Project Partnership Agreement
RHA	Rivers and Harbors Act 1930
SHPO	State Historic Preservation Officer
SLC	Sea level change
SLR	Sea level rise
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WRDA	Water Resources Development Act

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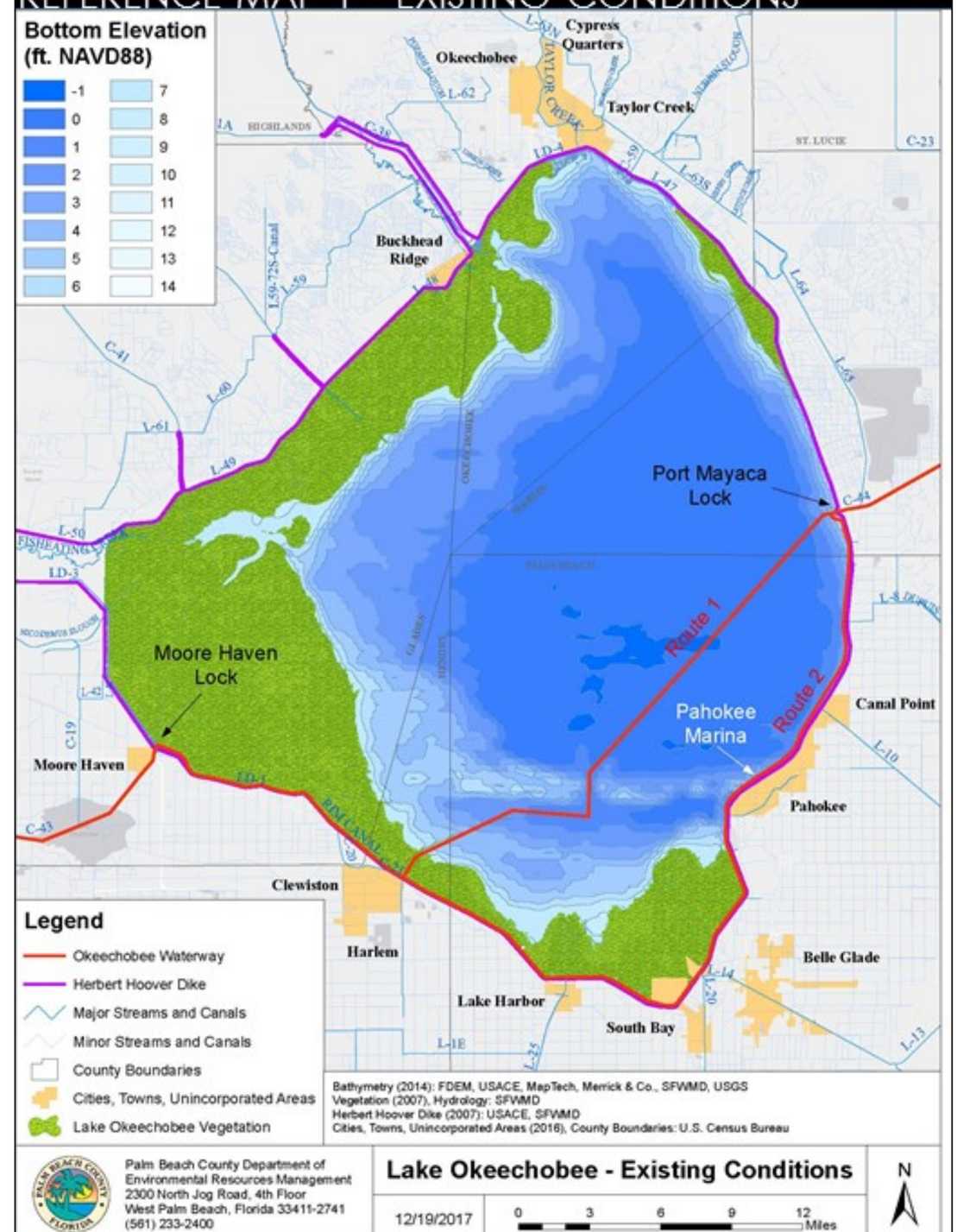
REFERENCE MAP 1 – EXISTING CONDITIONS



PAHOKEE RESTORATION CONTINUING AUTHORITIES PROGRAM SECTION 1135

REFERENCE MAP 2 – RECOMMENDED PLAN

Palm Beach County Department of
Environmental Resources Management
2300 North Jog Road, 4th Floor
West Palm Beach, Florida 33411-2741
(561) 233-2400

Recommended Plan

12/19/2017

0 0.2 0.4 0.6 0.8 Miles

N

PAHOKEE RESTORATION CONTINUING AUTHORITIES PROGRAM SECTION 1135