Conceptual Opinion of Probable Construction Costs for Storage and Treatment Area Additions in the Everglades Agricultural Area

Prepared for

Florida Crystals Corporation

February 2009

Burns & McDonnell
SINCE 1898

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COSTS FOR STORAGE AND TREATMENT AREA ADDITIONS IN THE EVERGLADES AGRICULTURAL AREA

prepared for

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West Palm Beach, Florida

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Project 51521

February 2009

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COSTS FOR STORAGE AND TREATMENT AREA ADDITIONS IN THE EVERGLADES AGRICULTURAL AREA PROJECT 51521

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CERTIFICATION

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Galen E. Miller, PE   Florida PE # 40624
Date: ______________________________
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Florida Professional Certificates: Architecture – AAC000567, Engineering – EB0000253

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EXECUTIVE SUMMARY

Burns & McDonnell Engineering Company, Inc. was retained by Florida Crystals Corporation to develop conceptual opinions of probable construction costs for potential storage reservoir and wetland treatment area additions in and near the Everglades Agricultural Area (EAA). Preparation of that opinion required the concurrent definition of an assumed set of project features on which to base the cost opinion. This report section presents an executive summary of this study.

ES.1 PROJECT BACKGROUND AND OBJECTIVES

On June 24, 2008, Florida Governor Charlie Crist announced that the South Florida Water Management District (SFWMD or District) would begin negotiating an agreement to acquire as much as 187,000 acres of agricultural land owned by the United States Sugar Corporation (U.S. Sugar or USSC). In the five months following the Governor's announcement, the District completed extensive negotiations with U.S. Sugar and due diligence investigations for the proposed land acquisition. The District's Governing Board approved the negotiated purchase and sale contract for this land acquisition on December 16, 2008.

District staff has begun the arduous task of planning just how these lands might be used in ogoing Everglades restoration efforts. This planning process is likely to take several months or years to complete but the staff has presented some preliminary development concepts to the District's Governing Board. While these preliminary concepts might evolve with time, they are used herein to form the basis for the analyses and cost opinions presented in this report.

A staff presentation to the Governing Board on October 8, 2008, suggested that reservoirs providing between 800,000 and 1.2 million acre-feet of water storage could be developed on those lands. It was further indicated in that presentation that additional stormwater treatment area(s) of between 12,000 and 45,000 acres would be required to treat additional flows directed south to the Everglades, and that the additional treatment area could be developed on lands previously acquired by the District and the State of Florida from Talisman Sugar.

The primary objectives of this study are as follows:

1. To complete conceptual analyses of potential storage and wetland treatment area additions that may be constructed within and nearby the EAA as a result of the planned acquisition of U.S. Sugar lands.

These analyses include conceptual estimates of the available storage volumes, embankment heights, and representative capacities for inflow and outflow structures.

2. From the conceptual design information developed in Item 1 above, develop conceptual opinions of probable construction cost for these potential facilities.

ES.2 PRINCIPAL PROJECT ASSUMPTIONS

The analyses and cost opinions presented herein were developed on a very short schedule so many simplifying assumptions were required to complete these analyses in the time allotted. Principal among the guiding assumptions used on this project are the following:

- The storage reservoirs planned within Compartment A of the Talisman Land Exchange (EAA Storage Reservoirs A-1 and A-2) might not be constructed. This land might be used instead for development of additional stormwater treatment areas (STAs).

- The new storage reservoirs might use an embankment design and designs for pumping stations and discharge structures similar to those prepared for the now-cancelled EAA Storage Reservoir A-1. Likewise, the opinions of probable construction cost developed in this study for the proposed storage reservoirs might be based on detailed estimates prepared for Reservoir A-1. The design and cost information used as a basis for this study was obtained from the Basis of Design Report (BODR) for the EAA Storage Reservoir A-1.

- One of the goals for these new storage reservoirs would be to eliminate, to the extent practicable, required regulatory releases from Lake Okeechobee to the St. Lucie River (C-44 Canal) and Caloosahatchee River (C-43 Canal). Releases to the St. Lucie River are normally made in pulses at a discharge rate of 7,500 cubic feet per second (cfs). Discharges to the Caloosahatchee River are much more variable but can also range up to 7,500 cfs or more. The total inflow pumping capacity for the new reservoirs was assumed to be 10,000 cfs. This total inflow capacity might be allocated to the individual storage reservoirs in proportion to their respective storage capacities.

- Presentations to the Governing Board by SFWMD staff have suggested that additional storage and treatment in the EAA might be developed under either of two options; the primary distinction between those options was the extent to which placement of the new facilities is limited to lands acquired from U.S. Sugar, or might use other suitably located lands in the EAA. Within each storage reservoir option, all of the component reservoirs were, for this analysis, assumed to have the same maximum storage depth, in the range of 12 to 15 feet above original ground surface, as suggested in a staff presentation to the Water Resources Advisory Commission on September 16, 2008.

- The combined discharge capacity of Pumping Stations S-7 and S-8 (6,660 cfs) might be used to define the total discharge capacity from the new storage reservoirs. The discharge capacities of the individual storage reservoirs were also apportioned based on their individual storage capacities.

- The inflow pumping capacity for the new STAs planned for construction within Compartment A might be equal to 7,200 cfs or 3,600 cfs for each of two pump stations.

ES.3 STORAGE OPTION 1 — USSC LANDS ONLY

One concept design for the potential EAA storage reservoirs would construct all of these reservoirs on land currently owned by U.S. Sugar. This reservoir configuration is referred to herein as Storage Option 1. Table ES-1 presents some basic information about each of the potential reservoirs included in Storage Option 1.

Table ES-1: Storage Option 1 Reservoirs

Reservoir Name	Area (acres)		Storage Volume (1000 ac-ft)	Embankment Length (feet)	Capacity (cfs)[b]	
	Gross	Net[a]			Inflow Pump Sta.	Outflow Structure
S-5A Basin	19,400	17,200	249.3	157,100	2,070	1,380
Lake Okeechobee	2,080	1,500	21.7	42,200	180	120
Lake Hicpochee	2,400	1,960	28.5	31,700	240	160
S-4 Basin	10,700	9,270	134.3	105,600	1,120	740
Northwest EAA	26,100	23,800	344.7	167,600	2,860	1,910
Northeast EAA	14,700	13,200	191.6	109,600	1,590	1,060
C-139 Annex	17,900	16,100	232.9	134,600	1,940	1,290
S-354 Spillway	---	---	---	---	---	8,060
Totals[c]	93,300	83,000	1,203.1	748,400	10,000	14,700

a. Reservoir embankments, seepage collection canals and access roads might occupy a swath approximately 600 feet wide around the perimeter of each storage reservoir. These features reduce the net area available for water storage.
b. Inflow and outflow capacities allocated proportional to available storage volume.
c. Totals may not add up exactly because of rounding.

ES.4 STORAGE OPTION 2 — MODIFIED CORRIDOR

The second reservoir concept developed by SFWMD staff is referred to herein as Storage Option 2. In this configuration, reservoir construction would not be confined to land currently owned by U.S. Sugar. Table ES-2 presents some basic information about each of the potential reservoirs included in Storage Option 2.

Table ES-2: Storage Option 2 Reservoirs

Reservoir Name	Area (acres)		Storage Volume (1000 ac-ft)	Embank-ment Length (feet)	Capacity (cfs)[b]	
	Gross	Net[a]			Inflow Pump Sta.	Outflow Structure
Lake Okeechobee	2,080	1,500	20.7	42,200	180	110
Lake Hicpochee	8,320	6,760	93.2	113,500	780	520
West EAA	44,800	41,800	576.3	244,200	4,810[d]	3,200
East EAA	22,700	20,800	286.4	142,600	7,200[e]	1,590
C-139 Annex	17,900	16,100	221.7	134,600	1,850	1,230
S-354 Spillway	---	---	---	---	---	7,910
Totals[c]	95, 800	86,800	1,198.4	677,200	10,000	14,700

a. Reservoir embankments, seepage collection canals and access roads might occupy a swath approximately 600 feet wide around the perimeter of each storage reservoir. These features reduce the net area available for water storage.
b. Inflow and outflow capacities allocated proportional to available storage volume.
c. Totals may not add up exactly because of rounding.
d. Miami Canal pump station at 4,310 cfs and L-1E Canal pump station at 500 cfs.
e. Two pumps stations at 3,600 cfs each, one on Miami Canal and the other on the North New River Canal.

ES.5 STORMWATER TREATMENT AREA A (STA-A)

To complement the potential construction of EAA storage reservoirs, additional wetland treatment area might also be necessary. The single potential treatment area configuration analyzed in this study would convert all of Compartment A to treatment wetlands. STA-A North would be constructed in the northern portion of Compartment A and the balance of this compartment would used to build STA-A South. The net available treatment areas of these two potential STAs are 25,700 and 8,800 acres, respectively.

The inflow pump stations and outflow structures for these two STAs would be arranged so these potential treatment areas could be supplied from and discharge water to either the Miami or North New River canals. The operation of these new treatment areas and STA-3/4 could be somewhat independent or the entire treatment system could operate in series.

ES.6 OPINIONS OF PROBABLE CONSTRUCTION COST

The opinions of probable construction cost (OPCC) developed for the potential EAA storage reservoir and treatment area additions are summarized below. These cost data were developed based on estimates available for the EAA Storage Reservoir A-1 and the Compartment C Buildout of STAs 5 and 6 (Black & Veatch, 2006; URS Corporation, 2007).

ES.6.1 Storage Option 1 Reservoirs

The cost opinions developed for the storage reservoirs in Storage Option 1 are summarized in Table ES-3. For the upper range storage limit (1.2 million acre-feet), the total OPCC is $5.44 billion. Reducing the target storage amount to approximately 800,000 acre-feet, would reduce this cost total to $3.08 billion.

Table ES-3: OPCC Summary for Storage Option 1 Reservoirs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				Unit Cost ($/ac-ft)
	Embankment	Inflow Pump Station(s)	Outflow Structure(s)	Total	
Northwest EAA	1,150	94	4.6	1,250	3,600
Northeast EAA	720	66	2.6	790	4,100
S-354 Spillway	---	---	19.4	20	---
C-139 Annex	940	75	3.1	1,020	4,400
S-5A Basin	1,070	78	3.3	1,150	4,600
S-4 Basin	680	54	1.8	740	5,500
Lake Hicpochee	190	21	0.4	210	7,300
Lake Okeechobee	240	18	0.3	260	12,000
Totals	4,990	406	35.5	5,440	---

ES.6.2 Storage Option 2 Reservoirs

The cost opinions developed for the storage reservoirs in Storage Option 2 are summarized in Table ES-4. For the upper range storage limit, the total OPCC is $4.98 billion. Reducing the target storage amount to approximately 800,000 acre-feet, would reduce this cost total to $3.01 billion.

Table ES-4: OPCC Summary for Storage Option 2 Reservoirs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				Unit Cost ($/ac-ft)
	Embankment	Inflow Pump Station(s)	Outflow Structure(s)	Total	
West EAA	1,630	154	7.7	1,790	3,100
East EAA	98	217	3.8	1,200	4,200
S-354 Spillway	---	---	19.1	20	---
C-139 Annex	920	73	3.0	1,000	4,500
Lake Hicpochee	670	43	1.3	710	7,600
Lake Okeechobee	240	17	0.3	260	12,500
Totals	4,440	503	35.1	4,980	---

ES.6.3 Compartment A Stormwater Treatment Areas

The OPCC cost data for the potential Compartment A STA are summarized in Table ES-5. These potential new treatment wetlands are estimated to cost approximately $400 million to develop. This cost would be additive to the reservoir costs summarized above for each storage option.

Table ES-5: OPCC Summary for Compartment A STAs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				
	Levee/Canal	Inflow Pump Station(s)	Internal Structure(s)	Outflow Structure(s)	Total
STA-A North	87.5	161.8	59.8	18.4	327.5
STA-A South	31.8	---	29.9	9.2	70.9
Totals	119.3	161.9	89.7	27.6	398.5

ES.6.4 OPCC Summary

An overall summary of the development costs for the potential EAA storage reservoir and treatment area additions are summarized in Table ES-6. This summary includes the project construction costs summarized above plus additional indirect costs and a system-wide contingency allowance.

Table ES-6: Total System Development Costs (January 2009)

Storage Option	Cost Item	Opinion of Probable Cost ($ billion)	
		Upper Storage Limit (1.2 million ac-ft)	Lower Storage Limit (800,000 ac-ft)
No. 1 USSC Land Only	Storage Reservoir Construction	5.44	3.08
	Compartment A STA Construction	0.40	0.40
	Planning, Engineering & Design	0.88	0.52
	Permitting	0.06	0.03
	Program Management	0.53	0.32
	Subtotal	7.30	4.35
	Contingency	1.82	1.08
	Grand Total	**9.12**	**5.43**
No.2 Modified Corridor	Storage Reservoir Construction	4.98	3.01
	Compartment A STA Construction	0.40	0.40
	Planning, Engineering & Design	0.81	0.51
	Permitting	0.05	0.03
	Program Management	0.49	0.31
	Subtotal	6.73	4.26
	Contingency	1.68	1.06
	Grand Total	**8.40**	**5.33**

Review of Table ES-6 shows a total cost range of $8.40 to $9.12 billion for development of a storage and treatment system with 1.2 million acre-feet of storage and about 34,500 acres of available treatment area. Reducing the target storage requirements to about 800,000 acre-feet would lower this cost range to $5.33 to $5.43 billion.

* * * * *

1.0 INTRODUCTION

On January 9, 2009, Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) was authorized by Florida Crystals Corporation to develop a conceptual analysis and conceptual opinion of probable construction costs for potential storage reservoir and wetland treatment area additions in and near the Everglades Agricultural Area (EAA). The balance of this report section presents discussions of the project background and assumed objectives.

1.1 PROJECT BACKGROUND

On June 24, 2008, Florida Governor Charlie Crist announced that the South Florida Water Management District (SFWMD or District) would begin negotiating an agreement to acquire as much as 187,000 acres of agricultural land owned by the United States Sugar Corporation (U.S. Sugar or USSC). These vast tracts of land within the EAA and nearby areas would then be used to reestablish a part of the historic connection between Lake Okeechobee and America's Everglades through a managed system of storage and treatment and, at the same time, safeguard the St. Lucie and Caloosahatchee rivers and estuaries (SFWMD, 2008a).

In the five months following the Governor's announcement, the District completed extensive negotiations with U.S. Sugar and due diligence investigations for the proposed land acquisition. The District's Governing Board approved the negotiated purchase and sale contract for this land acquisition on December 16, 2008 (SFWMD, 2008d).

If the planned acquisition of these USSC lands is completed, these newly acquired lands would be available for use in the ongoing Everglades restoration efforts. District staff has begun the arduous task of planning just how these lands might be developed. This planning process is likely to take several months or years to complete but the staff has presented some conceptual development concepts to the District's Governing Board. While these conceptual concepts might evolve with time, they are used herein to form the basis for the analyses and cost opinions presented in this report (SFWMD, 2008b).

1.2 PROJECT OBJECTIVES

The primary objectives of this study are as follows:

1. To complete conceptual analyses of potential storage and wetland treatment area additions that may be constructed within and nearby the EAA as a result of the planned acquisition of U.S. Sugar lands. These analyses include conceptual estimates of the available storage volumes, embankment heights, and representative capacities for inflow and outflow structures.

2. From the conceptual design information developed in Item 1 above, develop conceptual opinions of probable construction cost for these potential facilities.

1.3 PRINCIPAL PROJECT ASSUMPTIONS

The analyses and cost opinions presented herein were developed on a very short schedule (less than three weeks elapsed time) so many simplifying assumptions were required to complete these analyses in the time allotted. Principal among the guiding assumptions used on this project are the following:

- The storage reservoirs planned within Compartment A of the Talisman Land Exchange (EAA Storage Reservoirs A-1 and A-2) might not be constructed. This land might be used instead for development of additional stormwater treatment areas (STAs). Outside of Compartment A, all of the newly-developed facilities were assumed to be for storage and not treatment.

- The new storage reservoirs might use an embankment design and designs for pumping stations and discharge structures similar to those prepared for the now-cancelled EAA Storage Reservoir A-1. Likewise, the opinions of probable construction cost developed in this study for the potential storage reservoirs might be based on detailed estimates prepared for this reservoir. The design and cost information used as a basis for this study was obtained from the Basis of Design Report (BODR) for the EAA Storage Reservoir A-1 (Black & Veatch, 2006). These design and cost data evolved somewhat between completion of the BODR and final project design. These subsequent changes are not reflected in the conceptual design and cost opinions developed in this study for the potential new EAA storage reservoirs.

- One of the goals for these new storage reservoirs is to eliminate, to the extent practicable, required regulatory releases from Lake Okeechobee to the St. Lucie River (C-44 Canal) and Caloosahatchee River (C-43 Canal). Releases to the St. Lucie River are normally made in pulses at a discharge rate of 7,500 cubic feet per second (cfs); therefore, the combined inflow capacity for the new reservoirs must be a minimum of 7,500 cfs. Discharges to the Caloosahatchee River are much more variable but can also range up to 7,500 cfs or more. he total inflow pumping capacity for the new reservoirs was assumed to be 10,000 cfs. This total inflow capacity might be allocated to the individual storage reservoirs in proportion to their respective storage capacities.

- Conceptual analyses by SFWMD staff have shown that between 800,000 and 1.2 million acre-feet of storage south of Lake Okeechobee might be required to limit discharges to the St. Lucie and Caloosahatchee estuaries to acceptable levels (SFWMD, 2008c). Within each storage reservoir option, all of the component reservoirs are assumed to have the same maximum storage depth, in the range of 12 to 15 feet, above original ground surface (SFWMD, 2008b).

- The combined discharge capacity of Pumping Stations S-7 and S-8 (6,660 cfs) might be used to define the total discharge capacity from the new storage reservoirs (Cooper, 1989). The discharge capacities of the individual storage reservoirs were also apportioned based on their individual storage capacities.

- The inflow pumping capacity for the new STAs planned for construction within Compartment A might be equal to 7,200 cfs, or 3,600 cfs for each of two pump stations. One of these pump stations might be located on the Miami Canal and the other on the North New River Canal. These potential pump station capacities are consistent with the existing or planning conveyance capacities of these two canals.

* * * * *

2.0 CONCEPT DESIGN

Conceptual facility descriptions for the potential new storage reservoirs and STAs are presented in this report section. No detailed planning or design studies were feasible given the short duration for this study. The design concepts presented below would without question undergo considerable refinement as time passes and should be considered only conceptual in nature.

The concept designs analyzed in this study for the potential new EAA storage reservoirs are based on two alternative concepts developed by SFWMD staff. These two storage options are described below.

2.1 STORAGE OPTION 1 — USSC LANDS ONLY

Storage Option 1 would develop the potential storage reservoirs solely within USSC lands that would be acquired as part of the planned acquisition. This option is assumed to include seven individual storage reservoirs shown on Figure 2-1. Each of these potential storage reservoirs is discussed briefly below.

2.1.1 S-5A Basin Reservoir

The potential storage reservoir designated as S-5A Basin in Figure 2-1 would be located along the east shore of Lake Okeechobee. This reservoir would be located primarily within the S-5A Basin, but a small portion at the northern end of this reservoir would be located within the L-8 Basin. This reservoir was estimated to have a gross area of approximately 19,400 acres (30.3 square miles) and a perimeter of about 157,100 feet (29.8 miles). The footprint of the reservoir's perimeter embankment, seepage collection canals and maintenance roads were expected to occupy a corridor approximately 600 feet wide. Subtracting this corridor from the gross area of this reservoir area yields a net storage area of about 17,200 acres.

The potential S-5A Basin reservoir was assumed to have a single inflow pump station located on Lake Okeechobee near its northern end. The principal discharge structure for this reservoir might be located at the southernmost end of the reservoir and discharge into the West Palm Beach (L-10) Canal. The inflow pump station and outlet structure were assumed to have capacities of 2,070 and 1,380 cfs, respectively.

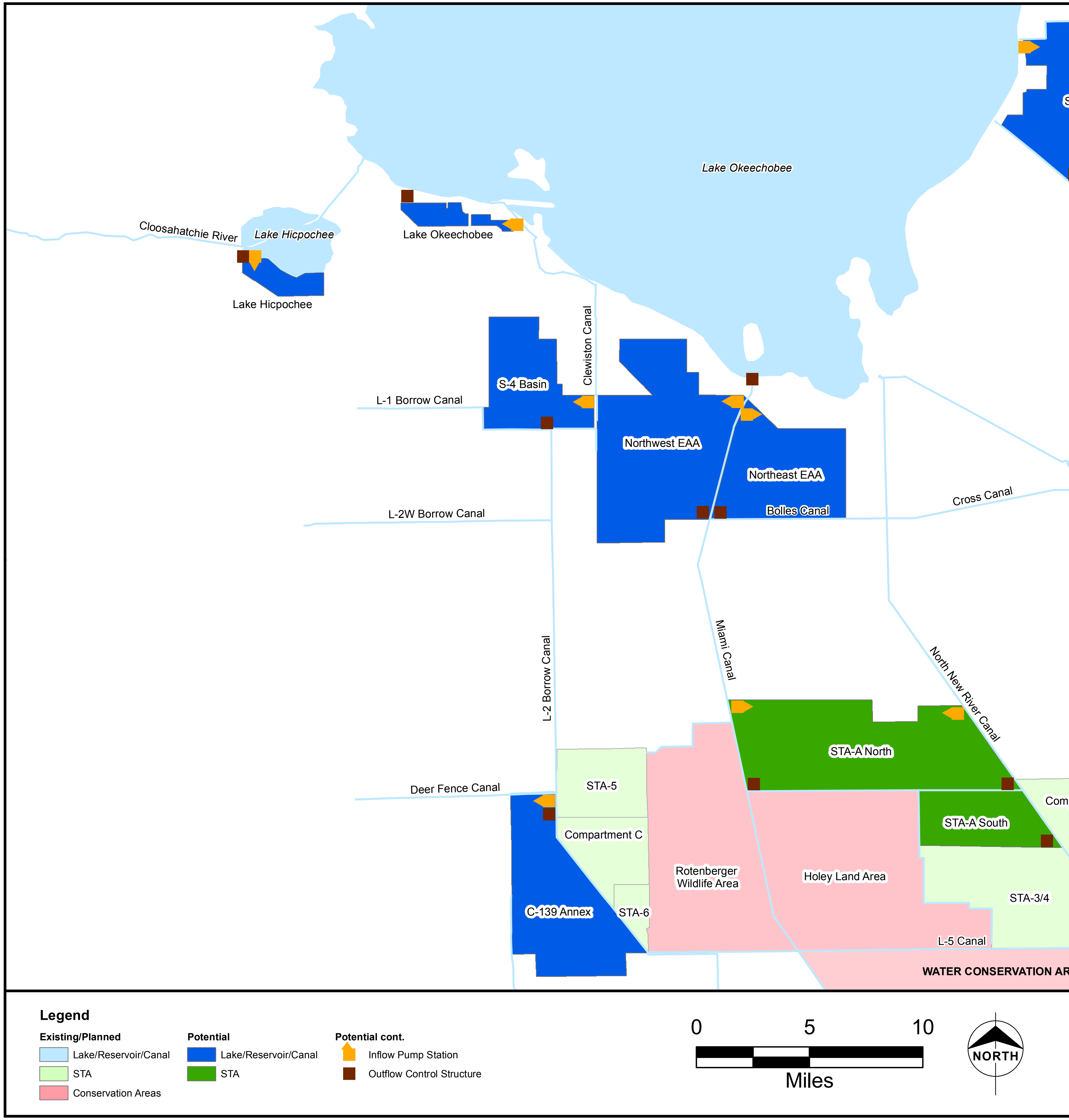

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Figure 2-1

Storage Option 1
USSC Lands Only

2.1.2 Lake Okeechobee Reservoir

The potential Lake Okeechobee reservoir would be located near the shore of Lake Okeechobee between Clewiston and Moore Haven. This area would be entirely within the northern S-4 Basin. The estimated gross area of this reservoir is only 2,080 acres (3.3 square miles), making it the smallest of the potential reservoirs. Subtracting the required footprint for the perimeter embankment and seepage collection canals, which have an estimated length of 42,200 feet (8.0 miles), leaves a net storage area of approximately 1,500 acres.

A single inflow pump station was assumed at this reservoir. This pump station would be located at the eastern end of this reservoir where it would be supplied from the LD-1 perimeter canal. The discharge structure from this reservoir would be located at the opposite (western) end of the reservoir. It was assumed that these discharges would flow into the C-43 Canal and not be delivered southward into the Everglades. The assumed inflow and outflow capacities of these structures were 180 and 120 cfs, respectively.

2.1.3 Lake Hicpochee Reservoir

The potential Lake Hicpochee reservoir would be constructed adjacent to the south shore of Lake Hicpochee. This reservoir would be located in the C-43 Basin, which is not a part of the EAA. This potential reservoir is also relatively small, with a gross land area of about 2,400 acres (3.8 square miles) and a perimeter length of approximately 31,700 feet (6.0 miles). The usable water storage area in the reservoir was estimated at about 1,960 acres.

This potential storage reservoir would draw its supply from and discharge back to the C-43 Canal (Caloosahatchee River). It was assumed that the inflow pump station and outflow structures for this reservoir would both be located at the western end of this reservoir adjacent to the C-43 Canal. The inflow pump station for this reservoir was assumed to have a capacity of 240 cfs; the outflow capacity would be approximately 160 cfs.

2.1.4 S-4 Basin Reservoir

The potential storage reservoir that is designated as S-4 Basin in Figure 2-1 would be located in the extreme southeastern portion of the S-4 Basin. This reservoir has an estimated gross land area of 10,700 acres (16.8 square miles). The perimeter embankment required to impound this reservoir would be about

105,600 feet (20 miles) long. After construction of this embankment, it was estimated this reservoir would have a net surface area of 9,270 acres.

The S-4 Basin reservoir would be supplied by a pump station located on the Clewiston (Industrial) Canal. The outflow structure for this reservoir would be located along the southern perimeter of the reservoir where it would discharge into the L-1 Borrow Canal. The estimated capacity of this inflow pump station would be 1,120 cfs and the outflow structure would have a capacity of 740 cfs.

2.1.5 Northwest EAA Reservoir

The potential Northwest EAA reservoir would be bordered on the east by the Miami Canal where it would occupy a significant part of the western S-3 Basin. This reservoir would have a gross footprint of approximately 26,100 acres (40.8 square miles). This potential reservoir is the largest of the reservoirs included under Storage Option 1. The perimeter embankment for this reservoir was estimated to be about 167,600 feet (31.8 miles). The net usable storage area for this reservoir was estimated as 23,800 acres.

This reservoir would be supplied from the Miami Canal by an inflow pump station potentially located near its northeast corner. The assumed outflow structure for this reservoir would be located at the southeast corner of the reservoir and discharge back into the Miami Canal. These two facilities would have inflow and outflow capacities of 2,860 and 1,910 cfs, respectively.

2.1.6 Northeast EAA Reservoir

The potential Northeast EAA reservoir would be located on the east side of the Miami Canal opposite the Northwest EAA reservoir. This reservoir has a gross area of approximately 14,700 acres (23.0 square miles). After construction of a perimeter embankment, which would have a length of about 109,600 feet (20.8 miles), the net usable storage area at this reservoir would be about 13,200 acres.

The inflow pump station and outflow structure for this potential reservoir would mirror those for the adjacent Northwest EAA reservoir. These structures would be located respectively at the northwest and southwest corners of the reservoir and have capacities of 1,590 and 1,060 cfs, respectively.

2.1.7 C-139 Annex Reservoir

The last potential reservoir included in Storage Option 1 is the C-139 Annex reservoir. This reservoir would be located in the L-28 Interceptor Basin and not within the EAA. The gross footprint of this reservoir would be approximately 17,920 acres (28.0 square miles). The perimeter embankment for this reservoir would have a total length of about 134,600 feet (25.5 miles). The net storage area at this reservoir would be approximately 16,100 areas.

The supply for this reservoir would come from the L-3 Canal via an inflow pump station located near the northeast corner of the reservoir. The outflow structure from this reservoir would be located in this same area. These structures might have capacities of approximately 1,940 and 1,290 cfs, respectively.

There is no current connection between the L-3 Canal and Lake Okeechobee. Delivering water from Lake Okeechobee to this reservoir might require a new connector canal between the Miami and L-3 canals. Stages in the L-3 Canal are typically higher than those in the Miami Canal so this new connection would also require a new pump station. Therefore, delivering water to this reservoir from Lake Okeechobee may require this water to be pumped twice — from the Miami Canal into the L-3 Canal and then again into the reservoir. Reservoir discharges would be directed through STA-5 for treatment before they are discharged into the Miami or L-4 Canals.

2.1.8 S-354 Spillway Modification

In order to supply the potential reservoirs described above, the capacity of the existing S-354 spillway might have to be increased by modification or replacement of this structure. This spillway controls releases from Lake Okeechobee to the Miami Canal. Under Storage Option 1, the new S-352 spillway was assumed to have a minimum capacity of 8,060 cfs.

2.1.9 Storage Summary

The data presented above for the seven individual storage reservoirs included under this storage option are summarized in Table 2-1. These reservoirs have total gross and net surface areas of approximately 93,300 and 83,000 acres, respectively. In order to yield an upper target storage volume of 1.2 million acre-feet, these reservoirs would need to provide a maximum storage depth of about 14.5 feet on average. Although it might not be an optimum assumption, all of these reservoirs are assumed to have the same storage depth for this conceptual analysis.

As shown in Table 2-1, these reservoirs would have a total storage volume of 1.2 million acre-feet with a maximum storage depth of 14.5 feet. District staff has stated the target for EAA storage ranges from 800,000 to 1.2 million acre-feet so this configuration would provide the maximum amount of storage desired. To lower the total system storage to near 800,000 acre-feet, it was assumed that some of the smaller, less cost-effective potential reservoirs would be eliminated entirely. As demonstrated later in

Section 3.0, the unit cost of storage in these individual potential reservoirs is generally inversely related to their storage volume. A reservoir system including three of the larger reservoirs only — Northwest EAA, Northeast EAA, and C-139 Annex — would have a total storage volume near the lower end of the desired target range (approximately 769,000 acre-feet). Another approach for modifying the total system storage would be to adjust the maximum storage depth and/or footprint of individual reservoirs. This storage optimization was considered to be beyond the scope of the conceptual analyses included in this study.

Table 2-1: Storage Option 1 Reservoirs

Reservoir Name	Area (acres)		Storage Volume (1000 ac-ft)	Embank-ment Length (feet)	Capacity (cfs)[b]	
	Gross	Net[a]			Inflow Pump Sta.	Outflow Structure
S-5A Basin	19,400	17,200	249.3	157,100	2,070	1,380
Lake Okeechobee	2,080	1,500	21,7	42,200	180	120
Lake Hicpochee	2,400	1,960	28.5	31,700	240	160
S-4 Basin	10,700	9,270	134.3	105,600	1,120	740
Northwest EAA	26,100	23,800	344.7	167,600	2,860	1,910
Northeast EAA	14,700	13,200	191.6	109,600	1,590	1,060
C-139 Annex	17,900	16,100	232.9	134,600	1,940	1,290
S-354 Spillway	---	---	---	---	---	8,060
Totals[c]	93,300	83,000	1,203.1	748,400	10,000	14,700

a. Reservoir embankments, seepage collection canals and access roads might occupy a swath approximately 600 feet wide around the perimeter of each storage reservoir. These features reduce the net area available for water storage.
b. Inflow and outflow capacities allocated proportional to available storage volume.
c. Totals may not add up exactly because of rounding.

2.1.10 Freeboard Analysis

The EAA Storage Reservoir A-1 had a planned maximum storage depth of 12 feet and an embankment height of 26 feet above its original ground elevation (OG). The difference between these two values is defined as freeboard. The purpose of freeboard is to provide sufficient additional embankment height so that extreme waves and other wind- and precipitation-induced phenomena cannot result in water overtopping the embankment. If significant overtopping of an embankment should occur, this action could lead to erosion of the embankment and subsequently its failure.

As stated above, the maximum storage depth for the seven individual reservoirs included in Storage Option 1 was estimated at 14.5 feet, which would be 2.5 feet deeper than that considered in the design of Reservoir A-1. Some of the fetch lengths of these reservoirs would also be significantly different from the

8.3 miles used in design of Reservoir A-1. Fetch is defined as the longest uninterrupted distance across the reservoir that could be subjected to extreme wind action. Fetch length has a direct impact on the magnitude of wind setup and wave run-up on an embankment and, therefore, on the amount of required freeboard.

As discussed in Section 3.0, the cost of building an embankment around the perimeter of these potential storage reservoirs would readily be the biggest cost component. Since the cost of these embankments is primarily a function of embankment length and height, a conceptual freeboard analysis was completed for each potential reservoir to estimate the required embankment height. This freeboard analysis was developed using the guidance provided in the SFWMD's Design Criteria Memorandum: DCM-2 and the U.S. Army Corps of Engineers' Coastal Engineering Manual (2003). DCM-2 defines four design cases for freeboard that specify different wind speeds and precipitation depths. From the freeboard analyses completed for Reservoir A-1, these design cases are as follows (Black & Veatch, 2006):

- Case No. 1: Wind speed of 103 miles per hour (mph) and rainfall depth of 4.5 feet
- Case No. 2: Wind speed of 122 mph and rainfall depth of 3.5 feet
- Case No. 3: Wind speed of 158 mph and no rainfall
- Case No. 4: Wind speed of 119 mph and no rainfall

The controlling case number (that is, the conditions that result in the highest maximum water level) will vary depending on maximum storage depth and fetch length. The results of the conceptual freeboard analysis for the Storage Option 1 reservoirs are summarized in Table 2-2. Review of this table shows that these embankment heights range from 24 to 29 feet above OG.

Table 2-2: Conceptual Freeboard Analysis for Storage Option 1 Reservoirs

Reservoir Name	DCM-2 Case No.[a]	Fetch Length (miles)	Wind Setup (feet)	Wave Run-up (feet)	Maximum Water Level (feet+OG)[b,c]	Design Embankment Height (feet+OG)[b,d]
S-5A Basin	2	8.5	2.76	7.28	28.04	28.5
Lake Okeechobee	2	2.8	1.15	4.51	23.66	24.0
Lake Hicpochee	2	3.8	1.44	5.39	24.83	25.0
S-4 Basin	2	6.0	2.05	6.48	26.54	27.0
Northwest EAA	2	9.0	2.90	7.42	28.32	28.5
Northeast EAA	2	6.9	2.31	6.79	27.10	27.5
C-139 Annex	3	9.4	6.54	7.58	28.62	29.0

a. Case number that produces the highest maximum water level.
b. Height in feet above the average original ground surface.
c. Maximum water level is calculated as the sum of maximum storage depth (14.5 feet), rainfall depth (varies by case number), wind setup and wave run-up.
d. Design embankment height based on maximum water level rounded up to nearest half-foot increment.

2.2 STORAGE OPTION 2 — MODIFIED CORRIDOR

The potential reservoirs included in Storage Option 2 are shown on Figure 2-2. This storage option would provide a nearly continuous corridor of storage reservoirs, treatment wetlands and wildlife management areas between Lake Okeechobee and WCA-3A. Unlike Storage Option 1, significant parts of these potential reservoirs would be constructed on lands that are not part of the proposed U.S. Sugar land acquisition. This storage option includes five individual storage reservoirs that are each discussed briefly below.

2.2.1 Lake Okeechobee Reservoir

The potential Lake Okeechobee reservoir is identical to the reservoir discussed above in Section 2.1.1, except that its maximum storage depth and inflow and outflow capacities might differ. The required maximum storage depth for this and the other reservoirs included in this storage option is discussed in Section 2.2.7 below. The inflow pump station and outflow structure capacities for this potential reservoir were estimated at 170 and 110 cfs, respectively.

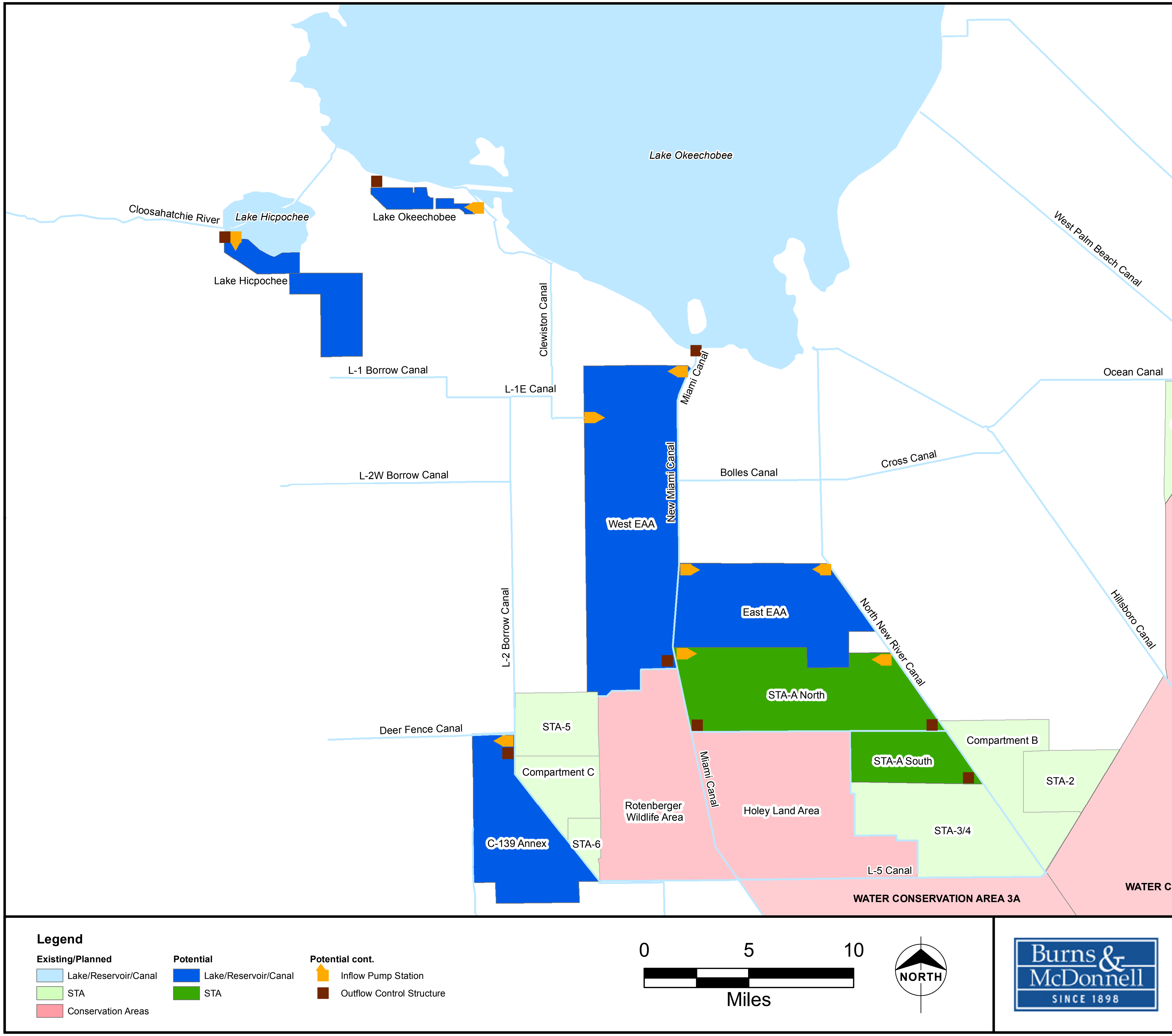


Figure 2-2

Storage Option 2
Modified Corridor

2.2.2 Lake Hicpochee Reservoir

Under this storage option, the storage reservoir designated as Lake Hicpochee is greatly expanded in size. This reservoir would have a gross area of approximately 8,320 acres, about 3.5 times larger than this same reservoir under Storage Option 1. The perimeter length of this reservoir would be approximately 113,500 feet (21.5 miles). The usable water storage area in the reservoir was estimated at about 6,760 acres.

In addition to its much larger size, this reservoir would have a different maximum storage depth and inflow/outflow capacities under this storage option. The capacities of its inflow and outflow facilities were estimated at 780 and 520 cfs, respectively

2.2.3 West EAA Reservoir

The potential West EAA reservoir is the largest reservoir included in this storage option. This reservoir would occupy an almost continuous corridor between Lake Okeechobee on the north and the Rotenberger Wildlife Management Area on the south. For this reservoir, it was assumed that the Miami Canal would be relocated to run along the eastern boundary of this reservoir. The West EAA reservoir would have a gross footprint of approximately 44,800 acres (70.0 square miles). The perimeter embankment for this reservoir was estimated to be about 220,400 feet (41.8 miles) long. Subtracting the land that might be occupied by the reservoir's embankment, seepage collection canals and access roads, the net usable storage area for this reservoir was approximately 41,800 acres.

It was assumed that this reservoir would be supplied by two inflow pump stations, one located near its northeast corner on the Miami Canal and the other where the L-1E Canal intersects the reservoir's western boundary. These two pump stations would have capacities of 4,310 and 500 cfs, respectively. The assumed outflow structure for this reservoir, with a capacity of about 3,200 cfs, would be located at the southeast corner of the reservoir and discharge back into the Miami Canal.

2.2.4 East EAA Reservoir

The potential East EAA reservoir would be located north of Compartment A between the Miami and North New River canals. This reservoir has a gross area of approximately 22,700 acres (33.5 square miles). After construction of a perimeter embankment, which would have a length of about 142,600 feet (27.0 miles), the net usable storage area at this reservoir would be approximately 20,800 acres.

This potential storage reservoir was assumed to have two inflow pump stations, one at the northwest corner of the reservoir on the Miami Canal and the other at the northeast corner on the North New River

Canal. Both of these pump stations were assumed to have capacities of 3,600 cfs. This reservoir would have a series of outflow structures, with total capacities of 1,590 cfs, distributed along its southern boundary. These structures would discharge directly into the inflow canal for the potential new Compartment A STA.

2.2.5 C-139 Annex Reservoir

The last potential reservoir included in Storage Option 2 is the C-139 Annex reservoir. The footprint of this reservoir would be identical to the reservoir described in Section 2.1.9 but it might have a different assumed maximum storage depth and inflow/outflow capacities. The inflow pump station and outflow structure for this potential reservoir were sized for 1,850 and 1,230 cfs, respectively.

2.2.6 S-354 Spillway Modification

The S-354 spillway modification or replacement described above in Section 2.1.8 would also be necessary for this storage option; however, the required capacity would be slightly less at 7,910 cfs.

2.2.7 Storage Summary

The data presented above for the five individual storage reservoirs included under this storage option are summarized in Table 2-3. These reservoirs have total gross and net surface areas of approximately 95,800 and 86,800 acres, respectively. In order to yield an upper target storage volume of 1.2 million acre-feet, these reservoirs would need to provide a maximum storage depth of about 13.8 feet on average. Although it might not be an optimum assumption, all of these reservoirs are assumed to have the same maximum storage depth for this conceptual analysis.

Eliminating all but the two largest reservoirs under this storage option would reduce the total system storage to near the lower end of the target storage range (approximately 859,000 acre-feet).

2.2.8 Freeboard Analysis

The underlying assumptions behind the freeboard analysis were described previously in Section 2.1.9. The maximum storage depth for the five individual reservoirs included in Storage Option 2 was estimated at 13.8 feet, which is 1.8 feet higher than Reservoir A-1. The estimated fetch lengths of these reservoirs are shown in Table 2-4, which also summarizes the results of the freeboard analysis. Review of this table shows that these embankment heights range from 23.5to 28.5 feet above OG.

Table 2-3: Storage Option 2 Reservoirs

Reservoir Name	Area (acres)		Storage Volume (1000 ac-ft)	Embank-ment Length (feet)	Capacity (cfs)[b]	
	Gross	Net[a]			Inflow Pump Sta.	Outflow Structure
Lake Okeechobee	2,080	1,500	20.7	42,200	180	110
Lake Hicpochee	8,320	6,760	93.2	113,500	780	520
West EAA	44,800	41,800	576.3	244,200	4,810[d]	3,200
East EAA	22,700	20,800	286.4	142,600	7,200[e]	1,590
C-139 Annex	17,900	16,100	221.7	134,600	1,850	1,230
S-354 Spillway	---	---	---	---	---	7,910
Totals[c]	95, 800	86,800	1,198.4	677,200	10,000	14,700

a. Reservoir embankments, seepage collection canals and access roads might occupy a swath approximately 600 feet wide around the perimeter of each storage reservoir. These features reduce the net area available for water storage.
b. Inflow and outflow capacities allocated proportional to available storage volume.
c. Totals may not add up exactly because of rounding.
d. Miami Canal pump station at 4,310 cfs and L-1E Canal pump station at 500 cfs.
e. Two pumps stations at 3,600 cfs each, one on Miami Canal and the other on the North New River Canal.

Table 2-4: Conceptual Freeboard Analysis for Storage Option 2 Reservoirs

Reservoir Name	DCM-2 Case No.[a]	Fetch Length (miles)	Wind Setup (feet)	Wave Run-up (feet)	Maximum Water Level (feet+OG)[b,c]	Design Embankment Height (feet+OG)[b,d]
Lake Okeechobee	2	2.8	1.19	4.51	23.00	23.5
Lake Hicpochee	2	4.1	1.58	5.60	24.48	24.5
West EAA	3	16.0	11.03	8.34	33.17	33.5
West EAA w/ levee[e]	3	9.1	6.66	7.32	27.78	28.0
East EAA	3	9.6	6.97	7.45	28.22	28.5
C-139 Annex	3	9.4	6.85	7.40	28.04	28.5

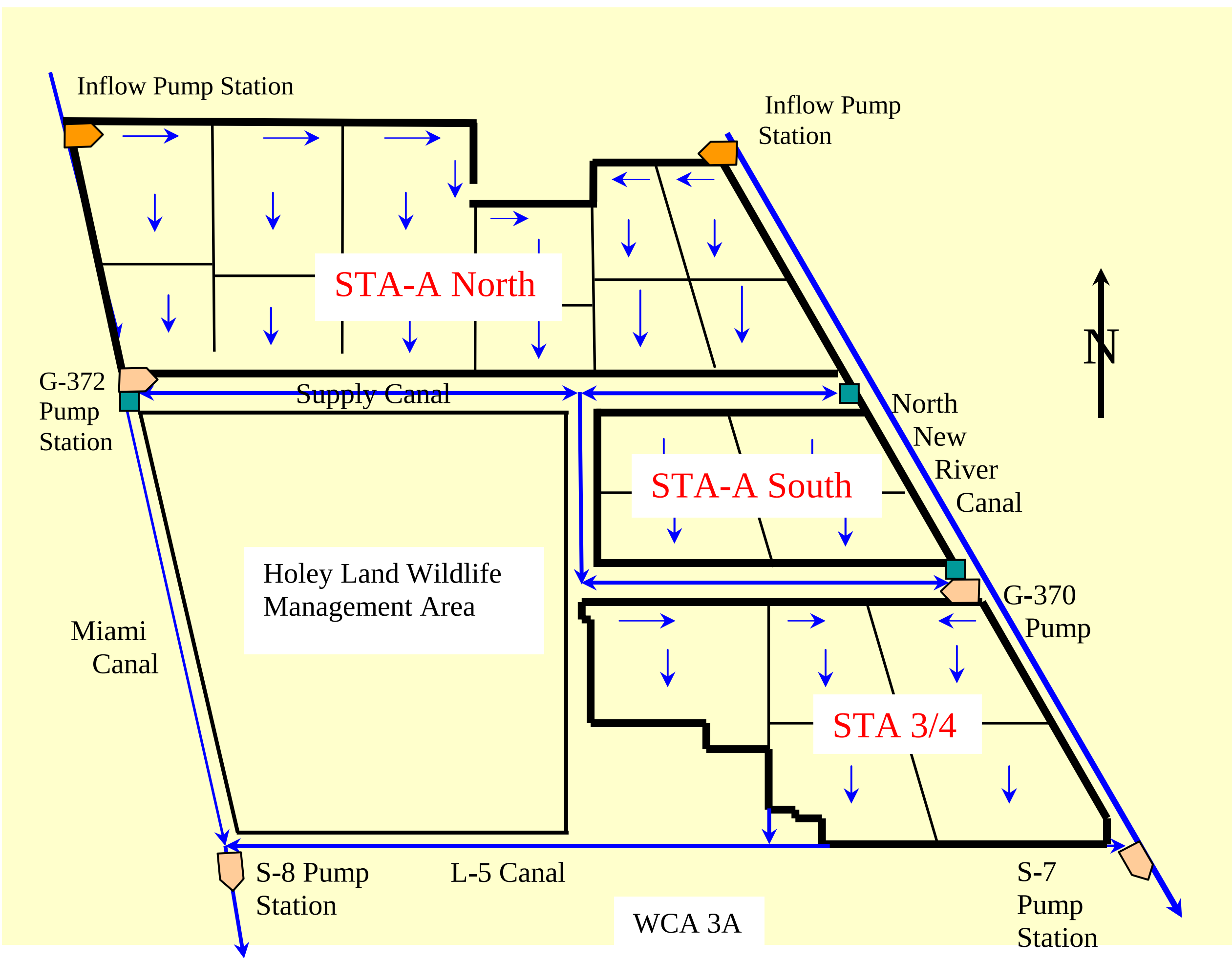
a. Case number that produces the highest maximum water level.
b. Height in feet above the average original ground surface.
c. Maximum water level is calculated as the sum of maximum storage depth (13.8 feet), rainfall depth (varies by case number), wind setup and wave run-up.
d. Design embankment height derived from maximum water level rounded up to nearest half-foot increment.
e. An intermediate levee or breakwater is included for this reservoir option that would reduce the longest fetch length from 16.0 to 9.1 miles.

Readers might notice there are two entries in Table 2-4 for the West EAA reservoir. The second entry assumes construction of an intermediate levee or breakwater in this reservoir to reduce the maximum fetch length from 16.0 to 9.1 miles. This breakwater might reduce the required embankment height by 5.5 feet from 33.5 to 28.0 feet above average original ground. As described in Section 3.0, the cost of this intermediate levee proved to be less than the savings available by lowering the embankment height by 5.5 feet.

2.3 STORMWATER TREATMENT AREA A (STA-A)

To complement the potential construction of EAA storage reservoirs, additional wetland treatment area might also be necessary. A single potential configuration for this new treatment area was assumed for the purpose of this study. It was assumed the entire area of Compartment A of the Talisman Land Exchange would be converted into STAs. One possible configuration for these new STAs is shown on the schematic included as Figure 2-3. The numerous inflow, intermediate and outflow structures that would be required in each new treatment flowway have been omitted from this schematic for clarity.

Figure 2-3: Schematic of New STAs in Compartment A



It was estimated that a total additional effective treatment area of approximately 34,500 acres could be developed in the additional treatment area. This total is within the range of 12,000 to 45,000 acres suggested by District staff in its October 8, 2008, presentation to the Governing Board.

2.3.1 STA-A North

As shown in Figure 2-3, the entire northern portion of Compartment A might be converted into a STA designated as STA-A North. STA-A North might be divided into six flow ways with two treatment cells each. The net available treatment area in these flowways would be approximately 25,700 acres.

Water would be delivered to the flowways in STA-A North via a supply canal that runs along its entire northern boundary. This canal might be supplied from both ends by two new inflow pump stations with (assumed) capacities of 3,600 cfs each. The eastern pump station would draw water from the North New River Canal and the western pump station from the Miami Canal.

The treated discharge from this STA would be delivered into what is now known as the STA-3/4 supply canal. This canal would be extended eastward along the bottom of this STA to meet the North New River Canal. The water discharged from STA-A North could be discharged to the Miami or North New River canals via two new discharge structures (assumed capacity of 3,600 cfs each) or used as inflow to STA-A South or STA-3/4.

2.3.2 STA-A South

A potential new treatment area designated STA-A South might be constructed in the balance of Compartment A, the portion that generally lies east of the Holey Land Wildlife Management Area. This new STA might consist of two flowways with two treatment cells each. The net usable treatment area in this STA would be approximately 8,800 acres.

This STA might be supplied from a canal that borders this STA on the north. The water delivered to this STA could be water discharged from STA-A North or water pumped from the Miami Canal at pump station G-372. Treated discharges from STA-A South would be delivered southward into the STA-3/4 supply canal. From this canal, this treated water could be discharge into the North New River Canal via a new discharge structure (assumed capacity 3,600 cfs) or serve as inflow to STA-3/4.

* * * * *

3.0 OPINION OF PROBABLE CONSTRUCTION COST

This report section discusses the opinions of probable construction cost (OPCC) that were developed from the conceptual designs presented in Section 2.0.

3.1 DISCLAIMER

The opinions of probable cost presented in this section are based on the experience and qualifications of Burns & McDonnell's professional engineering staff and its familiarity with the construction industry. Burns & McDonnell has no control over the cost of labor, materials, equipment or services furnished by others or over contractors' methods for determining prices, or over competitive bidding or market conditions; therefore, Burns & McDonnell cannot and does not guarantee that proposals, bids or actual total construction costs will not vary from the opinions of probable cost presented below.

3.2 UNIT COST DATA

The opinions of probable construction cost for each potential storage reservoir or STA were developed from unit cost data for the major components of each facility. These major cost components included reservoir embankments, levees and canals, inflow pump stations, and inflow and outflow control structures. These unit costs were derived from the OPCC data developed for other similar facilities, such as the EAA Storage Reservoir A-1 and the Compartment C Buildout for STAs 5 and 6. The sources and derivation of these unit cost data are discussed in more detail in the following subsections.

The unit cost data presented below include both direct and indirect construction costs. Indirect costs include the administrative and overhead costs associated with facility construction, such as the following:

- Sales taxes
- Construction contractor's administrative overhead and profit
- Bonds and insurance
- Project reserve
- Project contingency

The project contingency is an allowance for construction costs that cannot be readily estimated at the conceptual design phase, such as the following:

- Power line construction and relocation
- Bridges and other roadway relocations
- Additional pump stations and other conveyance improvements required to preserve existing flood service, control off-site seepage, etc.
- Interior land preparation — filling existing canals, removal of seepage paths, remediation to conditions conducive for environmental restoration use (which may be more restrictive than levels needed for normal commercial use), etc.
- Structure removal/demolition — existing agricultural pump stations and control structures, etc.

3.2.1 Construction Cost Escalation

A January 2009 basis was used for the project OPCC data presented in this report. However, the unit cost data used to develop these costs were developed at various times in the past so it was necessary to escalate these unit cost data to January 2009. Construction cost indices compiled by the R. S. Means Company for Tampa, Florida, were used to escalate these unit costs. These indices and the resulting cost escalation factors are summarized in Table 3-1.

Table 3-1: Construction Cost Escalation Factors

Year	Month	National Index[a]	Location Factor[b]	Composite Index[c]	Escalation Factor[d] (percent)
2005	Jul	151.6	87.3	132.35	27.96
2006	Jul	162.0	86.7	140.45	20.58
2007	Jul	169.4	86.7	146.87	15.31
2009	Jan	185.9	91.1	169.35	0.00

a. From Means, 2009.
b. Location adjustment factor for Tampa, Florida (percent of national index). From Means, 2005, 2006, 2007, 2009.
c. National index times location factor divided by 100.
d. Percent increase required to adjust cost data to January 2009.

3.2.2 Reservoir Embankment Costs

The unit cost data used for reservoir embankments were developed from OPCC data found in the Basis of Design Report (BODR) for the EAA Storage Reservoir A-1 (Black & Veatch, 2006). This reservoir project was considered representative of the possible designs for the potential storage reservoirs considered in this study.

In the BODR for the EAA Storage Reservoir A-1 (A-1 BODR), two general types of embankment cross section are identified. The first cross section (Type 1) has an associated seepage collection canal, seepage cutoff wall and other features designed to prevent impacts to adjacent non-project lands. The second cross section (Type 2) excludes many of these seepage control features and might be used only where the adjacent property consists of wetland treatment or wildlife management areas that are habitually flooded. Only the Type 1 cross section was used for the potential storage reservoirs considered in this report.

Table 8.13-1 of the A-1 BODR presents an OPCC for the selected embankment option. The cost data in this table were reviewed to identify the cost entries that apply to Type 1 cross section construction, Type 2 cross section construction and generally to the entire embankment construction contract. From this analysis, it was estimated that Type 1 cross section construction would cost $4,268 per lineal foot (LF) (January 2006 basis) and the Type 2 cross section $2,418/LF. Escalated to January 2009 using the rates in Table 3-1, these unit embankment costs become $5,146 and $2,916/LF, respectively.

The unit embankment costs listed above for the A-1 Reservoir are for an embankment with a top elevation 26 feet above original ground. The potential reservoirs considered in this study, however, have required embankment heights that might range from 23.5 to 33.5 feet above original ground. Therefore, some means for adjusting the embankment unit cost data based on embankment height was needed.

The embankment cross section for the A-1 Reservoir (Type 1 only) was studied to identify the embankment zones whose volume would change appreciably with varying embankment heights. The most significant volumetric changes are expected within the rockfill, random fill and roller-compacted concrete (RCC) slope protection zones. These three zones account for approximately two thirds of the total embankment cost. The specific unit costs for placement of the material in these three zones were determined from further review of Table 8.13-1 in the A-1 BODR. These unit costs are summarized in Table 3-2. Table 3-3 presents the adjusted unit embankment cost for each of the alternative embankment heights.

Table 3-2: Unit Cost Data for Embankment Components

Embankment Component	Unit Cost ($/cubic yard)	
	January 2006	January 2009
Rockfill	23.61	28.47
Random Fill	15.05	18.15
RCC Slope Protection	146.04	177.17

Table 3-3: Height-Adjusted Embankment Unit Costs (January 2009)

Embankment Height (feet+OG)	Height Difference from Base (feet)	Differential Unit Costs ($/LF)			Height-Adjusted Unit Cost[a] ($/LF)
		Rockfill	Random Fill	RCC Slope Protection	
Base (26.0)	0	0	0	0	5,146
23.5	-2.5	-196	-125	-164	4,661
24.0	-2.0	-158	-101	-131	4,756
24.5	-1.5	-120	-76	-98	4,851
25.0	-1.0	-81	-51	-66	4,948
27.0	+1.0	+84	+53	+66	5,349
27.5	+1.5	+127	+81	+98	5,452
28.0	+2.0	+171	+109	+131	5,557
28.5	+2.5	+215	+137	+164	5,663
29.0	+3.0	+261	+166	+197	5,770
33.5	+7.5	+706	+450	+492	6,794

a. Base unit cost ($5,146/LF) plus differential unit costs for rockfill, random fill and RCC slope protection.

3.2.3 Levees and Canals

The construction of levees and canals usually occur in tandem so the estimated unit costs for these features are combined. Two classes of levee/canal were evaluated for the potential new STA. Typical levee/canal construction (the first class considered) would produce a levee with adjacent borrow canal. The unit cost for these structures was estimated at $118/LF (October 2007) (URS, 2008). Escalated to January 2009, this unit cost becomes $136/LF.

The second class of levee/canal development applies to a STA inflow or discharge canal. These inflow canals typically have a major levee on both sides. On the other side of the major levees a seepage collection or spreader canal is typically developed. The unit cost of these larger canals was assumed to be twice that for a single levee at $272/LF (January 2009).

3.2.4 Inflow Pump Stations

The unit cost for reservoir inflow pump stations was derived from the cost data for the planned inflow pump station at the EAA A-1 Reservoir. In the A-1 BODR, Black & Veatch estimates the cost of this 3,600-cfs pump station at $84.5 million (July 2005). This cost was escalated to January 2009 ($108.1 million) and then adjusted for each new reservoir inflow pump station included in this study based on the capacity ratio between the assumed new pump station and original A-1 Reservoir station (3,600 cfs) raised to the 0.6 power. This adjustment recognizes that there are economies of scale (that is, as the capacity increases, the unit cost would be expected to decrease).

The pump station cost data cited above applies to a reservoir inflow pump station. An inflow pump station for a STA would have a lower design head requirement. The unit costs for a STA inflow pump station were derived from the BODR for the Compartment C Buildout for STAs 5 and 6 (URS Corporation, 2007). In this BODR, URS estimates the cost of the proposed G-508 pump station at $50.4 million (October 2007). This pump station would have a total capacity of 2,080 cfs. To estimate the cost for a 3600-cfs pump station, the same adjustment described above — capacity ratio raised to the 0.6 power — was used. The resulting cost ($70.1 million) was then escalated to January 2009 to give an estimated STA inflow pump station cost of $80.9 million each.

3.2.5 Inflow and Outflow Structures

Control structures were segregated into two general categories: reservoir outflow structures and STA control structures. The reservoir outflow category was also assumed to apply to the potential large outflow structures between STA outflow canals and the Miami or North New River canals and to the potential S-354 spillway replacement. The unit cost for this first structure type was derived from information in the A-1 BODR for the planned southeast and southwest outflow structures (Black & Veatch, 2006). These two structures have an estimated cost of $12.7 million combined (January 2006) and a combined capacity of 6,475 cfs. These data yield a unit cost of approximately $2,000/cfs (January 2006) or about $2,412/cfs when escalated to January 2009.

The STA control structure category was applied to the inflow, intermediate and outflow structures in the potential new Compartment A STAs. The unit costs for these structures were derived from information in the BODR for Compartment C (URS Corporation, 2007). This analysis yielded a unit cost for these small structures of $2,400/cfs. This October 2007 value was escalated to January 2009 yielding a unit cost of approximately $2,767/cfs.

3.3 STORAGE OPTION 1

The OPCC for the storage reservoirs in Storage Option 1 are summarized in this section. The primary physical characteristics assumed for each of these reservoirs are listed in Table 3-4. These physical quantity data were combined with the unit costs data discussed above to yield the OPCC for each individual reservoir. These OPCC data are summarized in Table 3-5. The reservoirs in these two tables are listed in order of increasing unit storage costs.

Table 3-4: Physical Data Summary for Storage Option 1 Reservoirs

Name	Storage	Embankment	Discharge Capacity (cfs)

	Volume (1000 ac-ft)	Length (feet)	Height (feet+OG)	Inflow Pump Station(s)	Outflow Structure(s)
Northwest EAA	345	167,600	28.5	2,860	1,910
Northeast EAA	192	109,600	27.5	1,590	1,060
S-354 Spillway	---	---	---	---	8,060
C-139 Annex	233	134,600	29.0	1,940	1,290
S-5A Basin	249	157,100	28.5	2,070	1,380
S-4 Basin	134	105,600	28.5	1,120	740
Lake Hicpochee	28	31,700	25.0	240	160
Lake Okeechobee	22	42,200	24.0	180	120
Totals	1,203	748,400	---	10,000	14,700

Table 3-5: OPCC Summary for Storage Option 1 Reservoirs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				Unit Cost ($/ac-ft)
	Embankment	Inflow Pump Station(s)	Outflow Structure(s)	Total	
Northwest EAA	1,150	94	4.6	1,250	3,600
Northeast EAA	720	66	2.6	790	4,100
S-354 Spillway	---	---	19.4	20	---
C-139 Annex	940	75	3.1	1,020	4,400
S-5A Basin	1,070	78	3.3	1,150	4,600
S-4 Basin	680	54	1.8	740	5,500
Lake Hicpochee	190	21	0.4	210	7,300
Lake Okeechobee	240	18	0.3	260	12,000
Totals	4,990	406	35.5	5,440	---

Table 3-5 shows the total OPCC for the reservoirs in Storage Option 1 is $5.44 billion. The seven reservoirs included under this option would provide approximately 1.2 million acre-feet of storage. To meet the lower end of the possible storage range (800,000 acre-feet) indicated in the District staff's presentation to the Governing Board, only the top three reservoirs might be required. These three reservoirs — Northwest EAA, Northeast EAA and C-139 Annex — would have an aggregate storage volume of 770,000 acre-feet. This Storage Option 1 subset is estimated to have a total cost of $3.08 billion.

3.4 STORAGE OPTION 2

The OPCC for the storage reservoirs in Storage Option 2 are summarized in this section. The primary physical characteristics assumed for each of these reservoirs are listed in Table 3-6. These physical quantity data were combined with the unit costs data discussed above to yield the OPCC for each individual reservoir. These OPCC data are summarized in Table 3-7.

Table 3-7 shows the total OPCC for the reservoirs in Storage Option 2 is $4.98 billion. The five reservoirs included under this option would provide approximately 1.2 million acre-feet of storage. To meet the lower end of the possible storage range (800,000 acre-feet) indicated in the District staff's presentation to the Governing Board, only the top two reservoirs might be required. These two reservoirs have the lowest unit costs of storage. These two reservoirs — West EAA and East EAA — would have an aggregate storage volume of 862,000 acre-feet. This Storage Option 2 subset is estimated to have a total cost of $3.01 billion.

Table 3-6: Physical Data Summary for Storage Option 2 Reservoirs

Name	Storage Volume (1000 ac-ft)	Embankment		Discharge Capacity (cfs)	
		Length (feet)	Height (feet+OG)	Inflow Pump Station(s)	Outflow Structure(s)
West EAA	576	244,200	28.0	4,810	3,200
East EAA	286	142,560	28.5	2x3,600	1,590
S-354 Spillway	---	---	---	---	7,910
C-139 Annex	222	134,640	28.5	1,850	1,230
Lake Hicpochee	93	113,520	24.5	780	520
Lake Okeechobee	21	42,240	23.5	170	120
Totals	1,198	677,160	---	14,800	14,600

Table 3-7: OPCC Summary for Storage Option 2 Reservoirs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				Unit Cost ($/ac-ft)
	Embankment	Inflow Pump Station(s)	Outflow Structure(s)	Total	
West EAA	1,630	154	7.7	1,790	3,100
East EAA	98	217	3.8	1,200	4,200
S-354 Spillway	---	---	19.1	20	---
C-139 Annex	920	73	3.0	1,000	4,500
Lake Hicpochee	670	43	1.3	710	7,600
Lake Okeechobee	240	17	0.3	260	12,500
Totals	4,440	503	35.1	4,980	---

3.5 STORMWATER TREATMENT AREA A

The OPCC for the potential new STAs that might be built within Compartment A of the Talisman Land Exchange is summarized in this section. The assumed physical characteristics for these two STAs are listed in Table 3-8. These physical quantity data were combined with the unit cost data discussed above to yield the OPCC for each STA, summarized in Table 3-9.

Table 3-8: Physical Data Summary for Compartment A STAs

Name	Levees & Canals (1000 feet)		Discharge Capacity (cfs)		
	Single	Double	Inflow Pump Station(s)	Internal Control Structures	Outflow Structure(s)
STA-A North	265	63	2x3,600	21,600	2x3,600
STA-A South	94	24	---	10,800	3,600
Totals	359	87	7,200	32,400	10,800

Table 3-9: OPCC Summary for Compartment A STAs

Name	Opinion of Probable Construction Cost ($ million, 1/2009)				
	Levee/Canal	Inflow Pump Station(s)	Internal Structure(s)	Outflow Structure(s)	Total
STA-A North	87.5	161.8	59.8	18.4	327.5
STA-A South	31.8	---	29.9	9.2	70.9
Totals	119.3	161.9	89.7	27.6	398.5

3.6 OPCC SUMMARY

The OPCC data for the two storage options and the Compartment A STAs are summarized in the previous sections. These costs reflect possible construction costs for development of these facilities. There are additional costs that would apply to the development of an integrated storage and treatment system that are not included in these construction costs. These additional costs are listed below along with their estimated magnitude:

- Planning, engineering and design (PE&D): 15 percent of construction costs
- Permitting: 1 percent of construction costs
- Program management: 9 percent of construction costs

In addition to the additional costs described above, a contingency of 25 percent is recommended to account for other improvements that might be required (such as conveyance canal improvements for delivery of water to the various reservoirs) and uncertainty in projecting actual construction costs.

Applying these additional cost factors, the total OPCC for the potential EAA storage and treatment additions are summarized in Table 3-10. Overall, the anticipated cost for development of these storage and treatment additions in the EAA ranges from a high of about $9.1 billion to a low of $5.3 billion.

Table 3-10: Total System Development Costs (January 2009)

Storage Option	Cost Item	Opinion of Probable Cost ($ billion)	
		Assumed Upper Storage Volume (1.2 million ac-ft)	Assumed Lower Storage Volume (800,000 ac-ft)
No. 1 USSC Land Only	Storage Reservoir Construction	5.44	3.08
	Compartment A STA Construction	0.40	0.40
	Planning, Engineering & Design	0.88	0.52
	Permitting	0.06	0.03
	Program Management	0.53	0.32
	Subtotal	7.30	4.35
	Contingency	1.82	1.08
	Grand Total	**9.12**	**5.43**
No.2 Modified Corridor	Storage Reservoir Construction	4.98	3.01
	Compartment A STA Construction	0.40	0.40
	Planning, Engineering & Design	0.81	0.51
	Permitting	0.05	0.03
	Program Management	0.49	0.31
	Subtotal	6.73	4.26
	Contingency	1.68	1.06
	Grand Total	**8.40**	**5.33**

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4.0 REFERENCES

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