APPENDIX E
PLAN FORMULATION SCREENING

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

This page intentionally left blank.

APPENDIX E PLAN FORMULATION SCREENING

This plan formulation screening appendix serves as supplemental supporting information to **Section 3.0** of the main report. It addresses potential storage, treatment, and conveyance management measures in the Everglades Agricultural Area (EAA) that would represent a post authorization change to measures included in the authorized Central Everglades Planning Project (CEPP) plan.

E.1 Storage, Treatment and Conveyance Management Measures

This section provides supporting information regarding the identification of management measures, screening of management measures, and formulation of options for storage, treatment, and conveyance improvements south of Lake Okeechobee for the CEPP Post Authorization Change Report (PACR). Various storage and treatment management measures were evaluated during CEPP (USACE 2014). Based on the results of this previous effort, a subset of management measures, which are consistent with the objectives and constraints of this CEPP PACR, were identified and included in the screening evaluation conducted for this study.

E.1.1 Screening of Storage and Treatment Management Measures

This section lists and describes management measures, which were compiled from previous CERP planning efforts, and the rationale for their inclusion as the basis for alternative plan development. An array of 13 distinct management measures (9 storage measures and 4 treatment measures) was identified with multiple size and configuration potentials for each measure.

E.1.1.1 Storage Management Measures

Higher Lake Levels: Raising water levels within Lake Okeechobee to reduce damaging discharges to the Northern Estuaries would require substantial modifications to the Herbert Hoover Dike (HHD). The U.S. Army Corps of Engineers is currently conducting a project to strengthen and secure the existing dike, and any increase in water levels above the design specifications of the current HHD rehabilitation would require a commensurate increase in the dike dimensions for human health and safety concerns.

Higher water levels within Lake Okeechobee could also cause significant impacts to the littoral zone. The lake's natural resources are dependent on the littoral zone since it provides nursery areas, spawning areas, foraging areas, and roosting areas required for the completion of aquatic fauna and higher trophic level (e.g., water bird) life cycles. The frequency and duration of inundation of the lake littoral zone would increase with higher lake levels which would result in the loss of beneficial littoral zone plant communities in favor of introduced exotics (e.g., torpedo grass) as well as impacts to wading birds and other water-dependent wildlife.

Operational Changes in Lake Okeechobee: Operational changes in Lake Okeechobee could be utilized to redirect excess flows normally directed to the Northern Estuaries and optimize the timing and distribution of deliveries south into and through the Everglades. Water quality treatment facilities will be necessary to treat additional flows. Water retained in the Lake for delivery to the Everglades that is not identified for the natural system will be available for water supply. This can be considered excess water that would not be of beneficial use to the environment.

Partition Lake Okeechobee: Compared with simply holding the entire lake at a higher elevation, compartmentalized storage within a partitioned Lake Okeechobee would allow for greater storage capacity and more flexible control of regulatory releases to the Northern Estuaries and the Everglades. However, fragmentation of the lake would be a substantial ecological concern, restricting movement of the native aquatic animal species. Higher water levels within certain compartments would damage the littoral zone, disrupting natural cycles of native flora and fauna. Navigation would also be disrupted within the lake, and substantial visual and aesthetic impacts would occur. Partitioning of Lake Okeechobee was previously considered in CERP and other C&SF studies, and eliminated due to the adverse environmental impacts. Due to these factors, this measure has been eliminated from further consideration.

Dredging of Lake Okeechobee for Storage: This measure consists of dredging sediment from Lake Okeechobee and depositing it in an approved spoil site. Dredging of the lake would allow for increased water storage capacity, decreasing the need for discharges to the Northern Estuaries and improving the timing and distribution of water deliveries to the Everglades. Although this measure is feasible from an engineering perspective, the costs to dredge such a massive waterbody would be excessive. Additionally, disposal of the spoil material would require a massive containment area located near the lake for return water, creating environmental concerns with such a large discharge of fill material required. There may also be concerns regarding relocations and community displacement if such a large site were required to be constructed adjacent to the lake. As such, this measure was eliminated from further consideration.

Above-Ground Storage Reservoir: Above-ground storage reservoirs would be utilized to capture and temporarily store Lake Okeechobee releases, that would normally be conveyed to the Northern Estuaries, and stormwater runoff, effectively providing dynamic storage for water prior to being directed south to the Everglades when desirable. Above-ground storage reservoirs could have water depths up to approximately 24 feet. Storage reservoirs at these water depths have relatively high construction costs when compared to shallow reservoirs due to additional dam safety requirements, however, above-ground storage reservoirs are operationally flexible and offer the potential to redirect excess flows normally directed to the Northern Estuaries and optimize the timing and distribution of deliveries south into and through the Everglades. Above-ground storage reservoirs would experience dryout conditions during extended drought periods and do not offer substantial wildlife habitat value. Above-ground storage reservoir was retained for consideration during screening.

Ecoreservoir: An Ecoreservoir could be utilized for water storage, however, it is predominantly designed and maintained to encourage habitat utilization and recreational opportunities. The secondary function of water storage limits the primary uses, which forces a trade-off for onsite habitat benefits, and leads to significantly increased costs per unit volume of water stored. Water levels are maintained at 4 feet or less to encourage the growth of vegetation. Embankment side slopes are shallow (12:1) and vegetated to promote wildlife use, making land requirements more extensive and increasing the risk of levee failure by including vegetation on the levee embankment and protection system. Construction and maintenance costs can be as much as three times higher than an above-ground reservoir with the same storage volume and as such is an inefficient means to store and deliver large quantities of water. Operational flexibility is limited and hydraulic capabilities are inadequate. Due to the factors mentioned above, ecoreservoir was eliminated from further consideration.

Flow Equalization Basin (FEB): An FEB is a shallow above-ground impoundment that would provide the temporary storage of water with some limited water quality improvement. Levee design would be similar

to that of a 4-foot deep above-ground storage reservoir, however, operations would be optimized for storage and peak flow attenuation. The FEB would receive Lake Okeechobee releases and stormwater runoff and would have target water depths of 1-3 feet to sustain the growth of wetland vegetation, thereby limiting deep water events and dryout conditions. An FEB, in addition to providing water storage, would also help control the rate of water flow from Lake Okeechobee to the Everglades Stormwater Treatment Areas (STAs) by minimizing hydraulic surges and providing more stable flows. Additionally, some nutrient reduction will occur within the FEB, however, unlike an STA, design and operations is not optimized for nutrient uptake. An FEB would likely be compatible with future CERP projects, enabling conversion to a deep reservoir or STA with limited infrastructure modifications. During CEPP, FEBs were extensively evaluated, however FEBs were eliminated from further consideration in this PACR.

Dry/Wet Flow Way: A Flow Way is an above-ground impoundment that would be operated like a flowing wetland system. Maximum water depths would be no higher than 4 feet with minimal engineering or alteration of the land surface. Vegetation would be allowed to naturally recruit and would also be unmanaged except for exotic vegetation control/removal. Similar to an ecoreservoir, operational flexibility is limited and hydraulic capabilities are inadequate. With costs similar to that of an ecoreservoir and extremely limited storage and treatment capabilities, A Flow Way is an inefficient means to meet the project objectives. Due to the factors mentioned above, a Flow Way was eliminated from further consideration.

Localized Aquifer Storage and Recovery (ASR): ASR is the storage of available water deep within the aquifer, and the recovery of that water for use when there are system demands. Preliminary results from the ASR Pilot Study indicated that ASR may be feasible in regard to toxicology, groundwater migration, etc. However, ASR may need to be used in combination with other water storage and water quality improvement management measures as it may not be sufficient to meet the project objectives as a stand-alone measure. While opportunities to incorporate ASR technology in other CERP projects is being explored, ASR was not considered for this increment of CERP and was therefore eliminated from further consideration.

E.1.1.2 Water Quality Treatment Measures

Stormwater Treatment Areas (STAs)**:** STAs, or large-scale constructed treatment wetlands, have been successfully operated by the South Florida Water Management District (SFWMD or District) for over 20 years to reduce nutrients, primarily phosphorous, from water prior to being discharged into the Everglades. STAs are typically managed as shallow, above-ground impoundments and are vegetated with a variety of native and non-native species. Most STAs consist of multiple parallel flow-ways that include treatment cells dominated by emergent aquatic vegetation (EAV) followed by treatment cells dominated by submerged aquatic vegetation (SAV). Water is directed through STAs via pump stations and passive and/or operable water control structures with the goal of maximizing phosphorus retention. Water levels and vegetation conditions are managed to promote desirable wetland vegetation survival while strategic herbicide application is used to prevent or minimize the colonization and expansion of undesirable, nuisance and exotic vegetation. Due to their long history of success, STAs were retained for consideration during screening.

Chemical Precipitation: Chemical Precipitation using ferric chloride, aluminum or other salts of iron can be utilized for phosphorus removal from water. Although the amount of land required for chemical precipitation is substantially less than STAs, there are some drawbacks to using this process to improve

water quality. The chemicals required for chemical precipitation are expensive and due to the large volumes of water to be treated, the process would not be cost-effective. Additionally, excessive sludge and waste products would require disposal, adding to the substantial costs and creating an environmental issue with sludge disposal. In addition, there are concerns that the water discharged to the Everglades after undergoing chemical precipitation may not be compatible with the Everglades and may result in other adverse environmental impacts. As such, due to excessive costs and environmental concerns, Chemical Precipitation was eliminated from further consideration.

Dredging of Lake Okeechobee near Primary Canal Intakes: This measure would involve dredging sediment from Lake Okeechobee in the areas just north of the confluence of the EAA canals and Lake Okeechobee. The removal of the sediment should decrease the amount of residual nutrients that would be suspended in the water before flowing to the Everglades. Although it is likely that this measure would have some success in nutrient removal, it would likely be on an extremely small scale, and substantial treatment would still be required before water could flow to the Everglades. Due to the relative inefficiency of this measure, it was eliminated from further consideration.

Hybrid Wetland Treatment Technology (HWTT): HWTT systems employ chemical treatment systems for phosphorus removal and utilize wetland vegetation to the maximum extent possible to minimize chemical amendment use. Chemical coagulants are added, either continuously or intermittently, to the front end of the treatment system, which contains one or more deep zones to capture the resulting floc material. A fundamental concept of the HWTT technology is that the floc resulting from coagulant additional generally remains active and has the capability of additional phosphorus sorption. Both active and passive reuse of floc material is practiced in this technology. Passive re-use refers to the accumulation of viable flocs on plant roots and stems that are situated near the front-end and mid-regions of the systems. Active re-use refers to the mechanical re-suspension of settled floc. HWTT systems in use north of Lake Okeechobee have shown promising results with total phosphorus concentration reductions ranging from 70 to 95 percent. Although HWTT has been shown to be cost effective for smaller watersheds and aquatic systems, there remains a high level of technological and cost uncertainty in applying HWTT to large volume treatment efforts. While there may be opportunities to incorporate HWTT in other CERP projects, HWTT was not considered for this increment of CERP and was therefore eliminated from further consideration.

E.1.1.3 Results of Preliminary Screening of Storage and Treatment Management Measures

Table E.1-1 summarizes the results of the preliminary screening of management measures and identifies the three management measures that are retained: Above-Ground Storage Reservoir, Lake Okeechobee Operational Changes, and Stormwater Treatment Area. Management measures that were not retained are marked with an “X.”

Table E.1-1. Summary of Screening of Storage and Treatment Management Measures

Management Measure		Screening Criteria						
		Project Objectives	Operational Flexibility	Environmental Effects	Human Health and Safety	Constructability /Technical Uncertainty	Land Requirement	Efficiency
Storage Measures	Higher Lake Levels							
	Lake Okeechobee Operational Changes	Retained						
	Partition Lake Okeechobee							
	Dredge Lake Okeechobee							
	Above-Ground Reservoir	Retained						
	Ecoreservoir							
	Flow Equalization Basin							
	Aquifer Storage and Recovery							
	Dry/Wet Flow Way							
Treatment Measures	Chemical Precipitation							
	Stormwater Treatment Area	Retained						
	Dredging Canal Intakes							
	Hybrid Wetland Treatment Technology							

E.1.1.4 Siting of Storage Reservoirs and Stormwater Treatment Areas

Above-ground storage reservoirs and STAs require large land areas to function. Several regional and local sites for these management measures were previously analyzed during CEPP. The CEPP siting analysis was described in detail in Section 3 and Appendix E of the CEPP PIR. **Table E.1-2** provides the Siting Criteria utilized during CEPP's siting analysis, which are also appropriate for use in the CEPP PACR plan formulation process.

Storage reservoirs and STAs located within the EAA between the Miami and North New River Canals have the advantage of being strategically located to temporarily store Lake Okeechobee releases and stormwater runoff from the EAA, especially due to their proximity to the existing canal system in the EAA.

The CERP identified the need for water storage in the EAA. Therefore, the storage and treatment management measures south of Lake Okeechobee are recommended to be located on and maximize the usage of the previously purchased A-1 and A-2 parcels in the EAA south of Lake Okeechobee that are owned by the State of Florida (**Figure E.1-1**). The identified project lands are located between and adjacent to the North New River and Miami Canals, which reduces the need to construct any additional conveyance features to move water from Lake Okeechobee to the project features and the Water Conservation Areas. The project lands are adjacent to existing treatment facilities (STA-3/4 and STA-2) that are currently being used for environmental purposes, creating a unique ability to optimize C&SF operations.

The only lands that were considered in the CEPP PACR are the public-owned lands within the EAA and lands that could be acquired on a willing-seller basis, specifically the A-1 parcel, the A-2 parcel, and the land west of the A-2 parcel and east of the Miami Canal (herein referred to as the A-2 Expansion lands) as shown in **Figure E.1-1**. Consideration of other lands was limited by the previous analyses and

recommendations described above and by the constraints and objectives of this study, as outlined in the Water Resources Law of 2017 (Chapter 373.4598, F.S.). Additional lands that would meet the siting criteria for an EAA Storage Reservoir were not identified by willing-sellers during this study.

Table E.1-2. Siting Criteria for Locating Storage and Treatment Features

Infrastructure
• Use of existing major canal networks (Miami Canal, Bolles & Cross Canal, and North New River Canal) • Proximity to move water from water source (Lake Okeechobee) • Proximity to existing public works (STAs, existing pump stations, roads, minor canal networks)
Socio-Political and Environmental
• Avoid unwilling sellers, no eminent domain authority in the EAA • Minimize impacts to local tax tolls • Use lands already acquired for purpose of environmental restoration • Minimize effects on Cultural Resources • Use previously impacted lands
Hydrology
• Reduce regulatory releases to the Northern Estuaries • Hydraulic connection to Lake Okeechobee with flexibility to manage high water levels • Improve the timing of environmental releases to the Water Conservation Areas (WCAs)
Construction Efficiency
• Topography • Muck depths • Construction and maintenance access • Seepage management • Availability of construction material

The CERP-recommended EAA Storage Reservoir configuration (60,000 acres by 6 feet deep) was considered but not evaluated in detail in the CEPP PACR. The CERP-recommended configuration is inconsistent with previously performed siting analysis described above which recommended that the EAA Storage Reservoir be located on and maximize the usage of the A-1 and A-2 parcels owned by the State of Florida

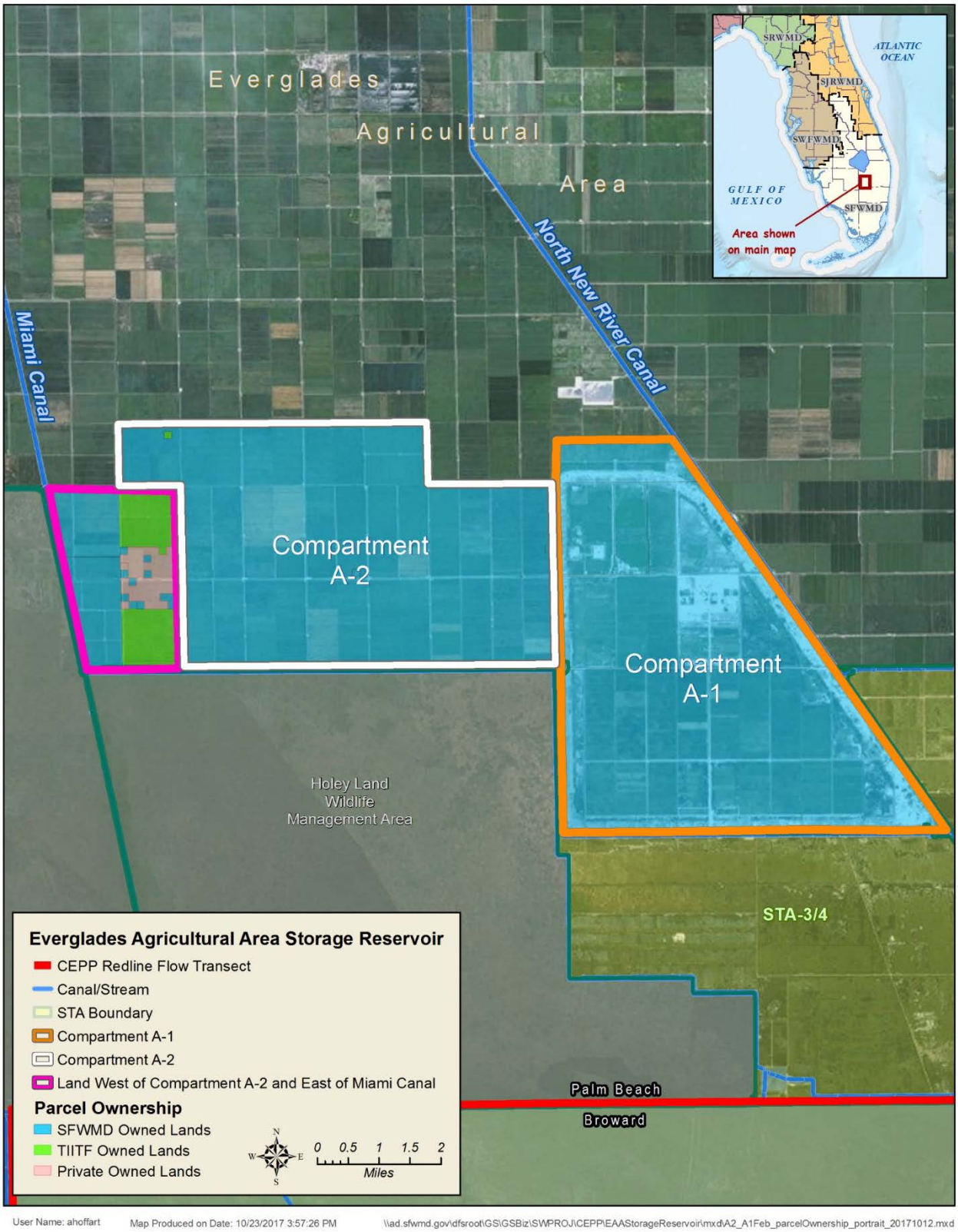

Figure E.1-1. A-1, A-2, and A-2 Expansion Area

E.1.2 Screening of Conveyance Management Measures

Utilization of operational flexibility within the existing 2008 Lake Okeechobee Regulation Schedule (LORS) and the implementation of conveyance improvements south of Lake Okeechobee within the EAA are expected to assist in achieving CEPP PACR objectives. Similar to CEPP, water from Lake Okeechobee will be redirected through EAA canals (instead of discharged to the Northern Estuaries) and stored, treated, and delivered to the Everglades. CEPP PACR conveyance management measures evaluated during screening include improvements to EAA canal conveyance, which are described below. These conveyance management measures were used in conjunction with storage and treatment management measures to develop alternative plans.

North New River Canal Conveyance Improvements: Improvements to the North New River Canal provide the necessary additional conveyance capacity needed to efficiently convey Lake Okeechobee releases south to the storage and treatment management measures. Additional North New River Canal conveyance capacity up to approximately 3,500 cubic feet per second (cfs) was evaluated during screening.

Miami Canal Conveyance Improvements: Improvements to the Miami Canal provide the necessary additional conveyance capacity needed to efficiently convey Lake Okeechobee releases south to the storage and treatment management measures. Additional Miami Canal capacity up to approximately 4,000 cfs was evaluated during screening.

E.2 Formulation of Storage, Treatment, and Conveyance Options

The combinations of storage, treatment, and conveyance management measures included above-ground storage reservoirs combined with existing and new STAs, and conveyance improvements. While the District's Reservoir Sizing and Operations Screening (RESOPS) model that was used in CEPP was not explicitly used in the CEPP PACR, the knowledge gained from the CEPP RESOPS simulations was integrated during the screening process during this study. The primary tools used during CEPP PACR screening were the Dynamic Model for Stormwater Treatment Areas (DMSTA) and the Regional Simulation Model for Basins (RSM-BN), which were used to define and assess combinations of management measures.

DSMTA was developed for the U.S. Department of Interior and the U.S. Army Corps of Engineers and was developed and calibrated to information specific to south Florida and to predict long-term phosphorus removal performance of Everglades STAs and above-ground storage reservoirs. DMSTA has been commonly used by both state and federal agencies for STA design and evaluation since 2001 and is the best available tool for simulating phosphorus removal performance of existing or proposed storage reservoir and STAs. DMSTA is configured to allow integration with the District's regional hydrologic models and has been configured to simulate complex regional networks of STAs and reservoirs. More information on DMSTA is available at www.wwwalker.net/dmsta. DMSTA simulations were used to ensure that the long-term simulated total phosphorus concentration was at or below the planning-level target of 13 parts per billion (ppb) or micrograms per liter (µg/L) for a variety of storage and treatment facility sizes.

The District's RSM-BN is a link-node model capable of simulating the hydrology and water management of the South Florida region with a model domain that covers Lake Okeechobee, the EAA, and the Kissimmee, St. Lucie, and Caloosahatchee River watersheds. More information on RSM-BN is provided in

Appendix A, Annex A-2. The SFWMD's RSM-BN was used to evaluate EAA canal conveyance improvements and their effects on flows to the Northern Estuaries. In addition, the District's Regional Simulation Model for the Everglades and Lower East Coast Service Area (RSM-GL) was used to verify that the southern distribution and conveyance improvements included in CEPP could accommodate the additional Everglades flows being evaluated in the CEPP PACR.

The DMSTA and RSM-BN modeling was performed consistent with the objectives and constraints of this study as well as the screening criteria described above. The result of DMSTA modeling led to the identification of five highly functioning combinations of storage and treatment configurations to undergo further detailed analysis. The results of the RSM-BN modeling led to the identification of conveyance improvement options (in the North New River and Miami Canals) to undergo further detailed analysis. Modeling is described in **Appendix A**.

E.3 Screening Evaluation Criteria

Performance of the combinations of above-ground storage reservoirs and STAs with improved EAA canal conveyance were evaluated using screening criteria described below in **Table E.3-1.** Methods of analysis and the results for the screening criteria are in the following sections.

Table E.3-1. Screening Criteria for Storage, Treatment, and Conveyance Options

Criteria	Objectives
Northern Estuary Conditions	Reduction in high-volume freshwater discharges from Lake Okeechobee to the St. Lucie and Caloosahatchee Estuaries
Improved Flow to the Everglades	Provide additional flow to the Everglades above the FWO project condition to achieve CERP goal
Water Quality	Achievement of phosphorus effluent limit for discharges from the Everglades STAs

E.3.1 Northern Estuary Conditions

E.3.1.1 Criterion Description

The benefits to the Northern Estuaries from the CEPP PACR are predicted to be a reduction in the damaging high-volume freshwater discharges from Lake Okeechobee. This criterion was developed to ensure that any necessary improvements to the Miami and North New River Canals in the EAA were appropriately considered and would not impact the benefits to the Northern Estuaries. Since CEPP eliminated a majority of the low to moderate discharge events to the Northern Estuaries from Lake Okeechobee, CEPP PACR plan formulation screening focused on storage, treatment and conveyance options that would reduce the lake discharge events that were not addressed by CEPP. To ensure adequate EAA canal conveyance is provided, multiple model-simulations were performed. The goal of this iterative process was to ensure that the necessary EAA canal conveyance capacity improvements were identified which would ensure the benefits of the redirection of Lake Okeechobee discharges away from the Northern Estuaries to proposed storage and treatment options were maintained.

Discharge events from Lake Okeechobee to the Northern Estuaries, as simulated with CEPP's project features in place (CEPP PACR FWO), were summarized and are provided in **Table E.3-2**. In an attempt to

capture all 12 events summarized in **Table E.3-2,** screening began by simulating 4,500 cfs of additional EAA conveyance (3,000 cfs in the Miami Canal and 1,500 cfs in the North New River Canal) and evaluated using RSM-BN. The 4,500 cfs capacity corresponds approximately to the highest average monthly flow observed during the period of record model runs which took place January through May of 1998 and depicted in **Table E.3-2**.

EAA canal conveyance capacity improvements were then iteratively decreased and the mean monthly flows from Lake Okeechobee to the Northern Estuaries were evaluated with each capacity reduction.

Table E.3-2. Discharge Events from Lake Okeechobee to the Northern Estuaries with CEPP

Event #	Start Month/Year	End Month/Year	Duration (months)	Average Monthly Flow (cfs)
1	August 1966	September 1966	2	2,348
2	July 1968	July 1968	1	1,024
3	October 1969	April 1970	7	3,163
4	October 1979	October 1979	1	2,526
5	February 1983	April 1983	3	2,566
6	October 1994	January 1995	4	1,252
7	September 1995	November 1995	3	3,760
8	January 1998	May 1998	4	4,330
9	June 2003	September 2003	4	2,698
10	October 2004	October 2004	1	2,875
11	June 2005	July 2005	2	2,364
12	October 2005	December 2005	3	1,740
		Total/Average	**35**	**2,554**

A 41-year period of daily flows to the Northern Estuaries was converted into 14-day moving average flows to the St. Lucie Estuary and mean monthly flows to the Caloosahatchee Estuary. The number of mean monthly flows greater than 2,800 cfs at S-79 (C-43 Basin runoff and Lake Okeechobee releases) was used to evaluate the effect of conveyance improvements on the Caloosahatchee Estuary. The number of times 14-day moving average flows exceeded 2,000 cfs for more than 14 days due to Lake Okeechobee releases was used to evaluate the effect of conveyance improvements on the St. Lucie Estuary. Total Lake Okeechobee regulatory releases to the St. Lucie and Caloosahatchee Estuaries was also summarized. See **Table E.3-3**.

Table E.3-3. Flows to the Northern Estuaries

Above-Ground Storage Reservoir Volume (acre-feet)	Additional Conveyance Capacity in Miami Canal (cfs)	Additional Conveyance Capacity in North New River Canal (cfs)	Number of Times the 14-day Moving Average Flow to St. Lucie Estuary Exceeds 2,000 cfs for 14 or More Days due to Lake Okeechobee Releases	Number of Months Flow to Caloosahatchee Estuary Exceeds 2,800 cfs due to the C-43 Basin Runoff and Lake Okeechobee Releases	Total Lake Okeechobee Regulatory Releases to St. Lucie and Caloosahatchee Estuaries (acre-feet)
240,000	4,000	3,500	25	63	327,000
	3,000	1,500	25	63	327,000
	1,000	200	26	63	325,000
	0	0	35	64	345,000
360,000	4,000	3,500	26	62	329,000
	3,000	1,500	26	62	329,000
	1,000	200	26	63	328,000
	0	0	31	63	346,000

E.3.1.2 Evaluation Tool Used

The SFWMD's Regional Simulation Model for Basins (RSM-BN) was used to evaluate EAA canal conveyance improvements and their effects on flows to the Northern Estuaries. RSM-BN is a link-node model capable of simulating the hydrology and water management of the South Florida region with a model domain that covers Lake Okeechobee, the EAA, and the Kissimmee, St. Lucie, and Caloosahatchee River watersheds. More information on RSM-BN is provided in **Appendix A, Annex A-2**.

E.3.1.3 Scoring Methodology

Rather than assign scores, this screening evaluation identified the additional canal conveyance needed for EAA canals that would maintain the Northern Estuary benefits obtained from the storage and treatment options.

E.3.1.4 Criteria Results

Based on the information provided in **Table E.3-3**, 1,000 cfs of additional capacity in the Miami Canal and 200 cfs of additional capacity in the North New River Canal was considered for further evaluation. Using the identified canal capacities, a HEC-RAS model was developed to evaluate conceptual designs to achieve the increased flows, which are documented in **Appendix A, Annex A-1**.

E.3.2 Improved Flow to Everglades

E.3.2.1 Criterion Description

This criterion was developed based on the CERP target of providing an additional 300,000 ac-ft per year of flow on average to the Everglades (i.e., across the "Red line"). This approach is also consistent with the CEPP project objectives related to restoring seasonal hydroperiods and freshwater distribution, and surface water depths within the project area. In the pre-drainage system, inundation patterns supported an expansive system of freshwater marshes including longer hydroperiod sawgrass "ridges" interspersed with open-water "sloughs", and higher elevation marl prairies. The depth, distribution, and duration of

surface flooding largely determined the vegetation patterns, as well as the distribution, abundance, seasonal movements, and reproductive dynamics of aquatic and terrestrial animals in the Everglades. Resumption of sheet flow and related patterns of hydroperiod and water depth will significantly help to restore and sustain the microtopography, directionality, and spatial extent of ridges and sloughs and improve the health of tree islands in the ridge and slough landscape.

The desired restoration condition for the Everglades ridge and slough landscape as it pertains to this criterion is to restore the natural patterns of flow volume characteristic of the pre-drainage Everglades.

E.3.2.2 Evaluation Tool Used

DMSTA was used to conduct a screening-level evaluation of the options in terms of the increase in the *Total Volume of Additional Average Annual Flow* delivered from the EAA to the Everglades, in excess of what would have been delivered by STAs 2, 3/4, 5, and 6, if the CEPP PACR was not implemented.

E.3.2.3 Scoring Methodology

Potential storage and treatment management measures which improved the volume of water delivered to the Central Everglades scored more favorably. Storage and treatment components were ranked on a scale of 1-4 to estimate the degree to which each project component performed. CEPP resulted in an average annual total volume of additional average annual flow across of approximately 210,000 ac-ft. The range of Total Volume of Additional Average Annual Flow to the Everglades in the CEPP PACR Improved Flow to the Everglades screening analysis varied from approximately 210,000 to 300,000 ac-ft. The scoring methodology is defined below.

4 (Best) – The project component received a score of 4 if the *Total Volume of Additional Average Annual Flow* was greater than or equal to 300,000 ac-ft.

3 (Good) – The project component received a score of 3 if the *Total Volume of Additional Average Annual Flow* fell between 250,000 and 299,999 ac-ft.

2 (Fair) – The project component received a score of 2 if the *Total Volume of Additional Average Annual Flow* fell between 200,000 and 249,999 ac-ft.

1 (Worst) – The project component received a score of 1 if the *Total Volume of Additional Average Annual Flow* fell below 200,000 ac-ft.

E.3.2.4 Criteria Results

Results of the *Improved Flow to the Everglades* screening criteria are presented in **Table E.3-4**.

Table E.3-4. Improved Flow to the Everglades – Screening Results

Storage and Treatment Component	Total Volume of Additional Average Annual Flow (ac-ft per year)	Rating or Score
240,000 ac-ft of Storage		
16,000-ac by 15.0-ft Reservoir and NO STA	200,000 – 249,999	2
14,400-ac by 16.7-ft Reservoir and a 1,600-ac STA	200,000 – 249,999	2
12,800-ac by 18.8-ft Reservoir and a 3,200-ac STA	250,000 – 299,999	3
11,200-ac by 21.4-ft Reservoir and a 4,800-ac STA	250,000 – 299,999	3

Table E.3-4. Improved Flow to the Everglades – Screening Results (continued)

Storage and Treatment Component	Total Volume of Additional Average Annual Flow (ac-ft per year)	Rating or Score
9,600-ac by 25.0-ft Reservoir and a 6,400-ac STA	>= 300,000	4
360,000 ac-ft of Storage		
31,000-ac by 11.6-ft Reservoir and NO STA	< 200,000	1
27,000-ac by 13.3-ft Reservoir and a 4,000-ac STA	200,000 – 249,999	2
24,000-ac by 15.0-ft Reservoir and a 7,000-ac STA	250,000 – 299,999	3
21,500-ac by 16.6-ft Reservoir and a 9,300-ac STA	>= 300,000	4

E.3.3 Water Quality

E.3.3.1 Criterion Description

This criterion was developed to ensure that the combinations of storage and treatment management measures achieve the effluent limit for total phosphorus concentration in Everglades STA discharges, referred to as the Water Quality Based Effluent Limit (WQBEL). Consistent with previously implemented CEPP and Restoration Strategies DMSTA modeling approaches, both of which were collaboratively developed and/or approved by the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, and the Florida Department of Environmental Protection, the target long-term total phosphorus concentration for STA discharges is at or below 13 ppb or micrograms per liter (µg/L). This planning-level target is intended to ensure that STA discharges do not cause or contribute to violations of state water quality standards and STA permit discharge limits. More information on Restoration Strategies is provided in **Section 2.0**.

E.3.3.2 Evaluation Tool Used

DMSTA was used to conduct a screening-level evaluation of the options in terms of the long-term total phosphorus concentration in Everglades STA discharges. For this study, only STA-2, STA-3/4 (and any new STA associated with the EAA Reservoir (ERSTA), when appropriate) were evaluated, as these are the only STAs that are proposed to receive additional flows as a result of the proposed CEPP PACR alternatives. Due to uncertainty associated with DSMTA-simulated low level annual phosphorus concentrations for STA discharges, annual values less than 12 ppb were replaced with a value of 12 ppb, prior to calculating the long-term total phosphorus concentration, which is referred to as the adjusted DMSTA outflow total phosphorus concentration. This approach is consistent with CEPP and Restoration Strategies.

E.3.3.3 Scoring Methodology

Storage and treatment components that resulted in the achievement of long-term total phosphorus discharge concentrations of 13 ppb or less at STA-2, STA-3/4, and ERSTA received a score of 1 (Best) and were retained. Storage and treatment components that achieved long-term total phosphorus concentrations above 13 ppb received a score of 0 (Worst) and were screened out.

E.3.3.4 Criteria Results

Results of the *Water Quality* screening criteria are presented in **Table E.3-5**. It should be noted that only the combinations of storage and treatment components that achieved scores of 1 (Best) are presented in **Table E.3-4**. Also, the total volume of additional average annual flow to the Everglades is not equivalent

for all of the storage and treatment component combinations listed in **Table E.3-5**. See **Table E.3-4** for the total volume of additional average annual flow.

Table E.3-5. Water Quality – Screening Results

Storage and Treatment Component	Adjusted DMSTA Outflow Total Phosphorus Concentration (ppb)		
	STA-2	STA-3/4	ERSTA
240,000 ac-ft of Storage			
16,000-ac by 15.0-ft Reservoir and NO STA	13.0	13.0	NA[1]
14,400-ac by 16.7-ft Reservoir and a 1,600-ac STA	12.9	12.9	12.9
12,800-ac by 18.8-ft Reservoir and a 3,200-ac STA	12.9	12.9	12.9
11,200-ac by 21.4-ft Reservoir and a 4,800-ac STA	12.9	12.9	12.9
9,600-ac by 25.0-ft Reservoir and a 6,400-ac STA	12.9	12.9	13.0
360,000 ac-ft of Storage			
31,000-ac by 11.6-ft Reservoir and NO STA	13.0	13.0	NA[1]
27,000-ac by 13.3-ft Reservoir and a 4,000-ac STA	12.9	13.0	13.0
24,000-ac by 15.0-ft Reservoir and a 7,000-ac STA	12.9	13.0	12.9
21,500-ac by 16.6-ft Reservoir and a 9,300-ac STA	12.9	12.9	13.0

[1] NA = Not applicable

E.4 Alternative Plans Proposed for Further Evaluation

The plan formulation screening evaluation resulted in five highly-functioning combinations of storage, treatment, and conveyance improvement options that are consistent with the objectives of this study. These five combinations were formulated into alternatives, described below, and were subsequently included in the array of alternatives identified for further evaluation. See **Figure 3-2** in **Section 3.4** for a graphical depiction of the array of alternatives.

Alternative R240A

- 240,000 ac-ft (10,500 acres by 23 feet deep) above-ground reservoir located on the eastern A-2 parcel
- 6,500-acre STA located on the western A-2 parcel and A-2 Expansion area
- A-1 FEB is unmodified
- 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA

Alternative 240B

- 240,000 ac-ft (10,500 acres by 23 feet deep) above-ground reservoir located on the western A-2 parcel and A-2 Expansion area
- 6,500-acre STA located on the eastern A-2 parcel
- A-1 FEB is unmodified

- 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA

Alternative R360C

- 360,000 ac-ft (20,500 acres by 18 feet deep) above-ground reservoir located on the A-1 parcel and the eastern A-2 parcel
- 11,500-acre STA located on the western A-2 parcel and the A-2 Expansion Area
- A-1 FEB is modified to a reservoir
- 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA

Alternative R360D

- 360,000 ac-ft (20,500 acres by 18 feet deep) above-ground reservoir located on the A-2 parcel, the A-2 Expansion area and the northern portion of the A-1 parcel
- 11,500-acre STA located on the southern portion of the A-1 parcel
- A-1 FEB is modified to an STA in the south and a reservoir in the north
- 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA

Alternative C360C

- 360,000 ac-ft (20,500 acres by 18 feet deep) above-ground reservoir located on the A-1 parcel and the eastern A-2 parcel
- 11,500-acre STA located on the western A-2 parcel and the A-2 Expansion Area
- A-1 FEB is modified to a reservoir
- 1,000 cfs of additional conveyance capacity in the Miami Canal within the EAA and 200 cfs of additional conveyance capacity in the North New River Canal within the EAA
- Additional operational flexibility is included which can serve multiple purposes including water supply as identified in Component G of the CERP