APPENDIX E
PLAN FORMULATION SCREENING

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E PLAN FORMULATION SCREENING

E.1 Plan Formulation

The Lake Okeechobee Storage Reservoir Section 203 Study (also referred to as LOCAR, Section 203 Study, or Project) has been formulated to restore, protect, and preserve water resources in central and southern Florida and the Everglades in keeping with the Comprehensive Everglades Restoration Plan (CERP). CERP was congressionally authorized under Section 601 of the Water Resources Development Act (WRDA) 2002 as a framework to restore, protect, and preserve water resources in central and southern Florida and the Everglades.

Section 9.1.1.1 of the *Central and Southern Florida Project Comprehensive Review Study: Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (Corps 1999), prepared for CERP describes the purpose of Storage Reservoir A, its features, and its analysis. The reservoir's purpose is water detention for controlled releases that will minimize stress to Lake Okeechobee's littoral ecosystem and downstream estuary ecosystems. Design specifics include a 20,000-acre (ac) facility (17,500-ac reservoir and 2,500-ac treatment area) located in Glades, Highlands or Okeechobee Counties with final site, size, depth, and configuration subject to detailed planning, land suitability analyses, and design.

LOCAR formulation and analysis focuses on aboveground water storage north of Lake Okeechobee to support reestablishing central and south Florida's ecosystem, estuaries, water delivery, water supply and achieving the level of restoration envisioned for CERP. The LOCAR plan formulation iteratively builds upon analysis for previously authorized restoration projects, scientific documentation, new studies, policy guidance, data collection, pilot projects, hydrologic systems modeling, and water management.

Certain features originally conceptualized in CERP, such as water quality features like stormwater treatment areas (STA) and reservoir-assisted stormwater treatment areas (RASTA), are excluded from alternative development because the State of Florida subsequently developed and implemented programs, policies, and regulations to achieve the objectives of these features. Florida adopted water quality Total Maximum Daily Loads (TMDL) for Lake Okeechobee and the Lake Okeechobee Watershed. The Northern Everglades and Estuaries Protection Program directs development and implementation of basin management action plans (BMAP) to improve water quality. BMAPs provide milestones and management measures necessary to meet the TMDL within a measured period. These state water quality programs meet the intent of water quality improvements originally proposed by CERP Component A. As a result, water quality features are no longer within the Project scope.

E.2 LOCAR Planning Strategy

E.2.1 LOCAR Planning Process

The LOCAR Project Team adhered to Engineering Regulation (ER) 1105-2-100, *Planning Guidance Notebook*, dated April 22, 2000, and the six-step planning process to:

- Define problems, opportunities, objectives, and constraints;

- Inventory the Project Area and forecast the Future With Project (FWP), Future Without Project (FWO), and conditions relevant to analysis;
- Formulate alternative plans;
- Evaluate alternative plans;
- Compare alternative plans; and
- Select a recommended plan.

The Project Team also abided by the *Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies Final Interagency Guidelines* dated December 2014; and *Principles and Requirements for Federal Investments in Water Resources* dated March 2013. This included evaluating alternatives against healthy and resilient ecosystems for sustainable economic development, to identify and manage floodplain impacts, for public safety impacts, for environmental justice opportunities, and to ensure a watershed approach.

The planning process incorporated requirements discussed in ER 1165-2-209, *Studies of Water Resources Development Projects by Non-federal Interests,* dated February 4, 2016, and the Memorandum for Commanding General U.S. Army Corps of Engineers, Subject: *Implementation Guidance for Section 1126 of WRDA 2016 – Study of Water Resources Development Project by Non-federal Interests* (Revised), dated June 21, 2018. These directives specify a Section 203 study must meet the basic requirements of a U.S. Army Corps of Engineers (Corps) feasibility study. ER 1165-2-209 also outlines requirements for ecosystem restoration projects and public involvement that must be met for a Section 203 feasibility study to be acceptable.

The South Florida Water Management District (SFWMD), as the non-federal sponsor for LOCAR, contracted the Corps to coordinate the Project National Environmental Policy Act (NEPA) documentation. This included a public scoping process as required by NEPA regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508). In-person and virtual public scoping meetings were held near the location of the proposed Project and its affected area(s) on Thursday, April 27, 2023, to allow all interested parties to participate in information-gathering and comment on the proposed Project. Meeting materials were also available on the Project website for stakeholders to access after the public meetings. The Public Scoping Report for the North of Lake Okeechobee Storage Reservoir Section 203 Study, Highlands County, Florida, describes the outreach and public involvement activities conducted during that process.

Stakeholders identified issues and concerns during the LOCAR Environmental Impact Statement (EIS) scoping process. The LOCAR Project Team determined how issues and concerns affected the scope of the EIS as related to the planning process and environmental resource considerations. The LOCAR Project Team considered the comments received within the authority of both the Corps and SFWMD in the formulation of alternatives and analysis of environmental consequences.

E.2.2 Purpose and Need

LOCAR's purpose is water detention during wet periods for later release to Lake Okeechobee during dry periods. Increased storage capacity and focused water management operations would reduce the duration and frequency of high and low water level fluctuations in Lake Okeechobee. The water level

fluctuations are stressful to the lake's littoral ecosystems and cause large lake discharges that are damaging to the Caloosahatchee and St. Lucie Estuary (Northern Estuary) ecosystems.

LOCAR is needed because historic and current operations of the Central and Southern Florida (C&SF) Project, including water supply and flood control releases to manage stage levels in Lake Okeechobee, Water Conservation Areas, and Everglades, changed the natural water regime. Prolonged high-volume flows of water from Lake Okeechobee to the Northern Estuaries combined with basin runoff from surrounding watersheds altered the estuaries' natural salinity gradients, in turn altering species diversity, the ecological balance, and health of estuary communities. System changes caused peak flows that are higher prior to and/or following major rain events and abruptly declining flow at wet season's end. The impoundment of the natural system; water drainage canals and conveyance features; and current C&SF Project operations disrupted the annual water elevation rise and fall in the remaining wetlands. Conversion of the remaining system's natural areas to urban and water storage uses resulted in a landscape mosaic of impounded, fragmented, over-inundated, and over-drained marshes.

E.2.3 Problem Statement

One hundred and twenty years of highly effective public and private efforts to drain water in the Project Area have altered the LOCAR Study Area ecosystems (**Figure**) by disrupting the natural timing, quantity, and distribution of flows entering and leaving Lake Okeechobee; diminishing overall water storage; increasing stormwater runoff volumes and rates; altering conditions in estuaries; and reducing the water volume available for the Everglades. These actions crucially affected nationally significant areas. Changes in the quantity, timing, and distribution of fresh water have resulted in atypical salinity fluctuations, causing subaquatic vegetation stress; loss of benthic organisms and habitat; redistribution of salinity sensitive species, including commercially and recreationally important fish; and significantly reducing the spatial area and ecological function of wetlands throughout the system.

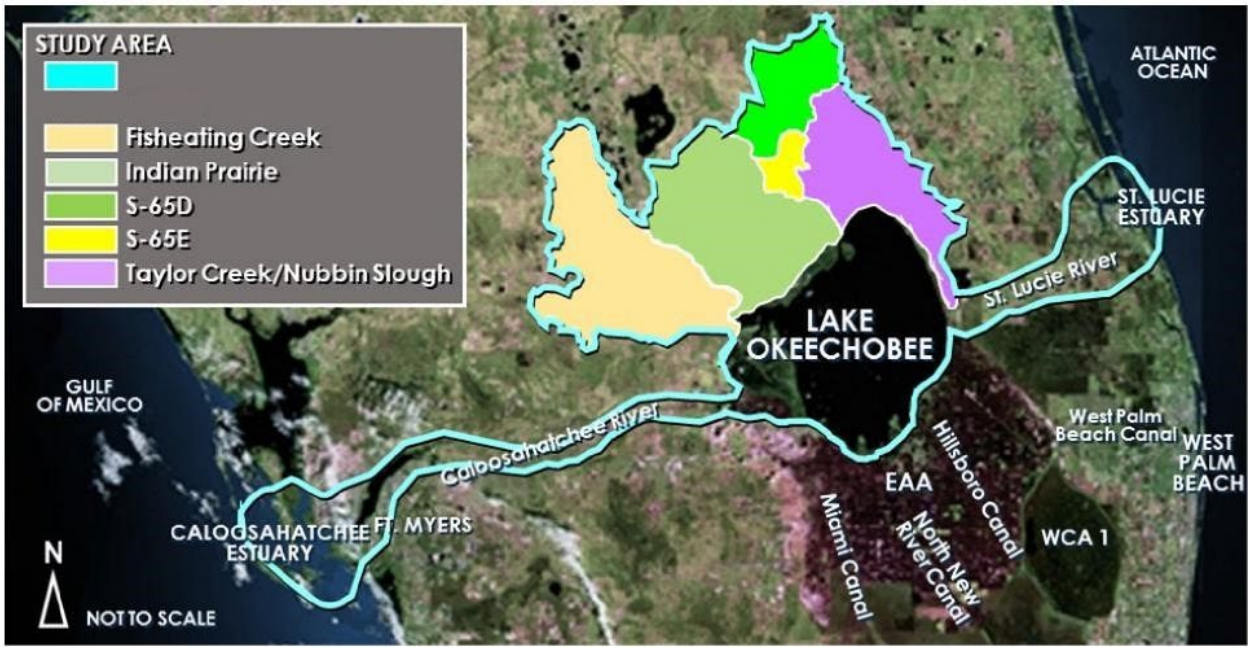

Figure E-1. LOCAR Study Area Map.

E.2.4 LOCAR Objectives, Problems, Opportunities, and Constraints

E.2.4.1 Federal and Sponsor LOCAR Project Objective

Congress's objective as described in WRDA 2000, Section 601(h), paraphrased here and adopted for this Project is: "[t]he overarching objective of the (*Comprehensive Everglades Restoration*) Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection." Within the context of this congressional authority, the Project Team developed LOCAR planning study objectives and goals to support development, evaluation, and selection of a National Ecosystem Restoration (NER) Plan that reasonably and cost effectively maximizes ecosystem restoration benefits.

E.2.4.2 LOCAR Planning Study Goals

As part of the formulation process, it was useful for the Project study team to define goals the LOCAR Project should accomplish when implemented. The team identified the following planning goals for the LOCAR planning study:

- Goal 1: Enhance ecological values in Lake Okeechobee and the Northern Estuaries.
- Goal 2: Enhance economic values and social wellbeing.
- Goal 3: Maintain the rights of the Seminole Tribe of Florida (STOF) under the 1987 Water Rights Compact among the STOF, State of Florida, and SFWMD (Savings Clause [Section 601 (h)(5)(C) of WRDA 2000]).

E.2.4.3 LOCAR Planning Study Objectives

The Project Team identified specific and measurable design and operation objectives to support achieving Project goals, in keeping with CERP, that are integral to aquatic ecosystem recovery and support maintaining water service. The LOCAR Project objectives are:

- Objective 1: Improve quantity, timing, and distribution of flows into Lake Okeechobee to maintain ecologically desired lake stage ranges more often.
- Objective 2: Improve the timing and volumes of freshwater flows from Lake Okeechobee to improve the salinity regime and the quality of habitats for oyster, submerged aquatic vegetation (SAV), and other estuarine communities in the Northern Estuaries.
- Objective 3: Increase water supply available to existing legal water users of Lake Okeechobee commensurate with improving Lake Okeechobee ecology.

E.2.4.4 LOCAR Problems

Lake Okeechobee Watershed

Problem: A loss of wetland habitat has resulted in reduced water storage on the landscape, increased stormwater runoff, and flashier hydroperiods in the Lake Okeechobee Watershed.

Wetlands losses throughout the Study Area altered the central and southern Florida hydrologic, ecological, and biological regimes. Land use conversions and drainage projects have reduced wetland habitat. These changes resulted in less water storage, increased stormwater runoff, flashier hydroperiods in the Lake Okeechobee Watershed, and interrupted hydrologic connectivity. Wetland

ecological functions diminished, and biological communities in the Study Area have shifted and are fragmented.

Lake Okeechobee

Problem: Lake Okeechobee has experienced frequent and prolonged high and low water levels over the past few decades that have been detrimental to both lake ecology and downstream ecosystems.

Landscape alterations have changed the size, depth, connectivity, and hydrologic regimes of Lake Okeechobee, the St. Lucie River and Estuary, the Caloosahatchee River and Estuary, and the Everglades. These changes impact the extent, stability, resilience, water storage, water distribution, water availability, and productivity of the freshwater and estuarine aquatic ecosystems throughout central and southern Florida. The physical changes in the Study Area, including fetch, water quality, turbidity, and sedimentation, have driven biological changes. These changes have altered distribution of native plants and animals, disadvantaged competition and survival of native species, and encouraged establishment of invasive species. It is unlikely the naturally existing ecosystem will recover under current conditions.

Northern Estuaries

Problem: The Northern Estuaries have been subject to watershed runoff and increased freshwater flows from Lake Okeechobee for decades, resulting in successive years of environmental and economic impacts to these regions.

Land use changes and water management in the central and south Florida region impacted the productivity, salinity, and distribution, abundance, and species diversity of biological communities in the Northern Estuaries. The altered hydrologic regime, including volume, timing, and distribution of freshwater flows into the estuaries, causes atypical salinity fluctuations and saltwater intrusion that impacts productivity and survival of native species, species of economic importance, and ecological function.

Water Supply

Problem: Drainage of the watershed and the associated loss in storage have impacted water supply for Lake Okeechobee Service Area water users.

Landscape alteration to prevent flooding and quickly redistribute water in the Study Area has affected water storage and subsurface recharge, and disrupted Lake Okeechobee's water level ranges. The central and south Florida population is forecasted to grow by 20 to 30 percent by 2035, with a commensurate increasing demand for water supply for municipal and industrial purposes as water becomes an increasingly scarce, valuable resource. Agriculture, a significant economic driver in the region, depends upon irrigation to maintain crop yield. Water supply shortages could translate to economic losses, reduced agricultural productivity, and social impacts.

Recreation

Problem: Degradation of the Everglades ecosystem reduces and restricts environmentally based recreation activities.

The State of Florida has one of the most robust tourism industries in the U.S., with up to 59 percent of Florida's visitors and 61 percent of residents participating in nature-based activities and reporting outdoor recreation as very important. Protecting and managing water resources maintains healthy vital ecosystems that are key to a variety of outdoor recreation activities and the substantial contribution those activities make to Florida's economy. The Everglades is a unique ecosystem that is intrinsic to the cultural identity of south Florida. Its healthy recovery to a fully functioning wetland will provide recreation opportunities and other wetlands functions, such as stormwater attenuation, that contribute to Florida's economy and quality of life.

E.2.4.5 LOCAR Opportunities

Lake Okeechobee Watershed

Opportunity: Increase regional water storage.

Increased water storage and its balanced management can achieve hydrology closer to that which might exist without land use conversions and drainage projects in the Study Area, while increasing water supply for agricultural and municipal and industrial uses. Management mimicking natural hydrology to the greatest extent possible supports recovery and maintenance of healthy freshwater and estuarine ecosystems and their functions.

Lake Okeechobee

Opportunity: Stabilization of the Study Area water regime.

Using stored water to manage for a more natural hydrologic regime would improve conditions for plant and animal communities in Lake Okeechobee. Minimizing extreme water level fluctuations and improving wetland inundation patterns will improve Lake Okeechobee abiotic factors, such as sedimentation, littoral zone desiccation, and erosion. A water regime more akin to naturally occurring would create conditions favoring competition of native plant and animal species by supporting subaquatic and emergent vegetation habitats necessary for fish, invertebrates, and plankton.

Northern Estuaries

Opportunity: Establish healthy salinity regimes in the Northern Estuaries.

Managing Lake Okeechobee flow volume, timing, and distribution into the Northern Estuaries could reestablish salinity regimes characteristic of healthy, diverse, and balanced estuarine ecosystems. A more favorable habitat for fish, shellfish, oysters, and SAV would increase productivity and, as an ancillary benefit, may contribute to the regional or national economy.

Water Supply

Opportunity: Increased water supply available to Lake Okeechobee Service Area users.

Water stored and managed for ecosystem restoration could also increase the quantity and reliability of water available for existing, legal Lake Okeechobee Service Area (LOSA) users under certain conditions.

Recreation

Opportunity: Improve recreation and related economic opportunities.

The storage reservoir could create a new recreation destination for residents. Aquatic ecosystem restoration increases the quantity and diversity of habitat and may enhance ecotourism, birdwatching, camping, hunting, fishing, boating, and other outdoor recreation opportunities.

E.2.4.6 LOCAR Constraints

Constraints are restrictions than an alternative plan should avoid. They guide data gathering, identify solutions, and gauge a plan's potential success. LOCAR constraints are:

- Compliance with all applicable federal, state, and local laws, regulations, and policies.
- Maintain navigability to, from, and within Lake Okeechobee and the Lake Okeechobee Watershed.
- Maintain and protect current water supply service levels for existing legal users located in the Study Area in keeping with the Savings Clause (WRDA 2000, Section 601 (h)(5)(A)).
- Maintain flood protection levels of service for agricultural and urban lands in keeping with the Savings Clause (WRDA 2000, Section 601 (h)(5)(B)).

E.2.5 LOCAR Future Without Project Condition

The FWO are the conditions expected to exist during the period of analysis assuming the proposed Project is not implemented. The FWO is the base from which alternative plans are developed and point of comparison to assess impacts and benefits of alternative plans. The LOCAR FWO assumes current physical conditions in the Study Area would remain agricultural with some socioeconomic changes related to Florida's forecasted population growth (reference **Section 2.0**). FWO water-related assumptions are described in **Table** .

Table E-1. LOCAR Future Without Project Conditions.

Feature or Related Projects/Plans	Future Without Project Assumptions
LOCAR	Would not be constructed
Lake Okeechobee Operations	Lake Okeechobee Regulation Schedule per CEPP/EAA
Herbert Hoover Dike	Complete with features operational
Kissimmee River Restoration	Complete with operations implemented
Indian River Lagoon	Ten Mile Creek Reservoir and stormwater treatment area: 1,001 acres with 3.6-foot operating depth
C-43 West Basin Storage Reservoir	Complete with features operational
CEPP Authorization	370,000 acre-feet represents the increase in the quantity of freshwater flowing into the historic Everglades flow path on an average annual basis with the authorized CEPP EAA project
Natural Resources Conservation Service wetland	All current projects complete; future acreage not projected

Feature or Related Projects/Plans	Future Without Project Assumptions
restoration projects and wetland reserve programs (currently partially operational within Project footprint)	
U.S. Fish and Wildlife Service Refuge project (not currently constructed)	Complete
Florida Department of Protection Basin Management Action Plans (currently partially operational)	Complete
2008 Lake Okeechobee Regulation Schedule with CEPP refinements	Lake Okeechobee System Operating Manual and CEPP refinements

CEPP–Central Everglades Planning Project; EAA–Everglades Agricultural Area; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study

Existing conditions are planning area resources, including the social setting, social circumstances, and other relevant factors, in the Study Area (

). These are quantified and qualified when formulation begins. Existing conditions inform the No Action Alternative.

Table E-2. LOCAR Existing Conditions.

Feature or Related Projects/Plans	Existing Baseline Conditions
Lake Okeechobee Operations	Lake Okeechobee System Operating Manual
Herbert Hoover Dike	Complete with features operational
Kissimmee River Restoration	Complete with operations implemented
Indian River Lagoon	C-44 operational at the time of LOCAR analysis
C-43 West Basin Storage Reservoir	Under construction, but not operational at the time of LOCAR analysis
CEPP Authorization	A-2 STA and A-1 Flow Equalization Basin. The A-2 STA is assumed as operational under grow-in conditions only. As of 2023, the South Florida Water Management District does not have 404/408 permits or an approved federal Water Control Plan (supported by NEPA) for flow-through operations.
Natural Resource Conservation Service wetland restoration projects and wetland reserve programs	Includes features operational at the time of LOCAR analysis
Florida Department of Protection Basin Management Action Plans (currently partially operational)	Includes features operational at the time of LOCAR analysis
2008 Lake Okeechobee Regulation Schedule with Central Everglades Planning Project refinements	As implemented at the time of analysis

LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; STA–stormwater treatment area

E.3 Plan Formulation Screening

This plan formulation appendix serves as supplemental supporting information to **Section 3.0** of the main report. It details the formulation of alternatives evaluated during the LOCAR formulation process.

LOCAR plan formulation builds on formulation of previous planning studies, including the Lake Okeechobee Watershed Restoration Project (LOWRP) described in the *Lake Okeechobee Watershed Restoration Project, Third Revised Draft Integrated Project Implementation Report and Supplemental Environmental Impact Statement* dated June 2022 (LOWRP PIR and EIS). LOWRP is currently being re-formulated due to aquifer storage and recovery well concerns.

LOCAR plan formulation, siting, and analysis of aboveground storage adopted LOWRP's formulation, analysis stakeholder concerns (i.e., deepwater storage dam breach potential and aquifer storage recovery wells), management measures, and findings as a starting point. Other LOWRP features (i.e., aquifer storage and recovery wells, wetland attenuation, deep injection wells, and dispersed water management) are not part of LOCAR. These features may be discussed in the context of LOWRP plan formulation but are not part of LOCAR and will not be included in a LOCAR recommended plan.

Stakeholder feedback solicited during the April 2023 LOCAR scoping process and public meetings confirmed aboveground storage features located in the vicinity of K-42 north of Canal 41A (C-41A) (**Figure**) were not a significant concern to the public.

E.3.1 Summary of LOWRP Formulation Adopted for LOCAR

The LOWRP's plan formulation presented here is applicable to aboveground storage reservoirs. LOWRP formulation is iterative, with each subsequent screening involving more analysis and greater resolution. This section discusses unincorporated LOWRP features to fully describe the formulation process. LOCAR does not incorporate other features considered in the LOWRP.

E.3.1.1 LOWRP Level 1 Screening

Level 1 screening criteria was conceptual, and used existing information and best professional judgment to determine if a water storage management measure would meet Corps Principles and Guidelines (P&G) criteria (**Table E-3**).

Table E-3. LOWRP Initial Screening Criteria.

LOWRP Initial Screening Criteria	
Effective	Contributes to meeting the project's goals and objectives and does not violate project constraints
Efficient	Cost efficiently meets project goals and objectives relative to other measures and features
Environmental Effects	Avoids or minimizes negative environmental impacts
Technical Uncertainty	Construction and operation have an acceptable level of uncertainty or risk

LOWRP–Lake Okeechobee Watershed Restoration Project

LOCAR does not consider dredging Lake Okeechobee, deep injection wells, and dispersed water management. These features were screened from consideration because they did not contribute to the goals and objectives of the proposed Project, were not cost effective, or posed unacceptable technical risk. Aboveground reservoirs, wetland attenuation features, and aquifer storage and recovery wells were retained for further analysis in LOWRP (**Table E-4**).

Table E-4. LOWRP Level 1 Screening, Corps Principles and Guidelines Criteria.

Water Storage Management Measure	LOWRP Screening Results	Principles and Guidelines Screening Criteria	Retained for LOCAR
Dredge Lake Okeechobee	Eliminated	Ineffective, Inefficient	No
Aboveground Reservoir	Retained	Effective, efficient, minimal environmental effects, acceptable uncertainty	Yes
Wetland Attenuation	Retained	Effective, efficient, minimal environmental	No

Water Storage Management Measure	LOWRP Screening Results	Principles and Guidelines Screening Criteria	Retained for LOCAR
Feature		effects, acceptable uncertainty	
ASR Wells	Retained	Effective, efficient, minimal environmental effects, acceptable uncertainty	No
Deep Injection Wells	Eliminated	Technical uncertainty	No
Dispersed Water Management	Eliminated	Ineffective	No

ASR–aquifer storage and recovery; Corps–U.S. Army Corps of Engineers; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; LOWRP–Lake Okeechobee Watershed Restoration Project

E.3.1.2 LOWRP Level 2 Screening

The second level of evaluation focused on placement and scale of aboveground storage measures to improve overall efficiency and effectiveness.

Deepwater reservoir screening criteria:

- **Reliable water source:** Proper function of an aboveground deep reservoir requires adequate and consistent water supply availability, accessibility, and reliability sufficient to maintain healthy lake stage levels in average and dry periods. Reservoir locations likely to have a dependable water supply and that could connect with Lake Okeechobee and the Kissimmee River, and its pools were assessed.
- **Water storage costs in dollars per acre-foot:** Parametric, "order of magnitude" cost estimates using site specifics, such as existing infrastructure and soil conditions, and reservoir specifics, such as depths, were developed. This information was used to compare relative costs of aboveground storage measures.

Other considerations:

- **Public land ownership:** Public land ownership was not used to screen features but was considered to the extent practicable to avoid displacing people, minimize local tax roll impacts, avoid eminent domain, reduce real estate acquisition costs and timelines, and reduce risk and uncertainty.
- **Dam safety:** Dam safety risks were acknowledged in Level 2 screening, but not used to screen aboveground storage features. Dam safety risks were used to screen aboveground storage locations in subsequent investigation.

Level 2 analysis consisted of four steps:

1. Sensitivity runs of various reservoir sizes and ranges.
2. Siting aboveground storage features to improve and optimize the storage feature's ability to achieve LOWRP's restoration objectives.
3. Combining features to achieve synergy and enhance delivering Project objectives.
4. Iterative water storage analysis to compare components more extensively than in Level 1 for their ability to meet restoration objectives.

E.3.1.3 Reservoir Siting

The LOWRP Project Development Team (PDT) analyzed the spatial relationships between reservoir placement sites and achieving an optimal volume of storage to accomplish restoration objectives. The PDT focused reservoir siting on areas where basin runoff would be adequate to fill the reservoir. It also screened for site-specific constraints, such as incompatible land uses, infrastructure limitations, real estate considerations, and existing water conveyance features.

Figure E-2 illustrates the locations of the 15 potential sites for deep aboveground storage initially screened for the LOWRP (Corps 2022).

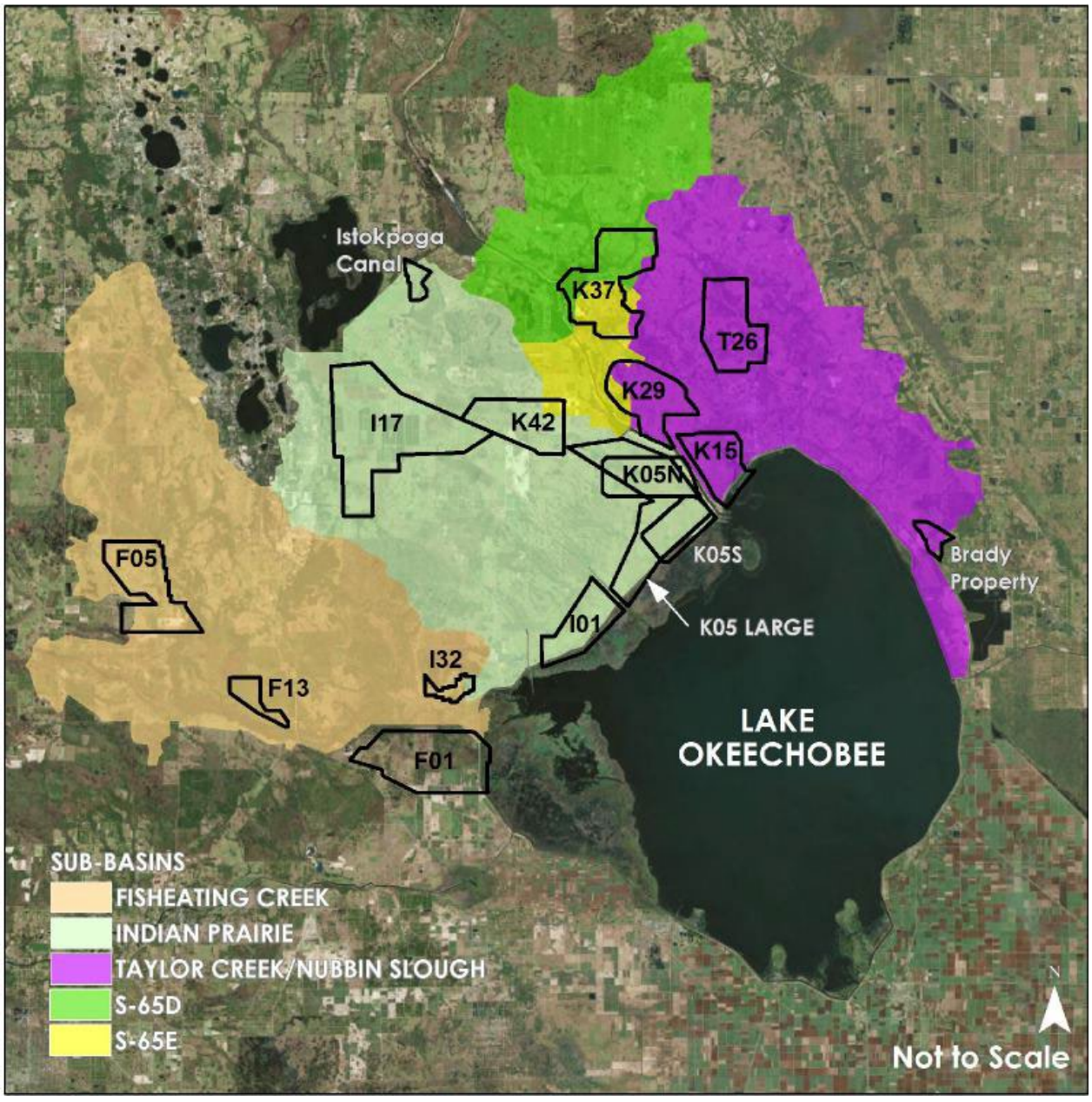

Figure E-2. Deep reservoir sites considered during LOWRP screening.

The PDT analyzed and screened out options in the Fisheating Creek Basin, but moved forward with sites in the Indian Prairie Basin, along the lower portions of the Kissimmee River (Structure 65D [S-65D] and Structure 65E [S-65E]) and in the Taylor Creek/Nubbin Slough Basin. Istokpoga Canal, K-37, T-26, I-17, K-29, K-15, F-05, F-13, I-32, and F-01 were screened out in LOWRP planning due to unreliable water sources and a comparatively expensive cost per acre-foot for storage. Colocation of other Project features was also used for LOWRP screening but is minimized in this discussion because colocation is not germane to LOCAR plan formulation.

Reservoir Sizing and Ranges

The Reservoir Sizing and Operations Screening (RESOPS) model was used to quickly assess various storage configurations and scenarios to identify those feasible for further in-depth analysis. The model identified Lake Okeechobee and Northern Estuaries environmental performance response to a broad range of storage volumes. **Figure E-3** shows that the number of high flow exceedances from Lake Okeechobee reduces linearly for St. Lucie Estuary and almost linearly for the Caloosahatchee Estuary. This linear relationship correlates increasing reservoir storage up to 350,000 ac-ft with increasing environmental benefits. The maximum reservoir storage considered in the sensitivity runs was 350,000 ac-ft. Three hundred and fifty thousand ac-ft substantially exceeds LOCAR's 200,000-ac-ft reservoir capacity.

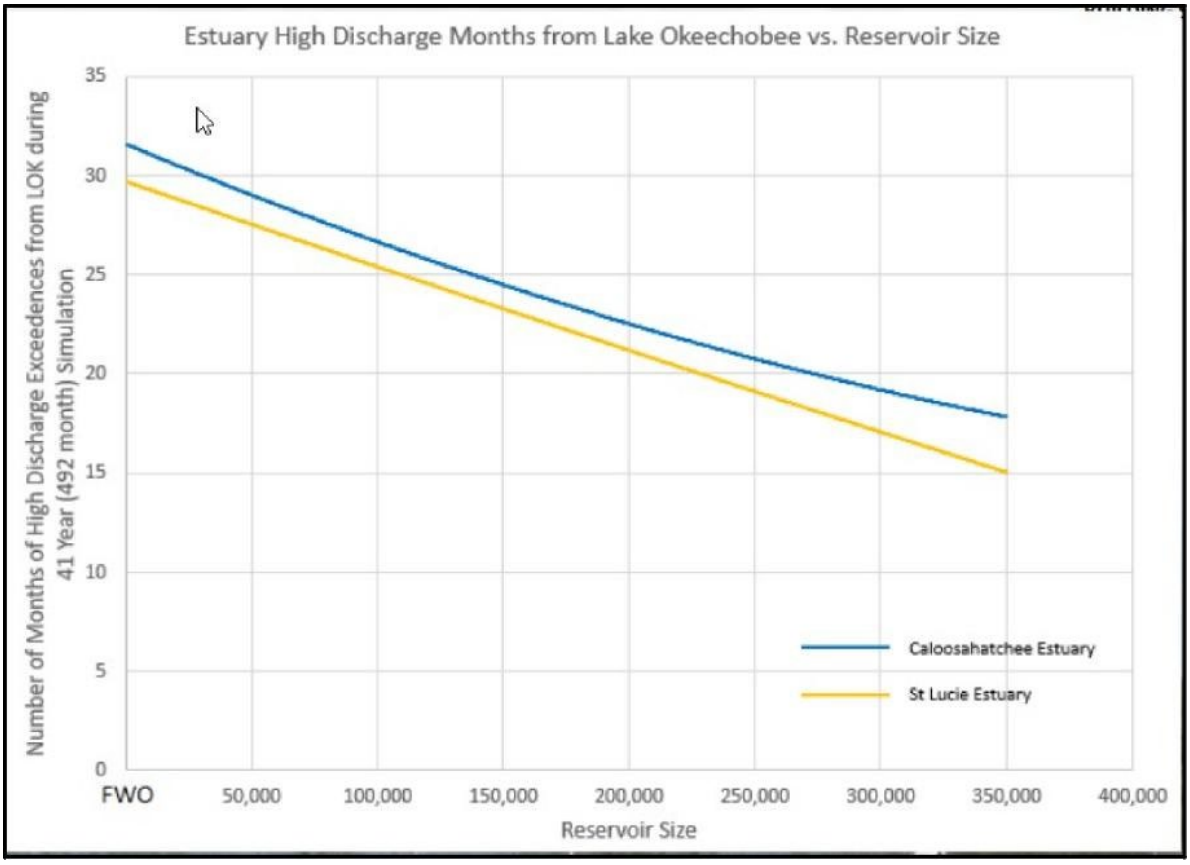

Figure E-3. Reservoir configuration and environmental performance correlation.

E.3.1.4 LOWRP Level 3 Screening

LOWRP Level 3 screening focused on combining an aboveground storage reservoir with wetlands attenuation features, reservoir assisted and watershed aquifer storage and recovery wells, and wetlands restoration sites. Level 3 screening criteria included:

- **Dam safety:** Concerns about dam safety, potential breaches, and possible downstream impacts were significant public concerns.
- **Water storage costs**: Costs were evaluated in dollars per acre-foot.
- **Private land ownership**: Reservoir siting considered private landowners' willingness to sell.

The PDT carried forward five deep reservoirs (i.e., K-05 Large, K-05 North, K-05 South, I-01, and K-42) (**Figure E-2**) for initial modeling, preliminary cost estimates, and habitat unit calculations. K-05, K-05 North, K-05 South, and I-01 were screened from further evaluation for deep storage based on the preliminary analyses and dam safety concerns to downstream communities. The K-42 deep reservoir, with approximately 195,000 ac-ft of storage, was retained for further analysis.

The Level 3 assessment also assessed shallow reservoirs at K-05, K-05 North, K-05 South, and K-42. All shallow reservoirs were screened due to inadequate storage without co-located features, high cost per ac-ft of storage, or reduced efficiency because of operational needs.

Public coordination of the LOWRP Recommended Plan and alternatives array identified serious public concerns with aquifer storage and recovery wells. In response to these concerns, the SFWMD and Corps agreed storage and recovery wells would move forward in a parallel phased design and construction, allowing technical uncertainties and stakeholder concerns to be addressed. Aboveground storage would be pursued independently under LOCAR.

E.3.1.5 Summary of Supporting Studies

LOCAR plan formulation was informed by a 2012 proposed Highlands Ethanol, LLC, facility located north of C-41A near the site of the K-42 reservoir alternative. Supporting studies included geotechnical borings and a biological assessment submitted to the U.S. Fish and Wildlife Service (USFWS). The USFWS' Biological Opinion (BO) concurred with Corps' determination of "may affect, but not likely to adversely affect" for the Florida panther (*Puma concolor coryi*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), and eastern indigo snake (*Drymarchon couperi*). The BO focused on the effects to the Audubon's crested caracara (*Caracara plancus*) (USFWS 2012).

E.4 LOCAR Formulation

LOCAR focuses on aboveground storage features that capture and hold normal and peak flows for release into Lake Okeechobee and the Northern Estuaries as needed for environmental performance. LOWRP analysis determined deepwater reservoirs are sufficiently operationally flexible to improve the timing and distribution of water to the natural system and identified where deepwater aboveground storage could be located within the Project Area. This is the starting point for LOCAR plan formulation.

E.4.1 LOCAR Planning Study Objectives

LOCAR aboveground storage alternatives were formulated, evaluated, and justified based on their ability to achieve LOCAR goals and objectives. The LOCAR Federal and Sponsor Project Objective, LOCAR

Planning Study Goals, and LOCAR Planning Study Objectives are described earlier in this appendix (**Section E.1**).

E.4.2 LOCAR Aboveground Storage Siting Considerations

E.4.2.1 Project Area

Deepwater aboveground storage siting focused on the area surrounding K-42 (**Figure E-2**). The LOWRP plan formulation and analysis identified Canal 42 (C-42) area as most suitable for deepwater aboveground storage using P&G criteria, access to a reliable water source, water storage cost per acre-foot, physical characteristics, size, dam safety, and private land ownership.

The LOCAR Project Team identified characteristics influencing where a reservoir could be located to minimize or prevent negative impacts, as discussed in the following subsections.

E.4.2.2 Water Conveyance

Maintaining and managing water levels within the Lake Okeechobee stage envelope and ensuring flows to the Northern Estuaries require water conveyance to and from Lake Okeechobee. Reservoir locations upstream of S-65E allows a connection to C-41A. Locations connecting or adjacent to C-41A allow for pumping to and from the canal. Areas connecting and adjacent to C-41A were considered because they allow water diversion to and from Lake Okeechobee.

E.4.2.3 Lake Istokpoga Connectivity

The Lake Istokpoga Regulation Schedule was identified as a CERP Other Project Element. The intent of the feature was to enhance fish and wildlife benefits when a reduction in Lake Istokpoga's annual water fluctuation reduced quality habitat (Corps 1999). At this time, Lake Istokpoga water levels remain relatively stable and performance metrics to quantify habitat conditions have not been defined. Developing performance metrics and a new regulation schedule for Lake Istokpoga is outside the LOCAR Feasibility Study scope. Therefore, measures increasing operational flexibility by connecting reservoir alternatives with Lake Istokpoga via the Istokpoga Canal were not carried forward.

E.4.2.4 Interdependency with CERP components

LOCAR was formulated as standalone features capable of providing benefits through independent operations and as CERP features that should function interdependently with other CERP features to enhance overall Project performance.

E.4.2.5 Infrastructure and Landscape Features

The Project Area was defined to avoid existing infrastructure and landscape features. Reservoir siting opportunities were evaluated within a preliminary Project Area bounded by the C-38/Kissimmee River to the east, County Road 621 to the west, C-41A to the south, and Istokpoga Canal and CSX Railroad to the north.

E.4.2.6 Tribal Lands

Miccosukee Tribe of Indians of Florida (MTI) and STOF Tribal lands are in the Study Area and its vicinity. Tribal land locations and potential effects and benefits were considered in Project siting and configuration.

E.4.2.7 Private Property

The presence of privately owned land was not a reservoir siting constraint. However, public scoping response highlighted concerns about private property ownership in the project vicinity. Residential areas in the southeast corner of the preliminary Project Area were avoided, narrowing the location of potential sites for LOCAR.

E.4.2.8 Operational Flexibility

Potential reservoir footprints were designed to maximize water management options in terms of release schedule and capturing water to maintain the reservoir's elevation.

E.4.2.9 Minimize Risk

Potential reservoir footprints were designed to minimize wave overtopping within the reservoir and minimize dam breach effects.

E.4.2.10 Lessons Learned

Effects of C-43 West Basin and Everglades Agricultural Area reservoirs were considered in planning and designing alternatives.

E.4.2.11 Cultural and Historic Resources

Field surveys were performed to identify cultural and historic resources. Reservoir footprints were drawn to exclude Project Areas where there is a possibility of cultural or historic resources based on surveys completed by the SFWMD. The final LOCAR footprint will be surveyed to ensure impacts to cultural and historic resources are minimized.

E.5 Alternatives Array Carried Forward

Figure , **Figure ,** and **Figure** illustrate the initial conceptual reservoir designs for Alternatives 1, 2, and 3. The alternatives varied by depth and operational flexibility. All alternatives were designed to store 200,000 ac-ft of water from Lake Okeechobee. **Table** describes reservoir features.

E.5.1 Alternative 1

Alternative 1 includes a 200,000-ac-ft aboveground storage reservoir along the north side of C-41A (**Figure**). The reservoir and its external features, including its perimeter canal and perimeter maintenance road, encompass approximately 12,800 ac. At its Normal Full Storage Level (NFSL) of 50.60 feet (ft) North American Vertical Datum, the reservoir would have an average storage depth of approximately 17 ft within each of two storage cells. The reservoir's major components include a perimeter dam and interior divider dam that form its two storage cells, a gated water control structure within the divider dam, an inflow pump station, a seepage return pump station, two gated outflow culverts, a perimeter canal (for the collection and conveyance of seepage and stormwater flows), an inflow-outflow canal, an outflow canal, and two ungated overflow spillways.

Construction. The reservoir would be constructed with a perimeter dam and an interior divider dam having average heights of approximately 33 ft above the ground. The perimeter dam would be approximately 18 miles (mi) around, allowing for recreational opportunities. Material from the Project footprint and the surrounding perimeter canal would be used to construct the dams. A gated outflow culvert would be constructed on the west side of the reservoir to discharge water into C-41A upstream

of Structure 83 (S-83), while another gated culvert would be constructed near the southeast side of the reservoir to discharge water into C-41A downstream of S-83.

An interior divider would split the reservoir's two storage cells (i.e., east and west) to reduce wave runup. The interior divider dam would include a 1,500-cubic-foot-per-second (cfs), gated water-control structure to allow for controlled conveyance of water between the two cells. Each cell would include an ungated overflow spillway designed to discharge into C-41A.

A perimeter canal would be constructed outside the perimeter dam of the reservoir. Seepage from the reservoir would collect in the canal and be returned to the reservoir via a seepage pump station. If the seepage pump station is not operational, the seepage collected in the canal would eventually overflow by gravity into the C-41A via overflow weir structures.

Operations. Two pump stations would be used to fill the reservoir at a maximum design rate of 1,500 cfs. One pump station would be located at Structure 84 (S-84) and move water from the downstream side of S-84 to the upstream side of S-84. The second pump station would be located between the reservoir and C-41A, and pump water from C-41A via the reservoir inflow-outflow canal into the reservoir. Water would be conveyed to the reservoir in one of two ways: (1) full or partial diversion of flow in C-41A, downstream of S-83, into the reservoir; or (2) back-pumping water from Lake Okeechobee by operating both pumps concurrently. The location of two reservoir outflow culverts allows water to be released from the reservoir into the C-41A, upstream and/or downstream of S-83, to convey water to the Indian Prairie Sub-basin, via C-41A, C-41, C-39A, C-40, and/or C-38 as well as to Lake Okeechobee.

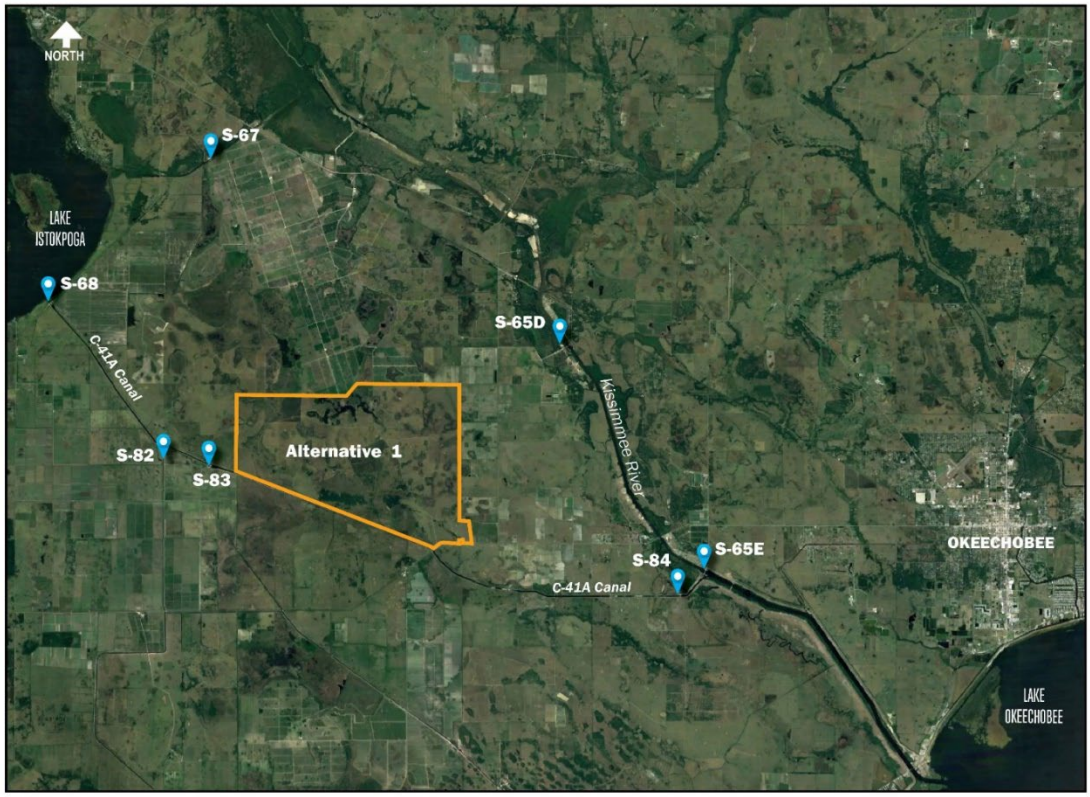

Figure E-4. LOCAR Alternative 1.

In the course of project development, Alternative 1 underwent strategic modifications in order to mitigate impacts on an environmentally sensitive upland area. This refinement included a reduced footprint in an effort to align with environmental considerations. These modifications would not result in any additional effects associated with the construction or operations of LOCAR. The refined Alternative 1 includes a 200,000 ac-ft aboveground storage reservoir along the north side of Canal 41A (C-41A), an. The reservoir and its external features, including its perimeter canal and perimeter maintenance road, would encompass an area of approximately 12,316 ac. The total area of the reservoir, bounded by the centerline of the perimeter dam, is approximately 11,352 ac (17.74 square miles [mi^2]), which includes approximately 6,561 ac (10.25 mi^2) for the east cell and 4,791 ac (7.49 mi^2) for the west cell. At its Normal Full Storage Level (NFSL) of 51.70 ft North American Vertical Datum (NAVD88), the reservoir would have an average storage depth of approximately 18 ft within each of its two storage cells since the average ground surface elevation within the storage cells is about 33.9 ft NAVD88. **Section 6.1.1.** provides further detailed information on the modifications associated with Alternative 1.

E.5.2 Alternative 2

Alternative 2 has a capacity, structures, and operations like Alternative 1, but covers a larger area, allowing for a shallower storage depth. Alternative 2 includes two reservoirs connected by a canal (**Figure**). The southern includes east and west cells in the same configuration and location as Alternative 1. The northern reservoir would be located south of the Istokpoga Canal at U.S. Highway 98 with an overflow spillway into the Istokpoga Canal. The two reservoirs would have a combined storage capacity of 200,000 ac-ft, covering a total area of approximately 20,400 ac. Each reservoir's average storage depth is 11 ft at its NFSL.

Construction. Each of the two reservoirs would be constructed with a perimeter dam having an average height of approximately 27 ft above the ground. The total length of the perimeter dams for both reservoirs would be approximately 30 mi, allowing for recreational opportunities. Material from the Project footprint, connector canal, and the surrounding perimeter canal would be used to construct the dams.

Two pump stations would be constructed similar to Alternative 1. A third pump station would also be constructed to pump water through a connector canal from the southern reservoir to the northern reservoir.

The southern reservoir would be constructed like Alternative 1 with two storage cells (i.e., east and west) split by an interior divider dam to reduce wave runup. The interior divider dam would include a 1,500-cfs, gated water-control structure for controlled conveyance of water between the two cells. Each cell would include an ungated overflow spillway into C-41A. The second reservoir would be constructed to the north, as illustrated in **Figure** .

A perimeter canal would also be constructed outside the perimeter dam of each reservoir. Seepage from each reservoir would collect in the canal and be returned to the reservoirs via seepage pump stations. If the seepage pump stations were not operational, the seepage collected in the canals would eventually overflow by gravity into the C-41A via overflow weir structures.

Operations. Operations would be similar to Alternative 1 with the following difference. In addition to the features in Alternative 1, a third pump station would pump water through a connector canal from the southern to northern reservoir to utilize the full storage capacity.

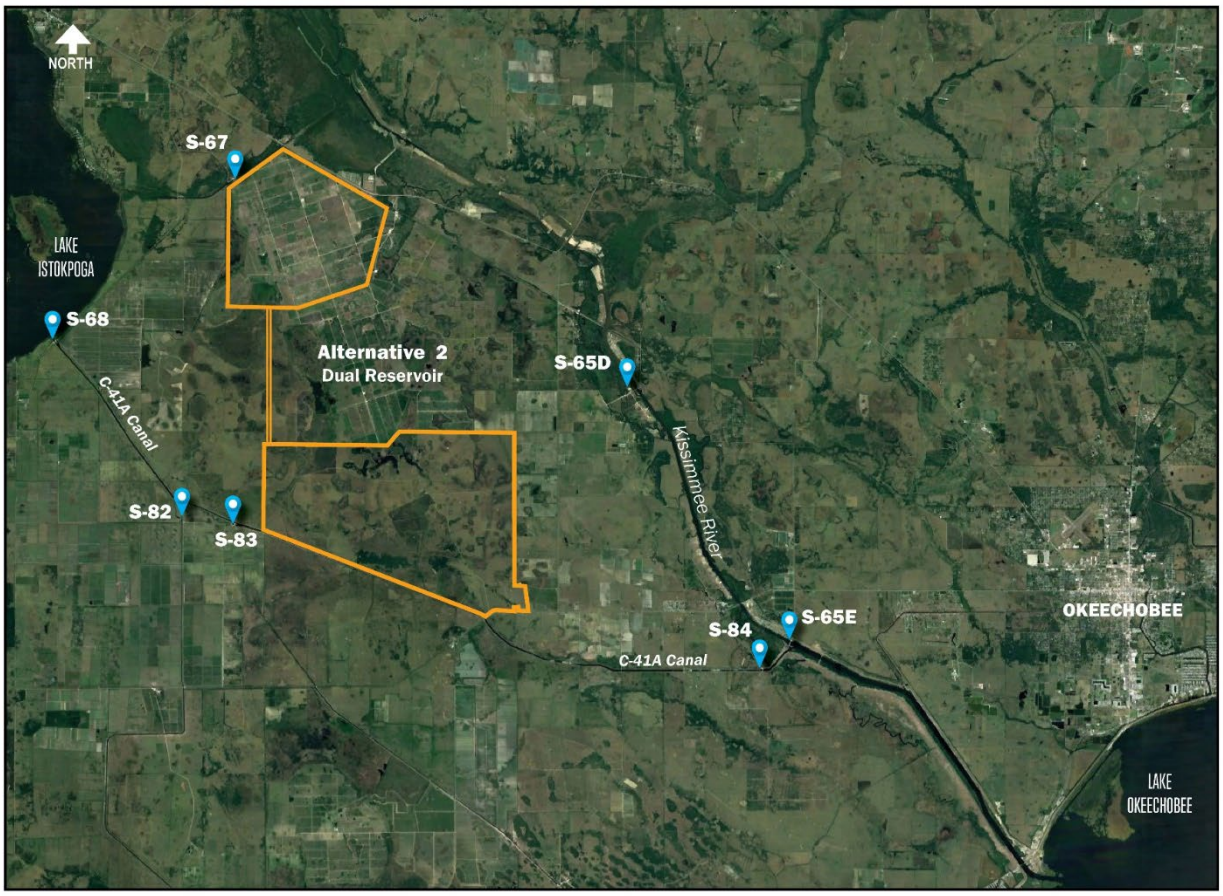

Figure E-5. LOCAR Alternative 2.

E.5.3 Alternative 3

Alternative 3 has capacity and operations similar to Alternative 1, but is configured north to south between the Istokpoga Canal and C-41A (**Figure**). The reservoir would include an interior divider dam with a 1,500-cfs, gated water-control structure and a 1,500-cfs pump station used to move water from the southern cell into the northern cell. A seepage canal would be constructed outside the perimeter dam.

Construction. The reservoir would be constructed with a perimeter dam having an average height of approximately 32 ft above the ground. The interior divider dam would have an average height of approximately 36 ft above the ground. The perimeter dam would be approximately 23 mi around, allowing for recreational opportunities. Three pump stations would be constructed and material from the Project footprint and connector canal, and the surrounding perimeter canal would be used to construct the dams.

Operations. Reservoir operations would be similar to Alternative 1, bringing water into and releasing water from the reservoir from/to C-41A. Unlike Alternative 2, this proposed configuration does not

include a connector canal requiring pumping of water within the canal to utilize the full capacity of the reservoir.

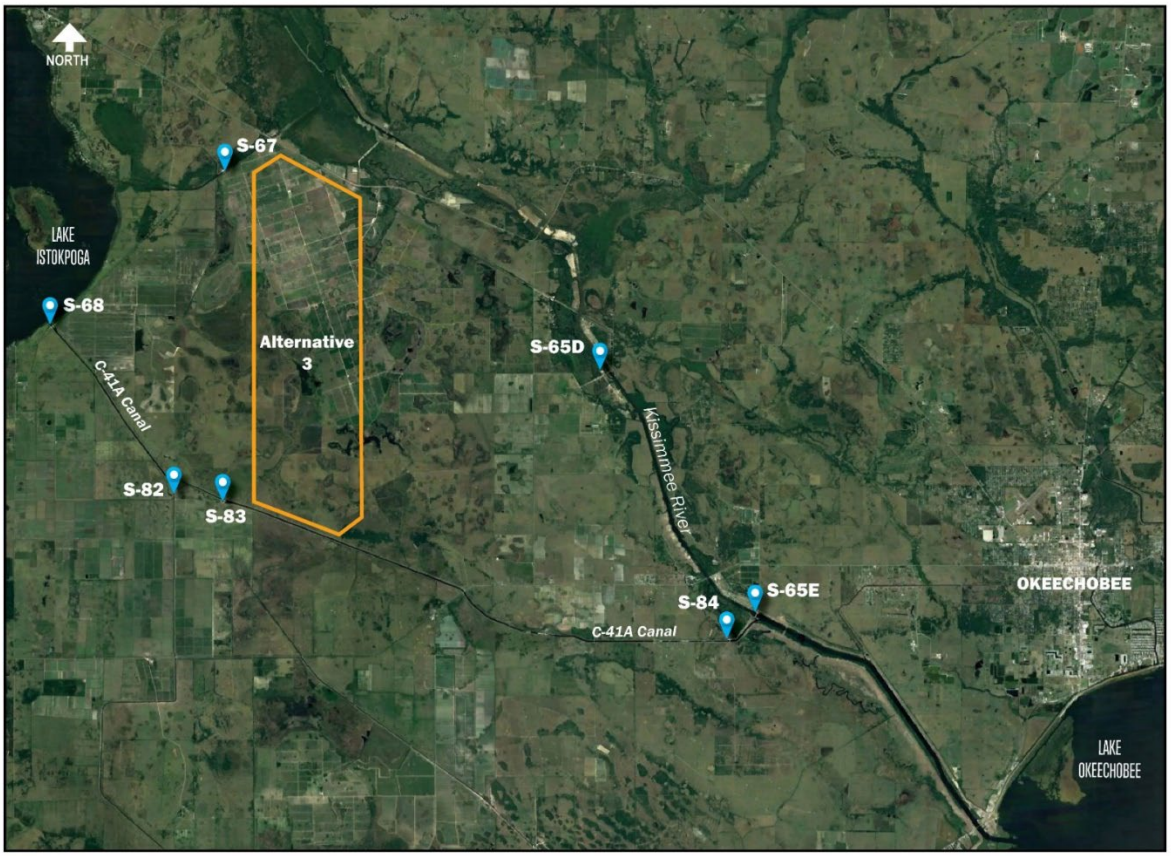

Figure E-6. LOCAR Alternative 3.

Table E-5. Alternatives' Physical and Operations Features.

Physical Feature	Alternative 1	Alternative 2	Alternative 3
Water storage capacity (ac-ft)	200,000	200,000	200,000
Land area of reservoir site (ac)	12,800	20,400	14,900
Average storage depth (ft)	17	11	15
Perimeter/interior dam height (ft)	33	27	32/36
Perimeter dam length (mi)	18	30	23
Operational Features			
Number of reservoir inflow pump stations (total number)	2	3	3
Total reservoir inflow capacity (cfs)	1,500	1,500	1,500
Total reservoir outflow capacity (cfs)	3,000	3,000	3,000

*Note: Quantities for water-storage capacity, depth, and land area are approximate and based on normal full storage levels determined for the planning level design of the alternative.
ac–acre; ac-ft–acre-foot; cfs–cubic foot per second; ft–foot; mi–mile

All alternatives' operations would be similar, allowing for a combination of methods to divert water from and to Lake Okeechobee. Water would be conveyed to a reservoir in one of two ways: (1) full or partial diversion of flow in C-41A downstream of S-83, or (2) back-pumping water from Lake Okeechobee via pumping from C-41A downstream of S-84 into C-41A between S-83 and S-84. Water

would be returned to Lake Okeechobee by discharging from the reservoir to C-41A upstream and/or downstream of S-83. The location of the reservoir outflow culverts would allow for water to be conveyed south to provide opportunities for storage in surrounding canals (e.g., C-41A, C-41, C-40, and C-39A).

E.6 Alternatives Array Comparison

E.6.1 LOCAR Screening

E.6.1.1 Principles and Guidelines Criteria

The Corps P&G embody the intent of the federal objective for any water resources project to contribute to the national good. LOCAR, as an aquatic ecosystem restoration project, should also eliminate or avoid damage to the environment and increase the quantity or quality of ecosystem resources. The P&G criteria are analytical touchstones to confirm a plan is reasonable, appears to maximize national benefits, reflects sound judgment, and demonstrates systematic and comprehensive watershed resource treatment.

The P&G criteria are:

- **Effectiveness:** Extent to which an alternative plan contributes to achieving the planning objectives, alleviates specified problems, and achieves specified opportunities;
- **Acceptability:** Workability and viability of the alternative plan with respect to acceptance by state and local entities and the public and the extent to which the alternative plans are acceptable in terms of existing laws, regulations, and public policies;
- **Completeness:** Extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planning objectives and planned effects; and
- **Efficiency:** Extent to which an alternative plan is the most cost-effective means of achieving the objective, alleviating specified problems, and realizing specified opportunities.

Each of the LOCAR alternatives satisfies the Corps P&G.

Effectiveness

All LOCAR alternatives were determined to be effective in meeting planning objectives with minimal differences in their performance.

Objective 1: Improve Quantity, Timing, and Distribution of Flows into Lake Okeechobee to Maintain Ecologically Desired Lake Stage Ranges More Often.

Table E-6. Corps' Principles and Guidelines Evaluation, Effectiveness, Objective 1.

Corps Principles and Guideline Evaluation			
Effectiveness: Extent to which an alternative plan contributes to achieving the planning objectives, alleviates specified problems, and achieves specified opportunities.			
Objective 1: Improve Quantity, Timing, and Distribution of Flows into Lake Okeechobee to Maintain Ecologically Desired Lake Stage Ranges More Often.			
Performance Metric: Percentage of time above, within, and below Lake Okeechobee stage envelope.			
Lake Okeechobee Stage Levels (NVGD29)	**Alternative 1**	**Alternative 2**	**Alternative 3**
% Time inside Ecologically Preferred Stage Envelope (Seasonally Variable 11.5–15.5 ft)	28%	28%	28%
% Time above Stage Envelope (Seasonally Variable >12.5–15.5 ft)	41%	41%	41%
% Time below Stage Envelope (Seasonally Variable <11.5–14.5 ft)	31%	31%	31%
% Time above Extreme High Stage (>17 ft)	0.6%	0.6%	0.6%
% Time above Moderate High Stage (>16 ft)	5.8%	5.8%	5.8%
% Time below Moderate Low Stage (<11 ft)	10.3%	10.1%	10.3%
% Time below Extreme Low Stage (<10 ft)	4.1%	4.0%	4.1%
Lake Okeechobee Weighted Index Score	73.1	73.4	72.8
Lake Okeechobee Navigation Stage			
% Time below Navigational Minimum Stage (<12.56 ft)	30.1%	29.6%	30.2%

Corps–U.S. Army Corps of Engineers; ft–foot; NVGD29–National Vertical Geodetic Datum of 1929

Summary:

All alternatives improve the lake stage durations within the Lake Okeechobee ecological envelope and reduce the frequency and duration of high stage exceedances.

All alternatives effectively moderate or stabilize lake levels without comparative increases in low-stage events, demonstrating the utility of watershed storage.

Ecological scores (i.e., Lake Okeechobee Weighted Index Score) for all alternatives are comparable, showing approximately 12 percent performance improvement compared to the FWO.

LOCAR alternatives maintain Lake Okeechobee navigation stage above 12.56 ft between 69.8 and 70.4 percent of the time. This data demonstrates navigability to, from, and within Lake Okeechobee and the Lake Okeechobee Watershed will be maintained in keeping with the LOCAR planning study constraint.

Objective 2: Improve Timing and Volume of Freshwater Flows from Lake Okeechobee to Improve the Salinity Regime and the Quality of Oyster, SAV, and Other Estuarine Community Habitats in the Northern Estuaries

Table E-7 and **Table E-8**).

Summary:

There are marginal differences in alternatives' performance for high and damaging flows from lake releases to the Northern Estuaries.

High and damaging flows to the Northern Estuaries attributable to Lake Okeechobee regulatory releases improve.

Despite reservoir water storage and water management, the number of stressful and damaging flows to the Northern Estuaries from basin runoff associated with high precipitation events will cause damaging freshwater inflows.

Table E-7. Corps' Principles and Guidelines Evaluation, Effectiveness, Objective 2, St. Lucie Estuary.

Corps Principles and Guideline Evaluation								
Effectiveness: Extent to which an alternative plan contributes to achieving the planning objectives, alleviates specified problems, and achieves specified opportunities.								
Objective 2: Improve Timing and Volume of Freshwater Flows from Lake Okeechobee to Improve the Salinity Regime and the Quality of Oyster, SAV, and Other Estuarine Community Habitats in the Northern Estuaries								
Performance Metric: St. Lucie Estuary Alternative Performance								
Scenario	**# of 14-day ma Low Flow Events <150 cfs**	**# of 14-day ma Optimal Flow Events ≥150 cfs and ≤1,400 cfs**	**# of 14-day ma Stressful (High) Flow Events ≥1,400 cfs and ≤1,700 cfs (from LOK)***	**# of 14-day ma Stressful (High) Flow Events ≥1,400 cfs and ≤1,700 cfs (from Basin Runoff)***	**# of 14-day ma Damaging Flow Events ≥1,700 cfs* (from LOK)***	**# of 14-day ma Damaging Flow Events ≥1,700 cfs* (from Basin Runoff)***	**# of 14-day ma Damaging Flow Events ≥1,700 cfs and ≤4,000 cfs**	**# of 14-day ma Damaging Flow Events ≥4,000 cfs**
Alternative 1	209	1013	20	262	29	350	337	118
Alternative 2	208	1011	20	261	30	350	339	118
Alternative 3	210	1012	20	263	27	351	339	118

*Flow events triggered by either Lake Okeechobee Regulatory Releases (LOK) or basin runoff.
cfs–cubic foot per second; Corps–U.S. Army Corps of Engineers; LOK–Lake Okeechobee regulatory releases; Northern Estuaries–Caloosahatchee and St. Lucie Estuaries; SAV–submerged aquatic vegetation.

Table E-8. Corps' Principles and Guidelines Evaluation, Effectiveness, Objective 2, Caloosahatchee Estuary.

Corps Principles and Guideline Evaluation									
Effectiveness: Extent to which an alternative plan contributes to achieving the planning objectives, alleviates specified problems, and achieves specified opportunities.									
Objective 2: Improve Timing and Volume of Freshwater Flows from Lake Okeechobee to Improve the Salinity Regime and the Quality of Oyster, SAV, and Other Estuarine Community Habitats in the Northern Estuaries									
Performance Metric: Caloosahatchee Estuary Alternative Performance									
Scenario	**# of 14-day ma Low Flow Events <750 cfs**	**# of 14-day ma Optimal Flow Events ≥750 cfs and ≤2,100 cfs**	**# of 14-day ma Stressful (High) Flow Events ≥2,100 cfs and ≤2,600 cfs (from LOK)***	**# of 14-day ma Stressful (High) Flow Events ≥2,100 cfs and ≤2,600 cfs (from Basin Runoff)***	**# of 14-day ma Damaging Flow Events ≥2,600 cfs* (from LOK)***	**# of 14-day ma Damaging Flow Events ≥2,600 cfs* (from Basin Runoff)***	**# of 14-day ma Damaging Flow Events ≥2,600 cfs and ≤4,500 cfs**	**# of 14-day ma Damaging Flow Events ≥4,500 cfs and ≤6,500 cfs**	**# of 14-day ma Damaging Flow Events ≥6,500 cfs**
Alternative 1	586	688	42	153	55	179	179	75	64
Alternative 2	584	686	42	154	56	178	178	77	64
Alternative 3	586	689	41	154	55	179	178	76	64

*Flow events triggered by either Lake Okeechobee Regulatory Releases (LOK) or basin runoff.
cfs–cubic foot per second; Corps–U.S. Army Corps of Engineers; LOK–Lake Okeechobee regulatory releases; Northern Estuaries–Caloosahatchee and St. Lucie Estuaries; SAV–submerged aquatic vegetation.

Lake Okeechobee water is not released during dry periods to reduce the percentage of time water stages are below the lake ecological stage envelope and extreme low stage, increasing low flow events in the Northern Estuaries.

Objective 3: Increase Availability of Water Supply to the Existing Legal Water Users of Lake Okeechobee (**Table E-9**).

Table E-9. Corps Principles and Guidelines Evaluation, Effectiveness, Objective 3.

Corps Principles and Guideline Evaluation				
Effectiveness: Extent to which an alternative plan contributes to achieving the planning objectives, alleviates specified problems, and achieves specified opportunities.				
Objective 3: Increase Availability of Water Supply to the Existing Legal Water Users of Lake Okeechobee.				
Performance Metric: LOCAR Water Supply Restrictions				
Simulation*	**Cutback Total (Thousand ac-ft)**	**Frequency**	**Severity Score**	**Number of Water Years with at Least One Cutback**
FWO	600	9	16	9
Alternative 1	753	10	18	10
Alternative 2	734	9	17	9
Alternative 3	755	10	18	10

*All simulations are based on the 51-year period of record (1965–2016)

ac-ft–acre-foot; Corps–U.S. Army Corps of Engineers; FWO–Future Without Project; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study

Summary:

All alternatives reduce the number, frequency, and severity of water supply cutbacks as compared to existing conditions baseline, when LOCAR-stored water maintains Lake Okeechobee. The FWO water supply performs marginally better than the alternatives.

This data demonstrates that all alternatives improve water supply service levels in keeping with the LOCAR planning study constraint to maintain and protect current water service levels for existing, legal LOSA water users.

Acceptability

The Project Team used public, stakeholder, and agency concerns to refine alternatives' design and ensure acceptability. All plans comply with laws, regulations, and policies. Tribal consultation is ongoing with final acceptability to be determined. At this writing, the Project Team believes Tribal concerns have been addressed and the Tribes will find the alternatives acceptable.

Table E-10. Corps' Principles and Guidelines Evaluation, Acceptability.

Corps Principles and Guideline Evaluation			
Acceptability: Workability and viability of the alternative plan with respect to acceptance by state and local entities and the public and the extent to which the alternative plans are acceptable in terms of existing laws, regulations, and public policies.			
Performance Metric: LOCAR potential for implementation, legal compliance, and stakeholder concurrence			
	Alternative 1	**Alternative 2**	**Alternative 3**
Implementable			
Technically Feasible	Yes	Yes	Yes
Laws, Regulation, and Policy			
Complies with applicable laws, regulation, policies, and guidelines	Yes	Yes	Yes
Advances the Comprehensive Everglades Restoration Plan	Yes	Yes	Yes
All aspects are within Project scope	Yes	Yes	Yes
Acceptable			
Stakeholders	Yes	Yes	Yes
Seminole Tribe of Florida	To be determined	To be determined	To be determined
Miccosukee Tribe of Indians of Florida	To be determined	To be determined	To be determined
Federal, state, and local agencies	Yes	Yes	Yes
Public	Yes	Yes	Yes
Landowners	Yes	Yes	Yes

Corps–U.S. Army Corps of Engineers; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; Project–Lake Okeechobee Storage Reservoir Section 203 Study

Summary:

All alternatives were configured to avoid MTI- and STOF-owned lands, reservation lands, and traditional cultural properties.

MTI and STOF expressed concerns regarding flooding Tribal lands. The Tribes' final concurrence with the Recommended Plan is subject to ongoing consultation and flood risk mitigation actions. A planning study constraint is maintenance of flood protection levels of service for agricultural and urban lands in keeping with the Savings Clause (WRDA 2000, Section 601 (h)(5)(B)). Adherence to this constraint should mitigate flood risk.

Public scoping indicated landowner concerns with eminent domain.

Completeness

The LOCAR alternatives include all investments and actions to achieve planning objectives and satisfy the Corps' completeness criteria (**Table E-11**).

Table E-11. Corps' Principles and Guidelines Evaluation, Completeness.

Corps Principles and Guideline Evaluation			
Completeness: Extent to which a given alternative plan provide and account for all necessary investments or other actions to ensure the realization of the planning objectives and planned effects.			
Performance Metric: LOCAR operation to achieve LOCAR goals, objectives, and environmental benefits.			
	Alternative 1	**Alternative 2**	**Alternative 3**
LOCAR Planning			
LOCAR achieves the planning study objectives and goals	Yes	Yes	Yes
LOCAR addresses planning study problems	Yes	Yes	Yes
LOCAR addresses planning study opportunities	Yes	Yes	Yes
LOCAR does not violate planning study constraints	Yes	Yes	Yes
LOCAR Operations			
LOCAR can be independently operated to achieve environmental benefits in Lake Okeechobee and Northern Estuaries	Yes	Yes	Yes
LOCAR can be operated in concert with other CERP projects to achieve regional environmental benefits	Yes	Yes	Yes
LOCAR is compatible with current and future Lake Okeechobee regulation schedules.	Yes	Yes	Yes
CERP			
LOCAR completes an essential CERP component	Yes	Yes	Yes
LOCAR achieves a CERP objective for an aboveground storage feature	Yes	Yes	Yes
Design			
The LOCAR design is thorough and includes all features needed to realize planning objectives and desired effects	Yes	Yes	Yes
The LOCAR design is thorough and includes all features needed to develop a cost estimate	Yes	Yes	Yes

CERP–Comprehensive Everglades Restoration Plan; Corps–U.S. Army Corps of Engineers; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; Northern Estuaries

Efficient

Efficiency is determined through the Project's annual average cost and cost per habitat unit (HU). HUs are proxy for ecosystem improvements. The IWR Planning Suite model identified the plan maximizing environmental benefits compared to costs (**Table E-12**).

Table E-12. Corps Principles and Guidelines Evaluation, Efficiency.

Corps Principles and Guideline Evaluation			
Efficiency: The extent to which an alternative is the most cost-efficient means of achieving project objectives.			
Performance Metric: Average annual cost and cost per habitat unit			
	Alternative 1	**Alternative 2**	**Alternative 3**
Total Annual Average HUs (FWO HUs + Alternative HUs)	8,424	8,453	8,396
Increase in HUs	1,109 (+13%)	1,138 (+14%)	1,082 (+13%)
Alternative Annual Average Cost	**$122,392,400**	**$181,284,600**	**$148,501,400**
Alternative Cost per Habitat Unit	**$110,363**	**$159,301**	**$137,247**
Outputs	Best Buy	Best Buy	Not Cost Effective

Corps–U.S. Army Corps of Engineers; FWO–Future Without Project; HU–habitat unit

The IRW Planning Suite identified two best buy plans (Alternatives 1 and 2) based on costs and number of HUs created. Alternative 3 was determined cost inefficient.

Alternative 1 is less expensive; Alternative 2 produces more HUs. The substantial additional investment in Alternative 2 ($48,938/HU and $58,892,200 average annual cost increase) does not justify the minimal additional 29 HUs (a 1 percent HU increase) gained over the Project life.

Alternative 1 is the NER plan because of benefits to Lake Okeechobee and Northern Estuaries and a best buy based on estimated investments.

E.6.1.2 Corps System of Accounts

National Ecosystem Restoration

The NER plan should meet planning objectives and constraints, reasonably maximize environmental benefits, be cost effective and efficient, result in significant outputs, and satisfy the Corps P&G criteria (**Table E-13**). Wherever possible, restoration projects should be cooperatively planned with other agencies and make significant contribution to other programs, such as CERP.

Table E-13. Corps' System of Accounts, National Ecosystem Restoration.

Corps System of Accounts			
National Ecosystem Restoration Plan: The plan that reasonably maximizes ecosystem restoration benefits compared to cost consistent with the study objectives.			
Performance Metric: Cost effectiveness and level of output			
	Alternative 1	**Alternative 2**	**Alternative 3**
Increase in HUs	1,109	1,138	1,082
Alternative Cost per HU	$105,724	$154,391	$131,327

Corps–U.S. Army Corps of Engineers; HU–habitat unit

Summary:

Analysis demonstrates all alternatives comply with the Corps P&G criteria and provide environmental benefits.

Project planning was a cooperative effort by the SFWMD and Corps.

National Economic Development

A federal objective of water and related land resources project planning is national economic development (NED) contribution, consistent with protecting the nation's environment, laws, and regulations. NED contributions are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits of marketed and not marketed goods and services that accrue in the planning area and the rest of the nation.

Table E-14. Corps System of Accounts, National Economic Development.

Corps System of Accounts			
National Economic Development Plan: The plan that reasonably maximizes the economic benefits consistent with protecting the nation's environment.			
Performance Metric: Changes in the economic value of national outputs of goods and services			
	Alternative 1	**Alternative 2**	**Alternative 3**
Recreation			
Net annual recreation benefits[1]	$226,656	$226,656	$226,656
Water Supply	No or positive effect	No or positive effect	No or positive effect
Navigation	Minor effect	Minor effect	Minor effect
Flood Risk Management	No effect	No effect	No effect
Hydropower	No effect	No effect	No effect
Commercial Fishing	Positive effect	Positive effect	Positive effect
Agriculture (floodwater, erosion, sedimentation reduction, drainage, irrigation)	No effect	No effect	No effect

1/ Similar recreation benefits are assumed for all alternatives because recreation features and estimated daily use are similar for all alternatives.
Corps–U.S. Army Corps of Engineers

Summary:

Planning study constraints mandate maintenance of the current level of water supply and flood risk protection in the Study Area. This minimizes negative impacts on water supply and flood risk management. Aboveground storage may supplement water supply to existing LOSA users as an ancillary benefit.

Planning study constraints require maintenance of navigation to, from, in, and around Lake Okeechobee. Alternatives maintain Lake Okeechobee's navigation stage (above 12.56 ft) between 69.8 and 70.4 percent of the time.

The proposed Project does not impact hydropower generation or hydropower generation facilities.

Water regime stabilization and aquatic habitat restoration in Lake Okeechobee and the Northern Estuaries would positively affect conditions supporting commercial fishing.

NED/NER Plan

The NED/NER plan offers the best balance between the NED and NER federal objectives. The Recommended Plan is based on NED benefit-cost analysis and NER benefits analysis, including cost effectiveness and incremental cost analysis.

Table E-15. Corps System of Accounts, National Economic Development/National Ecosystem Restoration.

Corps System of Accounts			
National Economic Development/National Ecosystem Restoration Plan: The plan that balances the National Economic Development and National Ecosystem Restoration federal objectives.			
Performance Metric: Changes in the economic value of national output of goods and services and ecosystem benefits.			
	Alternative 1	**Alternative 2**	**Alternative 3**
National Economic Development			
Net annual recreation benefits	$216,450	$216,450	$216,450
National Ecosystem Restoration			
Increase in HUs	1,109 (+13%)	1,138 (+14%)	1,082 (+13%)
Alternative Cost per Habitat Unit	$105,724	$154,391	$131,327
Alternative Annual Average Cost	$117,247,455	$175,696,359	$142,095,678

Corps–U.S. Army Corps of Engineers; HU–habitat unit

Summary:

All alternatives yield similar NED benefits.

Alternative 1, on balance, is the most cost-efficient and effective environmental restoration plan.

Regional Economic Development

Regional Economic Development (RED) represents the changes in regional economic activity attributable to an alternative plan (**Table E-16**).

Table E-16. Corps System of Accounts, Regional Economic Development.

Corps System of Accounts			
Regional Economic Development: A plan's positive and negative effects on regional economic development			
Performance Metric: Changes in income and employment in the Study Area			
	Alternative 1	**Alternative 2**	**Alternative 3**
Construction, Construction Management, and Preconstruction Engineering and Design Benefits			
Direct Jobs			
Local	23,535	42,516	34,314
State	26,440	47,247	38,132
National	27,618	49,270	39,764
Total Jobs			
Local	31,453	56,220	45,374
State	41,430	70,908	57,228
National	51,049	84,716	68,372
Total Gross Regional Product			
Local	$1,866,928,607	$3,444,513,489	$2,779,976,318
State	$3,075,157,764	$5,313,514,468	$4,141,510,475
National	$4,417,517,479	$6,949,482,059	$5,608,744,343

	Alternative 1	Alternative 2	Alternative 3
Operations and Maintenance Annual Benefits			
Direct Jobs			
Local	27	45	38
State	37	62	52
National	37	63	52
Total Jobs			
Local	42	70	58
State	71	120	100
National	89	149	124
Total Gross Regional Product			
Local	$2,997,105	$3,039,399	$4,195,225
State	$6,572,319	$11,026,920	$9,199,662
National	$9,301,601	$15,606,062	$13,020,000

Corps–U.S. Army Corps of Engineers; PED–preconstruction engineering and design; Study Area–Project Area plus Lake Okeechobee, Caloosahatchee Estuary, and St. Lucie Estuary

Summary:

All alternatives make substantial contributions to the regional economy of the Study Area. All alternatives impact Highlands County tax revenue (**Table E-17**).

No alternative represents a transfer of income or activity outside the region.

Table E-17. Maximum 2023 Forfeit Ad Valorem Tax Revenue for Highlands County for LOCAR Alternatives (Land Value Only).

Corps System of Accounts			
Regional Economic Development: A plan's positive and negative effects on regional economic development.			
Performance Metric: Changes in the Study Area's tax base			
Alternatives	**Total Parcel Acres**	**Private Parcel Acres**	**2023 Ad Valorem Taxable Land Value**
Alternative 1	13,000	13,000	-$1,979,000
Alternative 2	20,500	20,500	-$3,197,000
Alternative 3	14,900	14,900	-$2,435,000

Corps–U.S. Army Corps of Engineers; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; Study Area–Project Area plus Lake Okeechobee, Caloosahatchee Estuary, and St. Lucie Estuary

Summary:

All alternatives diminish property taxes commensurate with the size of Project footprints.

Environmental Quality

The environmental quality account represents non-monetary positive and negative effects on significant or unique ecological, natural, cultural, and aesthetic resources that are likely to be affected by the ecosystem restoration plans. The objective of the environmental quality account is to consider effects to natural or cultural forms, processes, systems, or other phenomena that sustain and enrich human life that cannot be monetized and are essential to plan selection (**Table E-18**).

Table E-18. Corps' System of Accounts, Environmental Quality.

Corps' System of Accounts			
Environmental Quality: Extent to which an ecosystem restoration plan effects significant ecological, natural, cultural, or aesthetic resources.			
Performance Metric: Positive and negative impacts to significant natural and cultural resources and the duration of those impacts			
Ecological: Components of the environment and the interactions among all its living and nonliving components that directly or indirectly sustain dynamic, diverse, viable ecosystems.			
Northern Estuaries: Central and south Florida water regime alterations have decreased the Northern Estuaries' biological productivity and ecological function. St. Lucie and Caloosahatchee Estuaries are designated Estuaries of National Significance. The Indian River Lagoon (St. Lucie) and Charlotte Harbor (Caloosahatchee) Estuaries are part of the National Estuary Program sponsored by the U.S. Environmental Protection Agency (EPA).			
FWO	**Alternative 1**	**Alternative 2**	**Alternative 3**
Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life
Northern Estuaries' ecological performance improves under FWO conditions (91,387 HUs and 1,828 average annual HUs).	Increases of 887 HUs (92,274 total) and 17 average annual HUs (1,845 total).	Increases of 882 HUs (92,269 total) and 17 average annual Hus (1,845 total).	Increases of 614 HUs (92,001 total) and 12 average annual HUs (1,840 total).
Lake Okeechobee: Lake Okeechobee is a 730-square-mile, shallow lake that is critical for flood control during wet seasons and water supply during dry seasons. Lake functions also include navigation, recreation, fisheries, and wildlife habitat. Agriculture is the predominant user of Lake Okeechobee water. The lake is a significant economic driver in the Study Area and central and south Florida region.			
FWO	**Alternative 1**	**Alternative 2**	**Alternative 3**
Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life	Beneficial effects realized throughout the Project life
Lake Okeechobee ecological performance improves under FWO conditions (274,335 HUs, 5,487 average annual HUs, and water levels within the ecologically preferred stage envelope 22% of the time).	Increases of 54,567 Hus (328,902 total) and 1,091 average annual HUs (6,578 total) and water levels within the ecologically preferred stage envelope 28% of the time (6% improvement).	Increases of 56,034 HUs (330,369 total) and 1,120 average annual HUs (6,607 total) and water levels within the ecologically preferred stage envelope 28% of the time (6% improvement).	Increases of 53,487 Hus (327,822 total) and 1,069 average annual HUs (6,556 total) and water levels within the ecologically preferred stage envelope 28% of the time (6% improvement).
Wetlands: Historically, approximately 40% of the Lake Okeechobee Watershed was composed of cypress and bay tree forests, inland swamps, freshwater marsh, wet prairie, and sawgrass marsh wetlands habitat. Fifteen percent of the watershed is wetlands today, in keeping with the national downward trend. Reference Subsection E.6.1.2, Ecologically Significant *Resources, Wetlands.*			
FWO	**Alternative 1**	**Alternative 2**	**Alternative 3**
No effect	Permanent adverse effect realized within footprint at construction; permanent beneficial effects in Lake Okeechobee	Permanent adverse effect realized within footprint at construction; permanent beneficial effects in Lake Okeechobee	Permanent adverse effect realized within footprint at construction; permanent beneficial effects in Lake Okeechobee

FWO	Alternative 1	Alternative 2	Alternative 3
Wetlands in the Project Area would not be filled, excavated, or otherwise altered.	Wetlands and waterways permanently impacted: Wetlands Hardwood Forest: 137 acres Vegetated Non-forested Wetlands: 2,215 acres Streams and Waterways: 10 acres Improvements to Lake Okeechobee fringe wetlands attributable to water stage regulation	Wetlands and waterways permanently impacted: Wetlands Hardwood Forest: 467 acres Vegetated Non-forested Wetlands: 2,804 acres Streams and Waterways: 14 acres Improvements to Lake Okeechobee fringe wetlands attributable to water stage regulation	Wetlands and waterways permanently impacted: Wetlands Hardwood Forest: 236 acres Vegetated Non-forested Wetlands: 1,784 acres Streams and Waterways: 15 acres Improvements to Lake Okeechobee fringe wetlands attributable to water stage regulation

Threatened and Endangered Species: The Florida grasshopper sparrow (*Ammodramus savannarum floridanus*, federally listed as endangered) and Audubon's crested caracara (*Caracara plancus*, federally listed as threatened) have habitat in and have been sighted in the vicinity of the LOCAR footprint. Reference Subsection E.6.1.2, Ecologically Significant *Resources, Threatened and Endangered Species.*

Florida grasshopper sparrow

FWO	Alternative 1	Alternative 2	Alternative 3
No effect	May but not likely to adversely affect	May but not likely to adversely affect	May but not likely to adversely affect
Sparrow habitat and ranges would not be affected unless future land use changes.	Reservoir siting avoids sparrow habitat and should not affect their range.	Reservoir siting avoids sparrow habitat and could affect their western range.	Reservoir siting avoids sparrow habitat and should not affect their range.

Audubon's crested caracara

FWO	Alternative 1	Alternative 2	Alternative 3
No effect	May effect	May effect	May effect
Audubon's crested caracara habitat, roosting areas, or gathering areas would not be affected unless future land use changes.	The footprint is within crested caracara habitat and near sites where the bird has been observed.	The dual reservoir footprint is partially within crested caracara habitat and roosting and gathering areas, and near sites where the bird has been observed.	The footprint is partially within crested caracara habitat and roosting and gathering areas.

Cultural: Cultural attributes are evidence of past and present habitation that can be used to reconstruct or preserve human lifeways. Included in this category are structures, sites, artifacts, environments, and other relevant information, and the physical contexts in which these occur. Reference Subsection E.6.1.2, *Culturally Significant Resources*.

FWO	Alternative 1	Alternative 2	Alternative 3
No effect	No effect	No effect	No effect
Cultural resources that may be in the Project Area would not be affected unless future land use changes.	Areas identified as potentially containing cultural resources were excluded from the Project Area.	Areas identified as potentially containing cultural resources were excluded from the Project Area.	Areas identified as potentially containing cultural resources were excluded from the Project Area.

Aesthetics: Aesthetic attributes are perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation. Included in this category are sights, sounds, scents, tastes, and tactile impressions and the interactions of these sensations, of natural and cultural resources. Reference Subsection E.6.1.2, *Aesthetically Significant Resources*.

FWO	Alternative 1	Alternative 2	Alternative 3
No effect	Positive affect upon Project operation	Positive affect upon Project operation	Positive affect upon Project operation
The area has limited aesthetic attributes that are not available for public enjoyment and appreciation.	The area would be converted to a deep, freshwater feature available for public enjoyment and appreciation.	The area would be converted to a deep, freshwater feature available for public enjoyment and appreciation.	The area would be converted to a deep, freshwater feature available for public enjoyment and appreciation.

Corps–U.S. Army Corps of Engineers; FWO–Future Without Project; HU–habitat unit; Northern Estuaries–Caloosahatchee and St. Lucie Estuaries; Project–Lake Okeechobee Storage Reservoir Section 203 Study

Ecologically Significant Resources

Wetlands

The dominant vegetation communities in the region are improved pastures with a mix of wet and dry prairies, freshwater marshes, hardwood swamps, cypress swamps, mesic temperate hammock, and pine flatwoods. Wetlands would be removed by construction and excavation activities (**Table E-19**). Placement of excavated materials would adversely affect wetlands in the construction vicinity by destroying vegetation and smothering biota. Wetlands within the reservoir footprint would be permanently converted to deepwater ecosystems, reducing primary productivity and photosynthesis (**Figure E-7)**.

Table E-19. LOCAR Affected Wetlands.

Freshwater Wetland Type	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Emergent Wetlands-Vegetated Non-forested	2,214.5	2,804.4	1,783.7
Forested Wetlands-Shrub Hardwood Forest	137.0	467.2	236.1
Lakes-Ponds-Reservoir	286.0	286.0	377.0
Riverine-Streams-Waterways	10.0	13.7	14.7

Thirty percent of wetlands in the Alternative 1 footprint, 60 percent of the wetlands in the Alternative 2 footprint, and 50 percent of the wetlands in the Alternative 3 footprint are agricultural aboveground impoundments (reference **Subsection E.6.1.2, *Other Social Effects***).

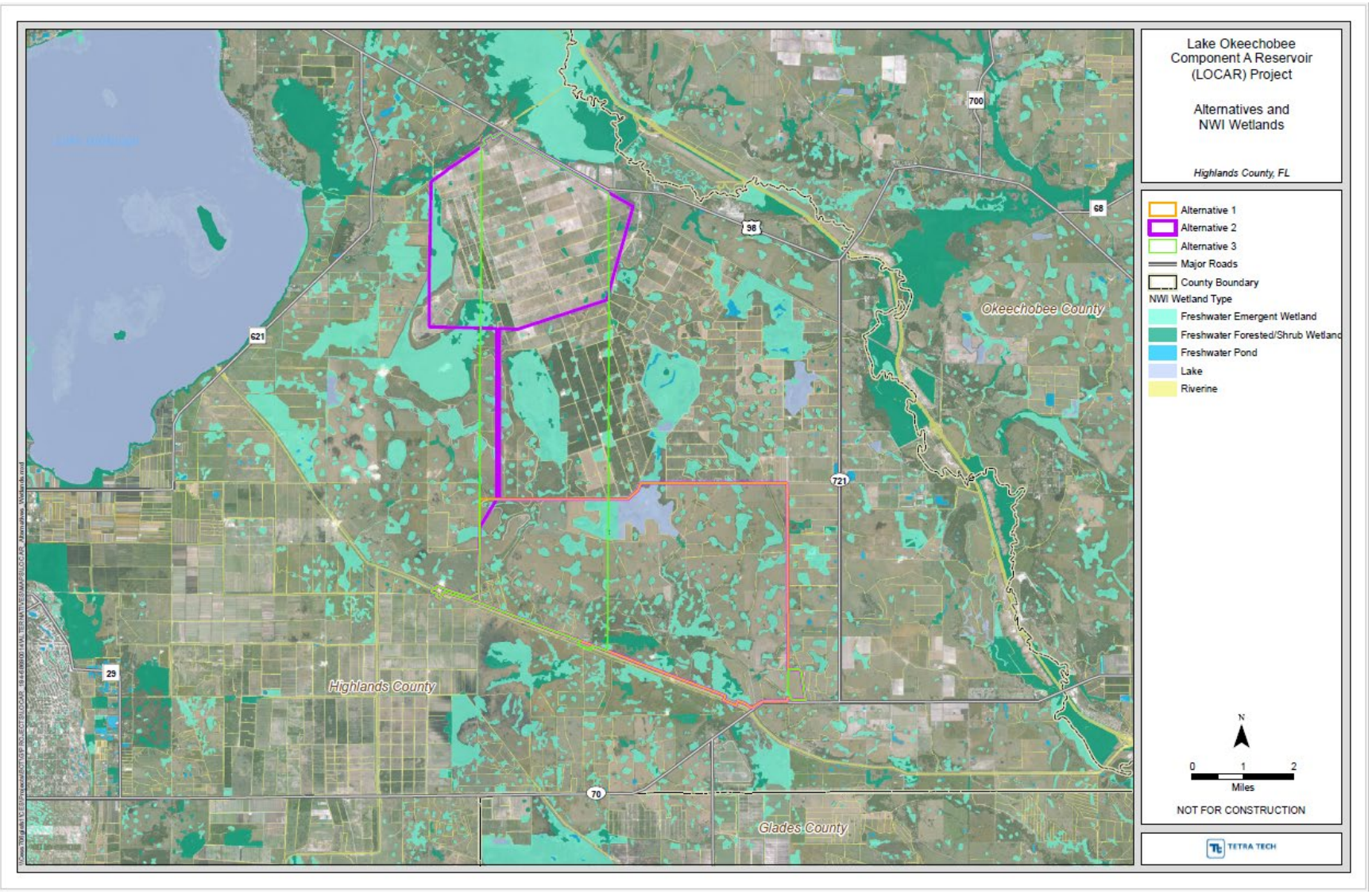

Figure E-7. National Wetlands Inventory map.

LOCAR will improve hydroperiods and hydro-patterns in the watershed; stage regulation; and the quantity, timing, and distribution of water delivered to Lake Okeechobee and the downstream estuaries. This will benefit the Lake Okeechobee and Northern Estuaries ecosystems and provide positive, regional ecological benefits in central and south Florida.

Threatened and Endangered Species

Field surveys determined if threatened and endangered species and habitat were in the Project Area.

Florida grasshopper sparrow (*Ammodramus savannarum floridanus*)

The Florida grasshopper sparrow is federally listed as endangered and is one of four subspecies of grasshopper sparrows in North America. The Florida grasshopper sparrow is endemic to the dry prairie of central and southern Florida. This subspecies is extremely habitat specific and relies on a 2- to 3-year fire regime to maintain its habitat. They nest in April to July on the ground, under palmettos, or in grass clumps. Most individuals are thought to live their entire lives within a few miles of their birthplace.

A portion of the Project Area is Florida grasshopper sparrow habitat (**Figure E-8**), but alternatives' footprints avoid the habitat. There has been no sighting of the bird in the area.

The USFWS made a BO determination of "may affect, but not likely to adversely affect" regarding impacts to the Florida grasshopper sparrow for the 2012 Highlands Ethanol, LLC, facility. A Biological Assessment addressing the Florida grasshopper sparrow was submitted to the USFWS in August 2023. A BO for LOCAR is being prepared by the USFWS.

Audubon's crested caracara (*Caracara plancus*)

The threatened Audubon's crested caracara is a unique raptor scavenger in the family *Falconidae* that reaches the northern limit of its geographic range in the southern U.S. It occurs in Florida as an isolated population in the south-central region of the state. Changes in land use patterns throughout central Florida have resulted in this population becoming of concern. This raptor has been documented to occur almost exclusively in cabbage palms (*Sabal palmetto*) on privately owned cattle ranches in the south-central part of the state. Available evidence suggests that the most serious threat to Florida's caracara population is loss or degradation of nesting and feeding habitat.

The improved pasture in the Project Area is ideal habitat for the Audubon's crested caracara. The crested caracara has been sighted in the Project vicinity but not within a reservoir footprint (confirmed by the 2012 Highlands Ethanol, LLC, facility BO (USFWS 2012). The falcon's habitat extends into Alternatives' 1 and 2 footprints. Roosts and gathering areas extend into Alternatives' 2 and 3 footprints (**Figure E-9**).

A Biological Assessment addressing the crested caracara was submitted to the USFWS in August 2023. A BO is being prepared by the USFWS.

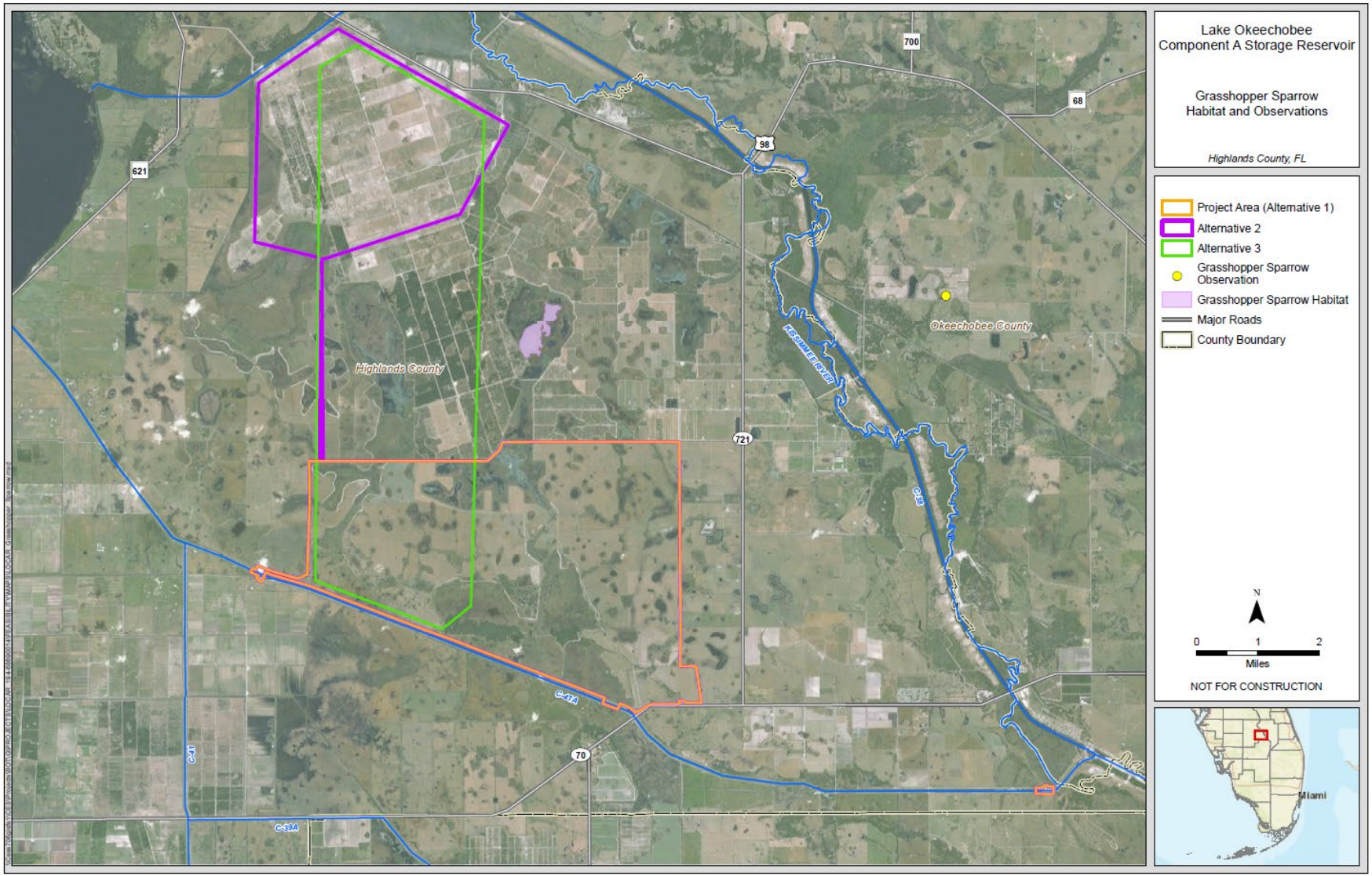

Figure E-8. Florida grasshopper sparrow habitat map.

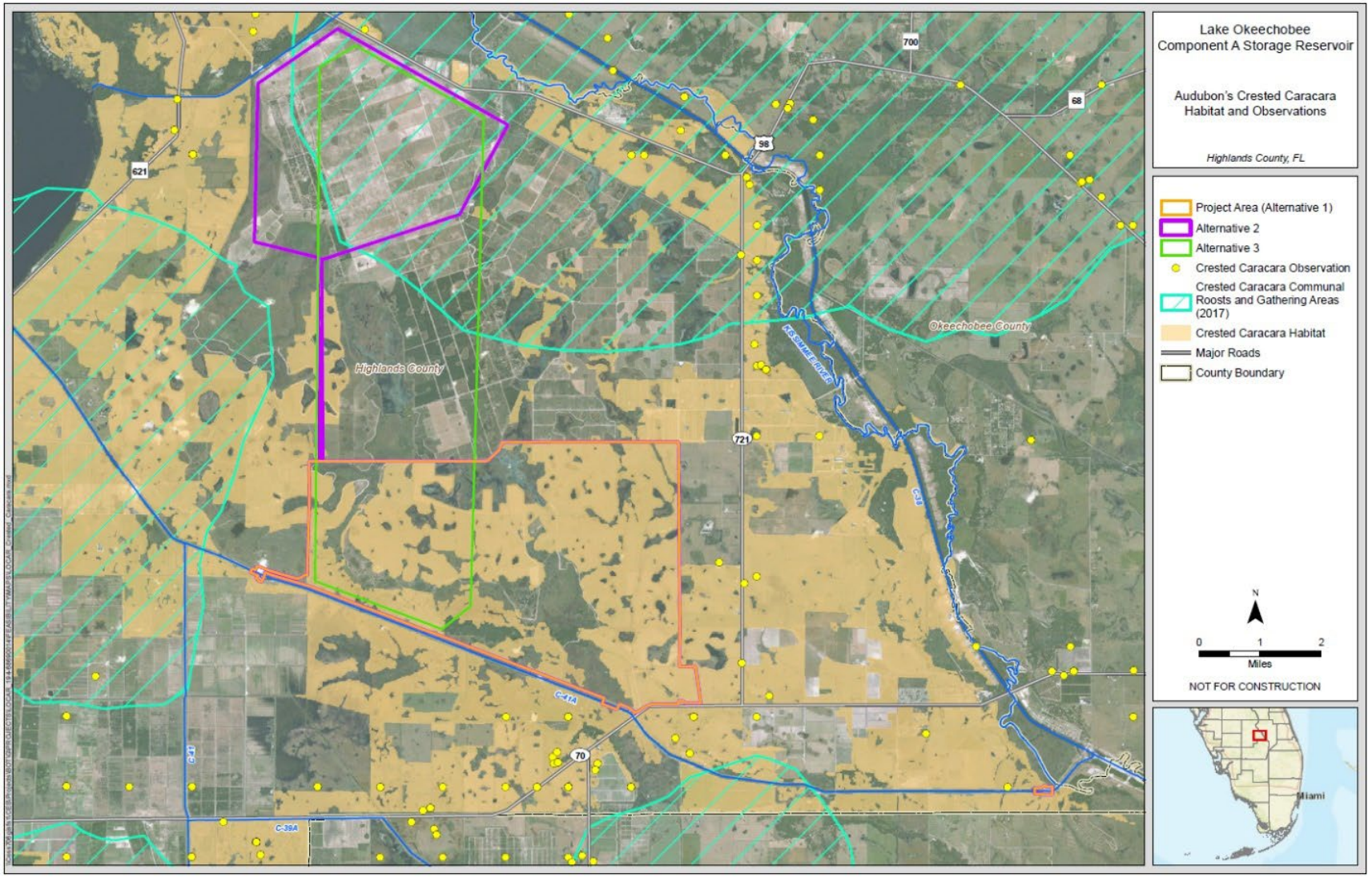

Figure E-9. Audubon's crested caracara range, habitat, and occurrences.

Culturally Significant Resources

Areas potentially containing cultural resources were excluded from the Project footprints. Additional site-specific cultural resources surveys and historic property evaluations will be conducted during the Preconstruction Engineering and Design Phase of the Project, with ongoing consultation to ensure the most up-to-date information is considered in subsequent effects determinations. Project planning considered National Register-eligible properties. The Corps is currently compliant through an executed Programmatic Agreement and will continue to meet the requirements throughout construction and operation.

Aesthetically Significant Resources

Seventy-eight percent of the Alternative 1 footprint is cropland, pasture, or disturbed; 81 percent of Alternative 2 is cropland, pasture, disturbed, tree crops or transportation corridors; and 77 percent of Alternative 3 is cropland, pasture, disturbed, tree crops, or transportation corridors with limited aesthetic attributes. The remaining acreage, while pleasant and diverse within the context of a heavily altered ecosystem, are in private ownership.

LOCAR would convert these areas to a deep storage water feature that is available for public enjoyment and appreciation.

Other Social Effects

Other Social Effects (OSE) is a quantitative and qualitative means to address social effects of a plan that are not addressed in other Corps accounts, but the Project Team thinks are relevant (**Table E-20)**.

Most of LOCAR's social effects are related to the permanent conversion of agricultural, undeveloped, and disturbed land to a deepwater storage reservoir with recreation features. Impacts evaluation of this conversion are a balance between negative effects associated with permanently removing land from agricultural productivity and positive effects of additional water supply and storage. The OSE evaluation incorporates public input volunteered through scoping and public meetings and regional effects to the greatest degree possible.

Table E-20. Corps' System of Account, Other Social Effects.

Corps' System of Accounts				
Other Social Effects: The extent to which an alternative plan effects social wellbeing.				
Performance Metric: Positive and negative impacts to social wellbeing contributions				
	FWO	**Alternative 1**	**Alternative 2**	**Alternative 3**
Agriculture				
Agricultural Land Permanently Removed from Production (cropland, pasture and tree crop acres)	0	10,133	16,425	11,540
Wells Removed from Service	0	4	7	5
Water Use Permitted Facilities Affected	0	22	101	102
Aboveground Impoundments Affected	No	Yes	Yes	Yes
Urban and Community Impacts				
Real Income	No effect The assumption is current activities would continue indefinitely with little to no effect on employment, populations, incomes, or fiscal conditions.	Minor negative effect**	Minor negative effect**	Minor negative effect**
Employment Distribution				
Population Distribution				
Population Composition				
State or Local Fiscal Conditions		Negative $1,979,000 taxable land decrease	Negative $3,197,000 taxable land decrease	Negative $2,435,000 taxable land decrease
**The alternative footprints are primarily agricultural and do not include communities, businesses, or residences. Some redistribution of employment and population related to lost agricultural activities in the area may occur. This would also result in a real income decline. There would be no replacement employment or income because the area would be converted to deepwater storage.				
Educational, Cultural, and Recreational Opportunities				
Community Services	No effect	No effect	No effect	No effect
Recreation	No effect	Positive effect 200,000-ac-ft reservoir with recreation features, $216,450 positive economic impact, and estimated 97 daily users	Positive effect 200,000-ac-ft reservoir with recreation features, $216,450 positive economic impact, and estimated 97 daily users	Positive effect 200,000-ac-ft reservoir with recreation features, $216,450 positive economic impact, and estimated 97 daily users
Quality of Life	No effect	No effect	No effect	No effect

	FWO	Alternative 1	Alternative 2	Alternative 3
Environmental Justice				
	No effect	Analysis demonstrates LOCAR does not disproportionately impact disadvantaged communities	Analysis demonstrates LOCAR does not disproportionately impact disadvantaged communities	Analysis demonstrates LOCAR does not disproportionately impact disadvantaged communities
Life, Safety, and Health				
Reduce exposure to flood, drought, or disaster	No effect	Positive effect LOCAR is a new water supply source that could mitigate drought impacts	Positive effect LOCAR is a new water supply source that could mitigate drought impacts	Positive effect LOCAR is a new water supply source that could mitigate drought impacts
Reduce pathogen exposure	No effect	No effect	No effect	No effect
Reduce concentrations/ exposures to water and air pollution	No effect	No effect	No effect	No effect
Improved consumer choices	No effect	No effect	No effect	No effect
Displacement				
People, businesses, and farms	No effect	Negative effect	Negative effect	Negative effect
Emergency Preparedness				
Critical Water Supply	No effect	Positive effect LOCAR is a new water supply source that could be used as an emergency water source	Positive effect LOCAR is a new water supply source that could be used as an emergency water source	Positive effect LOCAR is a new water supply source that could be used as an emergency water source
Energy				
Requirements	No effect	No effect	No effect	No effect
Conservation	No effect	No effect	No effect	No effect

Corps–U.S. Army Corps of Engineers; FWO–Future Without Project; LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study; Project–Lake Okeechobee Storage Reservoir Section 203 Study

Land Use

Table E-21 describes land use conversions. **Figure E-10** displays land use conversions.

Table E-21. LOCAR Land Use Conversion.

Land Use	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Cropland and Pastureland	10,132.8	10,220.5	4,394.6
Disturbed Lands	36.7	49.2	28.5
Herbaceous	189.8	352.3	955.6
Ponds, Reservoirs, and Lakes	286.0	286.0	377.0
Shrub and Brushland	37.1	96.2	93.6
Streams and Waterways	10.0	13.7	14.7
Transportation	0	1.4	1.4
Tree Crops	0	6,204.2	7,145.5
Upland Hardwood Forests	0	21.2	16.2
Upland Mixed Forests	0	0.9	0
Vegetated Non-forested Wetlands	2,214.5	2,804.4	1,783.7
Wetland Hardwood Forests	137.0	467.2	236.1
Total	**13,043.9**	**20,517.1**	**15,046.8**

LOCAR–Lake Okeechobee Storage Reservoir Section 203 Study

Water Supply Wells and Permitted Use Facilities

All alternatives remove water supply wells from service and affect water use permitted facilities (**Table E-20**, **Figure E-11**, **Figure E-12,** and **Figure E-13**).

A LOCAR Project constraint requires that the proposed Project maintain and protect current water supply service levels for existing legal users located in the Project Area in keeping with the Savings Clause (WRDA 2000, Section 601 (h)(5)(A)). Impacts to water supply wells and water use permitted facilities will not affect water supply available to LOSA water users.

Aboveground Impoundments

Eight hundred and sixty-seven acres of agricultural aboveground impoundments are located throughout the Project Area (**Figure E-14**). These ponds collect stormwater and surface flow from the nearby citrus fields. The collected water leaves the ponds by gravity-fed discharge structures, evapotranspiration, and sub-surface percolation.

LOCAR will perform the pond functions. LOCAR will capture stormwater and surface flow that currently feeds the aboveground impoundments. Some irreversible water loss due to evapotranspiration and groundwater percolation is expected. Horizontal seepage will be recaptured in LOCAR's perimeter canal and pumped back into the reservoir.

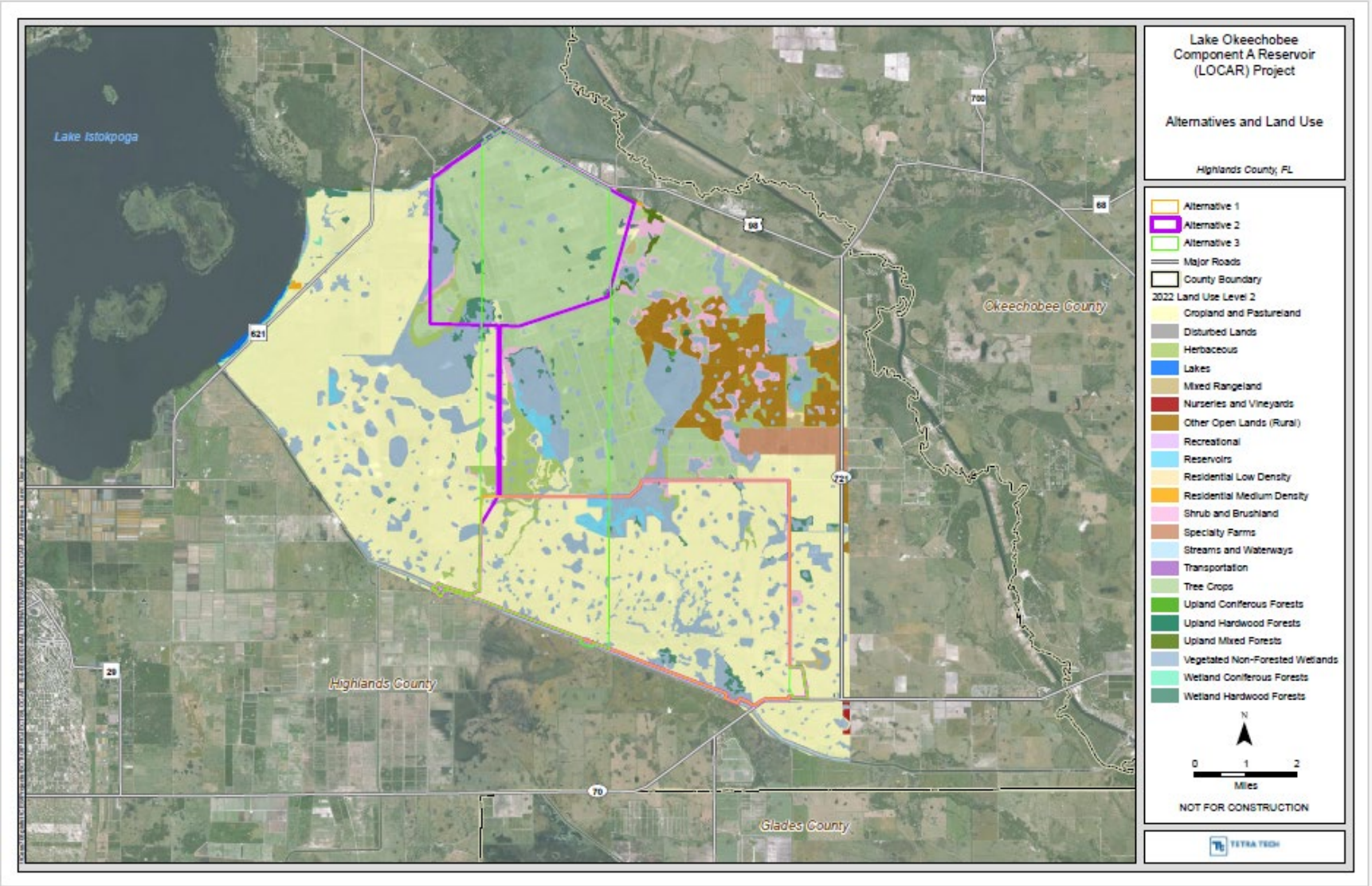

Figure E-10. LOCAR land use.

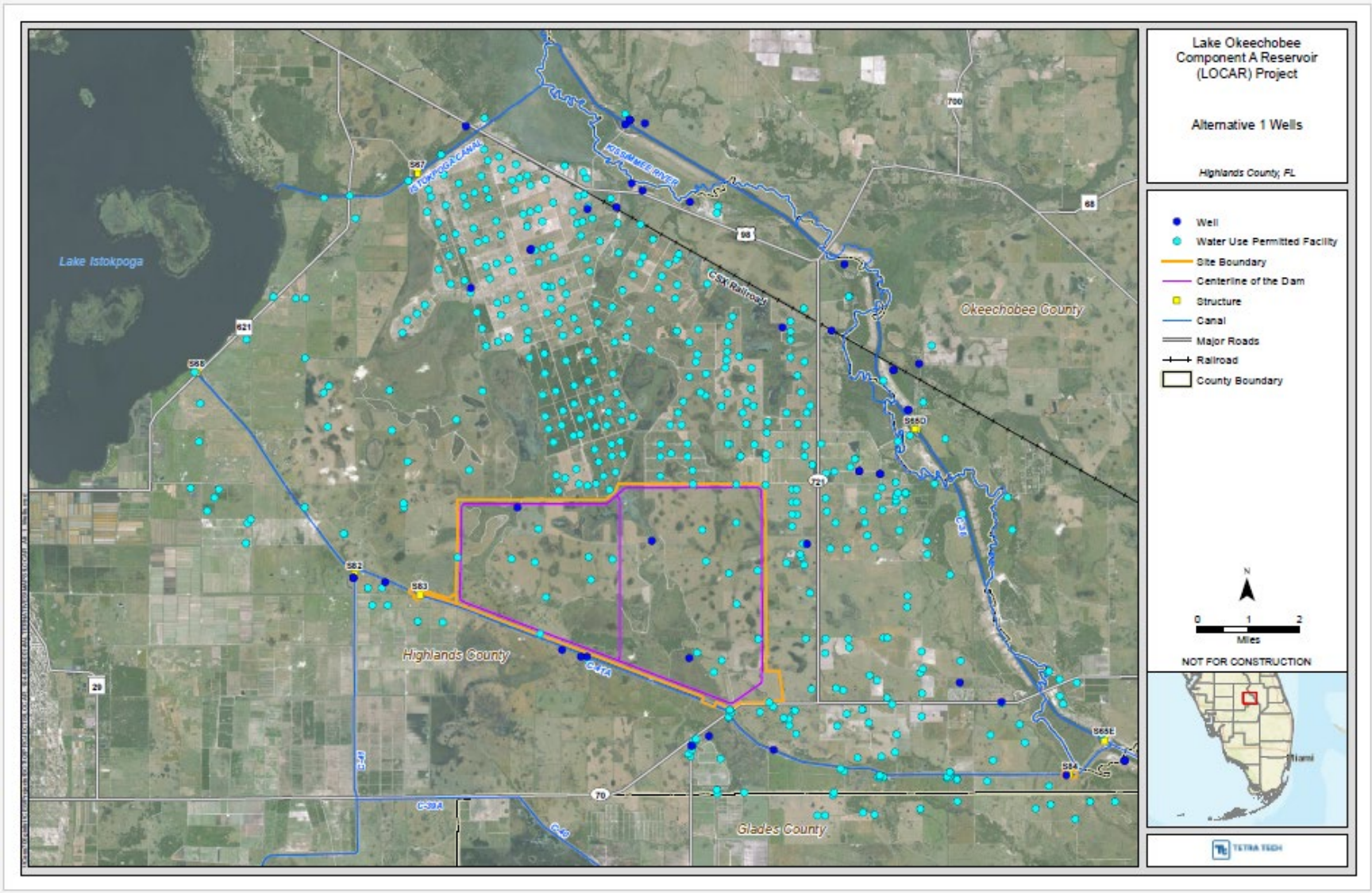

Figure E-11. Alternative 1, water supply wells and permitted use facilities.

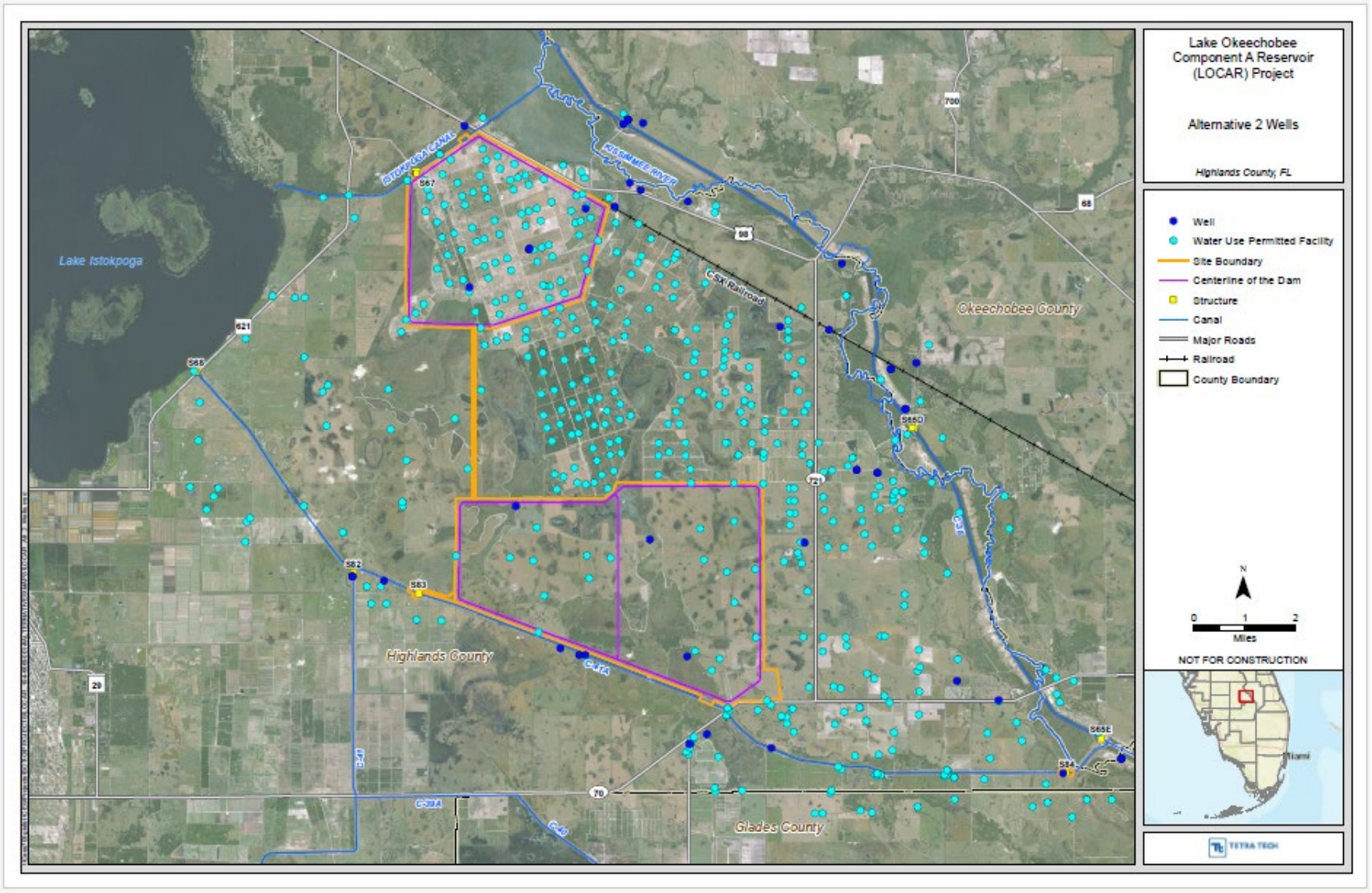

Figure E-12. Alternative 2, water supply wells and permitted use facilities.

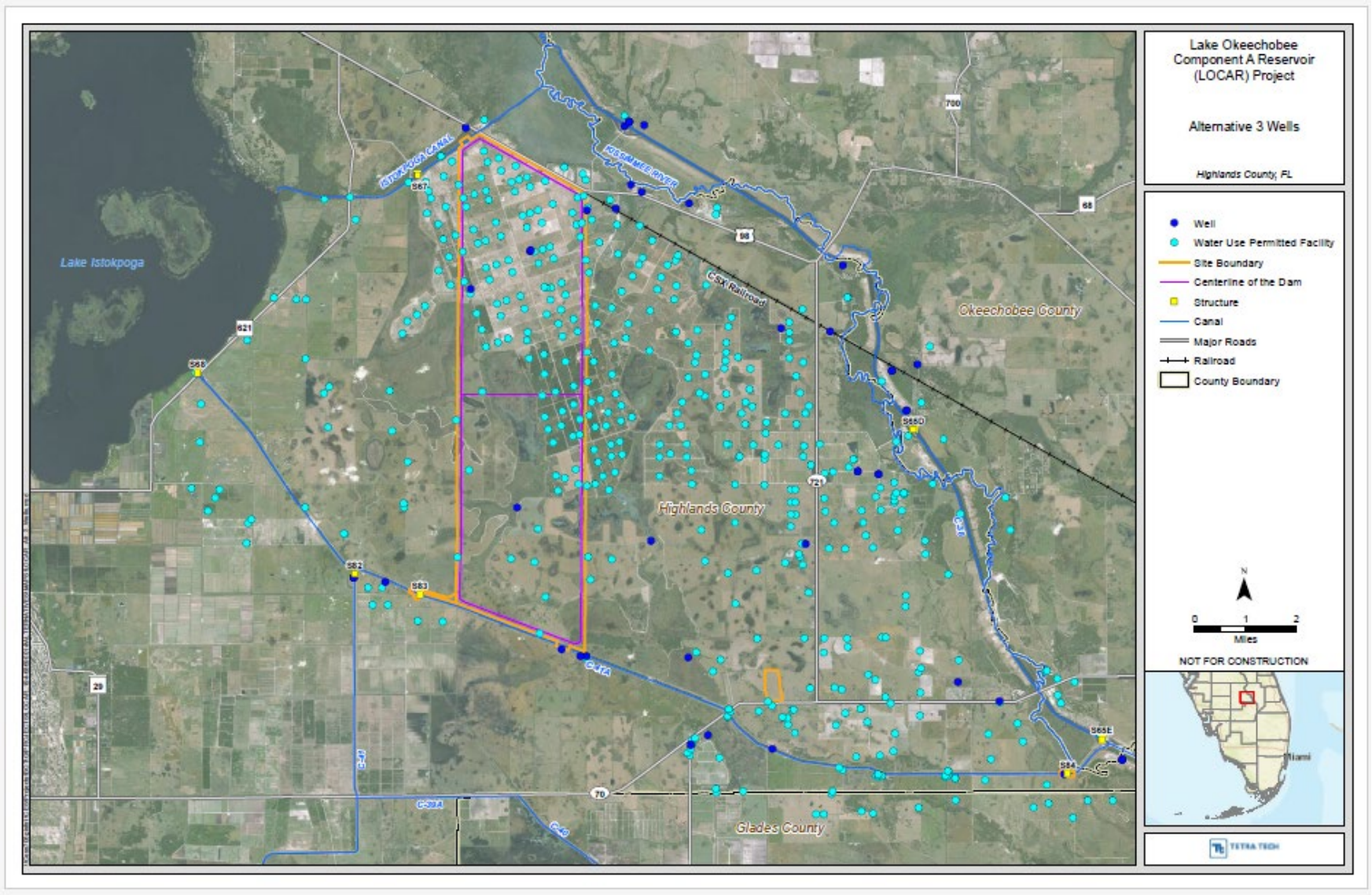

Figure E-13. Alternative 3, water supply wells and permitted use facilities.

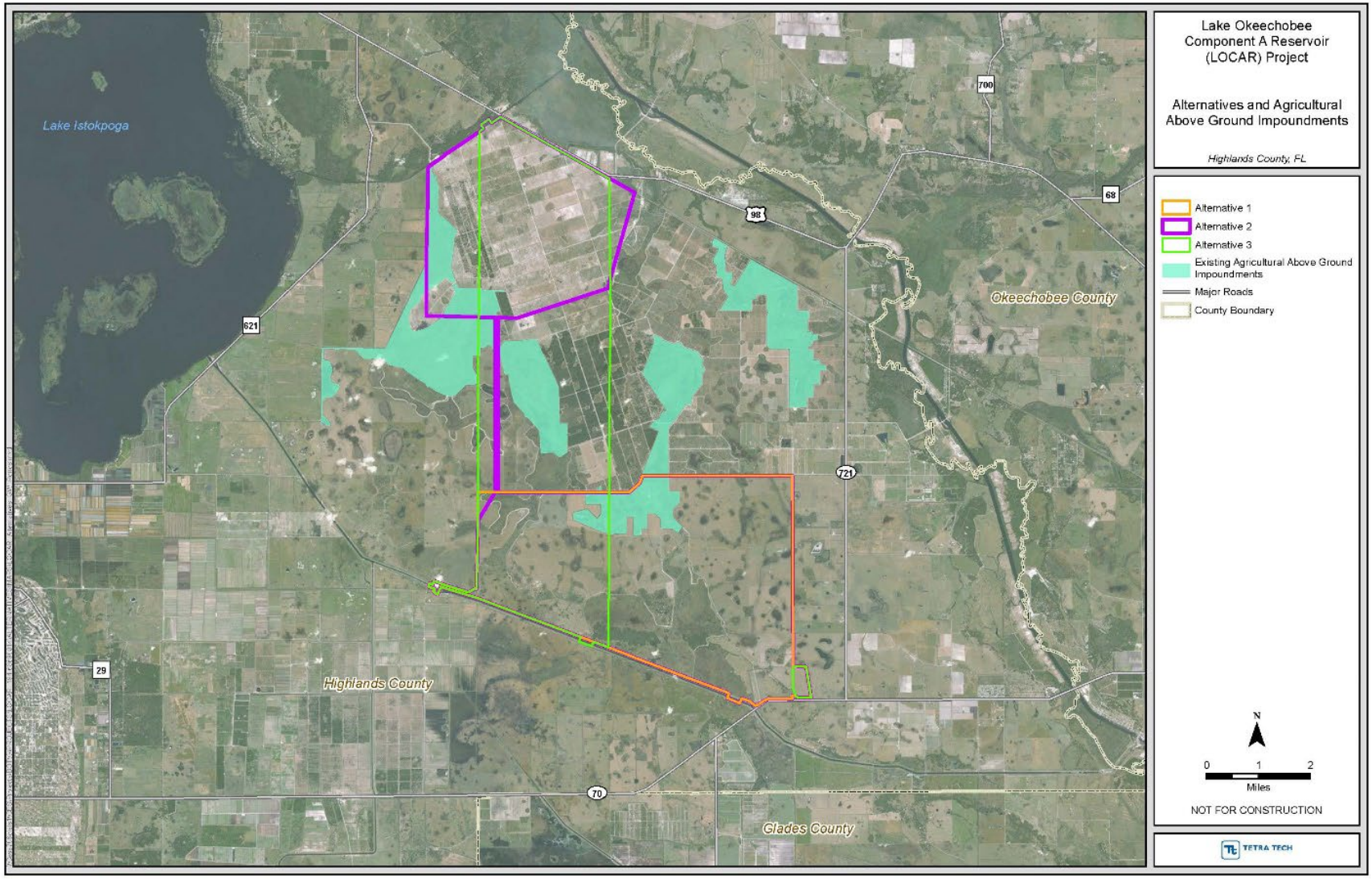

Figure E-14. Agricultural aboveground impoundments.

E.7 Risk and Uncertainty

LOCAR focuses on siting a 200,000-ac-ft aboveground water storage using existing data, professional judgement, planning-level analysis, and risk assessment. Design and construction methodology will be industry standard and are not new or experimental. Based on information available, there do not appear to be other potential reservoir siting locations within the Study Area that would be more efficient, acceptable, effective, complete, or capable of delivering more environmental benefits with less investment. All proposed storage alternatives have similar levels of risk and uncertainty and are mitigatable to an acceptable level.

The public and Tribes identified flood risk management due to a reservoir perimeter wall breach as a concern. **Appendix A** describes the Dam Breach Analysis. Maintaining flood protection levels of service for agricultural and urban lands, in keeping with the Savings Clause (WRDA 2000, Section 601 (h)(5)(B)), is a LOCAR planning study constraint. Adhering to this constraint will minimize flood risk.

E.8 LOCAR-CERP Comparison

The CERP programmatic regulations require that authorized CERP components, such as LOCAR, be considered in the alternative evaluation process. The CERP Recommended Plan provides a framework of components needed to achieve a practicable level of restoration of the Everglades. This Section 203 Study addresses CERP Component A, which proposed a 200,000-ac-ft reservoir in the Kissimmee River region and a 2,500-ac stormwater treatment area (STA).

CERP recommended an 11.5-ft deep, 17,500-ac reservoir to be located north of Lake Okeechobee. Based on previous studies, timing and availability of flows, and locations of communities within the Project Area, the Project Team identified cost-effective reservoir configurations capable of meeting the original CERP A Component intent by storing 200,000 ac-ft. All three alternatives were carried forward for evaluation.

CERP also recommended a 2,500-ac STA be located north of Lake Okeechobee. Water quality treatment features are not being pursued. State of Florida water quality programs, such as BMAPs, are being used to meet the intent of water quality improvements originally proposed by CERP Component A. The Florida Department of Environmental Protection collaborated with local stakeholders to adopt BMAPs for the Study Area, which includes Lake Okeechobee, Caloosahatchee River and Estuary, and St. Lucie River and Estuary watersheds. The BMAPs outline projects and programs for nutrient reductions, implementation milestones to achieve reductions, and monitoring plans to evaluate water quality trends to determine progress and adjust the plan.

It is possible that other viable, operational alternatives could be pursued and evaluated in the future.

E.9 References

Corps (U.S. Army Corps of Engineers). 1999. Central and Southern Florida Project Comprehensive Review Study: Final Integrated Feasibility Report and Programmatic Environmental Impact Statement. Jacksonville District, Jacksonville, Florida.

Corps. 2022 Lake Okeechobee Watershed Restoration Project Third Revised Draft Integrated Project Implementation Report and Supplemental Environmental Impact Statement. Jacksonville District, Jacksonville, Florida.

USFWS (U.S. Fish and Wildlife Service). 2012. Biological Opinion for the Proposed Highlands Ethanol, LLC, Facility in Highlands County, Florida. 41420-2009-F-0017. December 18.