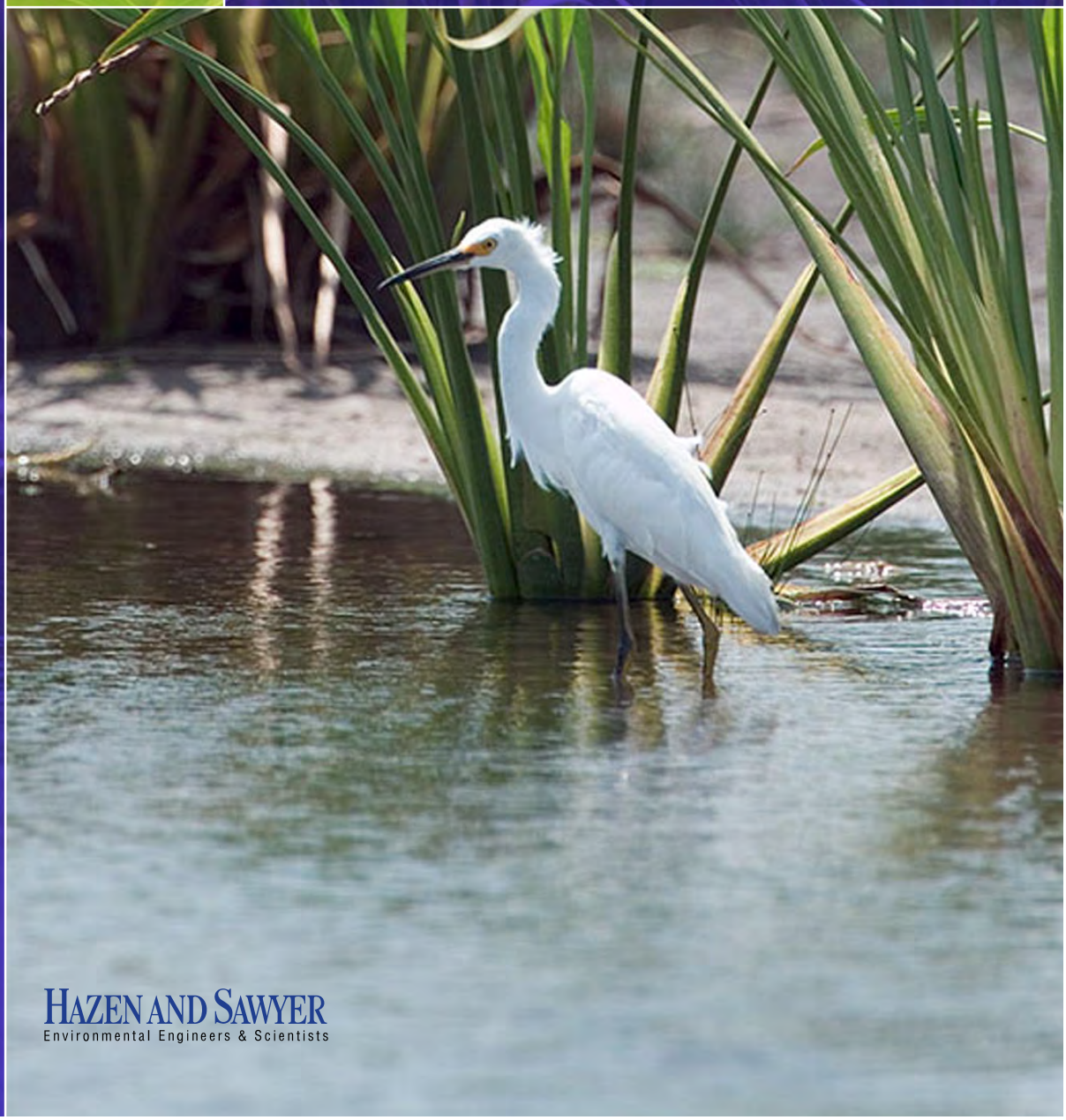
Compilation of Benefits and Costs of STA and Reservoir Projects in the South Florida Water Management District

Report

Prepared by Hazen and Sawyer

For the World Wildlife Fund
acting on behalf of the
Florida Ranchlands Environmental Services Project

July 2011



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July 21, 2011

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Compilation of Benefits and Costs of STA and Reservoir Projects in the South Florida Water Management District – FINAL REPORT

Dear Dr. Lynch:

We are pleased to submit the final report and Excel file as our deliverable for the project titled "Compilation of Benefits and Costs of STA and Reservoir Projects in the South Florida Water Management District". This document is a deliverable for the Agreement Number JS-94 between the World Wildlife Fund and Hazen and Sawyer dated July 14, 2010.

We thank you; Dr. Len Shabman, Resources for the Future; and Mr. James Laing, South Florida Water Management District for assisting us with this effort. We are especially thankful to the four project experts representing the South Florida Water Management District who completed the spreadsheet forms that compiled these benefit and cost values: Lisa Kreiger, Jianchang Cai, Janet Starnes and Brooke Ahrens. All persons who contributed to this study are listed in Section 1.0 of this report.

We enjoyed working with you, Len Shabman and the District to complete this study.

Very truly yours,

HAZEN AND SAWYER, P.C.

Grace M. Johns, Ph.D.
Senior Associate and Economist

Enclosure

c: File No. 46516-000

Table of Contents

Section 1.0
Project Purpose and Methods

This report and associated Excel file is a compilation of the benefits and costs of five water management projects in the South Florida Water Management District. These projects are the responsibility of the U.S. Army Corps of Engineers and/or the District and are in various stages of design, construction and operation. The five projects are as follows.

1. Taylor Creek Stormwater Treatment Area (STA) in Okeechobee County
2. Nubbin Slough Stormwater Treatment Area (STA) in Okeechobee County
3. Lakeside Ranch Stormwater Treatment Area (STA) in Martin County
4. Caloosahatchee (C-43) West Basin Storage Reservoir in Hendry County
5. St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area in Martin County

The projects include four stormwater treatment areas and two reservoirs. The primary purpose of the stormwater treatment areas is to reduce the amount of phosphorus entering water bodies within south Florida. The primary purposes of the reservoirs are to control the flow of water entering estuaries to protect them from harm and to provide a water supply source using water that would otherwise flow to tide. These projects also provide other benefits as described in this report.

The five projects were chosen by the District. District staff who participated in choosing the projects were Benita Whalen, Deputy Department Director, Okeechobee Service Center; Temperince Morgan, Department Director, Policy and Coordination; Jeff Kivett, Department Director; and Susan Ray, Engineer Chief, Accelerated Projects Office. The District's project manager who led the effort to compile the benefit and cost information was James Laing, Senior Environmental Scientist. The directors of the Florida Ranchlands Environmental Services Project (FRESP), Sarah Lynch, Ph.D., World Wildlife Fund (WWF) Director – Agriculture and Leonard Shabman, Ph.D., Resident Scholar, Resources for the Future, directed Hazen and Sawyer for this effort. WWF was the contracting agent on behalf of the FRESP partners.

A companion document to the Hazen and Sawyer report written by Dr. Lynch and Dr. Shabman entitled **"**Background and Context for Interpreting the Compilation of Benefits and Costs of STA and Reservoir Projects in the South Florida Water Management

District for the Northern Everglades Payment for Environmental Services Program" is available at the FRESP web site www.fresp.org.

Hazen and Sawyer designed an Excel spreadsheet that, once completed by the manager of the STA or reservoir project, describes the project and provides the benefits and costs of the project. The spreadsheet includes information needed to calculate the total cost per pound of phosphorus removed and the total cost per acre-foot of water storage capacity under normal operations in 2011 dollars. This spreadsheet was presented at a meeting of those persons employed or contracted by the South Florida Water Management District who had direct knowledge of these projects. These persons were asked to complete the Excel spreadsheet corresponding to the project assigned to them. The persons who provided this information and the corresponding projects are provided in Table 1.1.

Table 1.1
Persons Who Provided the Benefit and Cost Information

Name	Affiliation	Project for which Benefits and Costs Were Provided
Lisa Kreiger Project Manager	South Florida Water Management District	Taylor Creek STA Nubbin Slough STA
Jianchang Cai Lead Engineer	South Florida Water Management District	Lakeside Ranch STA
Janet Starnes Principal Project Manager	South Florida Water Management District	Caloosahatchee (C-43) West Basin Storage Reservoir
Brooke Ahrens, P.E. Water Resources Engineer	HDR, Inc.	St. Lucie Canal (C-44) Reservoir and STA

Each person listed in Table 1.1 completed the Excel spreadsheet for each project. The completed spreadsheets were then reviewed by Hazen and Sawyer. After a round of follow-up questions, a second meeting was held to go over the completed spreadsheets. The experts listed in Table 1.1 were then asked to provide a final review of the Excel spreadsheet and make any necessary corrections. The results of this exercise are provided in the Tables presented in this report. These tables reflect the information contained in the Excel file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011".

The organization of this report is as follows.

1.0 Project Purpose and Methods
2.0 Taylor Creek Stormwater Treatment Area - Benefits and Costs
3.0 Nubbin Slough Stormwater Treatment Area - Benefits and Costs

4.0 Lakeside Stormwater Treatment Area - Benefits and Costs
5.0 Caloosahatchee (C-43) West Basin Storage Reservoir - Benefits and Costs
6.0 St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area - Benefits and Costs
7.0 Sensitivity Analysis
8.0 Overall Summary of Benefits and Costs
9.0 References

The methods used to convert costs to 2011 dollars; the calculation of the project cost per unit of benefit; and the discount rate used to annualize the capital cost; the recurring non-annual O&M cost and the initial monitoring cost are common to all five projects. These methods are described as follows.

Converting Costs to 2011 Dollars. The costs compiled for each project represent a year prior to 2011. For consistency, all costs, except the cost for land already purchased, were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index which is also called the GDP Price Index[1]. The table of GDP Price Indices from 1940 to 2010 and forecasts of 2011 to 2016 are provided in each project's Excel spreadsheet called "GDP Index Table". The calculations using these indices are provided in the Excel spreadsheet for each project.

The GDP (Chained) Price Index measures the prices paid for the quantities of goods and services produced by the U.S. economy in a given year relative to the prices and quantities produced in a base year. It is derived from the prices associated with personal consumption expenditures, gross private domestic investment, net exports of goods and services, government consumption expenditures and gross investment. The index is called "chained" because the weights given to items in the index are affected by the substitutions that purchasers might make across item categories in response to changes in relative prices over time.

The land needed to site the five projects was purchased by the District during the period 1999 to 2006. The cost (or purchase price) of this land was not updated to 2011 dollars because land prices in south Florida over the past 10 years went through a boom and bust period. Currently prices are believed to be in recovery mode but are not expected to fully recover to normal "equilibrium" conditions for at least two years. Updating the land cost using the GPD price index would not provide any meaningful information. Also, updating the cost to reflect current land price conditions would reflect costs as if the land

[1] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

were purchased today when in fact the land was purchased many years earlier. With these issues in mind, the project team decided not to adjust the purchase price of the land to 2011 dollars. The land cost used in the capital cost values represents the cost in the year that the land was purchased. A sensitivity analysis of unit costs using estimated 2010 land price data is provided in Section 7.0 of this report.

Discount Rate Used to Calculate Annualized Costs. The discount rate is used to annualize the capital cost, the initial monitoring cost and the recurring non-annual O&M cost associated with the project. The total annualized cost is the sum of the annualized capital cost, the annualized initial monitoring cost, the annualized recurring non-annual O&M cost and the annual O&M and monitoring costs.

The equation to annualize a capital, initial, or recurring non-annual cost is as follows.

Annualized Cost = Present Value Cost x (D x (1+D)N) / ((1+D)N – 1)

Where Present Value Cost is the estimated Capital, Initial and/or Recurring Non-Annual Cost;

D is the annual Discount Rate which is a value between and including 0 and 1; and

N is the number of years over which the Present Value Cost is to be annualized.

The “pmt” function of Excel will calculate the negative of this value. The “pmt” function and the conversion of the annualized cost to a positive number is:

Annualized Cost =-1*pmt(discount rate, years of useful life, present value cost)

The Discount Rate, D, is the rate at which the future value of the Present Value Cost grows over time due to the time value of money. For example, if the Present Value Cost is borrowed at 4 percent annual interest, then the appropriate discount rate would be 4 percent per year. If the loan is repaid over ten years, then the Annualized Cost would reflect the principal and interest payments on the loan such that it is paid off in ten years (N=10). If the Present Value Cost is taken from a savings account that earns 3 percent interest per year, then the discount rate (D) would be equal to 3 percent.

For the purposes of evaluating regional water supply and water quality projects, an appropriate discount rate to use is the current Rate for Federal Water Projects published by the United States Department of Agriculture, Natural Resources Conservation Service at:

http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html

For example, the 2011 rate published in this link is 4.125 percent per year.

Total Cost per Unit of Benefit. To obtain the total cost per unit of benefit provided by the project, the total annualized project cost is divided by the annual benefit of the project. If the values of the cost are roughly the same from year to year and the values of the benefit are roughly the same from year to year, then this calculation is equivalent to calculating the present value cost per unit of benefit. Under this calculation, the yearly costs and the yearly benefits are discounted to present value using an appropriate discount rate, such as the 2011 rate for Federal Water Projects of 4.125 percent.

The benefit of an STA is the average annual amount of phosphorus removed from the water that flows through the STA during a year in pounds. So the annualized cost per unit of benefit is the cost per pound of phosphorus removed.

The benefit of a reservoir is the maximum acre-feet of water that can be stored under normal operations. So the annualized cost per unit of benefit is the cost per acre-foot of water storage capacity per year.

The total cost per unit of benefit associated with the reservoirs and STAs of the five projects are provided in Sections 2.0 through 8.0 of this report.

Section 2.0
Taylor Creek Stormwater Treatment Area – Benefits and Costs

This Section provides a compilation of the benefits and costs of the Taylor Creek Stormwater Treatment Area (STA) in Okeechobee County. A description of this project is provided in Table 2.1. Column (1) is the row number that corresponds to the row in the Excel spreadsheet called "TC NS Compile Costs Benefits" that is located in the file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011". Column (2) is the item being described or measured and Column (3) is the description or value. Column (4) provides notes regarding the item and the information source. The numbers in brackets correspond to the citations listed in Section 9.0 References.

The Taylor Creek STA is a 142 acre stormwater treatment area located in Okeechobee County with the primary goal of reducing the amount of phosphorus entering Lake Okeechobee. The U.S. Army Corps of Engineers (US ACE) is the agency responsible for this project which has been in operation since 2008. This STA is expected to remove 2.08 tons of phosphorus per year from the water that flows through it for the purpose of reducing the amount of phosphorus entering Lake Okeechobee. As of this date, this phosphorus reduction level has been reached. Table 2.1 also provides the discount rate that was used to annualize the capital and initial monitoring costs of the project and is the 2011 rate for Federal Water Projects.[1] The project required the purchase of 193 acres of land.

The costs associated with constructing, operating and maintaining the project are provided in Table 2.2. The first column is the row number associated with the spreadsheet cited above. The total capital cost in 2006 dollars was $5.6 million. This is the actual cost incurred to build the project. The capital cost includes the construction cost, the land cost and the non-construction cost. The construction cost of $3.2 million is the cost of materials, machinery and labor needed to build the project. The land cost is the actual cost of the land in the year that it was purchased. For this project, the land was purchased in 1999 for $280,500. The non-construction cost of $2.1 million includes those items other than construction such as the cost of engineering design, construction management, and the costs of financing, legal and administration. The useful life of this project is expected to be 50 years.

[1] The 2011 rate for Federal Water Projects is at: http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html.

Table 2.1
Project Description and Phosphorus Reduction Benefits
Of the Taylor Creek Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
1	**(1)**	**(2)**	**(3)**
2	Person Providing the Cost and Benefit Information	Lisa Kreiger, SFWMD	April 2011 / Final reviewed and approved by Lisa on 05-19-11
3	Responsible Agency	US ACE	
4	Location - County	Okeechobee	
5	Check if STA	X	
6	Check if Reservoir		
7	STA Total Size in Acres	142	From [5]
8	Reservoir Size in Acres	Not Applicable	
9	Construction Status	Complete and in Flow-Through (Discharge) activities	Lisa Kreiger, SFWMD
10	No. of Years to Construct and Place in Operation	2 years to construct and place in operation	Lisa Kreiger, SFWMD
11	Year of Initial Operation (20XX)	2008 - Operation began	2006 - Construction completed; Lisa Kreiger, SFWMD
12	Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	Not Applicable	
13	STA Volume at Average Depth in acre-feet	147	From [5], page 11
14	Amount of Land Purchased, in acres	193	Land Purchase agreement for the property; from Lisa Kreiger, SFWMD
15	Annual Discount Rate	0.04125	2011 Rate for Federal Water Projects
16	Phosphorus Reduction, average metric tons per year	2.08	From [13]
17	Percent Phosphorus Removal	37%	Actual figure for the 11 month flow-through period

Table 2.2
Cost of the Taylor Creek Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
18	**Capital Cost**		
19	Year Represented by Non-Land Costs	2006	
20	Total Construction Cost, not including land	$3,230,417	This is actual construction cost. From SFWMD, Lisa Kreiger
21	Year that the land was purchased	1999	
22	Land Cost	$280,500	From SFWMD, Lisa Kreiger
23	Non-Construction Cost (engineering design, construction management, financing, legal and admin)	$2,131,376	From SFWMD, Lisa Kreiger
24	**Total Capital Cost**	**$5,642,293**	
25	Useful Life of Project, in years	50	
26	**Recurring O&M Cost, other than annual**		
27	Year Represented by Costs		
28	Recurring O&M Cost, other than annual	0	No recurring costs such as solids removal are anticipated at this time.
29	Useful Life of Recurring O&M		
30	**Annual O&M Cost**		
31	Year Represented by Costs	FY 2010	
32	Annual O&M Cost	$105,560	Cost excluding electricity is $71,959. Electricity cost is $2,800 per month from SFWMD, Lisa Kreiger. There are 4 electric submersible pumps totaling 24 cfs and 17 hp each. Two pumps run for 24 hours per day.
33	**Cost of project monitoring and data collection**		
34	Year Represented by Costs	2005	
35	a. Initial cost	$385,129	From Statement of Work for telemetry.$385,129 is design & installation of telemetry-operated instrumentation & communications, & calibration of control facilities. 10 year life.
36	b. Annual cost	$83,000	SFWMD estimate using O&M cost estimating tool

Also included in Table 2.2 is the recurring O&M cost, other than annual. For this project the recurring non-annual O&M cost is zero because intermittent solids removal is not expected to be needed. The annual O&M cost is provided beginning in Row 30 of Table 2.2. The year represented is 2010 and the annual O&M cost is about $106,000. The cost of project monitoring and data collection begins in Row 34 of Table 2.2. This item includes those costs that are not included in the recurring or annual O&M cost items. For this project, the costs are in 2005 dollars. The initial cost is $385,129 for the telemetry system that has a ten year useful life and the annual cost is $83,000.

The costs presented in Table 2.2 were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index or GDP Price Index[2]. The explanation of this index is provided in Section 1.0 of this report. Next, the 2011 costs were annualized over the useful life of the project or the item at the annual discount rate provided in Table 2.1 of 4.125 percent. The results are presented in Rows 44 through 49 of Table 2.3. The 2011 annualized capital cost over 50 years is $291,298. The annualized initial monitoring cost over 10 years is $53,871. The annual O&M cost and the annual monitoring cost do not need adjustment. The total annualized cost of $545,714 is the sum of the annualized capital cost, the annualized recurring non-annual O&M cost, the annualized initial monitoring cost, the annual O&M cost and the annual monitoring cost.

The total cost per pound of phosphorus removed was then calculated as the ratio of the total annualized cost of $545,714 and the pounds of phosphorus removed which is the 2.08 metric tons provided in Table 2.1 times 2,205 pounds per metric ton. The result is provided in Row 50 of Table 2.3. The Taylor Creek STA removes 2.08 metric tons of phosphorus at a cost of $119 per pound of phosphorus removed.

[2] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

Table 2.3
Calculation of Annualized Cost per Pound of Phosphorus Removed or Per Acre-Foot Stored in 2011 Dollars - Taylor Creek Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
37	**Costs in 2011 dollars**		
38	Capital Cost	$6,126,005	Calculated from the information provided in Table 2.2 and the Gross Domestic Product Price Deflator from Table 10.1 http://www.whitehouse.gov/omb/budget/Historicals
39	Recurring Cost Other Than Annual	$0	
40	Annual O&M Cost	$106,964	
41	Initial Monitoring Cost	$434,233	
42	Annual Monitoring Cost	$93,583	
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$291,298	Using the Discount Rate and Useful Life of Project
45	Recurring Cost Other Than Annual	$0	Using the Discount Rate and Useful Life of Recurring Cost Items
46	Annual O&M Cost	$106,964	Annual O&M Cost
47	Initial Monitoring Cost	$53,871	Using the Discount Rate and Useful Life of Monitoring Investment
48	Annual Monitoring Cost	$93,583	Annual Monitoring Cost
49	Total Annualized Cost	$545,714	Sum of Annualized Component Costs
50	**Total Cost per Pound of Phosphorus Removed**	**$119**	Total Annualized Cost divided by Pounds of Phosphorus Removed
51	**Total Cost per Acre Foot of Water Storage Capacity Per Year**	Not Applicable	Total Annualized Cost divided by Acre-Feet of Storage

The Taylor Creek STA provides benefits in addition to phosphorus reduction. These benefits are listed in Table 2.4 where a YES is indicated in Column (3) of this table. These benefits are listed in Rows 52 through 69 of this project's Excel spreadsheet.

Table 2.4
Other Benefits of the Taylor Creek Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
52	**Other Benefits**		
53	1. Provides retention or detention of water collected from off-site & water is not stored	YES	Lisa Kreiger, SFWMD
54	2. Provides base flow to Lake Okeechobee in dry periods	NO	Lisa Kreiger, SFWMD
55	3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	NO	Lisa Kreiger, SFWMD
56	4. Keeps Lake O in preferred stage envelope	NO	Lisa Kreiger, SFWMD
57	5. Reduces water releases to the estuaries	NO	Lisa Kreiger, SFWMD
58	6. Facilitates Lake O operational flexibility through water storage	NO	Lisa Kreiger, SFWMD
59	7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	YES, 4.00	From 16 months of nitrogen removal data from the SFWMD from 2008 to 2011 weighted by month of the year
60	8. Provides for nutrient removal from public surface waters and storm water	YES	Lisa Kreiger, SFWMD
61	9. Provides for nutrient removal from on-farm surface and storm water	YES	Lisa Kreiger, SFWMD
62	10. Prior land use of project area to identify original ecosystem.	Dairy farm	Lisa Kreiger, SFWMD
63	11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)		
64	12. Meets other water management objectives	NO	Lisa Kreiger, SFWMD
65	13. Provides for boating access	NO	Lisa Kreiger, SFWMD
66	14. Provides public viewing access	YES	Lisa Kreiger, SFWMD
67	15. Provides picnic areas and/or restrooms	YES	Lisa Kreiger, SFWMD
68	16. Provides water for irrigation	NO	Lisa Kreiger, SFWMD
69	17. List other benefits	Passive recreation and public education.	Positive public response. Lisa Kreiger, SFWMD
70	Map available	YES	Lisa Kreiger, SFWMD

The Taylor Creek STA provides the following benefits.

- Provides retention or detention of water collected from off-site & water is not stored
- Reduces nitrogen load by 4 metric tons per year on average
- Provides for nutrient removal from public surface waters and storm water
- Provides for nutrient removal from on-farm surface and storm water
- Provides public viewing access
- Provides picnic areas and/or restrooms
- Provides for passive recreation and public education

The prior use of the land was a dairy farm so the project provides a different type of ecosystem than previously existed.

Section 3.0
Nubbin Slough Stormwater Treatment Area – Benefits and Costs

This Section provides a compilation of the benefits and costs of the Nubbin Slough Stormwater Treatment Area (STA) in Okeechobee County. A description of this project is provided in Table 3.1. Column (1) is the row number that corresponds to the row in the Excel spreadsheet called "TC NS Compile Costs Benefits" that is located in the file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011". Column (2) is the item being described or measured and Column (3) is the description or value. Column (4) provides notes regarding the item and the information source. The numbers in brackets correspond to the citations listed in Section 9.0 References.

The Nubbin Slough STA is a 809 acre stormwater treatment area located in Okeechobee County with the primary goal of reducing the amount of phosphorus entering Lake Okeechobee. The U.S. Army Corps of Engineers is the agency responsible for this project. The project is constructed but repairs are needed to make it operational. The types of repairs needed are currently being identified. This STA is expected to be put into operation by 2013 and will remove an estimated 5.00 metric tons of phosphorus per year from the water that flows through it for the purpose of reducing the amount of phosphorus entering Lake Okeechobee. Table 3.1 also provides the discount rate that was used to annualize the capital and initial monitoring costs of the project and is the 2011 rate for Federal Water Projects.[1] The land needed for this project was part of a total purchase of 2,135 acres. The acreage not used for this project will be used for other purposes.

The costs associated with constructing, operating and maintaining the project are provided in Table 3.2. The first column is the row number associated with the spreadsheet cited above. The total capital cost in 2006 dollars is $17 million. The capital cost includes the construction cost, the land cost and the non-construction cost. The construction cost of $9.7 million is the cost of materials, machinery and labor needed to build the project. This is the actual construction cost to build the project and does not include the cost of the repairs that are needed to make it operational. The land cost is the actual cost of the 809 acres in the year that it was purchased. For this project, the land was purchased in 2001 for $1.8 million. The non-construction cost of $5.4 million

[1] The 2011 rate for Federal Water Projects is at: http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html.

includes those items other than construction such as the cost of engineering design, construction management, and the costs of financing, legal and administration. The additional engineering design cost and the estimated construction management cost to make the repairs is included in the non-construction cost. Thus, the only cost item missing is the construction cost of the repairs. The useful life of this project is expected to be 50 years.

Table 3.1
Project Description and Phosphorus Reduction Benefits
of the Nubbin Slough Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
1	**(1)**	**(2)**	**(3)**
2	Person Providing the Cost and Benefit Information	Lisa Kreiger, SFWMD	April 2011 / Final reviewed and approved by Lisa on 05-19-11
3	Responsible Agency	US ACE	
4	Location – County	Okeechobee	
5	Check if STA	X	
6	Check if Reservoir		
7	STA Total Size in Acres	809	From [4]
8	Reservoir Size in Acres	Not Applicable	
9	Construction Status	Construction Complete - repairs needed before operational	Lisa Kreiger, SFWMD
10	No. of Years to Construct and Place in Operation	2 years to construct - not yet in operation	Lisa Kreiger, SFWMD
11	Year of Initial Operation (20XX)	2013	Lisa Kreiger, SFWMD
12	Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	Not Applicable	
13	STA Volume at Average Depth in acre-feet	1,546	From [4]
14	Amount of Land Purchased, in acres	2,135	Land Purchase agreement for the property; from Lisa Kreiger, SFWMD
15	Annual Discount Rate	0.04125	2011 Rate for Federal Water Projects
16	Phosphorus Reduction, average metric tons per year	5.00	From [4]
17	Percent Phosphorus Removal	90%	From [4]

Table 3.2
Cost of the Nubbin Slough Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
18	**Capital Cost**		
19	Year Represented by Non-Land Costs	2006	
20	Total Construction Cost, not including land	$9,714,616	This is actual construction cost to date. Lisa Kreiger will provide additional cost to put into operation when it is available.
21	Year that the land was purchased	2001	
22	Land Cost	$1,818,829	Cost only includes 809 acres. Rest of land will be used for other projects or sold. Lisa Kreiger, SFWMD.
23	Non-Construction Cost (engineering design, construction management, financing, legal and admin)	$5,423,705	$3,542,074 is total engineering design cost. $133,000 is estimated design to make operational. Cost of construction mgmt was estimated using info from Lisa. Other non-construction estimated using %s.
24	**Total Capital Cost**	**$16,957,150**	
25	Useful Life of Project, in years	50	
26	**Recurring O&M Cost, other than annual**		
27	Year Represented by Costs		
28	Recurring O&M Cost, other than annual	$0	No recurring costs such as solids removal are anticipated at this time.
29	Useful Life of Recurring O&M		
30	**Annual O&M Cost**		
31	Year Represented by Costs	**FY 2010**	
32	Annual O&M Cost	$341,929	$119,000 per year from SFWMD, Lisa Kreiger, not including electricity.(a)

Table 3.2
Cost of the Nubbin Slough Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
33	**Cost of project monitoring and data collection**		
34	Year Represented by Costs	2005, 2006	
35	a. Initial cost	$548,628	From Statement of Work for telemetry. (b)
36	b. Annual cost	$105,957	See footnote (c)

(a) Electricity cost was estimated as follows. There are 4 electric submersible 215 hp pumps totaling 120 cfs. The District does not know how long the pumps will run per day but pump run times will be shorter than for the Taylor Creek STA due to water availability. For the electricity cost estimation, four 215 hp pumps operating 8 hours per day on average were used. This is the same as two 215 hp pumps operating 16 hours per day on average. Electricity cost is $0.10 per kwh.

(b) $548,628 for design & installation of telemetry-operated instrumentation, and communications and calibration of control facilities. The equipment has a 10 year useful life.

(c) This cost includes $60,000 for water quality sample analysis from SFWMD, Lisa Kreiger, plus 1.28 times ($83,000-$47,000) to account for other annual O&M costs. The 1.28 is $60,000 / $47,000, where $47,000 is the cost of the water quality sample analysis for Taylor Creek STA and $83,000 is total annual monitoring cost for Taylor Creek STA provided by Lisa Kreiger.

Also included in Table 3.2 is the recurring non-annual O&M cost. For this project the recurring non-annual O&M cost is zero because intermittent solids removal is not expected to be needed. The annual O&M cost is provided beginning in Row 30 of Table 3.2. The year represented is 2010 and the annual O&M cost is estimated to be $342,000. The cost of project monitoring and data collection begins in Row 34 of Table 3.2. This item includes those costs that are not included in the recurring or annual O&M cost items. For this project the costs are in 2005 and 2006 dollars. The initial cost is $548,628 for the telemetry system that has a ten year useful life and the annual cost is $105,957.

The costs presented in Table 3.2 were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index or GDP Price Index.[2] The explanation of this index is provided in Section 1.0 of this report. The costs in 2011 dollars are presented in Table 3.3. Next, the 2011 costs were annualized over the useful life of the project or the item at the annual discount rate provided in Table 3.1 of 4.125 percent. The results are presented in Rows 44 through 49 of Table 3.3. The 2011 annualized capital cost over 50 years is $871,270. The annualized initial monitoring cost over 10 years is $78,095. The

[2] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

annual O&M cost and the annual monitoring cost do not need adjustment. The total annualized cost of $1.4 million is the sum of the annualized capital cost, the annualized recurring non-annual O&M cost, the annualized initial monitoring cost, the annual O&M cost and the annual monitoring cost.

The total cost per pound of phosphorus removed was then calculated as the ratio of the total annualized cost of $1.4 million and the pounds of phosphorus removed which is the 5.00 metric tons provided in Table 3.1 times 2,205 pounds per metric ton. The result is provided in Row 50 of Table 3.3. The Nubbin Slough STA is expected to remove 5.00 metric tons of phosphorus at a cost of $129 per pound of phosphorus removed. This cost does not include the construction cost of repairs to this STA to make it operational.

Table 3.3
Calculation of Annualized Cost per Pound of Phosphorus Removed or Per Acre-Foot Stored In 2011 Dollars - Nubbin Slough Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
37	**Costs in 2011 dollars**		
38	Capital Cost	**$18,322,849**	Calculated from the information provided in Table 3.2 and the Gross Domestic Product Price Deflator from Table 10.1 http://www.whitehouse.gov/omb/budget/Historicals
39	Recurring Cost Other Than Annual	$0	
40	Annual O&M Cost	$346,366	
41	Initial Monitoring Cost	$629,496	
42	Annual Monitoring Cost	$121,576	
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$871,270	Using the Discount Rate and Useful Life of Project
45	Recurring Cost Other Than Annual	$0	Using the Discount Rate and Useful Life of Recurring Cost Items
46	Annual O&M Cost	$346,366	Annual O&M Cost
47	Initial Monitoring Cost	$78,095	Using the Discount Rate and Useful Life of Monitoring Investment
48	Annual Monitoring Cost	$121,576	Annual Monitoring Cost
49	Total Annualized Cost	**$1,417,306**	Sum of Annualized Component Costs
50	**Total Cost per Pound of Phosphorus Removed**	$129	Total Annualized Cost divided by Pounds of Phosphorus Removed
51	**Total Cost per Acre Foot of Water Storage Capacity Per Year**	Not Applicable	Total Annualized Cost divided by Acre-Feet of Storage

The Nubbin Slough STA provides benefits in addition to phosphorus reduction. These benefits are listed in Table 3.4 where a YES is indicated in Column (3) of this table. These benefits are listed in Rows 52 through 69 of this project's Excel spreadsheet.

Table 3.4
Other Benefits of the Nubbin Slough Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
52	**Other Benefits**		
53	1. Provides retention or detention of water collected from off-site & water is not stored	YES	Lisa Kreiger, SFWMD
54	2. Provides base flow to Lake Okeechobee in dry periods	NO	Lisa Kreiger, SFWMD
55	3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	NO	Lisa Kreiger, SFWMD
56	4. Keeps Lake O in preferred stage envelope	NO	Lisa Kreiger, SFWMD
57	5. Reduces water releases to the estuaries	NO	Lisa Kreiger, SFWMD
58	6. Facilitates Lake O operational flexibility through water storage	NO	Lisa Kreiger, SFWMD
59	7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	YES	The amount of the nitrogen reduction is not available.
60	8. Provides for nutrient removal from public surface waters and storm water	YES	Lisa Kreiger, SFWMD
61	9. Provides for nutrient removal from on-farm surface and storm water	YES	Lisa Kreiger, SFWMD
62	10. Prior land use of project area to identify original ecosystem.	Dairy farm	Lisa Kreiger, SFWMD
63	11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)		
64	12. Meets other water management objectives	NO	Lisa Kreiger, SFWMD
65	13. Provides for boating access	NO	Lisa Kreiger, SFWMD
66	14. Provides public viewing access	NO	Lisa Kreiger, SFWMD
67	15. Provides picnic areas and/or restrooms	NO	Lisa Kreiger, SFWMD
68	16. Provides water for irrigation	NO	Lisa Kreiger, SFWMD
69	17. List other benefits		
70	Map available	YES	Lisa Kreiger, SFWMD

The Nubbin Slough STA is expected to provide the following benefits.

- Provide retention or detention of water collected from off-site & water is not stored
- Reduce nitrogen load
- Provide for nutrient removal from public surface waters and storm water
- Provide for nutrient removal from on-farm surface and storm water

The prior use of the land was a dairy farm so the project provides a different type of ecosystem than previously existed.

Section 4.0
Lakeside Ranch Stormwater Treatment Area – Benefits and Costs

This Section provides a compilation of the benefits and costs of the Lakeside Ranch Stormwater Treatment Area (STA) in Martin County. A description of this project is provided in Table 4.1. Column (1) is the row number that corresponds to the row in the Excel spreadsheet called "Lakeside Compile Costs Benefits" that is located in the file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011". Column (2) is the item being described or measured and Column (3) is the description or value. Column (4) provides notes regarding the item and the information source. The numbers in brackets correspond to the citations listed in Section 9.0 References.

The Lakeside Ranch STA has two phases. Phase I is a 925 acre STA called STA-N that is currently under construction and is expected to become operational in 2012. Phase II is a 788 acre STA called STA-S that is not yet under construction and the engineering design was completed in May 2011. The primary goal of the two STAs is to reduce the amount of phosphorus entering Lake Okeechobee. The South Florida Water Management District is the agency responsible for this project. Both STAs are expected to remove 25.80 metric tons of phosphorus per year from the water that flows through it for the purpose of reducing the amount of phosphorus entering Lake Okeechobee. Table 4.1 also provides the discount rate that was used to annualize the capital and initial monitoring costs of the project and is the 2011 rate for Federal Water Projects.[1] The amount of land purchased for this project was 2,700 acres.

The costs associated with constructing, operating and maintaining the project are provided in Table 3.2. The first column is the row number associated with the spreadsheet cited above. The total capital cost in 2006 dollars is $108.5 million. The capital cost includes the construction cost, the land cost and the non-construction cost. The construction cost of $67.5 million is the cost of materials, machinery and labor needed to build both STAs. This is the actual construction cost of STA-N and the estimated cost of STA-S based on its engineering design.

[1] The 2011 rate for Federal Water Projects is at: http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html.

Table 4.1
Project Description and Phosphorus Reduction Benefits of the Lakeside Ranch Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
1	**(1)**	**(2)**	**(3)**
2	Person Providing the Cost and Benefit Information	Jianchang Cai, SFWMD	May 2011 / Final reviewed and approved by J. Cai on 6/7/11.
3	Responsible Agency	SFWMD	
4	Location – County	Martin	
5	Check if STA	X	
6	Check if Reservoir		
7	STA Total Size in Acres	Phase 1 STA-N: 925 acres; Phase 2 STA-S: 788 acres	From [8] and updated by L. Cai, SFWMD
8	Reservoir Size in Acres	Not Applicable	
9	Construction Status	STA-N: Construction began April 2009 and will be complete Jan. 2012. STA-S: 100% design delivered in May 2011.	L. Cai, SFWMD
10	No. of Years to Construct and Place in Operation	STA-N: 28 months	L. Cai, SFWMD
11	Year of Initial Operation (20XX)	STA-N: July 2012	L. Cai, SFWMD
12	Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	Not Applicable	
13	STA Volume at Average Depth in acre-feet	2,560	J. Cai, SFWMD, volume at optimum depth of 1.5 feet. This is the design depth. Actual average depth not yet available.
14	Amount of Land Purchased, in acres	2,700	J. Cai, SFWMD
15	Annual Discount Rate	0.04125	2011 Rate for Federal Water Projects
16	Phosphorus Reduction, average metric tons per year	25.8	From [8] and confirmed by J. Cai, SFWMD, STA-N = about 15.4 metric tons / year; STA-S about 10.4 metric tons/year (Modeled results)
17	Percent Phosphorus Removal	Not Available	

Table 4.2
Cost of the Lakeside Ranch Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
18	**Capital Cost**		
19	Year Represented by Non-Land Costs	2008	From [2] and confirmed by J. Cai, SFWMD
20	Total Construction Cost, not including land	$67,463,000	Both STA N and S from J. Cai, SFWMD (including 4 components, from the contract cost and engineering cost estimates) Includes 5% contingency.
21	Year when the land was purchased	2004	J. Cai, SFWMD
22	Land Cost	$8,522,260	J. Cai, SFWMD, from SFWMD's Land Acquisition Specialist obtained from a finance report.
23	Non-Construction Cost (engineering design, construction management, financing, legal and admin)	$32,537,000	J. Cai, SFWMD
24	**Total Capital Cost**	**$108,522,260**	
25	Useful Life of Project, in years	50	From [1] and confirmed by J. Cai, SFWMD
26	**Recurring O&M Cost, other than annual**		
27	Year Represented by Costs		
28	Recurring O&M Cost, other than annual	$0	No recurring costs other than what is in capital, annual O&M and monitoring cost
29	Useful Life of Recurring O&M		
30	**Annual O&M Cost**		
31	Year Represented by Costs	2011	
32	Annual O&M Cost	$914,844	J. Cai, SFWMD - provided by the field station
33	**Cost of project monitoring and data collection**		
34	Year Represented by Costs	2011	
35	a. Initial cost	$0	J. Cai, SFWMD.
36	b. Annual cost	$64,557	J. Cai, SFWMD. This is the FY 2012 annual cost. The O&M cost for other years is not available.

The land cost is the actual cost of the 2,700 acres in the year that it was purchased. For this project, the land was purchased in 2004 for $8.5 million. The non-construction cost for both STAs is $32.5 million and includes those items other than construction such as the cost of engineering design, construction management, and the costs of financing, legal and administration. This cost is based on the actual costs to date and includes estimates for those costs that have not yet been incurred. The useful life of this project is expected to be 50 years.

Also included in Table 4.2 is the recurring O&M cost, other than annual. For this project the recurring O&M cost is zero. The annual O&M cost is provided beginning in Row 30 of Table 4.2. The year represented is 2011 and the annual O&M cost is estimated to be $914,844. The cost of project monitoring and data collection begins in Row 34 of Table 4.2. This item includes those costs that are not included in the recurring or annual O&M cost items. For this project the costs are in 2011 dollars. The initial cost is $0 and the annual cost is $64,557.

The costs presented in Table 4.2 were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index or GDP Price Index[2]. The explanation of this index is provided in Section 1.0 of this report. The costs in 2011 dollars are presented in Table 4.3. Next, the 2011 costs were annualized over the useful life of the project or the item at the annual discount rate provided in Table 4.1 of 4.125 percent. The results are presented in Rows 44 through 49 of Table 4.3. The 2011 annualized capital cost over 50 years is $5.3 million. The annual O&M cost and the annual monitoring cost do not need adjustment. The total annualized cost of $6.3 million is the sum of the annualized capital cost, the annualized recurring non-annual O&M cost, the annualized initial monitoring cost, the annual O&M cost and the annual monitoring cost.

The total cost per pound of phosphorus removed was then calculated as the ratio of the total annualized cost of $6.3 million and the pounds of phosphorus removed which is the 25.80 metric tons provided in Table 4.1 times 2,205 pounds per metric ton. The result is provided in Row 50 of Table 4.3. The Lakeside Ranch STA is expected to remove 25.80 metric tons of phosphorus at a cost of $111 per pound of phosphorus removed.

[2] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

Table 4.3
Calculation of Annualized Cost per Pound of Phosphorus Removed or Per Acre-Foot Stored In 2011 Dollars - Lakeside Ranch Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
37	**Costs in 2011 dollars**		
38	Capital Cost	$111,981,610	Calculated from the information provided in Table 4.2 and the Gross Domestic Product Price Deflator from Table 10.1 http://www.whitehouse.gov/omb/budget/Historicals
39	Recurring Cost Other Than Annual	$0	
40	Annual O&M Cost	$914,844	
41	Initial Monitoring Cost	$0	
42	Annual Monitoring Cost	$64,557	
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$5,324,837	Using the Discount Rate and Useful Life of Project
45	Recurring Cost Other Than Annual	$0	Using the Discount Rate and Useful Life of Recurring Cost Items
46	Annual O&M Cost	$914,844	Annual O&M Cost
47	Initial Monitoring Cost	$0	Using the Discount Rate and Useful Life of Monitoring Investment
48	Annual Monitoring Cost	$64,557	Annual Monitoring Cost
49	Total Annualized Cost	**$6,304,238**	Sum of Annualized Component Costs
50	**Total Cost per Pound of Phosphorus Removed**	**$111**	Total Annualized Cost divided by Pounds of Phosphorus Removed
51	**Total Cost per Acre Foot of Water Storage Capacity Per Year**	Not Applicable	Total Annualized Cost divided by Acre-Feet of Storage

The Lakeside Ranch STA provides benefits in addition to phosphorus reduction. These benefits are listed in Table 4.4 where a YES is indicated in Column (3) of this table. These benefits are listed in Rows 52 through 69 of this project's Excel spreadsheet.

Table 4.4
Other Benefits of the Lakeside Ranch Stormwater Treatment Area (STA)

Row	Item	Value	Notes and Data Sources
52	**Other Benefits**		
53	1. Provides retention or detention of water collected from off-site & water is not stored	YES	J. Cai, SFWMD
54	2. Provides base flow to Lake Okeechobee in dry periods	NO	J. Cai, SFWMD
55	3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	YES	J. Cai, SFWMD
56	4. Keeps Lake O in preferred stage envelope	NO	J. Cai, SFWMD - It may but there is no direct benefit.
57	5. Reduces water releases to the estuaries	NO	J. Cai, SFWMD
58	6. Facilitates Lake O operational flexibility through water storage	YES	J. Cai, SFWMD
59	7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	YES	J. Cai, SFWMD
60	8. Provides for nutrient removal from public surface waters and storm water	YES	J. Cai, SFWMD
61	9. Provides for nutrient removal from on-farm surface and storm water	YES	J. Cai, SFWMD
62	10. Prior land use of project area to identify original ecosystem.	Pasture, sugarcane	J. Cai, SFWMD
63	11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)	NO	J. Cai, SFWMD
64	12. Meets other water management objectives	YES	J. Cai, SFWMD
65	13. Provides for boating access	6 concrete boat ramps	Confirmed by J. Cai, SFWMD. From [2] page 88 of pdf file
66	14. Provides public viewing access	YES	J. Cai, SFWMD
67	15. Provides picnic areas and/or restroom	No for STA-N and Yes for STA-S	Confirmed by L. Cai, SFWMD, From [1] page 463 of pdf file
68	16. Provides water for irrigation	NO	J. Cai, SFWMD
69	17. List other benefits	NONE	J. Cai, SFWMD
70	Map available	YES	J. Cai, SFWMD

The Lakeside Ranch STA is expected to provide the following benefits.

- Provide retention or detention of water collected from off-site & water is not stored
- Moderate and reduce flow to Lake Okeechobee during high rainfall events
- Facilitate Lake Okeechobee operational flexibility through water storage
- Reduce nitrogen load
- Provide for nutrient removal from public surface waters and storm water
- Provide for nutrient removal from on-farm surface and storm water
- Provide for boating access
- Provide public viewing access
- Provide picnic areas and/or restrooms

The prior use of the land was pasture and sugarcane production so the project provides a different type of ecosystem than previously existed.

Section 5.0
Caloosahatchee (C-43) West Basin Storage Reservoir – Benefits and Costs

This Section provides a compilation of the benefits and costs of the Caloosahatchee (C-43) West Basin Storage Reservoir in Hendry County (C-43 Reservoir). A description of this project is provided in Table 5.1. Column (1) is the row number that corresponds to the row in the Excel spreadsheet called "C43 Rez Compile Costs Benefits" that is located in the file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011". Column (2) is the item being described or measured and Column (3) is the description or value. Column (4) provides notes regarding the item and the information source. The numbers in brackets correspond to the citations listed in Section 9.0 References.

This project is a 10,700 acre storage reservoir that will store a maximum of 170,000 acre-feet of water under normal operations to provide the following benefits.[1]

- Capture and store stormwater runoff from the C-41 basin, reducing excess water flow to the Caloosahatchee Estuary
- Capture and store regulatory releases from Lake Okeechobee, reducing discharges to coastal estuaries
- Improve the salinity balance for the Caloosahatchee Estuary by controlling peak flows during the wet season and providing essential flows during the dry season
- Provide an additional source of water to meet irrigation needs and urban demand after restoration needs are met
- Provide public access and recreational opportunities

The U.S. Army Corps of Engineers (US ACE) and the South Florida Water Management District are the agencies responsible for this project. Engineering design was completed in 2007. It is likely that the US ACE will take the lead in constructing this project. The request for Congressional Authorization was submitted to Congress in March 2011 for

[1] The benefits were taken directly from the South Florida Water Management District document titled "Quick Facts on: Acceler8 – C-43 (Caloosahatchee River) West Reservoir", May 2006.

the next Water Resources Development Act (WRDA) bill. It is expected that, once authorization is granted, US ACE will start construction after redesign and bid repackaging activities are complete.

Table 5.1
Project Description and Phosphorus Reduction Benefits of the Caloosahatchee (C-43) West Basin Storage Reservoir

Row	Item	Value	Notes and Data Sources
1	**(1)**	**(2)**	**(3)**
2	Person Providing the Cost and Benefit Information	Janet Starnes, SFWMD	May 2011 / Final reviewed and approved by J. Starnes on 5/19/11
3	Responsible Agency	US ACE and SFWMD	
4	Location – County	Hendry	From [11]
5	Check if STA		
6	Check if Reservoir	X	
7	STA Total Size in Acres	NA - no STA associated with the West Reservoir	
8	Reservoir Size in Acres	10,700	From [14], page 2
9	Construction Status	SFWMD design completed in 2007. Date to begin construction not known at this time. (a)	Janet Starnes, SFWMD
10	No. of Years to Construct and Place in Operation	3	Janet Starnes, SFWMD
11	Year of Initial Operation (20XX)	To be determined	Janet Starnes, SFWMD
12	Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	170,000	From [12] and [14], page 2 (Janet confirmed the 170,000)
13	STA Volume at Average Depth in acre-feet	Not Applicable	
14	Amount of Land Purchased, in acres	12,412	From [3] and Janet Starnes, SFWMD
15	Annual Discount Rate	0.04125	2011 Rate for Federal Water Projects
16	Phosphorus Reduction, average metric tons per year	0	Janet Starnes, SFWMD
17	Percent Phosphorus Removal	0	

Table 5.1 also provides the discount rate that was used to annualize the capital and initial monitoring costs of the project and is the 2011 rate for Federal Water Projects.[2] The amount of land purchased for this project was 12,412 acres.

The costs associated with constructing, operating and maintaining the project are provided in Table 5.2. The first column is the row number associated with the spreadsheet cited above. The total capital cost in 2009 dollars is $570.5 million. The capital cost includes the construction cost, the land cost and the non-construction cost. The construction cost of $402.6 million is the cost of materials, machinery and labor needed to build the project. This is the most current estimated construction cost based on the engineering design.

The land cost is the actual cost of the 12,412 acres in the year that it was purchased. For this project, the land was purchased in 2000 for $84.7 million. The non-construction cost is $83.3 million and includes those items other than construction such as the cost of engineering design, construction management, and the costs of financing, legal and administration. This cost is an estimate that reflects the engineering design of the project. The useful life of this project is expected to be 50 years.

Also included in Table 5.2 is the recurring non-annual O&M cost. For this project, the recurring non-annual O&M cost is zero because such costs have been incorporated into the estimated annual O&M cost. The annual O&M cost is provided beginning in Row 30 of Table 5.2. The year represented is 2009 and the annual O&M cost is estimated to be $2.5 million. The cost of project monitoring and data collection begins in Row 34 of Table 5.2. This item includes those costs that are not included in the recurring or annual O&M cost items. For this project the costs are in 2009 dollars. The initial cost is $0 and the annual cost is $830,000.

[2] The 2011 rate for Federal Water Projects is at: http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html.

Table 5.2
Cost of the Caloosahatchee (C-43) West Basin Storage Reservoir

Row	Item	Value	Notes and Data Sources
18	**Capital Cost**		
19	Year Represented by Non-Land Costs	2009	
20	Total Construction Cost, not including land	$402,580,000	From [14], page 3, Costs represent Final Integrated Project Implementation Report and EIS. The cost are MII costs meaning that MCACES 2nd Generation software was used.
21	Year when the land was purchased	2000	Janet Starnes, SFWMD
22	Land Cost	$84,650,000	From [14], page 3
23	Non-Construction Cost (engineering design, construction management, financing, legal and admin)	$83,250,000	From [14], page 3
24	**Total Capital Cost**	**$570,480,000**	
25	Useful Life of Project, in years	50	
26	**Recurring O&M Cost, other than annual**		
27	Year Represented by Costs		
28	Recurring O&M Cost, other than annual	$0	Included in Annual Cost
29	Useful Life of Recurring O&M		
30	**Annual O&M Cost**		
31	Year Represented by Costs	2009	
32	Annual O&M Cost	$2,505,000	$3,160,000 in 2009 dollars from [3], page 2 minus $680,000 annual monitoring cost plus $25,000 annual OMRR&R cost for recreation ([14], page 5)
33	**Cost of project monitoring and data collection**		
34	Year Represented by Costs	2009	
35	a. Initial cost	$0	Janet Starnes, SFWMD
36	b. Annual cost	$830,000	$680,000 (2009 dollars) Water Quality only from [3]. Cost for Ecological modeling not known. $150,000 per year in 2009 dollars used as a placeholder.

The costs presented in Table 5.2 were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index or GDP Price Index[3]. The explanation of this index is provided in Section 1.0 of this report. The costs in 2011 dollars are presented in Table 5.3. Next, the 2011 costs were annualized over the useful life of the project or the item at the annual discount rate provided in Table 5.1 of 4.125 percent. The results are presented in Rows 44 through 49 of Table 5.3. The 2011 annualized capital cost over 50 years is $581 million. The annual O&M cost and the annual monitoring cost do not need adjustment. The total annualized cost of $31.0 million is the sum of the annualized capital cost, the annualized recurring non-annual O&M cost, the annualized initial monitoring cost, the annual O&M cost and the annual monitoring cost.

The total cost per acre-foot of water stored per year was then calculated as the ratio of the total annualized cost of $31.0 million and the maximum acre-feet of water that can be stored under normal operations of 170,000 acre-feet as was provided in Table 5.1. The result is provided in Row 51 of Table 5.3. The Caloosahatchee (C-43) West Basin Storage Reservoir is expected to store 170,000 acre-feet of water at a cost of $182 per acre foot of water stored each year.

[3] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

Table 5.3
Calculation of Annualized Cost per Pound of Phosphorus Removed or Per Acre-Foot Stored in 2011 Dollars - Caloosahatchee (C-43) West Basin Storage Reservoir

Row	Item	Value	Notes and Data Sources
37	**Costs in 2011 dollars**		
38	Capital Cost	$580,686,697	Calculated from the information provided in Table 5.2 and the Gross Domestic Product Price Deflator from Table 10.1 http://www.whitehouse.gov/omb/budget/Historicals
39	Recurring Cost Other Than Annual	$0	
40	Annual O&M Cost	$2,557,627	
41	Initial Monitoring Cost	$0	
42	Annual Monitoring Cost	$847,437	
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$27,612,228	Using the Discount Rate and Useful Life of Project
45	Recurring Cost Other Than Annual	$0	Using the Discount Rate and Useful Life of Recurring Cost Items
46	Annual O&M Cost	$2,557,627	Annual O&M Cost
47	Initial Monitoring Cost	$0	Using the Discount Rate and Useful Life of Monitoring Investment
48	Annual Monitoring Cost	$847,437	Annual Monitoring Cost
49	Total Annualized Cost	**$31,017,292**	Sum of Annualized Component Costs
50	**Total Cost per Pound of Phosphorus Removed**	Not Applicable	Total Annualized Cost divided by Pounds of Phosphorus Removed
51	**Total Cost per Acre Foot of Water Storage Capacity Per Year**	**$182**	Total Annualized Cost divided by Acre-Feet of Storage

The Caloosahatchee (C-43) West Basin Storage Reservoir provides benefits in addition to water storage. These benefits are listed in Table 5.4 where a YES is indicated in Column (3) of this table. These benefits are listed in Rows 52 through 69 of this project's Excel spreadsheet.

Table 5.4
Other Benefits of the Caloosahatchee (C-43) West Basin Storage Reservoir

Row	Item	Value	Notes and Data Sources
52	**Other Benefits**		
53	1. Provides retention or detention of water collected from off-site & water is not stored	NO	Janet Starnes, SFWMD
54	2. Provides base flow to Lake Okeechobee in dry periods	NO	Janet Starnes, SFWMD
55	3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	NO	Janet Starnes, SFWMD
56	4. Keeps Lake O in preferred stage envelope	NO	Janet Starnes, SFWMD
57	5. Reduces water releases to the estuaries	YES	Janet Starnes, SFWMD
58	6. Facilitates Lake O operational flexibility through water storage	YES	Janet Starnes, SFWMD
59	7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	NO	Janet Starnes, SFWMD
60	8. Provides for nutrient removal from public surface waters and storm water	NO	Janet Starnes, SFWMD
61	9. Provides for nutrient removal from on-farm surface and storm water	NO	Janet Starnes, SFWMD
62	10. Prior land use of project area to identify original ecosystem.	Citrus Grove	71,000 acres of habitat improved in Caloosahatchee Estuary. Janet Starnes, SFWMD
63	11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)	Release water back to the Caloosahatchee River/Estuary	Janet Starnes, SFWMD
64	12. Meets other water management objectives	Management of water flows to Caloosahatchee Estuary	Janet Starnes, SFWMD and [12], page 1
65	13. Provides for boating access	2 boat ramps - one for each cell (non-motorized)	Janet Starnes, SFWMD and [10]
66	14. Provides public viewing access	Top of Levee Access	Janet Starnes, SFWMD
67	15. Provides picnic areas and/or restrooms	YES	Janet Starnes, SFWMD
68	16. Provides water for irrigation	NO	Janet Starnes, SFWMD
69	17. List other benefits	Improved ecological function of the Caloosahatchee Estuary	This is the primary purpose of the project. Janet Starnes, SFWMD
70	Map available	YES	Janet Starnes, SFWMD

The Caloosahatchee (C-43) West Basin Storage Reservoir is expected to provide the following benefits.

- Reduce water releases to the estuaries
- Facilitate Lake Okeechobee operational flexibility through water storage
- Release water back to the Caloosahatchee River and Estuary
- Manage water flows to the Caloosahatchee Estuary
- Provide for boating access
- Provide public viewing access
- Provide picnic areas and/or restrooms
- Improve the ecological function of the Caloosahatchee Estuary

The prior use of the land was a citrus grove so the project provides a different type of ecosystem than previously existed.

Section 6.0
St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area – Benefits and Costs

This Section provides a compilation of the benefits and costs of the St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area (STA) in Martin County. A description of this project is provided in Table 6.1. Column (1) is the row number that corresponds to the row in the Excel spreadsheet called "C44 Compile Costs Benefits" that is located in the file called "Cost n Benefit Compilation 5 STA REZ Projects June 2011". Column (2) is the item being described or measured and Column (3) is the description or value. Column (4) provides notes regarding the item and the information source. The numbers in brackets correspond to the citations listed in Section 9.0 References.

The project includes a 6,300 acre STA and a 3,400 acre reservoir that is expected to store a maximum of 50,600 acre-feet under normal operations. This project is currently under construction and is expected to become operational in 2018. The project will provide the following benefits.[1]

- Capture and store local stormwater runoff from the basin; treat some or all of the runoff, and return it to the C-44 (St. Lucie) Canal when needed
- Decrease / attenuate excess water flow to the St. Lucie Estuary
- Improve water quality by reducing the amounts of phosphorus, pesticides, herbicides and other pollutants in the runoff entering the estuary, improving the health of the ecosystem
- Increase available water supplies for the environment and human needs
- Provide public access and recreational opportunities

The South Florida Water Management District is the agency responsible for this project. The STA is expected to remove 20.0 metric tons of phosphorus per year from the water that flows into the lake.

[1] The benefits were taken directly from the South Florida Water Management District document titled "Quick Facts on: Acceler8 – C-44 (St. Lucie Canal) Reservoir / Stormwater Treatment Area", July 2006.

Table 6.1
Project Description and Phosphorus Reduction Benefits of the
St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
1	**(1)**	**(2)**	**(3)**
2	Person Providing the Cost and Benefit Information	Brooke Ahrens, HDR, Inc.	April 2011 / Final reviewed and approved on 6/8/11.
3	Responsible Agency	SFWMD	From [9]
4	Location – County	Martin	From [9]
5	Check if STA	X	From [9]
6	Check if Reservoir	X	From [9]
7	STA Total Size in Acres	6,300	From [9] and [7], page 10
8	Reservoir Size in Acres	3,400	From [9] and [7], page 7
9	Construction Status	Under Construction	Final design completed by SFWMD April 2008. USACE construction to begin sometime from June 2011 to June 2015. Construction scheduled for completion in February 2018. Brooke Ahrens, HDR, Inc.
10	No. of Years to Construct and Place in Operation		
11	Year of Initial Operation (20XX)	2018	Brooke Ahrens, HDR, Inc.
12	Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	50,600	From [9]
13	STA Volume at Average Depth in acre-feet	9,450	From Brooke Ahrens, wetted area times average depth (6,300 x 1.5 feet)
14	Amount of Land Purchased, in acres	10,900	From [9]
15	Annual Discount Rate	0.04125	2011 Rate for Federal Water Projects
16	Phosphorus Reduction, average metric tons per year	20	From DMSTA2 Output from 2008 Final Design Report and [7], page 2 (a)
17	Percent Phosphorus Removal	Not provided	

(a) Model run includes C-44 Canal observed TP data and flows from the District data used in the RESHDR water budget model, 1987-2000 period of record, actual regulatory and irrigation releases at S-308, includes proposed pumping schedule based on C-44 Canal stage at S-80.

Table 6.2
Cost of the St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
18	**Capital Cost**		
19	Year Represented by Non-Land Costs	2008	From [6]
20	Total Construction Cost, not including land	$324,095,000	From [6], Table 1 Updated C-44 Project Budget. These are estimated design costs - no contingencies included. (a)
21	Year when the land was purchased	2006	Brooke Ahrens, HDR, Inc.
22	Land Cost	$179,000,000	From [9]
23	Non-Construction Cost (engineering design, construction management, financing, legal and admin)	$53,000,000	From [6]
24	**Total Capital Cost**	**$556,095,000**	
25	Useful Life of Project, in years	50	Brooke Ahrens, HDR, Inc.
26	**Recurring O&M Cost, other than annual**		
27	Year Represented by Costs		
28	Recurring O&M Cost, other than annual	$0	Does not include STA scrapping. Other types of recurring costs are already factored into the OPCC based Annual O&M Costs below. From Brooke Ahrens, HDR, Inc.
29	Useful Life of Recurring O&M		
30	**Annual O&M Cost**		
31	Year Represented by Costs	2008	
32	Annual O&M Cost	$3,400,000	$3,400,000 (Includes Annual Operations and Maintenance and Annual Monitoring). From Sue Ray's WIK Fact Sheet - created 2010, based on [6] and [9].
33	**Cost of project monitoring and data collection**		
34	Year Represented by Costs	2008	
35	a. Initial cost	$14,100,000	Brooke Ahrens, HDR, Inc. This is the estimated cost to monitor the project after construction to make sure it performs as planned.
36	b. Annual cost	$0	

(a) Total cost includes Intake Canal / Access Road/ C-133 Canal (Contract 1); Reservoir and Pump Station Construction (Contract 2); STA Construction (Contract 3); Test Cell Construction; Site Preparation / Tree Clearing and Relocations. These are estimated design costs - no contingencies included.

Table 6.1 also provides the discount rate that was used to annualize the capital and initial monitoring costs of the project and is the 2011 rate for Federal Water Projects.[2] The amount of land purchased for this project was 10,900 acres.

The costs associated with constructing, operating and maintaining the project are provided in Table 6.2. The first column is the row number associated with the spreadsheet cited above. The total capital cost in 2008 dollars is $556.1 million. The capital cost includes the construction cost, the land cost and the non-construction cost. The construction cost of $324.1 million is the cost of materials, machinery and labor needed to build the reservoir and the STA. This is the estimated cost based on the engineering design.

The land cost is the actual cost of the 10,900 acres in the year that it was purchased. For this project, the land was purchased in 2006 for $179 million. The non-construction cost is $53.0 million and includes those items other than construction such as the cost of engineering design, construction management, and the costs of financing, legal and administration. This cost is based on the engineering design of the project. The useful life of this project is expected to be 50 years.

Also included in Table 6.2 is the recurring non-annual O&M cost. For this project the recurring non-annual O&M cost is zero because all recurring costs were incorporated into the annual O&M cost. The annual O&M cost is provided beginning in Row 30 of Table 6.2. The year represented is 2008 and the annual O&M cost is estimated to be $3.40 million which includes annual project monitoring.

The cost of project monitoring and data collection begins in Row 34 of Table 6.2. This item includes those costs that are not included in the recurring or annual O&M cost items. For this project the costs are in 2008 dollars. The initial cost is $14.10 million which is the estimated cost to monitor the project after construction to make sure it performs as planned. The annual monitoring cost is $0 because this cost is included in the annual O&M cost in Row 32 of Table 6.2.

The costs presented in Table 6.2 were converted to 2011 dollars using the Gross Domestic Product (Chained) Price Index or GDP Price Index[3]. The explanation of this index is provided in Section 1.0 of this report. The costs in 2011 dollars are presented in

[2] The 2011 rate for Federal Water Projects is at: http://www.economics.nrcs.usda.gov/cost/priceindexes/rates.html.

[3] The values of the GDP (Chained) Price index are calculated by the U.S. Bureau of Economic Analysis and may be obtained from http://www.whitehouse.gov/omb/budget/Historicals/ under Table 10.1 on the site.

Table 6.3. Next, the 2011 costs were annualized over the useful life of the project or the item at the annual discount rate provided in Table 6.1 of 4.125 percent. The results are presented in Rows 44 through 49 of Table 6.3. The 2011 annualized capital cost over 50 years is $27.1 million. The total annualized initial project monitoring cost over 50 years is $693,663. The annual O&M cost and the annual monitoring cost do not need adjustment. The total annualized cost of $31.3 million is the sum of the annualized capital cost, the annualized recurring non-annual O&M cost, the annualized initial monitoring cost, the annual O&M cost and the annual monitoring cost.

Table 6.3
Calculation of Annualized Costs in 2011 Dollars
St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
37	**Costs in 2011 dollars**		
38	Capital Cost	$569,140,037	Calculated from the information provided in Table 6.2 and the Gross Domestic Product Price Deflator from Table 10.1 http://www.whitehouse.gov/omb/budget/Historicals
39	Recurring Cost Other Than Annual	0	
40	Annual O&M Cost	$3,517,618	
41	Initial Monitoring Cost	$14,587,768	
42	Annual Monitoring Cost	0	
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$27,063,173	Using the Discount Rate and Useful Life of Project
45	Recurring Cost Other Than Annual	$0	Using the Discount Rate and Useful Life of Recurring Cost Items
46	Annual O&M Cost	$3,517,618	Annual O&M Cost
47	Initial Monitoring Cost	$693,663	Using the Discount Rate and Useful Life of Monitoring Investment
48	Annual Monitoring Cost	$0	Annual Monitoring Cost
49	Total Annualized Cost	$31,274,453	Sum of Annualized Component Costs

To calculate the total cost per pound of phosphorus removed and the total cost per acre-foot of water stored per year, the project costs were assigned to the reservoir and to the STA as presented in Table 6.4. This table provides the construction cost, land cost, non-construction cost, annual O&M cost and initial monitoring cost for the reservoir in Column (3) and for the STA in Column (4). All costs are in 2008 dollars except for the land cost which is in 2006 dollars as described in Chapter 1.0 of this report.

These costs were then converted to 2011 dollars and the results are provided in Table 6.5. The capital cost allocated to the reservoir is $302.0 million in 2011 dollars and the

capital cost allocated to the STA is $267.2 million in 2011 dollars. The annual O&M cost was allocated equally between the two components: $1.76 million to the reservoir and $1.76 million to the STA. The initial monitoring cost was also allocated equally and is $7.3 million each for the reservoir and the STA. The capital and initial monitoring costs were then annualized over 50 years at 4.125 percent discount rate. The annualized costs are presented in Rows 44 through 49 of Table 6.5. The total annualized cost of the reservoir is estimated to be $16.5 million and the total annualized cost of the STA is estimated to be $14.8 million.

Table 6.4
Itemized Estimated Construction Costs and Annual O&M Cost In 2008 Dollars for St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Item	Cost	Reservoir Cost	STA Cost
(1)	**(2) = (3) + (4)**	**(3)**	**(4)**
Construction Cost			
Intake Canal / Access Road/ C-133 Canal (Contract 1)	$39,088,000	$19,544,000	$19,544,000
Reservoir and Pump Station Construction (Contract 2)	$171,169,000	$171,169,000	
STA Construction (Contract 3)	$85,838,000		$85,838,000
Test Cell Construction	$10,000,000	$5,000,000	$5,000,000
Site Preparation / Tree Clearing	$6,000,000	$3,000,000	$3,000,000
Relocations	$12,000,000	$6,000,000	$6,000,000
Sub-Total Construction Cost	$324,095,000	$204,713,000	$119,382,000
Land Cost (land was purchased in 2006. Cost is in 2006 dollars)	$179,000,000	$62,742,268	$116,257,732
Non-Construction Cost			
Construction Management Services	$22,000,000	$11,000,000	$11,000,000
Engineering During Construction	$10,000,000	$5,000,000	$5,000,000
Design Cost of Plan and Specification Development	$21,000,000	$10,500,000	$10,500,000
Sub-Total Non-Construction Cost	$53,000,000	$26,500,000	$26,500,000
Total Capital Cost	$556,095,000	$293,955,268	$262,139,732
Annual O&M Cost	$3,400,000	$1,700,000	$1,700,000
Initial Monitoring Cost	$14,100,000	$7,050,000	$7,050,000

From Brooke Ahrens, HDR, Inc. on April 29, 2011

Table 6.5
Calculation of Annualized Cost per Pound of Phosphorus Removed and Per Acre-Foot Stored in 2011 Dollars St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Reservoir	STA
37	**Costs in 2011 dollars**		
38	Capital Cost	$301,953,736	$267,186,301
39	Recurring Cost Other Than Annual	0	0
40	Annual O&M Cost	$1,758,809	$1,758,809
41	Initial Monitoring Cost	$7,293,884	$7,293,884
42	Annual Monitoring Cost	0	0
43	**Annualized Costs, 2011 dollars**		
44	Capital Cost	$14,358,199	$12,704,973
45	Recurring Cost Other Than Annual	$0	$0
46	Annual O&M Cost	$1,758,809	$1,758,809
47	Initial Monitoring Cost	$346,831	$346,831
48	Annual Monitoring Cost	$0	$0
49	Total Annualized Cost	$16,463,840	$14,810,614
50	**Total Cost per Pound of Phosphorus Removed**		**$336**
51	**Total Cost per Acre Foot of Water Storage Capacity Per Year**	**$325**	

The total cost per pound of phosphorus removed was then calculated as the ratio of the total annualized STA cost of $14.8 million and the pounds of phosphorus removed which is the 20.00 metric tons provided in Table 6.1 times 2,205 pounds per metric ton. The result is provided in Row 50 of Table 6.5. The St. Lucie Canal (C-44) STA is expected to remove 20.00 metric tons of phosphorus at a cost of $336 per pound of phosphorus removed.

The total cost per acre-foot of water stored per year was calculated as the ratio of the total annualized reservoir cost of $16.50 million and the maximum acre-feet of water that can be stored under normal operations of 50,600 acre-feet as was provided in Table 6.1. The result is provided in Row 51 of Table 6.5. The St. Lucie Canal (C-44) Reservoir is expected to store 50,600 acre-feet of water at a cost of $325 per acre foot of water stored each year.

The St. Lucie Canal (C-44) Reservoir and STA provides benefits in addition to water storage and phosphorus reduction. These benefits are listed in Table 6.6 where a YES is indicated in Column (3) of this table. These benefits are listed in Rows 52 through 69 of this project's Excel spreadsheet.

The St. Lucie Canal (C-44) Reservoir and STA is expected to provide the following benefits.

- Provide retention or detention of water collected from off-site & water is not stored
- Reduce water releases to the estuaries
- Reduce nitrogen load by 43 metric tons per year
- Provide for nutrient removal from on-farm surface and storm water
- Attenuate peak C-44 basin flows to St. Lucie Estuary
- Provide for boating access
- Provide public viewing access
- Provide picnic areas and/or restrooms
- Provide 3,818 acre-feet per year for agricultural irrigation

The prior use of the land was citrus groves so the project provides a different type of ecosystem than previously existed.

Table 6.6
Other Benefits of the St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
52	**Other Benefits**		
53	1. Provides retention or detention of water collected from off-site & water is not stored	YES	For STA portion of project. Brooke Ahrens, HDR, Inc.
54	2. Provides base flow to Lake Okeechobee in dry periods	NO	Brooke Ahrens, HDR, Inc.
55	3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	NO	Brooke Ahrens, HDR, Inc.
56	4. Keeps Lake O in preferred stage envelope	NO	Brooke Ahrens, HDR, Inc.
57	5. Reduces water releases to the estuaries	YES	When space available can assist in reduction. Brooke Ahrens, HDR, Inc.
58	6. Facilitates Lake O operational flexibility through water storage	NO	Project facilitates basin flows. Brooke Ahrens, HDR, Inc.
59	7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	YES - 43	Model run mimics conditions from the PIR. Brooke Ahrens, HDR, Inc.
60	8. Provides for nutrient removal from public surface waters and storm water	NO	Brooke Ahrens, HDR, Inc.
61	9. Provides for nutrient removal from on-farm surface and storm water	YES	Basin land use is agricultural. Brooke Ahrens, HDR, Inc.
62	10. Prior land use of project area to identify original ecosystem.	Citrus	Brooke Ahrens, HDR, Inc.
63	11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)	STA cells are gravity flow so no power needed for operations, electrical pump drivers used instead of diesel, non-labor intensive operations - project can be run as "un-manned" project. Brooke Ahrens, HDR, Inc. and [7], page 2	
64	12. Meets other water management objectives	Attenuate peak C-44 Basin flows to St. Lucie Estuary & provide nutrient removal. Fact Sheet.	
65	13. Provides for boating access	YES	1 public boat ramp at the reservoir. Boat types not yet determined. Brooke Ahrens, HDR, Inc. and [7], page 28
66	14. Provides public viewing access	YES	Brooke Ahrens, HDR, Inc.
67	15. Provides picnic areas and/or restrooms	YES	Brooke Ahrens, HDR, Inc.

Table 6.6
Other Benefits of the St. Lucie Canal (C-44) Reservoir and Stormwater Treatment Area

Row	Item	Value	Notes and Data Sources
68	16. Provides water for irrigation, acre-feet per year	3,818	For agricultural irrigation. Brooke Ahrens, HDR, Inc.
69	17. List other benefits	Potential for wildlife enhancement, recreation, education, and water supply.	
70	Map available	YES	Brooke Ahrens and [7], Figure 1 in Figures Section

Section 7.0
Sensitivity Analysis

The STA cost per pound of phosphorus removed and the reservoir cost per acre foot of water storage capacity per year were recalculated under two scenarios to evaluate the sensitivity of these values to changes in land costs and the discount rate. The two scenarios are as follows.

Scenario 1 – Convert the land purchase price to estimated 2010 dollars

Scenario 2 – Use an annual discount rate of 3.25 percent instead of the 4.125 percent used in the body of this report.

These scenarios and the results are provided below.

Scenario 1 – Land Purchase Price. In Sections 1.0 though 6.0 and Section 8.0 of this report, the land cost associated with each project was not updated to 2011 dollars but instead was kept at its purchase price in the year that it was purchased. All other costs were converted to 2011 dollars. In this sensitivity analysis, these land prices were converted to estimates of what they would have sold for had they been purchased in 2010. This is the most recent year for which land price data for land similar to that purchased for these projects is available.

The 2010 land purchase prices were estimated as the actual land price paid times the land price ratio. This ratio is the Florida land value for similar-type properties in 2010 divided by the Florida land value for similar-type properties in the year that the land was purchased. The land values used to calculate the land price ratios for each project are from the University of Florida, IFAS Extension, Gainesville, Florida, Annual Land Values Survey report for the years 2010, 2007, 2006, 2005, 2004, and 2002 and the Florida Department of Citrus, Economic and Market Research, Citrus Reference Book 2003, Table 33.[1] The 2010 land price values are estimates based on the best available data and do not necessarily reflect the amount of money that would actually be required to purchase the land if it was purchased in 2010. The data from these documents that were used to estimate the land price ratios for each project are provided in Table 7.1.

[1] http://edis.ifas.ufl.edu/topic_agricultural_land_values to access the Florida land values survey and http://www.fred.ifas.ufl.edu/citrus/pubs/ref/index2.htm to access the Citrus Reference Book.

Table 7.1
Calculation of the Florida Land Price Ratio for Each Project

Project	Year (a)	Land Use and Geographic Area of Florida (b)	Price per Acre	Year	Land Use	Price per Acre	Land Price Ratio
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = (7) / (4)
Taylor Creek STA	1999	Average of Mature Citrus Grove in South and Central	$6,868	2010	Mature Citrus Grove in South	$7,982	1.16
Nubbin Slough STA	2001	Average of Improved Pastureland in South and Central	$1,954	2010	Improved Pastureland in South	$4,826	2.47
Lakeside STA	2004	Average of Improved Pasture and Irrigated Cropland, South and Central	$3,620	2010	Average of Improved Pasture and Irrigated Cropland in South	$6,226	1.72
C43 Reservoir	2000	Average of Mature Citrus Grove in South and Central	$6,986	2010	Mature Citrus Grove in South	$7,982	1.14
C44 Reservoir and STA	2005 and 2007	Average of Mature Citrus Grove in South and Central in 2005 and 2007 (2006 values not available)	$13,002	2010	Mature Citrus Grove in South	$7,982	0.61

(a) This is the year that the land was purchased.

(b) Prior to 2006, Florida was divided into four sectors for the purpose of reporting land values (south, central, northeast and northwest). In 2006, Florida was divided into two sectors where the south sector is the old south and central sectors.

To obtain the estimated 2010 land price for each project, the land purchase price was multiplied by the land price ratio in Column (8) of Table 7.1. This calculation is shown in Table 7.2. This 2010 land price was used to calculate the cost per unit of benefit.

Table 7.2
Estimated 2010 Land Prices By Project

Project	Year Purchased	County	Prior Land Use	Purchase Price	Land Price Ratio (a)	2010 Land Price Estimate
(1)	(2)	(3)	(4)	(5)	(6)	(7) = (5) x (6)
Taylor Creek STA	1999	Okeechobee	Dairy farm	$280,500	1.16	**$325,998**
Nubbin Slough STA	2001	Okeechobee	Dairy farm	$1,818,829	2.47	**$4,492,154**
Lakeside STA	2004	Martin	Pasture and Sugarcane	$8,522,260	1.72	**$14,657,346**
C43 Reservoir	2000	Hendry	Citrus	$84,650,000	1.14	**$96,718,623**
C44 Reservoir and STA	2006	Martin	Citrus	$179,000,000	0.61	**$109,891,207**

(a) Table 7.1, Column (8)

Scenario 2 – Discount Rate. For all projects, the annual discount rate used in Sections 1.0 through 6.0 and Section 8.0 of 4.125 percent was replaced with an annual discount rate of 3.25 percent. In addition, the unit costs using the estimated 2010 land prices and both discount rates were calculated.

Results of Sensitivity Analysis. The results of the sensitivity analysis are provided in Table 7.3 for the STAs and Table 7.4 for the reservoirs. For the St. Lucie Canal (C-44) STA and Reservoir project, the costs were allocated to the STA and to the reservoir prior to calculating the unit costs. Thus, the STA unit cost includes only those costs associated with the STA and the reservoir unit costs includes only those costs associated with the reservoir.

Table 7.3
Summary of Sensitivity Analysis of STA Cost Per Pound of Phosphorus Removed

	Land Purchase Price Used		Estimated 2010 Land Price Used	
Project	4.125% Discount Rate	3.25% Discount Rate	4.125% Discount Rate	3.25% Discount Rate
Taylor Creek STA	$119	$109	$119	$110
Nubbin Slough STA	$129	$117	$140	$127
Lakeside Ranch STA	$111	$97	$116	$102
St. Lucie Canal (C-44) STA	$336	$293	$287	$252

Table 7.4
Summary of Sensitivity Analysis of Reservoir Cost Per Acre Foot Of Water Storage Capacity Per Year

	Land Purchase Price Used		Estimated 2010 Land Price Used	
	4.125% Discount Rate	3.25% Discount Rate	4.125% Discount Rate	3.25% Discount Rate
St. Lucie Canal (C-44) Reservoir	$325	$284	$303	$264
Caloosahatchee (C-43) West Basin Storage Reservoir	$182	$159	$186	$162

In comparing the unit costs among the different land price and discount rate scenarios, these unit costs do not vary by more than $30 except for the St. Lucie Canal (C-44) STA and its reservoir. The unit cost of this project varies by as much as $84 for the STA and $61 for the reservoir ($336 minus $252 and $325 minus $264, respectively).

The land costs as a percent of the actual capital cost for each project using the land purchase price and the estimated 2010 land price are provided in Table 7.5. The table shows that the land price as a percent of the capital cost is relatively large for the St. Lucie Canal (C-44) STA compared to the other projects. The unit cost is sensitive to the land value because the land value as a percent of the total capital cost is 44 percent using the land purchase price and 33 percent using the 2010 land price. For the St. Lucie Canal (C-44) Reservoir, the high land cost as a percent of capital cost and the high total capital cost causes the unit cost to vary significantly when both the land price value and the discount rate are changed and when just the discount rate is changed ($325 versus $284).

Table 7.5
Land Cost as a Percent of Total Actual Capital Cost Using the Land Price Indicated

Project	Land Purchase Price Used	Estimated 2010 Land Price Used
Taylor Creek STA	5%	6%
Nubbin Slough STA	11%	23%
Lakeside Ranch STA	8%	13%
St. Lucie Canal (C-44) STA	44%	33%
St. Lucie Canal (C-44) Reservoir	21%	14%
Caloosahatchee (C-43) West Basin Storage Reservoir	15%	17%

Section 8.0
Overall Summary of Benefits and Costs

This chapter provides a summary of the benefits and costs compiled for the five projects. This summary is provided in Table 8.1.

Table 8.1
Benefit and Cost Summary of Five Stormwater Treatment Area and / or Reservoir Projects

Item	Taylor Creek STA	Nubbin Slough STA	Lakeside Ranch STA	Caloosahatchee (C-43) West Basin Storage Reservoir	St. Lucie Canal (C-44) Reservoir and STA
Responsible Agency	US ACE	US ACE	SFWMD	US ACE and SFWMD	SFWMD
Location – County	Okeechobee	Okeechobee	Martin	Hendry	Martin
Check if STA	X	X	X		X
Check if Reservoir				X	X
STA Total Size in Acres	142	809	STA-N: 925 acres; STA-S: 788 acres	Not Applicable	6,300
Reservoir Size in Acres	Not Applicable	Not Applicable	Not Applicable	10,700	3,400
Construction Status	Complete	Construction Complete - repairs needed before operational	STA-N: Under Construction. STA-S: 100% design delivered in May 2011.	SFWMD design completed in 2007. Construction not yet started.	Under Construction
Year of Initial Operation (20XX)	2008	2013	STA-N: July 2012	TBD	2018
Benefits					
Design Water Storage Capacity of Reservoir under normal operations, in acre-feet	Not Applicable	Not Applicable	Not Applicable	170,000	50,600

Table 8.1
Benefit and Cost Summary of Five Stormwater Treatment Area and / or Reservoir Projects

Item	Taylor Creek STA	Nubbin Slough STA	Lakeside Ranch STA	Caloosahatchee (C-43) West Basin Storage Reservoir	St. Lucie Canal (C-44) Reservoir and STA
Phosphorus Reduction, average metric tons per year	2.08	5.00	25.80	0.0	20.00
Annualized Costs, 2011 dollars					
Capital Cost	$291,298	$871,270	$5,324,837	$27,612,228	$27,063,173
Recurring Cost Other Than Annual	$0	$0	$0	$0	$0
Annual O&M Cost	$106,964	$346,366	$914,844	$2,557,627	$3,517,618
Initial Monitoring Cost	$53,871	$78,095	$0	$0	$693,663
Annual Monitoring Cost	$93,583	$121,576	$64,557	$847,437	$0
Total Annualized Cost	$545,714	$1,417,306	$6,304,238	$31,017,292	$31,274,453
Cost per Unit Benefit, 2011 dollars					
Total Cost per Pound of Phosphorus Removed	$119	$129	$111	Not Applicable	$336
Total Cost per Acre Foot of Water Storage Capacity Per Year	Not Applicable	Not Applicable	Not Applicable	$182	$325
Other Benefits					
1. Provides retention or detention of water collected from off-site & water is not stored	YES	YES	YES	NO	YES

Table 8.1
Benefit and Cost Summary of Five Stormwater Treatment Area and / or Reservoir Projects

Item	Taylor Creek STA	Nubbin Slough STA	Lakeside Ranch STA	Caloosahatchee (C-43) West Basin Storage Reservoir	St. Lucie Canal (C-44) Reservoir and STA
2. Provides base flow to Lake Okeechobee in dry periods	NO	NO	NO	NO	NO
3. Moderates and reduces flow to Lake Okeechobee during high rainfall events	NO	NO	YES	NO	NO
4. Keeps Lake O in preferred stage envelope	NO	NO	NO	NO	NO
5. Reduces water releases to the estuaries	NO	NO	NO	YES	YES
6. Facilitates Lake O operational flexibility through water storage	NO	NO	YES	YES	NO
7. Reduces Nitrogen Load, Average Annual Reduction in Metric Tons	YES, 4.00	YES	YES	NO	YES, 43
8. Provides for nutrient removal from public surface waters and storm water	YES	YES	YES	NO	NO
9. Provides for nutrient removal from on-farm surface and storm water	YES	YES	YES	NO	YES

Table 8.1
Benefit and Cost Summary of Five Stormwater Treatment Area and / or Reservoir Projects

Item	Taylor Creek STA	Nubbin Slough STA	Lakeside Ranch STA	Caloosahatchee (C-43) West Basin Storage Reservoir	St. Lucie Canal (C-44) Reservoir and STA
10. Prior land use of project area to identify original ecosystem.	Dairy farm	Dairy farm	Pasture, sugarcane	Citrus Grove	Land was in citrus
11. Aspects that provide the most benefits for the least amount of energy (energy efficiency aspects)				Release of water back to the Caloosahatchee River/Estuary	STA cells use gravity flow so no power needed & non-labor intensive operations
12. Meets other water management objectives	NO	NO	YES	Management of Water Flows to Caloosahatchee Estuary	Attenuate peak C-44 Basin flows to the St.Lucie Estuary and provide nutrient removal
13. Provides for boating access	NO	NO	6 concrete boat ramps	2 boat ramps (non-motorized)	1 public boat ramp at the reservoir site. Boat type TBD
14. Provides public viewing access	YES	NO	YES	Top of Levee Access	YES
15. Provides picnic areas and/or restrooms	YES	NO	No for STA-N. Yes for STA-S	YES	YES
16. Provides water for irrigation, acre-feet per year	NO	NO	NO	NO	3,818 for agricultural irrigation
17. List other benefits	Passive recreation and public education	NONE	NONE	Improved ecological function of the Caloosahatchee Estuary	Potential for wildlife enhancement, recreation, education, and water supply.

Section 9.0
References

The references cited in this report are provided in Table 9.1 and are referred to in this document by the Reference Number as indicated in the first column.

Table 9.1
References

Ref. No.	Author	Document Name	Date
[1]	Camp Dresser & Mckee, Inc.	LOFT LRSTA Final Design Report	No date
[2]	Camp Dresser & Mckee, Inc. and South Florida Water Management District	Lakeside Ranch Stormwater Treatment Area Work Order No. 4600000852-WO03, STA-North, Final Design, Opinion of Probable Construction Cost Estimate	December 2008
[3]	Department of the Army, Office of the Assistant Secretary, Civil Works	Letter to Honorable John A. Boehner, Speaker of the House of Representatives	April 13, 2011
[4]	Gary Goforth, Inc.	Operation Plan, Vegetation Management Plan, Performance Plan Nubbin Slough / New Palm STA - Final for SFWMD	November 2005
[5]	Gary Goforth, Inc.	Operations Plan, Taylor Creek / Grassy Island STA	August 2005
[6]	HDR Engineering, Inc.	C-44 Reservoir / STA Project, OPCC & Schedule	April 18, 2008
[7]	HDR Engineering, Inc.	Work Order 16, Task 6.1, CN040918, Draft Project Operations Plan, Version 2	April 18, 2008
[8]	Jeff Kivett, P.E., Director, South Florida Water Management District	PowerPoint Presentation: Lakeside Ranch Stormwater Treatment Area (STA) Update	August 12, 2009
[9]	South Florida Water Management District	Quick Facts on Acceler8: C-44 (St. Lucie Canal) Reservoir / Stormwater Treatment Area	July 2006
[10]	South Florida Water Management District	PowerPoint Presentation: C-43 West Basin Storage Reservoir Project, Technical Review Briefing	January 23, 2008
[11]	South Florida Water Management District	Quick Facts on Acceler8: C-43 (Caloosahatchee River) West Reservoir	May 2006

Table 9.1
References

Ref. No.	Author	Document Name	Date
[12]	Stanley Consultants, Inc.	Caloosahatchee River (C-43) West Basin Storage Reservoir Project, Contract C-C10401P-WO14, Final Design Report, Appendix C, Opinion of Probable Cost	January 2008
[13]	Stanley Consultants, Inc.	Lake Okeechobee Water Retention / Phosphorus Removal Design Analysis Report	2002
[14]	U.S. Army Corps of Engineers	Central and Southern Florida Project Caloosahatchee River (C-43) West Basin Storage Reservoir, Final Integrated Project Implementation Report and Environmental Impact Statement, Addendum A	March 2010

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