JonesEdmunds

INDIAN RIVER LAGOON STORMWATER CAPTURE AND TREATMENT PROJECT DEVELOPMENT AND FEASIBILITY STUDY UPDATE

St. Johns River Water Management District | June 2024

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Prepared for:

St. Johns River Water Management District

4049 Reid Street

Palatka, Florida 32178

Prepared by:

Jones Edmunds & Associates, Inc.

13545 Progress Boulevard, Suite 100

Alachua, Florida 32615

and

Tetra Tech, Inc.

1353 North Courtenay Parkway, Suite S

Merritt Island, FL 32953

Jones Edmunds Project No.: 19750-074-01

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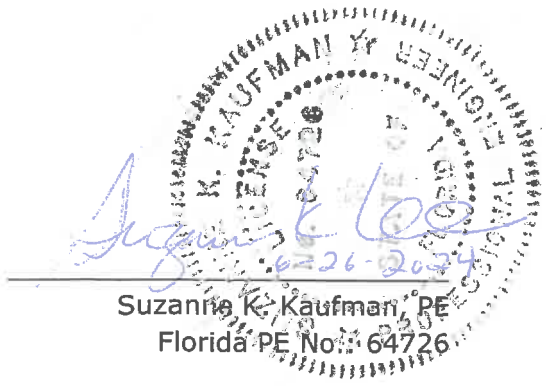

Suzanne K. Kaufman, PE

Florida PE No.: 64726

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INTRODUCTION

This report evaluates the feasibility of potential stormwater capture projects aimed at enhancing the ecological well-being of the Indian River Lagoon (IRL) system. A feasibility study conducted by Jones Edmunds in 2017 titled *Indian River Lagoon Stormwater Capture and Treatment Preliminary Feasibility Analysis* outlined regional-scale stormwater treatment projects targeting a reduction of nutrient load to the IRL by 25,000 to 100,000 pounds (lbs) of total nitrogen (TN) annually. This 2024 study, in partnership with the St. Johns River Water Management District (SJRWMD), focuses on identifying local- to medium-scale projects with the aim of further decreasing annual nutrient and sediment loading to the IRL within the range of 5,000 to 25,000 lbs of TN. The primary objective of this report is to provide adequate information to identify and prioritize stormwater capture and treatment projects within the IRL watershed that could be implemented in the near future pending availability of funds. The stormwater management and nutrient reduction projects identified in this report align with priorities identified in the "Indian River Lagoon Protection Program" (Governor DeSantis Executive Order 23-06), goals of the Central Indian River Lagoon Basin Management Action Plan (Florida Department of Environmental Protection, 2021), strategies outlined in SJRWMD's 2024-2028 Strategic Plan, and the "Level 1 - Critical Health Concern" priorities identified in the IRL Comprehensive Conservation and Management Plan – Looking Ahead to 2030 (IRL National Estuary Program, 2019).

BACKGROUND

The IRL stands as one of North America's most diverse and productive estuary systems, holding significant economic value in Florida's marine ecosystem. Historically, canal systems were constructed, offering flood protection, but diverting additional stormwater and freshwater to the IRL. These diversions have led to increased nutrient (TN and total phosphorus [TP]) and sediment loading, and excess freshwater inputs to the IRL while reducing flow to the St. Johns River. Over recent decades, numerous projects have been implemented to mitigate nutrient and sediment loadings to the IRL and restore historical flows back to the St. Johns River. Effectively capturing and treating stormwater is critical for the long-term health of this estuary. The identification and implementation of beneficial projects in key locations across the IRL watershed continues to be an important effort toward lagoon restoration.

FEASIBILITY STUDY

The 2017 study included developing an existing conditions report and an analysis of contributing watersheds and the receiving water response. This 2024 study consisted of the following major tasks:

- Reviewing projects recommended in 2017 and revising conceptual designs and associated costs. Some of the projects from 2017 that have not yet been implemented still held potential for great benefit to the IRL. Previous projects were reviewed with SJRWMD, who recommended two areas to revisit and update conceptual ideas in the

area. Updating designs for two previous project areas included new treatment technology and evaluating the potential for alternative methods of delivery.

- Interviewing up to four local government entities to discuss local-scale stormwater treatment plans and for input on concepts generated during this study. Stakeholders offered insightful feedback and assisted with direction during project conceptualization.
- Screening potential stormwater capture and treatment projects for evaluation. A desktop evaluation was performed across the IRL drainage areas with the goal of identifying areas that may be used for stormwater projects in the future which would benefit the IRL. Evaluation considered spatial data such as topography, land use, soils, hydrography, parcel ownership, proximity to a conveyance to the IRL, as well as known stakeholder planning information.
- Evaluating the results of the screening process to determine areas for focus during project conceptualization. Evaluation metrics included ease of construction, rough magnitude of conceptual costs, and nutrient reduction benefits to the IRL.
- Developing a final feasibility study that included conceptual designs, planning-level costs, and projected benefits for multiple alternative projects at eight selected areas within the IRL watershed.
- Prioritizing project alternatives at each site and providing recommendations for progressing into detailed design and implementation.

RESULTS

In this feasibility assessment, the project team identified and screened 30 local- to medium-scale projects that will benefit the IRL. Many of these projects involve using land owned by cities, counties, or SJRWMD. Out of the 30 projects identified, SJRWMD staff chose to further evaluate eight. Solutions are scalable when space and ability to increase treatment capacity are feasible. Multiple alternatives were considered at each of these locations. A project alternative that references biosorptive activated media (BAM) as a design element implies that any locally sourced or commercially available nutrient reducing media may be considered.

Included in the list below are two projects that were re-evaluated from the 2017 study (Sottile Canal Flow Restoration and C-1 Canal Baseflow Treatment). The following 10 projects are listed in geographic order from north to south.

- Chain of Lakes Enhanced Nutrient Reduction: The Chain of Lakes system in Brevard County is a regional-scale series of stormwater treatment ponds. Considered alternatives included construction of a treatment wetland on purchased land adjacent to the Chain of Lakes, as well as in-bank, BAM systems to further treat stormwater collected from an urban area before it enters the IRL.
- North Merritt Island Mosquito Impoundment Nutrient Reduction: Brevard County controls a mosquito impoundment on Sykes Creek in North Merritt Island. The evaluated alternatives involve pumping water from Sykes Creek and treating it via a pumped underground denitrification system on site and returning treated water back to the creek. These project alternatives treat water from a large, natural land use contributing area with a high removal efficiency.
- Horse Creek Water Quality Improvements: Canal water flows through a pond system at Wickham Park in Brevard County before discharging to Horse Creek and eventually the

IRL. This proposed project pumps pond water through an underground denitrification facility on park grounds. Treated water with a lowered nutrient load discharges downstream to the creek system.

- Eau Gallie River Mouth Water Quality Improvements: The nearly 4-mile-long Eau Gallie River drains a 5,900-acre basin including an interconnecting ditch system and the Melbourne Orlando International Airport. The proposed alternatives in this area involve pumping canal water through a denitrification facility before discharging treated water back to the canal and eventually Elbow Creek, a tributary to the Eau Gallie River. These project alternatives lower nutrient loading with a small footprint and an efficient removal process.
- Crane Creek Offline Treatment: An existing bermed area that is part of land owned by the City of Melbourne at the Grant Street Wastewater Treatment Plant is proposed for stormwater treatment for canal water flowing into Crane Creek. The evaluated project alternatives treat canal water either by a wet detention area followed by a polishing BAM system or by a pumped denitrification facility before discharging back to the canal.
- C-1 Canal Baseflow Treatment (re-evaluated from the 2017 study): The C-1 Canal in Brevard County is an agricultural canal constructed to drain portions of the Upper St. Johns River Basin (USJRB) to the IRL. The evaluated alternatives at this site propose pumping canal water through a treatment facility before discharging back to the canal. Considered treatment facilities include an offline wet detention pond followed by a BAM filter for increased nutrient reduction and pumped underground denitrification facilities.
- Sottile Canal Flow Restoration (re-evaluated from the 2017 study): The project alternatives at this site involve installing an operable weir on the Sottile Canal in Brevard County, constructing a water management area (WMA), and diverting stormwater and baseflows to the WMA for treatment before being conveyed to the Three Forks Marsh Conservation Area (TFMCA) and ultimately the St. Johns River. The project alternatives reduce freshwater discharges and nutrient and sediment loads to the IRL and restore historic flows to USJRB.
- Micco Water Management Area Improvements: The project concepts considered at the Micco WMA in Brevard County, owned by SJRWMD, include retrofitting an existing stormwater pond by adding a series of baffles. Increasing the tortuosity and residence time within the pond will remove short-circuiting of flow and reduce nutrient loads to the IRL. A pumped denitrification facility was also considered at this location.
- South Prong St. Sebastian River Stormwater Treatment: Indian River County owns a 41-acre parcel adjacent to the South Prong of the St. Sebastian River. This area is proposed to be used for stormwater treatment of the surrounding residential neighborhood by constructing a wet detention pond, which may also be followed by a BAM filtration system. The two project alternatives will reduce nutrient loading to the river and ultimately the IRL.
- Fellsmere Offline Treatment: The City of Fellsmere is drained by a series of canals that connect to the St. Sebastian River and eventually the IRL. The proposed projects in this area involve constructing a treatment wetland on City property that will treat water from an existing canal or further treat discharges from an existing City stormwater pond. A small, pumped denitrification facility was also considered at a separate City-owned pond. In both cases, treated water will be returned to the canal system with a lowered nutrient load.

The project team evaluated benefits of the above project concepts, as well as planning-level estimates of capital and operation and maintenance (O&M) costs (including replacement costs). We used these costs to develop an estimate of the annualized project cost based on the expected design life of each of the major components of the system. Table ES-1 summarizes the approximate water quality improvement benefits of these projects, and Table ES-2 provides the estimated costs.

Table ES-1 Nutrient Load Reduction of Evaluated Projects

Project Name		Annual Flow Treated (MGD)	TN Reduction (lb/year)	TP Reduction (lb/year)
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	0.6	900	80
	Alt 2	1.7	1,400	150
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	12.9	5,000	800
	Alt 2	12.9	5,000	800
Horse Creek Water Quality Improvements	Alt 1	3.2	1,000	100
Eau Gallie River Mouth Water Quality Improvements	Alt 1	3.2	8,000	1,000
	Alt 2	3.2	12,000	2,000
	Alt 3	3.2	12,000	2,000
Crane Creek Offline Treatment	Alt 1	3.2	5,000	300
	Alt 2	3.2	8,000	300
C-1 Baseflow Treatment	Alt 1	12.9	13,000	1,200
	Alt 2	12.9	27,000	1,000
	Alt 3	12.9	27,000	1,000
Sottile Canal Flow Restoration	Alt 1	3.9*	29,000	6,100
	Alt 2	3.9*	29,000	6,100
Micco Water Management Area Improvements	Alt 1	32.2	13,000	6,000
	Alt 2	32.2	40,000	11,000
	Alt 3	6.5	20,000	4,000
South Prong St. Sebastian River Stormwater Treatment	Alt 1	3.2	1,000	200
	Alt 2	3.2	3,000	300
Fellsmere Offline Treatment	Alt 1	0.4	1,000	100
	Alt 2	1.6	3,000	300

* Flow treated and restored to the USJRB.

Note: MGD = Million Gallons per Day.

Table ES-2 Summary of Project Costs

Project Name		Capital Costs (2023 dollars)	Annual O&M Cost (2023 dollars)	Annualized Project Costs
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	$3.5M	$0.2M to $0.3M	$0.3M to $0.4M
	Alt 2	$1.8M	$13,000	$70,000 to $80,000
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$39.2M	$2.3M to $3.1M	$3.5M to $4.6M
	Alt 2	$41.7M	$2.4M to $3.2M	$3.6M to $4.7M

Project Name		Capital Costs (2023 dollars)	Annual O&M Cost (2023 dollars)	Annualized Project Costs
Horse Creek Water Quality Improvements	Alt 1	$8.9M	$0.5M to $0.6M	$0.8M to $1.0M
Eau Gallie River Mouth Water Quality Improvements	Alt 1	$11.1M	$0.5M to $0.7M	$0.9M to $1.1M
	Alt 2	$9.9M	$0.5M to $0.7M	$0.8M to $1.0M
	Alt 3	$9.4M	$0.5M to $0.6M	$0.8M to $1.0M
Crane Creek Offline Treatment	Alt 1	$4.2M	$0.2M	$0.3M to $0.4M
	Alt 2	$8.7M	$0.5M to $0.6M	$0.8M to $1M
C-1 Baseflow Treatment	Alt 1	$17.5M	$0.3M to $0.4M	$0.8M to $1M
	Alt 2	$35.6M	$2M to $3M	$3M to $4M
	Alt 3	$35.4M	$2M to $3M	$3M to $4M
Sottile Canal Flow Restoration	Alt 1	$48.8M	$0.8M to $1.4M	$2.3M to $3.2M
	Alt 2	$48.3M	$0.9M to $1.4M	$2.3M to $3.1M
Micco Water Management Area Improvements	Alt 1	$3M	$7,000 to $13,000	$0.1M
	Alt 2	$9.1M	$12,000 to $32,000	$0.3M to $0.4M
	Alt 3	$16.2M	$0.9M to $1.2M	$1.4M to $1.9M
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$24.7M	$19,000 to $21,000	$0.8M to $0.9M
	Alt 2	$30.6M	$0.6M	$1.5M to $1.8M
Fellsmere Offline Treatment	Alt 1	$3.0M	$22,000	$0.1M
	Alt 2	$5.0M	$0.3M	$0.4M to $0.5M

The project team used the annual water quality improvement benefits from Table ES-1 and the annualized project costs from Table ES-2 to calculate annual cost-benefit ratios for the nutrient reductions. Table ES-3 summarizes annual costs for the TN and TP removal. These cost-benefit results show a significant variation in the annual cost per pound of TN and TP reductions to the IRL.

Table ES-3 Cost-Benefit Analysis Summary

Project Name		Annual Project Cost-Benefit (2023 dollars)	
		TN Reduction Cost-Benefit ($/lb TN)	TP Reduction Cost-Benefit ($/lb TP)
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	$333 to $444	$3,750 to $5,000
	Alt 2	$50 to $57	$467 to $533
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$700 to $920	$4,375 to $5,750
	Alt 2	$720 to $940	$4,500 to $5,875
Horse Creek Water Quality Improvements	Alt 1	$800 to $1,000	$8,000 to $10,000
Eau Gallie River Mouth Water Quality Improvements	Alt 1	$113 to $138	$900 to $1,100
	Alt 2	$67 to $83	$400 to $500
	Alt 3	$67 to $83	$400 to $500
Crane Creek Offline Treatment	Alt 1	$60 to $70	$1,000 to $1,167
	Alt 2	$94 to $120	$2,500 to $3,200

Project Name		Annual Project Cost-Benefit (2023 dollars)	
		TN Reduction Cost-Benefit ($/lb TN)	TP Reduction Cost-Benefit ($/lb TP)
C-1 Baseflow Treatment	Alt 1	$62 to $77	$667 to $833
	Alt 2	$111 to $148	$3,000 to $4,000
	Alt 3	$111 to $148	$3,000 to $4,000
Sottile Canal Flow Restoration	Alt 1	$79 to $110	$377 to $525
	Alt 2	$79 to $107	$377 to $508
Micco Water Management Area Improvements	Alt 1	$8 to $9	$17 to $20
	Alt 2	$7 to $9	$26 to $34
	Alt 3	$70 to $95	$350 to $475
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$800 to $900	$4,000 to $4,500
	Alt 2	$500 to $600	$5,000 to $6,000
Fellsmere Offline Treatment	Alt 1	$110 to $130	$1,100 to $1,300
	Alt 2	$133 to $167	$1,333 to $1,667

Based on the project team's review of the project costs, benefits, and feedback from SJRWMD and other stakeholders, we recommend implementation of the highest priority projects first, followed by medium, and then lower priority projects, if desired. Prioritization of projects are described below:

- High-Priority Implementation:
  - Eau Gallie River Mouth Water Quality Improvements Alternative 3 will take advantage of a canal passing through the project area, removing the need for a lengthy pipe system. This alternative is sited on a parcel owned by the City of Melbourne but may be shifted onto the adjacent parcel owned by the Melbourne Airport Authority as a secondary alternative. This project has a low cost-benefit ratio, showing its treatment efficiency.
  - Crane Creek Offline Treatment Alternative 1, which involves wet detention followed by a BAM filter, is recommended in the City of Melbourne. Capital costs and nutrient removal are in the mid-range for this project, which has the support of the City of Melbourne.
  - Micco Water Management Area Improvements Alternative 2 has the largest nutrient-load reduction to the IRL of the three assessed alternatives. Adding gabion baffles greatly increases the load reduction over the earthen berm proposed as Alternative 1, with a low cost per pound of TN removed. This project involves retrofitting a stormwater pond on SJRWMD-owned land.
- Medium-Priority Implementation:
  - Chain of Lakes Enhanced Nutrient Reduction Alternative 2 is recommended for this area in Brevard County. A constructed wetland will reduce nutrient loading to the IRL for a favorable cost-benefit ratio. Further, the construction footprint is on SJRWMD-owned land.
  - C-1 Canal Baseflow Treatment Alternative 1 is recommended. This project involves purchasing a privately-owned parcel adjacent to the C-1 Canal for construction of an

offline wet detention pond and additional BAM treatment area. This alternative is preferred because of cost considerations and relative ease of construction.

- Sottile Canal Flow Restoration Alternative 2 is the recommended solution since the proposed WMA area and location of the force main is preferential to that proposed as part of Alternative 1. This project will reduce freshwater flows to the IRL and restore flow to the USJRB by 3.9 MGD. While load reductions for Alternative 1 and 2 are the same, capital costs for Alternative 2 are slightly lower than for Alternative 1.
- Fellsmere Offline Treatment Alternative 1 is recommended over Alternative 2 since it is supported by the City, who favors construction of a treatment wetland on a parcel they own. This solution will reduce nutrient loading to the IRL.

- Lower-Priority Implementation

  - Alternative 1 for the North Merritt Island Mosquito Impoundment area project concept is preferred over Alternative 2 since it uses less pumped pipe length. Both alternatives are not as favorable as others concepts due to high capital costs and high cost-benefit ratio. Both of these alternatives also require coordination with Brevard County Mosquito Control, who controls the impoundment water levels.
  - Alternative 1 and other concepts evaluated in the Horse Creek area resulted in low nutrient load reductions. These project concepts and others may be pursued by SJRWMD and Brevard County in the future if warranted or desired.
  - The South Prong St. Sebastian River Stormwater Treatment Alternative 1 is recommended over Alternative 2 but is lower priority than other projects because of its high capital and O&M cost and high nutrient-load reduction cost per pound. In addition, Indian River County may be unable to use the property for stormwater treatment since there is a management plan in place that may exclude such land use.

Table ES-4 summarizes recommendations for the 10 evaluated projects. The priority assigned to each is based on factors such as capital cost, cost-benefit, ease of implementation, availability of land, and opportunities to partner with local stakeholders. The table shows the preferred project alternative geographically listed from north to south for each priority class.

Table ES-4 Summary of Project Recommendations

Project Name		Capital Costs (2023 dollars)	TN Reduction (lb/year)	TP Reduction (lb/year)	Priority
Eau Gallie River Mouth Water Quality Improvements	Alt 3	$9.4M	12,000	2,000	High
Crane Creek Offline Treatment	Alt 1	$4.2M	5,000	300	High
Micco Water Management Area Improvements	Alt 2	$9.1M	40,000	11,000	High
Chain of Lakes Enhanced Nutrient Reduction	Alt 2	$1.8M	1,400	150	Medium
C-1 Baseflow Treatment	Alt 1	$17.5M	13,000	1,200	Medium

Project Name		Capital Costs (2023 dollars)	TN Reduction (lb/year)	TP Reduction (lb/year)	Priority
Sottile Canal Flow Restoration	Alt 2	$48.3M	29,000	6,100	Medium
Fellsmere Offline Treatment	Alt 1	$3.0M	1,000	100	Medium
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$39.2M	5,000	800	Low
Horse Creek Water Quality Improvements	Alt 1	$8.9M	1,000	100	Low
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$24.7M	1,000	200	Low

1 INTRODUCTION

The Indian River Lagoon (IRL) stands as one of North America's most diverse and productive estuary systems, holding significant economic value in Florida's marine ecosystem. Historically, canal systems were constructed, offering flood protection while resulting in the diversion of additional stormwater and freshwater to the IRL. These diversions have led to increased nutrient (total nitrogen [TN] and total phosphorus [TP]) and sediment loading and excess freshwater inputs to the IRL while reducing flow to the St. Johns River. Over recent decades, numerous projects have been implemented to mitigate nutrient and sediment loadings to the IRL and restore historical flows back to the St. Johns River. Effectively capturing and treating stormwater is critical for the long-term health of this estuary. The identification and implementation of beneficial projects in key locations across the IRL watershed continues to be an important effort towards lagoon restoration.

Over the past century, multiple canal systems were constructed that divert freshwater runoff to the IRL. Many of these canals were excavated to drain marshlands, thereby facilitating agricultural development in the nutrient-rich Upper St. Johns River (USJRB) floodplain and enhancing drainage for flood protection. As Florida's population increased, much of this agricultural land transitioned to residential and commercial uses. These new, more intensive uses rely heavily on the canal infrastructure to provide flood protection and stormwater flows. Although effective at providing flood protection, canal diversions to the IRL came with an ecological price: increased nutrient, sediment, and freshwater loading to the IRL and decreased flows to the St. Johns River. Work within the St. Johns River Water Management District (SJRWMD) to restore the IRL is ongoing and has already made significant improvement.

A study in partnership with the SJRWMD conducted by Jones Edmunds in 2017 titled *Indian River Lagoon Stormwater Capture and Treatment Preliminary Feasibility Analysis* outlined regional-scale stormwater treatment projects targeting a reduction of annual TN nutrient loading to the IRL by 25,000 to 100,000 lbs. This 2024 study builds on the 2017 study and focuses on identifying local- to medium-scale projects with the aim of further decreasing nutrient and sediment loading to the IRL within the annual TN range of 5,000 to 25,000 lbs. The primary objective of this report is identifying and prioritizing stormwater capture and nutrient reduction treatment projects within the IRL watershed that could be implemented in the near future (pending funding availability).

2 2017 PROJECT UPDATES

The 2017 study resulted in the conceptual design of eight recommended stormwater capture and treatment projects, some with multiple alternative designs at each site. This chapter revisits two of the previously recommended projects and evaluates alternative designs. Based on discussions with SJRWMD, Jones Edmunds has developed additional design alternatives for the C-1 Baseflow Treatment project and the Sottile Canal Flow Restoration project.

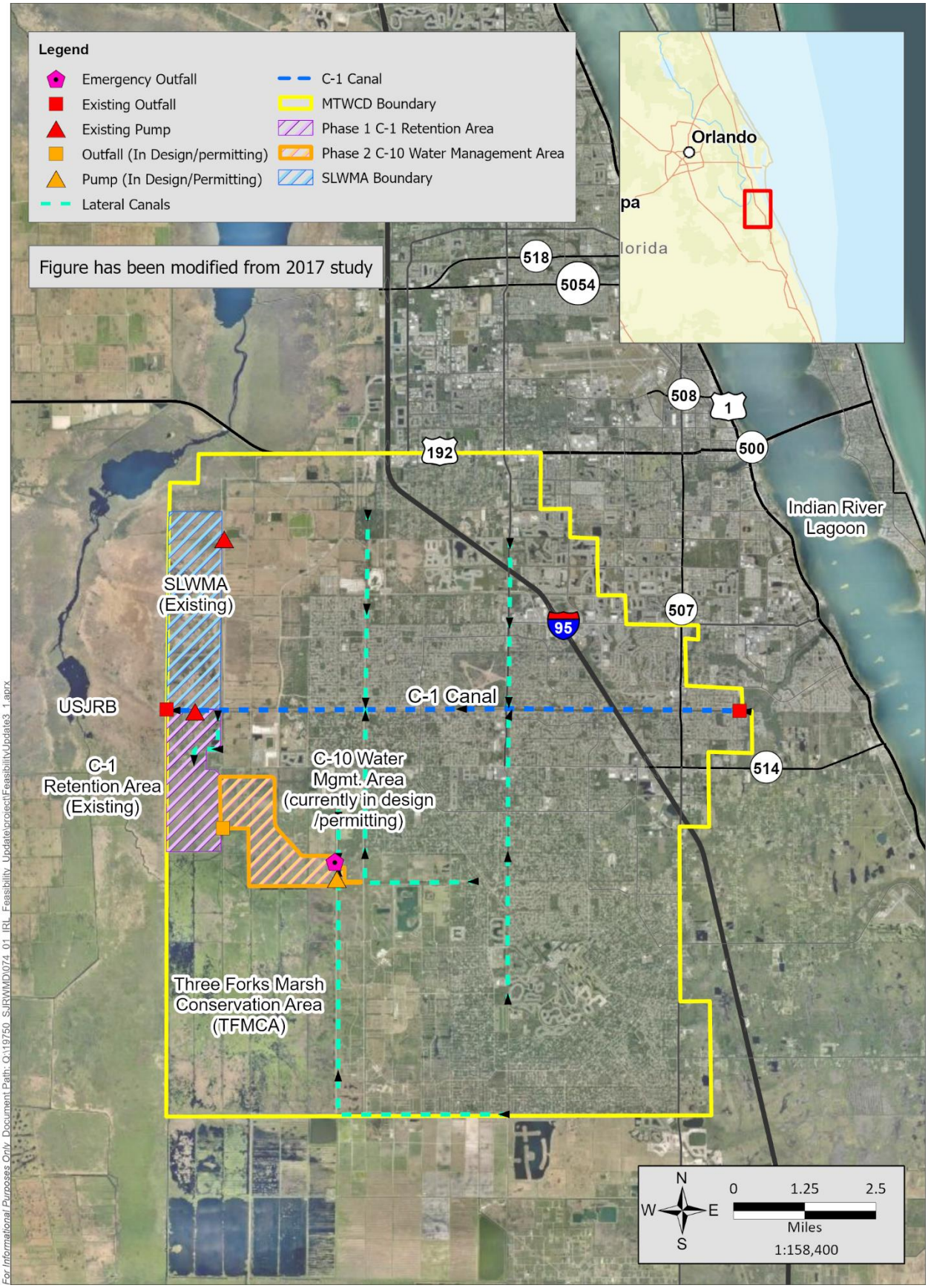
2.1 C-1 BASEFLOW TREATMENT

2.1.1 PROJECT OVERVIEW

The C-1 Canal is an agricultural canal constructed in the 1920s to drain portions of the USJRB to the IRL. The initial purpose of the canal was to reclaim land for agricultural development. Currently, C-1 Canal conveys stormwater flows from the Melbourne Tillman Water Control District (MTWCD) to Turkey Creek and the IRL. Historically, this area drained to the USJRB. The C-1 Canal drains predominantly industrial, commercial, and residential areas. Approximately 64,500 acres drain to C-1 Canal from more than 160 miles of canals throughout the MTWCD.

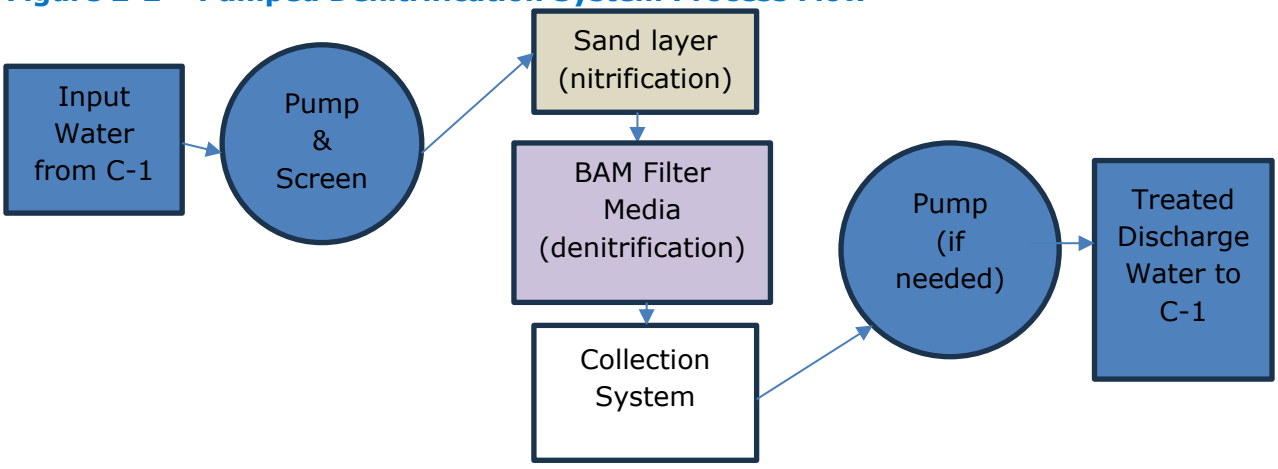
Significant flow from the C-1 Canal has already been restored back to USJRB through the C-1 Canal Rediversion Project, also known as C-1/Sawgrass Lake Water Management Area Project (C-1/SLWMA), which was constructed by SJRWMD. Additional flow restoration is planned as a subsequent phase to C-1/SLWMA with design and future construction of the C-10 WMA. Figure 2-1 shows the general location of the C-1 Canal and the referenced projects.

Figure 2-1 C-1 Baseflow Treatment – General Location



The C-1 Canal project alternatives analyzed in the 2017 study are intended to provide water quality treatment to base flows that continue to drain to Turkey Creek and the IRL. The 2017 study included a project alternative that involved an offline stormwater treatment train with a pumped denitrification filtration system using biosorptive activated media (BAM) to remove TN and TP. For this update, we propose two additional alternatives using pumped denitrification systems similar to the 2017 study. Project benefits include reductions in sediment and nutrient loads to the IRL. Figure 2-2 shows the general flow through a pumped denitrification system.

Figure 2-2 Pumped Denitrification System Process Flow



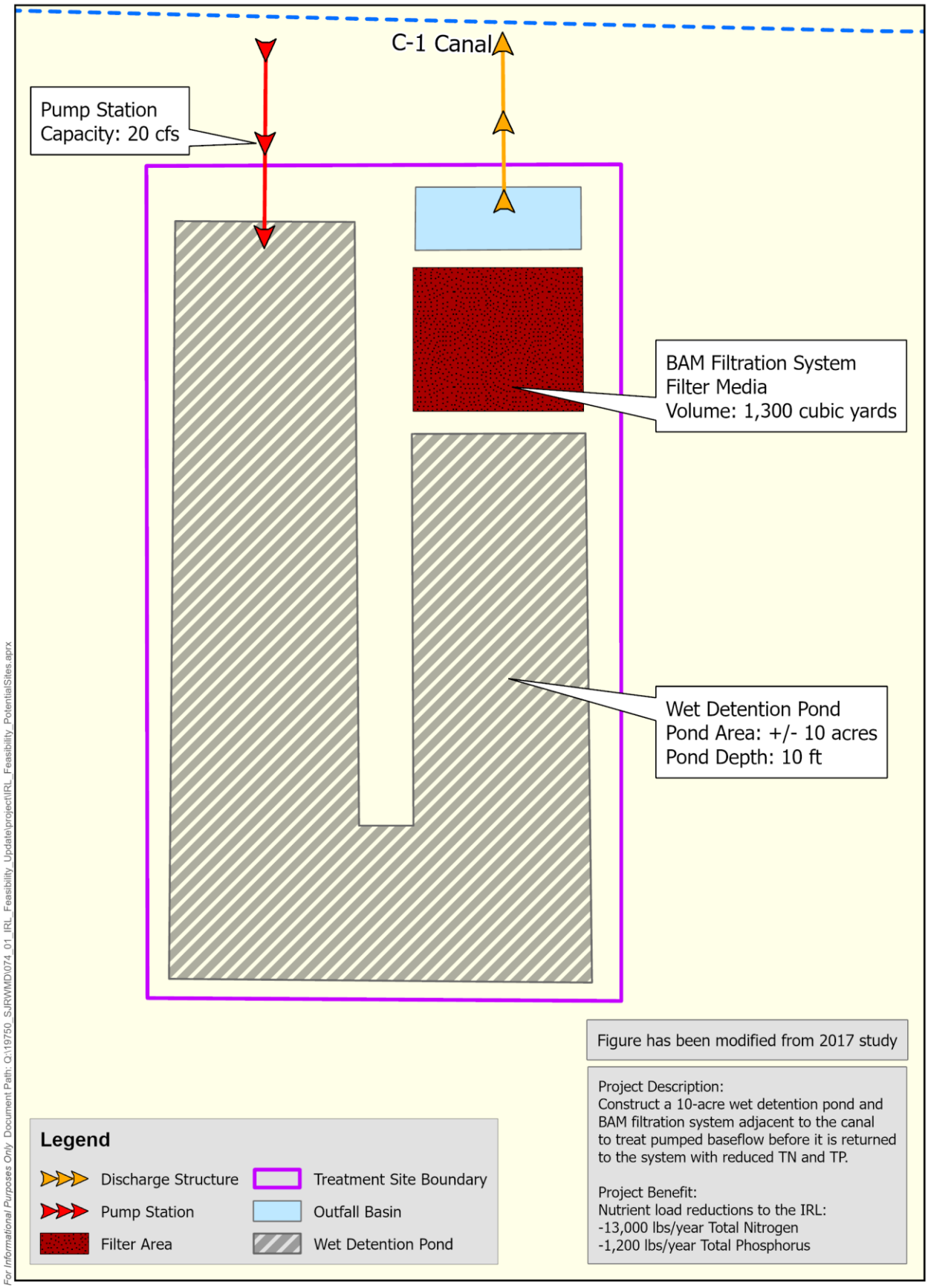
The 2017 effort included reviewing water quality grab samples available from the Florida Department of Environmental Protection (FDEP) and SJRWMD within the canal to determine an average baseflow concentration; for this update, data spanning the period of record since the 2017 study were reviewed and it was confirmed that the 2017 assumptions are still representative for this 2024 study. The calculated average annual concentrations from these data in the C-1 Canal are 0.89 mg/L TN, 0.04 mg/L TP, and 4.84 mg/L total suspended solids (TSS). We used these concentrations to calculate pollutant loading to the proposed treatment train and the estimated pollutant-load reductions based on a continuous maximum flow rate of 20 cfs to the system.

2.1.2 Conceptual Project Layout and Design

2.1.2.1 Alternative 1

Alternative 1, originally suggested in the 2017 study, may still be a feasible project option. This alternative is composed of an offline treatment system in the vicinity of the C-1 Canal. A privately-owned parcel would need to be purchased for implementation of this alternative. The treatment system will pump 20 cfs (12.9 MGD) of water continuously from the C-1 Canal into an approximately 10-acre wet detention pond. This pond will most likely need to be lined to reduce losses through infiltration. The water will move through the wet detention pond and enter a BAM filtration system, where denitrification will occur. Once the water has left the BAM filter, it will be discharged back into the C-1 Canal through an outfall basin. Figure 2-3 presents a layout of the system.

Figure 2-3 C-1 Canal Baseflow Treatment – Alternative 1



The treatment train proposed as this alternative consists of two main elements: a wet detention pond and a BAM filtration system. The proposed lined wet detention pond was sized with a mean residence time of 2.5 days, a total footprint of approximately 10 acres, and a depth of 10 feet. With a residence time of 2.5 days, removal efficiencies for TN and TP were calculated to be 16 percent and 47 percent, respectively, from efficiency curves presented in FDEP's *Evaluation of Current Stormwater Design Criteria Within the State of Florida* (June 2007).

The BAM filtration system was sized to have an empty bed contact time (EBCT) of 29 minutes based on the design of similar treatment systems. At a constant flow rate of 20 cfs, 1,300 cubic yards of BAM will be required to achieve this EBCT. According to the findings presented in the Florida Department of Transportation (FDOT) report, *Demonstration Bio Media for Ultra-urban Stormwater Treatment,* May 2014, Bold & Gold BAM filtration columns with an EBCT in this range produced removal efficiencies of 26 percent for TN and 52 percent for TP. If the treatment train were loaded at the constant flow rate of 20 cfs with the 29-minute EBCT, the filter alone could produce load reductions of 9,000 lbs of TN and 800 lbs of TP per year. While Bold & Gold media is referenced here, other types of BAM or nutrient reducing media are commercially available and may be considered for this and other similar stormwater treatment project alternatives described within this report.

With the wet detention pond and BAM filtration system, we estimate that the treatment train will remove a total of 13,000 lbs of TN and 1,200 lbs of TP per year.

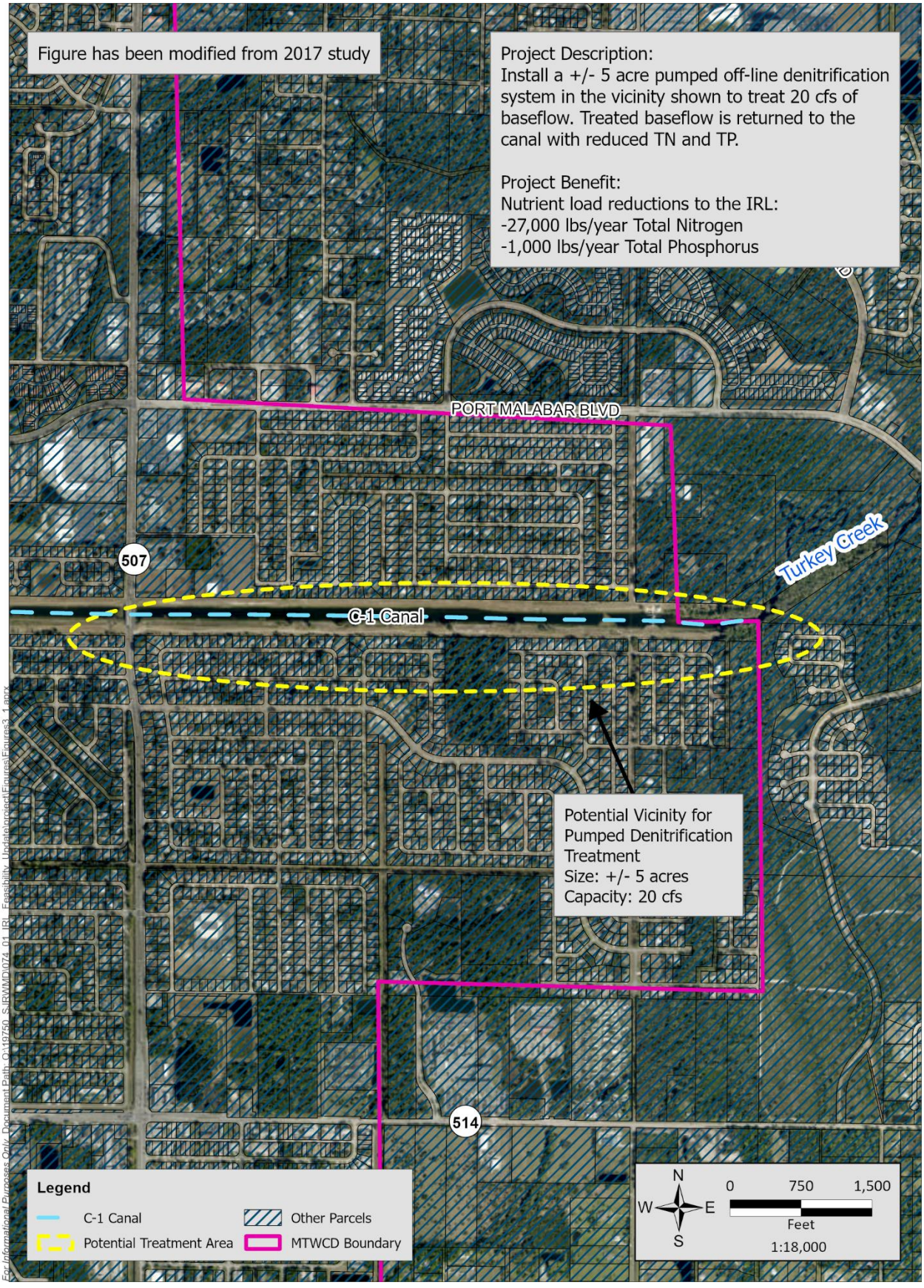
2.1.2.2 Alternative 2

Alternative 2 involves purchasing all or part of a parcel adjacent to the C-1 Canal and constructing a pumped downflow denitrification system, as shown in Figure 2-2. One benefit of this system is that a high level of treatment can be achieved in a relatively small footprint. The treatment system would include pumping approximately 20 cfs of water (similar to Alternative 1) from the C-1 Canal continuously through a 5-acre treatment facility consisting of a layer of sand for nitrification above a layer of BAM for denitrification and phosphorus adsorption. The flow will be collected by an underdrain and discharged to the C-1 Canal. The difference between this system and that proposed in Alternative 1 is that a smaller footprint can be used for greater treatment, albeit more costly.

2.1.2.3 Alternative 3

Alternative 3 is similar to Alternative 2 in that 20 cfs of flow is being pumped through a denitrification system. However, in this case, the denitrification system is proposed to be installed underground along the south side of the C-1 Canal, within the MTWCD right-of-way. The layout of the 5-acre media portion would stretch along the bank from SR-507 to the MTWCD control structure 1 mile to the east. The same treatment concepts apply here, with water being pumped from the canal through a nitrification layer first, and then flowing down through the denitrification layer, and collected by an underdrain perforated pipe. It may be possible to return the effluent to the canal by gravity flow, assuming sufficient head, which would be determined during the preliminary design phase. Figure 2-4 shows the vicinity of Alternatives 2 and 3. SJRWMD had a preliminary discussion with MTWCD staff about the potential installation of an underground treatment system within the C-1 Canal right-of-way. Additional follow-up with MTWCD would be required prior to initiating design.

Figure 2-4 C-1 Canal Baseflow Treatment – Alternatives 2 and 3



Since pumped denitrification systems can be configured in numerous ways, design elements for systems like these would need to consider the following:

- Inflow concentrations and quality
- Outfall considerations and whether dissolved oxygen replenishment is needed
- Treatment footprint and profile
- Underdrain hydraulics
- Specific pumping system requirements
- Site aesthetics, access, and maintenance

This type of facility is expected to remove 66 percent of TN and 66 percent of TP from the inflow, based on information from BAM applications and appropriately designed contact time. The BAM filter media is expected to be continuously wet with the pumped canal water. Based on the flow rate and concentrations noted above, the system could reduce the nutrient load by approximately 27,000 lbs of TN and 1,000 lbs of TP per year.

2.1.3 Planning-Level Evaluation

Table 2-1 summarizes the planning-level evaluation for the C-1 Canal Baseflow Treatment Project for Alternatives 1 through 3. Table 2-2 summarizes the land acquisition required for the project, including easement considerations. Easement costs necessary for Alternative 3 are assumed to be 50 percent of market value per acre in this area, per discussion with SJRWMD.

Table 2-1 C-1 Canal Baseflow Treatment Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County, SJRWMD, MTWCD, City of Palm Bay, City of West Melbourne
Land Use/Zoning Issues	Alternative 1 and 2 candidate project sites likely to be zoned Vacant Residential Land Single-Family, Unplatted by Brevard County. Alternative 3 is MTWCD right-of-way.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation and environmental site assessment.
Soil Characteristics	Sandy soils; moderate to well-drained when soil storage capacity is available. A geotechnical analysis is required.
Wetlands and Mitigation	No adverse impacts to wetlands expected. Final design must maintain adequate baseflow to Turkey Creek.
Environmental Contaminants	Environmental assessment is required.
Proximity to Residential Land and Potential Hazard Classification	Candidate project sites for Alternatives 1 and 2 are within close proximity to a residential neighborhood. Public outreach recommended during design.

Table 2-2 C-1 Canal Baseflow Treatment Project Land Acquisition

Alternative	Market Value (Estimated, 2023)
1	$500,000
2	$250,000
3	$62,500 (Easement)

2.1.4 Summary of Benefits

The project team estimated the benefits of the C-1 Canal Baseflow Treatment Project updated alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 2-3 and Table 2-4 summarize the project treatment capacity for Alternatives 1 through 3.

Table 2-3 C-1 Canal Baseflow Treatment – Alternative 1 Project Benefit Summary

Average Annual Flow Treated	12.9 MGD
Average Annual TN Load Reduction to IRL	13,000 lbs
Average Annual TP Load Reduction to IRL	1,200 lbs

Table 2-4 C-1 Canal Baseflow Treatment – Alternatives 2 and 3 Project Benefit Summary

Average Annual Flow Treated	12.9 MGD
Average Annual TN Load Reduction to IRL	27,000 lbs
Average Annual TP Load Reduction to IRL	1,000 lbs

2.1.5 Planning-Level Cost Opinions

The project team developed planning-level opinions of the capital and life cycle costs for the new alternatives. Capital cost opinions were prepared based on cost databases such as the FDOT Construction Contract History, vendor and contractor cost information, and construction cost data from similar recent projects including the Crane Creek M-1 Canal Flow Restoration project currently in construction. Unit costs used in the capital cost opinions are fully "loaded", meaning they account for labor, materials, equipment, markups, contractor overhead, profit, and prime contractor markup of subcontractors. In addition, 10-percent escalation is included to adjust costs to the current planning period (2023). It should also be noted that materials and construction costs are on the rise, and the trend may continue, leading to a drastic change in cost over time.

The Association for the Advancement of Cost Engineering International's Cost Estimate Classification System (Recommended Practice No. 18R-97) provides expected accuracy ranges for various classifications of project cost estimates. The classifications depend on the level of project definition, with Class 1 being the highest level of definition and Class 5 being the lowest level of definition. Based on the level of project definition described in this report,

these cost opinions are considered to be Class 5, defined as having the engineering 0- to 2-percent complete, with a maximum range of accuracy of -50 to +100 percent. Based on this range, 30 percent was added to the cost opinion for miscellaneous and contingency to account for unknown or undefined construction elements. O&M costs were derived from the Florida Stormwater Association Best Management Practice (BMP) Life Cycle Cost Tool. The life cycle costs were evaluated at an economic duration of 60 years for this and all life cycle calculations in this report.

Table 2-5 provides an opinion of planning-level costs for the new alternatives. The most significant driver in the difference of the project costs is amount of BAM required by the design. The most significant driver of O&M and annualized cost is how frequently the BAM may need replaced. Life of the BAM can vary depending on inflow characteristics and type of media. The average standard life of 20 years for media was used in life cycle calculations, which is true for all alternatives and costs described in this report. Costs for the denitrification systems were scaled up by size based on actual construction costs in 2021 of a similar denitrification system, along with actual construction bid costs for pump stations and force mains from the ongoing Crane Creek M-1 Canal Flow Restoration project.

Table 2-5 C-1 Canal Baseflow Treatment Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$17.5M	$0.3M to $0.4M	$0.8M to $1M
Alternative 2	$35.6M	$2M to $3M	$3M to $4M
Alternative 3	$35.4M	$2M to $3M	$3M to $4M

Appendix A provides details of these cost estimates.

2.1.6 Future Water Quality and Flow Monitoring

The project team recommends monthly ambient or baseflow water quality sampling in the C-1 Canal upstream of the MS-1 outfall structure. This should be combined with sampling water quality and flows for several storm events at this site. This monitoring would help better estimate nutrient concentrations in the C-1 Canal before treatment.

2.1.7 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the C-1 Canal Baseflow Treatment Project 2024 alternatives. Table 2-6 and Table 2-7 provide a preliminary planning-level estimate of the approximate timeframe and approximate annual funding requirements for implementing the C-1 Baseflow Treatment Project for Alternatives 1 through 3.

Table 2-6 C-1 Canal Baseflow Treatment Alternative 1 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$0.5M	—	—	—
Land Acquisition and ESA	$0.5M	—	—	—
Survey, Design, and Permitting	—	$1.5M	—	—
Procurement and Construction	—	—	$8M	$7M
Total	**$1M**	**$1.5M**	**$8M**	**$7M**

Table 2-7 C-1 Canal Baseflow Treatment Alternative 2 or 3 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$0.7M	—	—	—
Land Acquisition and ESA	$0.3M	—	—	—
Survey, Design, and Permitting	—	$3.0M	—	—
Procurement and Construction	—	—	$16.3M	$15.3M
Total	**$1M**	**$3M**	**$16.3M**	**$15.3M**

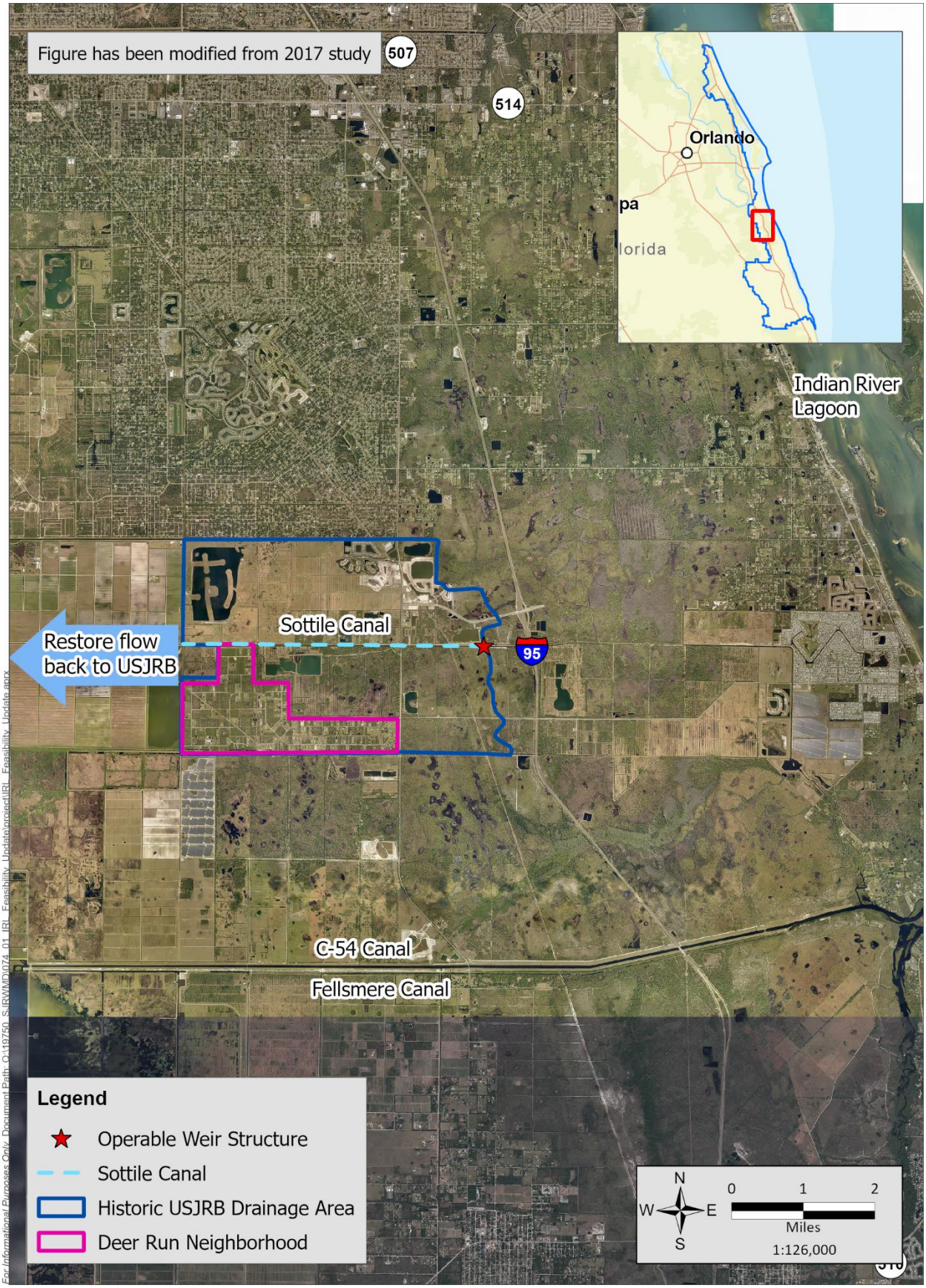
2.2 Sottile Canal Flow Restoration

2.2.1 Project Overview

Sottile Canal is an agricultural drainage canal that was constructed in the 1920s to drain portions of the USJRB to the IRL. Sottile Canal conveys stormwater flows from east of Sartori Avenue toward the south prong of the St. Sebastian River. Historically, this area drained to the USJRB. The areas drained by Sottile Canal are predominantly agricultural and residential. Some flows from Sottile Canal have been restored to the USRJB; however, approximately 7,800 acres of agricultural, residential, and undeveloped land west of the historical basin divide still drain to Sottile Canal and then to the IRL.

The updated proposed Sottile Canal Flow Restoration Project alternatives would divert Sottile Canal baseflows west of the historical basin divide back to the USJRB by constructing an operable diversion structure in Sottile Canal approximately 0.6 mile west of I-95, similar to the project alternatives from 2017. Figure 2-5 shows the general project location and associated basin boundary. Project benefits remain the same as proposed in 2017, which include reducing freshwater flows and nutrient and sediment loads to the south prong of the St. Sebastian River and IRL and restoring historical flows to the USJRB. The 2024 alternatives include a different means of conveying the diverted canal water to the USJRB, because using the S-255 flow-way to restore flows to the west, as initially proposed in 2017, would be logistically challenging and cost prohibitive. The new alternatives also consider different locations for potential treatment before conveyance.

Figure 2-5 Sottile Canal Flow Restoration – General Location

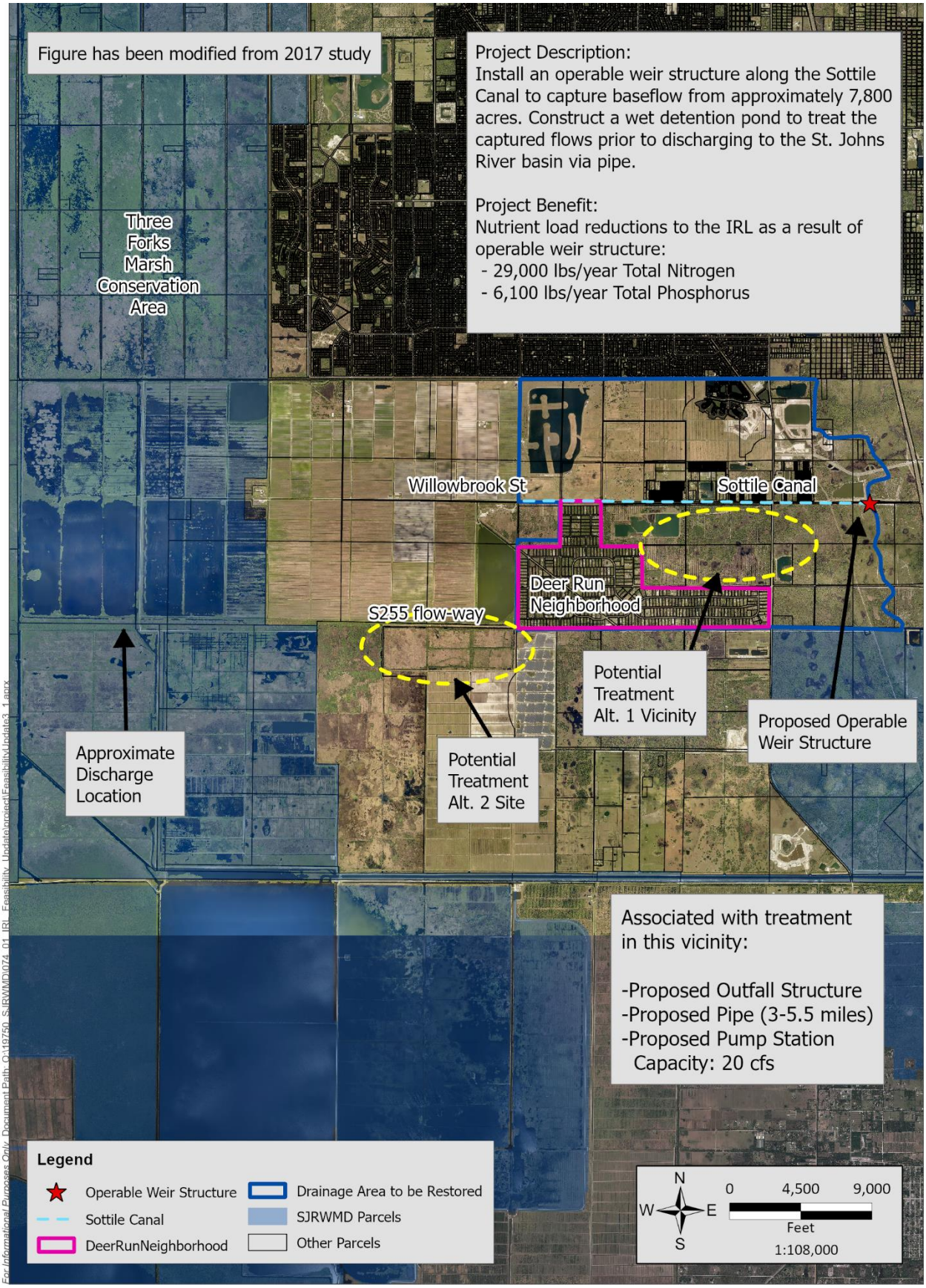


The hydrologic calculations from the 2017 study are assumed to still be valid. That effort included reviewing daily flow records within the canal and determining a likely contributing area to calculate the volume of potential flow-diversion capacity. Volume losses from evapotranspiration along the restoration pathway were also calculated. A review of land use data collected since 2017 (including aerial photography) did not indicate significant land use changes, so assumptions taken into account related to land use assessment in 2017 were also considered valid for this update.

2.2.1.1 Alternative 1 General Description

Alternative 1 is to construct an operable gate structure in Sottile Canal, pump and treat flow from Sottile Canal, then pump and discharge at the SJRWMD-owned TFMCA to the west. The treatment will occur in a proposed 275-acre WMA potentially located around the area shown in Figure 2-6. Land acquisition opportunities and constraints will be fully evaluated and considered before advancing to preliminary design. From the proposed WMA, treated stormwater will be conveyed via approximately 5.5 miles of 36-inch-diameter force main west to the USJRB at TFMCA, preferably due west along Willowbrook Street. Other longer or less direct discharge routes to the USJRB may also be considered.

Figure 2-6 Sottile Canal Flow Restoration – Alternatives 1 and 2



2.2.1.2 Alternative 2 General Description

Alternative 2 shares the same general concept as Alternative 1; however, the diverted canal water is pumped into a WMA on property southwest of the Deer Run subdivision (Figure 2-6). This parcel is currently owned by Florida Power & Light (FPL), and SJRWMD had a preliminary discussion with FPL about its potential use. Additional follow-up with FPL would be required before proceeding further. The entirety of the parcel would not be necessary for treatment, but a low section of approximately 550 acres that previously received drainage from a citrus grove may be suitable for wet detention. Piping from the Sottile Canal to the WMA is the preferred means of conveyance to avoid using existing drainage ditches for conveyance. The option to use the existing drainage ditch immediately west of the Deer Run subdivision canal for conveyance is not desirable due to potential impacts, perceived or real, to residential properties from the project.

After treatment at the WMA, stormwater would be pumped via force main approximately 3 miles west along the S-255 flow-way to TFMCA.

2.2.2 Conceptual Project Layout and Design

Restoring historical flows back to the USJRB using Alternative 1 or 2 would require constructing some of the same stormwater infrastructure proposed during the 2017 study, with additional infrastructure. Alternatives 1 and 2 will require the following:

- An operable diversion structure in Sottile Canal near the historical basin divide, which is approximately 0.6 mile west of I-95.
- A stormwater pump station capable of pumping untreated water from the Sottile Canal to one of two WMAs (Alternative 1 or Alternative 2). The pump station capacity will be 20 cubic feet per second (cfs) peak capacity and allow continuous operation under low flow conditions. The pumped water will be conveyed by a 36-inch-diameter force main (for both WMAs).
- WMA for treating the water pumped out of Sottile Canal. For Alternative 1, the untreated pump station would draw water off Sottile Canal and pump into a nearby proposed WMA through a short length of force main. Alternative 2 proposes a WMA on property currently owned by FPL southwest of Deer Run, requiring a longer run of force main piping.
- A second stormwater pump station and 36-inch-diameter force main to convey treated water from the proposed WMA along Willowbrook Street for Alternative 1, or along the S-255 flow-way for Alternative 2, to a proposed outfall on the SJRWMD property at TFMCA.

2.2.2.1 Diversion Structure

The considerations for locating the operable diversion structure discussed in the 2017 study are valid for the two new alternative designs. The complexity of the structure is a design variable that can be determined in the future preliminary design phase. The operable diversion structure could consist of culverts with operable gates or an operable overflow weir structure such as an overshot gate. Operation of this structure needs to consider the permitted Rolling Meadow Lakes stormwater system (SJRWMD Environmental Resource Permit [ERP] 15821-14), which includes a plug in the Sottile Canal near the northwest corner of the Deer Run subdivision. The remainder of this analysis will assume that

Alternatives 1 and 2 are viable and will accommodate the permitted stormwater system design.

2.2.2.2 Pump Stations

The treated and untreaded stormwater pump stations would be similar in design. The stations would include two to three variable speed pumps, likely of equal size, for redundancy and to allow for pumping in low flow or peak flow conditions (20 cfs maximum). The pump stations are expected to be constructed with a precast concrete wet well, an above ground discharge piping valve and meter assemblies, and necessary power and controls components. Supervisory control and data acquisition (SCADA) systems are also assumed to allow remote monitoring and operation of the pump stations by SJRWMD personnel.

2.2.2.3 Water quality Treatment

The USJRB has a total maximum daily load (TMDL) with a maximum TP concentration of 0.09 milligram per liter (mg/L). Restored flows to this basin are required to have TP concentrations less than this maximum. As part of designing the Micco Water Management Area (formerly known as Wheeler Stormwater Park), SJRWMD determined that TP concentrations in Sottile Canal were 0.35 mg/L. Therefore, to meet the TMDL, the proposed treatment system would require a treatment efficiency of 74 percent reduction in TP. A wet detention system with an 80-day residence time is estimated to provide a 74-percent reduction in TP (Harper and Baker, 2007). Average available flow for restoration is 8.9 cfs as determined in the 2017 study based on gauge data from US Geological Survey (USGS) Stream Flow Site 2251500. The required permanent pool volume for an average flow restoration of 8.9 cfs is 1,416 acre-feet. We evaluated two additional treatment alternatives for this project described below.

Alternative 1 proposes a 275-acre WMA be constructed in the general vicinity shown in Figure 2-6. We recommend conducting an environmental site assessment and wetland determination before purchasing any properties or beginning design. The proposed stormwater system should be designed with a meandering flow path to achieve the needed residence time and accomplish adequate nutrient removal before discharge into USJRB. The 275-acre WMA would provide treatment for more than the 1,416 acre-feet minimum.

Under Alternative 2, property currently owned by FPL immediately south of the S-255 flow-way would be used for treating stormwater from Sottile Canal. Stormwater treatment would be provided by a constructed wet detention pond on the north 550-acre section of that property. The proposed treatment site should be graded in areas to create a meandering flow path through the site as with Alternative 1.

2.2.2.4 Piped Conveyance System

Alternatives for the Sottile Canal Flow Restoration Project included in the 2017 study were deemed unsuitable due to their use of the S-255 flow-way as a conveyance feature. A 36-inch-diameter piping system is proposed to eliminate this concern and avoid using existing drainage ditches for conveyance. Since these are strictly conveyance pipes and will not have any other connections, we expect the bulk of the piping will be fused high-density polyethylene (HDPE) piping. Installation may be by open cutting utility trenches, or by horizontal directional drilling (HDD) in areas where open-cut methods are not practical or

cost effective. Other pipe materials would also be considered in areas where HDPE is not best suited, such as for pump station plumbing, valve station, and at connection points between HDD bores. For budgeting, open-cut installation is assumed viable for most of the force main routes, with a small percentage budgeted for HDD. At inlet points to the pump stations and at discharge points into the WMAs and TFMCA, inlet and discharge structures would be installed, respectively. The inlet structures provide for screening and gating for maintenance activities. Discharge structures provide for releasing pressurized water from the force mains into the WMAs or marsh. These structures would likely be cast-in-place or precast concrete structures.

2.2.3 Planning-Level Evaluation

Table 2-8 summarizes the planning-level evaluation for the Sottile Canal Flow Restoration Project and is updated to include considerations for Alternatives 1 and 2. Table 2-9 summarizes the land acquisition required for Alternatives 1 and 2. The total market value cost of land for each alternative includes the land to construct the WMA as well as easements needed for piping and associated inlet/discharge structures. Following a conversation with SJRWMD, easement costs in these cases are assumed to be 10 percent of market value per acre for this area.

Table 2-8 Sottile Canal Flow Restoration Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County, SJRWMD
Land Use/Zoning Issues	Potential need to convert land use types, if applicable, depending on property available for purchase/use.
Suitability of Land for Stormwater Treatment	These considerations change depending on the property available for purchase use. Existing wetlands lend themselves to creation of wetland-treatment systems and borrow pits may be suitable for retrofit. Vacant land may be suitable for wet detention.
Soil Characteristics	Poorly drained soils. A geotechnical analysis is required.
Wetlands and Mitigation	Formal wetland determination required for design and permitting.
Environmental Contaminants	Environmental assessments are required.
Required Treatment Volume Estimate	1,416 acre-feet of permanent-pool wet detention
Proximity to Residential Land and Potential Hazard Classification	The Deer Run and the proposed Rolling Meadows residential communities are near the proposed piped conveyance systems. Project alternatives need to consider drainage for these communities.
Appraised Value of the Land	Alternative 1: Estimated (2023 dollars) Alternative 2: Estimated (2023 dollars)

Table 2-9 Sottile Canal Flow Restoration Project Land Acquisition

Alternative	Market Value (Estimated, 2023)
1	$1M
2	$2.4M

2.2.4 Summary of Benefits

The estimated nutrient load reduction benefits of Alternatives 1 and 2 are identical to those of the 2017 study project alternatives. Assuming a 20-cfs maximum flow diversion and ample treatment within the WMA, the benefits include freshwater-flow reduction to the IRL, nutrient-load reduction to the IRL, and flow restoration to the USJRB. Table 2-10 summarizes the project areas and treatment capacity.

Table 2-10 Sottile Canal Flow-Restoration Benefit Summary

Area Treated by Project	7,800 acres
Average Annual Flow Reduction to IRL	6,500 acre-feet
Average Annual Flow Restored to USJRB	3.9 million gallons per day (MGD)
Average Annual TN Load Reduction to IRL	29,000 lbs
Average Annual TP Load Reduction to IRL	6,100 lbs

2.2.5 Planning-Level Cost Opinions

The project team developed planning-level opinions of the capital and life cycle costs for the new alternatives. Capital cost opinions and life cycle costs were developed using the methodology as described in Section 2.1.5.

Table 2-11 provides an opinion of planning-level costs for the new alternatives. The most significant drivers of the project costs include:

- Constructing an operable structure on Sottile Canal.
- Constructing a force main.
- Acquiring land.
- Constructing two variable-flow-rate pump stations.

Table 2-11 Sottile Canal Flow Restoration Opinion of Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$48.8M	$0.8M to $1.4M	$2.3M to $3.2M
Alternative 2	$48.3M	$0.9M to $1.4M	$2.3M to $3.1M

2.2.6 Future Water Quality and Flow Monitoring

The project team recommends the same monitoring as suggested for the alternatives in the 2017 study. These include monthly ambient or baseflow water quality sampling near the I-95 bridge over Sottile Canal and flow monitoring in Sottile Canal near the I-95 bridge.

These should be combined with sampling water quality and flows for several storm events at this site. This additional information would allow for a more accurate estimate of the potential loads and flows that could be diverted from the IRL and restored to the USJRB.

2.2.7 Preliminary Implementation Schedule

The project team expected a multi-year timeframe for implementing the Sottile Canal Flow Restoration Project. The expected steps to implement each project would likely be as follows:

- Perform preliminary design and modeling to evaluate potential drainage impacts for SJRWMD review and approval.
  - Estimated timeframe: **6 months**
- Purchase land including performing Environmental Site Assessments (ESA).
  - Estimated timeframe: **6 months**
- Perform survey, geotechnical, design and permitting, including developing construction drawings and specifications.
  - Estimated timeframe: **12 months***
- Procurement, construction and activation.
  - Estimated timeframe: **24 months**

* The permitting process through local municipalities (city and county governments) FDEP and the US Army Corps of Engineers (USACE) if applicable, and other agencies may take up to a year or longer to complete.

Table 2-12 provides preliminary planning-level estimates of timeframes and annual funding requirements for implementing the Sottile Canal Flow Restoration Project for Alternatives 1 and 2.

Table 2-12 Sottile Canal Flow Restoration Alternative 1 and 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$1.5M	$0.5M	—	—
Land Acquisition and ESA	$1M to $2.5M	—	—	—
Survey, Design, and Permitting	$0.5M	$3M	—	—
Procurement and Construction	—	—	$20.4M	$20.4M
Total	**$4.5M**	**$3.5M**	**$20.4M**	**$20.4M**

3 IDENTIFICATION AND SCREENING OF POTENTIAL NEW STORMWATER PROJECT LOCATIONS

The 2017 study focused on regional-scale projects that would reduce nutrient loading to the IRL in the range of 25,000 lbs of TN per year or greater. The remainder and primary focus of this 2024 study focuses on identifying local- to medium-scale projects with the aim of further decreasing annual nutrient and sediment loading to the IRL within the range of 5,000 to 25,000 lbs.

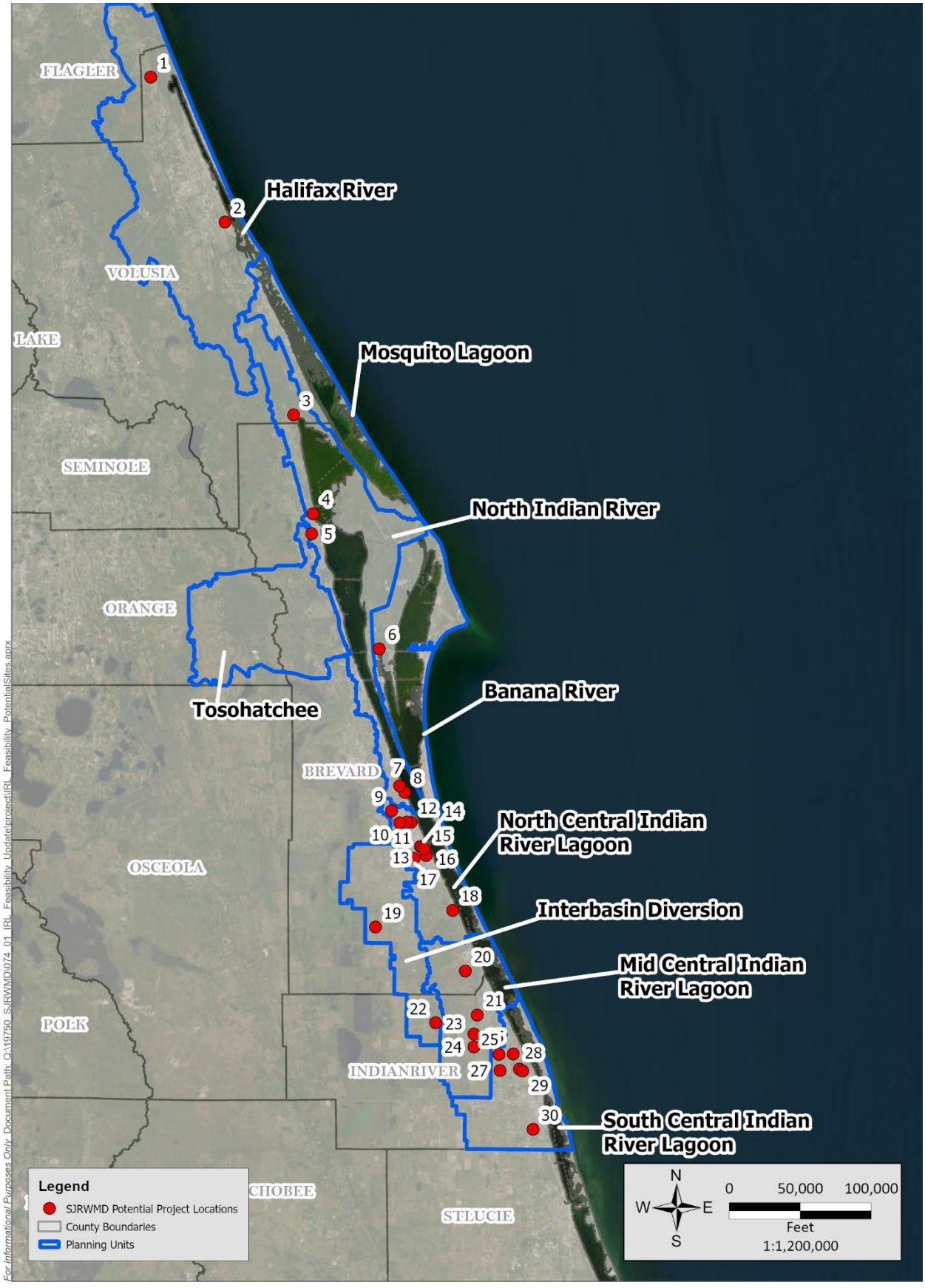
The screening of new project concepts at the local- to medium-scale began by identifying outfalls to the IRL via desktop reconnaissance using ArcGIS. The specific spatial information used for locating outfalls were aerial photography, the 2019 statewide light detection and ranging (LiDAR) data for topography, and the SJRWMD open data shapefile Hydro River USGS 100k for reference. Focus was placed on the local- to medium-scale outfalls, but screening also took place along regional-scale outfalls. More than 90 outfalls were identified within the project area. Each outfall was visually traced upstream while noting available land that could potentially be used for stormwater quality treatment projects.

During project screening, priority was placed on land that was already owned by a city, county, or SJRWMD for ease of implementing potential project concepts. In rare cases based on stakeholder feedback, privately-owned vacant land were also considered. Several types of treatment projects were considered based on the size of available land with respect to the contributing areas, as well as the surrounding surface water conveyances and land use. Parcels with adequate acreage were considered for wet detention and retention, with or without additional treatment using BAM or equivalent. Smaller (5 acres or less) available parcels could be considered for pumped denitrification systems since they have a high treatment capacity with a small footprint. Existing city or county parks and facilities were considered for retrofit concepts such as floating BAM skimmer structures, pond expansion, or pond water quality treatment additions like baffles or a BAM polishing section. Basins draining to the IRL are heavily channelized; therefore, several project concepts include pumping stormwater from a canal for treatment before being returned to the canal. Partnering opportunities with public utilities were also considered for several treatment concepts, such as stormwater treatment in rapid infiltration basins (RIBS), disconnecting stormwater from flowing east to the IRL and redirecting it west to the USJRB, and stormwater harvesting for golf course irrigation.

When practical, project concepts were vetted with stakeholders. Meetings were held to discuss concepts and to understand projects already under consideration by a stakeholder. Stakeholders offered feedback on the feasibility of project concepts or availability of land. Stakeholders included Brevard County, Indian River County, the City of Melbourne, and the City of Palm Bay. Jones Edmunds or SJRWMD staff also discussed some project concepts with MTWCD, the City of South Daytona, the City of Port Orange, the City of Fellsmere, Volusia County, and individual stakeholders.

Project screening resulted in 30 potential project concepts, some with multiple treatment options. Figure 3-1 displays the locations of these project locations across the IRL drainage area with location IDs numbered from north to south.

Figure 3-1 Potential Project Locations



Appendix B shows a comprehensive list of project concepts and associated information with the location ID corresponding to those in Figure 3-1. Other considerations are also identified in Appendix B that encompass stakeholder feedback and aspects that may make a project more or less favorable for construction.

A drainage area for each treatment project was estimated using spatial data including the LiDAR terrain data, Water Body Identification (WBID) number boundaries, and Hydrologic Unit Code (HUC) boundaries from FDEP. Many of the proposed projects are within Basin Management Action Plan (BMAP) areas covered by the Spatial Watershed Iterative Loading (SWIL) model, which is used for BMAP load calculations. For consistency with the BMAP, FDEPs Load Estimation Tool (LET), based on the SWIL model, was used to calculate the load within each project basin area and is shown as the starting load in the table in Appendix B. TN was used as the surrogate for nutrient loading for these general screening calculations. For areas not within the areas covered by the LET, loads for similar land uses that had been calculated by the LET were extrapolated to land use coverage as a way to estimate TN Loads outside the LET, but using the same methodology. Each treatment project was assigned an anticipated load reduction range (%), which is also shown in the table, as well as TN reduction ranges in pounds of removal per year. Load reduction ranges were approximations of what treatment may be achieved by a project as applied to the entire drainage area load for screening purposes and does not correspond to the specific BMP project expected reduction. Reductions notes are approximations for screening purposes.

All listed projects have potential to improve water quality in the IRL. To prioritize projects after the general screening of alternatives, a scoring matrix was created based on several factors.

Ease of implementation was considered for each of the projects, and Appendix B shows the score (from 1 for easy to 3 for more challenging). The scores rate the projects in reference to each other. A high (3) score was noted for projects that involved an innovative but not necessarily easy to implement treatment concept, large volume of BAM filtration media, or unfavorable feedback from stakeholders. A score of 2 was noted for projects that included BAM filtration or privately owned parcels. A score of 1 was noted for projects on publicly owned lands that included stormwater retrofitting of existing facilities or construction of wet detention without filter media.

Total nutrient load reduction to the IRL was also scored for each, from 1 for higher nutrient reduction to 3 for lower nutrient reduction. In this screening process, TN load reduction projects in the range of 6,000 lbs of TN per year or less were given a score of 3, a score of 2 was given to projects with load reductions in the range of 6,000 to 15,000 lbs of TN per year, and a score of 1 was given to projects that may reduce nutrient loading by 15,000 or more lbs of TN per year. Some of the proposed project concepts have the potential to remove a large (40,000 lbs of TN per year) nutrient load.

A score was given to each project to denote expected rough order of magnitude construction costs. Highest costs (more than $10M) were noted with a score of 3. A score of 2 was given to projects with estimated costs in the range of $5M to $10M, and a score of 1 was given to projects with an estimated cost of less than $5M.

The aggregate score was tabulated for each project, with the lowest score being most favorable for this screening effort. Projects with an overall additive score of 5 or lower are most favorable from the standpoint of being easily constructable and implemented, with a reasonable cost and appreciable nutrient load reduction/water quality improvement benefit.

4 STORMWATER PROJECT CONCEPTS

Staff from SJRWMD met internally to narrow the number of potential project locations to eight for conceptual development. These eight project areas were chosen based on the geographical spread within the IRL basins, ease of constructability, screening-level analysis, and scoring matrix results. Projects in this section are presented in order from north to south.

This chapter details multiple alternative project concepts for most of the eight project areas. Alternative solutions that involve BAM filter media are scalable when space and ability to increase treatment capacity are feasible. There are different types of BAM or nutrient reducing filter media that are commercially available and may be considered during design for projects involving this element. Assumptions that drove nutrient loading as well as removal calculations are noted for each alternative.

The project team developed planning-level opinions of capital costs and life cycle costs for the project alternatives following the methodologies described in Section 2.2.5 (Association for the Advancement of Cost Engineering International's Cost Estimate Classification Level 5, Recommended Practice No. 18R-97). Likewise, economic evaluations including O&M and annualized costs were calculated using the Florida Stormwater Association BMP Life Cycle Cost Tool based on a duration of 60 years. Costing for project alternatives that include filtration media assumed an average standard life of 20 years. Several of the proposed alternative projects are located on SJRWMD-, city-, or county-owned property. In these cases, the cost of land (including easements) was not included in capital cost opinions.

4.1 CHAIN OF LAKES ENHANCED NUTRIENT REDUCTION

4.1.1 PROJECT OVERVIEW

The Chain of Lakes Park, owned by SJRWMD and operated by Brevard County, is in the City of Titusville near Eastern Florida State College. The Florida East Coast (FEC) Railway runs between the Chain of Lakes Park and the IRL. The lake system at this park accepts stormwater runoff from a 1,175-acre drainage area as well as groundwater that enters the lakes. Currently three interconnected lakes cover an area of approximately 35 acres, which includes the stormwater pond at Parrish Medical Center (PMC) on the south end of the park. Lake elevation is controlled by small-diameter bleed-down pipes through the east berm and four major spillway structures that were designed to handle large rainfall events. This nutrient reduction project concept is proposed to further enhance the existing nutrient attenuation the lakes provide.

Two alternative project concepts were considered to enhance treatment at the Chain of Lakes Park. Alternative 1 involves installing floating skimmer systems in place of the bleed-down orifices at the four existing outfalls, which would feed pond bank BAM filter beds before discharging to the IRL. Alternative 2 involves purchasing parcels north of the Chain of Lakes Park and creating a polishing wetland treatment system incorporated into the lake system. Figure 4-1 shows the general location of the Chain of Lakes Park and these projects.

Figure 4-1 Chain of Lakes Enhanced Nutrient Reduction – General Location

4.1.1.1 Alternative 1 – Skimmer and BAM Systems

Alternative 1 would work with existing outfall structures on the Chain of Lakes Park connected lake system by replacing bleed-down orifices with a floating skimmer structure. The skimmer would be designed to draw water from the lake and feed it into a BAM filter bed via a manifold or delivery mechanism determined during design. The filter would be embedded in the pond bank to provide treatment between storm events. Treated water would be collected by a perforated pipe and discharged to the IRL. The detailed design would account for discharging past existing outfall structures so that enough head differential was obtained to allow this to be a gravity system. This type of system is scalable, with a higher cost of BAM, equipment, and construction providing a higher nutrient removal. The existing outfall weir structures would not be changed as part of this proposed design. Figure 4-2 presents a general layout of the system, which would be repeated at each outfall, and Figure 4-3 shows the overall project site and estimated nutrient removal.

Figure 4-2 Chain of Lakes Enhanced Nutrient Reduction – Alternative 1 General Layout

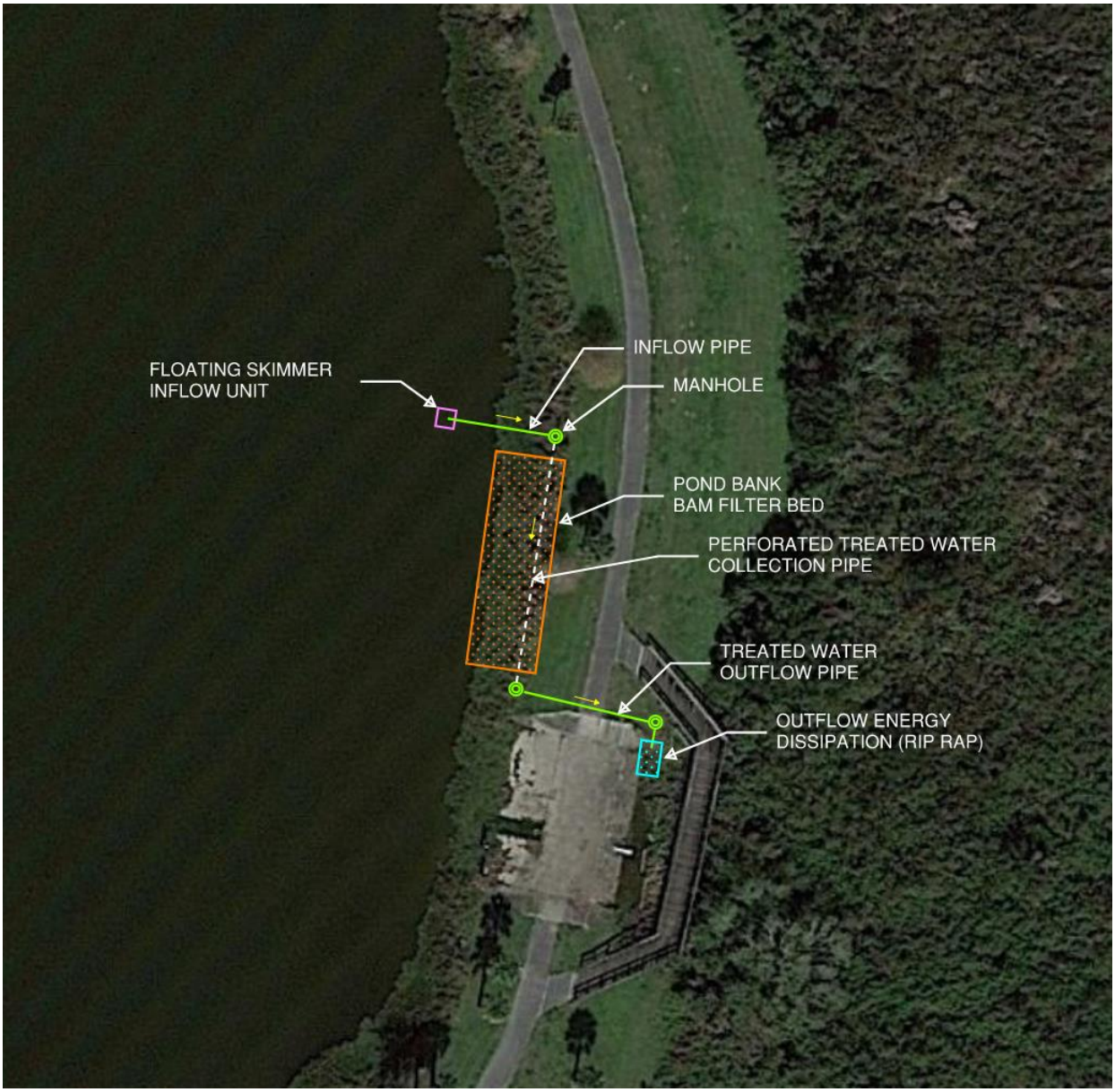


Figure 4-3 Chain of Lakes Enhanced Nutrient Reduction – Alternative 1

Water quality grab sample data were not available for the Chain of Lakes Park; therefore, SWIL model output was used as starting loads for the drainage basin assuming that all loads arrived at the pond system. We assumed that the ponds removed approximately 35 percent of TN load, or 4,000 lbs, and 60 percent of TP load, or 700 lbs, before being treated by the proposed alternative.

For the removal calculations, we assumed that a 4-inch skimmer system would be used at each outfall with a capacity of 104 gallons per minute (gpm). The BAM filtration system was sized at 3,000 cubic feet to attain removal of an additional 66 percent of the incoming TN and 66 percent of the incoming TP loads based on the BAM treatment rate of 0.052 gpm per square foot from the University of Central Florida's stormwater project evaluation model, BMPTrains. For the four treatment units, the BAM filter systems are expected to achieve a removal of 900 lbs of TN and 80 lbs of TP per year.

4.1.1.2 Alternative 2 – Treatment Wetland

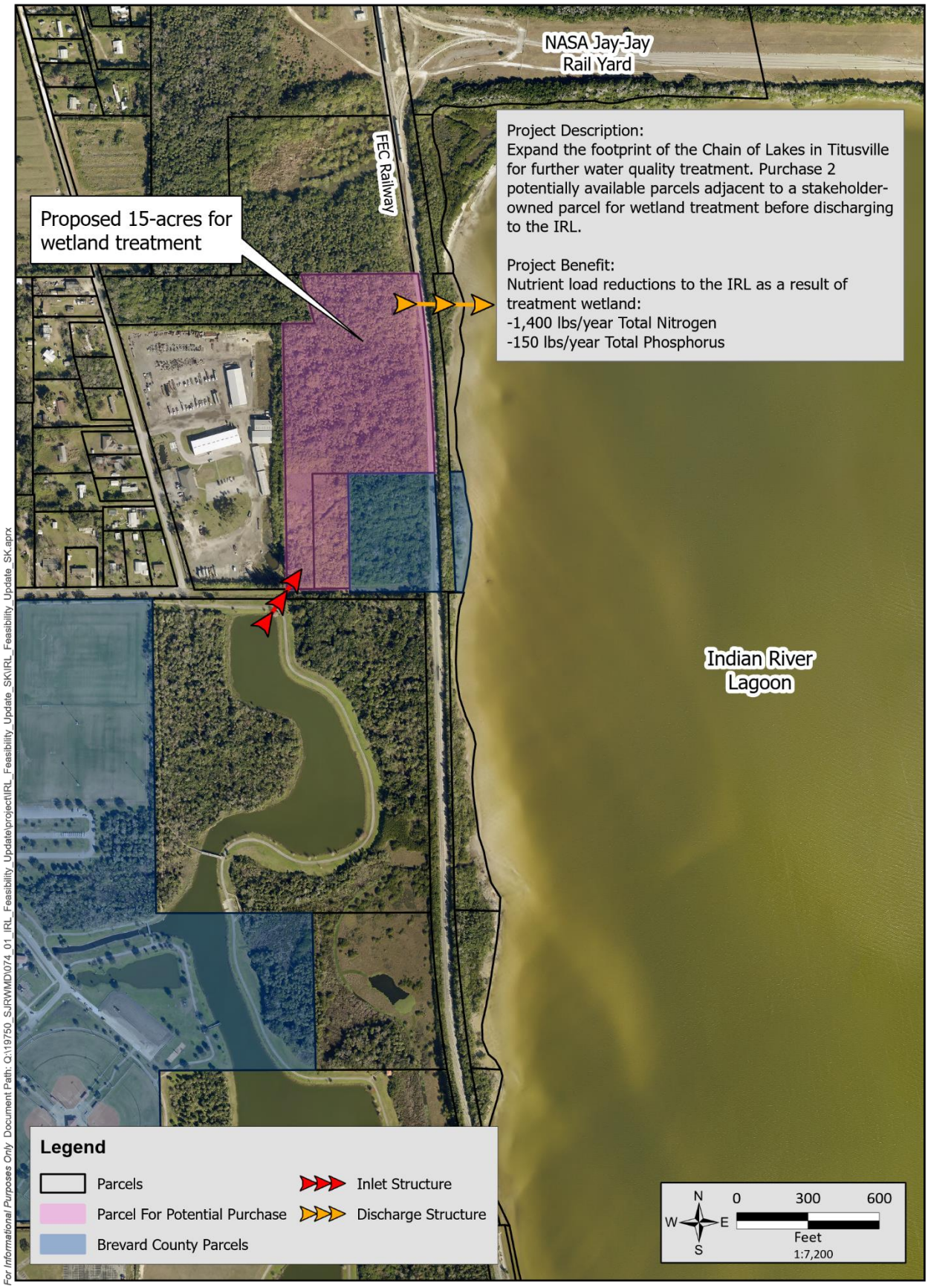
Alternative 2 involves purchasing two parcels, approximately 15 acres total, north of the Chain of Lakes Park and constructing a treatment wetland to enhance nutrient removal of the overall system. The existing land cover is predominantly wetland communities. Permitting considerations would include demonstrating to the regulatory agencies that the proposed treatment wetland would receive pre-treated water and not an untreated discharge. Existing wetlands would be enhanced to maximize nutrient uptake, and if available for use, the adjacent Brevard County parcel could be incorporated into to the design to create a larger treatment wetland. For the purposes of this report, this alternative is based on using only the SJRWMD parcels for treatment. The treatment wetland would receive treated pond inflow and then outfall east into the IRL.

The existing Chain of Lakes outfall structures were designed to alleviate lake levels during large storm events with lake levels being controlled by small bleed-down orifices. Detailed design would likely alter the bleed-down orifices to create a preferential flow path to the proposed wetland system.

Adding this area does not increase the drainage area for the overall system; therefore, the same input loads from the SWIL model were used in nutrient removal calculations. Stormwater and groundwater from the contributing area are currently treated by the Chain of Lakes before discharging to the IRL. The proposed wetland is intended for nutrient reduction enhancement. For the Alternative 2 conceptual design, a 15-acre wetland system is conservatively estimated to reduce the incoming load by 37 percent of TN and 46 percent of TP (Land, 2016). Actual reduction by treatment wetlands is site-specific and may be confirmed with monitoring data.

Assuming that half of the total flow that currently flows through bleed-down orifices could be redirected to the wetland, the system could reduce the nutrient load by an additional 1,400 lbs of TN and 150 lbs of TP per year. Figure 4-4 shows the layout of the proposed Alternative 2 for this project.

Figure 4-4 Chain of Lakes Enhanced Nutrient Reduction – Alternative 2



4.1.2 Planning-Level Evaluation

Table 4-1 summarizes the planning-level evaluation for the Chain of Lakes Enhanced Nutrient Reduction Project for Alternatives 1 and 2. Land acquisition costs were not included in figures for these alternatives.

Table 4-1 Chain of Lakes Enhanced Nutrient Reduction Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County, SJRWMD, and City of Titusville
Land Use/Zoning Issues	The area for wetland construction of Alternative 2 is primarily classified as wetlands. Meeting with regulatory staff will be necessary to determine permitting requirements for a constructed treatment wetland on this land use. Evaluation of a suitable existing outfall or coordination with FEC Railway will be necessary.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Sandy soils on proposed wetland site; moderate to well-drained when soil storage capacity is available. A geotechnical analysis is required.
Wetlands and Mitigation	See land use/zoning issues. Evaluation of the quality of wetlands and coordination with regulatory staff are essential.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	No hazard expected. Both alternatives are near a commercial area, and Alternative 2 is near but not adjacent to a residential area.

4.1.3 Summary of Benefits

The project team estimated the benefits of the Chain of Lakes Enhanced Nutrient Reduction Project alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 4-2 summarizes the project treatment capacity for Alternatives 1 and 2.

Table 4-2 Chain of Lakes Enhanced Nutrient Reduction Alternatives 1 and 2 Project Benefit Summary

	Alternative 1	Alternative 2
Average Annual Flow Treated	0.6 MGD	1.7 MGD
Average Annual TN Load Reduction to IRL	900 lbs	1,400 lbs
Average Annual TP Load Reduction to IRL	80 lbs	150 lbs

4.1.4 Planning-Level Cost Opinions

Table 4-3 provides an opinion of planning-level costs for the new alternatives. The most significant driver in the capital and O&M costs are the application of BAM and anticipated replacement needs of BAM in Alternative 1. The purchase of the parcels that are part of Alternative 2 is not included in cost calculations for that alternative.

Table 4-3 Chain of Lakes Enhanced Nutrient Reduction Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$3.5M	$0.2M to $0.3M	$0.3M to $0.4M
Alternative 2	$1.8M	$13,000	$70,000 to $80,000

4.1.5 Future Water Quality and Flow Monitoring

The project team recommends monthly ambient or baseflow water quality sampling in the lake and at outfall structures combined with sampling water quality and flows for several storm events to determine the actual loads entering the proposed treatment alternatives. The concentration of nitrogen and phosphorus constituents should also be evaluated to determine which BAM mixture would be most effective for Alternative 1. A monitoring plan should be designed to better understand the benefits the treatment wetland provides for Alternative 2.

4.1.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the Chain of Lakes Enhanced Nutrient Reduction Project alternatives. Table 4-4 and Table 4-5 provide a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternatives 1 and 2.

Table 4-4 Chain of Lakes Enhanced Nutrient Reduction Alternative 1 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3
Preliminary Design and Modeling	$0.25M	—	—
ESA	$0.05M	—	—
Survey, Design, and Permitting	—	$0.5M	—
Procurement and Construction	—	$0.7M	$2M
Total	**$0.3M**	**$1.2M**	**$2M**

Table 4-5 Chain of Lakes Enhanced Nutrient Reduction Alternative 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2
Preliminary Design and Modeling	$0.25M	—
Land Acquisition and ESA	$0.05M	—
Survey, Design, and Permitting	—	$0.5M
Procurement and Construction	—	$1M
Total	**$0.3M**	**$1.5M**

4.2 North Merritt Island Mosquito Impoundment Nutrient Reduction

4.2.1 Project Overview

A 6,500-acre mosquito impoundment on North Merritt Island is the proposed project site for two alternatives. This area is east of N. Courtenay Parkway and north of Florida A1A, and the headwaters of Sykes Creek flow through the impoundment. Mosquito control impoundments are typically marsh areas with a berm or dike around the perimeter that allows the area to be artificially flooded during the breeding season (May to October), which prevents mosquitos from laying eggs (Rey and Connelly, 2012). The impoundment is controlled by Brevard County Mosquito Control through manipulating three sets of double culverts beneath the south impoundment bermed access road that connects Sykes Creek to the Canaveral Barge Canal to the south. This area generates an estimated TN load of 32,000 lbs per year and 5,000 lbs of TP per year, based on the SWIL model LET calculations. Land use in the area is largely classified as saltwater marshes.

A floating skimmer system similar to that proposed as Alternative 1 for the Chain of Lakes Nutrient Enhancement Project was considered for this project at the double-barrel outfall location since the access road is elevated and could potentially allow the head needed. However, the access road may be too narrow for such a system to be constructed in that area. Two different BAM-related alternative project concepts were developed for this area to remove nutrients from the system. Alternative 1 involves constructing a pumped denitrification facility, similar to C-1 Baseflow Treatment Alternative 2, within the mosquito impoundment boundary. Water would be pumped from Sykes Creek, treated, and then discharged back to Sykes Creek. Alternative 2 is similar but involves constructing the system outside the impoundment boundary and then discharging back to Sykes Creek. It may be possible to discharge directly to the Canaveral Barge Canal, but the discharge path directly back to Sykes Creek is shorter. Figure 4-5 shows the general location of the North Merritt Island Mosquito Impoundment and these projects.

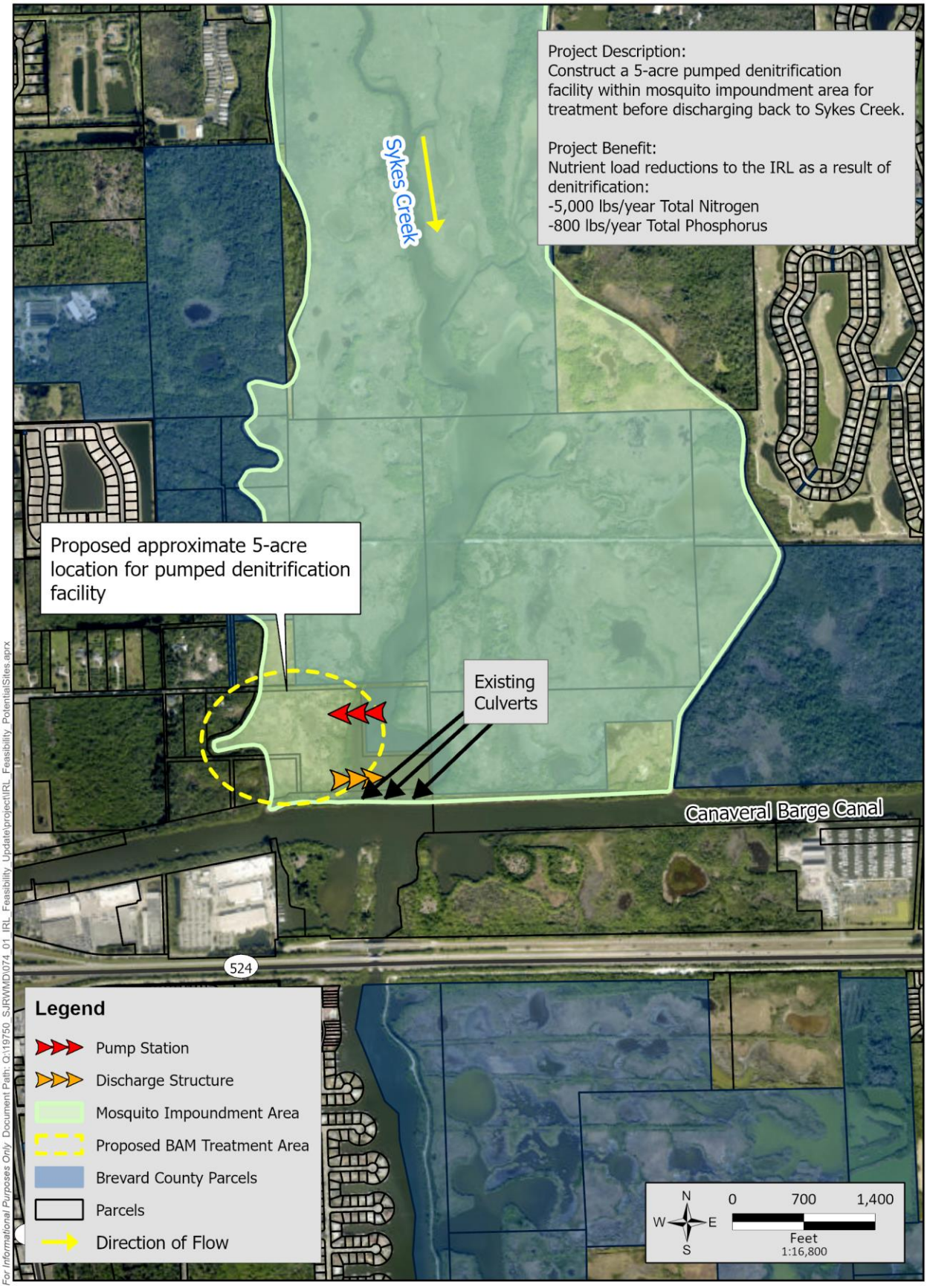
Figure 4-5 North Merritt Island Mosquito Impoundment Nutrient Reduction – General Location

4.2.1.1 Alternative 1 – Pumped Denitrification Facility within the Mosquito Impoundment Area

Alternative 1 involves constructing a 5-acre denitrification facility within the boundary of the mosquito impoundment. Keeping all the water within the bounds of the impoundment is expected to maintain the needed water levels as required by mosquito control. Twenty cfs (12.9 MGD) could be pumped from Sykes Creek to a facility designed similar to the C-1 Canal Baseflow Treatment Project Alternative 2. The treated water would then be pumped back into Sykes Creek. The mosquito impoundment land is owned by Brevard County, so many locations are possible for constructing a 5-acre treatment system.

No water quality or flow data are available for this area or vicinity; therefore, for the removal calculations we assumed that 20 cfs is capable of delivering a quarter of the total load from the impoundment to the denitrification facility. This type of facility is expected to remove 66 percent of TN and 66 percent of TP from the inflow based on information from BAM applications and appropriately designed contact time. The BAM filter is expected to be continuously wet with the pumped creek water. Based on the flow rate and load assumptions previously noted, the system could reduce the nutrient load by up to 5,000 lbs of TN and 800 lbs of TP per year. Figure 4-6 shows the overall project site and estimated nutrient removal for Alternative 1. The proposed general location for the denitrification area was selected for its proximity to the access road.

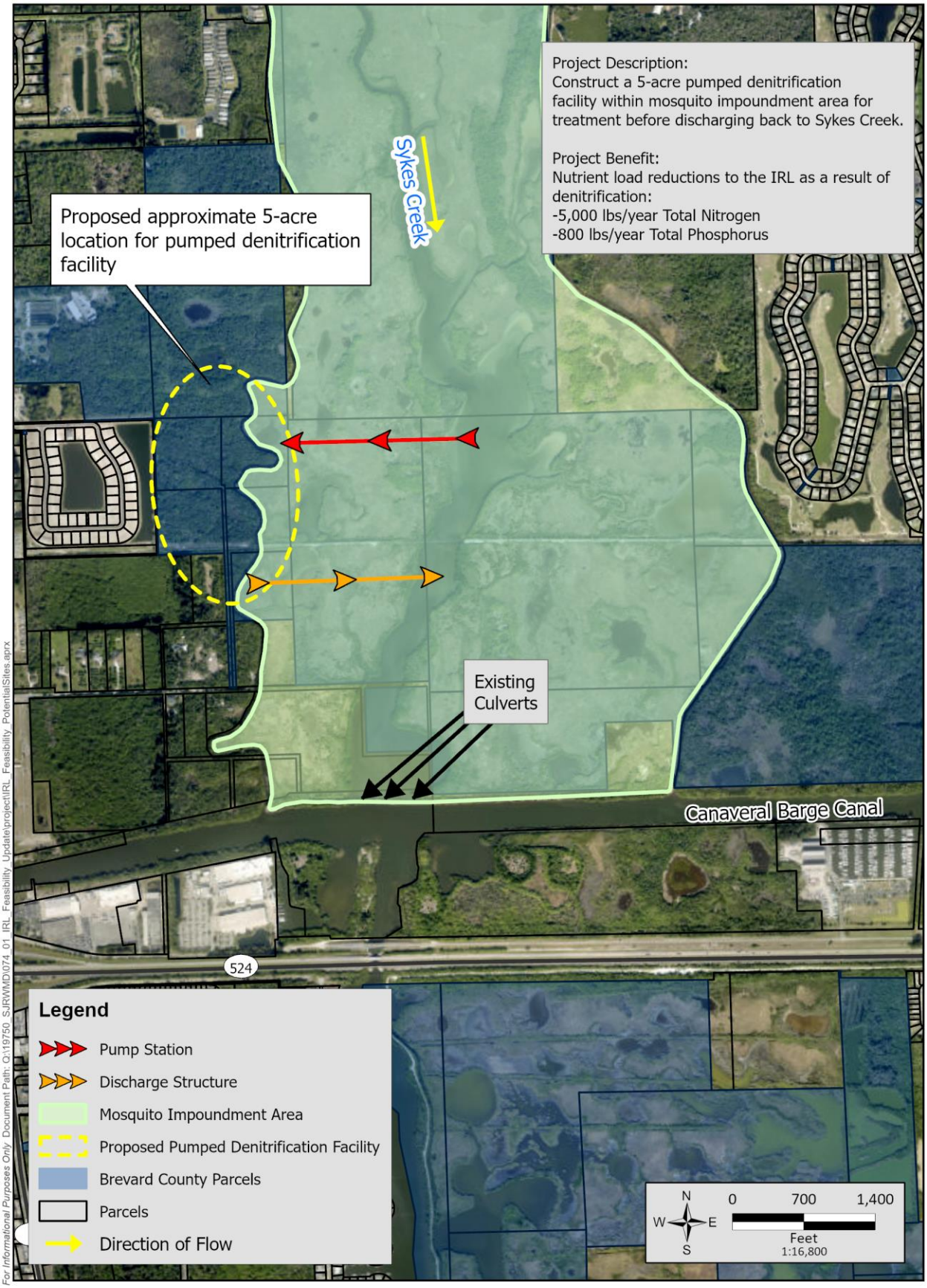
Figure 4-6 North Merritt Island Mosquito Impoundment Nutrient Reduction – Alternative 1



4.2.1.2 Alternative 2 – Pumped Denitrification Facility outside the Mosquito Impoundment Area

Alternative 2 is similar in construction to Alternative 1 but involves using Brevard County-owned parcels that are outside the mosquito impoundment area if the land noted for Alternative 1 is unsuitable or if cooperation with Brevard County Mosquito Control results in this preference. In addition, Alternative 2 involves constructing a 24-inch force main to get Sykes Creek water out of the impoundment and to the proposed facility and 30-inch outfall piping to send treated water back to the creek. The outfall location may depend on Mosquito Control operations as well as permitting issues. Figure 4-7 shows the location of Brevard County-owned parcels adjacent to the mosquito impoundment, several of which could accommodate a 5-acre facility. This alternative would reduce nutrient loads by up to 5,000 lbs of TN and 800 lbs of TP per year similar to Alternative 1.

Figure 4-7 North Merritt Island Mosquito Impoundment Nutrient Reduction – Alternative 2



4.2.1.3 Planning-Level Evaluation

Table 4-6 summarizes the planning-level evaluation for the North Merritt Island Mosquito Impoundment Nutrient Reduction Project for Alternatives 1 and 2. Land acquisition is not required for these alternatives.

Table 4-6 North Merritt Island Mosquito Impoundment Nutrient Reduction Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County and SJRWMD
Land Use/Zoning Issues	Land use within the mosquito impoundment is mostly saltwater marshes. Using this land use for nutrient removal will require discussion with regulatory staff. Land use on Brevard County-owned parcels is mixed wetland hardwoods.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Poorly drained soils within the impoundment. Sandy soils on Brevard County parcels outside the impoundment; moderate to well-drained when soil storage capacity is available. A geotechnical analysis is required.
Wetlands and Mitigation	See land use/zoning issues. Coordination with regulatory staff is required to assess wetland impacts and potential mitigation.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	No hazard expected. Alternative 2 is located near a small residential subdivision.

4.2.2 Summary of Benefits

The project team estimated the benefits of the North Merritt Island Mosquito Impoundment Nutrient Reduction Project alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 4-7 summarizes the project treatment capacity for Alternatives 1 and 2.

Table 4-7 North Merritt Island Mosquito Impoundment Nutrient Reduction – Alternatives 1 and 2 Project Benefit Summary

	Alternative 1	Alternative 2
Average Annual Flow Treated	12.9 MGD	12.9 MGD
Average Annual TN Load Reduction to IRL	5,000 lbs	5,000 lbs
Average Annual TP Load Reduction to IRL	800 lbs	800 lbs

4.2.3 Planning-Level Cost Opinions

Table 4-8 provides an opinion of planning-level costs for the alternatives. The most significant driver in the difference in the project costs is the piping required by the design. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing.

Table 4-8 North Merritt Island Mosquito Impoundment Nutrient Reduction Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$39.2M	$2.3M to $3.1M	$3.5M to $4.6M
Alternative 2	$41.7M	$2.4M to $3.2M	$3.6M to $4.7M

4.2.4 Future Water quality and Flow Monitoring

The project team recommends water quality sampling in Sykes Creek in the impoundment during and outside the impounding season. This sampling could be combined with pumped flow rates to determine actual load to the system and assist with removal calculations.

4.2.5 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the North Merritt Island Mosquito Impoundment Nutrient Reduction Project alternatives.

Table 4-9 provides a preliminary planning-level estimate of the approximate timeframe and approximate annual funding requirements for implementing Alternatives 1 and 2.

Table 4-9 North Merritt Island Mosquito Impoundment Nutrient Reduction Alternative 1 or 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$2.2M	—	—	—
ESA	$0.6M	—	—	—
Survey, Design, and Permitting	—	$2.4M to $3.2M	—	—
Procurement and Construction	—	$7M	$12M to $13.7M	$15M
Total	**$2.8M**	**$9.4M to $10.2M**	**$12M to $13.7M**	**$15M**

4.3 Horse Creek Water Quality Improvements

4.3.1 Project Overview

Horse Creek drains an approximately 2,000-acre area within the City of Melbourne, which includes Brevard County's Wickham Park. This 390-acre recreational area consists of camping grounds, equestrian areas, swimming lakes, and other facilities. The Horse Creek drainage area also includes a golf course and residential neighborhoods. The creek outfalls directly to the IRL. This area generates an estimated TN load of 15,000 lbs per year and 2,000 lbs of TP per year based on the SWIL model LET calculations.

Project alternatives in three locations were considered within the contributing area to Horse Creek. One alternative was considered at an FDOT pond near the Horse Creek outfall. This pond captures drainage from US-1 near the Horse Creek outfall. Retrofitting this 1-acre pond with a skimmer system and BAM will result in small nutrient-load reductions. The cost to benefits and level of difficulty are likely high so it was not developed further into conceptual design. Likewise, a ditch stabilization alternative was considered farther upstream along the Parkway Drive ditch but was not selected to move into conceptual design because of its small nutrient-load reduction benefit.

Estimated load reductions during screening were higher than load reductions calculated for the project alternatives during conceptual development. The screening process involved project alternative ideas at a broader scale of detail and consideration. Once concepts were tested with a finer level of detail for the Horse Creek area, potential nutrient removals resulting from one project alternative were determined to be similar in rough order of magnitude to initial screening calculations. The remaining alternative (Alternative 1) for this area entails constructing a pumped denitrification system near County ponds at Wickham Park, similar to other project concepts described in this report. Figure 4-8 shows the general location of Horse Creek and this alternative.

Figure 4-8 Horse Creek Water Quality Improvements – General Location

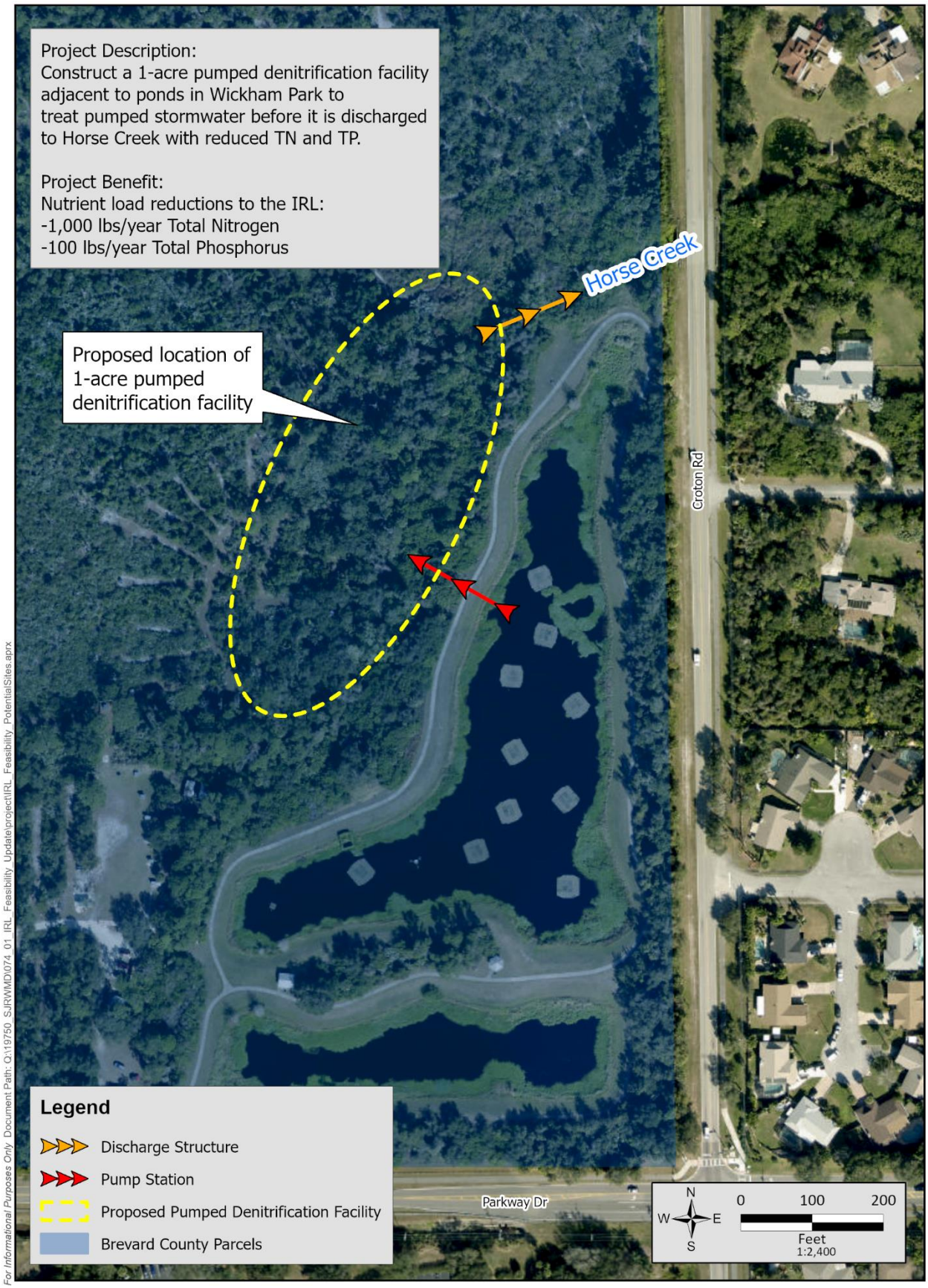
4.3.1.1 Alternative 1 – Pumped Denitrification System

A pond system at Brevard County's Wickham Park was constructed as part of the Parkway Drive Ditch Outfall project in 2000. This project was intended to provide conveyance improvements to the Parkway Drive ditch and create a regional pond system at the southeast corner of the park for flood abatement and nutrient removal. The two ponds at the site cover 8.5 acres and are connected by a weir. The north and larger pond outfalls to Horse Creek. This system receives runoff from an approximately 620-acre area. The north pond currently includes floating vegetation mats for water quality treatment placed by Brevard County.

To further enhance nutrient removal at this site, Alternative 1 involves constructing a pumped denitrification system similar to the North Merritt Island Mosquito Impoundment Project alternatives. The nearest land to the County pond is within the park and is actively used for recreational activities. Constructing a 1-acre system near the northmost pond without recreational impediments may be possible since the BAM filter shape can be variable. Pumping 5 cfs (3.2 MGD) continuously from the northmost pond through a filter and then discharging the treated water to Horse Creek was assumed to be a reasonable conceptual design for this system. As previously noted, the amount of treatment at this site can be scaled based on available area for the BAM filter, amount of water able to be pumped from the pond, as well as project budget.

Water quality and flow data for the contributing canals, park ponds, and Horse Creek were not available; therefore, SWIL model results were used for estimated removal calculations. Based on the pond parameters, the pair of ponds are assumed to remove 27 percent and 53 percent of their incoming TN and TP load per year, respectively. Of the remaining load, we estimated that approximately half of that load can be treated by the pumped denitrification system (BAM filter), assuming a pond residence time of 7 days. The BAM filter system would remove an additional 1,000 lbs per year of TN and 100 lbs per year of TP to enhance the existing pond system. Figure 4-9 shows the location of the Wickham Park ponds that are part of the Alternative 1 conceptual design.

Figure 4-9 Horse Creek Water Quality Improvements – Alternative 1



4.3.2 Planning-Level Evaluation

Table 4-10 summarizes the planning-level evaluation for the Horse Creek Water Quality Improvements Project for Alternative 1. Land acquisition is not required.

Table 4-10 Horse Creek Water Quality Improvements Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County and SJRWMD
Land Use/Zoning Issues	No land use changes are proposed with these alternatives.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Poorly drained soils within Wickham Park at the recreational area. Sandy soils immediately west of the northmost park pond noted in Alternative 1. A geotechnical analysis is required.
Wetlands and Mitigation	Wetlands are located in the vicinity of this alternative. Site assessment and coordination with regulatory staff are necessary during design.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	No hazard expected. Wickham Park is across Croton Road from a residential neighborhood, and this alternative is within the interior of the park boundary.

4.3.3 Summary of Benefits

The project team estimated the benefits of the Horse Creek Water Quality Improvements Project alternative. The primary benefit is nutrient-load reduction to the IRL. Table 4-11 summarizes the project treatment capacity for Alternative 1.

Table 4-11 Horse Creek Water Quality Improvements – Alternative 1 Project Benefit Summary

	Alternative 1
Average Annual Flow Treated	3.2 MGD
Average Annual TN Load Reduction to IRL	1,000 lbs
Average Annual TP Load Reduction to IRL	100 lbs

4.3.4 Planning-Level Cost Opinions

Table 4-12 provides an opinion of planning-level costs for the alternative. The most significant driver in the project cost is the amount of BAM associated with the design. The most significant driver of O&M and annualized cost is the need for BAM replacement.

Table 4-12 Horse Creek Water Quality Improvements Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$8.9M	$0.5M to $0.6M	$0.8M to $1.0M

4.3.5 Future Water Quality and Flow Monitoring

The project team recommends water quality sampling in the contributing ditch system and Horse Creek to better understand the water quality transformations happening as a result of the Wickham Park ponds and to quantify the benefit of a constructed BAM system. Flow monitoring in this area would help to determine if pumping 5 cfs from the Wickham Park pond system is feasible.

4.3.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement this alternative. Table 4-13 provides a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternative 1.

Table 4-13 Horse Creek Water Quality Improvements Alternative 1 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$250,000	—	—	—
ESA	$50,000	—	—	—
Survey, Design, and Permitting	—	$0.8M	—	—
Procurement and Construction	—		$5.0M	$2.8M
Total	**$0.3M**	**$0.8M**	**$5M**	**$2.8**

4.4 Eau Gallie River Mouth Water Quality Improvements

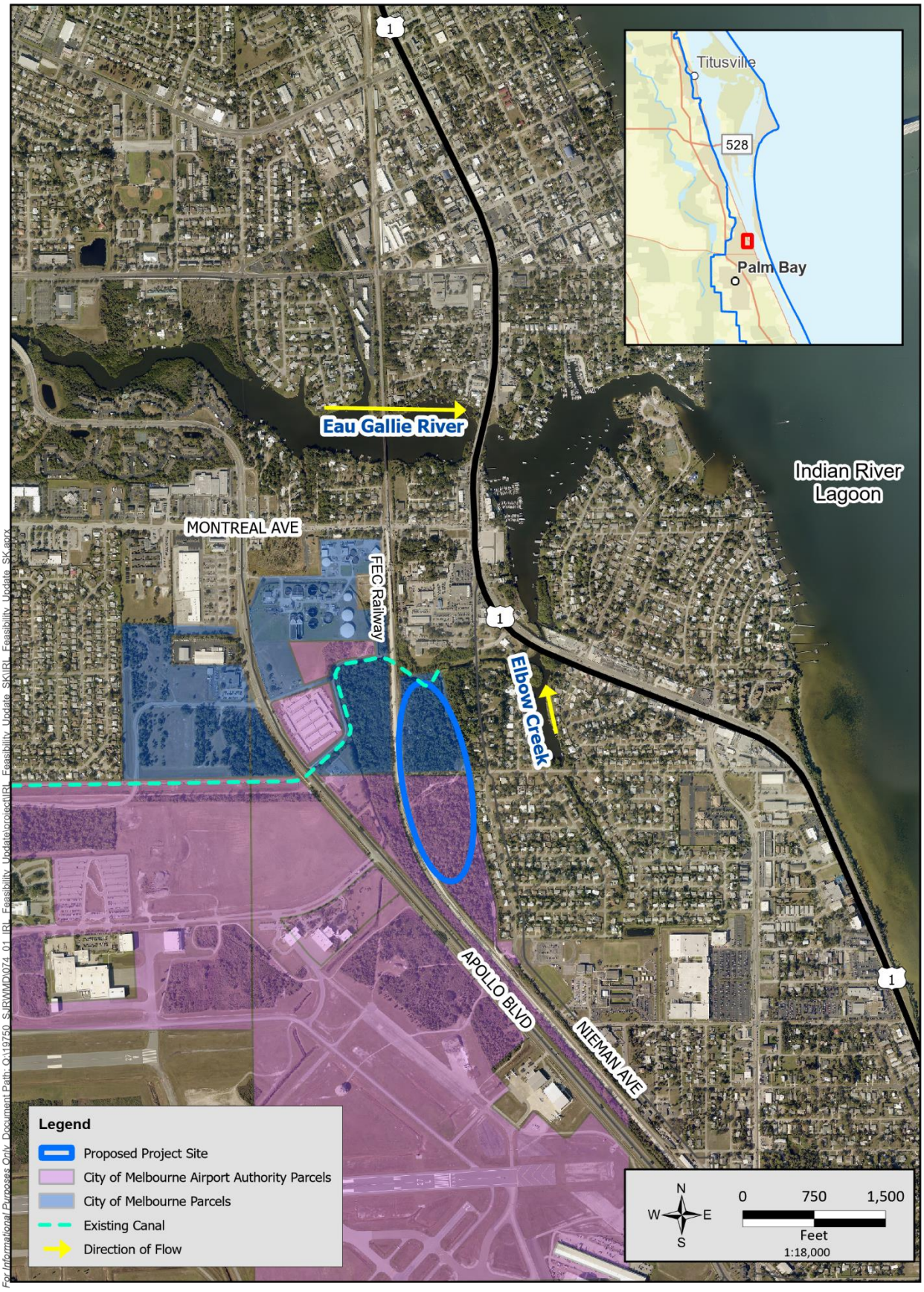
4.4.1 Project Overview

The Eau Gallie River receives drainage from a 5,900-acre basin in Melbourne. The basin includes residential areas with interconnecting ditch systems and the Melbourne Orlando International Airport. The FEC Railway crosses over the river west of US-1. Elbow Creek is a tributary that joins the Eau Gallie River before discharging into the IRL east of US-1.

The City of Melbourne owns a 12-acre parcel immediately east of the railway system. Immediately south of that parcel is a 23-acre parcel owned by the City of Melbourne Airport Authority. A series of canals and ditches crosses under Apollo Drive and the railroad and connects with Elbow Creek and eventually the Eau Gallie River. Construction of a stormwater treatment facility in this area may be feasible as detailed in Alternatives 1 through 3. Each alternative proposes a pumped denitrification facility with a BAM filter, which can be constructed in several shapes that may be suitable for the property. Each alternative involves treating water from a different source location.

Figure 4-10 shows the general location of the Eau Gallie River and the associated water quality alternatives discussed in the following subsections.

Figure 4-10 Eau Gallie River Mouth Water Quality Improvements – General Location

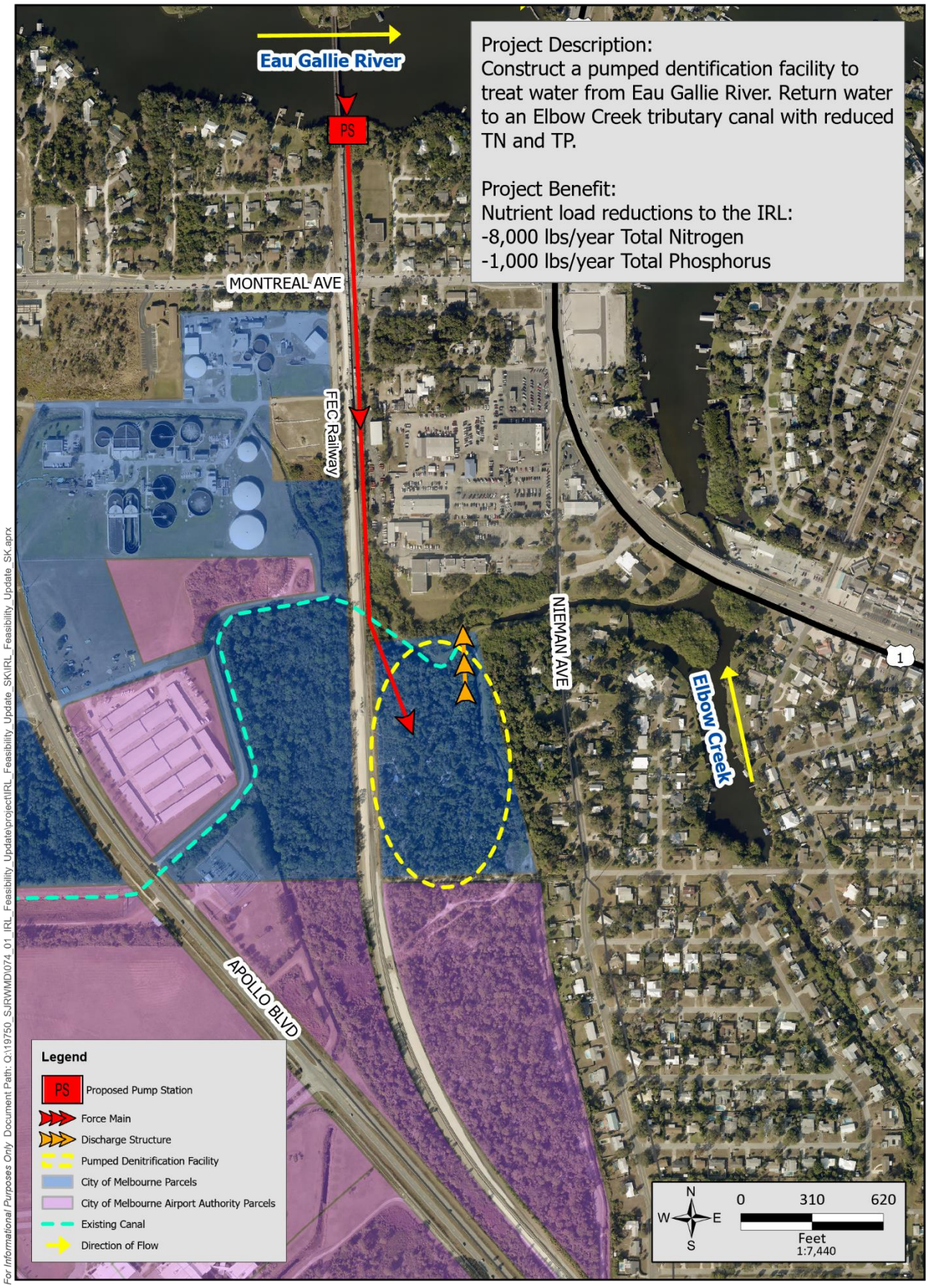


4.4.1.1 Alternative 1 – Denitrification Facility Treating Water from the Eau Gallie River

The Eau Gallie River flows east through Melbourne to the IRL. USGS Stream Flow Site 02249007 at Heather Glen Circle in Melbourne was analyzed to determine the allowable pumping rate of a pumped denitrification facility, which would treat water pumped directly from the Eau Gallie River. According to site statistics, the mean flow based on 33 years of data was 7.7 cfs. Alternative 1 involves pumping directly from the river to a denitrification facility approximately 3,000 feet south. Conceptual design includes using a 16-inch force main, which runs adjacent to the FECR. This project proposes pumping 5 cfs (3.2 MGD) to a 1-acre pumped denitrification facility described previously in this report. For this report, we assumed that a 1-acre facility would be constructed on City of Melbourne property. Discharge from the BAM filter could be piped to the east into Elbow Creek or discharged nearby to the contributing canal system. Discharging to the canal system that runs through the city-owned parcel is the project configuration for which costs were developed in Section 4.4.4.

Water quality in the Eau Gallie River was considered for nutrient removal calculations. Data from June 1991 through March 2023 from SJRWMD surface-water sampling site IRLEGU were analyzed for water quality characteristics. An average TN concentration of 1.25 mg/L and an average TP concentration of 0.15 mg/L were used to calculate the removal of nutrients considering Alternative 1. Based on analysis of the water quality data, a 1-acre pumped denitrification system could provide an approximate nutrient load reduction to the IRL of 8,000 lbs of TN and 1,000 lbs of TP each year. Figure 4-11 shows the overall project site and estimated nutrient load reduction for Alternative 1.

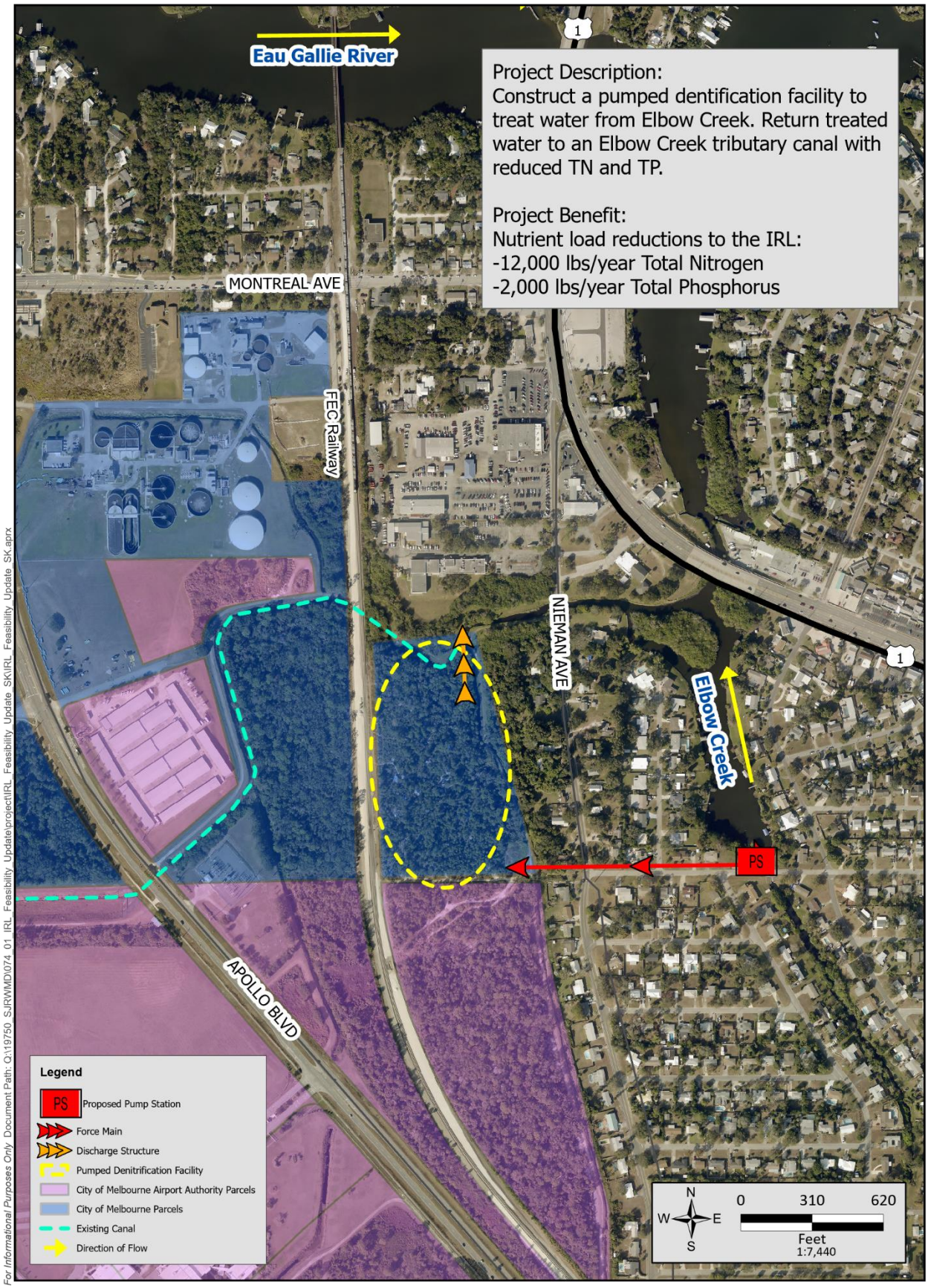
Figure 4-11 Eau Gallie River Mouth Water Quality Improvements – Alternative 1



4.4.1.2 Alternative 2 – Denitrification Facility Treating Water from Elbow Creek

Alternative 2 is similar in construction to Alternative 1 but involves piping a shorter distance and treating Elbow Creek water before discharging treated water to the canal draining to Elbow Creek. Approximately 1,200 feet of 16-inch force main would be constructed along Laurie Street to a 1-acre pumped denitrification facility. Likewise, treated discharge would be sent to the canal that runs through the city-owned parcel. Flow data were not available for this system; we assumed that pumping 5 cfs from Elbow Creek and returning the treated flow back to the system is possible. Water quality data from Elbow Creek were analyzed to determine nutrient removal resulting from this alternative. The period of record for SJRWMD site IRLEGU is from 1979 through 1996, which was the best available for this area. Based on this information, average concentrations of 1.78 mg/L for TN and 0.27 mg/L for TP were used in calculations. Constructing a 1-acre facility treating 5 cfs from Elbow Creek may reduce nutrient loading to the IRL by up to 12,000 lbs of TN and 2,000 lbs of TP each year. Figure 4-12 shows the general layout and benefits of Alternative 2.

Figure 4-12 Eau Gallie River Mouth Water Quality Improvements – Alternative 2



4.4.1.3 Alternative 3 – Denitrification System Treating Water from the Canal System

Alternative 3 is similar in construction to the other alternatives except for the origin of the water to be treated and the proposed location of the denitrification facility. This alternative involves pumping directly from the canal system that runs through the city-owned parcel to avoid constructing a lengthy force main. Pumping directly from the canal to a denitrification facility on the Airport Authority parcel may also be possible, providing another option for treatment placement if the City parcel is unavailable. Other elements would be the same as in Alternatives 1 and 2. Canal water quality data were not available; therefore, for calculation purposes, we assumed that the canal water quality is similar to that in Elbow Creek. Accordingly, expected load reductions for Alternative 3 are estimated at 12,000 lbs of TN and 2,000 lbs of TP each year. Figure 4-13 shows the location and benefits of Alternative 3.

Figure 4-13 Eau Gallie River Mouth Water Quality Improvements – Alternative 3

4.4.2 Planning-Level Evaluation

Table 4-14 summarizes the planning-level evaluation for the Eau Gallie River Mouth Water Quality Improvements for Alternatives 1 through 3. Land acquisition of the 23-acre City of Melbourne Airport Authority parcel was considered as part of Alternative 3.

Table 4-14 Eau Gallie River Mouth Water Quality Improvements Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County, City of Melbourne, and SJRWMD.
Land Use/Zoning Issues	No land use changes are proposed. Coordination with FECR is necessary to determine easement allowances, where applicable.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Poorly drained soils cover most of the City of Melbourne parcels with some areas of sandy soil. A geotechnical analysis is required in areas proposed for pipe construction.
Wetlands and Mitigation	Land use on site is pine flatwoods and wetlands. A site assessment is required and coordination with regulatory staff is necessary during detailed design.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	Residential and commercial areas are in close proximity to each of these alternatives. Public outreach recommended during design.

4.4.3 Summary of Benefits

The project team estimated the benefits of the Eau Gallie River Mouth Water Quality Improvement alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 4-15 summarizes the project treatment capacity for Alternatives 1 through 3.

Table 4-15 Eau Gallie River Mouth Water Quality Improvements – Alternatives 1 through 3 Project Benefit Summary

	Alternative 1	Alternative 2	Alternative 3
Average Annual Flow Treated	3.2 MGD	3.2 MGD	3.2 MGD
Average Annual TN Load Reduction to IRL	8,000 lbs	12,000 lbs	12,000 lbs
Average Annual TP Load Reduction to IRL	1,000 lbs	2,000 lbs	2,000 lbs

4.4.4 Planning-Level Cost Opinions

Table 4-16 provides an opinion of planning-level costs for the alternatives. The most significant driver in the difference of the project costs is the piping required by the design. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing.

Table 4-16 Eau Gallie River Mouth Water Quality Improvements Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$11.1M	$0.5M to $0.7M	$0.9M to $1.1M
Alternative 2	$9.9M	$0.5M to $0.7M	$0.8M to $1.0M
Alternative 3	$9.4M	$0.5M to $0.6M	$0.8M to $1.0M

4.4.5 Future Water Quality and Flow Monitoring

The project team recommends water quality sampling in Elbow Creek to update the period of record for data from that area. Flow monitoring in Elbow Creek and assessing pumping impacts on the Eau Gallie River and/or Elbow Creek would determine the most suitable pumping capacity for treatment. Water quality monitoring within the contributing canal system, which runs through City of Melbourne parcels, would better define the treatment benefits of the proposed system in Alternative 3.

4.4.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the Eau Gallie River Mouth Water Quality Improvement alternatives. Table 4-17 provides a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternatives 1 through 3.

Table 4-17 Eau Gallie River Mouth Water Quality Improvements Alternative 1, 2, or 3 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$0.2M to $0.4M	—	—	—
Land Acquisition and ESA	$0.2M to $0.6M	—	—	—
Survey, Design, and Permitting	—	$0.6M to $0.8M	—	—
Procurement and Construction	—		$4.2M to $4.5M	$4.2M to $4.8M
Total	**$0.4M to $1M**	**$0.6M to $0.8M**	**$4.2M to $4.5M**	**$4.2M to $4.8M**

4.5 Crane Creek Offline Treatment

4.5.1 Project Overview

Crane Creek is a natural creek in Brevard County, draining predominantly developed land uses within the City of Melbourne to the IRL. The drainage has been altered by canals that lead to the creek. Approximately 3,000 acres of primarily residential land south of Crane Creek drain through a main canal system along Leonard Weaver Boulevard that discharges to the creek; an approximately 5-acre, bermed containment area, owned by the City of Melbourne, is located between this canal and the city's Grant Street Wastewater Treatment

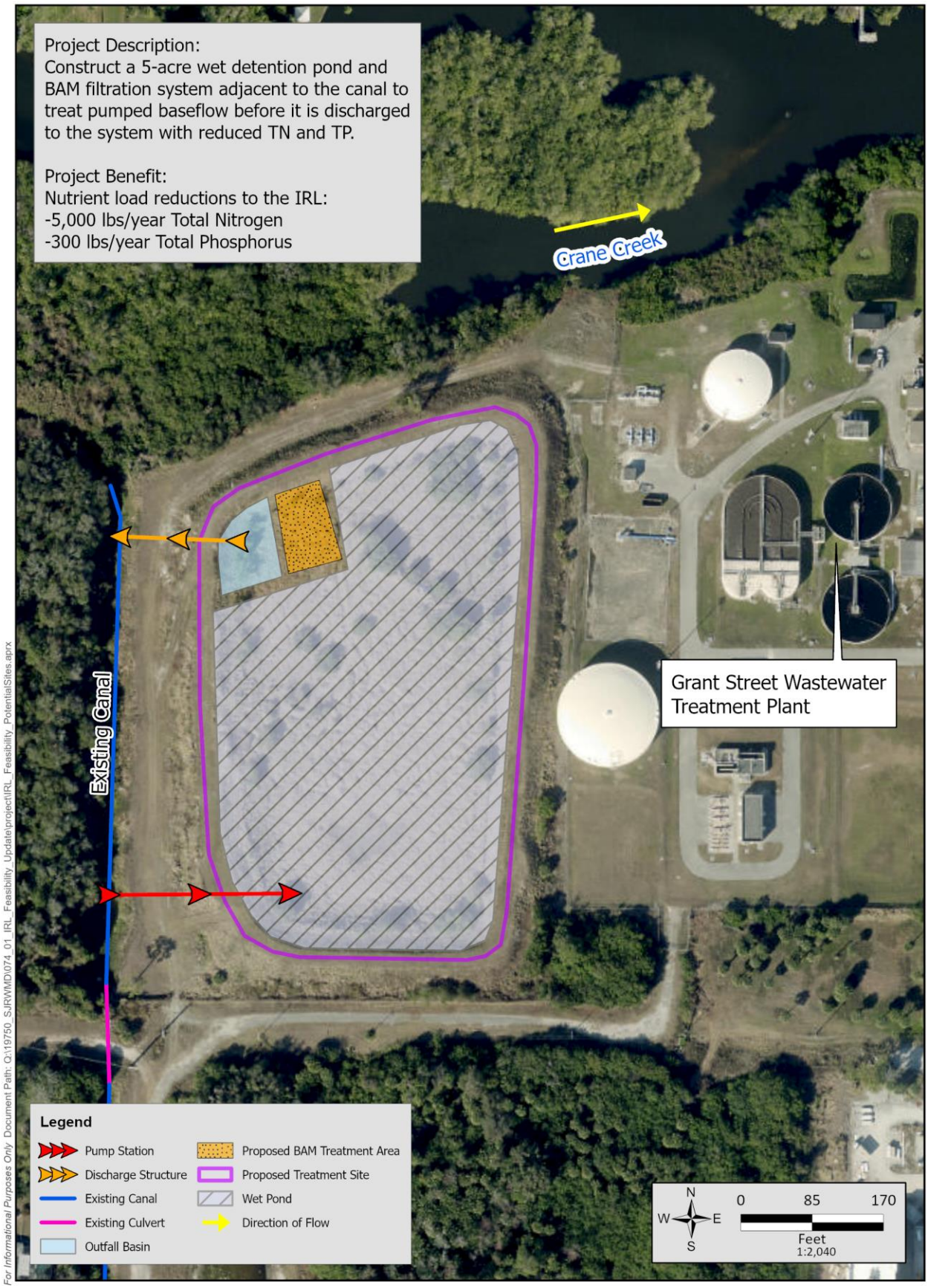
Plant. This area was used in the past for dredge spoil from Crane Creek dredging efforts and may potentially be used in the future. Currently, this containment area is used as an emergency overflow area for the treatment plant. However, the city intends to design and permit a separate UIC (Underground Injection Control) well that is expected to be in service within the next few years. Construction of the UIC well would then allow the 5-acre containment area to be available for other beneficial uses. This containment area is proposed to be repurposed for stormwater treatment as part of this feasibility study because the land is stakeholder-owned and the area is already formed as a pond with a continuous berm at a top elevation between 28 and 29 feet North American Vertical Datum of 1988 (NAVD 88). The center of the bermed area has an elevation between 11 and 12 feet NAVD 88. Water from the canal adjacent to Leonard Weaver Boulevard could be pumped into a proposed treatment facility on stakeholder property at this bermed site. Using the existing topography and bermed area would save time and construction cost. The facility could involve creating a wet detention pond with a BAM polishing area as in Alternative 1 or a pumped denitrification facility as in Alternative 2. Figure 4-14 shows the general location of Crane Creek and these projects.

Figure 4-14 Crane Creek Offline Treatment – General Location

4.5.1.1 Alternative 1 – Wet Detention Pond with a BAM Polishing Area

Alternative 1 comprises an offline treatment system in the vicinity of Crane Creek at the treatment plant emergency overflow area owned by the City of Melbourne. The treatment system will continuously pump 5 cfs (3.2 MGD) of water from the canal adjacent to Leonard Weaver Boulevard into an approximately 5-acre wet detention pond. This pond will probably need to be lined to reduce losses through infiltration. The water will move through the wet detention pond and enter a BAM filtration system, where denitrification will occur. Once the water has left the BAM filter, it will be discharged back into the canal through an outfall basin before it enters Crane Creek. Figure 4-15 presents a layout of the system.

Figure 4-15 Crane Creek Offline Treatment – Alternative 1



Flow or water quality data for this specific canal were not available for analysis. Aerial photography and a canal width of approximately 20 feet suggest that 5 cfs may be possible for pumping out of the canal. Nearby canal water quality sites (FDEP Station Identification Nos. (IDs) 20010717 and 41311), whose drainage areas are similar to the area in question, were analyzed for average TN and TP concentrations and used as an approximation of canal water quality. Data for Station ID 20010717 were collected in 2003, and data for Station ID 41311 were collected in 2012. The average TN concentration calculated and used for loading calculations was 1.2 mg/L. The average TP concentration calculated from these sites and used for loading calculations was 0.04 mg/L.

The proposed lined wet detention pond was conservatively sized with a mean residence time of 3.2 days, a total footprint of approximately 4.5 acres, and a depth of 10 feet. With a residence time of 4.5 days, removal efficiencies for TN and TP were calculated to be 22 percent and 50 percent, respectively, from efficiency curves presented in FDEP's *Evaluation of Current Stormwater Design Criteria Within the State of Florida* (June 2007).

The BAM filtration system was sized to have an EBCT of 61 minutes based on the design of similar treatment systems. At a constant flow rate of 5 cfs, 670 cubic yards of BAM will be required to achieve this EBCT. According to the findings presented in the FDOT report, *Demonstration Bio Media for Ultra-Urban Stormwater Treatment,* May 2014, Bold & Gold®BAM filtration columns with an EBCT in this range produce removal efficiencies of 26 percent for TN and 52 percent for TP.

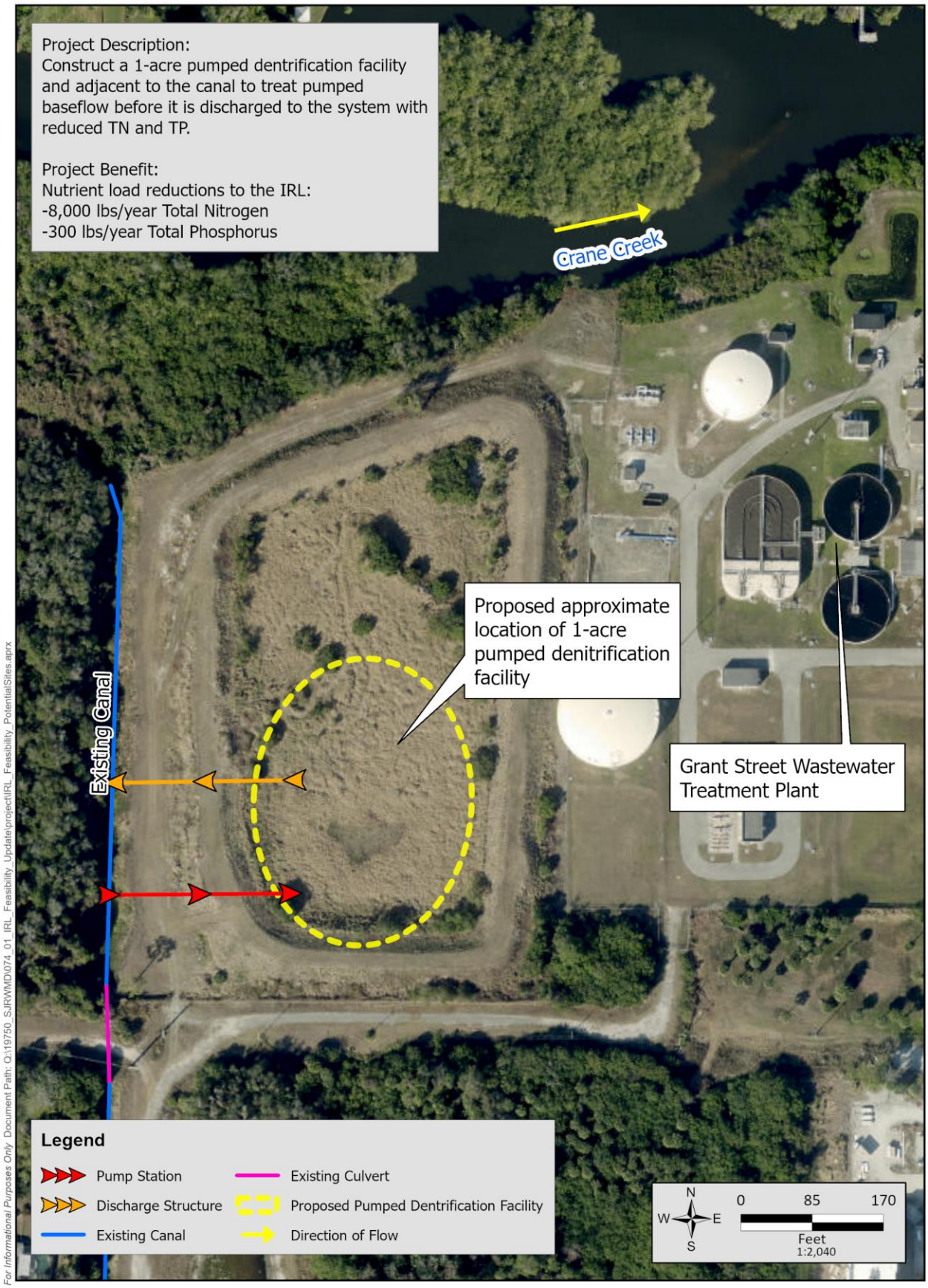
With the wet detention pond and BAM filtration system, the treatment train is estimated to remove 5,000 lbs of TN and 300 lbs of TP per year. Larger BAM filters and/or a longer BAM contact time would produce higher nutrient removal. The specific BAM filter media type as well as treatment rate and filter size versus pond size are design elements to be considered during detailed design, which may depend on site-specific constraints as well as cost.

4.5.1.2 Alternative 2 – Pumped Denitrification Facility

Alternative 2 involves using the 5-acre area for constructing an underground pumped downflow denitrification system to reduce nutrient loading to Crane Creek. However, less surface area is needed for the treatment footprint compared to Alternative 1. Similar to the denitrification facility proposed for the Eau Gallie River Mouth Water Quality project alternatives, the proposed treatment system includes pumping approximately 5 cfs of water from the adjacent canal continuously through a 1-acre treatment facility consisting of a layer of sand for nitrification above a layer of BAM for denitrification and phosphorus adsorption. The flow will be collected by an underdrain and discharged back to the canal. The media area was sized based on similar system designs, considering flow rate and contact time.

This type of facility is expected to remove 66 percent of TN and 66 percent of TP from the inflow based on information from BAM applications and appropriately designed contact time. The BAM filter media is expected to be continuously wet with the pumped canal water. Based on the flow rate and concentrations previously noted, the system will provide an estimated nutrient reduction of 8,000 lbs of TN and 300 lbs of TP per year. This system could be scaled up depending on detailed design determination of how much flow is available for pumping from the canal and available funds for construction and maintenance. Figure 4-16 shows the layout of proposed Alternative 2 for this project.

Figure 4-16 Crane Creek Offline Treatment – Alternative 2



4.5.2 Planning-Level Evaluation

Table 4-18 summarizes the planning-level evaluation for the Crane Creek Offline Treatment Project for Alternatives 1 and 2. Land acquisition is not required for these alternatives.

Table 4-18 Crane Creek Offline Treatment Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County, SJRWMD, and the City of Melbourne
Land Use/Zoning Issues	The area for construction is within the land use classified for sewage treatment plants. The bermed internal area is zoned as freshwater marshes. Coordination using this site with local governments will be necessary, including timing of any future dredging activities, injection well plans and construction.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Predominantly sandy soils; moderate to well-drained when soil storage capacity is available. A geotechnical analysis is required.
Wetlands and Mitigation	No adverse impacts to wetlands.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	No hazard expected. These project alternatives are not near any residential area.

4.5.3 Summary of Benefits

The project team estimated the benefits of the Crane Creek Offline Treatment Project alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 4-19 summarizes the project treatment capacity for Alternatives 1 and 2.

Table 4-19 Crane Creek Offline Treatment – Alternatives 1 and 2 Project Benefit Summary

	Alternative 1	Alternative 2
Average Annual Flow Treated	3.2 MGD	3.2 MGD
Average Annual TN Load Reduction to IRL	5,000 lbs	8,000 lbs
Average Annual TP Load Reduction to IRL	300 lbs	300 lbs

4.5.4 Planning-Level Cost Opinions

Table 4-20 provides an opinion of planning-level costs for the new alternatives. The most significant driver in the difference of the project costs is the amount of BAM required by the design. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing.

Table 4-20 Crane Creek Offline Treatment Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$4.2M	$0.2M	$0.3M to $0.4M
Alternative 2	$8.7M	$0.5M to $0.6M	$0.8M to $1M

4.5.5 Future Water Quality and Flow Monitoring

The project team recommends monthly ambient or baseflow water quality sampling in the canal upstream and downstream of the treatment site combined with water quality sampling and flow measurements for several storm events at this site. The data collected would help better estimate nutrient concentrations in the existing canal and nutrient load reductions resulting from the proposed improvements.

4.5.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the Crane Creek Offline Treatment Project alternatives.

Table 4-21 and Table 4-22 provide a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternatives 1 and 2.

Table 4-21 Crane Creek Offline Treatment Alternative 1 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3
Preliminary Design and Modeling	$0.4M	—	—
ESA	$0.1M	—	—
Survey, Design, and Permitting	—	0.2M	—
Procurement and Construction	—	$1M	$2.5
Total	**$0.5M**	**$1.2M**	**$2.5M**

Table 4-22 Crane Creek Offline Treatment Alternative 2 Preliminary Implementation Schedule

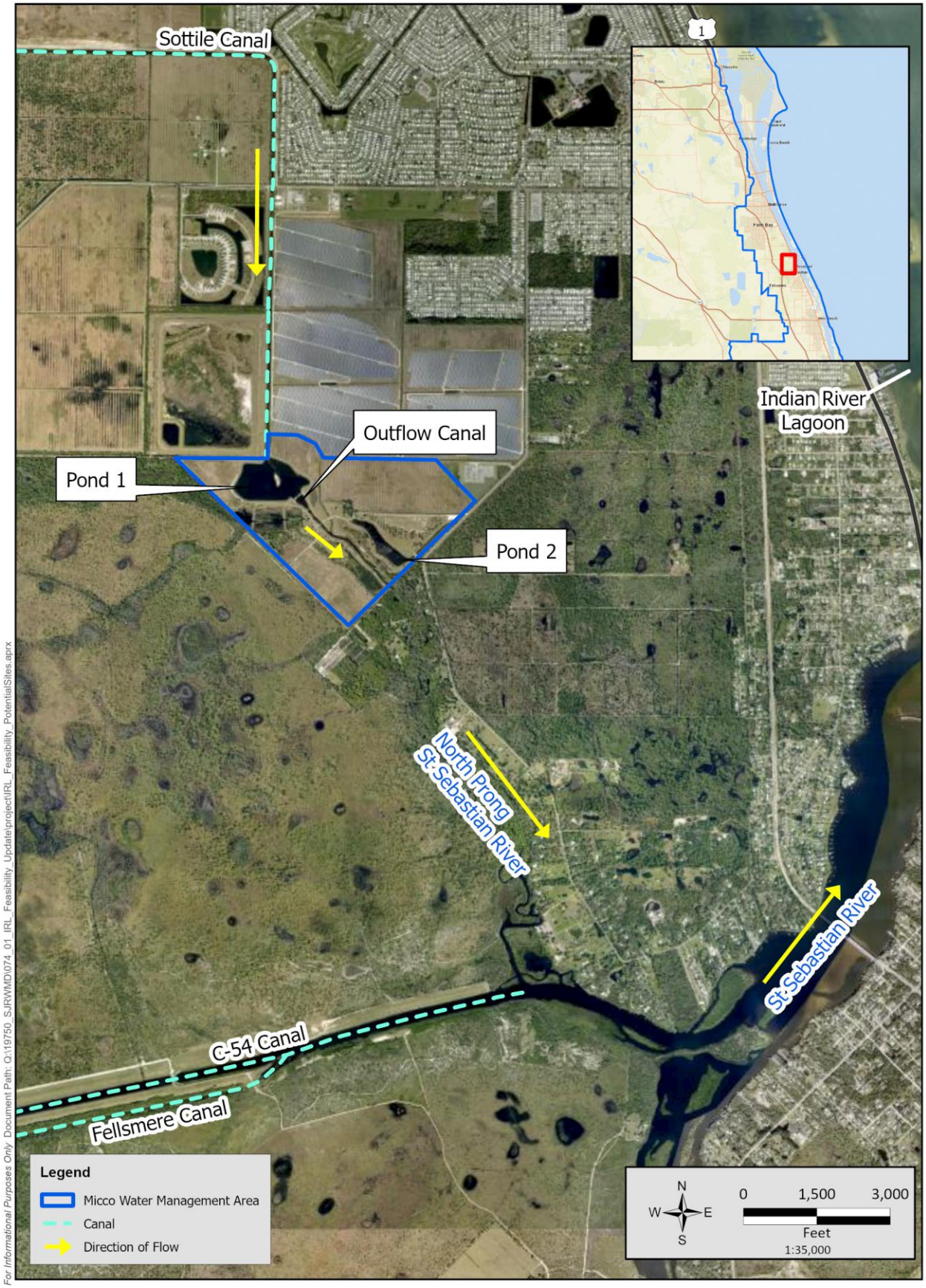
Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$0.6M	—	—	—
ESA	$0.2M	—	—	—
Survey, Design, and Permitting	—	$0.5M	$0.1M	—
Procurement and Construction	—	—	$2M	$5.3
Total	**$0.8M**	**$0.5M**	**$2.1M**	**$5.3M**

4.6 Micco Water Management Area Improvements

4.6.1 Project Overview

The Micco WMA (formerly known as Wheeler Stormwater Park) was designed to treat stormwater and baseflow from an approximately 21,000-acre drainage area in Brevard County. The WMA accepts flow from the Sottile Canal, Herndon Swamp, and Fleming Grant Road and routes it through a series of ponds and constructed wetlands. Figure 4-17 shows the overall location of the site. The hydrology of the property and alternative designs for Micco WMA were characterized in a SJRWMD report by Clapp and Smith (November 2015). The design and construction of the project occurred over multiple phases, with construction being completed in late 2015.

Figure 4-17 Micco Water Management Area Improvements – General Location



The Clapp and Smith report characterized the total load entering the stormwater park by Hydrological Simulation Program FORTRAN (HSPF) model results combined with flow-weighted averages of TN and TP concentrations. The removal efficiency for each park element was calculated to estimate the pounds of nutrient removal by the entire park based on flow rate, concentration, and hydraulic residence time. The pollutant inflow into each park element was characterized and dominated by the Sottile Canal inflow, which flows into Pond 1. For Pond 1, the average percent of total load that could be removed was estimated to be 45 percent for TP and 14 percent for TN based on an average hydraulic residence time of 2.7 days.

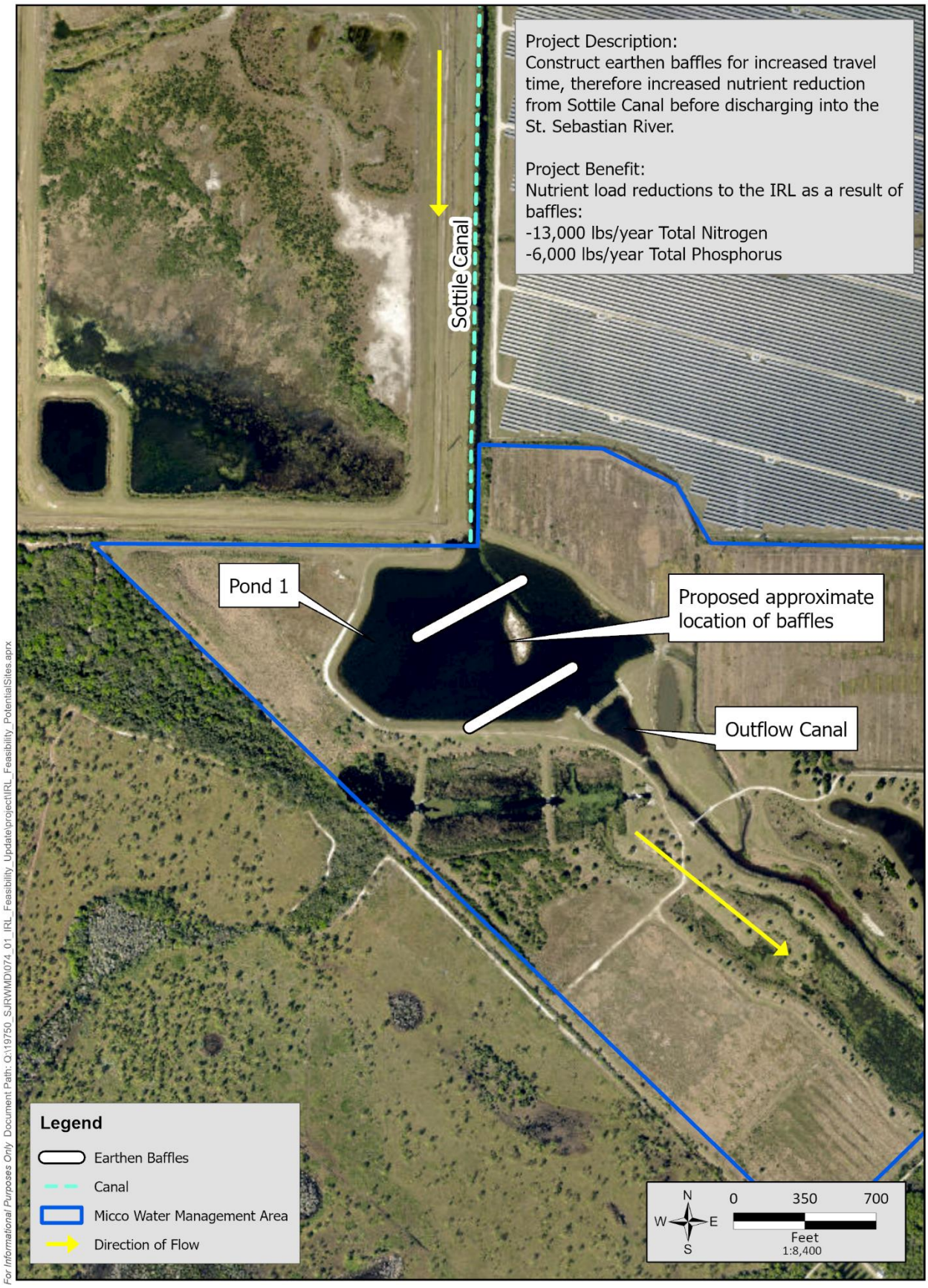
Harvey Harper's wet detention pond removal efficiencies depend on residence time (Harper and Baker, 2007). A residence time of 3 days would be expected to result in a low-removal efficiency based on the removal equations. Based on aerial photography and land-based photographs of Pond 1, flow appears to be short-circuiting from north to south, which may be compounding the low efficiency.

Since Pond 1 receives most of the load coming through Micco WMA, two alternatives for this project involve increasing the travel time from inflow to outflow by adding baffles. Increasing travel time allows further particulate separation and nutrient treatment functionality, as described by Dr. Sansalone in his 2016 report titled *Technical Report on the Water Management Performance of the FAA Pond at Naples Municipal Airport*. Alternative 1, the simplest alternative, is to construct two earthen berms to help move water through what appear to be stagnant areas. Alternative 2 would build onto Alternative 1 and follow the approach of Sansalone's gabion baffles as described in Sansalone, 2016. Alternative 3 involves constructing a pumped denitrification system to maximize nutrient removals out of Pond 1 and potentially Pond 2 treating stormwater and baseflow before discharging it back to the outflow canal, which forms the North Prong St. Sebastian River.

4.6.1.1 Alternative 1 – Earthen Baffles within Pond 1

Alternative 1 would use the existing earthen island in Pond 1 as part of the berm system to reduce the amount and cost of needed earthwork. Figure 4-18 shows an example baffle layout that improves volumetric utilization and residence time. In this alternative inflow water from the Sottile Canal enters as in the existing system, but moves through the pond around the proposed baffles. For the purposes of this study, it is assumed that constructing earthen baffles within the existing pond system is feasible. This pond was originally conceptualized with an average detention time of 2.7 days (Clapp, 2015). Adding the two proposed earthen baffles allows the entire pond volume to be used for treatment and the pond to attain the expected removals of 45 percent for TP and 14 percent for TN. Based on the calculated SWIL load and distributing that as loads were distributed in the Clapp report, Pond 1 may have up to 13,000 lbs of TN reduction and up to 6,000 lbs of TP reduction per year as a result of implementing Alternative 1.

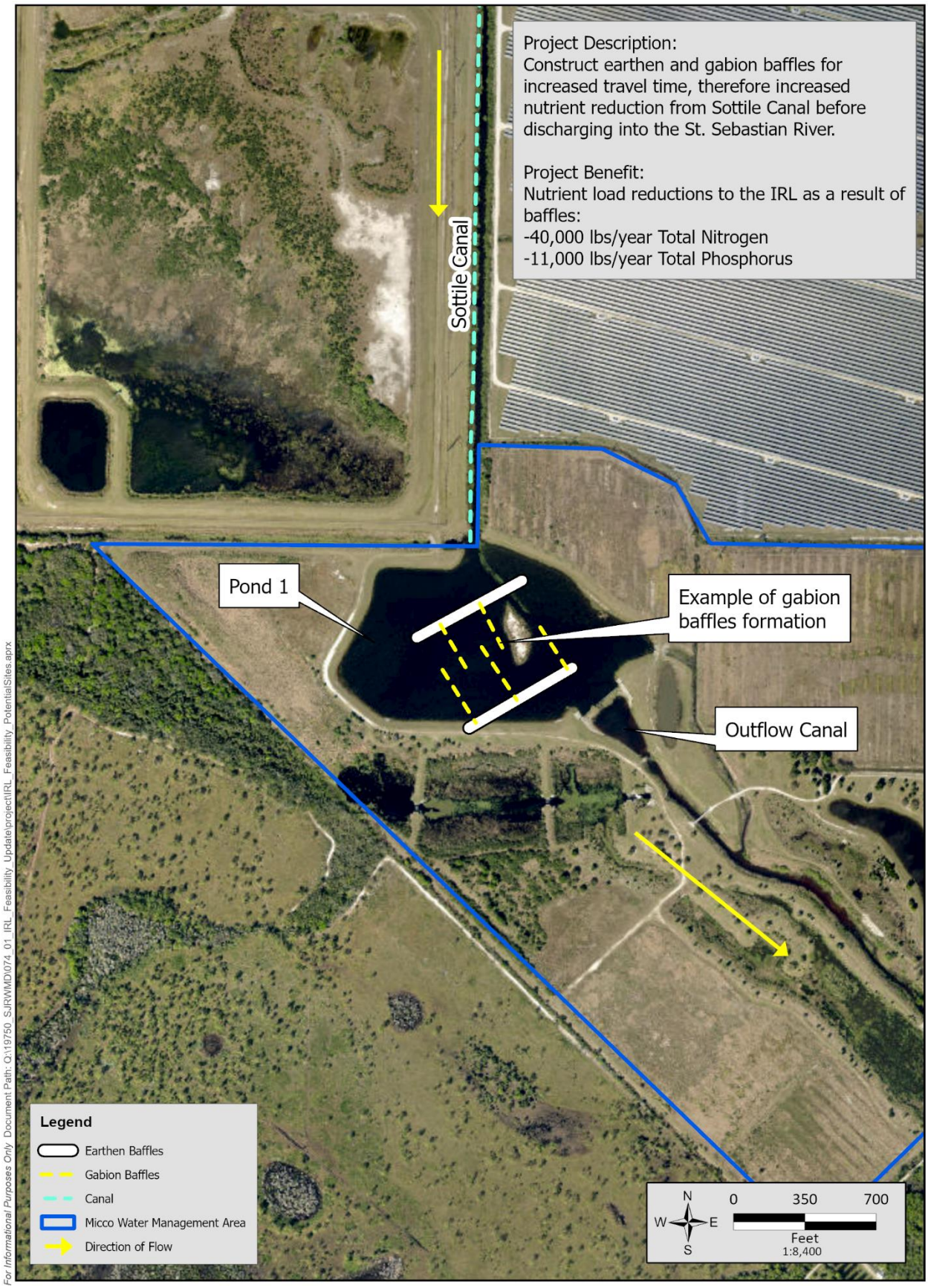
Figure 4-18 Micco Water Management Area Improvements – Alternative 1



4.6.1.2 Alternative 2 – Gabion Baffles Added to Alternative 1

For Alternative 2, gabion baffles could be added to the Alternative 1 earthen baffles to further increase the flow path through the pond. Sansalone developed a technical report in support of studying the performance of a retrofitted pond at the Naples Municipal Airport in 2016. The retrofit design included a series of gabion baffles to increase the flow path while not changing pond volume and inflow. The technical study reviewed the gabion design and effect on load, and results showed that increasing tortuosity of the flow path to attain the travel time equivalent of a 21-day residence time resulted in up to a 78-percent reduction of TP load and a 44-percent reduction of TN load even though the system was biologically young. A more developed system may further decrease loads by the biological uptake of nutrients from algae and bacteria found on rocks within the gabion baskets. Alternative 2 includes adding gabion baffles in a formation to increase travel time to the equivalent of a 21-day residence time following Sansalone's approach. In this alternative, similar to Alternative 1, water from the Sottile Canal enters Pond 1 and moves through the pond around the series of proposed baffles. For purposes of this study, it is assumed that adding baffles to an existing and functional pond system is possible, as in Sansalone's example. Based on the starting loads calculated for Pond 1 using the method described above, constructing a robust baffle system as noted for Alternative 2 could result in 40,000 lbs of TN reduction and 11,000 lbs of TP reduction per year. Figure 4-19 shows the general location of baffles and summarizes the nutrient reduction.

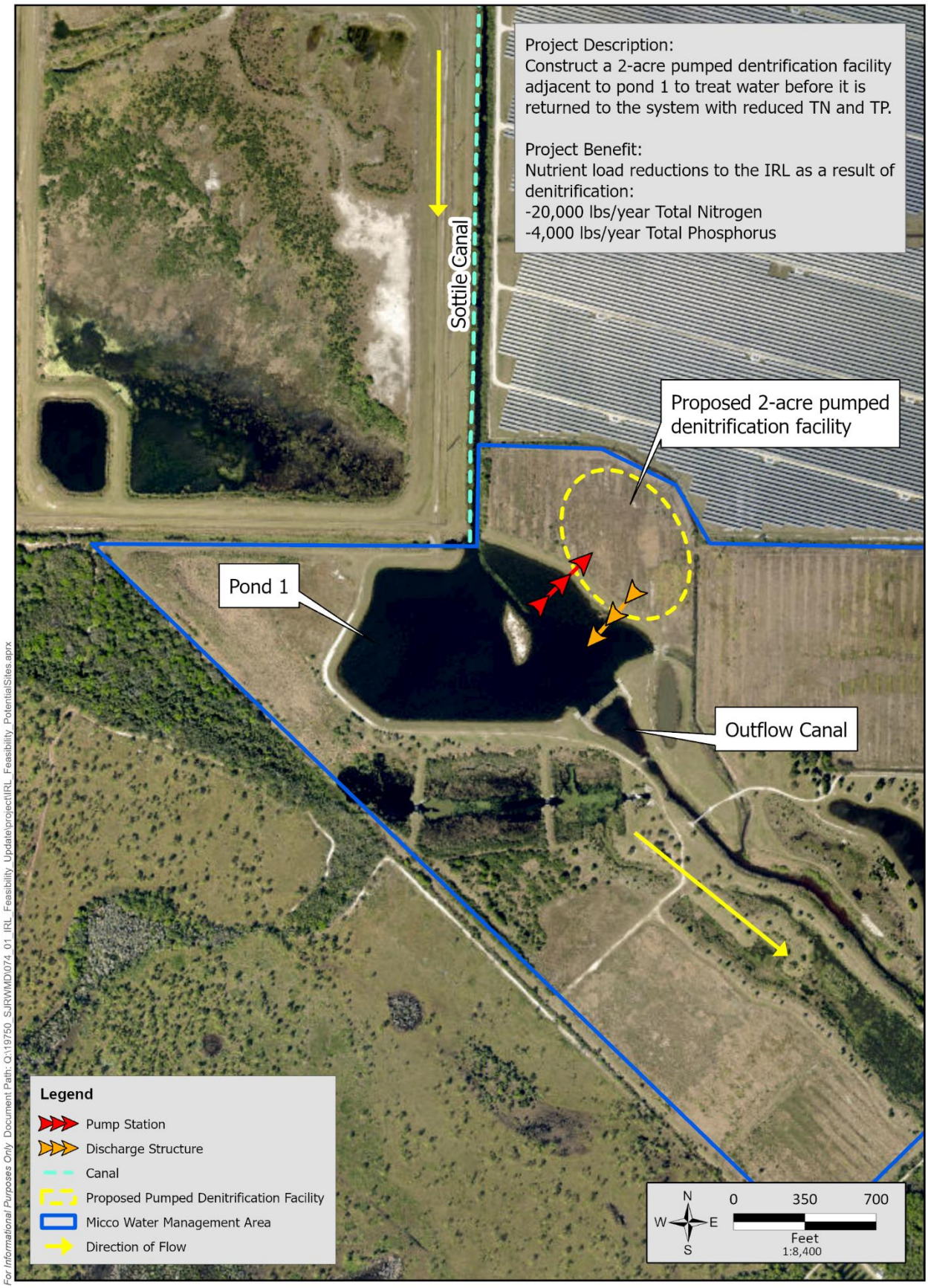
Figure 4-19 Micco Water Management Area Improvements – Alternative 2



4.6.1.3 Alternative 3 – Pumped Denitrification System

Alternative 3 is similar to the alternatives proposed for the C-1 Canal Baseflow project in Chapter 2 of this report, and the treated discharge would be recirculated to Pond 1. The Micco WMA land is owned by SJRWMD and has space on site for constructing an underground pumped denitrification facility. Several acres of land are available to treat 10 cfs (6.5 MGD) pumped from Pond 1 (the main acceptor of load for this basin), which is more than adequate space. Pumping 10 cfs through a denitrification facility would require a 2-acre area of media. Options are available on site for the 2-acre media portion of the facility, with the most appropriate inflow and outflow locations being determined during preliminary design and engineering. Treated water would be collected via an underdrain system and discharged back to the pond. The same treatment concepts apply here, with water pumped from the pond through a nitrification layer first, flowing down through the denitrification layer, and then collected by an underdrain perforated pipe. Returning the effluent by gravity flow would likely be possible because the facility would be constructed at an appropriate elevation for that option; elevation details would be determined during preliminary design. Figure 4-20 shows the vicinity of elements of Alternative 3.

Figure 4-20 Micco Water Management Area Improvements – Alternative 3



This type of facility is expected to remove 66 percent of TN and 66 percent of TP from the inflow based on information from BAM applications and appropriately designed contact time. The BAM filter media is expected to be continuously wet with the pumped pond water. This conceptual design is based on a design flow rate of 10 cfs and concentrations noted in Clapp, 2015 for the pond inflow, which are 1.66 mg/L TN and 0.35 mg/L TP. A 2-acre system could reduce the nutrient load by approximately 20,000 lbs of TN and 4,000 lbs of TP per year.

4.6.2 Planning-Level Evaluation

Table 4-23 summarizes the planning-level evaluation for the Micco Water Management Area Improvements Project for Alternatives 1 through 3. No land acquisition is required to accomplish any alternative for this project because SJRWMD owns the entire area.

Table 4-23 Micco Water Management Area Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Brevard County and SJRWMD
Land Use/Zoning Issues	Alternatives 1 through 3 project sites are all within SJRWMD land at the Micco WMA. No land use or zoning issues are expected.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Sandy soils; moderate to well-drained when soil storage capacity is available. A geotechnical analysis is required.
Wetlands and Mitigation	No adverse impacts to wetlands expected.
Environmental Contaminants	Environmental assessment is required.
Proximity to Residential Land and Potential Hazard Classification	The alternatives are not expected to raise water levels. These alternatives are not in close proximity to residential areas.

4.6.3 Summary of Benefits

The project team estimated the benefits of the Micco WMA Improvements Project alternatives. The primary benefit is nutrient-load reduction to the IRL. Table 4-24 summarizes the project treatment capacity for Alternatives 1 through 3.

Table 4-24 Micco Water Management Area Improvements – Alternatives 1 through 3 Project Benefit Summary

	Alternative 1	Alternative 2	Alternative 3
Average Annual Flow Treated	32.2 MGD	32.2 MGD	6.5 MGD
Average Annual TN Load Reduction to IRL	13,000 lbs	40,000 lbs	20,000 lbs
Average Annual TP Load Reduction to IRL	6,000 lbs	11,000 lbs	4,000 lbs

4.6.4 Planning-Level Cost Opinions

Table 4-25 provides an opinion of planning-level costs for the three project alternatives. The most significant driver in the difference of the project costs is the BAM required by the design for Alternative 3. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing. The life of BAM can vary depending on inflow characteristics and type of media. The average standard life of 20 years for media was used in life-cycle calculations. Costs for the denitrification systems were scaled up by size based on actual construction costs in 2021 of a similar denitrification system along with actual construction bid costs.

Table 4-25 Micco Water Management Area Improvements Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$3M	$7,000 to $13,000	$0.1M
Alternative 2	$9.1M	$12,000 to $32,000	$0.3M to 0.4M
Alternative 3	$16.2M	$0.9M to $1.2M	$1.4M to $1.9M

4.6.5 Future Water quality and Flow Monitoring

The project team recommends monthly ambient or baseflow water quality sampling in the Sottile Canal upstream and downstream of the WMA combined with sampling water quality and flows for several storm events at these sites. The data collected will allow for a more accurate estimate of nutrient load reductions resulting from the proposed improvements.

4.6.6 Preliminary Implementation Schedule

The project team expects different timeframes for implementing alternatives for the Micco WMA Improvements Project depending on what project or projects are chosen to construct. Building baffles are expected to take less time than constructing a pumped denitrification facility, which would necessitate a multi-year timeframe for implementation.

Table 4-26 and Table 4-27 provide a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing the Micco WMA Improvements Project for Alternatives 1 through 3.

Table 4-26 Micco Water Management Area Improvements Alternatives 1 and 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2
Preliminary Design and Modeling	$0.2M to $0.7M	—
ESA	$0.1M	—
Survey, Design, and Permitting	$0.1M to $0.2M	—
Procurement and Construction	$0.6M to $2M	$2M to $6M
Total	**$1M to $3M**	**$2M to $6M**

Table 4-27 Micco Water Management Area Improvements Alternative 3 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$1.2M	—	—	—
ESA	$0.3M	—	—	—
Survey, Design, and Permitting	—	$1.0M	—	—
Procurement and Construction	—	—	$7.5M	$6.2M
Total	**$1.5M**	**$1.0M**	**$7.5M**	**$6.2M**

4.7 South Prong St. Sebastian River Stormwater Treatment

4.7.1 Project Overview

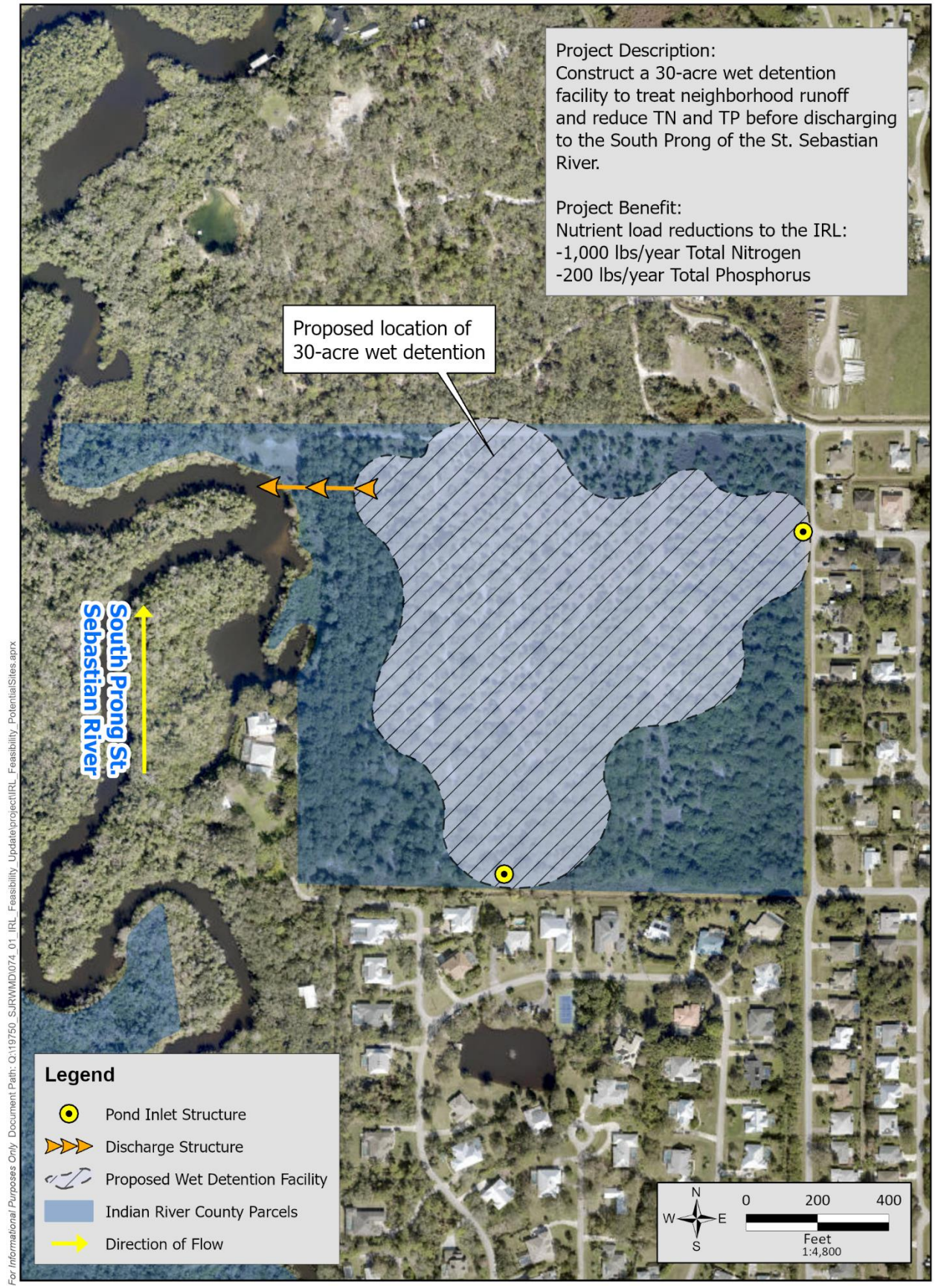
The St. Sebastian River is Indian River County's natural outlet to the IRL. The St. Sebastian River Preserve State Park is adjacent to and immediately west of the South Prong and north of Sebastian Boulevard (CR 512) near the City of Sebastian. Most of the area draining to the South Prong is residential with swales for stormwater capture in front yards and larger ditches between backyard lots. The residential neighborhood and some commercial development on the river side of Sebastian Boulevard and Roseland Road slope toward the South Prong bringing stormwater runoff to the river. Some residential areas northeast of Roseland Road may also drain toward the river in the same direction. Indian River County owns a 41-acre parcel near the Ocklawaha Boy Scout Campground that is a historical abandoned citrus grove. Currently, the land use is classified as non-forested uplands. This parcel could be used for capturing stormwater runoff from the neighboring residential neighborhoods to treat the total annual load of approximately 3,000 lbs of TN and 400 lbs of TP originating from the 520-acre area, as calculated by the SWIL model. This would provide stormwater treatment and a reduction in load to the South Prong of the St. Sebastian River and the IRL. Two alternatives were considered for this parcel, including wet detention in Alternative 1 and wet detention with a BAM polishing area in Alternative 2. Figure 4-21 shows the general location of the South Prong St. Sebastian River Stormwater Treatment alternatives.

Figure 4-21 South Prong St. Sebastian River Stormwater Treatment – General Location

4.7.1.1 Alternative 1 – Wet Detention Stormwater Facility

Alternative 1 involves constructing a wet detention stormwater pond to receive runoff from the adjacent neighborhoods. Due to moderately drained soils on site, it was conservatively assumed that the pond would need to be lined, creating wet detention. This detailed design consideration depends on geotechnical investigation results. The pond should be designed so that a meandering flow path would allow maximum settling and nutrient uptake. Structures at low points in the contributing area will bring stormwater to the pond. Preliminary design would determine the extent of conveyance retrofit required to get stormwater into the pond. For the conceptual design, inlet structures are proposed because the existing stormwater swales and ditches appear to already drain in the direction of the pond. A pond outfall structure would discharge by gravity to the South Prong to the west at the appropriate elevation to maximize nutrient removal. Two small neighborhood ponds are also within the area but it is clear that runoff connects to the South Prong to the west as well. Figure 4-22 shows the location of the proposed pond and conceptual design elements.

Figure 4-22 South Prong St. Sebastian River Stormwater Treatment – Alternative 1

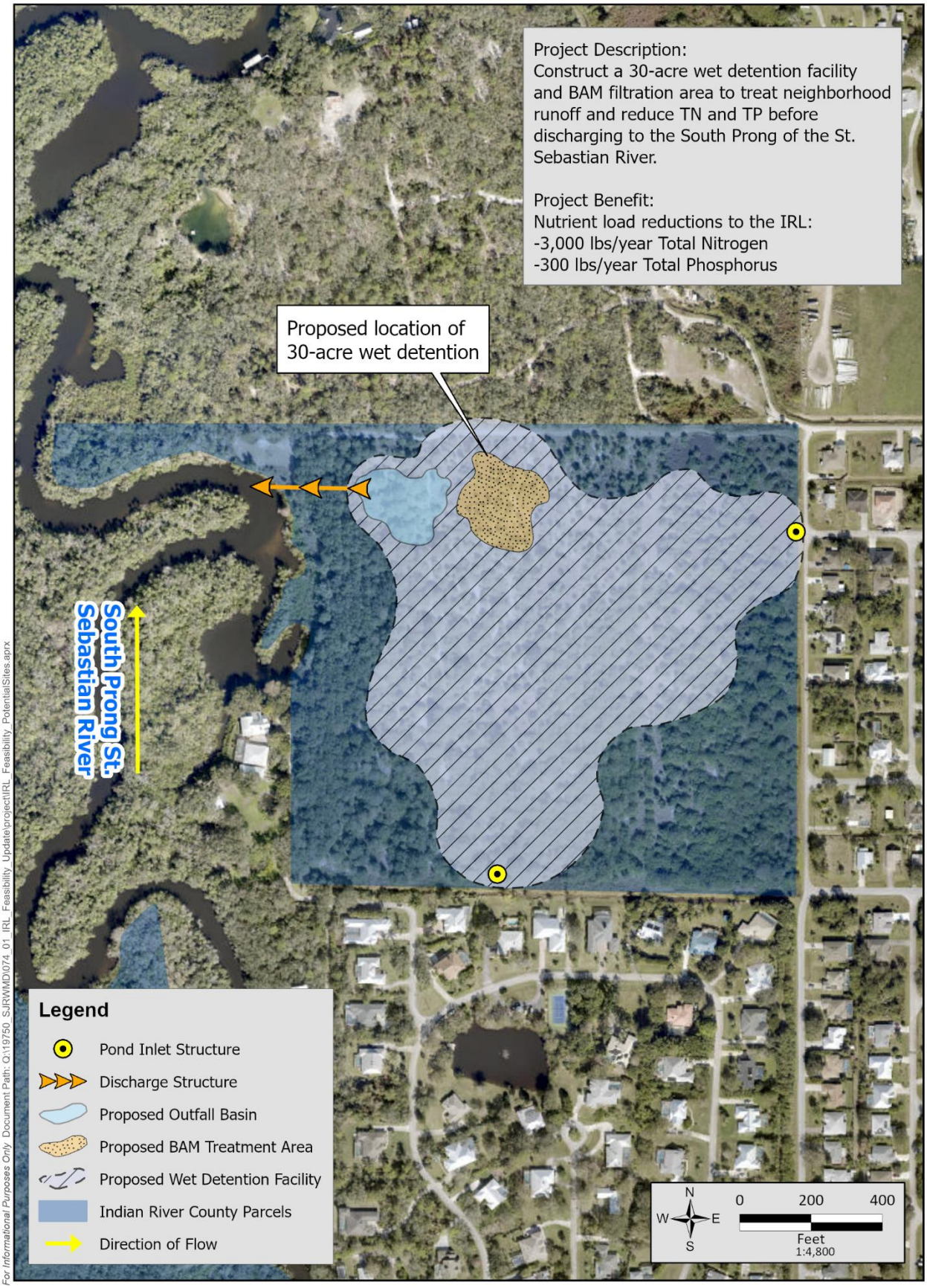


Nutrient load results from the SWIL model LET were used to calculate potential reductions from wet detention treatment. Based on a pond size of 30 acres and a depth of 6 feet, the pond could conservatively reduce 29 percent of the incoming TN load and 55 percent of the incoming TP load, or up to 1,000 lbs of TN and 200 lbs of TP each year. Increasing the pond size to over 30 acres would not increase nutrient reduction enough to justify the large earthwork cost. The possibility of diverting the entire load from the contributing area discussed previously to the constructed pond is assumed. Calculations are based on the assumption that low flow through the pond would be 5 cfs or 3.2 MGD.

4.7.1.2 Alternative 2 – Wet detention Stormwater Facility with a BAM Filter Area

Alternative 2 also uses the same Indian River County parcel for stormwater treatment but includes a BAM filter area for additional nutrient removal. Assuming that the pond would be full enough to drive 5 cfs (3.2 MGD) through a BAM filter system, adequate space is available for a 1-acre BAM filter that can attain 66-percent removal efficiency of the TN and TP loads to the filter. Assuming that all of the pond water can ultimately be cycled through the BAM filter at the design treatment rate before discharge, the combination of the pond and BAM filter could remove 3,000 lbs of TN and 300 lbs of TP each year. Figure 4-23 shows the location of the proposed pond and BAM filter system and other conceptual design elements and calculated benefits.

Figure 4-23 South Prong St. Sebastian River Stormwater Treatment – Alternative 2



4.7.2 Planning-Level Evaluation

Table 4-28 summarizes the planning-level evaluation for South Prong St. Sebastian River Stormwater Treatment Alternatives 1 and 2. Land acquisition is not required for these alternatives.

Table 4-28 South Prong St. Sebastian River Stormwater Treatment Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Indian River County and SJRWMD.
Land Use/Zoning Issues	Land use at the proposed pond site is unforested uplands. Indian River County may be unable to use this parcel for stormwater treatment since there is a management plan in place for habitat restoration and access for public recreation.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Moderate infiltration rate when drained across the proposed site. A geotechnical investigation is required.
Wetlands and Mitigation	Wetlands have been mapped along the west boundary and will be verified with a site assessment. Coordination with regulatory staff will be necessary.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	The proposed site is adjacent to a residential neighborhood.

4.7.3 Summary of Benefits

The project team estimated the benefits of the South Prong St. Sebastian River Stormwater Treatment alternatives. The primary benefit is nutrient-load reduction to the South Prong of the St. Sebastian River and eventually the IRL. The annual flow treated is based on the SWIL annual volume of load generated in the contributing area. Table 4-29 summarizes the project treatment capacity for Alternatives 1 and 2.

Table 4-29 South Prong St. Sebastian River Stormwater Treatment – Alternatives 1 and 2 Project Benefit Summary

	Alternative 1	Alternative 2
Average Annual Flow Treated	3.2 MGD	3.2 MGD
Average Annual TN Load Reduction to IRL	1,000 lbs	3,000 lbs
Average Annual TP Load Reduction to IRL	200 lbs	300 lbs

4.7.4 Planning-Level Cost Opinions

Table 4-30 provides an opinion of planning-level costs for the alternatives. The most significant driver in the total cost is earthwork for creating a pond. The difference of the

project costs is the BAM filter media required for Alternative 2. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing.

Table 4-30 South Prong St. Sebastian River Stormwater Treatment Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$24.7M	$19,000 to $21,000	$0.8M to $0.9M
Alternative 2	$30.6M	$0.6M	$1.5M to $1.8M

4.7.5 Future Water Quality and Flow Monitoring

The project team recommends water quality sampling of the pond inflow and outflow before and after the pond system has been established to quantify the benefit of nutrient removal.

4.7.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the South Prong St. Sebastian River Stormwater alternatives. Table 4-31 provides a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternatives 1 and 2.

Table 4-31 South Prong St. Sebastian River Stormwater Treatment Alternative 1 or 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$1M	—	—	—
ESA	$0.1M	—	—	—
Survey, Design, and Permitting	—	$1.8M to $2.5M	—	—
Procurement and Construction	—	—	$9.6M to $12M	$12.2M to $15M
Total	**$1.1M**	**$1.8M to $2.5M**	**$9.6M to $12M**	**$12.2M to $15M**

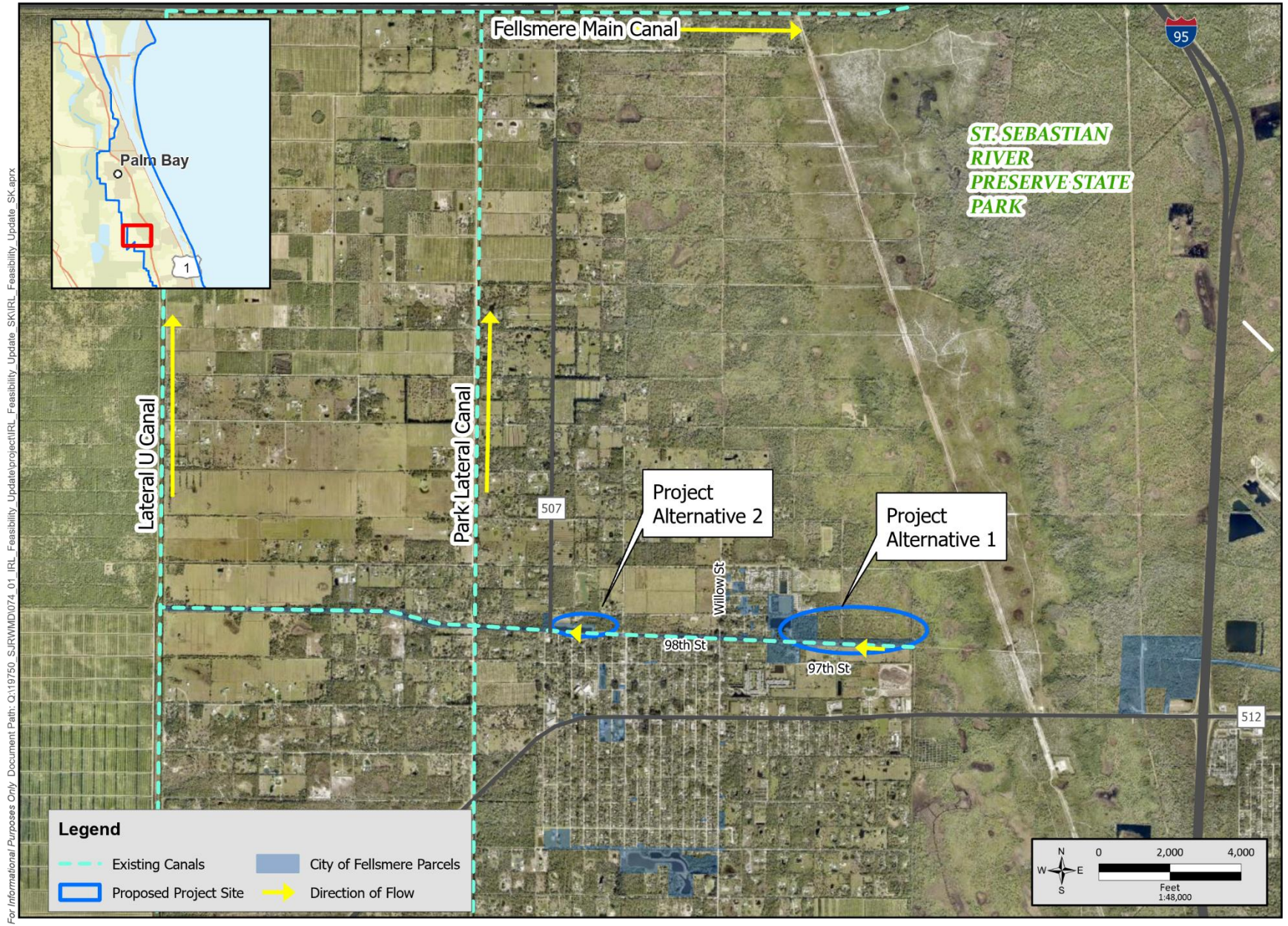
4.8 FELLSMERE OFFLINE TREATMENT

4.8.1 PROJECT OVERVIEW

The City of Fellsmere is in Indian River County west of I-95 and partially within the Interbasin Diversion Planning Unit. Fellsmere is drained by a series of canals that are operated and maintained by the Fellsmere Water Control District (FWCD). Some larger canals in this area were historically cut through the ridge to allow drainage towards the IRL in the east, which changed the natural hydrology of areas that historically had drained toward the St. Johns River to the west. Fellsmere is bordered by the St. Sebastian River Preserve State Park to the east and the Fellsmere Water Management Area (also known as Headwaters Lake) to the west. The FWCD canal system within the city generally drains west to Park Lateral and Lateral U canals, which flow north into Fellsmere Main Canal, which in turn drains east into the St. Sebastian River and IRL.

Two alternatives for water quality treatment within the City of Fellsmere were considered. Alternative 1 involves constructing a treatment wetland on city property. Alternative 2 involves adding a BAM filtration system at an already established pond along the same canal system within the city for further nutrient removal. Figure 4-24 shows the general location of the Fellsmere Offline Treatment alternatives concept.

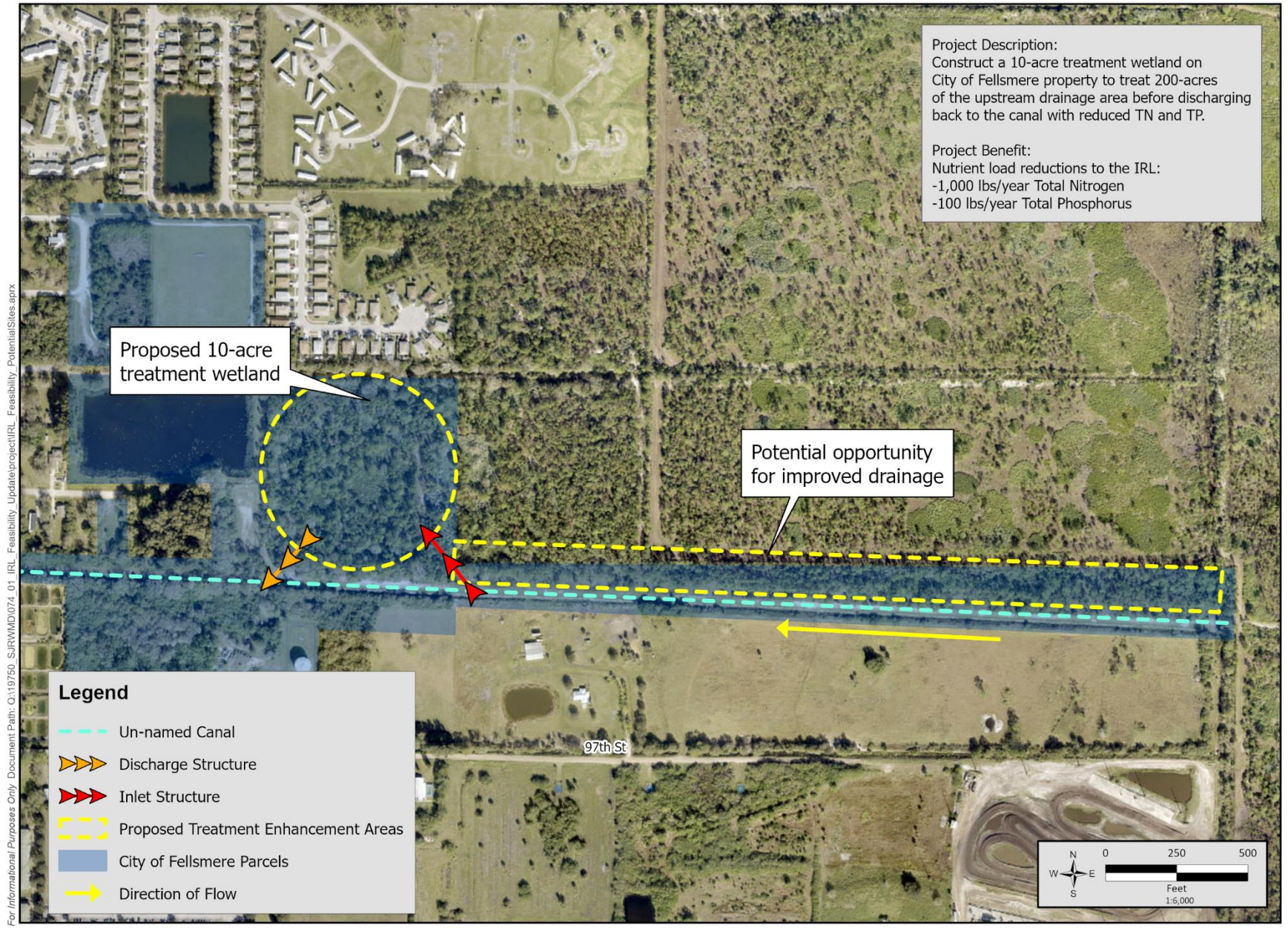
Figure 4-24 Fellsmere Offline Treatment – General Location



4.8.1.1 Alternative 1 – Treatment Wetland on City Property

The City of Fellsmere owns a 10-acre parcel north of 97th Street and east of Willow Street. The parcel is immediately north of a canal running east to west through the length of the city. The approximately 200-acre area upstream of the city's parcel is largely natural lands including the St. Sebastian River State Preserve. Alternative 1 involves using this parcel for constructing a 10-acre treatment wetland, which could serve as a city park and treat canal water directed to it or serve as a polishing system for the existing city pond directly to the west. The city also owns a parcel of land immediately north of the canal (visible in Figure 4-25) that may provide opportunity for drainage improvements to direct upstream water to the proposed treatment wetland. Ten acres would be appropriately sized to treat an upstream area of 200 acres. Since water quality data in this region are unavailable, SWIL loads were used to determine nutrient removal and annual volume treated. From annual volume, an annual flow of 0.65 cfs (0.4 MGD) was calculated for treatment. Conservative removal rates for an adequately sized wetland are 37-percent removal of TN and 46-percent removal of TP each year (Land, 2016). This means converting the city's parcel to a treatment wetland could remove up to 1,000 lbs of TN and 100 lbs of TP per year from a canal system that ultimately drains to the IRL. Figure 4-25 shows the proposed wetland project site and estimated nutrient removal for Alternative 1.

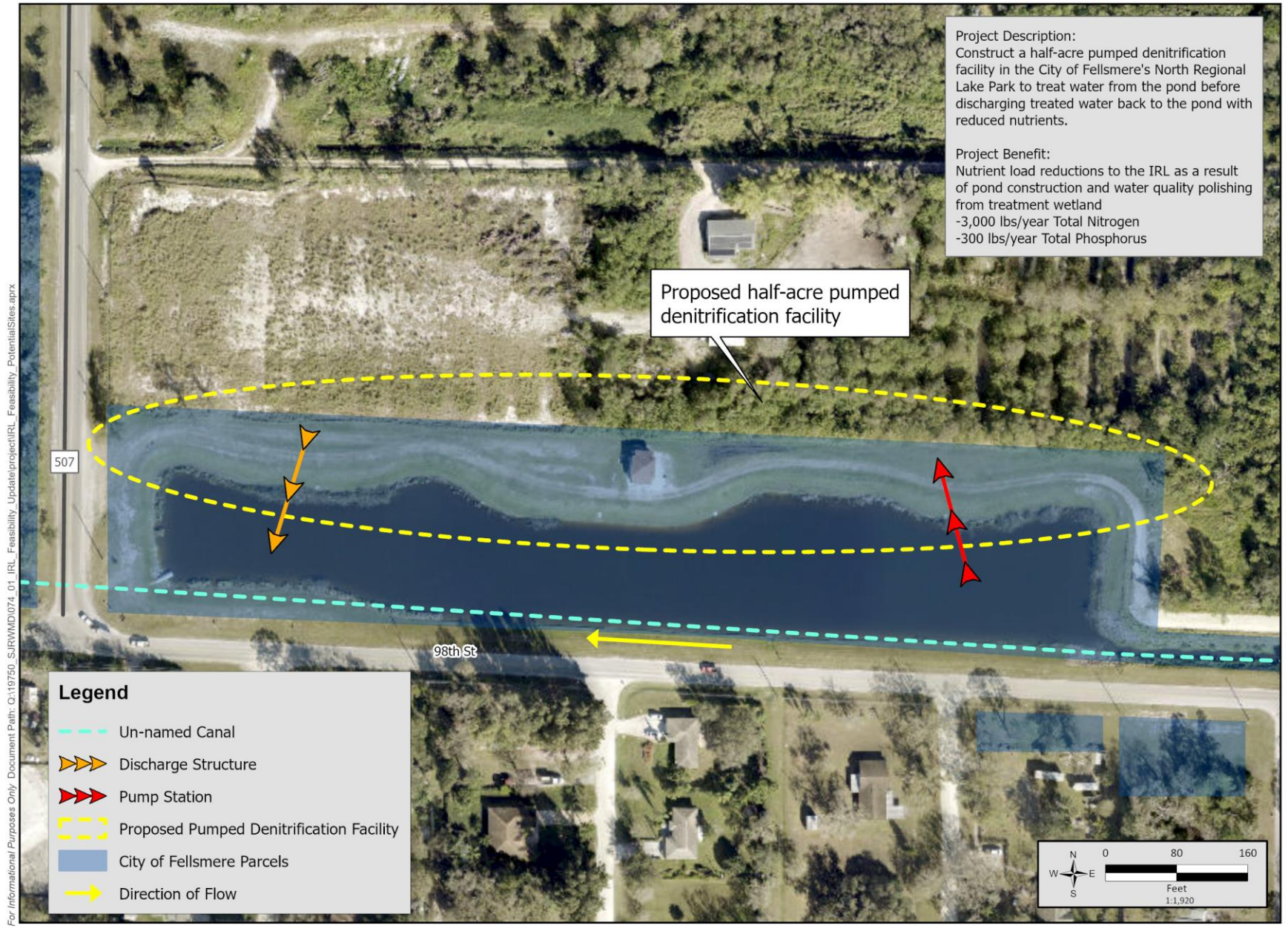
Figure 4-25 Fellsmere Offline Treatment – Alternative 1



4.8.1.2 Alternative 2 – Retrofit Construction with a BAM Filtration System

Alternative 2 involves retrofit construction at an existing pond farther downstream on the same canal noted as part of Alternative 1. An approximately 4-acre pond has been constructed on city property, which provides flood storage and water quality treatment for the watershed. The pond discharges under Highway 507 into another canal that flows into Park Lateral and then ultimately to the IRL. The upstream area for this pond is larger than that in Alternative 1, at 800 acres. The nutrient load was calculated using the SWIL model, with approximately 6,000 lbs of TN and 800 lbs of TP entering the pond annually. Pumping water from the pond into a BAM filter and then returning it to the pond downstream would further reduce nutrient load. Space is a limiting factor at this site, but if capturing and returning 2.5 cfs (1.6 MGD) from the pond is possible, then a half-acre pumped denitrification facility could be constructed along the pond border. Assuming that these design parameters can be achieved and that a system of that size could treat the entire load, then an additional 3,000 lbs of TN per year and 300 lbs of TP per year would be removed from the system. Figure 4-26 shows the location of the city pond proposed for retrofit with a BAM filtration system and the project benefits.

Figure 4-26 Fellsmere Offline Treatment – Alternative 2



4.8.2 Planning-Level Evaluation

Table 4-32 summarizes the planning-level evaluation for the Fellsmere Offline Treatment Alternatives 1 and 2. Land acquisition is not required for these alternatives.

Table 4-32 Fellsmere Offline Treatment Project Evaluation

Item	Evaluation Notes
Coordination with Local Governments	Indian River County, the City of Fellsmere, and SJRWMD
Land Use/Zoning Issues	Land use within the 10-acre city parcel noted in Alternative 1 would be converted to treatment wetland.
Suitability of Land for Stormwater Treatment	Determined through survey, geotechnical evaluation, and environmental site assessment.
Soil Characteristics	Moderate infiltration rate when drained across the proposed site. A geotechnical investigation is required.
Wetlands and Mitigation	This project involves creation of a treatment wetland. Coordination with regulatory staff is necessary during design.
Environmental Contaminants	Environmental assessments should be conducted.
Proximity to Residential Land and Potential Hazard Classification	No hazard expected. Alternatives are both adjacent to residential areas.

4.8.3 Summary of Benefits

The project team estimated the benefits of the Fellsmere Offline Treatment alternatives. The primary benefit is nutrient-load reduction to the FWCD canal system and ultimately to the St. Sebastian River and IRL. Table 4-33 summarizes the project treatment capacity for Alternatives 1 and 2.

Table 4-33 Fellsmere Offline Treatment – Alternatives 1 and 2 Project Benefit Summary

	Alternative 1	Alternative 2
Average Annual Flow Treated	0.4 MGD	1.6 MGD
Average Annual TN Load Reduction to IRL	1,000 lbs	3,000 lbs
Average Annual TP Load Reduction to IRL	100 lbs	300 lbs

4.8.4 Planning-Level Cost Opinions

Table 4-34 provides an opinion of planning-level costs for the alternatives. The most significant driver in the difference of the project costs is the BAM filtration media needed for Alternative 2. The most significant driver of O&M and annualized cost is how frequently the BAM may need replacing.

Table 4-34 Fellsmere Offline Treatment Planning-Level Project Costs

Description	Capital Cost (2023 dollars)	Estimated Replacement and O&M Costs (2023 dollars)	Total Annualized Project Costs
Alternative 1	$3.0M	$22,000	$0.1M
Alternative 2	$5.0M	$0.3M	$0.4M to $0.5M

4.8.5 Future Water quality and Flow Monitoring

The project team recommends water quality sampling in the Fellsmere system of canals to better understand the actual benefit of the proposed systems.

4.8.6 Preliminary Implementation Schedule

The project team expects a multi-year timeframe to implement the Fellsmere Offline Treatment alternatives. Table 4-35 provides a preliminary planning-level estimate of the approximate timeframe and annual funding requirements for implementing Alternatives 1 and 2.

Table 4-35 Fellsmere Offline Treatment Alternative 1 or 2 Preliminary Implementation Schedule

Project Component	Year 1	Year 2	Year 3	Year 4
Preliminary Design and Modeling	$0.1M	—	—	—
ESA	$0.1M	—	—	—
Survey, Design, and Permitting	—	$0.2M to $0.5M	—	—
Procurement and Construction	—	—	$1.2M to $1.8M	$1.4M to $2.5M
Total	**$0.2M**	**$0.2 to $0.5M**	**$1.2M to $1.8M**	**$1.4M to $2.5M**

5 PROJECT SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY OF PROJECT EVALUATION

5.1.1 PROJECT BENEFITS

The project concepts evaluated for this feasibility study benefit the IRL by reducing nutrient loads. This section of the report summarizes the project benefits that we identified as part of this feasibility report. We evaluated TN reduction, TP reduction, and annual volume treated for the conceptual project alternatives. Table 5-1 summarizes the direct project benefits to the IRL.

Table 5-1 Summary of Project Benefits

Project Name		Annual Flow Treated (MGD)	TN Reduction (lb/year)	TP Reduction (lb/year)
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	0.6	900	80
	Alt 2	1.7	1,400	150
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	12.9	5,000	800
	Alt 2	12.9	5,000	800
Horse Creek Water Quality Improvements	Alt 1	3.2	1,000	100
Eau Gallie River Mouth Water Quality Improvements	Alt 1	3.2	8,000	1,000
	Alt 2	3.2	12,000	2,000
	Alt 3	3.2	12,000	2,000
Crane Creek Offline Treatment	Alt 1	3.2	5,000	300
	Alt 2	3.2	8,000	300
C-1 Baseflow Treatment	Alt 1	12.9	13,000	1,200
	Alt 2	12.9	27,000	1,000
	Alt 3	12.9	27,000	1,000
Sottile Canal Flow Restoration	Alt 1	3.9*	29,000	6,100
	Alt 2	3.9*	29,000	6,100
Micco Water Management Area Improvements	Alt 1	32.2	13,000	6,000
	Alt 2	32.2	40,000	11,000
	Alt 3	6.5	20,000	4,000
South Prong St. Sebastian River Stormwater Treatment	Alt 1	3.2	1,000	200
	Alt 2	3.2	3,000	300
Fellsmere Offline Treatment	Alt 1	0.4	1,000	100
	Alt 2	1.6	3,000	300

* Flow treated and restored to the USJRB.

5.1.2 PROJECT COSTS

The project team developed planning-level opinions of probable capital and O&M costs for each of the project alternatives. Sections 2 and 4 of this report summarize the methods used to determine costs and provide a breakdown of the major components of the costs.

Table 5-2 shows the results of the cost analyses for each of the alternatives, and Table 5-3 summarizes the annual cost-benefits for each of the evaluated projects.

Table 5-2 Summary of Project Costs

Project Name		Capital Costs (2023 dollars)	Annual O&M Cost (2023 dollars)	Annualized Project Costs
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	$3.5M	$0.2M to $0.3M	$0.3M to $0.4M
	Alt 2	$1.8M	$13,000	$70,000 to $80,000
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$39.2M	$2.3M to $3.1M	$3.5M to $4.6M
	Alt 2	$41.7M	$2.4M to #3.2M	$3.6M to $4.7M
Horse Creek Water Quality Improvements	Alt 1	$8.9M	$0.5M to $0.6M	$0.8M to $1.0M
Eau Gallie River Mouth Water Quality Improvements	Alt 1	$11.1M	$0.5M to $0.7M	$0.9M to $1.1M
	Alt 2	$9.9M	$0.5M to $0.7M	$0.8M to $1.0M
	Alt 3	$9.4M	$0.5M to $0.6M	$0.8M to $1.0M
Crane Creek Offline Treatment	Alt 1	$4.2M	$0.2M	$0.3M to $0.4M
	Alt 2	$8.7M	$0.5M to $0.6M	$0.8M to $1M
C-1 Baseflow Treatment	Alt 1	$17.5M	$0.3M to $0.4M	$0.8M to $1M
	Alt 2	$35.6M	$2M to $3M	$3M to $4M
	Alt 3	$35.4M	$2M to $3M	$3M to $4M
Sottile Canal Flow Restoration	Alt 1	$48.8M	$0.8M to $1.4M	$2.3M to $3.2M
	Alt 2	$48.3M	$0.9M to $1.4M	$2.3M to $3.1M
Micco Water Management Area Improvements	Alt 1	$3M	$7,000 to $13,000	$0.1M
	Alt 2	$9.1M	$12,000 to $32,000	$0.3M to $0.4M
	Alt 3	$16.2M	$0.9M to $1.2M	$1.4M to $1.9M
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$24.7M	$19,000 to $21,000	$0.8M to $0.9M
	Alt 2	$30.6M	$0.6M	$1.5M to $1.8M
Fellsmere Offline Treatment	Alt 1	$3.0M	$22,000	$0.1M
	Alt 2	$5.0M	$0.3M	$0.4M to $0.5M

Table 5-3 Summary of Cost Benefits for Evaluated Projects

Project Name		Annual Project Cost-Benefit (2023 dollars)	
		TN Reduction Cost-Benefit ($/lb TN)	TP Reduction Cost-Benefit ($/lb TP)
Chain of Lakes Enhanced Nutrient Reduction	Alt 1	$333 to $444	$3,750 to $5,000
	Alt 2	$50 to $57	$467 to $533
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$700 to $920	$4,375 to $5,750
	Alt 2	$720 to $940	$4,500 to $5,875
Horse Creek Water Quality Improvements	Alt 1	$$800 to $1,000	$8,000 to $10,000

Project Name		Annual Project Cost-Benefit (2023 dollars)	
		TN Reduction Cost-Benefit ($/lb TN)	TP Reduction Cost-Benefit ($/lb TP)
Eau Gallie River Mouth Water Quality Improvements	Alt 1	$113 to $138	$900 to $1,100
	Alt 2	$67 to $83	$400 to $500
	Alt 3	$67 to $83	$400 to $500
Crane Creek Offline Treatment	Alt 1	$60 to $70	$1,000 to $1,167
	Alt 2	$94 to $120	$2,500 to $3,200
C-1 Baseflow Treatment	Alt 1	$62 to $77	$667 to $833
	Alt 2	$111 to $148	$3,000 to $4,000
	Alt 3	$111 to $148	$3,000 to $4,000
Sottile Canal Flow Restoration	Alt 1	$79 to $110	$377 to $525
	Alt 2	$79 to $107	$377 to $508
Micco Water Management Area Improvements	Alt 1	$8 to $9	$17 to $20
	Alt 2	$7 to $9	$26 to $34
	Alt 3	$70 to $95	$350 to $475
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$800 to $900	$4,000 to $4,500
	Alt 2	$500 to $600	$5,000 to $6,000
Fellsmere Offline Treatment	Alt 1	$110 to $130	$1,100 to $1,300
	Alt 2	$133 to $167	$1,333 to $1,667

5.2 Project Recommendations

The project team reviewed project costs and benefits for each alternative to determine a recommended alternative at each project site. We also prioritized the recommendations based on capital cost, cost-benefit, implementation timeframe, availability of land, complexity of coordination required, and ease of construction.

Stakeholder and SJRWMD feedback were also considered when prioritizing the project concepts and respective project alternatives. Priority was noted for each project area as high, meaning that SJRWMD is recommended to pursue the most favorable projects in the near term, medium for reasonable projects that may also be pursued in the future, and low for projects with unfavorable costs for the projected nutrient-removal benefit. Discussions for each area follow. The project concepts are listed from north to south for each priority class.

5.2.1 High-Priority Implementation

5.2.1.1 Eau Gallie River Mouth Water Quality Improvements

Three similar alternatives were analyzed near the mouth of the Eau Gallie River. Each alternative considers a pump-and-treat denitrification system with mid-range nutrient removal for each. Alternative 3 is recommended for its ease of construction, taking advantage of the canal passing through the project area, and requiring less piping and easement coordination. This project is also in the highest-priority range due to its higher cost-benefit.

5.2.1.2 Crane Creek Offline Treatment

Alternative 1 is recommended at the Crane Creek site as a high-priority project. Capital costs and nutrient removal are in the mid-range for highest priority projects. This project has been discussed with the City of Melbourne, who is supportive of the idea.

5.2.1.3 Micco Water Management Area Improvements

Out of the three alternatives analyzed at the Micco Water Management Area, Alternative 2 is recommended with a high priority. The project will remove a large amount of nutrient load to the IRL. The addition of gabion baffles in Alternative 2 greatly increases the load reduction over the simple earthen berm in Alternative 1, at a low cost per pound of TN removed on SJRWMD-owned land. However, Alternative 1 is a good alternative due to its low capital cost and cost-benefit ratio.

5.2.2 Medium-Priority Implementation

5.2.2.1 Chain of Lakes Enhanced Nutrient Reduction

The wetland treatment Alternative 2 at the Chain of Lakes site is recommended for its low capital and cost per pound of TN removal. Constructing on stakeholder-owned land allows this to be easily constructed. Priority was noted as medium for this site, behind the three highest-priority areas, because of its lower overall benefit.

5.2.2.2 C-1 Canal Baseflow Treatment

Alternative 1 is recommended in this area. This project involves purchasing a privately-owned parcel adjacent to the C-1 Canal for construction of an offline wet detention pond and additional BAM treatment area. This alternative is preferred over the others for cost considerations and relative ease of construction.

5.2.2.3 Sottile Canal Flow Restoration

Alternative 2 is the recommended solution since the proposed WMA area and location of the force main for Alternative 2 is preferential to that proposed as part of Alternative 1. Nutrient reduction as part of Alternative 2 is also more beneficial to the IRL.

5.2.2.4 Fellsmere Offline Treatment

Alternative 1 in Fellsmere recommends offline wetland treatment at a city-owned parcel. Alternative 1 is recommended over Alternative 2 because of its lower capital costs as well as the cost per pound of nutrient removal and easier construction means. This alternative is in the medium priority range due to its mid-level cost-benefit ratio and favorability of the City of Fellsmere.

5.2.3 Lower-Priority Implementation

5.2.3.1 North Merritt Island Mosquito Impoundment Nutrient Reduction

The North Merritt Island Mosquito Impound alternatives involved pump-and-treat denitrification facilities. Because of their size and the low relative load they would treat, the capital costs and cost-benefits are on the high side. Of the two, Alternative 1 may be easier to implement since it involves less piping, but it may require more coordination with

Brevard County Mosquito Control. These alternatives are ranked lowest priority for pursing because of these reasons.

5.2.3.2 Horse Creek Water Quality Improvements

The only alternative analyzed for the Horse Creek site provides little treatment for a high construction cost for the suggested pump-and-treat denitrification system. This area already includes other water-quality improvement projects, so Alternative 1 is ranked as low priority.

5.2.3.3 South Prong St. Sebastian River Stormwater Treatment

The proposed wet detention facilities at the South Prong St. Sebastian River site would treat stormwater from the nearby residential area. The stakeholder land is a large area but has a management plan for the property that includes habitat restoration and access for public recreation. High capital costs and low starting load for these alternatives lead to a low-priority ranking for pursuing design and construction.

Table 5-4 summarizes the project recommendations including priority.

Table 5-4 Summary of Project Recommendations

Project Name		Capital Costs (2023 dollars)	TN Reduction (lb/year)	TP Reduction (lb/year)	Priority
Eau Gallie River Mouth Water Quality Improvements	Alt 3	$9.4M	12,000	2,000	High
Crane Creek Offline Treatment	Alt 1	$4.2M	5,000	300	High
Micco Water Management Area Improvements	Alt 2	$9.1M	40,000	11,000	High
Chain of Lakes Enhanced Nutrient Reduction	Alt 2	$1.8M	1,400	150	Medium
C-1 Baseflow Treatment	Alt 1	$17.5M	13,000	1,200	Medium
Sottile Canal Flow Restoration	Alt 2	$48.3M	29,000	6,100	Medium
Fellsmere Offline Treatment	Alt 1	$3.0M	1,000	100	Medium
North Merritt Island Mosquito Impoundment Nutrient Reduction	Alt 1	$39.2M	5,000	800	Low
Horse Creek Water Quality Improvements	Alt 1	$8.9M	1,000	100	Low
South Prong St. Sebastian River Stormwater Treatment	Alt 1	$24.7M	1,000	200	Low

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Appendix A

Cost Opinion Worksheets

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:	
St John's River Water Management District	**R Koller/S Kaufman/J Harris**	
PROJECT TITLE:	PROJECT SEGMENT	
IRL Feasibility Study Update	**C-1 Canal Alt 1**	
PROJECT NUMBER:	DATE:	
19750-074-01	**9/15/2023**	
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE:	COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost**	**2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station with 67 HP Pumps	LS	1	$ 1,700,000	$ 1,700,000
	Denitrification System (BAM)	AC	0.4	$ 4,000,000	$ 1,600,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	161000	$ 50	$ 8,050,000
	Subtotal				$ 11,400,000
	Miscellaneous and Contingency		30%		$ 3,420,000
	Construction Cost (Rounded up)				**$ 14,900,000**
	Engineering		10%		$ 1,490,000
	Adminstrative		2%		$ 298,000
	Construction Supervision		2%		$ 298,000
	Project Cost (Rounded Up)				**$ 17,000,000**
	Land Acquisition	AC	20	$ 25,000	$ 500,000
	Total With Land Cost				**$ 17,500,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:	
St John's River Water Management District	**R Koller/S Kaufman/J Harris**	
PROJECT TITLE:	PROJECT SEGMENT	
IRL Feasibility Study Update	**C-1 Canal Alt 2**	
PROJECT NUMBER:	DATE:	
19750-074-01	**9/15/2023**	
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE:	COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost**	**2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station with 28 HP Pumps	LS	1	$ 1,600,000	$ 1,600,000
	36" HDPE Transmission Force Main - Open Cut	LF	1000	$ 600	$ 600,000
	Denitrification System (BAM)	AC	5	$ 4,300,000	$ 21,500,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Subtotal				$ 23,750,000
	Miscellaneous and Contingency		30%		$ 7,125,000
	Construction Cost (Rounded up)				**$ 30,900,000**
	Engineering		10%		$ 3,090,000
	Adminstrative		2%		$ 618,000
	Construction Supervision		2%		$ 618,000
	Project Cost (Rounded Up)				**$ 35,300,000**
	Land Acquisition	AC	10	$ 25,000	$ 250,000
	Total With Land Cost				**$ 35,600,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:	
St John's River Water Management District	**R Koller/S Kaufman/J Harris**	
PROJECT TITLE:	PROJECT SEGMENT	
IRL Feasibility Study Update	**C-1 Canal Alt 3**	
PROJECT NUMBER:	DATE:	
19750-074-01	**9/15/2023**	
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE:	COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost**	**2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station with 28 HP Pumps	LS	1	$ 1,600,000	$ 1,600,000
	36" HDPE Transmission Force Main - Open Cut	LF	1000	$ 600	$ 600,000
	Denitrification System (BAM)	AC	5	$ 4,300,000	$ 21,500,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Subtotal				$ 23,750,000
	Miscellaneous and Contingency		30%		$ 7,125,000
	Construction Cost (Rounded up)				**$ 30,900,000**
	Engineering		10%		$ 3,090,000
	Adminstrative		2%		$ 618,000
	Construction Supervision		2%		$ 618,000
	Project Cost (Rounded Up)				**$ 35,300,000**
	Land Acquisition (less than fee)	AC	0		$ -
	Easement	AC	5	$ 12,500	$ 62,500
	Total With Land Cost				**$ 35,400,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**R Koller/S Kaufman/J Harris**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Sottile Canal Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**9/15/2023**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Operable Gate Structure	LF	80	$ 61,000	$ 4,880,000
	Stormwater Pump Station with 30 HP Pumps	LS	1	$ 1,600,000	$ 1,600,000
	Stormwater Pump Station with 100 HP Pumps	LS	1	$ 3,100,000	$ 3,100,000
	36" HDPE Transmission Force Main - Open Cut	LF	29000	$ 600	$ 17,400,000
	36" HDPE Transmission Force Main - HDD	LF	3000	$ 1,000	$ 3,000,000
	Inlet and Discharge Structures	LS	4	$ 25,000	$ 100,000
	Stormwater Treatment Area Earthwork	CY	40000	$ 50	$ 2,000,000
	Subtotal				$ 32,080,000
	Miscellaneous and Contingency		30%		$ 9,624,000
	Construction Cost (Rounded up)				**$ 41,800,000**
	Engineering		10%		$ 4,180,000
	Adminstrative		2%		$ 836,000
	Construction Supervision		2%		$ 836,000
	Project Cost (Rounded Up)				**$ 47,700,000**
	Land Acquisition	AC	275	$ 3,640	$ 1,001,000
	Easement Acquisition	AC	7	$ 364	$ 2,674
	Total With Land Cost				**$ 48,800,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**R Koller/S Kaufman/J Harris**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Sottile Canal Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**9/15/2023**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Operable Gate Structure	LF	80	$ 61,000	$ 4,880,000
	Stormwater Pump Station with 60 HP Pumps	LS	1	$ 2,400,000	$ 2,400,000
	Stormwater Pump Station with 100 HP Pumps	LS	1	$ 3,100,000	$ 3,100,000
	36" HDPE Transmission Force Main - Open Cut	LF	24000	$ 600	$ 14,400,000
	36" HDPE Transmission Force Main - HDD	LF	900	$ 1,000	$ 900,000
	Inlet and Discharge Structures	LS	4	$ 25,000	$ 100,000
	Stormwater Treatment Area Earthwork	CY	100000	$ 50	$ 5,000,000
	Subtotal				$ 30,780,000
	Miscellaneous and Contingency		30%		$ 9,234,000
	Construction Cost (Rounded up)				**$ 40,100,000**
	Engineering		10%		$ 4,010,000
	Adminstrative		2%		$ 802,000
	Construction Supervision		2%		$ 802,000
	Project Cost (Rounded Up)				**$ 45,800,000**
	Land Acquisition	AC	550	$ 4,444	$ 2,444,200
	Easement Acquisition	AC	6	$ 444	$ 2,540
	Total With Land Cost				**$ 48,300,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Chain of Lakes Enhanced Nutrient Reduction Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Floating Skimmer System	LS	4	$ 100,000	$ 400,000
	Denitrification System (BAM)	AC	0.4	$ 4,000,000	$ 1,600,000
	Inlet and Discharge Structures	LS	8	$ 25,000	$ 200,000
	Stormwater Treatment Area Earthwork	CY	800	$ 50	$ 40,000
	Subtotal				$ 2,240,000
	Miscellaneous and Contingency		30%		$ 672,000
	Construction Cost (Rounded up)				**$ 3,000,000**
	Engineering		10%		$ 300,000
	Adminstrative		2%		$ 60,000
	Construction Supervision		2%		$ 60,000
	Project Cost (Rounded Up)				**$ 3,500,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 3,500,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Chain of Lakes Enhanced Nutrient Reduction Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Inlet and Discharge Structures	LS	4	$ 25,000	$ 100,000
	Stormwater Treatment Area Earthwork	CY	18000	$ 50	$ 900,000
	Wetland Planting	AC	5	$ 20,000	$ 100,000
	Subtotal				$ 1,100,000
	Miscellaneous and Contingency		30%		$ 330,000
	Construction Cost (Rounded up)				**$ 1,500,000**
	Engineering		10%		$ 150,000
	Adminstrative		2%		$ 30,000
	Construction Supervision		2%		$ 30,000
	Project Cost (Rounded Up)				**$ 1,800,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 1,800,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**N Merritt Island Mosquito Impoundment Nutrient Reduction Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,700,000	$ 1,700,000
	Denitrification System (BAM)	AC	5	$ 4,300,000	$ 21,500,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	62500	$ 50	$ 3,125,000
	Subtotal				$ 26,375,000
	Miscellaneous and Contingency		30%		$ 7,912,500
	Construction Cost (Rounded up)				**$ 34,300,000**
	Engineering		10%		$ 3,430,000
	Adminstrative		2%		$ 686,000
	Construction Supervision		2%		$ 686,000
	Project Cost (Rounded Up)				**$ 39,200,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 39,200,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**N Merritt Island Mosquito Impoundment Nutrient Reduction Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 2,000,000	$ 2,000,000
	Denitrification System (BAM)	AC	5	$ 4,300,000	$ 21,500,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	62500	$ 50	$ 3,125,000
	24-in Force Main	LF	3000	$ 200	$ 600,000
	30-inch Discharge Pipe	LF	3000	$ 250	$ 750,000
	Subtotal				$ 28,025,000
	Miscellaneous and Contingency		30%		$ 8,407,500
	Construction Cost (Rounded up)				**$ 36,500,000**
	Engineering		10%		$ 3,650,000
	Adminstrative		2%		$ 730,000
	Construction Supervision		2%		$ 730,000
	Project Cost (Rounded Up)				**$ 41,700,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 41,700,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Horse Creek Water Quality Improvements Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,000,000	$ 1,000,000
	Denitrification System (BAM)	AC	1	$ 4,300,000	$ 4,300,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12500	$ 50	$ 625,000
	Subtotal				$ 5,975,000
	Miscellaneous and Contingency		30%		$ 1,792,500
	Construction Cost (Rounded up)				**$ 7,800,000**
	Engineering		10%		$ 780,000
	Adminstrative		2%		$ 156,000
	Construction Supervision		2%		$ 156,000
	Project Cost (Rounded Up)				**$ 8,900,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 8,900,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Eau Gallie River Mouth Water Quality Improvements Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 2,000,000	$ 2,000,000
	Denitrification System (BAM)	AC	1	$ 4,300,000	$ 4,300,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12500	$ 50	$ 625,000
	16-in Force Main	LF	3000	$ 155	$ 465,000
	Subtotal				$ 7,440,000
	Miscellaneous and Contingency		30%		$ 2,232,000
	Construction Cost (Rounded up)				**$ 9,700,000**
	Engineering		10%		$ 970,000
	Adminstrative		2%		$ 194,000
	Construction Supervision		2%		$ 194,000
	Project Cost (Rounded Up)				**$ 11,100,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 11,100,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Eau Gallie River Mouth Water Quality Improvements Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,400,000	$ 1,400,000
	Denitrification System (BAM)	AC	1	$ 4,300,000	$ 4,300,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12500	$ 50	$ 625,000
	16-in Force Main	LF	1200	$ 155	$ 186,000
	Subtotal				$ 6,561,000
	Miscellaneous and Contingency		30%		$ 1,968,300
	Construction Cost (Rounded up)				**$ 8,600,000**
	Engineering		10%		$ 860,000
	Adminstrative		2%		$ 172,000
	Construction Supervision		2%		$ 172,000
	Project Cost (Rounded Up)				**$ 9,900,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 9,900,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Eau Gallie River Mouth Water Quality Improvements Alt 3**
PROJECT NUMBER:	DATE:
19750-074-01	**3/1/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,000,000	$ 1,000,000
	Denitrification System (BAM)	AC	1	$ 4,300,000	$ 4,300,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12500	$ 50	$ 625,000
	Subtotal				$ 5,975,000
	Miscellaneous and Contingency		30%		$ 1,792,500
	Construction Cost (Rounded up)				**$ 7,800,000**
	Engineering		10%		$ 780,000
	Adminstrative		2%		$ 156,000
	Construction Supervision		2%		$ 156,000
	Project Cost (Rounded Up)				**$ 8,900,000**
	Land Acquisition	AC	23	$ 19,483	$ 448,100
	Total With Land Cost				**$ 9,400,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Crane Creek Offline Treatment Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,000,000	$ 1,000,000
	Denitrification System (BAM)	AC	0.2	$ 4,000,000	$ 800,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12000	$ 50	$ 600,000
	Pond Liner	SF	175000	$ 1.5	$ 262,500
	Subtotal				$ 2,712,500
	Miscellaneous and Contingency		30%		$ 813,750
	Construction Cost (Rounded up)				**$ 3,600,000**
	Engineering		10%		$ 360,000
	Adminstrative		2%		$ 72,000
	Construction Supervision		2%		$ 72,000
	Project Cost (Rounded Up)				**$ 4,200,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 4,200,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Crane Creek Offline Treatment Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 850,000	$ 850,000
	Denitrification System (BAM)	AC	1	$ 4,300,000	$ 4,300,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	12000	$ 50	$ 600,000
	Subtotal				$ 5,800,000
	Miscellaneous and Contingency		30%		$ 1,740,000
	Construction Cost (Rounded up)				**$ 7,600,000**
	Engineering		10%		$ 760,000
	Adminstrative		2%		$ 152,000
	Construction Supervision		2%		$ 152,000
	Project Cost (Rounded Up)				**$ 8,700,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 8,700,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Micco Water Management Area Improvements Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Baffle Earthwork	CY	18000	$ 100	$ 1,800,000
	Turbitity Barriers	LS	2	$ 60,000	$ 120,000
	Stabilization	SY	4000	$ 8	$ 32,000
	Subtotal				$ 1,952,000
	Miscellaneous and Contingency		30%		$ 585,600
	Construction Cost (Rounded up)				**$ 2,600,000**
	Engineering		10%		$ 260,000
	Adminstrative		2%		$ 52,000
	Construction Supervision		2%		$ 52,000
	Project Cost (Rounded Up)				**$ 3,000,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 3,000,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Micco Water Management Area Improvements Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Baffle Earthwork	CY	18000	$ 100	$ 1,800,000
	Turbitity Barriers	LS	2	$ 60,000	$ 120,000
	Gabion Baffles	CY	9000	$ 450	$ 4,050,000
	Stabilization	SY	4000	$ 8	$ 32,000
	Subtotal				$ 6,002,000
	Miscellaneous and Contingency		30%		$ 1,800,600
	Construction Cost (Rounded up)				**$ 7,900,000**
	Engineering		10%		$ 790,000
	Adminstrative		2%		$ 158,000
	Construction Supervision		2%		$ 158,000
	Project Cost (Rounded Up)				**$ 9,100,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 9,100,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Micco Water Management Area Improvements Alt 3**
PROJECT NUMBER:	DATE:
19750-074-01	**1/24/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 1,000,000	$ 1,000,000
	Denitrification System (BAM)	AC	2	$ 4,300,000	$ 8,600,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	25000	$ 50	$ 1,250,000
	Subtotal				$ 10,900,000
	Miscellaneous and Contingency		30%		$ 3,270,000
	Construction Cost (Rounded up)				**$ 14,200,000**
	Engineering		10%		$ 1,420,000
	Adminstrative		2%		$ 284,000
	Construction Supervision		2%		$ 284,000
	Project Cost (Rounded Up)				**$ 16,200,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 16,200,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**South Prong St. Sebastian River Stormwater Treatment Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Inlet and Discharge Structures	LS	3	$ 25,000	$ 75,000
	Stormwater Treatment Area Earthwork	CY	290400	$ 50	$ 14,520,000
	Pond Liner	SF	1306800	$ 1.5	$ 1,960,200
	Subtotal				$ 16,555,200
	Miscellaneous and Contingency		30%		$ 4,966,560
	Construction Cost (Rounded up)				**$ 21,600,000**
	Engineering		10%		$ 2,160,000
	Adminstrative		2%		$ 432,000
	Construction Supervision		2%		$ 432,000
	Project Cost (Rounded Up)				**$ 24,700,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 24,700,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**South Prong St. Sebastian River Stormwater Treatment Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Denitrification System (BAM)	AC	1	$ 4,000,000	$ 4,000,000
	Inlet and Discharge Structures	LS	3	$ 25,000	$ 75,000
	Stormwater Treatment Area Earthwork	CY	290400	$ 50	$ 14,520,000
	Pond Liner	SF	1306800	$ 1.5	$ 1,960,200
	Subtotal				$ 20,555,200
	Miscellaneous and Contingency		30%		$ 6,166,560
	Construction Cost (Rounded up)				**$ 26,800,000**
	Engineering		10%		$ 2,680,000
	Adminstrative		2%		$ 536,000
	Construction Supervision		2%		$ 536,000
	Project Cost (Rounded Up)				**$ 30,600,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 30,600,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Fellsmere Offline Treatment Alt 1**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	35000	$ 50	$ 1,750,000
	Wetland Planting	AC	10	$ 20,000	$ 200,000
	Subtotal				$ 2,000,000
	Miscellaneous and Contingency		30%		$ 600,000
	Construction Cost (Rounded up)				**$ 2,600,000**
	Engineering		10%		$ 260,000
	Adminstrative		2%		$ 52,000
	Construction Supervision		2%		$ 52,000
	Project Cost (Rounded Up)				**$ 3,000,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 3,000,000**

OPINION OF PROBABLE CONSTRUCTION COST

JonesEdmunds

OWNER:	ESTIMATED BY:
St John's River Water Management District	**B Cunningham/R Koller/S Kaufman**
PROJECT TITLE:	PROJECT SEGMENT
IRL Feasibility Study Update	**Fellsmere Offline Treatment Alt 2**
PROJECT NUMBER:	DATE:
19750-074-01	**2/23/2024**
AACE 18R-97 ESTIMATE CLASSIFICATION	CONSTRUCTION OR PROJECT ESTIMATE: COST BASIS
Level 5 (AACE range -50% to +100%)	**Project Cost** **2023**

Item	Description	Unit	Qty	Unit Cost	Total Cost
	Stormwater Pump Station	LS	1	$ 750,000	$ 750,000
	Denitrification System (BAM)	AC	0.5	$ 4,300,000	$ 2,150,000
	Inlet and Discharge Structures	LS	2	$ 25,000	$ 50,000
	Stormwater Treatment Area Earthwork	CY	6250	$ 50	$ 312,500
	Subtotal				$ 3,262,500
	Miscellaneous and Contingency		30%		$ 978,750
	Construction Cost (Rounded up)				**$ 4,300,000**
	Engineering		10%		$ 430,000
	Adminstrative		2%		$ 86,000
	Construction Supervision		2%		$ 86,000
	Project Cost (Rounded Up)				**$ 5,000,000**
	Land Acquisition	AC			$ -
	Total With Land Cost				**$ 5,000,000**

Water Quality Project Life Cycle Cost Analysis

Alternative

C-1

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 13,410,000	$ 16,390,000
Capital Cost Annualized over the Project Evaluation Duration	$ 516,103	$ 630,792

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
1	Pump Station, Continuous		10	5.0	$ 425,000	$ 2,125,000	$ 595,000	$ 2,975,000
13	Biosorption Activated Media (BAM)3		20	2.0	$ 1,600,000	$ 3,200,000	$ 1,600,000	$ 3,200,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 5,325,000		$ 6,175,000
	Replacement Costs Annualized over the Project Life					$ 204,940		$ 237,654

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
1	Pump Station, Continuous	1	2.50%		$ 276,071	$ 10,625	2.50%	$ 386,500	$ 14,875
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 2,702,253	$ 104,000	7.00%	$ 2,910,118	$ 112,000
6	Wet Storage2	1	0.10%		$ -	$ -	0.10%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	10	$ 550		$ 142,908	$ 5,500	$ 550.00	########## #	######### ##
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 3,196,745			$ 3,515,364	
	TOTAL OF ANNUAL COSTS					$ 123,031			$ 135,294

LCC

ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 327,970	TO	$ 372,950
TOTAL ANNUALIZED COST RANGE	$ 840,000	TO	$ 1,000,000
TOTAL PRESENT WORTH COST RANGE[3]	**$ 21,930,000**	**TO**	**$ 26,080,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

C-1

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 27,810,000	$ 33,990,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,070,307	$ 1,308,153

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
2	Pump Station, Intermittent		20	2.0	$ 400,000	$ 800,000	$ 400,000	$ 800,000	
4	Piping, Force Main		50	1.0	$ 600,000	$ 600,000	$ 600,000	$ 600,000	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 16,125,000	$ 32,250,000	$ 21,500,000	$ 43,000,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 33,650,000		$ 44,400,000	
	Replacement Costs Annualized over the Project Life					$ 1,295,068		$ 1,708,797	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 259,832	$ 10,000	2.50%	$ 259,832	$ 10,000
4	Piping, Force Main	1	1.00%		$ 155,899	$ 6,000	1.00%	$ 155,899	$ 6,000
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 27,233,641	$ 1,048,125	6.50%	$ 36,311,521	$ 1,397,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 27,724,886			$ 36,803,091	
	TOTAL OF ANNUAL COSTS					$ 1,067,031			$ 1,416,419

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 2,362,100	TO	$ 3,125,220
LCC	TOTAL ANNUALIZED COST RANGE	$ 3,430,000	TO	$ 4,430,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 89,180,000**	**TO**	**$ 115,190,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

C-1

Alternative 3

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 27,810,000	$ 33,990,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,070,307	$ 1,308,153

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
2	Pump Station, Intermittent		20	2.0	$ 400,000	$ 800,000	$ 400,000	$ 800,000	
4	Piping, Force Main		50	1.0	$ 600,000	$ 600,000	$ 600,000	$ 600,000	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 16,125,000	$ 32,250,000	$ 21,500,000	$ 43,000,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 33,650,000		$ 44,400,000	
	Replacement Costs Annualized over the Project Life					$ 1,295,068		$ 1,708,797	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 259,832	$ 10,000	2.50%	$ 259,832	$ 10,000
4	Piping, Force Main	1	1.00%		$ 155,899	$ 6,000	1.00%	$ 155,899	$ 6,000
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 27,233,641	$ 1,048,125	6.50%	$ 36,311,521	$ 1,397,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 27,724,886			$ 36,803,091	
	TOTAL OF ANNUAL COSTS					$ 1,067,031			$ 1,416,419

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 2,362,100	TO	$ 3,125,220
LCC	TOTAL ANNUALIZED COST RANGE	$ 3,430,000	TO	$ 4,430,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 89,180,000**	**TO**	**$ 115,190,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Sottile Canal

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 37,620,000	$ 45,980,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,447,859	$ 1,769,605

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
8	Overflow Gate Structure		20	2.0	$ 1,220,000	$ 2,440,000	$ 1,708,000	$ 3,416,000
2	Pump Station, Intermittent		20	2.0	$ 400,000	$ 800,000	$ 560,000	$ 1,120,000
2	Pump Station, Intermittent		20	2.0	$ 775,000	$ 1,550,000	$ 1,085,000	$ 2,170,000
4	Piping, Force Main		50	1.0	$ 10,200,000	$ 10,200,000	$ 20,400,000	$ 20,400,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
9	Outlet Structure, Fixed		60	0.0	$ 25,000	$ -	$ 35,000	$ -
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 14,990,000		$ 27,106,000
	Replacement Costs Annualized over the Project Life					$ 576,911		$ 1,043,213

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
8	Overflow Gate Structure	1	2.00%		$ 633,990	$ 24,400	2.00%	$ 887,586	$ 34,160
2	Pump Station, Intermittent	1	2.50%		$ 259,832	$ 10,000	2.50%	$ 363,765	$ 14,000
2	Pump Station, Intermittent	1	2.50%		$ 503,424	$ 19,375	2.50%	$ 704,794	$ 27,125
4	Piping, Force Main	1	1.00%		$ 2,650,286	$ 102,000	1.00%	$ 5,300,573	$ 204,000
6	Wet Storage2	1	0.10%		$ -	$ -	0.10%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 1,624	$ 63	0.25%	$ 2,274	$ 88
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	275	$ 550		$ 3,929,959	$ 151,250	$ 550.00	############	###########
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 8,053,817			$ 11,263,652	
	TOTAL OF ANNUAL COSTS					$ 309,963			$ 433,498

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 886,870	TO	$ 1,476,710
LCC	TOTAL ANNUALIZED COST RANGE	$ 2,330,000	TO	$ 3,250,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 60,660,000**	**TO**	**$ 84,350,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Sottile Canal

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 36,090,000	$ 44,110,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,388,974	$ 1,697,635

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
8	Overflow Gate Structure		20	2.0	$ 1,220,000	$ 2,440,000	$ 1,708,000	$ 3,416,000	
2	Pump Station, Intermittent		20	2.0	$ 600,000	$ 1,200,000	$ 840,000	$ 1,680,000	
2	Pump Station, Intermittent		20	2.0	$ 775,000	$ 1,550,000	$ 1,085,000	$ 2,170,000	
4	Piping, Force Main		50	1.0	$ 7,650,000	$ 7,650,000	$ 15,300,000	$ 15,300,000	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
9	Outlet Structure, Fixed		60	0.0	$ 25,000	$ -	$ 35,000	$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 12,840,000		$ 22,566,000	
	Replacement Costs Annualized over the Project Life					$ 494,165		$ 868,484	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
8	Overflow Gate Structure	1	2.00%		$ 633,990	$ 24,400	2.00%	$ 887,586	$ 34,160
2	Pump Station, Intermittent	1	2.50%		$ 389,748	$ 15,000	2.50%	$ 545,647	$ 21,000
2	Pump Station, Intermittent	1	2.50%		$ 503,424	$ 19,375	2.50%	$ 704,794	$ 27,125
4	Piping, Force Main	1	1.00%		$ 1,987,715	$ 76,500	1.00%	$ 3,975,429	$ 153,000
6	Wet Storage2	1	0.10%		$ -	$ -	0.10%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 1,624	$ 63	0.25%	$ 2,274	$ 88
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	550	$ 550		$ 7,859,918	$ 302,500	$ 550.00	############	###########
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 11,451,121			$ 14,050,350	
	TOTAL OF ANNUAL COSTS					$ 440,713			$ 540,748

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 934,880	TO	$ 1,409,230
LCC	TOTAL ANNUALIZED COST RANGE	$ 2,320,000	TO	$ 3,110,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 60,380,000**	**TO**	**$ 80,730,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Chain of Lakes Enhanced Nutrient Reduction

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 2,700,000	$ 3,300,000
Capital Cost Annualized over the Project Evaluation Duration	$ 103,913	$ 127,005

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 200,000	$ 400,000	$ 260,000	$ 520,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 1,200,000	$ 2,400,000	$ 1,600,000	$ 3,200,000
9	Outlet Structure, Fixed		60	0.0	$ 50,000	$ -	$ 70,000	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 2,800,000		$ 3,720,000
	Replacement Costs Annualized over the Project Life					$ 107,762		$ 143,169

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 129,916	$ 5,000	2.50%	$ 168,891	$ 6,500
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 2,026,690	$ 78,000	6.50%	$ 2,702,253	$ 104,000
9	Outlet Structure, Fixed	1	0.25%		$ 3,248	$ 125	0.25%	$ 4,547	$ 175
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 2,234,555			$ 2,950,392	
	TOTAL OF ANNUAL COSTS					$ 86,000			$ 113,550

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 193,760	TO	$ 256,720
LCC	TOTAL ANNUALIZED COST RANGE	$ 300,000	TO	$ 380,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 7,730,000**	**TO**	**$ 9,970,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Section			
Alternative	Chain of Lakes Enhanced Nutrient Reduction		
	Alternative 2		
Duration	Economic Evaluation Duration	60	years
Construction Cost	Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
	Capital Cost, Range	$ 1,350,000	$ 1,650,000
	Capital Cost Annualized over the Project Evaluation Duration	$ 51,957	$ 63,503

Replacement Costs

No.	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End: 1 time Replacement Cost	Upper End: Replacement Cost (Present Worth Assumed)	
14	Wetland, Small		30	1.0	$ 100,000	$ 100,000	$ 100,000	$ 100,000	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 100,000		$ 100,000	
	Replacement Costs Annualized over the Project Life					$ 3,849		$ 3,849	

Upper End of Estimated Replacement Costs for Selected Elements (Optional)

Annual Costs

No.	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End: % of Initial Cost	Upper End: Present Worth	Upper End: Annual Cost
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832					
14	Wetland, Small	1	4.00%		$ 103,933	$ 4,000	2.00%	$ 51,966	$ 2,000
	#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.10%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.25%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -

Upper End of Estimated Annual Costs for Selected Elements (Optional)

No.	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	Upper End: $/ unit	Upper End: Present Worth	Upper End: Annual Cost
130	Miscellaneous Slope and Berm Repair	5	$ 150		$ 19,487	$ 750	$ 550.00	########## ##	######### ##
140	Mowing/Vegetation Control/Litter Removal	1	$ 1,850		$ 48,069	$ 1,850	$ 1,850.00	########## ##	######### ##
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 246,191			$ 246,191	
	TOTAL OF ANNUAL COSTS					$ 9,475			$ 9,475

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 13,320	TO	$ 13,320
LCC	TOTAL ANNUALIZED COST RANGE	$ 70,000	TO	$ 80,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 1,700,000**	**TO**	**$ 2,000,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

North Merritt Island Mosquito Impoundment Nutrient Reduction

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 30,870,000	$ 37,730,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,188,075	$ 1,452,092

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
2	Pump Station, Intermittent		20	2.0	$ 425,000	$ 850,000	$ 595,000	$ 1,190,000	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 16,125,000	$ 32,250,000	$ 21,500,000	$ 43,000,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 33,100,000		$ 44,190,000	
	Replacement Costs Annualized over the Project Life					$ 1,273,900		$ 1,700,714	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 276,071	$ 10,625	2.50%	$ 386,500	$ 14,875
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 27,233,641	$ 1,048,125	6.50%	$ 36,311,521	$ 1,397,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 27,585,226			$ 36,773,859	
	TOTAL OF ANNUAL COSTS					$ 1,061,656			$ 1,415,294

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 2,335,560	TO	$ 3,116,010
LCC	TOTAL ANNUALIZED COST RANGE	$ 3,520,000	TO	$ 4,570,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 91,560,000**	**TO**	**$ 118,690,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

North Merritt Island Mosquito Impoundment Nutrient Reduction

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 32,850,000	$ 40,150,000
Capital Cost Annualized over the Project Evaluation Duration	$ 1,264,278	$ 1,545,229

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
2	Pump Station, Intermittent		20	2.0	$ 500,000	$ 1,000,000	$ 700,000	$ 1,400,000	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 16,125,000	$ 32,250,000	$ 21,500,000	$ 43,000,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
4	Piping, Force Main		50	1.0	$ 300,000	$ 300,000	$ 600,000	$ 600,000	
5	Piping, Gravity Flow1		60	0.0	$ 375,000	$ -	$ 750,000	$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 33,550,000		$ 45,000,000	
	Replacement Costs Annualized over the Project Life					$ 1,291,219		$ 1,731,888	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 324,790	$ 12,500	2.50%	$ 454,706	$ 17,500
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 27,233,641	$ 1,048,125	6.50%	$ 36,311,521	$ 1,397,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
4	Piping, Force Main	1	1.00%		$ 77,950	$ 3,000	1.00%	$ 155,899	$ 6,000
5	Piping, Gravity Flow1	0	1.00%		$ -	$ -	1.00%	$ 194,874	$ 7,500
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 27,711,894			$ 37,192,838	
	TOTAL OF ANNUAL COSTS					$ 1,066,531			$ 1,431,419

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 2,357,750	TO	$ 3,163,310
LCC	TOTAL ANNUALIZED COST RANGE	$ 3,620,000	TO	$ 4,710,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 94,110,000**	**TO**	**$ 122,340,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Horse Creek Water Quality Improvements

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 7,020,000	$ 8,580,000
Capital Cost Annualized over the Project Evaluation Duration	$ 270,175	$ 330,213

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 250,000	$ 500,000	$ 250,000	$ 500,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 3,225,000	$ 6,450,000	$ 4,300,000	$ 8,600,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 6,950,000		$ 9,100,000
	Replacement Costs Annualized over the Project Life					$ 267,481		$ 350,226

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 162,395	$ 6,250	2.50%	$ 162,395	$ 6,250
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 5,446,728	$ 209,625	6.50%	$ 7,262,304	$ 279,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 5,684,637			$ 7,500,538	
	TOTAL OF ANNUAL COSTS					$ 218,781			$ 288,669

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 486,260	TO	$ 638,900
LCC	TOTAL ANNUALIZED COST RANGE	$ 760,000	TO	$ 970,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 19,650,000**	**TO**	**$ 25,180,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Eau Gallie River Mouth Water Quality Improvements

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 8,730,000	$ 10,670,000
Capital Cost Annualized over the Project Evaluation Duration	$ 335,986	$ 410,650

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 500,000	$ 1,000,000	$ 700,000	$ 1,400,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 3,225,000	$ 6,450,000	$ 4,300,000	$ 8,600,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
4	Piping, Force Main		50	1.0	$ 232,500	$ 232,500	$ 465,000	$ 465,000
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 7,682,500		$ 10,465,000
	Replacement Costs Annualized over the Project Life					$ 295,672		$ 402,760

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 324,790	$ 12,500	2.50%	$ 454,706	$ 17,500
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 5,446,728	$ 209,625	6.50%	$ 7,262,304	$ 279,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
4	Piping, Force Main	1	1.00%		$ 60,411	$ 2,325	1.00%	$ 120,822	$ 4,650
	#N/A	0	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 5,907,443			$ 7,913,670	
	TOTAL OF ANNUAL COSTS					$ 227,356			$ 304,569

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 523,030	TO	$ 707,330
LCC	TOTAL ANNUALIZED COST RANGE	$ 860,000	TO	$ 1,120,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 22,320,000**	**TO**	**$ 29,050,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Eau Gallie River Mouth Water Quality Improvements

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 7,740,000	$ 9,460,000
Capital Cost Annualized over the Project Evaluation Duration	$ 297,885	$ 364,081

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 350,000	$ 700,000	$ 490,000	$ 980,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 3,225,000	$ 6,450,000	$ 4,300,000	$ 8,600,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
4	Piping, Force Main		50	1.0	$ 93,000	$ 93,000	$ 186,000	$ 186,000
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 7,243,000		$ 9,766,000
	Replacement Costs Annualized over the Project Life					$ 278,757		$ 375,858

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 227,353	$ 8,750	2.50%	$ 318,294	$ 12,250
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 5,446,728	$ 209,625	6.50%	$ 7,262,304	$ 279,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
4	Piping, Force Main	1	1.00%		$ 24,164	$ 930	1.00%	$ 48,329	$ 1,860
	#N/A	0	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 5,773,759			$ 7,704,766	
	TOTAL OF ANNUAL COSTS					$ 222,211			$ 296,529

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 500,970	TO	$ 672,390
LCC	TOTAL ANNUALIZED COST RANGE	$ 800,000	TO	$ 1,040,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 20,760,000**	**TO**	**$ 26,930,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Eau Gallie River Mouth Water Quality Improvements

Alternative 3

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 7,020,000	$ 8,580,000
Capital Cost Annualized over the Project Evaluation Duration	$ 270,175	$ 330,213

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 250,000	$ 500,000	$ 350,000	$ 700,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 3,225,000	$ 6,450,000	$ 4,300,000	$ 8,600,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 6,950,000		$ 9,300,000
	Replacement Costs Annualized over the Project Life					$ 267,481		$ 357,924

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 162,395	$ 6,250	2.50%	$ 227,353	$ 8,750
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 5,446,728	$ 209,625	6.50%	$ 7,262,304	$ 279,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 5,684,637			$ 7,565,496	
	TOTAL OF ANNUAL COSTS					$ 218,781			$ 291,169

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 486,260	TO	$ 649,090
LCC	TOTAL ANNUALIZED COST RANGE	$ 760,000	TO	$ 980,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 19,650,000**	**TO**	**$ 25,450,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Crane Creek Offline Treatment

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 3,240,000	$ 3,960,000
Capital Cost Annualized over the Project Evaluation Duration	$ 124,696	$ 152,406

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
1	Pump Station, Continuous		10	5.0	$ 250,000	$ 1,250,000	$ 350,000	$ 1,750,000
13	Biosorption Activated Media (BAM)3		20	2.0	$ 800,000	$ 1,600,000	$ 800,000	$ 1,600,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 2,850,000		$ 3,350,000
	Replacement Costs Annualized over the Project Life					$ 109,686		$ 128,929

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
1	Pump Station, Continuous	1	2.50%		$ 162,395	$ 6,250	2.50%	$ 227,353	$ 8,750
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 1,351,126	$ 52,000	7.00%	$ 1,455,059	$ 56,000
6	Wet Storage2	1	0.10%		$ -	$ -	0.10%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	5	$ 550		$ 71,454	$ 2,750	$ 550.00	########## ##	########## ##
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 1,660,489			$ 1,829,704	
	TOTAL OF ANNUAL COSTS					$ 63,906			$ 70,419

LCC

ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 173,590	TO	$ 199,350
TOTAL ANNUALIZED COST RANGE	$ 300,000	TO	$ 350,000
TOTAL PRESENT WORTH COST RANGE[3]	**$ 7,750,000**	**TO**	**$ 9,140,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Crane Creek Offline Treatment

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 6,840,000	$ 8,360,000
Capital Cost Annualized over the Project Evaluation Duration	$ 263,247	$ 321,746

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 212,500	$ 425,000	$ 212,500	$ 425,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 3,225,000	$ 6,450,000	$ 4,300,000	$ 8,600,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 6,875,000		$ 9,025,000
	Replacement Costs Annualized over the Project Life					$ 264,594		$ 347,340

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 138,036	$ 5,313	2.50%	$ 138,036	$ 5,313
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 5,446,728	$ 209,625	6.50%	$ 7,262,304	$ 279,500
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 5,660,278			$ 7,476,178	
	TOTAL OF ANNUAL COSTS					$ 217,844			$ 287,731

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 482,440	TO	$ 635,070
LCC	TOTAL ANNUALIZED COST RANGE	$ 750,000	TO	$ 960,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 19,380,000**	**TO**	**$ 24,860,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Section	Item	Estimated Cost Low[1]	Estimated Cost High[2]
Alternative	Micco Water Management Area Improvements		
	Alternative 1		
Duration	Economic Evaluation Duration	60	years
Construction Cost	Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
	Capital Cost, Range	$ 2,340,000	$ 2,860,000
	Capital Cost Annualized over the Project Evaluation Duration	$ 90,058	$ 110,071

Replacement Costs				Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End: 1 time Replacement Cost	Upper End: Replacement Cost (Present Worth Assumed)	
	6	Wet Storage2		1000	0.1	$ -	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST						$ -		$ -	
	Replacement Costs Annualized over the Project Life						$ -		$ -	

Upper End of Estimated Replacement Costs for Selected Elements (Optional)

Annual Costs		Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End: % of Initial Cost	Present Worth	Annual Cost
Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries				25.9832			% of Initial Cost	Present Worth	Annual Cost
6	Wet Storage2	1	0.10%		$ -	$ -	2.00%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.10%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.25%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
Other Maintenance Costs, $/unit		Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
130	Miscellaneous Slope and Berm Repair	15	$ 150		$ 58,462	$ 2,250	$ 550.00	########### #	######### ##
140	Mowing/Vegetation Control/Litter Removal	1	$ 1,850		$ 48,069	$ 1,850	$ 1,850.00	########## ##	######### ##
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
Electrical Energy			25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
TOTAL PRESENT WORTH OF ANNUAL COST					$ 181,233			$ 337,132	
TOTAL OF ANNUAL COSTS						$ 6,975			$ 12,975

Upper End of Estimated Annual Costs for Selected Elements (Optional)

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 6,980	TO	$ 12,980
LCC	TOTAL ANNUALIZED COST RANGE	$ 100,000	TO	$ 120,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 2,520,000**	**TO**	**$ 3,200,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative	Micco Water Management Area Improvements									
	Alternative 2									
Duration	Economic Evaluation Duration					60	years			
Construction Cost	Initial Capital Cost					Estimated Cost Low[1]	Estimated Cost High[2]			
	Capital Cost, Range					$ 7,110,000	$ 8,690,000			
	Capital Cost Annualized over the Project Evaluation Duration					$ 273,638	$ 334,447			
Replacement Costs	Replacement Costs			Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional): 1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
	6	Wet Storage2		1000	0.1	$ -	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
		#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST						$ -		$ -	
	Replacement Costs Annualized over the Project Life						$ -		$ -	
Annual Costs	Annual Costs		Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries				25.9832			% of Initial Cost	Present Worth	Annual Cost
	6	Wet Storage2	1	0.10%		$ -	$ -	2.00%	$ -	$ -
		#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
		#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
		#N/A	1	0.00%		$ -	$ -	1.00%	$ -	$ -
		#N/A	1	0.00%		$ -	$ -	0.10%	$ -	$ -
		#N/A	1	0.00%		$ -	$ -	0.25%	$ -	$ -
		#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
		#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
		#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
		#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit		Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	130	Miscellaneous Slope and Berm Repair	50	$ 150		$ 194,874	$ 7,500	$ 550.00	########### #	########## #
	140	Mowing/Vegetation Control/Litter Removal	1	$ 1,850		$ 48,069	$ 1,850	$ 1,850.00	########## ##	######### ##
		0	0	$ -		$ -	$ -	$ -	$ -	$ -
		0	0	$ -		$ -	$ -	$ -	$ -	$ -
		0	0	$ -		$ -	$ -	$ -	$ -	$ -
		0	0	$ -		$ -	$ -	$ -	$ -	$ -
		0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy			25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST					$ 317,645			$ 837,309	
	TOTAL OF ANNUAL COSTS						$ 12,225			$ 32,225
	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE		$ 12,230		TO	$ 32,230				
LCC	TOTAL ANNUALIZED COST RANGE		$ 290,000		TO	$ 370,000				
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**		**$ 7,430,000**		**TO**	**$ 9,530,000**				

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Micco Water Management Area Improvements

Alternative 3

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 12,780,000	$ 15,620,000
Capital Cost Annualized over the Project Evaluation Duration	$ 491,856	$ 601,158

Replacement Costs

Replacement Costs			Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
2	Pump Station, Intermittent		20	2.0	$ 250,000	$ 500,000	$ 250,000	$ 500,000	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 6,450,000	$ 12,900,000	$ 8,600,000	$ 17,200,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
TOTAL PRESENT WORTH OF REPLACEMENT COST						$ 13,400,000		$ 17,700,000	
Replacement Costs Annualized over the Project Life						$ 515,718		$ 681,209	

Annual Costs

Annual Costs		Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries				25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 162,395	$ 6,250	2.50%	$ 162,395	$ 6,250
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 10,893,456	$ 419,250	6.50%	$ 14,524,608	$ 559,000
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
Other Maintenance Costs, $/unit		Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
Electrical Energy			25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
TOTAL PRESENT WORTH OF ANNUAL COST					$ 11,131,365			$ 14,762,842	
TOTAL OF ANNUAL COSTS						$ 428,406			$ 568,169

LCC

ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 944,120	TO	$ 1,249,380
TOTAL ANNUALIZED COST RANGE	$ 1,440,000	TO	$ 1,850,000
TOTAL PRESENT WORTH COST RANGE[3]	**$ 37,310,000**	**TO**	**$ 48,080,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

South Prong St. Sebastian River Stormwater Treatment

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 19,440,000	$ 23,760,000
Capital Cost Annualized over the Project Evaluation Duration	$ 748,176	$ 914,437

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
9	Outlet Structure, Fixed		60	0.0	$ 18,750	$ -	$ 26,250	$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ -		$ -	
	Replacement Costs Annualized over the Project Life					$ -		$ -	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
6	Wet Storage2	1	0.10%		$ -	$ -	2.50%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 1,218	$ 47	7.00%	$ 47,744	$ 1,838
	#N/A	1	0.00%		$ -	$ -	0.10%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.25%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	30	$ 550		$ 428,723	$ 16,500	$ 550.00	########## #	########## #
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 504,642			$ 551,169	
	TOTAL OF ANNUAL COSTS					$ 19,422			$ 21,213

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 19,420	TO	$ 21,210
LCC	TOTAL ANNUALIZED COST RANGE	$ 770,000	TO	$ 940,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 19,940,000**	**TO**	**$ 24,310,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

South Prong St. Sebastian River Stormwater Treatment

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 24,120,000	$ 29,480,000
Capital Cost Annualized over the Project Evaluation Duration	$ 928,292	$ 1,134,579

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -	
9	Outlet Structure, Fixed		60	0.0	$ 18,750	$ -	$ 26,250	$ -	
13	Biosorption Activated Media (BAM)3		20	2.0	$ 4,000,000	$ 8,000,000	$ 4,000,000	$ 8,000,000	
	#N/A		#N/A	#N/A	$ 4,000,000	$ -	$ 4,000,000	$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	#N/A		#N/A	#N/A		$ -		$ -	
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 8,000,000		$ 8,000,000	
	Replacement Costs Annualized over the Project Life					$ 307,891		$ 307,891	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
6	Wet Storage2	1	0.10%		$ -	$ -	2.50%	$ -	$ -
9	Outlet Structure, Fixed	1	0.25%		$ 1,218	$ 47	0.10%	$ 682	$ 26
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 6,755,632	$ 260,000	0.25%	$ 259,832	$ 10,000
	#N/A	1	0.00%		$ -	$ -	7.00%	$ 7,275,296	$ 280,000
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
110	STA Maintenance, $/acre	30	$ 550		$ 428,723	$ 16,500	$ 550.00	########## #	########## #
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 7,260,274			$ 8,039,234	
	TOTAL OF ANNUAL COSTS					$ 279,422			$ 309,401

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 587,310	TO	$ 617,290
LCC	TOTAL ANNUALIZED COST RANGE	$ 1,520,000	TO	$ 1,750,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 39,380,000**	**TO**	**$ 45,520,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Fellsmere Offline Treatment

Alternative 1

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 2,340,000	$ 2,860,000
Capital Cost Annualized over the Project Evaluation Duration	$ 90,058	$ 110,071

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)		
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	
14	Wetland, Small		30	1.0	$ 200,000	$ 200,000	$ 200,000	$ 200,000	
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
	#N/A		#N/A	#N/A	$ 1,000	$ -		$ -	
TOTAL PRESENT WORTH OF REPLACEMENT COST						$ 200,000		$ 200,000	
Replacement Costs Annualized over the Project Life						$ 7,697		$ 7,697	

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
14	Wetland, Small	1	4.00%		$ 207,866	$ 8,000	2.00%	$ 103,933	$ 4,000
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	2.50%	$ 11,368	$ 438
	#N/A	1	0.00%		$ -	$ -	2.50%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	1.00%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.10%	$ -	$ -
	#N/A	1	0.00%		$ -	$ -	0.25%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
130	Miscellaneous Slope and Berm Repair	10	$ 150		$ 38,975	$ 1,500	$ 550.00	########## #	######### ##
140	Mowing/Vegetation Control/Litter Removal	1	$ 1,850		$ 48,069	$ 1,850	$ 1,850.00	########## ##	######### ##
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 370,423			$ 380,979	
	TOTAL OF ANNUAL COSTS					$ 14,256			$ 14,663

LCC

ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 21,950	TO	$ 22,360

LCC

TOTAL ANNUALIZED COST RANGE	$ 110,000	TO	$ 130,000

LCC

TOTAL PRESENT WORTH COST RANGE[3]	**$ 2,910,000**	**TO**	**$ 3,440,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Water Quality Project Life Cycle Cost Analysis

Alternative

Fellsmere Offline Treatment

Alternative 2

Duration

Economic Evaluation Duration	60	years

Construction Cost

Initial Capital Cost	Estimated Cost Low[1]	Estimated Cost High[2]
Capital Cost, Range	$ 3,870,000	$ 4,730,000
Capital Cost Annualized over the Project Evaluation Duration	$ 148,942	$ 182,041

Replacement Costs

	Replacement Costs		Expected Service Life (Years)	# Replacements Over Project Life	1 time Replacement Cost	Replacement Cost (Present Worth Assumed)	Upper End of Estimated Replacement Costs for Selected Elements (Optional)	
							1 time Replacement Cost	Replacement Cost (Present Worth Assumed)
2	Pump Station, Intermittent		20	2.0	$ 187,500	$ 375,000	$ 187,500	$ 375,000
6	Wet Storage2		1000	0.1	$ -	$ -	$ -	$ -
13	Biosorption Activated Media (BAM)3		20	2.0	$ 1,612,500	$ 3,225,000	$ 2,150,000	$ 4,300,000
9	Outlet Structure, Fixed		60	0.0	$ 12,500	$ -	$ 17,500	$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	#N/A		#N/A	#N/A		$ -		$ -
	TOTAL PRESENT WORTH OF REPLACEMENT COST					$ 3,600,000		$ 4,675,000
	Replacement Costs Annualized over the Project Life					$ 138,551		$ 179,924

Annual Costs

	Annual Costs	Unit	% of Initial Cost	Present Worth Factor	Present Worth	Annual cost	Upper End of Estimated Annual Costs for Selected Elements (Optional)		
	Maintenance Cost of Items Listed in Replacement Cost Section. NOTE!: Must be in same order as Replacement Costs above as Annual Costs link to Replacement Cost Entries			25.9832			% of Initial Cost	Present Worth	Annual Cost
2	Pump Station, Intermittent	1	2.50%		$ 121,796	$ 4,688	2.50%	$ 121,796	$ 4,688
6	Wet Storage2	1	0.10%		$ -	$ -	1.00%	$ -	$ -
13	Biosorption Activated Media (BAM)3	1	6.50%		$ 2,723,364	$ 104,813	6.50%	$ 3,631,152	$ 139,750
9	Outlet Structure, Fixed	1	0.25%		$ 812	$ 31	0.25%	$ 1,137	$ 44
	#N/A	1	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A	0	0.00%		$ -	$ -	0.00%	$ -	$ -
	#N/A		0.00%		$ -	$ -	0.00%	$ -	$ -
	Other Maintenance Costs, $/unit	Unit	$/ unit	Present Worth Factor	Present Worth	Annual cost	$/ unit	Present Worth	Annual Cost
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	0	0	$ -		$ -	$ -	$ -	$ -	$ -
	Electrical Energy		25000	kwh	$ 74,702	$ 2,875		$ 74,702	$ 2,875
	TOTAL PRESENT WORTH OF ANNUAL COST				$ 2,920,674			$ 3,828,787	
	TOTAL OF ANNUAL COSTS					$ 112,406			$ 147,356

LCC

	ESTIMATED REPLACEMENT + O&M ANNUALIZED COST RANGE	$ 250,960	TO	$ 327,280
LCC	TOTAL ANNUALIZED COST RANGE	$ 400,000	TO	$ 510,000
LCC	**TOTAL PRESENT WORTH COST RANGE[3]**	**$ 10,390,000**	**TO**	**$ 13,230,000**

1 - Opinion of Probable Construction Cost on Base Bid Item List Projected Out to Time of Construction
2 - Opinion of Probable Construction Cost plus Contingency plus Add-Alternate Bid Items as Applicable
3 - These are the values used on the Unit Cost Summary Sheet for computing benefit/cost information

Appendix B

Potential Project Information

Appendix B
Identification of Potential Stormwater Project Locations

Map ID	Stakeholders	Planning Unit	Project Name	Project Description	Project Benefits	Considerations	Approximate Basin Acres	Approximate TN Starting Load (lb/yr)	Reduction Range (%)	TN Reduction Low (lb/yr)	TN Reduction High (lb/yr)	Order of Magnitude Cost	Ease of Implementation (1=easy to 3=difficult)	Reduction (1=high to 3=low)*	Cost (1=low to 3=high)**	Score (1=most favorable to 9=less favorable)
1	SJRWMD, Volusia County	Halifax River	Pump and Treat near Halifax Plantation Golf Club	Pump canal water to a stormwater treatment area (STA) or STA with biosprption activated media (BAM) treatment to Volusia County-owned parcels just south of the Halifax Plantation Golf Club. Two parcels totaling roughly 57 acres could be used to treat canal water before it enters the Bulow Creek State Park.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. Stakeholder may wish to use this area for future RIB site.	3,200	21,000	20-50%	4,200	10,500	Medium	2	2	2	6
2	SJRWMD, Volusia County, City of Port Orange	Halifax River	Spruce Creek Road Denitrification System	A small 3-acre parcel owned by the City of Port Orange could be used to construct a pumped denitrification facility with BAM to treat flows from the canal along Spruce Creek Road north of Margaret Buschman Park.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. Pumped denitrification facilities require a smaller footprint than a traditional stormwater treatment pond. Verification of proposed location ownership should occur. Multiple locations in this vicinity of County- or City-owned parcels could be viable.	2,700	21,000	40-50%	8,400	10,500	High	2	2	3	7
3	SJRWMD, Volusia County	North IRL	Turnbull Creek Baseflow Treatment	Construct an offline BAM system to treat stormwater and groundwater baseflow in Turnbull Creek before discharging to the Indian River on stakeholder-owned land adjacent to Turnbull Creek.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years.	22,500	82,600	40-50%	33,040	41,300	High	2	1	3	6
4	SJRWMD, Brevard County, City of Titusville, Eastern Florida State College	North IRL	Chain of Lakes Enhanced Nutrient Reduction	Construct an online nutrient reduction BAM and iron enhanced sand filter floating skimmer system replacing 12" bleed downs at the 4 outfalls to further treat stormwater and groundwater baseflow on stakeholder land before discharging to IRL.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Does not require pumping and ease of construction is a benefit. Filter media has to be replaced every 20 to 40 years.	1,175	9,677	20-30%	1,935	2,903	Low	2	3	1	6
5	SJRWMD, Brevard County, City of Titusvulle	Tosohatchee	Diversion West to USJRB Near Carol Ave. Ditch System in Titusville	Install an operable weir structure in the vicinity of Carol Ave. in Titusville on the ditch to divert water towards the west to the Upper St. Johns River Basin (USJRB). This would support flow restoration efforts as well as remove that entire load from entering the IRL.	Reduced stormwater nutrient loads, reduced stormwater flows to IRL, increased flows to St. Johns River.	Construction of an operable weir structure increases the complexity of this alternative. While this may be outside of the Interbasin Diversion planning unit LiDAR topography shows the diversion may be possible, but should be investigated if further considering this project.	3,500	24,000	100%	24,000	24,000	High	3	1	3	7
6	SJRWMD, Brevard County	Banana River	North Merritt Island Enhanced Nutrient Reduction Mosquito Impoundment Drawdown System	Construct an offline and/or online nutrient reduction BAM and iron enhanced sand filter system within the Sykes Creek Mosquito Impoundment, with the most likely location at or just prior to the discharge points/flash board risers where stormwater enters the Banana River Lagoon. Brevard County installed a pump station that moves stormwater water through the impoundment as well as via a drainage ditch extending north to south immediately west and adjacent to this impoundment. The County owns much of the land within the impoundment.	Reduced Nutrient Loads to the IRL.	This alternative would take advantage of existing hydraulics for treatment. Filter media has to be replaced every 20 to 40 years.	6,500	32,098	40-50%	12,839	16,049	Medium	2	1	2	5
7	SJRWMD, Brevard County, City of Melbourne	North IRL	Pond Expansion near Sherwood Glen	Expand the footprint of an existing 0.3-acre STA on City of Melbourne property near Sherwood Glen. Use the expanded pond for pumping and treating water from the canal before it discharges to the Indian River. BAM media could be added to the design for further treatment as an alternative.	Reduced Stormwater and Groundwater Baseflow nutrient loads and sediment to the IRL with enhanced flood control resiliency.	Filter media has to be replaced every 20 to 40 years, if used.	500	4,100	20-50%	820	2,050	Low	1	3	1	5
8	SJRWMD, Brevard County, City of Melbourne	North IRL	Horse Creek Water Quality Improvements	Construct an offline and/or online nutrient reduction BAM and iron enhanced sand filter system associated with the Wickham Park ponds on county property and an FDOT pond at US 1 to treat stormwater and groundwater baseflow for the large area ultimately discharging through Horse Creek to the IRL. Offline systems would require solar pumps and online systems would require filter floating skimmers replacing bleed down at pond outfalls. Furthermore, the Brevard County Wickham Park pond located on Croton Road and Parkway Drive has a lot of sediment build up due to the Parkway Drive ditch being deep, steep, and unlined and the City of Melbourne has looked at piping this system. Piping or bank stabilization would help with maintenance issues and reduce the sediment load while providing flood control so this multi-phased project would help with both water quality and resilience.	Reduced Stormwater and Groundwater Baseflow nutrient loads and sediment to the IRL with enhanced flood control resiliency.	May require pumping and will require maintenance. Filter media has to be replaced every 20 to 40 years.	2,000	15,450	40-50%	6,180	7,725	Low	2	2	1	5
9	SJRWMD, Brevard County	North Central IRL	Eau Gallie River Offline Pump and Treat	Brevard County owns a 3-acre parcel spanning the Eau Gallie River just east of North Wickham Rd. Construct a pumped denitrification system on the larger 1.6 acres on the north side of the river to treat a portion of baseflow before it is returned to the river.	Reduced Nutrient Loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. Pumped denitrification facilities require a smaller footprint than a traditional stormwater treatment pond.	800	6,600	40-50%	2,640	3,300	Medium	3	3	2	8

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Map ID	Stakeholders	Planning Unit	Project Name	Project Description	Project Benefits	Considerations	Approximate Basin Acres	Approximate TN Starting Load (lb/yr)	Reduction Range (%)	TN Reduction Low (lb/yr)	TN Reduction High (lb/yr)	Order of Magnitude Cost	Ease of Implementation (1=easy to 3=difficult)	Reduction (1=high to 3=low)*	Cost (1=low to 3=high)**	Score (1=most favorable to 9=less favorable)
10	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Diversion West to USJRB	Install an operable weir structure at Croton Road on Mosquito Ditch to divert water towards the west to the Upper St. Johns River Basin (USJRB). This would support flow restoration efforts as well as remove that entire load from entering the IRL.	Reduced stormwater nutrient loads, reduced stormwater flows to IRL, increased flows to St. Johns River.	Construction of an operable weir structure increases the complexity of this alternative. While this may be outside of the Interbasin Diversion planning unit LiDAR topography shows the diversion may be possible, but should be investigated if further considering this project.	900	7,600	100%	7,600	7,600	High	3	2	3	8
11	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Pump and Treat near Melbourne Airport	Construct a pumped denitrification system north of the Melbourne Airport to treat canal water before returning treated water back to the canal. This parcel may now be owned by the Airport, which may render it less feasible.	Reduced Nutrient Loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. The proposed area may not be available for use for treatment.	375	3,300	40-50%	1,320	1,650	Medium	3	3	2	8
12	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Eau Gallie River Mouth Water Quality Improvements	Construct an offline pumped and/or seepage slope wall nutrient reduction biosorption activated media and iron enhanced sand filter system to treat residential, city, and airport stormwater and groundwater baseflow in Eau Gallie River before discharging to the IRL. The City of Melbourne owns land between the water treatment plant and airport adjacent to a prong of the Eau Gallie River. Furthermore, there is a low level check dam salt water intrusion limiter in the Eau River between N. Apollo Drive and the rail road tracks that may have potential locations of extensive erosion and muck build up for dredging and/or water quality treatment if the state agencies will permit a project working in natural waters for additional nutrient reduction.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years.	5,900	35,064	40-50%	14,026	17,532	Medium	2	1	2	5
13	SJRWMD, Brevard County, City of Melbourne, Florida Institute of Technology	North Central IRL	Crane Creek Offline Pump and Treat	Construct an offline nutrient reduction biosorption activated media system to treat stormwater and groundwater baseflow in Crane Creek before discharging to the IRL on stakeholder owned land adjacent to Crane Creek.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years.	11,700	100,124	40-50%	40,050	50,062	High	2	1	3	6
14	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Crane Creek Offline Treatment at Dredge Spoil Area	This area is used by the City of Melbourne for dredging spoils, but not frequently. Using the existing spoil area, which isalready bermed, construct a treatment system to pump adjacent canal water into before it enters Crane Creek. The bermed area could be used as wet detention with additional BAM treatment before being discharged back to teh canal. Alternatively, depending on infiltration rates in the area, a BAM barrier could be constructed along the north and east sides of hte proposed pond for further treatment of groundwater.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. The proposed treatment area would take advantage of existing facility, and earthwork would be minimized.	3,000	25,100	40-50%	10,040	12,550	Medium	1	2	2	5
15	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Brothers Park Water Quality Improvements	Construct a pumped denitrification facility on the City-owned Brothers Park property. There are roughly 2.2 acres potentially available for construction to pipe pumped water from theadjacent canal. This system would be upstream of a proposed baffle box the City is planning.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Relatively small footprint and contributing area, may not provide significant removal.	150	1,500	40-50%	600	750	Medium	2	3	2	7
16	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Lipscomb Park Pond Retrofit	Pump from the canal immediately east of the Lakewood Village Mobile Home Park via a piped system along Florida Avenue to a treatment system at the City of Melbourne's Lipscomb Park. There is space on the west side of the western pond for a pumped denitrification facility or treatment wetland area which could be built to retrofit the ponds.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and a significant length of pipe, which will impact construction costs.	1,300	10,700	40-50%	4,280	5,350	Medium	1	3	2	6
17	SJRWMD, Brevard County, City of Melbourne	North Central IRL	Pump and Treat at Southwest Recreation Complex	Pump from the canal immediately south of the City of Melbourne's Southwest Recreation Complex into a pumped dentrification facility adjacent to the canal before discharging back to the canal.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years.	1,500	12,000	40-50%	4,800	6,000	High	2	3	3	8
18	SJRWMD, Brevard County, City of Grant-Valkaria	North Central IRL	Goat Creek Baseflow Treatment	Construct an offline nutrient reduction BAM system to treat baseflow in Goat Creek before discharging back to the creek as it flows to the Indian River on stakeholder-owned land adjacent to the creek. Feasibility may depend on whether Goat Creek is tidal in the area.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. If Goat Creek is tidal in this area, the alternative would not be feasible.	10,000	67,700	40-50%	27,080	33,850	High	2	1	3	6

Appendix B
Identification of Potential Stormwater Project Locations

Map ID	Stakeholders	Planning Unit	Project Name	Project Description	Project Benefits	Considerations	Approximate Basin Acres	Approximate TN Starting Load (lb/yr)	Reduction Range (%)	TN Reduction Low (lb/yr)	TN Reduction High (lb/yr)	Order of Magnitude Cost	Ease of Implementation (1=easy to 3=difficult)	Reduction (1=high to 3=low)*	Cost (1=low to 3=high)**	Score (1=most favorable to 9=less favorable)
19	SJRWMD, Brevard County, City of Palm Bay	North Central IRL	Stormwater Facility in Palm Bay	Construct a stormwater treatment facility at what is known as "the Compound" in Palm Bay. The Compound is an abandoned subdivision of about 2,800 acres of mostly privately owned parcels. The City owns some of the parcels and the paved roadways, totaling roughly 235 acres.	Reduced nutrient loads to the IRL.	Multiple options for construction of a treatment area exist. It may be necessary to purchase private parcels in some cases. Requires pumping and maintenance. This project could compete for water with C-10 Water Management Area.	18,000	94,000	20-30%	18,800	28,200	Medium	2	1	2	5
20	SJRWMD, Brevard County	South Central IRL	Micco Water Management Area Retrofit/Enhancements	Construct enhancements to the water quality treatment featuers at Micco Stormwater Park such as adding baffles to Wheeler Pond. It may be possible to construct a BAM treatment area near the pond's outfall to further remove nutrients.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	A more thorough analysis of the existing benefit of Micco Stormwater Park would aid in proposed removal with park enhancements.	18,000	97,000	30-50%	29,100	48,500	Low	1	1	1	3
21	SJRWMD, Indian River County	South Central IRL	South Prong St. Sebastian River Stormwater Treatment	Construct a wet detention facility on stakeholder owned property adjacent to the South Prong of the St. Sebastian River. Runoff from a residential and commercial neighborhood just west of Sebastian Blvd. would be treated before discharging to the South Prong.	Reduced Stormwater nutrient loads to the IRL.	Relatively small footprint and contributing area, may not provide significant removal.	520	4,700	20-30%	940	1,410	Low	1	3	1	5
22	SJRWMD, Indian River County, Fellsmere Water Control District	South Central IRL	Offline Pump and Treat in Fellsmere	Construct a stormwater treatment facility on a 10-acre stakeholder-owned parcel to pump and treat canal water in Fellsmere. It may be possible to increase nutrient reduction by incorporating BAM into the design.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Relatively small contributing area, may not provide significant removal unless BAM is incorporated.	13,000	9,800	20-50%	1,960	4,900	Medium	1	3	2	6
23	SJRWMD, Indian River County	South Central IRL	Vero Lakes Estates Borrow Pit Retrofit	The 8.4-acre borrow pit area at the Vero Lakes Estates neighborhood or other existing wet detention ponds nearby could be retrofitted for treament of pumped canal water out of Lateral D adjacent to the Sebastian River Improvement District (SRID). Treated water would be pumped back into the canal before it discharges to the South Prong.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Multiple options for construction of a treatment area exist. It may be necessary to purchase private parcels in some cases. Requires pumping and maintenance.	17,800	110,200	20-30%	22,040	33,060	Medium	2	1	2	5
24	SJRWMD, Indian River County	South Central IRL	Linear BAM Removal Along Lateral D	Construct a linear nutrient reduction BAM system along between 6,000 ft and 12,000 feet of Lateral D in the vicinity of Vero Lakes Estates to treat canal water before getting discharged back into the canal.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance. Filter media has to be replaced every 20 to 40 years. Proposed layout of BAM treatment makes this alternative complex.	17,800	110,200	40-50%	44,080	55,100	High	3	1	3	7
26	SJRWMD, Indian River County	South Central IRL	Sandridge Golf Club STA	Roughly 19 acres of open land as part of the County's Sandridge Golf Club may be available to pump from the adjacent canal into a proposed stormwater treatment area before being discharged back to the canal.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Requires pumping and maintenance.	1,200	9,300	20-30%	1,860	2,790	Medium	1	3	2	6
26	SJRWMD, Indian River County	South Central IRL	Water Quality Treatment off 66th Avenue	A stakeholder-owned parcel off 66th Avenue is currently used for debris management after storms, and is slated for partial use during the widening of 66th Avenue. Part of the 18-acre parcel could be used for a pumped denitrification system to treat water from Lateral A.	Reduced Stormwater and Groundwater Baseflow nutrient loads to the IRL.	Relatively small contributing area, may not provide significant removal unless a pumped denitrification facility is constructed. The County may not wish to alter use of this parcel.	1,200	9,400	40-50%	3,760	4,700	Medium	1	3	2	6
27	SJRWMD, Indian River County	South Central IRL	Treatment Train at PC Main Screening System	Construct a BAM treatment train at the end of the PC Main Screening System to further polish stormwater already being treated from the Main Canal.	Reduced nutrient loads to the IRL.	Treatment train installation on the existing treatment facilities is not a favorable approach for the County. Water quality in this region has already been improved.	22,800	18,000	30-50%	5,400	9,000	Medium	3	2	2	7
28	SJRWMD, Indian River County, Utility	South Central IRL	Utility Partnership - RIB Retrofit	In partnership with the County's Utility, rapid infiltration basins (RIBs) could be used also for stormwater treatment by pumping stormwater from the North Canal. RIBs could be retrofitted with BAM to reduce nutrients.	Reduced nutrient loads to the IRL.	Partnership with the local Utility causes complexity. Filter media has to be replaced every 20 to 40 years.	10,000	79,200	30-40%	23,760	31,680	High	3	1	3	7
29	SJRWMD, Indian River County, Hawks Nest Golf Club	South Central IRL	Stormwater Harvesting for Golf Course Irrigation	Partner with the Hawks Nest Golf Club to use stormwater harvesting as a means of irrigation there. The existing pond immediately south of North Canal may be able to be used for irrigation, with continuous pumping from North Canal to maintain water levels. This would remove the entire pumped load from the IRL.	Reduced nutrient loads to the IRL.	Partnership with the Golf Club causes complexity. Requires pumping and maintenance.	10,000	79,200	20-30%	15,840	23,760	Medium	3	1	2	6
30	SJRWMD, Indian River County	South Central IRL	Treatment Train at Osprey Marsh Algal Scrubber	Addition of a BAM filter as a treatment train after the Indian River County Utilities Osprey Marsh Stormwater Park.	Reduced nutrient loads to the IRL.	Treatment train installation on the existing treatment facilities is not a favorable approach for the County. Water quality in this region has already been improved.	9,800	27,000	30-50%	8,100	13,500	Medium	3	2	2	7

Not all project ideas were discussed with every stakeholder.
* Reduction range is not based on removal efficiency only, but on how much of the starting load may be treated plus the removal efficiency.
** Low ROM cost less than $5M; Medium ROM cost between $5M and $10M; High ROM cost greater than $10M.