Technical Memorandum

To: *Robert Naleway, St. Johns River Water Management District (District)*

From: *CDM Smith*

Date: *June 15, 2022*

Subject: *Lake Jesup Wetland Treatment System Alternative Analysis*

This Technical Memorandum (TM) summarizes the results of the Lake Jesup Wetland Treatment System Alternative Analysis. Lake Jesup, located within Seminole County, is located within the Middle St. Johns River Basin (MSJRB). Project opportunities within this basin are under consideration for nutrient reduction associated with the Lake Jesup Total Maximum Daily Load (TMDL) and Basin Management Action Plan (BMAP). The TMDL was adopted by the Florida Department of Environmental Protection (FDEP) in 2006 for both total phosphorus (TP) and total nitrogen (TN) and a BMAP was approved in 2010. Target concentrations of 0.096 mg/L TP and 1.27 mg/L TN were determined by FDEP to be appropriate for the assimilative capacity within the lake. Many projects have been completed since the execution of the first 5-year cycle of the BMAP to address the external phosphorus loading to the lake. FDEP amended the Lake Jesup BMAP in 2019, which included adjustments to the respective TN and TP load allocations. The amended BMAP also included estimates for sediment flux inputs of TN (83,800 lbs/yr) and TP (24,000 lb/yr) to the lake. To meet the TMDL targets set by FDEP, the District has determined that the Lake Jesup restoration strategy should focus on an approach to reduce the TP concentration in the lake's water column and from sediment flux. One approach to reducing TP concentrations in the lake water column being considered by the District is a flow-through wetland treatment system concept for water treatment adjacent to Lake Jesup.

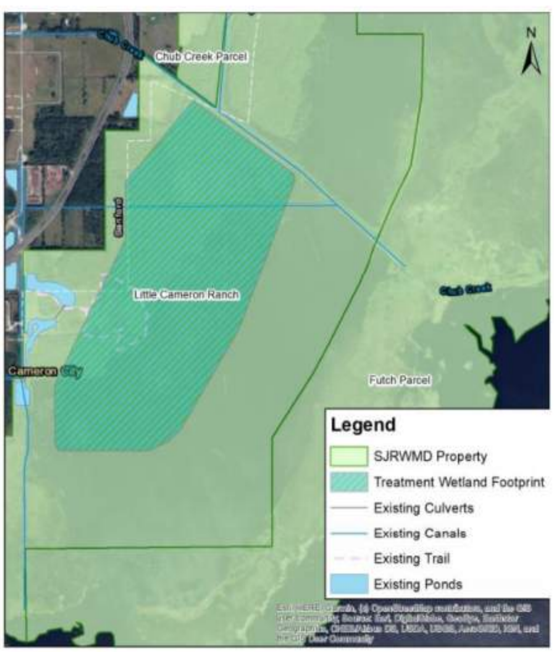


Figure 1 – LCR Site (Source: JMT, 2020)

The District has already evaluated and initiated the design of a 271-acre flow-through wetland treatment system on the northeast shore of Lake Jesup to remove nutrients from the lake. A feasibility study dated September 2014 by Environmental Consulting & Technology, Inc. (ECT), and 60 percent design plans, cost estimate and basis of design developed by Johnson, Mirmiran & Thompson (JMT), have been developed for the District's Little Cameron Ranch (LCR) property as shown in **Figure 1**.

Due to the proximity of the LCR property to the Orlando-Sanford International Airport (SFB) and avian concerns (i.e., bird strike) raised in Federal Aviation Authority (FAA) Advisory Circular 150/5200-33C, the District also conducted a preliminary alternative site analysis for other potential locations for a flow-through wetland treatment system. Other alternative sites were evaluated and eliminated by the District for various reasons, including real estate encumbrances, floodplain compensation issues, site access, power availability and the potential for significant increase in construction and operation and maintenance costs, Given the potential issues raised in the FAA advisory circular, the District desires to have a more in-depth evaluation utilizing the previous study of Alternative Site 3 (located on the southeast shore of Lake Jesup as shown in **Figure 2**) as an offline flow-through natural wetland treatment system alternative that will yield similar water quality improvements to Lake Jesup as the LCR system. It is currently estimated that the LCR flow-through wetland treatment system will provide annual TN and TP nutrient removal from the lake of 23,800 pounds and 2,800 pounds, respectively based on a steady-state design flow of about 27 cfs.

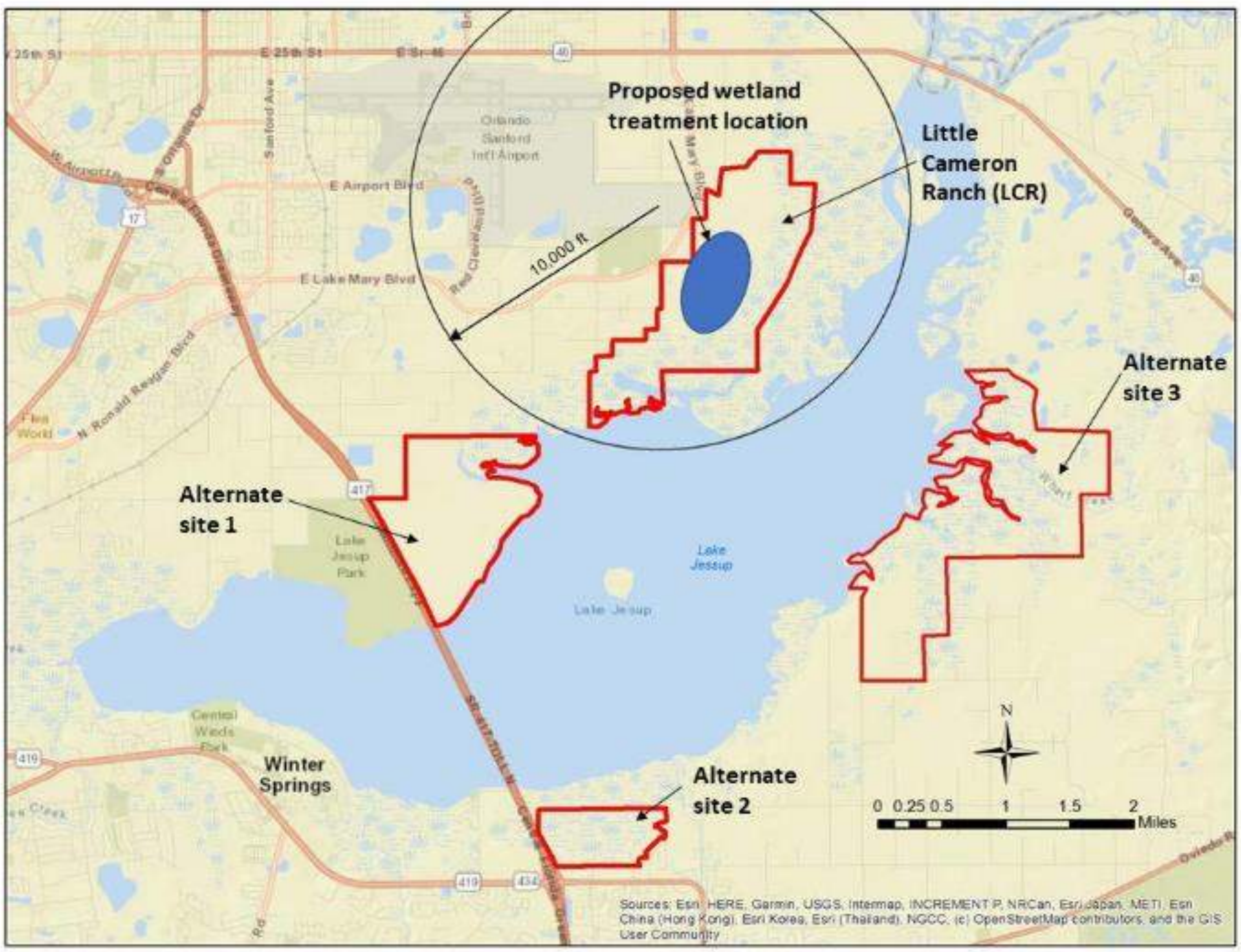


Figure 2 - Alternative Site 3 Location (Source: SJRWMD, 2021)

The objective of this study is to evaluate the feasibility of Alternative Site 3 for wetland treatment using existing wetlands and compare it to the LCR Site. General tasks completed under this effort are described as follows:

- **Task 1** included compiling and reviewing available existing information and data to support a preliminary desktop analysis of Alternative Site 3. Data included Geographic Information System (GIS) coverages, previous studies, hydrologic data, water quality data for the lake and regulatory information. As part of this task, CDM Smith also performed a detailed review of the feasibility study dated September 2014 by ECT, and 60% design plans, cost estimate, and basis of design previously developed by JMT for the LCR site.

- **Task 2** was the feasibility evaluation of a flow-through wetland treatment system on Alternative Site 3. CDM Smith identified a total of five different conceptual layouts (i.e., footprint and components) for a potential flow-through wetland treatment system that will maximize nutrient removal within the physical constraints of the Alternative Site 3. Factors considered to assess the feasibility of the wetland treatment system included: pollutant load (i.e., nutrients) removal capabilities, constructability, suitability of native soils for wetland treatment, proximity of site to the Orlando-Sanford International Airport operations, wetland impacts, capital construction and operation and maintenance (O&M) costs, site access, property ownership encumbrances, regulatory permitting constraints, accessibility for O&M, and availability and accessibility of electrical power supply. As part of this task CDM Smith also evaluated other alternative "small footprint" nutrient removal technologies at Alternative Site 3 that could provide similar nutrient removal benefits as the LCR site at similar or lower costs.

- **Task 3** is the preparation of a technical memorandum (this document) to summarize the Task 1 and Task 2 activities.

1.0 Data Compilation and Review

The CDM Smith team conducted a review of available data and information relevant to Alternative Site 3 including existing studies and reports as well as GIS data. A summary of the data compiled and reviewed is provided in **Table 1**. These data were referenced for the purposes of performing the feasibility analysis, which is described in more detail in the next section.

Table 1 Data Compilation Summary

Data Type	Data Description	Source
GIS Layer – Canals	Canals. Ditches and swales (unincorporated only)	Seminole County (accessed September 2021)
GIS Layer – Topographic Contours Light Detection and Ranging (LiDAR) information	1-foot contours, LiDAR based (2009, St Johns River Water Management District (SJRWMD))	Seminole County (accessed September 2021)
GIS Layer - County Boundary	County Boundaries	Florida Geographic Data Library (FGDL) updated September 2015 (accessed September 2021)
GIS Layer – Digital Elevation Model (DEM)	DEM	SJRWMD (LiDAR data Feb 2009, Data last modified May 5, 2010)
GIS Layer - Drainage Basins	Stormwater Drainage Basins	Seminole County (accessed September 2021)
GIS Layer - Environmentally Sensitive Lands	Conservation Areas	Seminole County (accessed September 2021)
GIS Layer - Existing Land Use	Existing land use based on the Property Appraisers DOR-4 Code values	Seminole County (accessed September 2021)
GIS Layer – Federal Emergency Management Agency (FEMA) Flood Zones	FEMA Flood Zones	FEMA (accessed September 2021)
GIS Layer - Florida Boundary	Florida Boundary	FGDL (accessed December 2021)
GIS Layer – Florida Land Use and Cover Classification System (FLUCCS)	Land Use and Land Cover from SJRWMD; Florida Land Use and Cover Classification System	SJRWMD (accessed September 2021). Imagery for 2014-2019.
GIS Layer - Future Land Use	Future Land Use Layer (Unincorporated Only)	Seminole County (accessed September 2021)
GIS Layer - National Wetland Inventory (NWI) Wetlands	NWI from United States Fish & Wildlife Service (USFWS)	USFWS (accessed September 2021)
GIS Layer - Parcels	Property Appraisers parcel polygons database	Seminole County (accessed September 2021)
GIS Layer - Preserved Land	County owned Natural Lands, large private preserved lands and State/Federal Natural Lands	Seminole County (accessed September 2021)
GIS Layer - Soils	National Resources Conservation Service Soils (NRCS)	NRCS (accessed September 2021)
GIS Layer - Streets	Seminole County street centerlines	Seminole County (accessed September 2021)
GIS Layer - Water Bodies	Major named lakes, rivers and conveyances	Seminole County (accessed September 2021)
GIS Layer - Wetland Vegetation	Wetlands geospatial content of SJRWMD	SJRWMD updated November 2018 (accessed September 2021)
GIS Layer - Zoning	Seminole County's Zoning Layer (Unincorporated Only)	Seminole County (accessed September 2021)
Lake Jesup Nutrient Reduction and Flow Enhancement 60% submittal	LCR Site 60% Plans	JMT, March 2021

Data Type	Data Description	Source
plans at original site location on the northwest shore of Lake Jesup		
Lake Jesup Nutrient Reduction and Flow Enhancement Project Cost Estimate, itemized.	LCR Site Cost Estimate 60%	JMT, March 2021
Literature Reference and Data Tables	Wetland Performance Model (K-c*) and performance data	Kadlec, R. H. and R. L. Knight, 1996. Treatment Wetlands. CRC Press, Boca Raton, FL
Literature Reference and Data Tables	Wetland Performance Model (K-c*) and performance data	Kadlec, R. H. and S. D. Wallace, 2009. Treatment Wetlands. Taylor and Francis, Boca Raton, FL, USA.
Report - Alternative Site Analysis for Lake Jesup Treatment Wetland	Project background, Alternative Site 3 information	SJRWMD, February 2021 (Revised April 2021)
Report - Hazardous Wildlife Attractants on or near Airports	Data on wildlife attractants near airports	United States Department of Transportation (USDOT) FAA Advisory Circular, February 2020
Report - Lake Jesup Flow-way Project Technical Memo	Treatment Performance data for comparison, cost estimate, k values	ECT & Wetland Solutions, Inc (WSI) (2014)
Report - Lake Jesup In-Lake Phosphorus Reduction	Technical memo that evaluates different methods of phosphorus removal from Lake Jesup.	CDM Smith (2017)
Report - Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%)	Steady-state flow design, C* values, TN & TP inflow and outflow concentrations, cost estimates, k values	JMT (2020)

2.0 Evaluation of Alternative Site 3

2.1 Conceptual Wetland Treatment System Feasibility Analysis

District-owned properties within Alternative Site 3 were evaluated to identify conceptual wetland footprint areas. Five initial wetland areas were identified based on the presence of wetlands, parcel boundaries, average lake level for Lake Jesup (0.98-ft NAVD) and hydrologic divides as shown on **Figure 3.** Using the National Wetlands Inventory and FLUCCS layer, CDM Smith identified wetland types (forested and emergent) within each of the five areas as shown in **Figure 4**. The breakdown of the upland and wetland areas is shown in **Table 2**.

Table 2 Wetland Area Breakdown

Land Cover/Wetland Type[1]	Area 1	Area 2A[2]	Area 2B[2]	Area 3	Area 4
Upland (Acres)	41.8	0.0	17.1	22.8	99.3
Emergent Wetlands (Acres)	2.2	39.6	139.3	186.6	138.8
Forested Wetlands (Acres)	109.9	75.7	138.4	128.8	96.9
Total Acres	154	115.3	294.8	338.3	335

1 - Source OpenData LCLU2014 Land Use GIS Layer (SJRWMD)

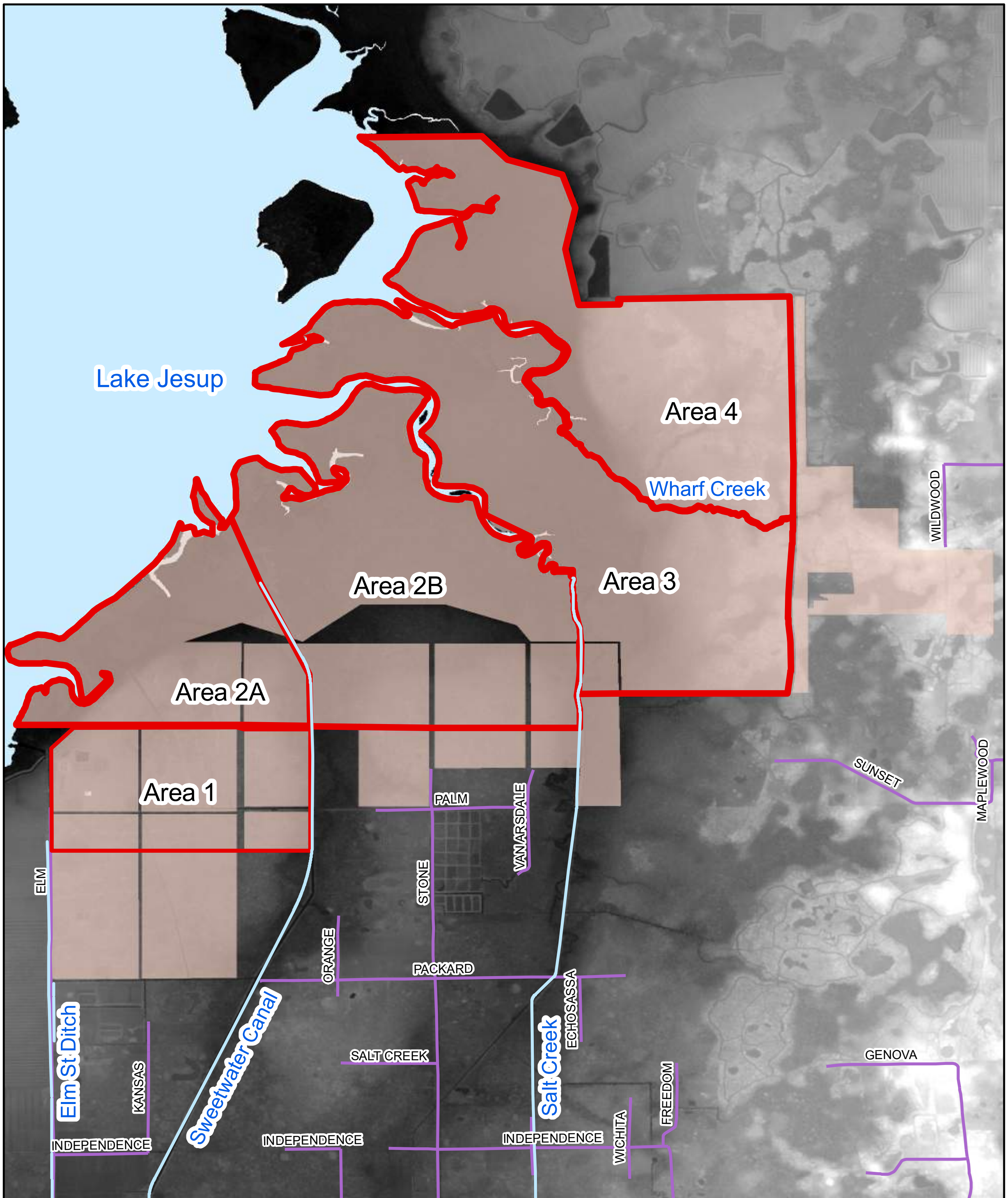
2 – During the preliminary screening phase, Area 2 was split into 2A and 2B and evaluated as two separate areas for the remainder of the analysis.

CDM Smith then performed a preliminary screening of each of the five areas followed by a preliminary feasibility, which evaluated the following factors for each of the five areas:

- Pollutant load (i.e., nutrients) removal capabilities for TN and TP;
- Suitability of native soils for wetland treatment;
- Proximity of area to the Orlando-Sanford International Airport operations;
- Wetland impacts;
- Capital costs and O&M costs; and,
- Constructability.

The following factors were evaluated by the District and provided to CDM Smith to include in the overall feasibility analysis:

- Area access;
- Property ownership encumbrances;
- Regulatory permitting constraints;
- Accessibility for O&M; and,
- Availability and accessibility of electrical power supply.



Legend

Wetland Area Outline

SJRWMD Parcels

Streets

Water Bodies

Canals

DEM

Value

High : 45.0515

Low : -0.83

Figure 3
Lake Jesup Treatment Wetland Alternatives Analysis

Wetland Areas and District Property

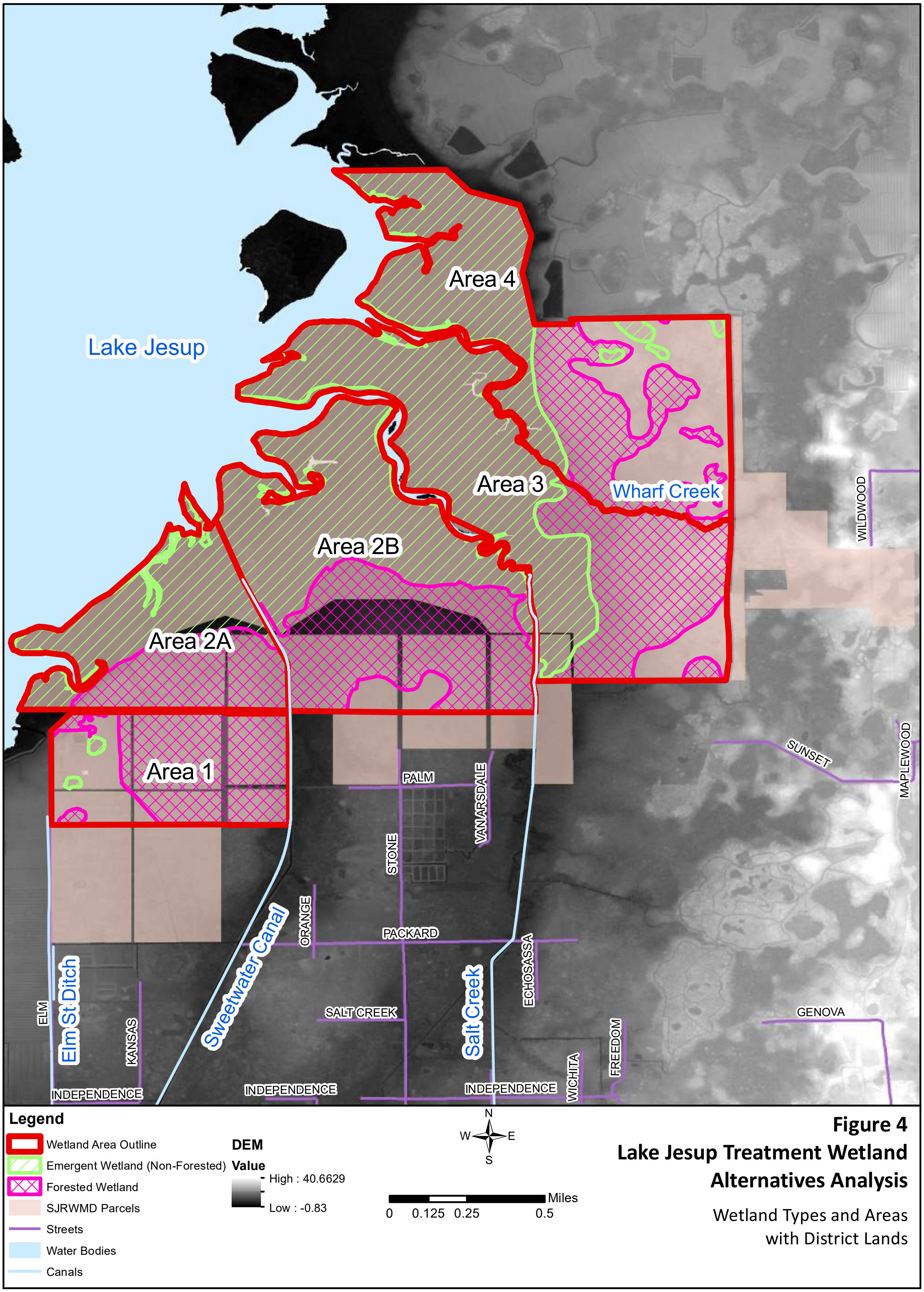


Figure 4
Lake Jesup Treatment Wetland Alternatives Analysis
Wetland Types and Areas with District Lands

CDM Smith

A detailed narrative prepared by the District for each of the five areas for the factors listed above is provided in **Attachment 1**. Highlights and conclusions noted in that document are noted below in the discussion.

2.1.1 Preliminary Screening

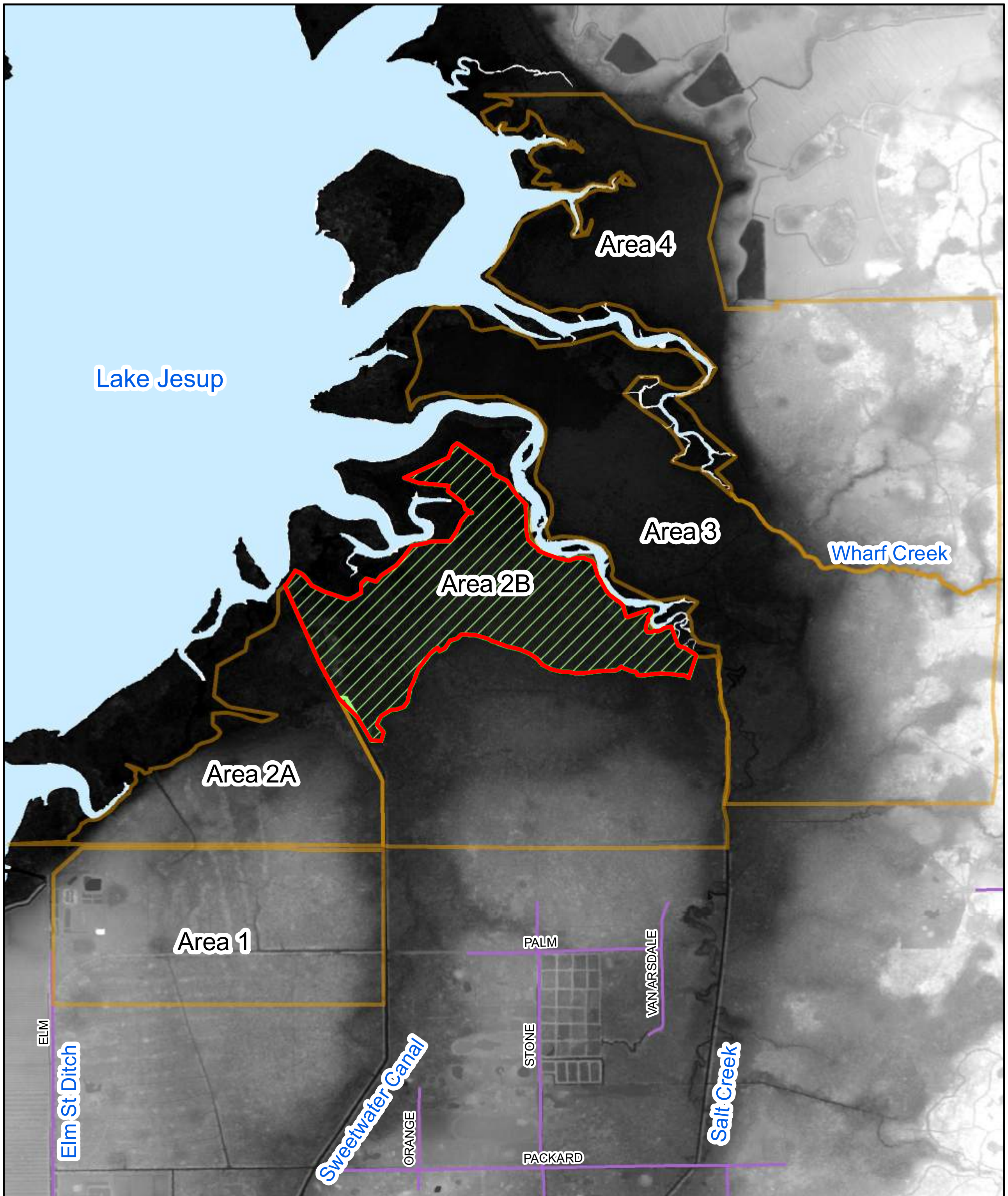
After reviewing the available wetland area and wetland types, the District indicated in their feedback that emergent marsh areas would be the preferred location from a permitting perspective. Modification of the hydrology in forested wetlands may decrease wetland functions and value requiring mitigation due to loss or alteration of function in addition to direct impacts for construction of infrastructure. Adverse impacts to the hydrology of the forested systems could be minimized by using operational criteria protective of woody vegetation, but those operational criteria would also reduce the nutrient removal efficiency of the system. Therefore, the use of forested wetlands for treatment in each of the five areas was eliminated from further consideration. Based on this direction and the primary goal of achieving similar water quality improvements to Lake Jesup, as the LCR system (i.e., e 23,800 pounds per year (lbs/yr) for TN and 2,800 lbs/yr for TP based on a steady-state design flow of 27 cubic feet per second (cfs)), an initial screening exercise, discussed in the following paragraphs, was performed to see which areas may be eliminated from further consideration. The initial screening exercise primarily focused on available existing emergent wetland areas for treatment. Significant challenges associated with area access/power availability and real estate encumbrance, which may pose limitations, and initial anticipated costs, were also considered as part of the initial screening exercise.

Area 1 has very little emergent wetlands (2.2 acres) and also contains a Florida Department of Transportation (FDOT) mitigation site. Coordination with FDOT is required with the possibility of unwillingness to consider alteration of previous mitigation projects. Based on this, Area 1 was eliminated from further consideration due to the lack of emergent wetland area as this would not meet the treatment goals of the project. It should be noted that of the five areas, Area 1 has the best access and viability for power supply so it may be a good candidate for alternative treatment technologies (discussed in the next section).

Area 2A does not have many real estate encumbrances, but has a relatively small amount of emergent wetland area (39.6 acre). Therefore, this area was also eliminated as it would fall significantly short of the desired treatment goals of the project. In addition to not meeting the treatment goals, access and power supply/availability would be the most challenging at this site due to its remote location.

The available emergent wetland acreage for treatment in Area 2B (**Figure 5**) is significantly higher (139.3 acres) than Areas 1 and 2A. While this area would also be challenging for access and power due to its remote location, it was included for further consideration based on the amount of emergent wetland area and lack of significant real estate encumbrances.

While Area 3 has the largest acreage of emergent wetlands (186.6 acres), it has more significant real estate encumbrances (including mitigation parcels) compared to the other areas previously discussed. These include a mitigation parcel jointly owned between Seminole County (75%) and the District (25%), which has several real estate restrictions.



Legend

- Wetland Area 2B
- Wetland Area Outline
- Emergent Wetlands (Non-Forested)
- Water Bodies
- Streets

DEM

Value

High : 32.0027

Low : -0.83

N W E S

0 0.125 0.25 0.5 Miles

Figure 5

Lake Jesup Treatment Wetland Alternatives Analysis

Wetland Area 2B

(Treatment Area above 1-ft NAVD88)

CDM Smith

A conservation easement over this parcel has been proposed as mitigation for a Sanford Airport Authority project. Typically, a conservation easement will include restrictions limiting the use of the parcel, but it may be possible to modify the easement language to allow for the proposed project before the easement is finalized. Additionally, parcel 1995-042, covering much of the eastern portion of Area 3, was purchased with P2000 funds and construction activities or alteration of hydrology within this area must fit within the relevant acquisition funding requirements, including no net loss in wetland function or mitigation may be necessary to offset impacts within the area. While these real estate restrictions should not eliminate this area from further consideration as noted by the District, new construction of significant berming along both Salt Creek and Wharf Creek would be required to prevent short-circuiting of applied water. This, in addition to high anticipated capital costs for this area, eliminated this area from further consideration. Attachment 1 provides a detailed description of the parcels referred to in this section.

Due to the presence of forested wetlands and real estate encumbrances associated with Area 4, CDM Smith reduced the project footprint area to the northern lobe of Area 4 (adjacent to the City of Sanford Site 10) as this is mostly emergent wetlands (116.3 acres) with no known property encumbrances (**Figure 6**). Access may occur through adjacent District lands or possibly through City of Sanford's Site 10 (with an agreement). There did not appear to be as many hurdles associated with the reduced Area 4 compared to the other areas previously discussed. Therefore, this area was included for further consideration.

2.1.2 Preliminary Feasibility Analysis

Based on the initial screening exercise, CDM Smith then performed a more in-depth feasibility analysis for Areas 2B and 4 to further evaluate the factors previously listed in Section 2.1. The feasibility analysis was largely based on whether the proposed treatment system on Alternative Site 3 can achieve a similar nutrient reduction load with comparable costs relative to the LCR site. Therefore, Areas 2B and 4 were further evaluated for pollutant load reduction, proximity to the Orlando-Sanford International Airport and conceptual planning level costs in addition to the other factors listed.

2.1.2.1 Pollutant Load Removal

The k-C* model developed by Kadlec and Knight (1996) was used to predict treatment performance of the proposed wetland application system for Areas 2B and 4. The k-C* model is an empirical model derived from the operational performance of surface flow treatment wetlands presented in the North American Wetland Treatment System Database (Knight, R.L. et al., 1993). That database was restricted to systems with flow rates greater than 190 m^3/day (0.05 mgd) and included 176 sites with 203 separate treatment wetlands. Of this total, 154 treated municipal wastewater, 9 treated industrial wastewater, 6 treated agricultural wastewater, and 7 treated stormwater. This model has been used to predict treatment performance of multiple wetland applications permitted under the Wetland Application Rule (Chapter 62-611, FAC) in Florida and is applicable to evaluate the feasibility of the site. It is also consistent with the methodology used by JMT to evaluate nutrient removal for the LCR site.

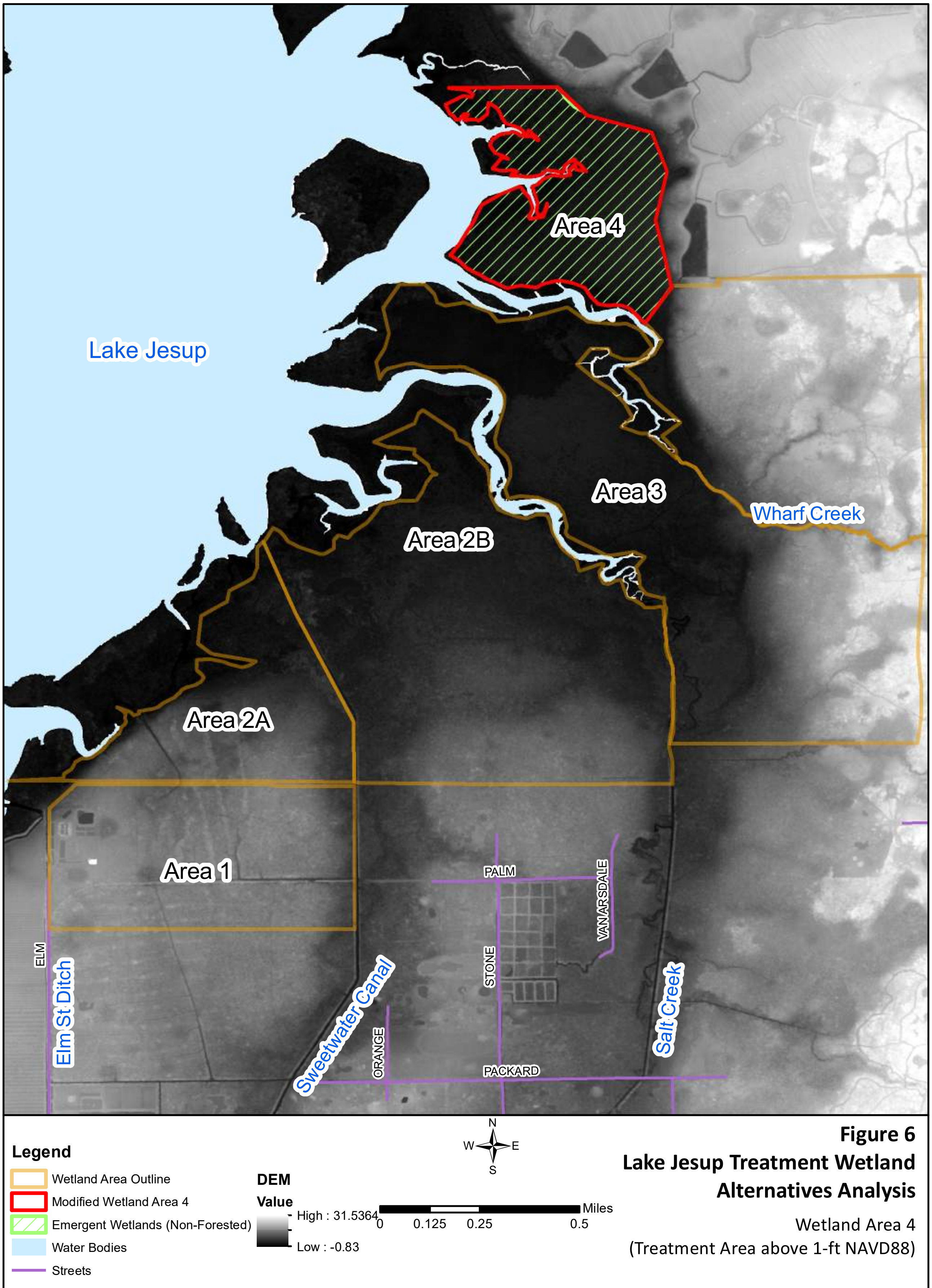


Figure 6
Lake Jesup Treatment Wetland Alternatives Analysis
Wetland Area 4
(Treatment Area above 1-ft NAVD88)

CDM Smith

The k-C* model incorporates wetland size, inflow rate, inflow concentrations, and background wetland concentrations to predict effluent concentrations using a first order areal rate constant (k value). Predicted treatment results represent gross scale estimates for planning purposes. Actual treatment capability will depend on a number of system parameters including but not limited to system design, wetland flow paths, hydraulic loading rates and residence times, wetland condition, inflow concentrations, and rainfall/runoff inflows. In 2009, Kadlec and Wallace presented various annual areal rate constants observed for wetland systems in North America in the second edition of Treatment Wetlands. This included the distribution of observed rate constants for biochemical oxygen demand (BOD), Total Kjeldahl nitrogen (TKN), TP, organic N, and fecal coliform. These values represent the range of observed treatment provided by wetland application systems.

CDM Smith assessed nutrient load removal of TN and TP using a range of k values for each nutrient to represent a range of likely nutrient load removals. These k values were generally consistent with those used at LCR. The lower treatment estimate for TN was based on the LCR k value of 12 m/yr. For the higher treatment estimate of TN, the 34 m/yr k value reflects values used by Kadlec and Knight (1996). For TP, the k value of 10 m/yr was used to represent the lower treatment estimate and 22 m/yr was used as the higher treatment estimate. Coveney et al. (2000) found at the Lake Apopka demonstration marsh that calibration of the model to demonstration data indicated simulated TP removal closely matched observed TP removal with a k value of 55 m/yr. This was due in part to most of the TP being in particulate form. Similarly, TP is mainly particulate form in Lake Jesup. Therefore, higher TP k values are justified in estimating TP removal.

Baseflow and stormwater runoff flows at different nutrient concentrations relative to the application of water from Lake Jesup may affect the predicted treatment of nutrients. For modeling purposes, the dominant nutrient load to the proposed treatment wetland areas was assumed to be the application of Lake Jesup water. A wetland inflow rate of 27 cfs was evaluated, which is consistent with the LCR site (27 cfs applied to the LCR site has an equivalent hydraulic loading rate of 17 inches/week). To maintain consistency with the LCR site analysis, influent concentrations to the receiving wetland were assumed to be 2.63 mg/L TN and 0.147 mg/L TP and wetland background concentrations were assumed to be 1.52 mg/L TN and 0.03 mg/L TP (**Table 3**). Table 3 shows the k-C* model inputs for the two areas.

Table 3 k-C* Model Wetland Treatment Input Parameters for Proposed Treatment Wetland Areas 2B & 4

Wetland Area	Treatment Area (acres)	Flow (cfs)	Hydraulic Loading Rate (in/week)	Parameter	Lake Water Inflow Concentration to Wetland (mg/l)	Wetland Background Concentration (mg/l)	K value range m/yr
2B	132.8	27	33.8	TN	2.63	1.52	12-34
2B	132.8	27	33.8	TP	0.147	0.03	10-22
4	116.3	27	38.6	TN	2.63	1.52	12-34
4	116.3	27	38.6	TP	0.147	0.03	10-22

The k-C* model was run for the two wetland areas and the estimated load reductions are summarized in **Table 4** below.

Table 4 k-C* Model Wetland Treatment Simulation Results for Proposed Wetland Treatment Areas 2B & 4

Wetland Area	Treatment Area (acres)	Flow (cfs)	Hydraulic Loading Rate (in/week)	Parameter	k value	Wetland Discharge Concentration (mg/l)	Load Removal Range (lbs/yr)
2B	132.8	27	33.8	TN	12	2.37	13,880
2B	132.8	27	33.8	TN	34	2.04	31,406
2B	132.8	27	33.8	TP	10	0.124	1,244
2B	132.8	27	33.8	TP	22	0.102	2,416
4	116.3	27	38.6	TN	12	2.4	12,345
4	116.3	27	38.6	TN	34	2.09	28,663
4	116.3	27	38.6	TP	10	0.126	1,104
4	116.3	27	38.6	TN	22	0.098	1,954

2.1.2.2 Proximity of site to the Orlando-Sanford International Airport Operations

CDM Smith performed a desktop evaluation to assess potential wildlife concerns at the proposed wetland areas with respect to Orlando-Sanford International Airport operations. This included review of the FAA Wildlife Strike Database for the Orlando-Sanford International Airport and of open source, publicly available databases documenting the presence of bird species.

Area 2B and Area 4 are located within 5 miles of the Orlando-Sanford International Airport's aircraft operations area. Therefore, the FAA may review the proposed land-use changes and wetland water treatment systems to determine if such changes increase risk to airport safety by attracting hazardous wildlife on and around airports. The FAA is not a permitting agency for land use modifications that occur off airport properties. Therefore, such reviews are typically initiated by state or federal permitting agencies seeking FAA input on new or revised permits. The proposed project would fall under Section 2.3 of Advisory Circular (AC) for Hazardous Wildlife Attractants on or near airports (Advisory Circular 150/5200-33C). If FAA requires a review of the wildlife hazards posed by the proposed wetland water treatment systems, then the level of documentation would most likely be a Wildlife Hazard Site Visit.

According to the FAA Wildlife Strike Database for the Orlando-Sanford International Airport for the last five years, there have been 205 strikes of known (identified) wildlife, including 173 bird strikes among 32 species of birds. Many of these strikes are records of birds or animals found dead on a runway or the strike had no damage to aircraft. The top seven species for airstrikes in the last 5 years were barn swallows (*Hirundo rustica*) with 75, eastern meadowlark (*Sturnella magna*) with 17, killdeer (*Charadrius vociferus*) with 16, gopher tortoise (*Gopherus polyphemus*) with 14, mourning dove (*Zenaida macroura*) with 12, bats with 12, and bald eagle (*Haliaeetus leucocephalus*) with 6. Strikes that were recorded as impacting aircraft or air travel include anhinga (*Anhinga anhinga*), black vulture (*Coragyps atratus*), great blue heron (*Ardea herodias*), sandhill crane (*Antigone* *canadensis*), and turkey vulture (*Cathartes aura*). The species recorded as impacting aircraft are larger species that are more likely to affect planes when struck due to mass and are therefore a greater risk to airport operations and safety.

The Cornell University eBird database is one of the world's largest biodiversity-related science projects. Bird observation data is collected within a simple, scientific framework by volunteers. Results are reviewed by regional experts. A total of 129 species of birds have been documented in the eBird database for a hotspot called Lake Jesup Conservation Area – East Tract. This hotspot is 0.6 miles south of Area 2b and 1.5 miles south of Area 4. Of the 129 species, 57 are dependent on wetlands while 72 species are either upland or use both upland and wetland habitats. Four species that are listed in the wildlife strike database for the Orlando-Sanford International Airport in the last five years have not been recorded near areas 2B and 4: common nighthawk (*Chordeiles minor*), ovenbird (*Seiurus aurocapilla*), American pipit (*Anthus rubescens*), and Connecticut warbler (*Oporornis agilis*).

The proposed increases in water application to Areas 2B and 4 could result in increases to local fish, insect, and aquatic invertebrate populations. This in turn could attract more piscivorous and insectivorous bird species. However, many of the bird species associated with aircraft impact at Orlando-Sanford International Airport already use the habitats in Areas 2B and 4 including great blue heron, sandhill crane, and anhinga. The addition of deeper water in areas 2B and 4 is unlikely to affect vulture populations, which is a top species for aircraft impact.

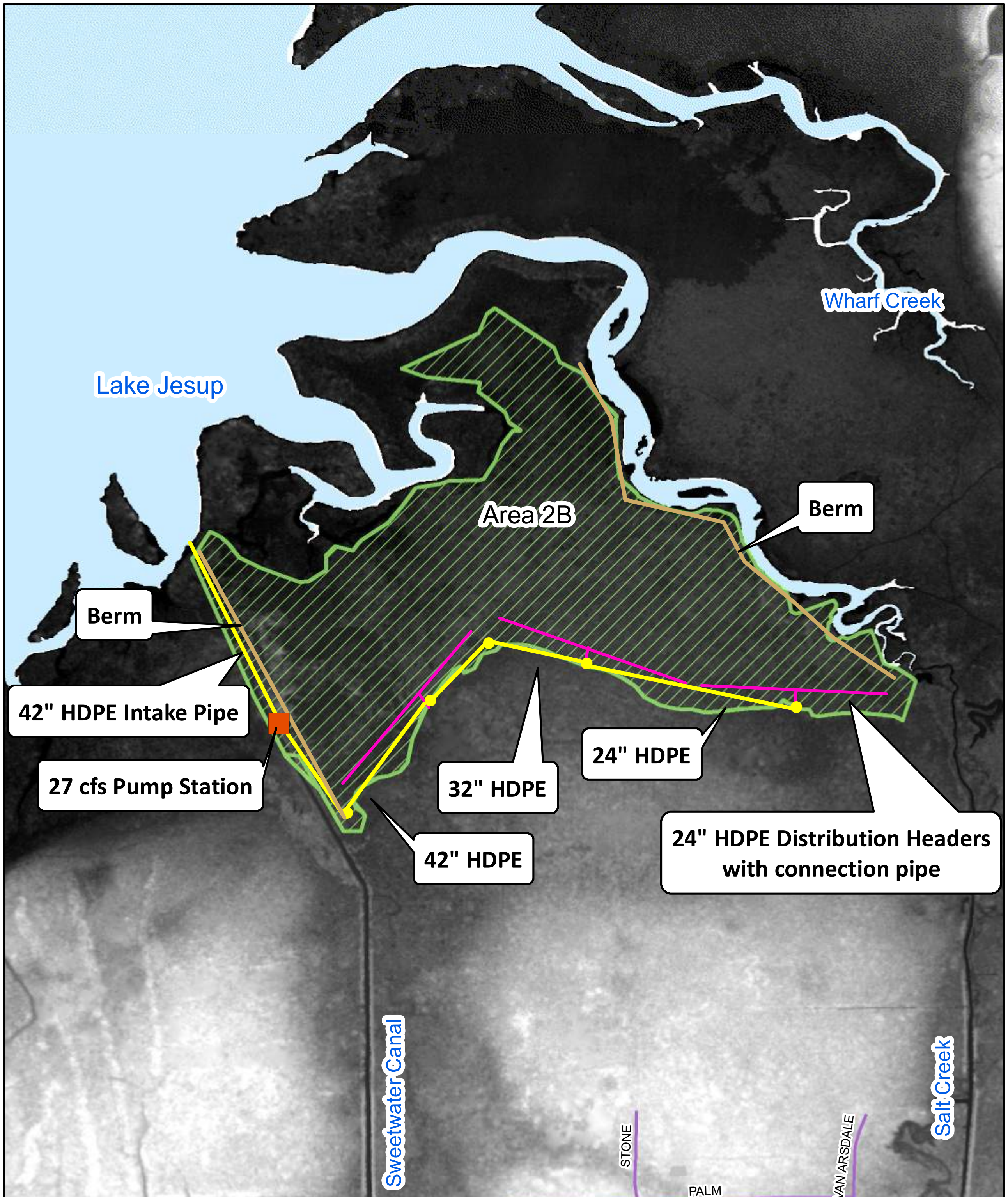
If a wetland treatment system is proposed within 5 miles of the Orlando-Sanford International Airport further evaluation of potential effects on airport activities is recommended including a Wildlife Hazard Site Visit by an FAA certified biologist.

2.1.2.3 Conceptual Cost Estimates

CDM Smith prepared a planning level capital cost estimate based on the conceptual level of detail provided as a result of the feasibility analysis. Both projects have similar infrastructure components, which consist of the following:

- 27 cfs pump station
- 42" high density polyethylene (HDPE) intake and water main distribution pipe (with varying pipe sizes and lengths to distribute the flow to headers)
- 24" HDPE distribution headers
- 3-ft high earthen berm with a 10-foot top width and 3:1 side slopes to prevent short circuiting

The proposed conceptual layouts for Areas 2B and 4 are shown in **Figures 7** and **8**. CDM Smith's opinion of probable construction costs for the aforementioned improvements for Areas 2B and 4 are $27,632,000 and $26,279,000 respectively. This includes a 25 percent contingency. A detailed breakdown of the construction cost estimate is provided in **Attachment 2**. It is important to note that since these costs are conceptual, they are not considered final construction costs. A limited



Legend

- Pump Station
- Berms
- Intake Pipe and Water Main
- Junctions
- Distribution Headers
- Emergent Wetlands (Non-Forested)
- Streets

DEM

Value

High : 14.60

Low : -0.83

Water Bodies

N W E S

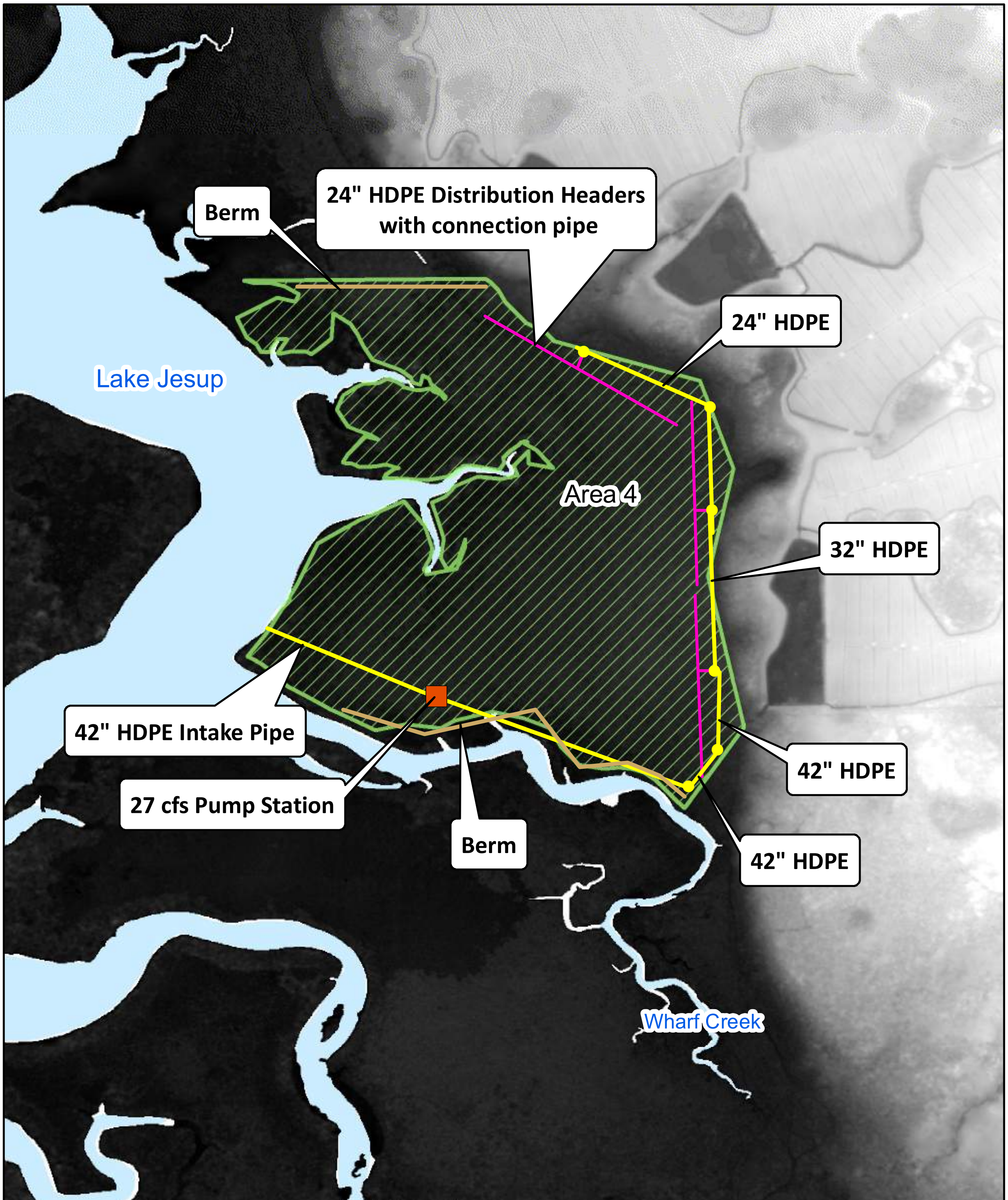
0 0.05 0.1 0.2 Miles

Figure 7

Lake Jesup Treatment Wetland Alternatives Analysis

Proposed Treatment Wetland Configuration
(Treatment Area above 1-ft NAVD88)

CDM Smith



Legend

- Pump Station
- Berms
- Intake Pipe and Water Main
- Junctions
- Distribution Headers
- Emergent Wetlands (Non-Forested)
- Water Bodies

DEM
Value
High : 21.91
Low : -0.83

N W E S

0 0.05 0.1 0.2 Miles

Figure 8
Lake Jesup Treatment Wetland Alternatives Analysis

Proposed Treatment Wetland Configuration
(Treatment Area above 1-ft NAVD88)

CDM Smith

constructability review was also performed which is provided in **Attachment 3**. If the District were to further consider wetland treatment as an alternative, hydrologic and hydraulic modeling is recommended to better determine flow paths and additional project elements that may be required to avoid potential short-circuiting of treated flows.

For comparison purposes, the 60 percent cost estimate for the LCR site (JMT, 2021) was reviewed and the estimated construction cost was $14.57M, which included a 25% contingency. To compare to present-day costs, CDM Smith applied an escalation factor which resulted in an updated cost of $15.86M.

CDM Smith also performed a limited cost-effectiveness evaluation for nutrient removal for a wetland treatment system at Areas 2B and 4. While the magnitude of the load removed is important, it is also essential to understand at what cost nutrients are being removed. As a detailed benefit cost analysis is beyond the scope of services, CDM Smith estimated the cost per lb of nutrient (TN and TP) removal by calculating an annualized cost (accounting for capital, O&M and land acquisition costs (which are not applicable)) using a standard design life for the types of treatment facilities recommended. CDM Smith assumed an annual O&M cost of $300,000 based on previous information received from the District for similar systems (see **Table 5**). A 20-year design life and an interest rate of 4% was assumed. The estimated cost effectiveness for TN and TP removal for Areas 2B and 4 is provided below. It should be noted that the values for the lower range of nutrient removal were used for a more conservative estimate.

- Area 2B: $2,206/lb TP and $197/lb TN removed
- Area 4: $1,873/lb TP and $168/lb TN removed

3.0 Wetland Treatment Feasibility Summary and Conclusions

Based on the feasibility analysis described in the TM, CDM Smith compiled the results for Areas 2B and 4 into a summary matrix that is presented in Table 5**.** Results of the feasibility factors that were evaluated are included in the matrix. This also includes several key parameters for the LCR site for comparison purposes. As indicated in the table, the target pollutant load removals for TN may be achieved at either area based on the range presented (with varying k values). However, the estimated TP reduction at either area is less than the target TP removal based on the range presented. Another significant factor is costs. The estimated costs for Areas 2B and 4 are significantly higher than the estimated cost for the LCR site (based on the 60 percent cost estimate that was adjusted by CDM Smith to reflect recent escalation). Additionally, power and site access will add to the capital costs presented in the table. It should also be noted that based on the goal of applying 27 cfs to the available treatment area, the hydraulic loading rates (HLR) are much higher for Areas 2B and 4 and may not be feasible. There is the option to reduce the flow rate but that will further reduce the pollutant loading removal capabilities and lower the cost-effectiveness of the system.

Based on this conclusion for the wetland treatment feasibility analysis, CDM Smith also evaluated the feasibility of other alternative treatment technologies for the District to consider which is discussed in the next section.

Table 5 Lake Jesup Conceptual Wetland Treatment System Comparison

Parameter	LCR Site	Area 2B	Area 4
Size (acres)	271	133.2	116.5
Upland (acres)	0	0.0	0.0
Forested Wetland (acres)	0	0.3	0.2
Emergent Wetland (acres)	271	132.8	116.3
Application Flow Rate (cfs)	27	27	27
Hydraulic Loading Rate (in/week)	17	33.8	38.6
TN Wetland Discharge Concentration (mg/l) Range (k value 12 to 34)	2.15	2.37 to 2.04	2.4 to 2.09
TN Removal (lbs/yr) Range (k value 12 to 34)	23,800	13,880 to 31,406	12,345 to 28,663
TP Wetland Discharge Concentration (mg/l) Range (k value 10 to 22)	0.09	0.124 to 0.102	0.126 to 0.098
TP Removal (lbs/yr) (k value 10 to 22)	2,800	1,244 to 2,416	1,104 to 1,954
Relative Constructability	Refer to Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%) (JMT 2020) and Lake Jesup Flow-way Project Technical Memo (ECT 2014)	Constructible with a number of items to be taken into consideration	Constructible with a number of items to be taken into consideration
Proximity to Airport	Within 5,000 to airport operations area	Within 5 miles	Within 5 miles

Parameter	LCR Site	Area 2B	Area 4
Regulatory Permitting Constraints	Refer to Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%) (JMT 2020) and Lake Jesup Flow-way Project Technical Memo (ECT 2014)	Flow-through treatment wetlands may be somewhat compatible with the wetland function of the emergent marsh areas, and from a permitting perspective these areas would be the preferred location for a flow-through wetland. Impacts to emergent marsh areas from infrastructure improvements to establish desired flow regimes, prevent short circuiting and provide maintenance access as necessary would result in wetland impacts requiring offsets or mitigation.	Flow-through treatment wetlands may be somewhat compatible with the wetland function of the emergent marsh areas, and from a permitting perspective these areas would be the preferred location for a flow-through wetland. Impacts to emergent marsh areas from infrastructure improvements to establish desired flow regimes, prevent short circuiting and provide maintenance access as necessary would result in wetland impacts requiring offsets or mitigation.
Soils Suitability	Refer to Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%) (JMT 2020) and Lake Jesup Flow-way Project Technical Memo (ECT 2014)	Soils in this area are mapped as Terra Ceia Muck with high organic content. These soils are suitable for wetland treatment systems.	Soils in this area are mapped as Terra Ceia Muck with high organic content. These soils are suitable for wetland treatment systems.
Qualitative Wetland Impacts	Direct impacts would result from the construction of access roads and distribution systems. Indirect impacts include conversion of forested wetland to emergent marsh. Additionally, species community shifts would occur in areas that are currently natural emergent marsh that would be converted to a treatment wetland emergent marsh due to the higher hydraulic loading rates.	Direct impacts would result from the construction of access roads and distribution systems. Indirect impacts include potential species community shift in emergent wetlands depending on hydraulic loading rates. Overall impacts would be similar to Area 4.	Direct impacts would result from the construction of access roads and distribution systems. Indirect impacts include potential species community shift in emergent wetlands depending on hydraulic loading rates. Overall impacts would be similar to Area 2B.
Proposed Infrastructure	Refer to Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%) (JMT 2020) and Lake Jesup Flow-way Project Technical Memo (ECT 2014)	3,094 ft intake/water main pipe (42"HDPE) 1,096 ft water main pipe (32"HDPE) 1,663 ft water main and connection pipe (24"HDPE) 3,672 ft distribution headers (24"HDPE) 27 cfs pump station 5,182 ft earthen berm	3,481 ft intake/water main pipe (42"HDPE) 910 ft water main pipe (32"HDPE) 1,776 ft water main and connection pipe (24"HDPE) 3,327 ft distribution headers (24"HDPE) 27 cfs pump station 3,033 ft earthen berm

Parameter	LCR Site	Area 2B	Area 4
Conceptual Capital Cost Estimate (Area 2B and Area 4 - includes 25% contingency)	**$14.57M** 60P cost estimate (JMT, March 2021) **$15.86M** (March 2022 escalation applied by CDM Smith)	$27,632,000	$26,279,000
O&M (Planning Level) Cost Estimate	Refer to Lake Jesup Flow-way Project Technical Memo (ECT 2014)	Based on Kadlec & Wallace (2009), annual O&M costs can range from $500 - $10,000/hectare per year. This would be equivalent to $27,000 to $538,000 per year. Average O&M costs for Lake Apopka Marsh Flow-Way (over 13 years) were ~$315,000 per year (CDM Smith, 2017) which falls within this range.	Based on Kadlec & Wallace (2009), annual O&M costs can range from $500 - $10,000/hectare per year. This would be equivalent to $24,000 to $471,000 per year. Average O&M costs for Lake Apopka Marsh Flow-Way (over 13 years) were ~$315,000 per year (CDM Smith, 2017) which falls within this range.
Off-Site Access (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	Stone St (paved): Good condition to Palm Avenue. Would need significant improvement north of Palm Avenue of a little less than 1000 feet	Wildwood Trail can provide access and power to Area 4. Additional on-site road improvements and three phase power extension will be necessary for Area 4. An additional access to Area 4 could be through the City of Sanford (Site 10) spray field to the north. This route has not been explored, but if Area 4 is the preferred site, then additional evaluation of this route and coordination with the City would be recommended.
Off-site Access (Maintenance Road) Costs (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	$150,000	$0 / N/A (additional on-site road improvement costs not included)
Property Ownership Issues (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	**Moser Parcels**: As an alternative to full District ownership, a flowage and access easement could be pursued on these parcels to access 2B. Therefore, these parcels should not be excluded from the alternative analysis; **Sweetwater/Salt Creek Restoration Areas**: it is recommended to discuss with Seminole County and the loss of function of the existing restoration project be considered	No perceived property ownership issues for reduced Area 4

Parameter	LCR Site	Area 2B	Area 4
Power Supply Accessibility/Availability (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	Moderately Available - Single phase to District property line. 3 phase ends at CR 426. Approximately 3 miles of phase line to install/upgrade.	Wildwood Drive also provides access and power to Area 4. Single phase to end of maintained road. 3 phase ends at SR 46. Approximately 3 miles of 3 phase line to install/upgrade.
Off-Site Power Supply Costs (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	$300,000	$300,000
Potential for Tributary Inflow	Refer to Lake Jesup Nutrient Reduction and Flow Enhancement Basis of Design Report (30%) (JMT 2020) and Lake Jesup Flow-way Project Technical Memo (ECT 2014)	Yes, Sweetwater and Salt Creek	Yes, Wharf Creek

4.0 Alternative Treatment Technologies

In 2017, CDM Smith completed a review of treatment options for in-lake phosphorus reduction for Lake Jesup (CDM Smith, 2017 [2017 Study]). As part of that review, a number of treatment options were reviewed, which included both traditional lake management techniques such as sediment removal, chemical treatment and lake recirculating treatment wetland and other treatment technology options. The treatment technology options were largely identified based on vendor provided information at a public workshop and included both direct treatment within the lake as well as off-line treatment options. For this task, the District is interested in evaluating small footprint alternative treatment strategies which could provide similar nutrient removal benefits to the LCR site. The project would most likely be implemented as an off-line operation on District -owned property just south of Lake Jesup adjacent to Elm Street as shown on **Figure 9.**

In addition to the top ranked technologies from the 2017 Study as discussed above, CDM Smith also considered some additional alternative treatment technologies not captured in the previous work. The identification of additional alternative treatment technologies is not meant to be an exhaustive review performed as part of a literature search for this current feasibility evaluation. The intent is to identify additional smaller footprint technologies that would be effective in removing nutrients and have more recent performance and cost data available since the 2017 Study was completed.

4.1 2017 Study Review

A review of the 2017 study was performed to identify which technologies would be suitable for a small footprint alternative treatment strategy to treat water from Lake Jesup. Several chemical (ViroPhos®, Alum and Phoslock®) and physical (cavitation) treatment technologies were the top ranked technologies based on a number of performance, economic and operational criteria. These top ranked technologies all scored relatively close to one another in the final ranking. It should be noted, except for traditional lake management techniques, the technologies were evaluated based largely on vendor-provided information and several limitations were identified with some of these technologies, specifically the Phoslock® and cavitation treatment technologies. Due to the closeness of the results of the top ranked technologies and potential limitations, reliance on vendor-reported information as well as the limited testing on Lake Jesup with these technologies, it was recommended that the District consider demonstration projects that test these chemicals (ViroPhos® and Phoslock®) and compare the results to alum treatment, which is a proven technique. Additionally, a demonstration project using cavitation was also recommended. Of the top ranked technologies from the 2017 Study, the following should be noted for application to a small off-line footprint application being considered for this current evaluation:

- While the information for Virophos® indicated high estimated nutrient load removal (5,070 lbs/yr and 2,900 lbs/yr of TP and TN, respectively), the values and costs provided were based on application of the chemical directly to the lake and not an off-line system. The vendor did present a stormwater filter strip concept as a secondary application for Lake Jesup, which is estimated to remove 53-56% TP and 58-68% TN based on the loading ratio but no costs

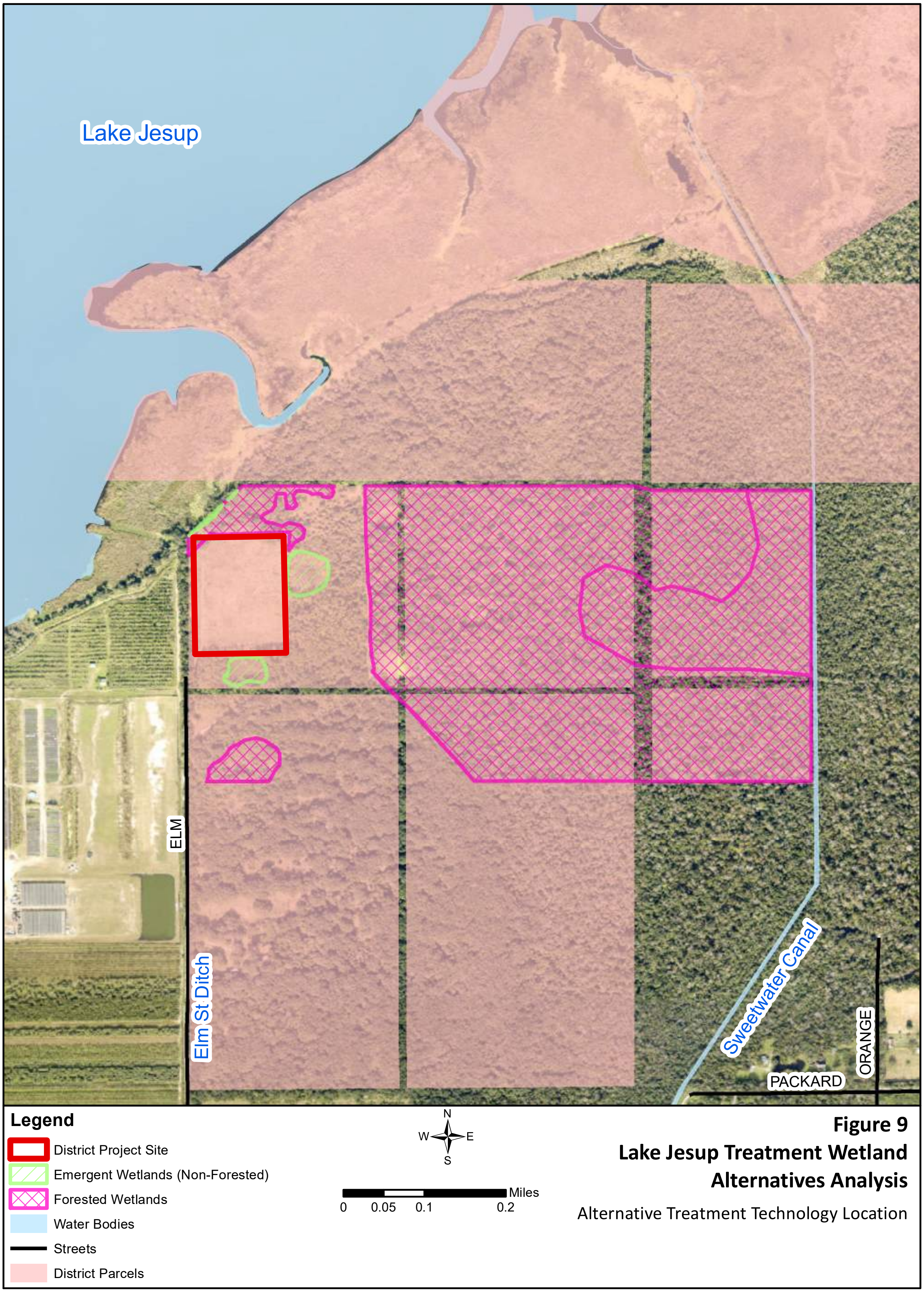


Figure 9
Lake Jesup Treatment Wetland Alternatives Analysis
Alternative Treatment Technology Location

CDM Smith

were provided for this type of application. It is assumed that a filter bed configuration could also be used with Virophos® with water applied from the lake but again there are no costs readily available for this type of application.

- The use of alum is considered a traditional lake management technique. In the 2017 Study, alum was considered only for an in-lake application with an estimated TP removal provided by the District of 22,930 lbs/year. It was noted a 23% reduction in nitrogen could be expected, however the load removal for TN was not quantified at the time. It should be noted that alum can be used for off-line applications, which is discussed in more detail in the next section. However, based on District input, they were not interested in pursuing an off-line alum system at Lake Jesup for this current study.

- Phoslock® was also another chemical treatment that showed potential to remove high quantities of nutrients (5,070 lbs TP/year) based on vendor provided information. Similar to Virphos®, the values and costs provided were based on application of the chemical directly to the lake and not an off-line system. The vendor also indicated there would not be any TN removal associated with the application of Phoslock®. Therefore, this technology was eliminated for further consideration as the target load reductions are for both TN and TP.

- The Ferthaul Cavitation process also ranked very high in the 2017 Study. This is a physical process that removes phosphorus from both the water column and sediments. Subsequent to the 2017 Study, the District requested that Environmental Science Associates (ESA) perform a follow-up evaluation in 2018 on a project at Lake Apopka that was employing the same technology. ESA's evaluation found that the Ferthaul process reported high removal efficiencies for TP (and therefore lower unit removal cost) in the 2017 Study that are in turn based on inflows that included unconsolidated floc – an inflow source not tested by the other vendors in the study for Lake Jesup. Through their evaluation and analysis of the data, ESA found that the removal efficiencies for TP in the water column were closer to 30 to 34 percent. Therefore, this technology was eliminated for further consideration.

Other technologies identified from the 2017 Study, which are off-line technologies with a smaller footprint are summarized in **Table 6** below. The remaining technologies are mostly filtration, algal removal and one physical type of treatment. The District already has extensive experience with algal based treatment systems at Lake Jesup so these were eliminated from further consideration. Those remaining were filtration and physical type treatment technologies. The District indicated they would like bio-sorption activated media (BAM) and the Phosphorus Elimination System (PES) treatment technologies further evaluated, which are reactive media filtration type treatments. In addition to these technologies, CDM Smith further evaluated the electrocoagulation technology as more recent information on costs and removal were available since the 2017 Study. These technologies are discussed in more detail in the following section.

Table 6 2017 Study Small Footprint Alternative Treatment Technologies

Treatment Technology	Treatment Type	Description	TP Removal (lbs/yr)	TN Removal (lbs/yr)	2017 Capital Costs	O&M Costs	$/lb P Removed	$/lb N Removed
Gator Aquatic	Chemical / Filtration	Combines ability to separate and dewater solids while at the same time remove TP from the water column to non-detectable levels. The process removes sediments containing the highest levels of TP, which are contributing to the majority of the water column contamination and the soluble P as well. The process also captures and removes algae that may be present in the water column.	4,409 lbs/year	Projected removal of 200K lb of TKN (Turkey Creek muck removal, Palm Bay FL)	$343,200	$842,137	$191	N/A
Allied Group (P-Kill)	Chemical / Filtration	Multiple technologies including media beds that are used in conjunction with a pump system. It's non-toxic and can be disposed of in farmlands for beneficial use	5,358 lbs/year	94,973 lbs/year	$545,129	$610,000	$133	$7
Clearas (ABNR™)	Chemical / Algal	System is highly modular and uses an advanced biological nutrient removal (ABNR) wastewater treatment process, Blend, nutrient recovery and separation are the 3 main phases of process.	5,110 lbs/year	34,310 lbs/year	$22,862,166	$480,224	$446	$66
Aquafiber (Mobile Unit)	Chemical / Algal	Treatment train that uses a proprietary technology. Includes dissolved air flotation process and no filtration is required. A series of physical and biological processes are used and sometimes chemical processes are included.	843 lbs/year	13,694 lbs/year	$1,000,000	$743,000	$1,088	$67

Treatment Technology	Treatment Type	Description	TP Removal (lbs/yr)	TN Removal (lbs/yr)	2017 Capital Costs	O&M Costs	$/lb P Removed	$/lb N Removed
Hydromentia (Algal Turf Scrubber)	Algal	The Algal Turf Scrubber is a culture unit for attached algae. As the algae grow, they strip out nutrients from the water. The algae is recovered and processed and managed on a weekly basis. Recovery of algal biomass maintains the culture units in an accelerated growth phase.	1,700 lbs TP (Test case in Indian River County)	9,000 lbs TN (Test case in Indian River County)	N/A	N/A	$67 to $309/lb	N/A
Gerber Pumps (Electro - coagulation)	Physical	Electrocoagulation is a technology with multiple applications and it does not use any polymers, chemicals or produce a brine waste stream. Electrocoagulation is the process of destabilizing suspended particles by introducing an electrical current and dissolving metal ions into the medium. The coagulated suspended particles are separable from the water column.	Tested in Lake Jesup, 99% removal of P (1 Metric Ton (MT) and 2.3 MT)	Tested in Lake Jesup, 80% removal of N (13.2 MT for lower flow)	N/A	N/A	$54-319/lb P removed (O&M Cost Estimate $/lb provided only)	N/A

4.2 Additional Alternative Treatment Technologies

CDM Smith also considered other treatment technologies not previously evaluated in the 2017 Study. Based on the District's input, CDM Smith was requested to further evaluate BAM and PES discussed in Sections 4.2.1 and 4.2.2. In addition to the BAM and PES, CDM Smith also evaluated Electrocoagulation as it has also been considered in the 2017 Study and recent work done by both the District (Black Creek Water Resource Development project) and the South Florida Water Management District (SFWMD) based on its capabilities to remove nutrients.

4.2.1 Bio-Sorption Activated Media (BAM)

Bio-sorption activated media (BAM) is a newer alternative treatment technology that is becoming more commonly used in stormwater best management practice (BMP) treatment applications in an effort to further reduce nutrients and pollutants in stormwater runoff. However, in recent years, it has been used in other innovative applications to provide treatment beyond just stormwater runoff. Two recent examples of the use of BAM in the Lake Jesup basin to treat surface water inflow were the Salt Creek Stream Restoration project implemented by Seminole County in 2018 and the Solary Canal Stormwater Treatment Area retrofit project implemented by the City of Winter Springs in 2018. Both projects included the use of BAM to reduce nutrient loads in the tributaries to Lake Jesup to help meet TMDL goals for the lake. In both cases, Bold & Gold® was the selected media and is also accepted by FDEP for meeting TMDL and BMAP goals.

CDM Smith reviewed available literature for an off-line treatment system using BAM for a small footprint alternative treatment project. *The C-43 West Basin Storage Reservoir Water Quality Feasibility Study - Deliverable 4.3.1: Final Feasibility Study Update* prepared for the SFWMD (November 2020) examined conventional and innovative biological, physical, and chemical technologies available and applicable to treating water entering and discharging from the C-43 West Basin Storage Reservoir (WBSR) or reducing potential algal biomass within the C-43 WBSR. The evaluation focused on 10 technologies where additional information was developed and gathered from vendors. Information requested from the vendors included technology sizing and performance for a system that treats flows within a range of 300–600 cubic feet per second (cfs) that could be applied to the C-43 WBSR. Additionally, to directly compare the technologies' ability to reduce nutrients, specific water quality targets were provided (reducing TN from 1.5 mg/L to 1.0 mg/L and TP from 0.16 mg/L to 0.08 mg/L). Several of the 10 technologies have also previously been evaluated for Lake Jesup including alum treatment, treatment wetlands and Electrocoagulation as well as off-line filtration media and are all applicable.

Based on this evaluation, the highest ranked technologies for the C-43 WBSR were treatment wetlands, alum treatment, and Hybrid wetlands treatment technology (HWTT). The next highest ranked technologies included Bold & Gold®, sand filtration, Air Diffusion System (ADS), and Electrocoagulation. The higher ranked technologies were further evaluated for implementation for treatment either as individual components or as part of a treatment train. The alternatives that were identified for the detailed cost-benefit analysis included:

- Alum treatment – both as an offline treatment facility and online, in-reservoir treatment system;
- Full scale treatment wetland;
- HWTT;
- Smaller treatment wetland with parallel Bold & Gold® treatment;
- Sand filter with parallel Bold & Gold® treatment; and,
- Electrocoagulation.

Bold & Gold® was one of the 10 technologies that was evaluated in further detail. Vendor responses were provided with detailed information on treatment capabilities, project specifications and costs. Based on the information provided by Environmental Conservation Solutions (ECS), a 5-acre filter cell will treat 25.2 cfs with a hydraulic loading rate of 5 inches per hour. This is comparable to the proposed treatment flow of 27 cfs for the LCR site. Each filter is a mix of graded sand, clay, and recycled tire crumbs called Bold & Gold® CTS. CTS refers to a mix with clay, tire crumbs, and sand. Based on past monitored and published data on water quality performance, ECS anticipated the following removal efficiencies with the CTS mix:

- Dissolved Organic Nitrogen (DON) 50% (±10%)
- Dissolved Bio-Available Organic Nitrogen (BON) 50% (±10%)
- Dissolved Inorganic Nitrogen forms, ammonia, nitrate and nitrite Nitrogen (NH_3 and NO_x) 90% (±10%)
- Particulate Nitrogen (PN) 90% (±10%)
- Total Nitrogen (TN) 70% (±10%)
- Particulate Phosphorus (PP) 95% (±2.5%)
- Soluble Reactive Phosphorus (SRP) 70% (±5%)
- Total Phosphorus (TP) 80% (±5%)
- Total Suspended Solids (TSS) 95% (±2.5%)

The filter media is installed in a treatment cell, which contains the media, drainage stone, cover sand and rock, separation fabric, liner, and piping. Using similar calculations performed by ECS to estimate nutrient load removal, CDM Smith estimated the potential TN and TP removal using a 5-acre cell that can treat 25.2 cfs of Lake Jesup water. CDM Smith also used the unit costs provided by ECS to estimate conceptual costs for an off-line application at Lake Jesup. **Table 7** summarizes the results of the load removal estimates and conceptual costs. ECS noted that the surface area of a filter is 5 acres and some additional area for cell bank and access maintenance will also be required. The District property has approximately 9.7 acres of open space that would not impact wetlands or require significant clearing.

This should provide sufficient area to accommodate a 5-acre Bold & Gold® filter cell plus additional space needed as noted. Based on the results presented in Table 7, the Bold & Gold® filter cell treatment removal estimates significantly exceed the target nutrient load reductions of the LCR site (23,800 pounds and 2,800 pounds, respectively for TN and TP based on a steady-state design flow of about 27 cfs) using a similar flow rate. discharge. The Bold & Gold® filter cell is estimated to reduce TN load by more than three times as much as the LCR site and twice as much for TP load. Since the filter achieves a TN and TP concentration that is lower than the lake target, ECS also noted the potential for greater operational flexibility of the filter by blending a portion of the treated filter effluent with source water to meet the lake target upon discharge.

Table 7 Bold & Gold® Treatment Filter Cell Estimate Load Removal and Costs using Lake Jesup Water

Parameter	Value
Input Data Assumptions	
Lake Jesup In-Lake Target TN (mg/l)	1.27
Lake Jesup In-Lake Target TP (mg/l)	0.096
Lake Jesup Existing TN (mg/l)	2.63
Lake Jesup In-Lake Existing TP (mg/l)	0.147
Lake Jesup In-Lake Existing SRP (mg/l)	0.0227
Phosphorus Removal	
% SRP of Existing TP	15%
B&G SRP Removal %	70%
B&G Particulate P Removal %	90%
Dissolved P concentration after treatment (mg/l)	0.007
Particulate P concentration after treatment (mg/l)	0.012
TP concentration after Treatment (mg/l)	0.019
% of Original TP concentration	13%
Incoming TP load (lbs/yr) based on 25.2 cfs	7,293
Treated TP load (lbs/yr)	955
TP Load Reduction (lbs/yr)	6,338
Nitrogen Removal	
Bold & Gold (B&G) TN Removal %	60%
Incoming TN load (lbs/yr) based on 25.2 cfs	130,480
Treated TN load (lbs/yr)	52,192
TN Load Reduction (lbs/yr)	78,288
Conceptual Construction Cost Estimate	
Total Cost to Construct a Five-Acre Bold & Gold® Treatment Cell (2020 $)	$4,500,000
Security Fencing Around Treatment Cell (if needed)	$5,000
Subtotal (Adjusted for 2022 $)	$5,019,000
27 cfs Pump Station (see Attachment 2)	$2,600,000
42-inch HDPE Intake Pipe (530 feet)	$798,000
Design and Permitting (assume 7.5% of construction cost)	$631,200
Total Estimated Conceptual Cost with 25% Contingency	$11,309,000

4.2.2 Biofiltration Phosphorus Elimination System (PES)

The biofiltration phosphorus elimination system (PES) developed by the Sustainable Water Infrastructure Group (SWIG) was also evaluated based on recent performance data associated with the District's Black Creek Water Resource Development project located in Clay County, Florida. The Black Creek project is intended to provide recharge to the Upper Florida Aquifer (UFA) near Alligator Creek and Lake Brooklyn by harvesting water from Black Creek. Based on differences in water quality between Black Creek and the intended receiving waters, additional treatment was needed to design and permit the project. The target parameters for treatment for this project included nutrients, metals and color in order to maintain water quality standards. The District performed pilot testing of the PES technology to determine if the PES could remove color below 40 platinum cobalt units (PCU), as well as removing nitrogen, phosphorus, total organic carbon (TOC), and lead. After pilot testing the passive treatment system, the PES technology was selected as the preferred treatment alternative for the Black Creek Water Resource Development project.

PES is a proprietary biofiltration media (sand, water treatment residuals, and other amendments) and was evaluated for its effectiveness on color and nutrient removal by SWIG. The application included large beds of biological media where source water would be pumped across; treatment occurs as water infiltrates through the media, where it then drains to the effluent discharge location. Removal occurs primarily by sorption of organic matter and phosphorus onto the media. Major elements that are expected to be included in the full-scale PES system include five adjacent treatment cells, distribution piping and control valves, PES treatment media (proprietary), one pre-welded 30-millimeter thickness reinforced polyethylene (RPE) liner, stone to place on top of the RPE liner, two 15-inch underdrains, and vegetation planted in the media. The PES alternative is a passive, outdoor system that does not require chemical addition and provides sufficient treatment for the project receiving waters (Alligator Creek, Lake Brooklyn and Lake Geneva) and for Floridan Aquifer recharge.

Based on information collected during the pilot test for Black Creek, CDM Smith estimated the nutrient load removal for Lake Jesup water based on the anticipated performance of a full-scale PES treatment system, which can treat on average 6.6 mgd (10.2 cfs). **Table 8** summarizes the results of the load removal estimates and opinion of probable construction costs based on information from the Black Creek project. As noted in the table, the full-scale treatment system has an area of 11.3 acres. For applicability to Lake Jesup, several assumptions were made for the calculations shown in Table 8:

- Only information on TKN removal was available from the Black Creek pilot testing as Nitrate (NO_3) + Nitrite (NO_2) measurements were below the detection limit. For Lake Jesup, the average TKN concentration (2012 through 2021) is 2.57 mg/l compared to the average lake TN concentration of 2.63 mg/l. CDM Smith used the Lake Jesup TKN concentration to calculate load removal.

- The TKN and TP removal rates (% removal) calculated from the anticipated performance of a full-scale PES treatment system for Black Creek were based on a much lower incoming nutrient concentration compared to Lake Jesup. It was assumed the PES would provide similar % removal (87% for TP and 41% for TKN) for source water at higher nutrient concentrations.

- Construction cost estimates shown are based on a combination of the available estimated costs for the Black Creek project as well as recent cost estimates prepared for the Lake Jesup wetland treatment feasibility (i.e., pump station and piping).

Based on the results presented in Table 8 for a treatment system in similar size (11.3 acres) to the Black Creek full-scale treatment system, the PES is estimated to remove 21,185 lbs/year and 2,580 lbs/year for TKN and TP, respectively based on a 10.2 cfs flow rate and Lake Jesup nutrient concentrations. This is somewhat less than the nutrient load reductions of the LCR site (23,800 pounds and 2,800 pounds, respectively for TN and TP based on a steady-state design flow of about 27 cfs). It should be noted however that load removals for the PES full-scale treatment were based on TKN removal as there was no data available on TN. It is assumed that the treatment goals may be met by scaling up the size of the treatment system; however, based on the available 9.7 acres of open space, this may require additional clearing of forested areas and potential nearby wetland impacts on the District's property.

Table 8 PES Nutrient Load Removal and Conceptual Cost Estimates using Lake Jesup Water

Parameter	Value
Input Data Assumptions	
Black Creek Existing TKN (mg/l)	0.794
Black Creek Existing TP (mg/l)	0.061
Black Creek Effluent TKN (mg/l) (Column Study Data)	0.468
Black Creek Effluent TP (mg/l) (Column Study Data)	0.008
TKN % Load Removal (lbs/yr) based on 10.2 cfs (6.6 mgd)	41%
TP % Load Removal (lbs/yr) based on 10.2 cfs (6.6 mgd)	87%
Lake Jesup Average Existing TN (mg/l)	2.63
Lake Jesup Average Existing TKN (mg/l)	2.57
Lake Jesup Average Existing TP (mg/l)	0.147
Estimated Phosphorus Removal for Lake Jesup	
PES TP Removal %	87%
Incoming TP load (lbs/yr) from Lake Jesup based on 10.2 cfs	2,955
TP Load Reduction (lbs/yr)	2,580
Estimated Nitrogen Removal for Lake Jesup	
PES TKN Removal %	41%
Incoming TKN load (lbs/yr) from Lake Jesup based on 10.2 cfs	51,662
TKN Load Reduction (lbs/yr)	21,185
Conceptual Construction Cost Estimate for Lake Jesup	
Total Cost to Construct a 11.3-Acre PES Treatment System	$23,731,000
12 cfs Pump Station (based on ratio of flows from 2022 CCI cost estimate for 27 cfs pump station)	$1,200,000
24-inch HDPE Intake Pipe (530 feet)	$651,900
Design and Permitting (assume 7.5% of construction cost)	$1,915,000
Total Estimated Conceptual Construction Cost with 25% Contingency	$33,838,000

4.2.3 Electrocoagulation

Electrocoagulation was previously considered for the 2017 Study. Detailed information was provided on the technology's nutrient load removal capabilities; however due to lack of information on costs at the time (only annual O&M costs were provided), the evaluation of this technology was more limited compared to other technologies where all costs were provided to make an equitable comparison. Recently, more information has been made available on estimated capital costs for this technology in order to develop a more informed evaluation.

In response to the District's 2016 Request for Information (RFI) for the 2017 Study, Gerber Pumps International Inc. provided detailed information on nutrient removal for Lake Jesup and O&M costs. As per the response to the RFI, their electrocoagulation process involves raw untreated water flowing vertically past a series of parallel sacrificial blades of 1/8" thickness. As the water flows up past the blades, a threshold voltage is applied such that the iron and/or aluminum ions dissolve into the water to supply the seed ions for precipitation and coagulation along with excess electrons from the power grid. With no chemicals, other than the ions from the sacrificial blades, suspended solids (TSS) are coagulated and dissolved contaminants (TDS) precipitate out of solution and coagulate with no additional chemicals and/or polymers. The coagulated solids can be removed from the treated water by various clarification means. In 2016, Gerber Pumps International Inc. tested the nutrient removal capabilities using water samples collected from Lake Jesup and calculated the flow and energy costs needed to meet the TP removal goals that were set for the lake at the time of the study (1 to 2.3 metric tons (MT)).

Table 9 summarizes the nutrient load reduction capabilities based on information provided by Gerber Pumps International Inc. in 2016. The nutrient load removals shown were based on the response to the District's 2016 RFI, which had goals to remove 1 MT and 2.3 MT of TP from the lake. As indicated in the table, the 1 MT is achievable with an electrocoagulation system operating 250 days per year. The removal of 1 MT of TP is somewhat less than the nutrient load reductions of the LCR site (23,800 pounds and 2,800 pounds, respectively for TN and TP based on a steady-state design flow of about 27 cfs). However, the TN removal goal is exceeded under this scenario. The projected nutrient removal based on achieving a 2.3 MT removal of TP results in load reductions ((5,070 and 67,111 lbs/yr of TP and TN, respectively) that far exceed the nutrient removal expected at the LCR site.

As mentioned previously, only annual O&M costs were provided in the response to the District's 2016 RFI. Review of the *C-43 West Basin Storage Reservoir Water Quality Feasibility Study - Deliverable 4.3.1: Final Feasibility Study Update* prepared for the SFWMD (November 2020) evaluated the electrocoagulation technology and included additional detail on unit and construction costs. CDM Smith used the unit costs provided for a 3,600-gpm (7.8 cfs) electrocoagulation unit as well as information associated with other construction costs provided (i.e., building enclosure, site work, electrical, clarifiers). As the SFWMD study included 23 coagulation units in the evaluation, CDM Smith used a ratio of the cost of the electrocoagulation units and the other related construction costs and applied that ratio for the cost of 2 units needed to achieve the 1 MT of TP removal. While no space requirements (i.e., footprint acreage) were mentioned in the SFWMD study, it is assumed that the units are small enough to fit within the footprint of available space on the District's property.

Table 9 Electrocoagulation Nutrient Load Removal and Conceptual Cost Estimates using Lake Jesup Water

Parameter	Value
Input Data Assumptions	
Lake Jesup Average Existing TN (mg/l) in 2016	2.7
Lake Jesup Average Existing TP (mg/l) in 2016	0.17
Phosphorus Removal for Lake Jesup Water	
ECG TP Removal %	96%
TP Load Reduction (lbs/yr) based on 10 cfs (6.48 mgd at 250 days per year) (achieves 1 MT of TP removal)	2,204
TP Load Reduction (lbs/yr) based on 23 cfs (14.9 mgd at 250 days per year) (achieves 2.3 MT of TP removal)	5,070
Nitrogen Removal for Lake Jesup Water	
ECG TN Removal %	80%
TN Load Reduction (lbs/yr) based on 10 cfs (6.48 mgd at 250 days per year) (achieves 13.2 MT of TN removal)	29,189
TN Load Reduction (lbs/yr) based on 23 cfs (14.9 mgd at 250 days per year) (achieves 30.4 MT of TN removal)	67,111
Annual O&M Costs[1]	
10 cfs (6.48 mgd operating at 250 days per year)	$638,000
23 cfs (14.9 mgd operating at 250 days per year)	$1,571,000
Conceptual Construction Cost Estimate[2]	
Electrocoagulation Units (2) (2020 $)	$4,375,240
Building Enclosure, Clarifiers, Electrical, Site Work (2020 $)	$3,866,723
Subtotal (Adjusted for 2022 $)	$9,182,000
12 cfs Pump Station (based on ratio of flows from 2022 CCI cost estimate for 27 cfs pump station)	$1,200,000
24-inch HDPE Intake Pipe (530 feet)	$651,900
Design and Permitting (assume 7.5% of construction cost)	$824,000
Total Estimated Conceptual Construction Cost with 25% Contingency	$14,766,000

1 – 2016 O&M Costs provided by Gerber Pumps and include electrical costs and costs of sacrificial blades
2 – Cost assumes two 3,600 gpm electrocoagulation units will be needed to achieve 1 MT of TP removal. Unit costs for electrocoagulation units and accessory structures/equipment/site work taken from SFWMD, 2020.

5.0 Summary and Conclusions

CDM Smith performed a wetland treatment feasibility analysis of potential treatment wetland areas on the south shore of Lake Jesup to assess the ability to achieve similar nutrient load reduction goals established for a treatment wetland system at the LCR site on the northwest shore of Lake Jesup (23,800 pounds and 2,800 pounds, respectively for TN and TP based on a steady-state design flow of about 27 cfs). CDM Smith utilized the natural wetland areas as part of the conceptual plan and identified two areas (2B and 4) that will provide the most nutrient load removal with the least amount of long-term wetland impacts compared to other footprints evaluated on the south shore of Lake Jesup. A number of additional factors were also considered in addition to conceptual cost estimates to construct a treatment wetland system that were described in Section 2. Based on this analysis, the target pollutant load removals for TN may be achieved at both Areas 2B and 4 based on the range presented (with varying k values). However, the estimated TP reduction at Areas 2B and 4 is less than the target TP removal based on the range presented. Another significant factor is costs. The estimated costs for Areas 2B and 4 are significantly higher than the estimated cost for the LCR site (based on the 60 percent cost estimate for LCR that was adjusted by CDM Smith to reflect recent escalation). Additionally, power and site access will add to the capital costs. It should also be noted that based on the goal of applying 27 cfs to the available treatment area, the HLRs are much higher for Areas 2B and 4 than at the LCR site and may not be feasible. There is the option to reduce the flow rate but that will further reduce the pollutant loading removal capabilities and lower the cost-effectiveness of the system. The results for the LCR Site and Areas 2B and 4 are summarized in **Table 10**.

In addition to wetland treatment, the District also requested CDM Smith to examine up to three alternative small footprint technologies that could be implemented on District property just south of the lake. As part of this exercise, CDM Smith re-visited the 2017 Study, which previously evaluated potential technologies to remove TP from the water column in Lake Jesup. Based on the technologies evaluated in the 2017 Study, scalability to a smaller footprint, effectiveness in removing nutrients as well as available cost information, CDM Smith concluded that Electrocoagulation warranted further analysis as part of the alternative treatment technology evaluation. Additionally, CDM Smith also considered more recent work done for the Black Creek Water Resources Development Project as well as evaluation of treatment technologies recently performed by the SFWMD (2020). Based on these studies and District input, the alternative treatment technologies further considered included Bold & Gold®, SWIG PES and Electrocoagulation. Using information available in the literature, CDM Smith estimated the potential load removal from Lake Jesup and developed conceptual cost estimates for a scalable project at the District site. These results are also summarized in Table 9. As indicated in this table, a 5-acre Bold & Gold® treatment cell appears to remove the largest amount of nutrients (exceeds the target goals) with the least amount of cost. Electrocoagulation has slightly higher costs but with less removal than the Bold & Gold®. Electrocoagulation also had higher O&M costs based on electricity and blade replacement. Of the three technologies, PES has the highest costs with similar nutrient removal capabilities to Electrocoagulation. It should be noted that all technologies are scalable and can be expanded to increase nutrient removal, however that will further increase costs.

Table 10 Lake Jesup Comparison of Evaluated Treatment Technologies

	LCR Site[1]	Treatment Wetland Area 2B	Treatment Wetland Area 4	Bold & Gold® Filtration	PES SWIG	Electrocoagulation
Size (acres)	271	133.2	116.5	5	11.2	N/A
Application Flow Rate (cfs)	27	27	27	25	10.2	10
Hydraulic Loading Rate (in/week)	17	33.8	38.6	840	17.5	N/A
TN Removal (lbs/yr) Range	23,800	13,880 to 31,406 (k value 12 to 34)	12,345 to 28,663 (k value 12 to 34)	78,288	21,185	29,189
TP Removal (lbs/yr)	2,800	1,244 to 2,416 (k value 10 to 22)	1,104 to 1,954 (k value 10 to 22)	6,338	2,580	2,204
Conceptual Capital Cost Estimate (includes 25% contingency)	**$14.57M** 60P cost estimate (JMT, March 2021) **$15.86M** (March 2022 escalation applied by CDM Smith)	$27.6M	$26.3M	$11.3M	$33.84M	$14.8M
O&M (Planning Level) Costs ($/year)	N/A	$315,000	$315,000	$1,163,000[1,]	$2,420,000[2]	$700,000[2]
Off-site Access (Maintenance Road) Costs (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	$150,000	N/A (additional on-site road improvement costs not included)	N/A	N/A	N/A
Off-Site Power Supply Costs (SJRWMD summary dated 2/23/22 (see Attachment 1))	N/A	$300,000	$300,000	N/A[3]	N/A[3]	N/A[3]

1 - ECS assumed the Bold & Gold media life is 50 years and will therefore not have to be replaced (SFWMD, 2020). Based on information on the ECS website, it is suggested media life is dependent on dissolved phosphorus (DP) removal which will limit the life of the media. CDM Smith performed a preliminary calculation based on typical DP concentration in Lake Jesup water and estimated the media life would be on the order of 14 years. Recent unit cost information on the Bold & Gold media was provided by the District (average unit costs were applied). CDM Smith assumed Bold & Gold installation cost based on ratio of actual media costs vs actual installation costs provided for PES application. In addition to installed costs, CDM Smith assumed a $500,000 annual operating cost and the resulting annualized value over 14 years is $1,163,000.

2 - O&M costs of 1.5% of the pump station construction costs were also included in overall estimated O&M costs.

3 – The power supply for alternative treatment technologies exists at the site; it is assumed the power supply is adequate for the purposes of this study.

Based on this evaluation, it is recommended the District further consider the use of a Bold & Gold® filter cell at the District property as this appears to provide the greatest nutrient removal with the least amount of cost compared to the wetland treatment systems and other alternative technologies evaluated. It is recommended that the District conduct a pilot study to test the effectiveness of the Bold & Gold® media in treating water from Lake Jesup. As cost information is compiled from different sources, it is also recommended that the District confirm estimated construction and annual O&M (media replacement) costs with the vendor supplying the recommended technology. It should also be noted that based on the conceptual values presented in Table 10, the Bold & Gold media appears to outperform the other technologies in terms of nutrient removal. Once the removal effectiveness is confirmed through pilot testing, it is possible that the project footprint could be downsized which would therefore also reduce costs.

6.0 References

CDM Smith. 2017. Lake Jesup In-Lake Phosphorus Reduction Review of Treatment Options Technical Memorandum. Prepared for the St. Johns River Water Management District.

ESA. 2018. Review of Phosphorus Removal Technologies Memorandum. Prepared for the St. Johns River Water Management District.

JTech (J-Tech, an Alliance between Jacobs Engineering and Tetra Tech, Inc. 2020. The C-43 West Basin Storage Reservoir Water Quality Feasibility Study - Deliverable 4.3.1: Final Feasibility Study Update. Prepared for the South Florida Water Management District.

7.0 List of Acronyms

Acronym	Definition
ABNR	Advanced Biological Nutrient Removal
AC	Advisory Circular
ADS	Air Diffusion System
B&G	Bold & Gold
BAM	Bio-sorption Activated Media
BAM	Biologically Activated Media
BMAP	Basin Action Management Plan
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BON	Bio-Available Organic Nitrogen
CTS	Clay, tire crumbs, and sand.
DEM	Digital Elevation Model
DON	Dissolved Organic Nitrogen
ECS	Environmental Conservation Solutions
ECT	Environmental Consulting & Technology, Inc.
ESA	Environmental Science Associates
FAA	Federal Aviation Authority
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGDL	Florida Geographic Data Library
FLUCCS	Florida Land Use and Cover Classification System
GAC	Granular Activated Carbon
GIS	Geographic Information System
HDPE	High Density Polyethylene
HLR	Hydraulic Loading Rate
HWTT	Hybrid Wetlands Treatment Technology
JMT	Johnson, Mirmiran & Thompson
LCR	Little Cameron Ranch
LiDAR	light detection and ranging
MSJRB	Middle St. Johns River Basin
MT	Metric Ton
NPDES	National Pollution Discharge Elimination System
NRCS	National Resources Conservation Service Soils
NWI	National Wetland Inventory
O&M	Operation and Maintenance
PCU	Platinum-Cobalt Units
PES	Phosphorous Elimination System

Acronym	Definition
PN	Particulate Nitrogen
PP	Particulate Phosphorus
RFI	Request for Information
RPE	Reinforced Polyethylene
SFB	Orlando-Sanford International Airport
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
SRP	Soluble Reactive Phosphorus
SWIG	Sustainable Water Infrastructure Group
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TSS	Total Suspended Solids
UF	Ultrafiltration
UFA	Upper Florida Aquifer
USDOT	United States Department of Transportation
USFWS	United States Fish & Wildlife Service
WBSR	West Basin Storage Reservoir
WSI	Wetland Solutions, Inc.

Attachment 1

Lake Jesup Alternative Site 3 Alternative Analysis Real Estate, Site Access, Power Supply, and Permitting Analysis

Lake Jesup Alternative Site 3 Alternative Analysis
Real Estate, Site Access, Power Supply, and Permitting Analysis

Prepared by
Bureau of District Projects and Construction
February 23, 2022

I. Real Estate and Land Use Restrictions

The Lake Jesup East Tract, Alternative Site 3, was reviewed by the District Real Estate Services to identify any real estate encumbrances on the East Tract. Figure 1 provides a map of the parcels identified with potential encumbrances. These parcels include a mitigation parcel jointly owned by the District and Seminole County (1), a Florida Department of Transportation (FDOT) mitigation parcel (2), mitigation parcel 1995-042-P1 (3), the Wildwood Trail Mitigation Donation Tract (4), two internal parcels (Moser Parcels) not currently owned by the District, and three completed mitigation projects that have some restrictions.

If any of the mitigation parcels will be impacted by construction or the hydrology alterations, replacement mitigation or reasonable assurance that the alterations do not result in a loss of wetland function would be required by the environmental regulatory agencies. The potential project footprints proposed by the District consultant, CDM Smith, are described as Area 1, 2A, 2B, 3 and 4, and are depicted in Figure 1.

The mitigation parcel jointly owned between Seminole County (75%) and the District (25%) has several real estate restrictions. The boundary between Seminole County and District ownership is unclear, as both parties are on the deed. Any changes to the Seminole County owned portion of the property would require approval from Seminole County. A conservation easement over this parcel has been proposed as mitigation for a Sanford Airport Authority project. Typically, a conservation easement will include restrictions limiting the use of the parcel, but it may be possible to modify the easement language to allow for the proposed project before the easement is finalized. If this property is needed for a portion of the project further real estate research will be necessary.

The FDOT mitigation parcel has additional restrictions related to the FDOT project for which it was used as mitigation. FDOT is typically not receptive to modifying existing permits that may have implications on other FDOT projects for which the mitigation was provided. Therefore, the use of the FDOT mitigation parcel should be restricted to allowances in the existing mitigation permit.

Parcel 1995-042, covering much of the eastern portions of Area 3 and Area 4, was purchased with P2000 funds and construction activities or alteration of hydrology within this area must fit within the relevant acquisition funding requirements, including no net loss in wetland function or mitigation may be necessary to offset impacts within the area. These restrictions should not eliminate this area from consideration.

Parcels identified in Areas 1, 2A, 2B and a small portion of Area 3 appear to include retained rights-of-way. Although typically ownership of parcels on both sides allows the rights-of-way to be vacated, this can be a lengthy process. These restrictions should not eliminate these areas from consideration.

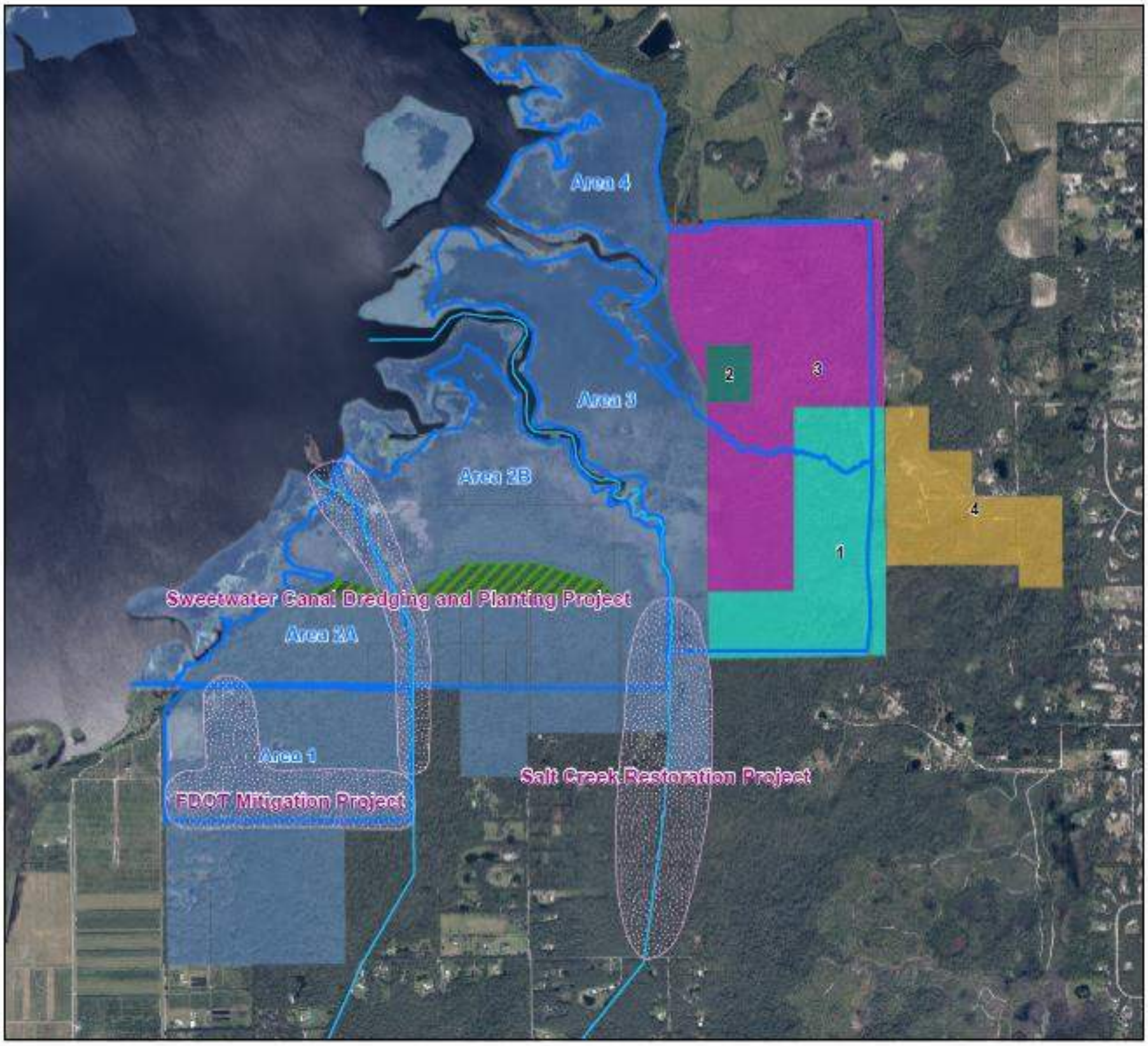
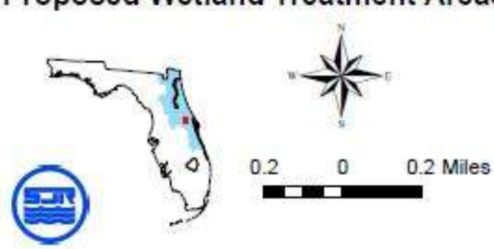


Figure 1
Lake Jesup Conservation Area
East Tract
Parcel Identification and
Proposed Wetland Treatment Areas



Legend

- Existing Project Areas
- Proposed Wetland Treatment Areas
- Moser Parcels

Area

- 1) Jointly owned: 75% Seminole County/25% SJRWMD
- 2) Acquired with FDOT Mitigation Funds
- 3) 1995-042-P1 Mitigation Parcel
- 4) Wildwood Trail Mitigation Donation Tract

District-Owned Land with No Real Estate Encumbrances

A land access restriction over the Wildwood Trail Mitigation parcel is a 10-year hunting lease. Although this lease has not yet been executed it is a requirement associated with the original acquisition of the parcel. This area includes the most likely access routes to Area 3 and Area 4. The lease could be modified to specifically allow access improvements and access for construction of the project.

Parcels not currently owned by the District, Moser Parcels noted in Figure 1, are within the Area 2A and Area 2B footprints. There is potential for these parcels to be acquired by the District, although acquisition may include restrictions associated with mitigation as described above. As an alternative to full District ownership, a flowage and access easement could be pursued on these parcels. Therefore, these parcels should not be excluded from the alternative analysis.

The area identified as the Seminole County Salt Creek Restoration Project located within Area 2B and a small portion of Area 3 does not have real estate encumbrances. However, improvements in Area 2B or Area 3 may impact the nutrient removal benefit of the Salt Creek Restoration project already constructed by Seminole County. Therefore, it is recommended any proposal to use the Area 2B site be discussed with Seminole County and the loss of function of the existing restoration project be considered and accounted for in the alternative design. Additionally, the Salt Creek restoration project discharges into the branch where the intake for Area 3 is located. This may have impacts on the source water quality if the treatment wetland is constructed in Area 3.

A dredging and wetland planting project associated with Sweetwater Canal along the boundary of Area 2A and 2B was also implemented by Seminole County. Like the Salt Creek Restoration Project, improvements in 2A or 2B may have impacts on the Sweetwater Canal project and should be considered if this area is considered for the wetland treatment project.

A restoration project constructed on the west end of the site was constructed using FDOT mitigation funds within Areas 1 and 2A. The use of mitigation funds for this construction may limit the ability to modify the site. Any improvements previously constructed using mitigation funding, may require replacement mitigation, or reasonable assurance that the alterations do not decrease the mitigation value of the improvements. Because these improvements were constructed using FDOT mitigation funding, any alteration of these improvements affect other FDOT permits associated with the mitigation. Coordination with FDOT is required with the possibility of FDOT unwillingness to consider alteration of previous mitigation projects.

Additional detailed real estate research, beyond the scope of this effort, will be required if any of East Tract mitigation sites are recommended as a suitable and cost-effective alternative to the Little Cameron Ranch site. Some of the mitigation details to be determined include; how the parcel was acquired, how much of the parcel was used for mitigation, was the mitigation footprint designated or just an acreage of a larger site designated, was the parcel used for state or federal credits and what was the UMAM score assigned to the mitigation wetland.

II. Site Access and Electric Power Availability

Table 1 describes the site access, road condition, and power constraints related to each of the alternative sites proposed. Only off-site access and power are evaluated below. On-site access improvements and power costs are not included.

Good road access and three phase power are available directly adjacent to Area 1 via Elm Street. This access to the District property does not require any offsite improvements and there is no cost anticipated to access Area 1. Additionally, three phase power runs directly to the site and there would be little to no cost to providing three phase power to the site.

The accesses to Area 2A and 2B are by local rural streets, Stone Street and Palm Avenue. These roads do not lead directly to the property and some improvements would be needed to access the site. Planning level cost estimates for these improvements are provided in Table 1. Single phase power is also available near but not directly abutting both areas. This single-phase power currently terminates at the ends of the local road. Extensions and upgrades to three phase power to bring power to the site are estimated in Table 1.

The access and power to Area 3 can be via Sunset Trail or Wildwood Drive as described in Table 1. Sunset Trail does not abut Area 3 at any location and significant offsite improvements would be necessary to provide access and power from Sunset Trail to Area 3. Additionally, there may be limited access through the gated community that Sunset Trail crosses through. Therefore, the access by Sunset Trail is not recommended. Wildwood Drive directly abuts the District property and road access to Area 3 is good. Therefore, Wildwood Drive is the recommended access and power to Area 3. Wildwood Drive also provides access and power to Area 4. Additional on-site road improvements and three phase power extension will be necessary for Area 3 and Area 4. These additional costs are not included in Table 1. An additional access to Area 4 could be through the Seminole County spray field to the north. This route has not been explored, but if Area 4 is the preferred site, then additional evaluation of this route and coordination with Seminole County would be recommended.

III. Regulatory Permitting Constraints

The presence of wetlands on the various sites will require permitting by the Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (USACE) for construction activities and potential hydrologic alterations at the selected site. The types of land uses vary somewhat and include forested wetland, emergent marsh wetland, and upland. The constraints for each of these is described below.

The use of the forested wetlands for a wetland treatment system could have several wetland permitting constraints. First, complete removal of the trees would alter the wetland value significantly and could require significant mitigation to offset the adverse wetland impacts. Additionally forested wetland clearing impacts may be considered un-permittable impacts based on an avoidance and minimization analysis at the proposed scale. Therefore, complete removal of the wetland trees is not recommended. The proposal described in the alternatives analysis of simply flowing water through the forested wetland to achieve the desired nutrient removal could also have permitting implications. Modification of the hydrology in forested wetlands may decrease wetland functions and value requiring mitigation due to loss or alteration of function in addition to direct impacts for construction of infrastructure. Adverse impacts to the hydrology of the forested systems could be minimized by using operational criteria protective of woody vegetation, but those operational criteria would also reduce the nutrient removal efficiency of the system.

Flow-through treatment wetlands may be somewhat compatible with the wetland function of the emergent marsh areas, and from a permitting perspective these areas would be the preferred location for a flow-through wetland. Impacts to emergent marsh areas from infrastructure improvements to establish desired flow regimes, prevent short circuiting and provide maintenance access as necessary would result in wetland impacts requiring offsets or mitigation.

The eastern half of Area 1 is forested wetland. The use of forested wetland for a wetland treatment system would likely have significant permitting constraints as described above. The western half of Area 1 is a mixture of emergent wetland and upland. It is expected the alterations proposed with the Area 1 alternative would have minimal to no impact of the function of these wetlands and may not require any mitigation. Additionally, infrastructure impacts to the eastern portion of Area 1 to aid in the control of water movement of a treatment wetland on the western half of Area 1 could potentially be limited to the upland portion of the site.

Area 2A is the smallest of the four alternative sites, and more than half of the site is forested wetland. The difficulties of working within the forested wetland already described could be significant in Area 2A. The emergent marsh portion of Area 2A is very small and would only seem reasonable to use for a treatment wetland if combined with an adjacent site. Area 1 abuts Area 2A within the forested wetland portion of Area 2A. Area 2B abuts area 2A within the emergent marsh portion.

Area 2B is very similar to 2A in that the southern portion is forested wetland and the northern portion is emergent marsh. As mentioned for Area 2A, potentially the most viable way to use Area 2B would be to combine the emergent marsh portion of Area 2B with the emergent marsh portion of Area 2A to create a long narrow treatment wetland with a shorter flow path. This could likely make infrastructure improvements more costly and reduce efficiencies due to the short flow path. There is also a ditch and somewhat natural channel separating these two areas. Combining 2A and 2B would require filling the ditch/channel, degrading the spoil berms and addressing permitting and drainage impacts resulting from filling this ditch/channel.   Existing improvements to ditch/channel were part of the Seminole County Sweetwater Creek restoration project. Changes to this ditch/channel would require coordinating with Seminole County.

Area 3 has a higher percentage of emergent marsh than either 2A or 2B. However, the long flow path through the emergent marsh portions of Area 3 would increase the likelihood of short circuits forming within the cell. Infrastructure improvements may be necessary in Area 3 to prevent water from short circuiting to Wharf Creek or Salt Creek. These infrastructure improvements within the emergent marsh portion of Area 3 would likely have permitting implications.

The proposed layout for Area 4 appears to use the upland and forested wetland portions of Area 4 almost exclusively. While treatment from the emergent marsh portion of Area 4 is assumed, it seems difficult to establish flow through the emergent marsh without significant infrastructure improvements at the head of the Area 4 emergent marsh. If these additional infrastructure improvements are proposed, significant permitting constraints and costs are likely.

Table 1 Alternative Site 3 Site Access and Power Availability Assessment

Access to	Roadway	Roadway Surface	Distance to District Property	Road condition	Opinion of Construction and O&M access	Power	Planning Level Costs		Regulatory
							Maintenance Road	3 Phase Power	
Area 1	Elm Street	Paved - Asphalt	Abuts District property - adjacent to project location	County Road asphalt good condition through rural residential - Least impact route in from CR 426 is Van Arsdale/Florida/Elm	Road suitable for access, however the along approximately 3 miles of rural residential with a mix of homes and agricultural land.	3 phase power runs to District property line	$0	$0	Eastern half forested wetland difficult to permit, western half upland and emergent wetland.
Area 2A	Stone/Palm Avenue	Paved (Stone) and dirt (Palm)	Abuts District property	Stone Street is paved and in good condition. Palm Avenue may be private and is a narrow dirt road of a little less than 2000 feet	Palm Avenue single lane road not suitable for large trucks.	Single phase to District property line. 3 phase ends at CR 426. approximately 3.5 miles of phase line to install/upgrade.	$300,000	$350,000	More than half forested wetland difficult to permit. The remaining portion is emergent marsh easier to permit but small area.
Area 2B	Stone Street	Paved	Abuts District property	Good condition to Palm Avenue. Would need significant improvement north of Palm Avenue of a little less than 1000 feet	Good to Palm Avenue. Improvements needed north of Palm Avenue.	Single phase to District property line. 3 phase ends at CR 426. approximately 3 miles of phase line to install/upgrade.	$150,000	$300,000	More than half forested wetland difficult to permit. The remaining portion is emergent marsh easier to permit but small area.
Area 3	Sunset Trail	Dirt	Terminates approximately 1500 Feet from District boundary may be public ROW or easement that is completely unimproved to access site	Adequate Condition/Long stretch of narrow dirt road. May require some level of improvement or upgrade	Long stretch of unpaved road, and Sunset Trail does not abut district property and could require easements, acquisition and improvements of non-District owned properties. Sunset trail may be private.	Single phase to end of maintained road. 3 phase ends at SR 46 approximately 4 miles of 3 phase line to install/upgrade.	$225,000	$400,000	More than half is emergent marsh and upland, therefore easier to permit. Additional infrastructure to prevent short circuits would have permitting implications.
Area 3 or 4	Wildwood Trail	Paved/compacted unpaved	Abuts District property	Adequate Condition	Long stretch of unpaved road. Low trees may require trimming and right-of-way maintenance.	Single phase to end of maintained road. 3 phase ends at SR 46 approximately 3 miles of 3 phase line to install/upgrade.	$0	$300,000	Mixture of upland, forested wetland and emergent marsh. The forested wetland and infrastructure need to address the short circuiting of flow through the narrow throat would make permitting difficult.

Attachment 2

Conceptual Cost Estimates

SJRWMD, FL
Lake Jesup Wetlands
Opinion of Probable Construction Cost, March 2022, Conceptual Design

Project name	Lake Jesup Wetlands FL
Architect	CDM Smith
Engineer	CDM Smith
Labor rate table	FL22 Orlando
Equipment rate table	22R1 $6EquipRate BOF
Estimate Type	OPCC
Design Level	Conceptual
CDM Smith DB Ver.	V8
Date Reviewed:	3/16/22
Reviewed By:	*EA*
Estimators	JJ
ENR 20 City CCI:	Mar 2022:12,791.43
Notes	This is an Opinion of Probable Construction Cost only, as defined by the documents provided at the level of design indicated above. CDM Smith has no control over the cost of labor, materials, equipment, or services furnished, over schedules, over contractor's methods of determining prices, competitive bidding (at least 3 each - both prime bidders and major subcontractors), market conditions or negotiating terms. CDM Smith does not guarantee that this opinion will not vary from actual cost, or contractor's bids. There are not any costs provided for: Change Orders, Design Engineering, Construction Oversight, Client Costs, Finance or Funding Costs, Legal Fees, Land Acquisition or temporary/permanent Easements, Operations, or any other costs associated with this project that are not specifically part of the bidding contractor's proposed scope. This OPCC shall remain valid for 30 days. Beyond this date, CDM Constructors should be notified of design changes. The estimate will also be reviewed to reflect current market conditions. Assumptions: No rock excavation is required. Dewatering based on wetlands condition, ie portadam protection and well-points on each side of trench. No consideration for contaminated soils or hazardous materials is included (i.e. asbestos, lead, etc). Based on a normal 40 hour work week with no overtime.
Report format	Sorted by 'Bid Item/Area/95CSI Sctn/Element' 'Element' summary Allocate addons

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
01 Area 2B								
05 27 CFS PUMP STATION								
02200 Steel Sheeting								
05.02250.8205 23'x32'x20' Steel Sheet Pile Cofferdam	2,200.00 sf	36,757	60,138	110,826	51,218		117.70 /sf	258,940
02200 Steel Sheeting		36,757	60,138	110,826	51,218			258,940
02240 Dewatering								
05.02240.8205 PS Dewatering	1.00 ls	27,726	15,029	31,863			74,617.33 /ls	74,617
02240 Dewatering		27,726	15,029	31,863				74,617
02250 Portadam Protection								
05.02250.8210 Wetlands Portadam Protection	400.00 lf	38,504	5,949	34,175	78,163		391.98 /lf	156,792
02250 Portadam Protection		38,504	5,949	34,175	78,163			156,792
02300 Earthwork								
05.02300.8205 Excavation and Backfill	409.00 cy	8,486	5,811	6,081	18,537		95.15 /cy	38,915
02300 Earthwork		8,486	5,811	6,081	18,537			38,915
02730 Aggregate Surfacing								
05.02730.8205 Parking- Aggregate Surfacing- 6.0"	1,111.00 sy	3,023	9,589	2,724	5,711		18.95 /sy	21,049
02730 Aggregate Surfacing		3,023	9,589	2,724	5,711			21,049
02820 Fencing								
05.02820.8205 6' Chain Link Fence	400.00 lf			30,935			77.34 /lf	30,935
02820 Fencing				30,935				30,935
03300 Cast-in-Place Concrete								
05.03300.8205 PS 19'x23'x24" Thick Slab	32.37 cy	15,218	32,916	788	1,602	282	1,569.53 /cy	50,806
05.03300.8210 PS 12' high x 12" Thick Exterior Walls	34.67 cy	50,332	86,898	2,237	2,348	300	4,099.07 /cy	142,115
05.03300.8215 PS Interior Walls	10.67 cy	19,398	27,997	944	722	92	4,606.79 /cy	49,154
05.03300.8220 PS Top Slab	13.33 cy	11,623	17,804	677	2,033	116	2,419.51 /cy	32,252
05.03300.8225 Intake Structure Concrete Allowance	1.00 ls			184,710			184,710.23 /ls	184,710
03300 Cast-in-Place Concrete		96,570	165,615	189,357	6,705	790		459,037
05585 Formed Metal Fabrications								
05.05585.8205 3'x3' Aluminum Hatches	4.00 ea	1,572	12,526				3,524.56 /ea	14,098
05.05585.8210 Aluminum Ladder	1.00 ea	1,750	4,131				5,880.84 /ea	5,881
05585 Formed Metal Fabrications		3,322	16,657					19,979
11217 Submersible Non-Clog Pump 150 HP								
05.11217.8205 Submersible Non-Clog Pump 150 HP	3.00 ea	11,497	834,272		27,373	1,261	291,467.49 /ea	874,402
11217 Submersible Non-Clog Pump 150 HP		11,497	834,272		27,373	1,261		874,402
11330 Screening Systems								
05.11330.8205 36" DIA Automatic Backwash Screen	1.00 ea	25,200	265,907	29,554	8,784	5,634	335,080.12 /ea	335,080
11330 Screening Systems		25,200	265,907	29,554	8,784	5,634		335,080
13120 Pre-Engineered Structures								
05.13120.8205 32' x 12' x 12' High Precast Concrete Building	384.00 sf			177,322			461.78 /sf	177,322
13120 Pre-Engineered Structures				177,322				177,322
13400 Measurement & Control Instrumentation								
05.13400.8205 PS II&C Allowance	1.00 ls			277,065			277,065.38 /ls	277,065
13400 Measurement & Control Instrumentation				277,065				277,065
15111 Plug Valves								
05.15111.8205 20" Discharge Plug Valves	3.00 ea	6,058	157,371		66	65	54,519.90 /ea	163,560
15111 Plug Valves		6,058	157,371		66	65		163,560
15113 Gate Valves								
05.15113.8205 4" Sceen Wash Gate Valve	1.00 ea	505	3,305		22	22	3,853.55 /ea	3,854
15113 Gate Valves		505	3,305		22	22		3,854
15114 Check Valves								
05.15114.8205 20" Discharge Check Valves	3.00 ea	4,860	96,213		66	65	33,734.55 /ea	101,204
15114 Check Valves		4,860	96,213		66	65		101,204
15210 Ductile Iron Pipe								
05.15210.8205 36" DIP Discharge Header	1.00 ls	20,268	504,645		5,666		530,578.44 /ls	530,578
05.15210.8210 20" DIP Discharge Piping	1.00 ls	25,465	248,476		6,469	274	280,683.92 /ls	280,684
15210 Ductile Iron Pipe		45,732	753,121		12,135	274		811,262
15221 Stainless Steel Pipe								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
05.15221.8205 4" 316 SS Burst Piping in PS	50.00 lf	1,705	12,247		119	19	281.79 /lf	14,089
15221 Stainless Steel Pipe		1,705	12,247		119	19		14,089
15245 Polyethylene Pipe								
05.15245.8255 4" Screen Wash Water	1,000.00 lf	39,013	26,366	10,326	22,727	13,111	111.54 /lf	111,543
15245 Polyethylene Pipe		39,013	26,366	10,326	22,727	13,111		111,543
16000 Electrical Allowance/Miscellaneous								
05.16000.8205 PS Electrical Allowance	1.00 ls			554,131			554,130.69 /ls	554,131
16000 Electrical Allowance/Miscellaneous				554,131				554,131
05 27 CFS PUMP STATION	17.50 MGD	348,961	2,427,589	1,454,359	231,625	21,242	256,215.75 /MGD	4,483,776
25 3,094 LF - 42" SDR 11 IPS HDPE								
02230 Site Clearing								
25.02230.8205 Site Clearing	2.00 ac	23,638			30,723		27,180.62 /ac	54,361
02230 Site Clearing		23,638			30,723			54,361
02240 Dewatering								
25.02240.8205 Wetland Trench Dewatering	3,094.00 lf	802,877	331,095	1,249,029			770.20 /lf	2,383,000
02240 Dewatering		802,877	331,095	1,249,029				2,383,000
02250 Portadam Protection								
25.02250.8205 Wetlands Portadam Protection	3,094.00 lf	256,262	8,354	408,445	1,176,093		597.66 /lf	1,849,153
02250 Portadam Protection		256,262	8,354	408,445	1,176,093			1,849,153
02300 Earthwork								
25.02300.8205 Temporary Road Mats	3,094.00 lf	155,406		366,708	125,601		209.35 /lf	647,715
02300 Earthwork		155,406		366,708	125,601			647,715
02990 Restore Disturbed Areas								
25.02990.8205 Restore Disturbed Areas	77,350.00 sf			42,862			0.55 /sf	42,862
02990 Restore Disturbed Areas				42,862				42,862
15245 Polyethylene Pipe								
25.15245.8205 3,094 LF - 42" SDR 11 IPS HDPE	3,094.00 lf	355,646	2,328,724	66,610	286,962	74,770	1,006.05 /lf	3,112,712
15245 Polyethylene Pipe		355,646	2,328,724	66,610	286,962	74,770		3,112,712
25 3,094 LF - 42" SDR 11 IPS HDPE	3,094.00 LF	1,593,828	2,668,172	2,133,654	1,619,380	74,770	2,614.68 /LF	8,089,804
30 1,096 LF - 32" SDR 11 IPS HDPE								
02230 Site Clearing								
30.02230.8205 Site Clearing	0.75 ac	8,864			11,521		27,180.63 /ac	20,385
02230 Site Clearing		8,864			11,521			20,385
02240 Dewatering								
30.02240.8205 Wetland Trench Dewatering	1,096.00 lf	286,859	123,261	441,744			777.25 /lf	851,863
02240 Dewatering		286,859	123,261	441,744				851,863
02250 Portadam Protection								
30.02250.8205 Wetlands Portadam Protection	1,096.00 lf	90,301	3,940	144,415	417,257		598.46 /lf	655,914
02250 Portadam Protection		90,301	3,940	144,415	417,257			655,914
02300 Earthwork								
30.02300.8205 Temporary Road Mats	1,096.00 lf	55,050		129,901	44,492		209.35 /lf	229,443
02300 Earthwork		55,050		129,901	44,492			229,443
02990 Restore Disturbed Areas								
30.02990.8205 Restore Disturbed Areas	27,400.00 sf			15,183			0.55 /sf	15,183
02990 Restore Disturbed Areas				15,183				15,183
15245 Polyethylene Pipe								
30.15245.8205 1,096 LF - 32" SDR 11 IPS HDPE	1,096.00 lf	115,846	658,278	30,425	90,590	29,581	843.72 /lf	924,721
15245 Polyethylene Pipe		115,846	658,278	30,425	90,590	29,581		924,721
30 1,096 LF - 32" SDR 11 IPS HDPE	1,096.00 LF	556,921	785,479	761,668	563,861	29,581	2,461.23 /LF	2,697,510
35 1,663 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
35.02230.8205 Site Clearing	1.15 ac	13,592			17,666		27,180.59 /ac	31,258
02230 Site Clearing		13,592			17,666			31,258
02240 Dewatering								
35.02240.8205 Wetland Trench Dewatering	1,663.00 lf	433,296	182,241	669,196			772.54 /lf	1,284,733
02240 Dewatering		433,296	182,241	669,196				1,284,733
02250 Portadam Protection								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
35.02250.8205 Wetlands Portadam Protection	1,663.00 lf	134,025	4,890	218,775	625,387		591.15 /lf	983,077
02250 Portadam Protection		134,025	4,890	218,775	625,387			983,077
02300 Earthwork								
35.02300.8205 Temporary Road Mats	1,663.00 lf	83,529		197,103	67,510		209.35 /lf	348,142
02300 Earthwork		83,529		197,103	67,510			348,142
02990 Restore Disturbed Areas								
35.02990.8205 Restore Disturbed Areas	41,575.00 sf			23,038			0.55 /sf	23,038
02990 Restore Disturbed Areas				23,038				23,038
15245 Polyethylene Pipe								
35.15245.8205 1,663 LF - 24" SDR 11 IPS HDPE	1,663.00 lf	147,329	556,948	37,169	109,968	36,353	533.84 /lf	887,768
15245 Polyethylene Pipe		147,329	556,948	37,169	109,968	36,353		887,768
35 1,663 LF - 24" SDR 11 IPS HDPE	1,663.00 LF	811,772	744,079	1,145,281	820,531	36,353	2,139.52 /LF	3,558,016
40 3,672 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
40.02230.8205 Site Clearing	2.50 ac	29,548			38,404		27,180.60 /ac	67,952
02230 Site Clearing		29,548			38,404			67,952
02240 Dewatering								
40.02240.8205 Wetland Trench Dewatering	3,672.00	952,155	391,219	1,467,024			765.36	2,810,398
02240 Dewatering		952,155	391,219	1,467,024				2,810,398
02250 Portadam Protection								
40.02250.8205 Wetlands Portadam Protection	3,672.00 lf	299,401	10,154	470,975	1,374,656		586.92 /lf	2,155,187
02250 Portadam Protection		299,401	10,154	470,975	1,374,656			2,155,187
02300 Earthwork								
40.02300.8205 Temporary Road Mats	3,672.00 lf	184,438		435,214	149,065		209.35 /lf	768,717
02300 Earthwork		184,438		435,214	149,065			768,717
02990 Restore Disturbed Areas								
40.02990.8205 Restore Disturbed Areas	91,800.00 sf			50,869			0.55 /sf	50,869
02990 Restore Disturbed Areas				50,869				50,869
15245 Polyethylene Pipe								
40.15245.8205 3,672 LF - 24" SDR 11 IPS HDPE	3,672.00 lf	332,084	1,253,135	84,492	248,940	74,819	542.88 /lf	1,993,470
15245 Polyethylene Pipe		332,084	1,253,135	84,492	248,940	74,819		1,993,470
40 3,672 LF - 24" SDR 11 IPS HDPE	3,672.00 LF	1,797,625	1,654,508	2,508,575	1,811,065	74,819	2,136.87 /LF	7,846,593
45 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope								
02300 Earthwork								
45.02300.8205 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope	11,000.00 cy	57,296	309,896	266,249	130,543		69.45 /cy	763,983
02300 Earthwork		57,296	309,896	266,249	130,543			763,983
02730 Aggregate Surfacing								
45.02730.8205 Aggregate Surfacing- 6.0"	5,758.00 sy	15,668	49,692	14,118	29,596		18.94 /sy	109,074
02730 Aggregate Surfacing		15,668	49,692	14,118	29,596			109,074
02990 Restore Disturbed Areas								
45.02990.8205 Restore Disturbed Areas	150,278.00 sf			83,274			0.55 /sf	83,274
02990 Restore Disturbed Areas				83,274				83,274
45 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope	5,182.00 LF	72,963	359,588	363,641	160,139		184.55 /LF	956,331
01 Area 2B	**1.00 LS**	**5,182,070**	**8,639,415**	**8,367,178**	**5,206,601**	**236,765**	**27,632,028.71 /LS**	**27,632,029**
02 AREA 4								
05 27 CFS PUMP STATION								
02200 Steel Sheeting								
05.02250.8205 23'x32'x20' Steel Sheet Pile Cofferdam	2,200.00 sf	36,757	60,138	110,826	51,218		117.70 /sf	258,940
02200 Steel Sheeting		36,757	60,138	110,826	51,218			258,940
02240 Dewatering								
05.02240.8205 PS Dewatering	1.00 ls	27,726	15,029	31,862			74,617.32 /ls	74,617
02240 Dewatering		27,726	15,029	31,862				74,617
02250 Portadam Protection								
05.02250.8210 Wetlands Portadam Protection	400.00 lf	38,504	5,949	34,175	78,163		391.98 /lf	156,792
02250 Portadam Protection		38,504	5,949	34,175	78,163			156,792
02300 Earthwork								
05.02300.8205 Excavation and Backfill	409.00 cy	8,486	5,811	6,081	18,537		95.15 /cy	38,915

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
02300 Earthwork		8,486	5,811	6,081	18,537			38,915
02730 Aggregate Surfacing								
05.02730.8205 Parking- Aggregate Surfacing- 6.0"	1,111.00 sy	3,023	9,589	2,724	5,711		18.95 /sy	21,049
02730 Aggregate Surfacing		3,023	9,589	2,724	5,711			21,049
02820 Fencing								
05.02820.8205 6' Chain Link Fence	400.00 lf			30,935			77.34 /lf	30,935
02820 Fencing				30,935				30,935
03300 Cast-in-Place Concrete								
05.03300.8205 PS 19'x23'x24" Thick Slab	32.37 cy	15,218	32,916	788	1,602	282	1,569.53 /cy	50,806
05.03300.8210 PS 12' high x 12" Thick Exterior Walls	34.67 cy	50,332	86,898	2,237	2,348	301	4,099.07 /cy	142,115
05.03300.8215 PS Interior Walls	10.67 cy	19,398	27,997	944	722	92	4,606.79 /cy	49,154
05.03300.8220 PS Top Slab	13.33 cy	11,623	17,804	677	2,033	116	2,419.51 /cy	32,252
05.03300.8225 Intake Structure Concrete Allowance	1.00 ls			184,710			184,710.22 /ls	184,710
03300 Cast-in-Place Concrete		96,570	165,615	189,357	6,705	790		459,037
05585 Formed Metal Fabrications								
05.05585.8205 3'x3' Aluminum Hatches	4.00 ea	1,572	12,526				3,524.57 /ea	14,098
05.05585.8210 Aluminum Ladder	1.00 ea	1,750	4,131				5,880.82 /ea	5,881
05585 Formed Metal Fabrications		3,322	16,657					19,979
11217 Submersible Non-Clog Pump 150 HP								
05.11217.8205 Submersible Non-Clog Pump 150 HP	3.00 ea	11,497	834,272		27,373	1,261	291,467.50 /ea	874,402
11217 Submersible Non-Clog Pump 150 HP		11,497	834,272		27,373	1,261		874,402
11330 Screening Systems								
05.11330.8205 36" DIA Automatic Backwash Screen	1.00 ea	25,200	265,907	29,554	8,784	5,634	335,080.08 /ea	335,080
11330 Screening Systems		25,200	265,907	29,554	8,784	5,634		335,080
13120 Pre-Engineered Structures								
05.13120.8205 32' x 12' x 12' High Precast Concrete Building	384.00 sf			177,322			461.78 /sf	177,322
13120 Pre-Engineered Structures				177,322				177,322
13400 Measurement & Control Instrumentation								
05.13400.8205 PS II&C Allowance	1.00 ls			277,065			277,065.34 /ls	277,065
13400 Measurement & Control Instrumentation				277,065				277,065
15111 Plug Valves								
05.15111.8205 20" Discharge Plug Valves	3.00 ea	6,058	157,371		66	65	54,519.90 /ea	163,560
15111 Plug Valves		6,058	157,371		66	65		163,560
15113 Gate Valves								
05.15113.8205 4" Sceen Wash Gate Valve	1.00 ea	505	3,305		22	22	3,853.57 /ea	3,854
15113 Gate Valves		505	3,305		22	22		3,854
15114 Check Valves								
05.15114.8205 20" Discharge Check Valves	3.00 ea	4,860	96,213		66	65	33,734.54 /ea	101,204
15114 Check Valves		4,860	96,213		66	65		101,204
15210 Ductile Iron Pipe								
05.15210.8205 36" DIP Discharge Header	1.00 ls	20,268	504,645		5,666		530,578.47 /ls	530,578
05.15210.8210 20" DIP Discharge Piping	1.00 ls	25,465	248,476		6,469	274	280,683.92 /ls	280,684
15210 Ductile Iron Pipe		45,733	753,121		12,135	274		811,262
15221 Stainless Steel Pipe								
05.15221.8205 4" 316 SS Burst Piping in PS	50.00 lf	1,705	12,247		119	19	281.79 /lf	14,089
15221 Stainless Steel Pipe		1,705	12,247		119	19		14,089
15245 Polyethylene Pipe								
05.15245.8255 4" Screen Wash Water	1,000.00 lf	39,013	26,366	10,326	22,727	13,111	111.54 /lf	111,543
15245 Polyethylene Pipe		39,013	26,366	10,326	22,727	13,111		111,543
16000 Electrical Allowance/Miscellaneous								
05.16000.8205 PS Electrical Allowance	1.00 ls			554,131			554,130.68 /ls	554,131
16000 Electrical Allowance/Miscellaneous				554,131				554,131
05 27 CFS PUMP STATION	17.50 MGD	348,960	2,427,589	1,454,359	231,625	21,242	256,215.75 /MGD	4,483,776
50 3,481 LF - 42" SDR 11 IPS HDPE								
02230 Site Clearing								
50.02230.8205 Site Clearing		23,638			30,723			54,361
02230 Site Clearing		23,638			30,723			54,361
02240 Dewatering								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
50.02240.8205 Wetland Trench Dewatering	3,481.00 lf	902,826	371,351	1,402,717			769.00 /lf	2,676,894
02240 Dewatering		902,826	371,351	1,402,717				2,676,894
02250 Portadam Protection								
50.02250.8205 Wetlands Portadam Protection	3,481.00 lf	285,482	8,643	457,919	1,323,074		596.13 /lf	2,075,118
02250 Portadam Protection		285,482	8,643	457,919	1,323,074			2,075,118
02300 Earthwork								
50.02300.8205 Temporary Road Mats	3,481.00 lf	174,844		412,576	141,312		209.35 /lf	728,732
02300 Earthwork		174,844		412,576	141,312			728,732
02990 Restore Disturbed Areas								
50.02990.8205 Restore Disturbed Areas	87,025.00 sf			48,223			0.55 /sf	48,223
02990 Restore Disturbed Areas				48,223				48,223
15245 Polyethylene Pipe								
50.15245.8205 3,481 LF - 42" SDR 11 IPS HDPE	3,481.00 lf	397,196	2,621,566	76,084	307,758	85,113	1,001.93 /lf	3,487,717
15245 Polyethylene Pipe		397,196	2,621,566	76,084	307,758	85,113		3,487,717
50 3,481 LF - 42" SDR 11 IPS HDPE	3,481.00 LF	1,783,986	3,001,559	2,397,520	1,802,867	85,113	2,605.87 /LF	9,071,045
55 910 LF - 32" SDR 11 IPS HDPE								
02230 Site Clearing								
55.02230.8205 Site Clearing	0.50 ac	5,910			7,681		27,180.58 /ac	13,590
02230 Site Clearing		5,910			7,681			13,590
02240 Dewatering								
55.02240.8205 Wetland Trench Dewatering	910.00 lf	238,821	103,913	367,878			780.89 /lf	710,612
02240 Dewatering		238,821	103,913	367,878				710,612
02250 Portadam Protection								
55.02250.8205 Wetlands Portadam Protection	455.00 lf	42,419	3,528	62,470	174,167		621.07 /lf	282,585
02250 Portadam Protection		42,419	3,528	62,470	174,167			282,585
02300 Earthwork								
55.02300.8205 Temporary Road Mats	455.00 lf	22,854		53,928	18,471		209.35 /lf	95,252
02300 Earthwork		22,854		53,928	18,471			95,252
02990 Restore Disturbed Areas								
55.02990.8205 Restore Disturbed Areas	22,750.00 sf			12,606			0.55 /sf	12,606
02990 Restore Disturbed Areas				12,606				12,606
15245 Polyethylene Pipe								
55.15245.8205 910 LF - 32" SDR 11 IPS HDPE	910.00 lf	100,890	582,082	27,417	80,909	27,847	900.16 /lf	819,144
15245 Polyethylene Pipe		100,890	582,082	27,417	80,909	27,847		819,144
55 910 LF - 32" SDR 11 IPS HDPE	910.00 LF	410,893	689,523	524,299	281,228	27,847	2,125.04 /LF	1,933,790
60 1,776 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
60.02230.8205 Site Clearing	1.20 ac	14,183			18,434		27,180.59 /ac	32,617
02230 Site Clearing		14,183			18,434			32,617
02240 Dewatering								
60.02240.8205 Wetland Trench Dewatering	1,776.00 lf	462,481	193,995	716,380			773.00 /lf	1,372,856
02240 Dewatering		462,481	193,995	716,380				1,372,856
02250 Portadam Protection								
60.02250.8205 Wetlands Portadam Protection	888.00 lf	75,680	4,314	119,996	331,924		599.00 /lf	531,914
02250 Portadam Protection		75,680	4,314	119,996	331,924			531,914
02300 Earthwork								
60.02300.8205 Temporary Road Mats	888.00 lf	44,603		105,248	36,048		209.35 /lf	185,899
02300 Earthwork		44,603		105,248	36,048			185,899
02990 Restore Disturbed Areas								
60.02990.8205 Restore Disturbed Areas	44,400.00 sf			24,603			0.55 /sf	24,603
02990 Restore Disturbed Areas				24,603				24,603
15245 Polyethylene Pipe								
60.15245.8205 1,776 LF - 24" SDR 11 IPS HDPE	1,776.00 lf	157,014	594,647	39,669	117,482	37,870	533.04 /lf	946,681
15245 Polyethylene Pipe		157,014	594,647	39,669	117,482	37,870		946,681
60 1,776 LF - 24" SDR 11 IPS HDPE	1,776.00 LF	753,960	792,956	1,005,897	503,888	37,870	1,742.44 /LF	3,094,571
65 3,327 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
65.02230.8205 Site Clearing	1.90 ac	22,456			29,187		27,180.61 /ac	51,643
02230 Site Clearing		22,456			29,187			51,643
02240 Dewatering								
65.02240.8205 Wetland Trench Dewatering	3,327.00 lf	863,053	355,332	1,329,553			765.84 /lf	2,547,938
02240 Dewatering		863,053	355,332	1,329,553				2,547,938
02250 Portadam Protection								
65.02250.8205 Wetlands Portadam Protection	3,327.00 lf	276,786	9,884	433,928	1,263,888		596.48 /lf	1,984,486
02250 Portadam Protection		276,786	9,884	433,928	1,263,888			1,984,486
02300 Earthwork								
65.02300.8205 Temporary Road Mats	3,327.00 lf	167,109		394,324	135,060		209.35 /lf	696,493
02300 Earthwork		167,109		394,324	135,060			696,493
02990 Restore Disturbed Areas								
65.02990.8205 Restore Disturbed Areas	83,175.00 sf			46,090			0.55 /sf	46,090
02990 Restore Disturbed Areas				46,090				46,090
15245 Polyethylene Pipe								
65.15245.8205 3,327 LF - 24" SDR 11 IPS HDPE	3,327.00 lf	302,481	1,137,974	76,607	224,329	65,663	543.15 /lf	1,807,053
15245 Polyethylene Pipe		302,481	1,137,974	76,607	224,329	65,663		1,807,053
65 3,327 LF - 24" SDR 11 IPS HDPE	3,327.00 LF	1,631,886	1,503,189	2,280,501	1,652,464	65,663	2,144.19 /LF	7,133,703
70 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope								
02300 Earthwork								
70.02300.8205 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope	6,400.00 cy	34,924	180,303	154,908	79,532		70.26 /cy	449,667
02300 Earthwork		34,924	180,303	154,908	79,532			449,667
02730 Aggregate Surfacing								
70.02730.8205 Aggregate Surfacing- 6.0"	3,370.00 sy	9,170	29,085	8,263	17,322		18.94 /sy	63,841
02730 Aggregate Surfacing		9,170	29,085	8,263	17,322			63,841
02990 Restore Disturbed Areas								
70.02990.8205 Restore Disturbed Areas	87,957.00 sf			48,740			0.55 /sf	48,740
02990 Restore Disturbed Areas				48,740				48,740
70 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope	3,033.00 LF	44,094	209,388	211,911	96,855		185.38 /LF	562,248
02 AREA 4	**1.00 LS**	**4,973,779**	**8,624,204**	**7,874,488**	**4,568,925**	**237,735**	**26,279,131.38 /LS**	**26,279,131**

Estimate Totals

Description	Amount	Totals	Hours	Rate
Labor	10,155,849		110,311 hrs	
Material	17,263,619			
Equipment	9,775,526		32,508 hrs	
Subcontract	16,241,666			
Other	474,500			
	53,911,160	**53,911,160**		
Total		***53,911,160***		

"This Opinion of Probable Construction Cost is produced in accordance with CDM Smith's Firmwide Quality policies and best practices as described in CDM Smith's Estimating Manual Dated 01/03/12 Section 10 titled Quality Control. I hereby acknowledge that the Cost Estimating policies and procedures were followed in preparation of the Opinion of Probable Cost".

Lead Estimator initials - JJ Date 3/16/2022

SJRWMD, FL
Lake Jesup Wetlands
Opinion of Probable Construction Cost, March 2022, Conceptual Design

Project name	Lake Jesup Wetlands FL
Architect	CDM Smith
Engineer	CDM Smith
Labor rate table	FL22 Orlando
Equipment rate table	22R1 $6EquipRate BOF
Estimate Type	OPCC
Design Level	Conceptual
CDM Smith DB Ver.	V8
Date Reviewed:	3/16/22
Reviewed By:	*EA*
Estimators	JJ
ENR 20 City CCI:	Mar 2022:12,791.43
Notes	This is an Opinion of Probable Construction Cost only, as defined by the documents provided at the level of design indicated above. CDM Smith has no control over the cost of labor, materials, equipment, or services furnished, over schedules, over contractor's methods of determining prices, competitive bidding (at least 3 each - both prime bidders and major subcontractors), market conditions or negotiating terms. CDM Smith does not guarantee that this opinion will not vary from actual cost, or contractor's bids. There are not any costs provided for: Change Orders, Design Engineering, Construction Oversight, Client Costs, Finance or Funding Costs, Legal Fees, Land Acquisition or temporary/permanent Easements, Operations, or any other costs associated with this project that are not specifically part of the bidding contractor's proposed scope. This OPCC shall remain valid for 30 days. Beyond this date, CDM Constructors should be notified of design changes. The estimate will also be reviewed to reflect current market conditions. Assumptions: No rock excavation is required. Dewatering based on wetlands condition, ie portadam protection and well-points on each side of trench. No consideration for contaminated soils or hazardous materials is included (i.e. asbestos, lead, etc). Based on a normal 40 hour work week with no overtime.
Report format	Sorted by 'Bid Item/Area/95CSI Sctn/Element' 'Element' summary Allocate addons

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
01 Area 2B								
05 27 CFS PUMP STATION								
02200 Steel Sheeting								
05.02250.8205 23'x32'x20' Steel Sheet Pile Cofferdam	2,200.00 sf	22,614	34,736	60,104	29,584		66.84 /sf	147,038
02200 Steel Sheeting		22,614	34,736	60,104	29,584			147,038
02240 Dewatering								
05.02240.8205 PS Dewatering	1.00 ls	17,058	8,681	17,280			43,018.37 /ls	43,018
02240 Dewatering		17,058	8,681	17,280				43,018
02250 Portadam Protection								
05.02250.8210 Wetlands Portadam Protection	400.00 lf	23,689	3,436	18,534	45,147		227.02 /lf	90,807
02250 Portadam Protection		23,689	3,436	18,534	45,147			90,807
02300 Earthwork								
05.02300.8205 Excavation and Backfill	409.00 cy	5,221	3,356	3,298	10,707		55.21 /cy	22,582
02300 Earthwork		5,221	3,356	3,298	10,707			22,582
02730 Aggregate Surfacing								
05.02730.8205 Parking- Aggregate Surfacing- 6.0"	1,111.00 sy	1,860	5,539	1,478	3,299		10.96 /sy	12,175
02730 Aggregate Surfacing		1,860	5,539	1,478	3,299			12,175
02820 Fencing								
05.02820.8205 6' Chain Link Fence	400.00 lf			16,777			41.94 /lf	16,777
02820 Fencing				16,777				16,777
03300 Cast-in-Place Concrete								
05.03300.8205 PS 19'x23'x24" Thick Slab	32.37 cy	9,604	19,484	427	964	163	946.64 /cy	30,643
05.03300.8210 PS 12' high x 12" Thick Exterior Walls	34.67 cy	31,225	50,697	1,213	1,397	174	2,443.22 /cy	84,707
05.03300.8215 PS Interior Walls	10.67 cy	12,014	16,327	512	430	53	2,749.42 /cy	29,336
05.03300.8220 PS Top Slab	13.33 cy	7,250	10,478	367	1,190	67	1,451.78 /cy	19,352
05.03300.8225 Intake Structure Concrete Allowance	1.00 ls			100,173			100,172.64 /ls	100,173
03300 Cast-in-Place Concrete		60,094	96,986	102,692	3,982	456		264,211
05585 Formed Metal Fabrications								
05.05585.8205 3'x3' Aluminum Hatches	4.00 ea	967	7,235				2,050.59 /ea	8,202
05.05585.8210 Aluminum Ladder	1.00 ea	1,077	2,386				3,462.66 /ea	3,463
05585 Formed Metal Fabrications		2,044	9,621					11,665
11217 Submersible Non-Clog Pump 150 HP								
05.11217.8205 Submersible Non-Clog Pump 150 HP	3.00 ea	7,073	481,879		15,811	729	168,496.90 /ea	505,491
11217 Submersible Non-Clog Pump 150 HP		7,073	481,879		15,811	729		505,491
11330 Screening Systems								
05.11330.8205 36" DIA Automatic Backwash Screen	1.00 ea	15,504	153,589	16,028	5,074	3,254	193,449.09 /ea	193,449
11330 Screening Systems		15,504	153,589	16,028	5,074	3,254		193,449
13120 Pre-Engineered Structures								
05.13120.8205 32' x 12' x 12' High Precast Concrete Building	384.00 sf			96,166			250.43 /sf	96,166
13120 Pre-Engineered Structures				96,166				96,166
13400 Measurement & Control Instrumentation								
05.13400.8205 PS II&C Allowance	1.00 ls			150,259			150,258.96 /ls	150,259
13400 Measurement & Control Instrumentation				150,259				150,259
15111 Plug Valves								
05.15111.8205 20" Discharge Plug Valves	3.00 ea	3,727	90,898		38	38	31,566.88 /ea	94,701
15111 Plug Valves		3,727	90,898		38	38		94,701
15113 Gate Valves								
05.15113.8205 4" Sceen Wash Gate Valve	1.00 ea	311	1,909		13	13	2,244.83 /ea	2,245
15113 Gate Valves		311	1,909		13	13		2,245
15114 Check Valves								
05.15114.8205 20" Discharge Check Valves	3.00 ea	2,990	55,573		38	38	19,546.16 /ea	58,638
15114 Check Valves		2,990	55,573		38	38		58,638
15210 Ductile Iron Pipe								
05.15210.8205 36" DIP Discharge Header	1.00 ls	12,469	291,485		3,273		307,226.73 /ls	307,227
05.15210.8210 20" DIP Discharge Piping	1.00 ls	15,667	143,521		3,737	158	163,082.26 /ls	163,082
15210 Ductile Iron Pipe		28,136	435,005		7,009	158		470,309
15221 Stainless Steel Pipe								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
05.15221.8205 4" 316 SS Burst Piping in PS	50.00 lf	1,049	7,074		69	11	164.05 /lf	8,202
15221 Stainless Steel Pipe		1,049	7,074		69	11		8,202
15245 Polyethylene Pipe								
05.15245.8255 4" Screen Wash Water	1,000.00 lf	24,002	15,229	5,600	13,127	7,573	65.53 /lf	65,531
15245 Polyethylene Pipe		24,002	15,229	5,600	13,127	7,573		65,531
16000 Electrical Allowance/Miscellaneous								
05.16000.8205 PS Electrical Allowance	1.00 ls			300,518			300,517.91 /ls	300,518
16000 Electrical Allowance/Miscellaneous				300,518				300,518
05 27 CFS PUMP STATION	17.50 MGD	215,372	1,403,511	788,733	133,897	12,269	145,930.37 /MGD	2,553,781
25 3,094 LF - 42" SDR 11 IPS HDPE								
02230 Site Clearing								
25.02230.8205 Site Clearing	2.00 ac	14,543			17,746		16,144.35 /ac	32,289
02230 Site Clearing		14,543			17,746			32,289
02240 Dewatering								
25.02240.8205 Wetland Trench Dewatering	3,094.00 lf	493,955	191,242	677,377			440.39 /lf	1,362,574
02240 Dewatering		493,955	191,242	677,377				1,362,574
02250 Portadam Protection								
25.02250.8205 Wetlands Portadam Protection	3,094.00 lf	157,660	4,825	221,509	679,316		343.67 /lf	1,063,310
02250 Portadam Protection		157,660	4,825	221,509	679,316			1,063,310
02300 Earthwork								
25.02300.8205 Temporary Road Mats	3,094.00 lf	95,611		198,874	72,548		118.63 /lf	367,033
02300 Earthwork		95,611		198,874	72,548			367,033
02990 Restore Disturbed Areas								
25.02990.8205 Restore Disturbed Areas	77,350.00 sf			23,245			0.30 /sf	23,245
02990 Restore Disturbed Areas				23,245				23,245
15245 Polyethylene Pipe								
25.15245.8205 3,094 LF - 42" SDR 11 IPS HDPE	3,094.00 lf	218,805	1,345,079	36,124	165,751	43,187	584.66 /lf	1,808,946
15245 Polyethylene Pipe		218,805	1,345,079	36,124	165,751	43,187		1,808,946
25 3,094 LF - 42" SDR 11 IPS HDPE	3,094.00 LF	980,573	1,541,146	1,157,130	935,360	43,187	1,505.30 /LF	4,657,397
30 1,096 LF - 32" SDR 11 IPS HDPE								
02230 Site Clearing								
30.02230.8205 Site Clearing	0.75 ac	5,454			6,655		16,144.36 /ac	12,108
02230 Site Clearing		5,454			6,655			12,108
02240 Dewatering								
30.02240.8205 Wetland Trench Dewatering	1,096.00 lf	176,485	71,196	239,568			444.57 /lf	487,248
02240 Dewatering		176,485	71,196	239,568				487,248
02250 Portadam Protection								
30.02250.8205 Wetlands Portadam Protection	1,096.00 lf	55,556	2,276	78,320	241,009		344.13 /lf	377,161
02250 Portadam Protection		55,556	2,276	78,320	241,009			377,161
02300 Earthwork								
30.02300.8205 Temporary Road Mats	1,096.00 lf	33,869		70,448	25,699		118.63 /lf	130,015
02300 Earthwork		33,869		70,448	25,699			130,015
02990 Restore Disturbed Areas								
30.02990.8205 Restore Disturbed Areas	27,400.00 sf			8,234			0.30 /sf	8,234
02990 Restore Disturbed Areas				8,234				8,234
15245 Polyethylene Pipe								
30.15245.8205 1,096 LF - 32" SDR 11 IPS HDPE	1,096.00 lf	71,272	380,224	16,500	52,325	17,086	490.34 /lf	537,408
15245 Polyethylene Pipe		71,272	380,224	16,500	52,325	17,086		537,408
30 1,096 LF - 32" SDR 11 IPS HDPE	1,096.00 LF	342,635	453,696	413,070	325,688	17,086	1,416.22 /LF	1,552,175
35 1,663 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
35.02230.8205 Site Clearing	1.15 ac	8,362			10,204		16,144.35 /ac	18,566
02230 Site Clearing		8,362			10,204			18,566
02240 Dewatering								
35.02240.8205 Wetland Trench Dewatering	1,663.00 lf	266,577	105,263	362,920			441.83 /lf	734,761
02240 Dewatering		266,577	105,263	362,920				734,761
02250 Portadam Protection								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
35.02250.8205 Wetlands Portadam Protection	1,663.00 lf	82,456	2,825	118,647	361,226		339.84 /lf	565,154
02250 Portadam Protection		82,456	2,825	118,647	361,226			565,154
02300 Earthwork								
35.02300.8205 Temporary Road Mats	1,663.00 lf	51,390		106,893	38,994		118.63 /lf	197,277
02300 Earthwork		51,390		106,893	38,994			197,277
02990 Restore Disturbed Areas								
35.02990.8205 Restore Disturbed Areas	41,575.00 sf			12,494			0.30 /sf	12,494
02990 Restore Disturbed Areas				12,494				12,494
15245 Polyethylene Pipe								
35.15245.8205 1,663 LF - 24" SDR 11 IPS HDPE	1,663.00 lf	90,642	321,695	20,158	63,518	20,998	310.89 /lf	517,010
15245 Polyethylene Pipe		90,642	321,695	20,158	63,518	20,998		517,010
35 1,663 LF - 24" SDR 11 IPS HDPE	1,663.00 LF	499,428	429,783	621,112	473,942	20,998	1,229.86 /LF	2,045,262
40 3,672 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
40.02230.8205 Site Clearing	2.50 ac	18,179			22,182		16,144.34 /ac	40,361
02230 Site Clearing		18,179			22,182			40,361
02240 Dewatering								
40.02240.8205 Wetland Trench Dewatering	3,672.00	585,796	225,969	795,601			437.74	1,607,366
02240 Dewatering		585,796	225,969	795,601				1,607,366
02250 Portadam Protection								
40.02250.8205 Wetlands Portadam Protection	3,672.00 lf	184,201	5,865	255,421	794,006		337.55 /lf	1,239,493
02250 Portadam Protection		184,201	5,865	255,421	794,006			1,239,493
02300 Earthwork								
40.02300.8205 Temporary Road Mats	3,672.00 lf	113,472		236,027	86,101		118.63 /lf	435,599
02300 Earthwork		113,472		236,027	86,101			435,599
02990 Restore Disturbed Areas								
40.02990.8205 Restore Disturbed Areas	91,800.00 sf			27,588			0.30 /sf	27,588
02990 Restore Disturbed Areas				27,588				27,588
15245 Polyethylene Pipe								
40.15245.8205 3,672 LF - 24" SDR 11 IPS HDPE	3,672.00 lf	204,308	723,815	45,822	143,789	43,216	316.16 /lf	1,160,950
15245 Polyethylene Pipe		204,308	723,815	45,822	143,789	43,216		1,160,950
40 3,672 LF - 24" SDR 11 IPS HDPE	3,672.00 LF	1,105,956	955,650	1,360,458	1,046,078	43,216	1,228.58 /LF	4,511,358
45 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope								
02300 Earthwork								
45.02300.8205 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope	11,000.00 cy	35,250	178,997	144,393	75,402		39.46 /cy	434,042
02300 Earthwork		35,250	178,997	144,393	75,402			434,042
02730 Aggregate Surfacing								
45.02730.8205 Aggregate Surfacing- 6.0"	5,758.00 sy	9,639	28,703	7,657	17,095		10.96 /sy	63,093
02730 Aggregate Surfacing		9,639	28,703	7,657	17,095			63,093
02990 Restore Disturbed Areas								
45.02990.8205 Restore Disturbed Areas	150,278.00 sf			45,161			0.30 /sf	45,161
02990 Restore Disturbed Areas				45,161				45,161
45 5,182 LF - 3FT High, 10 FT Top with 3:1 Slope	5,182.00 LF	44,889	207,699	197,211	92,497		104.65 /LF	542,296
01 Area 2B	**1.00 LS**	**3,188,853**	**4,991,484**	**4,537,714**	**3,007,461**	**136,756**	**15,862,269.37 /LS**	**15,862,269**
02 AREA 4								
05 27 CFS PUMP STATION								
02200 Steel Sheeting								
05.02250.8205 23'x32'x20' Steel Sheet Pile Cofferdam	2,200.00 sf	22,614	34,736	60,104	29,584		66.84 /sf	147,038
02200 Steel Sheeting		22,614	34,736	60,104	29,584			147,038
02240 Dewatering								
05.02240.8205 PS Dewatering	1.00 ls	17,058	8,681	17,280			43,018.37 /ls	43,018
02240 Dewatering		17,058	8,681	17,280				43,018
02250 Portadam Protection								
05.02250.8210 Wetlands Portadam Protection	400.00 lf	23,689	3,436	18,534	45,147		227.02 /lf	90,807
02250 Portadam Protection		23,689	3,436	18,534	45,147			90,807
02300 Earthwork								
05.02300.8205 Excavation and Backfill	409.00 cy	5,221	3,356	3,298	10,707		55.21 /cy	22,582

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
02300 Earthwork		5,221	3,356	3,298	10,707			22,582
02730 Aggregate Surfacing								
05.02730.8205 Parking- Aggregate Surfacing- 6.0"	1,111.00 sy	1,860	5,539	1,478	3,299		10.96 /sy	12,175
02730 Aggregate Surfacing		1,860	5,539	1,478	3,299			12,175
02820 Fencing								
05.02820.8205 6' Chain Link Fence	400.00 lf			16,777			41.94 /lf	16,777
02820 Fencing				16,777				16,777
03300 Cast-in-Place Concrete								
05.03300.8205 PS 19'x23'x24" Thick Slab	32.37 cy	9,604	19,484	427	964	163	946.64 /cy	30,643
05.03300.8210 PS 12' high x 12" Thick Exterior Walls	34.67 cy	31,225	50,698	1,213	1,397	174	2,443.22 /cy	84,707
05.03300.8215 PS Interior Walls	10.67 cy	12,014	16,327	512	430	53	2,749.42 /cy	29,336
05.03300.8220 PS Top Slab	13.33 cy	7,250	10,478	367	1,190	67	1,451.78 /cy	19,352
05.03300.8225 Intake Structure Concrete Allowance	1.00 ls			100,173			100,172.63 /ls	100,173
03300 Cast-in-Place Concrete		60,094	96,986	102,692	3,982	456		264,211
05585 Formed Metal Fabrications								
05.05585.8205 3'x3' Aluminum Hatches	4.00 ea	967	7,235				2,050.60 /ea	8,202
05.05585.8210 Aluminum Ladder	1.00 ea	1,077	2,386				3,462.65 /ea	3,463
05585 Formed Metal Fabrications		2,044	9,621					11,665
11217 Submersible Non-Clog Pump 150 HP								
05.11217.8205 Submersible Non-Clog Pump 150 HP	3.00 ea	7,073	481,878		15,811	729	168,496.91 /ea	505,491
11217 Submersible Non-Clog Pump 150 HP		7,073	481,878		15,811	729		505,491
11330 Screening Systems								
05.11330.8205 36" DIA Automatic Backwash Screen	1.00 ea	15,504	153,589	16,028	5,074	3,254	193,449.09 /ea	193,449
11330 Screening Systems		15,504	153,589	16,028	5,074	3,254		193,449
13120 Pre-Engineered Structures								
05.13120.8205 32' x 12' x 12' High Precast Concrete Building	384.00 sf			96,166			250.43 /sf	96,166
13120 Pre-Engineered Structures				96,166				96,166
13400 Measurement & Control Instrumentation								
05.13400.8205 PS II&C Allowance	1.00 ls			150,259			150,258.95 /ls	150,259
13400 Measurement & Control Instrumentation				150,259				150,259
15111 Plug Valves								
05.15111.8205 20" Discharge Plug Valves	3.00 ea	3,727	90,898		38	38	31,566.88 /ea	94,701
15111 Plug Valves		3,727	90,898		38	38		94,701
15113 Gate Valves								
05.15113.8205 4" Sceen Wash Gate Valve	1.00 ea	311	1,909		13	13	2,244.83 /ea	2,245
15113 Gate Valves		311	1,909		13	13		2,245
15114 Check Valves								
05.15114.8205 20" Discharge Check Valves	3.00 ea	2,990	55,573		38	38	19,546.16 /ea	58,638
15114 Check Valves		2,990	55,573		38	38		58,638
15210 Ductile Iron Pipe								
05.15210.8205 36" DIP Discharge Header	1.00 ls	12,469	291,485		3,273		307,226.73 /ls	307,227
05.15210.8210 20" DIP Discharge Piping	1.00 ls	15,667	143,521		3,737	158	163,082.26 /ls	163,082
15210 Ductile Iron Pipe		28,136	435,005		7,009	158		470,309
15221 Stainless Steel Pipe								
05.15221.8205 4" 316 SS Burst Piping in PS	50.00 lf	1,049	7,074		69	11	164.05 /lf	8,202
15221 Stainless Steel Pipe		1,049	7,074		69	11		8,202
15245 Polyethylene Pipe								
05.15245.8255 4" Screen Wash Water	1,000.00 lf	24,002	15,229	5,600	13,127	7,573	65.53 /lf	65,531
15245 Polyethylene Pipe		24,002	15,229	5,600	13,127	7,573		65,531
16000 Electrical Allowance/Miscellaneous								
05.16000.8205 PS Electrical Allowance	1.00 ls			300,518			300,517.91 /ls	300,518
16000 Electrical Allowance/Miscellaneous				300,518				300,518
05 27 CFS PUMP STATION	17.50 MGD	215,372	1,403,511	788,733	133,897	12,269	145,930.37 /MGD	2,553,781
50 3,481 LF - 42" SDR 11 IPS HDPE								
02230 Site Clearing								
50.02230.8205 Site Clearing		14,543			17,746			32,289
02230 Site Clearing		14,543			17,746			32,289
02240 Dewatering								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
50.02240.8205 Wetland Trench Dewatering	3,481.00 lf	555,447	214,494	760,726			439.72 /lf	1,530,666
02240 Dewatering		555,447	214,494	760,726				1,530,666
02250 Portadam Protection								
50.02250.8205 Wetlands Portadam Protection	3,481.00 lf	175,638	4,992	248,340	764,213		342.77 /lf	1,193,182
02250 Portadam Protection		175,638	4,992	248,340	764,213			1,193,182
02300 Earthwork								
50.02300.8205 Temporary Road Mats	3,481.00 lf	107,570		223,750	81,622		118.63 /lf	412,942
02300 Earthwork		107,570		223,750	81,622			412,942
02990 Restore Disturbed Areas								
50.02990.8205 Restore Disturbed Areas	87,025.00 sf			26,153			0.30 /sf	26,153
02990 Restore Disturbed Areas				26,153				26,153
15245 Polyethylene Pipe								
50.15245.8205 3,481 LF - 42" SDR 11 IPS HDPE	3,481.00 lf	244,367	1,514,226	41,262	177,762	49,162	582.24 /lf	2,026,779
15245 Polyethylene Pipe		244,367	1,514,226	41,262	177,762	49,162		2,026,779
50 3,481 LF - 42" SDR 11 IPS HDPE	3,481.00 LF	1,097,564	1,733,712	1,300,230	1,041,343	49,162	1,500.15 /LF	5,222,011
55 910 LF - 32" SDR 11 IPS HDPE								
02230 Site Clearing								
55.02230.8205 Site Clearing	0.50 ac	3,636			4,436		16,144.32 /ac	8,072
02230 Site Clearing		3,636			4,436			8,072
02240 Dewatering								
55.02240.8205 Wetland Trench Dewatering	910.00 lf	146,930	60,021	199,509			446.66 /lf	406,460
02240 Dewatering		146,930	60,021	199,509				406,460
02250 Portadam Protection								
55.02250.8205 Wetlands Portadam Protection	455.00 lf	26,097	2,038	33,879	100,599		357.39 /lf	162,614
02250 Portadam Protection		26,097	2,038	33,879	100,599			162,614
02300 Earthwork								
55.02300.8205 Temporary Road Mats	455.00 lf	14,060		29,246	10,669		118.63 /lf	53,975
02300 Earthwork		14,060		29,246	10,669			53,975
02990 Restore Disturbed Areas								
55.02990.8205 Restore Disturbed Areas	22,750.00 sf			6,837			0.30 /sf	6,837
02990 Restore Disturbed Areas				6,837				6,837
15245 Polyethylene Pipe								
55.15245.8205 910 LF - 32" SDR 11 IPS HDPE	910.00 lf	62,070	336,212	14,869	46,734	16,085	523.04 /lf	475,970
15245 Polyethylene Pipe		62,070	336,212	14,869	46,734	16,085		475,970
55 910 LF - 32" SDR 11 IPS HDPE	910.00 LF	252,794	398,271	284,340	162,438	16,085	1,224.10 /LF	1,113,928
60 1,776 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								
60.02230.8205 Site Clearing	1.20 ac	8,726			10,647		16,144.33 /ac	19,373
02230 Site Clearing		8,726			10,647			19,373
02240 Dewatering								
60.02240.8205 Wetland Trench Dewatering	1,776.00 lf	284,533	112,052	388,510			442.06 /lf	785,094
02240 Dewatering		284,533	112,052	388,510				785,094
02250 Portadam Protection								
60.02250.8205 Wetlands Portadam Protection	888.00 lf	46,561	2,492	65,077	191,721		344.43 /lf	305,850
02250 Portadam Protection		46,561	2,492	65,077	191,721			305,850
02300 Earthwork								
60.02300.8205 Temporary Road Mats	888.00 lf	27,441		57,078	20,822		118.63 /lf	105,341
02300 Earthwork		27,441		57,078	20,822			105,341
02990 Restore Disturbed Areas								
60.02990.8205 Restore Disturbed Areas	44,400.00 sf			13,343			0.30 /sf	13,343
02990 Restore Disturbed Areas				13,343				13,343
15245 Polyethylene Pipe								
60.15245.8205 1,776 LF - 24" SDR 11 IPS HDPE	1,776.00 lf	96,600	343,470	21,514	67,858	21,874	310.43 /lf	551,315
15245 Polyethylene Pipe		96,600	343,470	21,514	67,858	21,874		551,315
60 1,776 LF - 24" SDR 11 IPS HDPE	1,776.00 LF	463,860	458,014	545,521	291,048	21,874	1,002.43 /LF	1,780,317
65 3,327 LF - 24" SDR 11 IPS HDPE								
02230 Site Clearing								

Spreadsheet Level	Takeoff Quantity	Labor Amount	Material Amount	Sub Amount	Equip Amount	Other Amount	Total Cost/Unit	Total Amount
65.02230.8205 Site Clearing	1.90 ac	13,816			16,858		16,144.34 /ac	30,674
02230 Site Clearing		13,816			16,858			30,674
02240 Dewatering								
65.02240.8205 Wetland Trench Dewatering	3,327.00 lf	530,977	205,241	721,048			438.01 /lf	1,457,266
02240 Dewatering		530,977	205,241	721,048				1,457,266
02250 Portadam Protection								
65.02250.8205 Wetlands Portadam Protection	3,327.00 lf	170,288	5,709	235,329	730,026		343.06 /lf	1,141,352
02250 Portadam Protection		170,288	5,709	235,329	730,026			1,141,352
02300 Earthwork								
65.02300.8205 Temporary Road Mats	3,327.00 lf	102,811		213,851	78,011		118.63 /lf	394,673
02300 Earthwork		102,811		213,851	78,011			394,673
02990 Restore Disturbed Areas								
65.02990.8205 Restore Disturbed Areas	83,175.00 sf			24,996			0.30 /sf	24,996
02990 Restore Disturbed Areas				24,996				24,996
15245 Polyethylene Pipe								
65.15245.8205 3,327 LF - 24" SDR 11 IPS HDPE	3,327.00 lf	186,096	657,298	41,546	129,573	37,927	316.33 /lf	1,052,440
15245 Polyethylene Pipe		186,096	657,298	41,546	129,573	37,927		1,052,440
65 3,327 LF - 24" SDR 11 IPS HDPE	3,327.00 LF	1,003,987	868,247	1,236,769	954,469	37,927	1,232.76 /LF	4,101,400
70 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope								
02300 Earthwork								
70.02300.8205 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope	6,400.00 cy	21,486	104,144	84,010	45,938		39.93 /cy	255,578
02300 Earthwork		21,486	104,144	84,010	45,938			255,578
02730 Aggregate Surfacing								
70.02730.8205 Aggregate Surfacing- 6.0"	3,370.00 sy	5,642	16,799	4,481	10,006		10.96 /sy	36,928
02730 Aggregate Surfacing		5,642	16,799	4,481	10,006			36,928
02990 Restore Disturbed Areas								
70.02990.8205 Restore Disturbed Areas	87,957.00 sf			26,433			0.30 /sf	26,433
02990 Restore Disturbed Areas				26,433				26,433
70 3,033 LF - 3FT High, 10 FT Top with 3:1 Slope	3,033.00 LF	27,128	120,943	114,924	55,944		105.16 /LF	318,939
02 AREA 4	**1.00 LS**	**3,060,706**	**4,982,698**	**4,270,517**	**2,639,137**	**137,317**	**15,090,375.69 /LS**	**15,090,376**

Estimate Totals

Description	Amount	Totals	Hours	Rate
Labor	6,249,559		110,311 hrs	
Material	9,974,182			
Equipment	5,646,599		32,508 hrs	
Subcontract	8,808,231			
Other	274,073			
Subtotal Allowances	30,952,644	30,952,644		
General Conditions				
GC General Conditions	3,090,758			10.00 %
Subtotal General Conditions	3,090,758	34,043,402		
Indirect Costs				
Building Permits	169,992			0.50 %
Sales Tax (Permanent Mat'l)	557,433			7.00 %
Sales Tax (Non-Permanent)	331,071			7.00 %
Bldr's Risk Ins (% total cost)	539,112			1.00 %
Gen Liab Ins (% total cost)	539,112			1.00 %
GC Bonds (% total cost)	808,667			1.50 %
Subtotal Prior to OH&P	2,945,387	36,988,789		
Contractor Total OH&P	3,698,879			10.00 %
Subtotal with OH&P	3,698,879	40,687,668		
Construction Contingency	10,171,917			25.00 %
Total Cost in Today's Dollars	10,171,917	50,859,585		
Escalation to Mid Point Constr	3,051,575			6.00 %
Based on 6% per year				
	3,051,575	53,911,160		
Total		***53,911,160***		

"This Opinion of Probable Construction Cost is produced in accordance with CDM Smith's Firmwide Quality policies and best practices as described in CDM Smith's Estimating Manual Dated 01/03/12 Section 10 titled Quality Control. I hereby acknowledge that the Cost Estimating policies and procedures were followed in preparation of the Opinion of Probable Cost".

Lead Estimator initials - JJ Date 3/16/2022

Attachment 3

Lake Jesup Conceptual Wetland Treatment System Areas 2B and 4 – Constructability Review

Memorandum

To: *Danielle Honour*

From: *George Reilly*

Date: *3/18/22*

Subject: *Lake Jesup Conceptual Wetland Treatment System Areas 2B and 4 – Constructability Review*

Water Intake

Lake Jesup is a shallow lake with an approximate water depth as described to be between one- and two-and-one-half feet near the intake. Based on this information, if the 32" HDPE intake pipe invert is placed at the lake bottom, the pipe will only be partially full of water most of the year. Therefore, it would appear to be necessary, as a minimum, for the pipe to be at least partially buried at the intake location to obtain the volume of water desired for the wetland restoration. Consideration should be given to install a water catchment structure on the lake bottom with the 42" HDPE penetrating the side wall receiving the lake flow. Because of water movement, add grating on the intake water catchment and screening on the pipe entrance to prevent debris from entering the pipe. Also, place on the lake bottom rip rap surrounding the water catchment to further stabilize the lake bottom and reduce the impact of water movement.

Lift Station Installation

If a suction lift station is considered, it would be located approximately 1,000 feet +/- from proposed catchment structure and 42" HDPE intake and pump 27 CFS of water from the lake through 42", 32" and 24" HDPE pipe and 24" header system to the wetland restoration areas. A suction lift station will have more limited operating parameters than a pump station. I would recommend for consideration a duplex submersible pump station similar to those used for wastewater applications. The 42" HDPE intake pipe can gravity feed water to the pump station wet well and water pumping can be controlled through a series of floats in the wet well and the pump controls. Since the lake water is being gravity fed the pump station can be installed wherever most convenient (based on environmental considerations) along the 42" HDPE intake pipe.

Pipe Installation

Flotation of the HDPE pipe is of concern. Flotation can be resolved by 1) depth of cover, installing the pipe deeper or 2) installing an anchoring system around the pipe. A third alternative to be considered would be to install valves which keep the pipe at least partially filled with water when it is not in operation. A combination of any of the three could be used.

Different pipe installation techniques should be considered to reduce the potential environmental impacts to the wetland areas. Pipe installation by the directional drill method could be used which would substantially reduce above ground impacts and dewatering requirements during construction. This method would also offer flexibility in selecting equipment set-up locations.

Other Considerations

1. Provisions need to be made to provide electrical service to the lift/pump station in each area.
2. When developing a plan for access to the two sites, remember the plan will need to accommodate equipment lay down areas, pipe and lift/pump station installation, hauling off site of construction debris and miscellaneous fill, and testing of the pipe and equipment.
3. Mat placement for moving equipment over environmentally sensitive areas as well as structural mesh and fill over wet areas.
4. Much of this, of course, will be determined when establishing the permit conditions.

Attachment 4

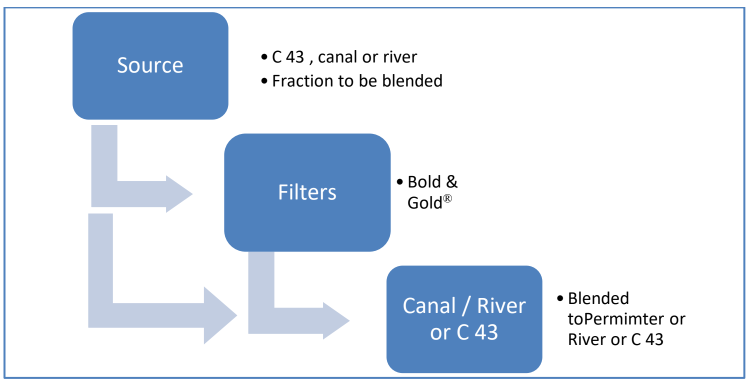
Excerpts of Vendor Provided Information (SFWMD, 2020)

Bold & Gold (B&G)

Environmental Conservation Solutions (ECS) is pleased to submit this response to the request for information from the C-43 WBSR Water Quality Feasibility Study Working Group. The information provided is compiled from laboratory research conducted by the University of Central Florida along with field data from projects throughout Florida installed since 2003. Dr. Martin Wanielista, Professor Emeritus, University of Central Florida, Dr. Ni-Bin Chang, Professor, University of Central Florida, Dr. Ikiensinma Gogo-Abite, ECS, and RJS Construction contributed to the response. Chris Bogdan is the point of contact from ECS if the Water Quality Feasibility Study Working Group has any questions related to our response or require additional information. We appreciate the opportunity to be involved with this project.

I. Treatment Process: Bold & Gold® Filtration Media

A. Process Flow Diagram



At average flow of 457 CFS, 12 filter cells are needed with a blending of source and filtered water.
And (15) filter cells for treatment of the maximum flow of 600 CFS
At minimum flow time, less filter acreage is needed, or greater mass removal is possible.

The media is called Bold & Gold® (B&G) and it removes more pollution than the target levels specified. Thus, there is an opportunity to treat by filtration a fraction of the source water and blend the treated water with the source water before discharge. This also provides an option to not blend when the discharge flow is lower than the average or when influent water quality conditions deteriorate (i.e. mass in the source is in excess of what is expected). A **very flexible** operating rule for treatment results from blending. There are changing source water quality and flow discharge conditions. Blending will permit operation that will allow the targets to be met while achieving a reduced cost from not over building the treatment capacity. A 5-acre filter cell size is recommended to give additional flexibility for meeting source water quality variations and flow discharge to the River. The treatment filtration rate using the media is 5 inches per hour. A 5-acre filter cell will treat 25.2 CFS or [5 (in/hr) x 5 ac x 43,560 (SF/ac) / 12 (in/ft) / 3600 (sec/hr)]. We are proposing to build 15 treatment cells.

Each filter is a mix of graded sand, clay, and recycled tire crumb. The filter mix is called Bold & Gold® CTS. The processes Bold & Gold® CTS media use to attain the desired removal are:

- Removal of particulate species of TN and TP is by physical separation or straining.
- Removal of dissolved species of TP is by chemical means, primarily sorption, and precipitation.
- Removal of dissolved species of TN is by chemical as well as biological means.
  Nitrate removal is by denitrifying organisms and anammox (AMX). AMX functions in an anaerobic environment for the removal of nitrate.

Ammonia is also removed when Ammonia Oxidizing Bacteria (AOB), and Nitrite Oxidizing Bacteria (NOB) are present. Diagram shows bacteria mix on B&G CTS media.

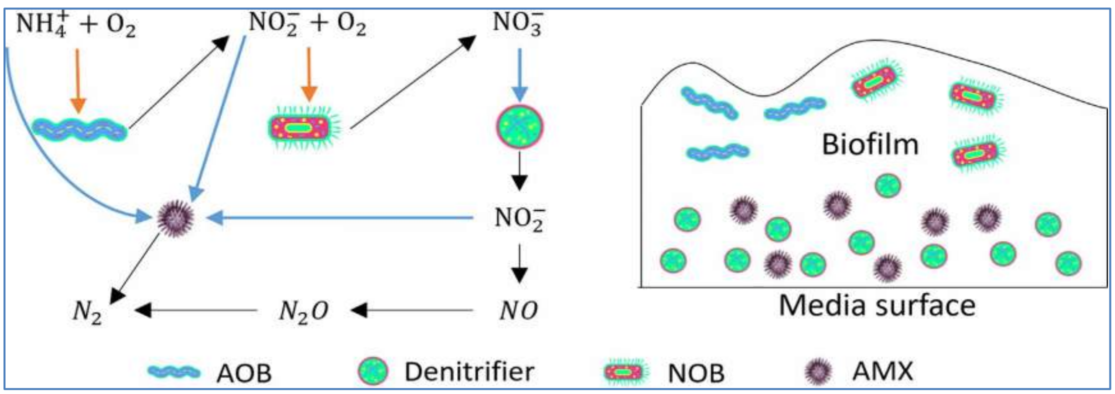


Figure 1 Nitrogen Process Diagram for B&G From: Wen, Chang and Wanielista. Comparative Copper Toxicity impact and enzymatic cascade effects on Biosorption Activated Media. **J. Chemosphere** 2018.09.062 The media in this publication is a form of B&G CTS. Biosorption Activated Media is a term first used by the research team at UCF under a grant from water management districts, Florida DOT and Florida DEP.

B. Flow Equalization - (Temporary detention of water volume or reduction in flow rate required to implement the treatment process using storage tanks, basins, or other means).

A distribution basin is planned so that water can be provided to each cell at the specific treatment rate of 5 inches per hour.

C. Distribution

For the Filter Cell: Water is distributed by pipe and risers onto the surface of the filters. This is common practice with this type of treatment and has been used for infiltration basins.
For the Blending Basin: Values and weirs are used to provide the amount of water that must be mixed from the source as well as from the filters.

D. Pre-Treatment Processes

None, the water quality expected in the reservoir, river or canal has been treated before with the use of a B&G filter and without pre-treatment. We do not expect a need for pre-treatment.

E. Treatment

1. Provide information demonstrating prior pilot/project capability to achieve the project water quality criteria
2. Treatment chemicals and/or media required for the process will be described

Achieve Water Quality Criteria (prior project performance):

B&G has documented performance for nutrient removal from full scale operations. B&G has been used in at least 200 locations around the State of Florida for the reduction of phosphorus and nitrogen species. A partial listing of sites is shown in Appendix "A". Four sites are operational for over 10 years without media replacement. The removal efficiencies are summarized in Appendix "B" and supported by referred publications. In Appendix "B", are other references for the use of the materials found in Bold & Gold® and a summary of pollution control effectiveness. The C 43 filter cells will use B&G CTS mix. CTS refers to a mix with **C**lay, **T**ire Crumb, and **S**and. Based on past monitored and published data on water quality performance, we expect the following average removal percentages and a range (shown in %) with this B&G CTS mix.:

1. Dissolve Organic Nitrogen (DON) 50% (±10%)
2. Dissolved Bio-Available Organic Nitrogen (BON) 50% (±10%)
3. Dissolved Inorganic Nitrogen forms, ammonia and nitrate (NH_3 and NOx) 90% (±10%)
4. Particulate Nitrogen (PN) 90% (±10%)
5. Total Nitrogen (TN) 70% (±10%)
6. Particulate Phosphorus (PP) 95% (±2.5%)
7. Soluble Reactive Phosphorus (SRP) 70% (±5%)
8. Total Phosphorus (TP) 80% (±5%)
9. Total Suspended Solids (TSS) 95% (±2.5%)

Notes: Nitrite is rarely measured above detection levels in the effluent from a B&G filter. Percent removal is based on an understanding of existing Nitrogen and Phosphorus concentrations. The organic nitrogen in the input is assumed to be 50% of TN.

Media Used:

To achieve the above specified removals, the filter uses a Biosorption Activated Media (BAM) called Bold & Gold® (B&G). B&G is a non-degradable media consisting of mineral and recycled materials. BAM is a term first published by the State University System researchers at the University of Central Florida.

The service life is dependent on the removal of SRP and has been economically used to meet design life of Florida Department of Transportation (FDOT) Projects. FDOT specifies a life of at least 30 years for most applications. We are proposing a 50 years life expectancy with lowest cost. See Appendix "A" for a partial listing of locations where the media is used in the State, all with media to match a service life.

The filter media is installed in a treatment cell. A treatment cell contains the media, drainage stone, cover sand and rock, separation fabric, liner, and piping. The B&G mix is composed of sand, clay, and tire crumb. There has been no acute toxicity measured when using B&G (see Appendix "F"). The largest filter built to date is a 3.5-acre stormwater pond in Marion County. A one-acre rapid infiltration basin in DeLand, Florida was built to treat reclaimed water and stormwater. The filters have been used to treat a range of influent nutrient concentrations.

A Material Safety Data Sheet (MSDS) is also available for B&G CTS media. The use of B&G CTS is supported by use over the last 15 years and thus requires a MSDS. One of the first applications was in greenroof technologies (planted areas on roof tops) in Southeast Florida (namely in Bonita Bay in 2003).

Filter Size to Achieve Water Quality Target Concentrations

For TP, the percent SRP is assumed at 58.5 % of the total. This is based on phosphorus species measurements at S -78. Example calculations for phosphorus removal using average TP concentration and 70% removal of SRP are:

Influent TP concentration is 0.16 mg/L
The dissolved concentration **remaining (after treatment)** is 0.16 x .585 x (1-0.70) = 0.028 mg/L
The particulate concentration **after treatment** is 0.16 x (1-.585) x (1.-0.90) = 0.0066 mg/L
The total TP **after treatment** is 0.028 + 0.0066 = 0.0346 mg/L or 22% of input (0.0346/0.16) x 100.

The target TP removal percent is 50%. Based on an input of 0.16 mg/L, this leaves 0.08 mg/L TP discharge. The B&G CTS filter removes 78% (1-22), or 0.125 mg/L removed: leaving a discharge of 0.0346 mg/L. Thus, a unique situation exists that provided great flexibility for operation of the filter. Based on influent conditions, a blending of treated filter effluent with source water is possible to meet the target of 0.08 mg/L. For the treatment level specified in the above calculations and an average discharge of 457 CFS, 292 CFS must be treated by the filter. It is blended with 165 CFS from the source (canal, upstream river or reservoir). The treated fraction is 64% of the total flow. This is based on the following TP mass balance and with details on the calculation, we have:

Mass in the Discharge = Mass from source (reservoir, river or canal) + mass from Filter.
457 x (0.08) = Flow from source (0.16) + Flow from filter (0.0346) and the total flow = 457.
And: 36.56 = S (0.16) + F (0.0346) with S+F=457, where S is source flow (CFS) and F=Filter flow (CFS)
36.56 – 15.81 = (0.16-0.0346)S results in S = 165 CFS, F = 292 CFS.
And: Each filter cell treats 25.2 CFS, thus the number of filter cells is 11.59 (round to 12)

Resiliency: (Reliable Operation) Filter Cells with Blending Achieve Target Level Concentrations for Many Discharge and Source Water Quality Conditions.

It is well known that concentrations in the source water and river discharge change over time. Thus, the number of filter cells used should be large enough to provide treatment for a variety of discharge and source water quality conditions.
For a flow discharge that varies from 300 – 600 CFS, and using the target concentrations and removals, the filter size must be large enough to treat a flow from 192 CFS (7.62 filter cells) to 383 CFS (15.2 filter cells). We are providing 15 cells. The calculations for 600 CFS flow are:

Mass in the Discharge = Mass from source (reservoir, river or canal) + mass from Filter.
600 x (0.08) = Flow from source (0.16) + Flow from filter (0.0346) and the total flow = 600.
And: 48.0 = S (0.16) + F (0.0346) with S+F=600, where S is source flow (CFS) and F=treatment flow (CFS)
48.0 – 20.76 = (0.16-0.0346)S results in S =217 CFS, F = 383 CFS.
And: Each filter cell treats 25.2 CFS, thus the number of filter cells is 15.2 (round to 15)

For a source TP concentration that is 50% higher than assumed (0.24 mg/L) and an average discharge, the number of filter cells needed is 14.28 (call 15). The calculations are:

Mass in the Discharge = Mass from source (reservoir, river or canal) + mass from Filter.
457 x (0.08) = Flow from source (0.24) + Flow from filter (0.0346) and the total flow = 457.
And: 36.56 = S (0.24) + F (0.0346) with S+F=457, where S is source flow (CFS) and F=Filter flow (CFS)
36.56 – 15.81 = (0.24-0.0346)S results in S = 100 CFS, F = 357 CFS.
And: Each filter cell treats 25.2 CFS, thus the number of filter cells is 14.28 (round to 12)

Additional operating rules can be developed and based on monitoring water quality and flow demand. Based on the professional talent of the SFWMD and with the project team, it is expected that the rules will be both in a graphical form as well as a computer-based algorithm that is remotely operational. The rule is used to determine the fraction of flow from the source to the filter and the number of filters used.

TN removed with the Filter Cells to Meet the TN Target Concentration of 1.0 mg/L

TN discharge concentration is also managed. With the filter flow of 292 CFS and blending, will total nitrogen removal exceed the target reduction of 33%? Particulate Nitrogen removal using B&G CTS is about 90% and dissolved Nitrogen removal is about 70%. Some of the particulate fraction is converted to inorganic dissolved forms, so simply adding the removals based on source water measured dissolved and particulate forms will not result in total Nitrogen removal. Based on past monitoring of B&G, we are assuming a low TN removal (conservative) of 60% (70% average – 10% variation). Based on the following with

Influent TN is 1.5 mg/L, Target level discharge is 1.0 mg/L (33% removal)
Filter removal of 60% or **remaining (discharged)** is 0.6 mg/L.

For an average discharge to the river of 457 CFS, if 292 CFS (required by TP target removal) is used, the blended discharge concentration for TN is 0.93 mg/L or (292 x 0.6 + 165 x 1.5)/457). Note 0.93 mg/L is less than the target level of 1.0 mg/L or we have achieved the 33% removal target for TN. TP is the limiting nutrient in terms of meeting discharge concentration levels after blending.

Total Suspended Soils Removal

Total Suspended Soils (TSS) removal typically is equal to or greater than particulate TP removal. TSS target removal is 50%. TP removal is 50%. Thus, it is expected that the control for any blended waters due to suspended soils will be meet provided TP target levels are met.

Additional Water Quality Benefits

Additional benefits from the use of B&G is the removal of algal toxins and Polyfluorinated Alkyl Substances (PFAS). The PFAS removals in the lab were documented using duplicated field water quality conditions. Using the B&G CTS mix initial testing documents 76-85% removal of the most common forms of PFAS (see Appendix “D”). Algal mass removal is more obvious because of its particulate form and B&G removes most (about 95%) particulates. Algal toxin and PFAS removal are added environmental benefit from the use of B&G media.

Effluent from B&G have not exceeded Class III receiving water standards. Anammox and other microbial populations has been identified in B&G and thus a partial reason for BON removal (see Wen, et al. 2020, End of Appendix “B”).

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Location and Some Filter Details

The location for the 15 filter cells is an area suitably close to the source water of the river, a canal and the C-43 reservoir. The exact location will depend on the availability and cost of land. The reservoir location with the perimeter canal is shown below. The river is to the north of the reservoir.

There are 15 filter cells treating the water with a flow equalization basin and a blending basin. In addition, there is an access road with a stormwater pond. The surface area of a filter is 5 acres for a total area of 75 acres. Added to the filter area is the cell bank area and an access maintenance area. The total area is about 130 acres. The reservoir holding the water will occupy about 10,500 acres and has a perimeter of about 16 miles. Thus, the relative size of the filter cells is about 1.2% of the reservoir size.

The filter cells do not all have to be located adjacent to the perimeter ditch or within a fixed distance from the reservoir or river. The filter can accept water from the canals and river. The location of the filter may provide for that flexibility.

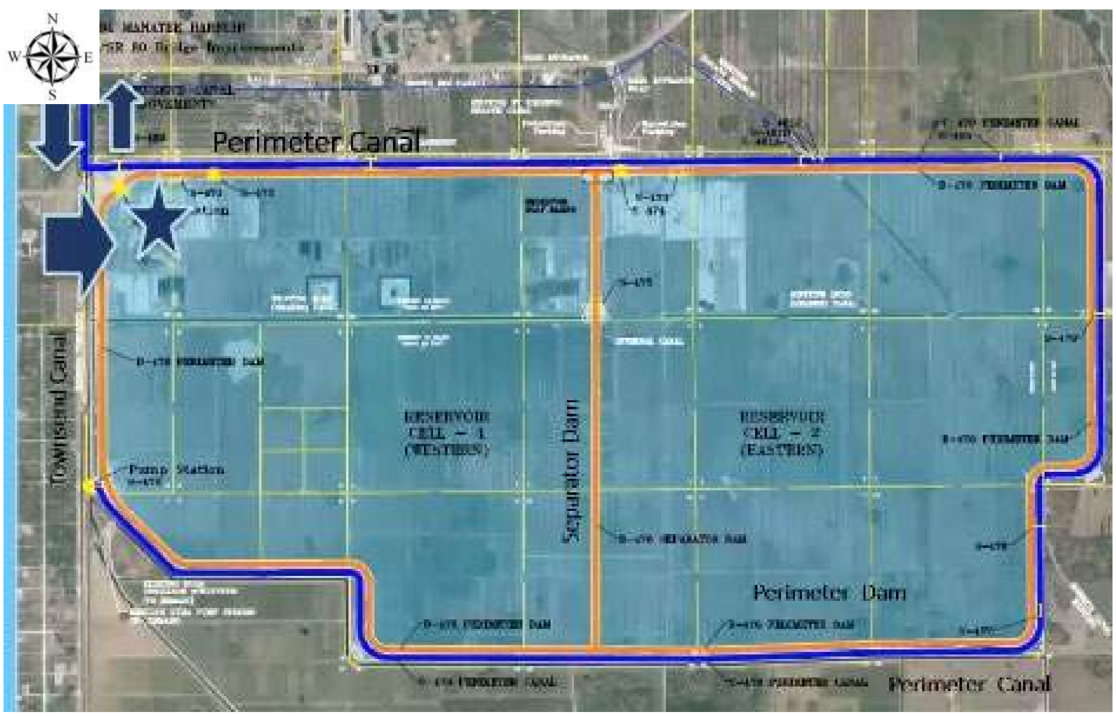

Figure 2 **Site Location Map for C-43 Reservoir**
From: C43 West Storage Reservoir Test Cell Water Quality Summary: Stanley Consultants, 2007

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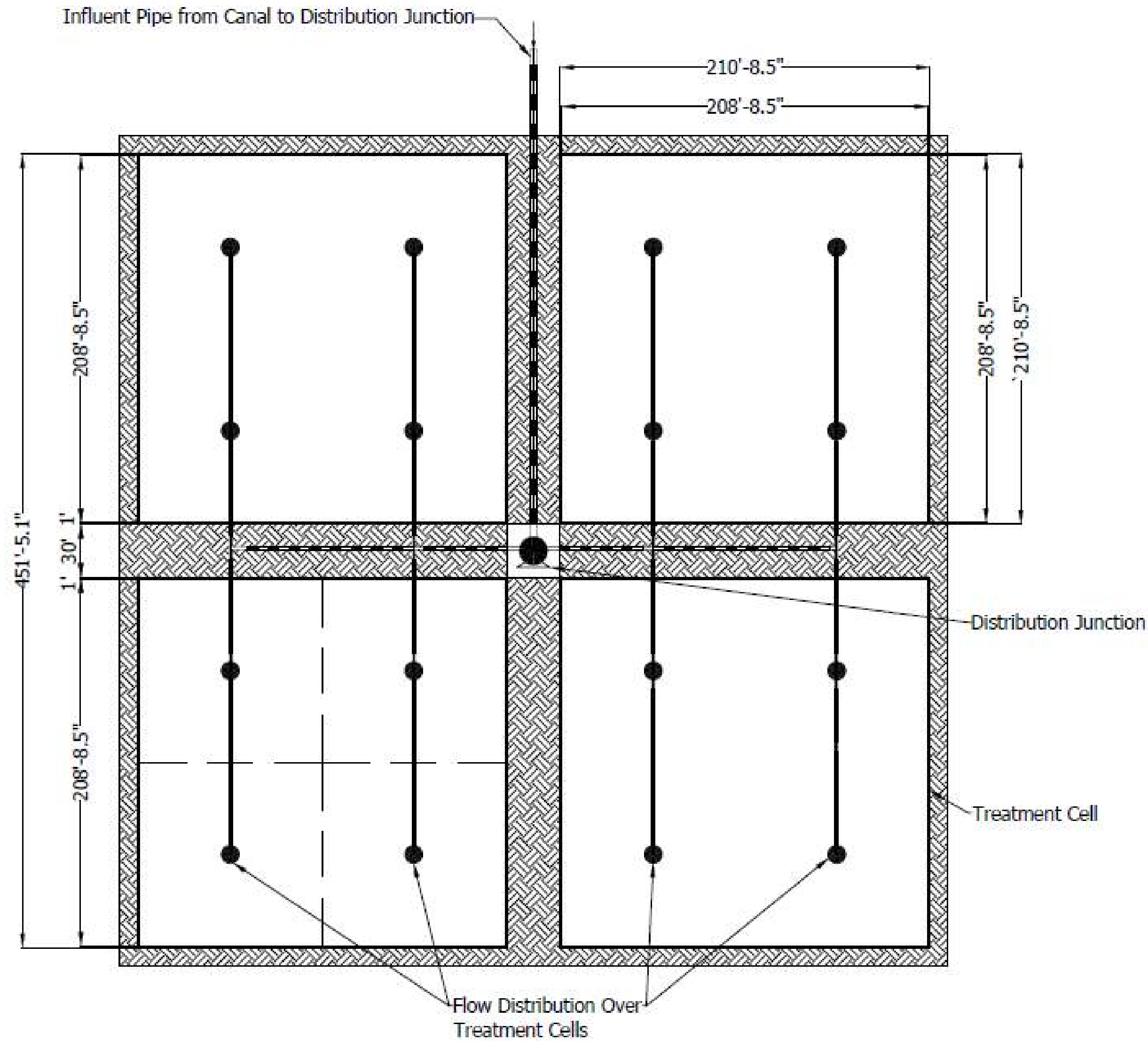

Figure 3 **Plan View of a typical 5-acre filter Cell (total of 15). Other shapes to fit the available land configuration are possible. Raw water from reservoir or canal is available for treatment. A maximum water depth of 24 inches is anticipated above the top of the filter with free board depth of 2 feet. A total depth of 8 feet from bottom of filter to top of bank is used to estimate cost.**

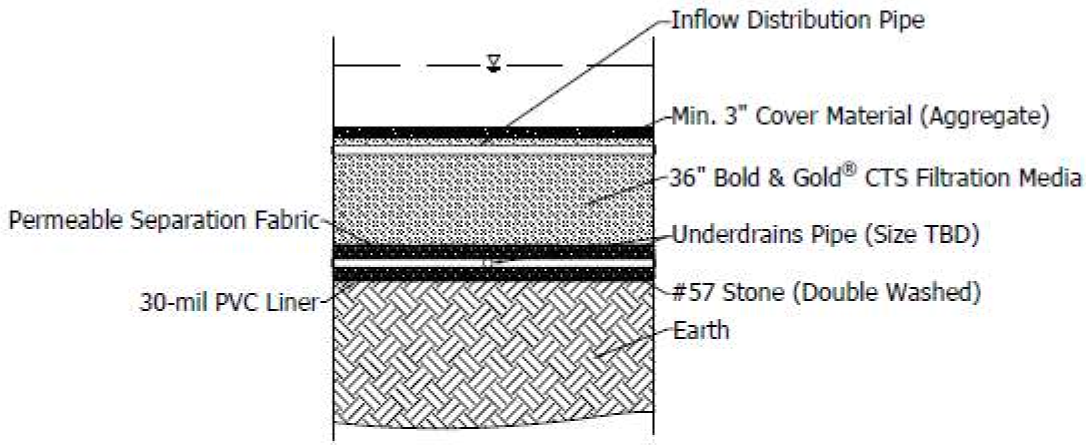

Figure 4 **Bold & Gold® CTS Media Cross Section along Influent Pipe**

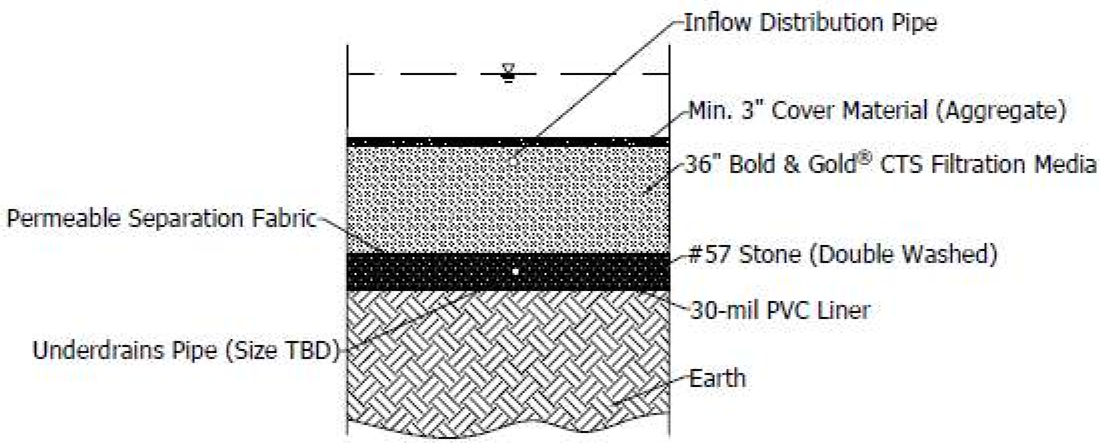

Figure 5 **Bold & Gold® CTS Media Cross Section Perpendicular to the Influent Pipe.**

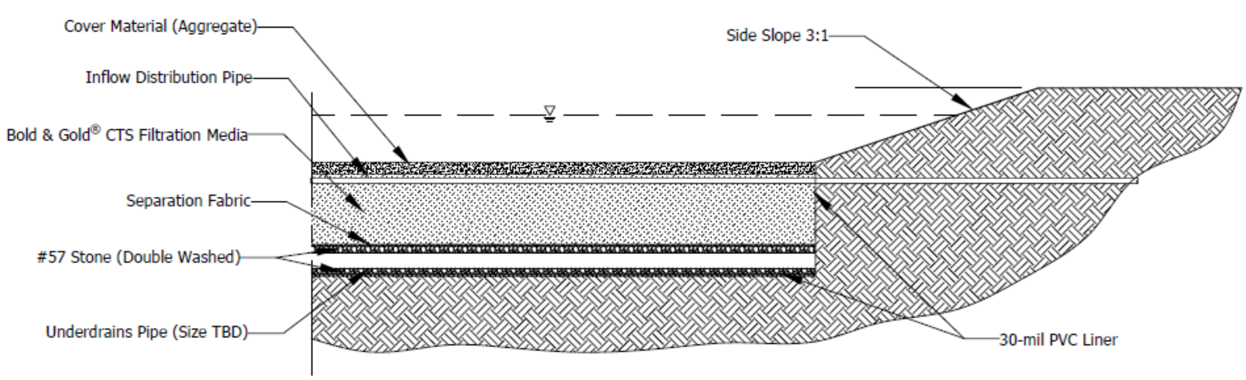

Figure 6 **Bold & Gold® CTS Filtration Media Bank Side Cross Section**

NOTES: 1. ALL DRAWINGS ARE CONCEPTUAL PENDING ENGINEERING DESIGN. 2. EXACT DIMENSIONS SHALL BE DETERMINED AFTER SITE VISIT AND DESIGN BY CONSULTING ENGINEER. 3. DETAILS SHALL BE AS DETERMINED BY CONSULTING ENGINEER IN ACCORDANCE WITH RELEVANT LOCAL REGULATIONS and SFWMD REVIEW. 4. EXACT LOCATIONS OF TREATMENT CELLS TO BE DETERMINED AFTER SITE VISIT.

The proposed location of the treatment filter is shown with preliminary design details. Water entering the B&G filter will be treated and mixed with source water. A flow measuring device for continuous monitoring of discharge flow rate will be used to document performance. Inflow to the filters is distributed by riser pipes, now planned to be at most 6 inches above the top of the cover material. Rip-rap rock will surround the riser pipe to minimize erosion. The treatment rate is based on the filtration rate of the media, which is 5 inches per hour. The daily rate of treatment is about 15 million gallons per day per treatment cell (about 23 CFS). The underdrain pipes minimize water accumulation within the filter and thus the treatment rate is not affected by excess water levels in the filter. Nevertheless, there will be a water level recorder for water depth above the filter and if the water level exceeds 24 inches, the input water will be shut down. A free board is planned at two feet for cost estimating purposes. The exact freeboard to be determined at final design.

F. Post-Treatment Processes

No treatment is expected after the filter; however, a blending of the source and treated water is done.

G. Collection

Water is pumped to the treatment filters and it flows by gravity to a blending tank and then either back to the reservoir, or to the perimeter canals, or to the river.

H. Chemical Supply

No chemicals are used.

II. Residuals Process

A. Collection or Removal

No residuals are expected.

B. Volume Reduction/Dewatering

None required

C. Storage

A blending tank or pond to accommodate a maximum flow of 600 CFS is planned. It will consist of valves and other sensors to adjust flow.

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D. Transfer

E. Disposal Process and Location

F. Centrate Management

It is anticipated that professional staff with environmental and hydrological capabilities will be available to collect and monitor water quality and discharge. In addition, field staff to check pipe connections and repair or replace monitoring is needed. It is understood that this capability and understanding now exists within the staff of the District. Nevertheless, the persons who fill the need will be provided with training from the ECS team.

III. Land Area (total)

A. Treatment Facility (including process tanks or basins, chemical storage, electrical system, buildings)

A total of 130 acres is needed. A building for the storage of replacement pipes and other monitoring equipment is desirable.

B. Supporting Facilities (Vehicle Access Roads, Fencing, Security, Equipment Garage, Storage, Parking, and Administration)

The site is assumed to be fenced for cost estimation.

C. Residuals Handling and Solids Storage

D. Stormwater Management

It is expected that the rainfall on the filters and from the bank will be treated in the filter. A stormwater wet pond is added to the access road with the discharge from the pond to one of the 5-acre filter cells.

IV. Power (annual)

A. Process requirements

B. Site requirements

C. Monitoring

We expect water quality and discharge measurements. A monitoring cost of about $80,000 per year based on a vendor lease agreement for a similar filter is anticipated. This monitoring cost however can be offset by District professional staff.

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V. Fuel Consumption (annual)

None

A. Chemical Supply, Storage, and Transport

None

B. Site Vehicle Operation

None Expected except for repairs and inspections.

C. Residuals Transport and Disposal

The filter Bold & Gold® media is expected to have a service life of around 50 years. Thus, no residual transport is needed. The filter material is also primarily sand and may even be left on site after 50 years.

VI. Other Beneficial Attributes

A. Additional Vendor Provided Information

ECS is licensed to manufacture Bold & Gold® Filtration media since 2015. During that time, we manufactured over 30,000 tons of Bold & Gold® Filtration media for projects funded by the Florida Department of Transportation, Florida Department of Environmental Protection, St. John's Water Management District, Suwanee River Water Management District, Southwest Florida Water Management District, and private development. A partial list of these projects is available in Appendix "A". Several of these projects were monitored for effectiveness and some of that data is presented in this report.

The production of a consistent product is critical for the nutrient removal effectiveness of any media. Every cubic yard of Bold & Gold® manufactured by ECS meets stringent product specifications. The ECS testing lab was built by Dr. Ikiensinma Gogo-Abite specifically for purpose of manufacturing Bold & Gold® Filtration media. He earned his PhD at the University of Central Florida in geotechnical engineering and worked with Dr. Martin Wanielista while Bold & Gold® was in development. Our lab is used to test the component materials of Bold & Gold® along with the finished product to ensure that the manufactured product meets the patent specifications of the University of Central Florida.

Bold & Gold® Filtration media can be manufactured at our factory and/or at a project site based on economic costs. To keep transportation costs low, we will manufacture the Bold & Gold® CTS Filtration media required for this project at the installation site. Our state-of-the-art blending equipment is portable and has the capacity to produce 300 cubic yards of Bold & Gold® CTS media per hour. The blending equipment uses FDOT certified scales to monitor the input of the component materials in real time during production. The sand required to manufacture the Bold & Gold® CTS media will be sourced in LaBelle. Our engineers have tested the material to ensure it meets our component material specifications.

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VII Capital Cost (2020 Dollars)

A. Process Facility (including components described under Items I & II)

The following cost analysis includes typical materials and installation practices associated with constructing a dry detention system to include an underdrain system to discharge the water after treatment. ECS consulted with a contractor certified to work with the South Florida Water Management District to determine construction costs. The costs may not be representative of material costs and labor rates in the geographic area where the Bold & Gold® treatment cells will be constructed since the exact location is unknown.

The proposed cost to construct a five-acre Bold & Gold® treatment cell is $4,500,000.00. This estimate includes the labor, equipment and materials for the following:

1. Excavate the existing soil in the designated five-acre area. Utilize the excavated material to build a berm around the treatment cell. Grade the excavated area to prepare for material installation.
2. Install a 30-mil impermeable PVC liner in the treatment cell. The liner will cover the bottom and embankments of the filtration cell.
3. Install the underdrain system to include HDPE perforated pipe, washed #57 stone and a 6-ounce non-woven filter fabric.
4. Install twenty-four thousand and two hundred (24,200) cubic yards of Bold & Gold® CTS media on the bottom of the treatment cell. The Bold & Gold® media will be installed in a three-foot thick layer.
5. Install four-thousand eight hundred and forty (4,840) cubic yards of clean sand over the Bold & Gold® CTS media. The sand will be free of organics and have a permeability greater than or equal to the Bold & Gold®. The sand will be installed in a six-inch thick layer.
6. Install sod on the embankment of the treatment cell. The bottom of the cell will be left natural with the sand cover.
7. Connect the inflow and outflow conveyance systems to the Bold & Gold® treatment cell. Test the system for performance to include flow, leaks and operation.

Total Cost to Construct Fifteen Five-Acre Bold & Gold® Treatment Cells:	$ 67,500,000.00
MS Level Engineer for Design and Construction Management:	$ 80,000.00
Security Fencing Around 110 Acre Treatment Cells:	$ 105,000.00
Cost to Construct Proposed Onsite Stormwater Treatment Pond:	$ 50,000.00
Monitoring Costs:	$ 80,000.00
Total Proposed Project Cost:	**$ 67,815,000.00**

B. Land (including components under Item III)

No estimate included in the cost. Approximately 130 acres are required.

VIII Operations and Maintenance (Annual)

The service life of the Bold & Gold® Filtration media is determined based on the concentration of influent Soluble Reactive Phosphate (SRP), the volume of influent water, the volume of the filter media, and the flow rate. For the Bold & Gold® CTS Filtration media, the estimation for the life expectancy is based on the rate of removal of SRP, which is 0.2 mg per gram of media. For this project it is estimated be 50 years.

The filter will need weekly inspection. Inspections are to insure there is flow through the filters. Nevertheless, there is a possible need for pipe replacement though infrequent.

It is assumed that the water is delivered to the filter treatment site, thus no operating and maintenance costs is associated with the delivery.

Birds are attracted to the area and if a wildlife viewing station or area is established, there is a need for trash management.

A. Labor

Based on 8 hours per week and $40 per hour for inspections. $16,640 per year

B. Materials

There is no need to replace the media, a design life of 50 years is expected.

i. Acquisition

ii. Management

iii. Disposal

C. Residuals

None to manage, thus no cost

D. Power

No power cost for the filters.

E. Fuel

No fuel cost.

F. Monitoring or Other

Monitoring of the B&G CTS performance has been done in the past. It is anticipated that monitoring of the influent and effluent will be done for this project. Flow rate (treatment rate) was monitored in the past as well. Monitoring points are the point of influent to the filters as well as effluent is typically done, and the cost of the sampling ports have been included in the construction cost.

BUDGET COSTS

C-43 RESERVOIR

1May2020

BUDGETARY QUOTATION:

We make the following comments regarding the pricing attached on the following page.
Our own supply of ElectroCoagulation equipment is accurate at this point in the process regarding our normal scope of supply and related costs and items that are handled by others.

The costing for the balance of the equipment, building, clarifying and thickening equipment is an educated estimate from an excellent contractor, Wharton Smith, Inc., who participates in large scale municipal and industrial projects so am confident we are in the ballpark with the size and scope of the project. The budget pricing was in response for orders of magnitude for a structure to house the EC units and clarify and thicken the treated water and removed solids. Some roadwork around the building and clarifiers as well as some pumping equipment is included in the cost estimate. t

Respectfully submitted,

Gerber Pumps International, Inc.
Bert Gerber, PE MSE
President

CC: Scott Powell
President, Powell Water Systems, Inc.

GPI GERBERPUMPS international inc.

QUOTATION SUMMARY

Powell Water

Budget Prices based on May 2020

Item #	Description	Qty	Unit Cost	Total
1	ElectroCoagulation units GPiECpw_M_3600_10-sec HRT	36	$2,157,620	$77,674,320
2	Miscellaneous - Feed & CIP tanks	36	$30,000	$1,080,000
			Sub Total ECpw	**$78,754,320**
	Contractor Estimate for Preliminary "Rough" Scope			
3	Metal Building with raised structural mezzanine for EC support, Hurricane rated (1850' x 140' x 25')	1	$25,229,431	$25,229,431
4	Clarifiers: 250' Dia. Rated 52 MGD ea.	1	$18,211,359	$18,211,359
5	Thickeners & Dewatering (GBTs & Centrifuges)	1	$4,774,787	$4,774,787
6	Electrical and I&C	1	$13,668,282	$13,668,282
7	Site Work & Piping	1	$7,717,156	$7,717,156
			Sub Total GC	**$69,601,015**
	Additional Estimates:			
8	Roads - $6/sq foot	20 ft wide	$120	per ft length
	Options (Solids Separation):			
9	5 Star Disk Filter (replace clarifiers) (Will Require smaller thickeners for backwash solids)	36	$292,000	$10,512,000
10	Huesker Dewatering bags	5 / Da.	$1,500 / bag	
11	Slow Rate Sand Filters 465 ft x 465 ft	3	**?**	