Fort Pierce Utilities Authority and St. Lucie County

Wastewater Plant Relocation Conceptual Analysis

Draft Report

May 2020

Raftelis
341 N. Maitland Avenue, Suite 300
Maitland, FL 32751 • 407.628.2600

Hazen and Sawyer
2101 NW Corporate Boulevard, Suite 301
Boca Raton, FL 33431 • 561.997.8070

RAFTELIS

May 18, 2020

Mr. Bo Hutchinson, P.E.
Director Water/Wastewater Systems
Fort Pierce Utilities Authority
206 South 6th Street
Fort Pierce, FL 34950

Mr. George Landry
Interim Director of Public Utilities
St. Lucie County
2300 Virginia Avenue
Fort Pierce, FL 34982

Subject: Wastewater Plant Relocation Conceptual Analysis (Draft)

Dear Mr. Hutchinson and Mr. Landry:

The Fort Pierce Utilities Authority ("FPUA") and St. Lucie County ("County") requested that Raftelis and its sub-consultant, Hazen and Sawyer ("Hazen") (the "Project Team"), provide professional services to prepare a Wastewater Plant Relocation Conceptual Analysis to construct a Mainland Water Reclamation Facility ("MWRF") and remove from service the FPUA Island Water Reclamation Facility ("IWRF") and affected County plants for joint use by FPUA and the County (the "Parties"). It is our understanding that the main objectives for the effective relocation of the IWRF to the mainland is to: i) regionalize wastewater treatment and disposal service on behalf of the Parties and its customers; ii) essentially provide an upgrade to the wastewater facilities since many components of the facilities are in need of replacement or expansion for growth; iii) promote economies of scale in the cost of providing service; and iv) provide capacity for economic growth in the region. The analysis as discussed in the report is considered as a conceptual or desktop review based on available information and meetings with the Parties and does not reflect a Master Planning level analysis which will be necessary based on the needs and directives of the Parties.

The Project Team has reviewed existing reports and condition assessments of existing facilities, geographic information systems (GIS), existing facility permits (including deep injection wells), Capacity Analysis Reports and Monthly Operating Reports as submitted to the Florida Department of Environmental Protection (FDEP), and other information available from the Parties. Technical review meetings were held with the Parties to discuss the Project Team's understanding of the project requirements. Specifically, the meetings included discussions about the following tasks:

- Discuss approach to the availability and use of existing wastewater collection lines and lift stations, and the possible rerouting of the lines to the potential MWRF locations.

341 North Maitland Avenue, Suite 300 610
Maitland, FL 32751
www.raftelis.com

- Discuss condition of existing facilities for each party.
- Discuss approach to identifying existing and the determination of future flow projections and wastewater capacity characteristics.
- Review current regulations and future/pending regulations.
- Discuss Design Criteria for each potential site.

During the technical review meetings, the Parties agreed on certain planning criteria, including but not limited to, transmission routes within the existing systems, methods of estimating future wastewater plant flows and customer demands, plant design options related to the facility costs and efficiencies, and the overall planning horizon to estimate the plant capacity at construction (through 2035).

Preliminary results of the conceptual analysis were provided to the Parties on March 9, 2020 with an emphasis on the proposed plant capacity and conceptual capital costs by location, including the costs to reroute the Parties' collection system based on each prospective plant site. Based on a review of the design criteria and updated construction costs, the proposed amounts have been updated. In addition, an analysis has been performed to estimate the additional decommissioning costs of existing facilities that will not remain in service after construction of the MWRF and to develop an initial projection of the annual operating expenses of the proposed MWRF. Please see the attached engineering report prepared by Hazen.

In preparing the conceptual analysis, the Parties agreed to certain basic assumptions regarding the proposed study. The following is a list of the major assumptions used to develop the scope of services:

- The Parties wish to evaluate options to relocate the wastewater treatment function by removing the IWRF from service and constructing a mainland wastewater treatment facility.
    - The Project Team was not tasked with evaluating the financial feasibility of maintaining the IWRF and/or the County's existing mainland wastewater treatment facilities.
    - The Project Team was also not tasked with evaluating the estimated utility rate impacts, if any, to each individual party based on the operating and/or capital costs of any option.
- The Project Team evaluated two (2) locations for the MWRF.
- The governance and administrative costs of the proposed regional system was assumed to be the same under any wastewater plant location option and have not been included in the evaluation.
- Effluent disposal is assumed to be by deep injection well and any reclaimed water conveyance costs in addition to the plant site options were assumed to be the responsibility of and funded by each respective Party for their own specific water resource benefit; no potential reclaimed water costs or associated revenues were assumed in the conceptual analysis.

- Future population projections and wastewater flows were based on available reports and documentation provided by the Parties.
- Condition assessments based on existing reports provided by the Parties and were limited to those facilities that will be impacted by the construction of the MWRF. Facilities that will not contribute wastewater flow to the MWRF or not have flow redirected to it was not included in the condition assessment.
- Other than the decommissioning costs of the IWRF, no other analysis of the IWRF site was conducted. Specifically, this study did not include an evaluation of the property rights, the property value, or whether proceeds from the potential sale of the property would be available to off-set any potential costs of moving the IWRF.

The following section provides a summary discussion of the projected costs of the proposed MWRF including initial capital costs of new facilities, decommissioning costs of existing facilities, and projected annual operating expenses under combined operations.

Summary of MWRF Conceptual Costs

Summary of Projected Capital Costs of New Facilities (Millions) [1]		
Description	**North County (Taylor Dairy Road)**	**South County / FPUA (Treasure Coast Energy Center)**
MWRF Construction Costs [2]	$119.440	$104.620
Collection System / Routing	26.510	22.746
Sub-total Capital Costs of Proposed New Facilities	$145.950	$127.366
Decommission IWRF Site	$2.382	$2.382
Decommission 3 SLC Plants	1.733	1.733
Sub-total Decommission Costs	$4.115	$4.115
Total Capital Costs of Proposed New Facilities	$150.065	$131.481

____
[1] Amounts reflect estimated costs (in today's dollars) as derived from Tables 7-1 and 7-2 of the Hazen report, which is attached for your consideration. The amounts are based on information provided by the Parties and the assumptions as documented in the report, which should be read in its entirety.
[2] The MWRF facility design and costs are identical for both locations except that the North County site requires an additional deep injection well for redundancy whereas the South County site already has an existing deep injection well that is available for effluent disposal from the MWRF.

As discussed in Hazen's report, future population forecasts were used to estimate the wastewater demands to size the amount of capacity to be constructed at the MWRF. When evaluating the future development data and reports made available by the Parties, no specific service area within either Party's service territory was identified for specific development. As such, the future rate of growth is assumed to be service area-wide for both Parties.

As shown on the previous page, utilizing the FPUA location at the Treasure Coast Energy Center is projected to have a total capital cost of $131.481 million or approximately $18.5 million less when compared to the Taylor Dairy Road location. The lower cost is primarily attributed to: i) the availability of having existing deep injection wells at the FPUA site for effluent disposal that would have to be duplicated if the County site is chosen, and ii) overall lower rerouting costs of the collection systems. Based on information provided by Hazen, several key assertions and assumptions were made to develop the capital cost estimates:

- The initial plant sizing was estimated to support annual average flows of 8.0 MGD and peak hourly flows of 20.0 MGD based on projected flows and loadings in Year 2035.
- It is assumed that the build-out capacity of the MWRF will be for an annual average flow 10.0 MGD; future facilities are shown on the conceptual facility site plan.
- The development of the conceptual costs were based on: i) applying historical cost of similar facilities available to Hazen, including regional bid tabulations and estimated additional ancillary cost from RS Means Cost Works, and ii) the design an sizing criteria of the MWRF. The proposed MWRF costs are identical except for the savings realized by existing deep injection well infrastructure at the FPUA Energy Center site.
- Amounts shown above are based on FPUA's existing South Hutchinson Island flows being redirected to the MWRF regardless of the site chosen.

To provide the Parties additional information regarding the operation of the proposed MWRF, an operating cost analysis was prepared as shown in Section 8 of the Hazen report. The analysis began with identifying recent actual operating expenses for the combined IWRF and SLC facilities, which totaled approximately $2.86 million for Fiscal Year 2018. Hazen developed a projection of the direct facility operating expenses through Fiscal Year 2025 based on the projected wastewater treatment flows in order to provide a comparison to the projected MWRF expenses. Fiscal Year 2025 was selected since it is the first full year the proposed MWRF is assumed to be in service and operational. The following table provides a comparison of the existing and projected operating expenses of the current and proposed facilities based on projected wastewater demands for Fiscal Year 2025:

-Remainder of this page intentionally left blank-

Comparison of Projected Operating Expenses – FY 2025 [1]		
Description	**Combined IWRF & SLC Facilities**	**Proposed WRF**
Labor	$1,454,650	$1,247,688
Power	641,294	612,105
Chemicals	121,179	235,653
Sludge	622,791	592,648
Repairs & Maintenance	183,803	90,754
Administrative / Other	123,223	101,422
Total Annual Cost	**$3,146,940**	**$2,880,271**
MGD - AADF	5.59	5.59
Projected Flows MGY	2,040	2,040
Cost, $ / MG Treated	$1,542	$1,412

____

[1] Amounts reflect estimated costs (in today's dollars) to treat future estimated 2025 wastewater flows of 5.59 MGD (AADF) as derived from Table 8-3 of the Hazen report, which should be read in its entirety.

MG – Million Gallons
MGD - Million Gallons per Day
MGY - Million Gallons per Year
AADF - Annual Average Daily Flow

As shown above, the proposed MWRF is projected to have a lower annual cost of $2.88 million when compared to the projected operating expenses of the combined existing facilities, or approximately 8% less. Section 8 of the attached report provides a detail discussion about the development of the estimated operating expenses, which are summarized in today's dollars and were not adjusted for inflation. The amounts shown above are based on the projected treatment demands by Fiscal Year 2025, which are estimated to be approximately 2,040 million gallons per year, or 5.59 MGD (AADF). Fiscal Year 2025 was selected for the analysis since it represents the first full year the MWRF is proposed to be in service. For the purposes of estimating labor costs, existing staffing levels at the IWRF were assumed to be adequate to operate the proposed facility.

To provide the Parties additional information related to operating expenses, Hazen developed a comparison of operating costs for similarly sized facilities. Please refer to Section 8 of the report for a detailed review of the cost analysis. The following summarizes Hazen's observations based on a comparison of the projected unit costs to the survey results:

- IWRF power costs ($/MG treated) are within the range of unit power costs.
- IWRF labor costs are at the high end of unit labor costs.
- IWRF repairs and maintenance expenses and facility renewal and replacement costs are at the low end of the unit costs. Benchmarking data from the American Water Works Association (AWWA) indicates that the average utility investment in capital renewal and replacement is approximately 1.5% per year of the gross asset value of the plant. Based on discussions with the Parties, only critical repairs and

maintenance are being conducted at the existing facilities since the future operation of the plants is unknown.

- IWRF chemical costs are significantly lower than unit chemical costs for the surveyed utilities; this may be attributed to the fact that IWRF disposes effluent to deep injection wells that require lower chlorine dosages than for facilities treating to high-level disinfection standards for reclaimed water distribution.
- IWRF unit costs for administration, sludge disposal and other categories are within the range of costs when compared to the surveyed utilities.

The projected costs recognized the observations and the estimated operating expenses considered the results of the cost comparison survey. The study results associated with the proposed construction of the MWRF (relocation of the IWRF) were based on discussions with and information provided by the Parties, as well as certain assumptions and analyses made by the consulting engineers. This report includes a summary of estimates and opinions regarding the flow and capacity demands, the proposed wastewater transmission, treatment and effluent disposal facilities to be constructed, and the estimated direct cost of operation of the wastewater treatment plant regarding the proposed project, and the report should be read in its entirety.

Additional Study Tasks

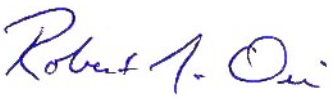
The project scope of services negotiated between the Parties envisioned the need to develop a financial forecast of the projected expenditure requirements over the life of the new assets (not to exceed forty years). Specifically, this task provided for the evaluation of the estimated direct lifecycle operating and capital costs for the conceptual MWRF sites. Based on the best planning information available, Raftelis recommends developing a financial evaluation of one or both of the two planning scenarios that includes the relocation construction costs of the IWRF to the mainland and any operating cost increases or reductions as a result of the relocation of facilities. While a portion of capital costs may be funded from future capital improvement charges or impact fees and revenue bonds, a financial forecast could also consider other funding sources as may identified by the Parties. As of the date of this report, certain key assumptions about the proposed operation of the facilities and projected new development are not known, and long-term projections of the existing facilities' needs for comparison purposes are not available. Raftelis will meet with the Parties to discuss and develop study parameters that may allow for the reasonable estimation of operating results over time that is consistent with current phase of planning. When completed at the convenience of the Parties, this task will be submitted as a separate report.

-Remainder of this page intentionally left blank-

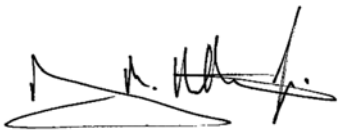
The scope of services for this study were limited to a desktop review and development of a conceptual analysis based on the available planning data from the Parties, and did not include Master Planning level analysis, such as, hydraulic modeling, examination of property and/or right of way acquisition, or the physical assessment of any existing infrastructure or assets. As such, the Parties should consider a more detailed Master Planning study if future phases of the proposed project are approved.

We appreciate the support and effort provided by the Parties in completion of this study.

Sincerely,
RAFTELIS FINANCIAL CONSULTANTS, INC.



Robert J. Ori
Executive Vice President



Murray M. Hamilton, Jr.
Senior Manager

Attachments
Wastewater Plant Relocation Conceptual Analysis – Draft May 2020
Prepared by Hazen

Hazen and Sawyer
2101 NW Corporate Boulevard, Suite 301
Boca Raton, FL 33431 • 561.997.8070

Fort Pierce Utilities Authority and St. Lucie County

Wastewater Plant Relocation Conceptual Analysis

Draft Report

May 2020

Table of Contents

List of Tables

List of Figures

1. Introduction

The scope of this study is to perform a conceptual analysis to determine the feasibility of building a Mainland Water Reclamation Facility (MWRF) that could be a joint use facility between the project participants. The scope of the analysis is a desktop review based on available data provided by the project participants and does not include Master Planning level analysis such as hydraulic modeling, property and/or rights of ways acquisition, age of existing infrastructure, criticality of existing infrastructure or any physical assessment any existing infrastructure.

1.1 Project Background

The Fort Pierce Utilities Authority (FPUA) would like to decommission their Island Water Reclamation Facility (IWRF), located on South Hutchinson Island, and build a mainland WRF. St Lucie County (SLC) has five WWTFs, one each on North and South Hutchinson Island (that will remain in service), and three smaller package plants on the mainland. SLC would like to decommission the three mainland package plants and redirect corresponding wastewater flow to the proposed MWRF. FPUA is working jointly with St. Lucie County to locate a MWRF where both utilities could utilize the new facility.

1.2 Project Participants

SLC and the FPUA executed Amendment 1 to the Bulk Service Agreement with FPUA in April 2019. This Amendment created an agreement between the entities to share the cost in conducting a conceptual analysis to determine if it would be feasible to relocate the FPUA IWRF to a mainland location that could be shared between FPUA and SLC.

1.3 Data Collection and Review

The scope of this conceptual analysis is to look at locating the MWRF at either the SLC North County Site or the FPUA Treasure Coast Energy Center. The conceptual analysis also included a possible third location for the MWRF that was not previously considered by the project participants. The third location would be based on planned future growth that would create a densely populated area which could be identified as a reasonable location to build a MRWF. Based on the review of data made available for this analysis a third location meeting the defined criteria was not found.

The following data was requested to conduct the conceptual analysis:

- GIS layers of all existing SLC and FPUA infrastructure and delineation of service areas
- Existing WRF Operating Permits including the Deep Injection wells
- Most current Capacity Analysis Reports for each facility
- Most current Operation and Maintenance Performance Reports for each facility
- Most current Wastewater Master Plans including data on all lift stations

- FPUA and St Lucie County Design Standards
- Future Land Use Plans, including population and flow projections
- Five years of WRF Monthly Operating Reports (MOR's) for the (5) county WWTFs and FPUA's MOR data for the IWRF
- Operations and CIP budgets for the FPUA and County relative to the wastewater service (including collection, transmission, treatment, and disposal)

A project kickoff meeting was conducted with the project participants to discuss data collection and to discuss the project understanding from the perspective of both participants. A subsequent technical review meeting was held to review collected data, any outstanding data collection needs, and how to proceed if the participants were unable to provide these data. The technical review meeting was also used to present preliminary findings from the provided data analysis, discuss the planned approach to the analysis, and to obtain buy-in from both participants.

1.4 Project Objectives

The objective of this project is to provide FPUA and SLC with a conceptual analysis of a MWRF that would serve the needs of both participants. This conceptual analysis provides the layout of the MWRF and associated costs of two potential sites to assist the two participants in their determination of the feasibility of relocating the IWRF to a Mainland location.

2. Existing Service Areas, Existing and Proposed Facilities

2.1 Introduction

FPUA's and SLC's GIS data was reviewed and used to develop service area maps. Service areas and existing infrastructure were then reviewed to determine how they overlap with each other and how they relate to the overall County Urban Service Area. For the purpose of this study, focus was placed on looking at growth within the County's Urban Service Area. The review included existing utility infrastructure to determine possible routing of new force mains and the re-routing of existing lift stations to direct wastewater flows to the two possible MWRF locations.

The scope of the study includes determining how to re-route existing wastewater flows from the FPUA's IWRF located on South Hutchinson Island and the three mainland St. Lucie County WRF's located in the northern county service area to the two proposed mainland facility locations. The three St. Lucie County facilities are: The Fairwinds Golf Course WRF, Holiday Pines WRF and Lakewood Park WRF. The two proposed mainland facility locations are the County's North County Site located just south of Indrio Rd along Taylor Dairy Rd, and the FPUA site located at the Treasure Coast Energy Center just east of the Florida Turnpike off Glades Cut-off Rd.

Based on a review of the existing FPUA and St. Lucie County infrastructure and coordination meetings with the Project Team, three scenarios were developed to direct wastewater from the FPUA IWRF and the three SLC mainland facilities to each of the proposed MWRF locations.

To make the scenario maps less cluttered, the FPUA lift stations that have a capacity of less than 300 gpm are not shown. Similarly, all force mains for both St Lucie County and FPUA that are 4-inches and less are not shown on the scenario maps. FPUA's existing wastewater collection system is routed to Master Lift Station "A". Flow from Master Lift Station "A" is then pumped across the intercostal waterway to the IWRF. Scenarios were developed such that repumping all FPUA's flow to the west, to the proposed north/south force main, would not be required. Selected lift stations were re-routed to eliminate and/or minimize some of the repumping that would occur if all the flow from the FPUA system was collected and sent to Master Lift Station "A". The re-routing of selected lift stations is consistent between the two mainland scenarios to eliminate or minimize cost bias in the site selection process. The selected lift stations that are shown to be re-routed to either the St Lucie County North County Site or the FPUA Treasure Coast Energy Center, would redirect approximately seven (7) MGD of pumping capacity. This repumping capacity would be eliminated from the FPUA Master Lift Station "A".

Scenario 1 is based on locating the MWRF at the St. Lucie County North County Site. Scenario 2 is based on locating the MWRF at the FPUA Treasure Coast Energy Center. Scenario 3 is based on re-routing all FPUA's South Hutchinson Island service area wastewater flow to the St. Lucie County SHI WRF. Under Scenarios 1 and 2, all the FPUA South Hutchinson Island wastewater flow is re-routed to Master Lift Station "A" and then westward to a north-south transmission main. Based on existing infrastructure and Project Team discussions, it was agreed the re-routed flow from the IWRF would flow to the west to a proposed 24-inch north/south transmission main along Jenkins Rd for which some of the 24-inch force main already exist.

To eliminate sending all FPUA mainland collection/transmission system flow to Master Lift Station "A" and then re-routing it back to the west, ten of the existing FPUA lift stations would be redirected to the north/south transmission main. Five St. Lucie County lift stations around the Treasure Coast International Airport and Business Park and the three master lift stations located at the County's three mainland facilities would also be redirected under Scenarios 1 and 2 to the MWRF.

2.2 Force Main Flow Velocity Assessment Criteria

The velocity of wastewater flowing through a force main is a key factor in assessing force main capacity. The diameter of the force main should be sized such that the velocity during pumping will be neither too low (less than two feet per second) such that deposits build-up (potentially clogging the pipeline) nor too high (greater than eight feet per second) resulting in excessive energy consumption. The force main is considered the piping outside of the lift station; piping internal to the lift station is not considered force main. **Table 2-1** presents the criteria utilized to size the conceptual force mains relative to flow velocity.

Table 2-1: Force Main Flow Velocity Assessment Criteria

Flow Velocity (fps)	Assessment
less than 2	Not Acceptable
2 to 8	Acceptable
greater than 8	Not Acceptable

For this study standard hydraulics tables were utilized for force main piping conceptual sizing. Lift stations were sized based on projected future flows utilizing the FPUA standard peaking factors. Computer modeling of the collection/transmission system is not part of this scope. Detailed hydraulic modeling of the FPUA and SLC collection/transmission systems should be done to determine if the assumptions made for redirecting flows from existing lift stations and conceptual force main sizing are adequate.

2.3 Redirected Flow Scenarios

The following explains the assumptions that were utilized in the development of the three scenarios.

Scenario 1 – Redirect Flow to SCL North County Site (see attached Scenario 1 Figure and Table 2-4, found at the end of this section)

Assumptions:

1. Install a 24-inch FM from the intersection of Jenkins Rd and Orange Ave running north to Keen Rd, west along St. Lucie Blvd to Taylor Dairy Rd and north to the SCL North County Site.
2. Install a 12-inch FM between Edwards and existing 24-inch FM at Okeechobee Rd.
3. Install a 16-inch Reuse main between both facilities following the routing of the 24-inch FM.

4. Install a 1,000 gpm master lift station at the IWRF to re-direct flow from the SHI FPUA service area to Master Lift Station "A".
5. Master Lift Station "A" will be re-routed to pump to the west to the 24-inch FM located at the intersection of Jenkins Rd and Orange Ave.
6. Ten of the existing FPUA lift stations will be re-routed to send flow to the 24-inch FM.
7. Five existing St. Lucie County lift stations (around the Treasure Coast International Airport and Business Park) will be re-routed to the 24-inch FM.
8. The master lift station at Fairwinds Golf Course WWTF will be re-routed to the MWRF located at the North County Site.
9. The master lift stations at Holiday Pines and Lakewood Park WWTF's will be re-routed to the existing 16-FM from Portofino Shores.
10. Holiday Pines, Lakewood park and Fairwinds WWTP's would all be decommissioned under this scenario.
11. A 4-inch FM will be installed from the Lakewood Park WWTF master lift station along Green Dr to the 16-inch FM from Portofino Shores to redirect flow.
12. A 4-inch FM will be installed from the Holiday Pines WWTF master lift station and connect to the existing 16-inch FM for Portofino Shores to redirect flow.
13. Road Crossings will be open cut, except for Okeechobee Rd and Glades Cutoff Rd.
14. Canal 1, Belcher Canal, Ten Mile Creek and Okeechobee Rd will be crossed via Horizontal Directional Drilling.

Scenario 2 – Redirect to Treasure Coast Energy Center MWRF (see attached Scenario 2 Figure and Table 2-5, found at the end of this section)

Assumptions

1. Install a 24-inch FM from the intersection of Jenkins Rd and Okeechobee Rd running south along Jenkins Rd to the FPUA Treasure Coast Energy Center site.
2. Install a 12-inch FM running south between West Angle Rd and the existing 24-inch FM at Orange Ave.
3. Install a 16-inch Reuse main between both facilities following the routing of the 24-inch FM.
4. Install a 1,000 gpm master lift station at the IWRF to re-direct flow from the SHI FPUA service area to Master Lift Station "A".
5. Master Lift Station "A" will be re-routed to pump to the west to the 24-inch FM located at the intersection of Jenkins Rd and Orange Ave.

6. Ten of the existing FPUA lift stations will be re-routed to send flow to the 24-inch FM.
7. Five existing St. Lucie County lift stations (around the Treasure Coast International Airport and Business Park) will be re-routed to Master Lift Station "A".
8. The master lift station at Fairwinds Golf Course WWTF will be re-routed to Master Lift Station "A".
9. The master lift stations at Holiday Pines and Lakewood Park WWTF's will be re-routed to the existing 16-FM from Portofino Shores.
10. Holiday Pines, Lakewood Park and Fairwinds WWTP's would all be decommissioned under this scenario.
11. A 4-inch FM will be installed from the Lakewood Park WWTF master lift station along Green Dr to the 16-inch FM from Portofino Shores to redirect flow.
12. A 4-inch FM will be installed from the Holiday Pines WWTF
13. Road Crossings will be open cut, except for Okeechobee Rd and Glades Cutoff Rd.
14. Canal 1, Belcher Canal, Ten Mile Creek and Okeechobee Rd will be crossed via Horizontal Directional Drilling.

Scenario 3 – Redirect FPUA Flow to SLC WRF (see attached Scenario 3 Figure and Table 2-6, found at the end of this section)

Assumptions

1. This is a standalone scenario that does not impact Scenarios 1 and 2.
2. Install an 8-inch FM from the south end of the FPUA South Hutchinson Island service area south to the SLC South Hutchinson Island WRF.
3. Install a 1,000 gpm master lift station at the south end of the FPUA South Hutchinson Island service area to re-direct flow from the FPUA SHI service area to the SLC SHIWRF.
4. At minor creek crossings the FM can be routed alongside the bridge.
5. Horizontal directional drilling will be utilized to cross the FPL power plant intake and outflow canals.

2.4 Conceptual Flow Routing and Re-routing Costs

The estimated total construction and ancillary costs for redirecting flows and installing new force mains were calculated on a per foot basis using information obtained from regional bid tabulations and estimated additional ancillary costs from RS Means CostWorks. It was assumed that PVC DR-18 pressure pipe would be installed up to 24-inches in diameter. **Tables 2-2** and **2-3** provide the unit costs utilized to estimate the conceptual level opinion of probable cost for these scenarios.

Table 2-2: Unit Cost Summary Table for Pressure Pipe

Diameter	Construction Unit Cost ($/ft)	Total Cost ($/ft)
PVC DR-18		
4	$40	$76
6	$60	$114
8	$80	$152
10	$90	$171
12	$100	$190
16	$110	$209
18	$120	$228
21	$130	$247
24	$150	$285

Table 2-3: Additional Cost Summary Table for Pressure Pipe

Final Add-On Percentages	Additional Cost Categories
10%	Project Team Internal Costs
5%	Fittings and Appurtenances (valves, Fittings etc.)
10%	Pavement and Restoration
15%	Permitting and MOT
25%	Contingency
15%	Engineering = 10% Survey = 5%; Total 15% for Engineering and Survey
10%	Construction Management and Inspection
90%	**Total Extra Add-on Cost as a Percent of Construction Costs**

The estimated total capital cost for Scenarios 1, 2 and 3 are $26,510,000, $22,746,000, and $8,940,000, respectively. The proposed improvements are shown on **Figures 2-1, 2-2 and 2-3**, respectively. The conceptual costs are shown in the attached tables (**Tables 2-4, 2-5 and 2-6**) labeled as Scenarios 1, 2 and 3, respectively. These are conceptual Class 5 cost opinions and are consistent with Class 5 Estimate in accordance with the American Association of Cost Engineering (AACE) Recommended Practice No. 18R-97.

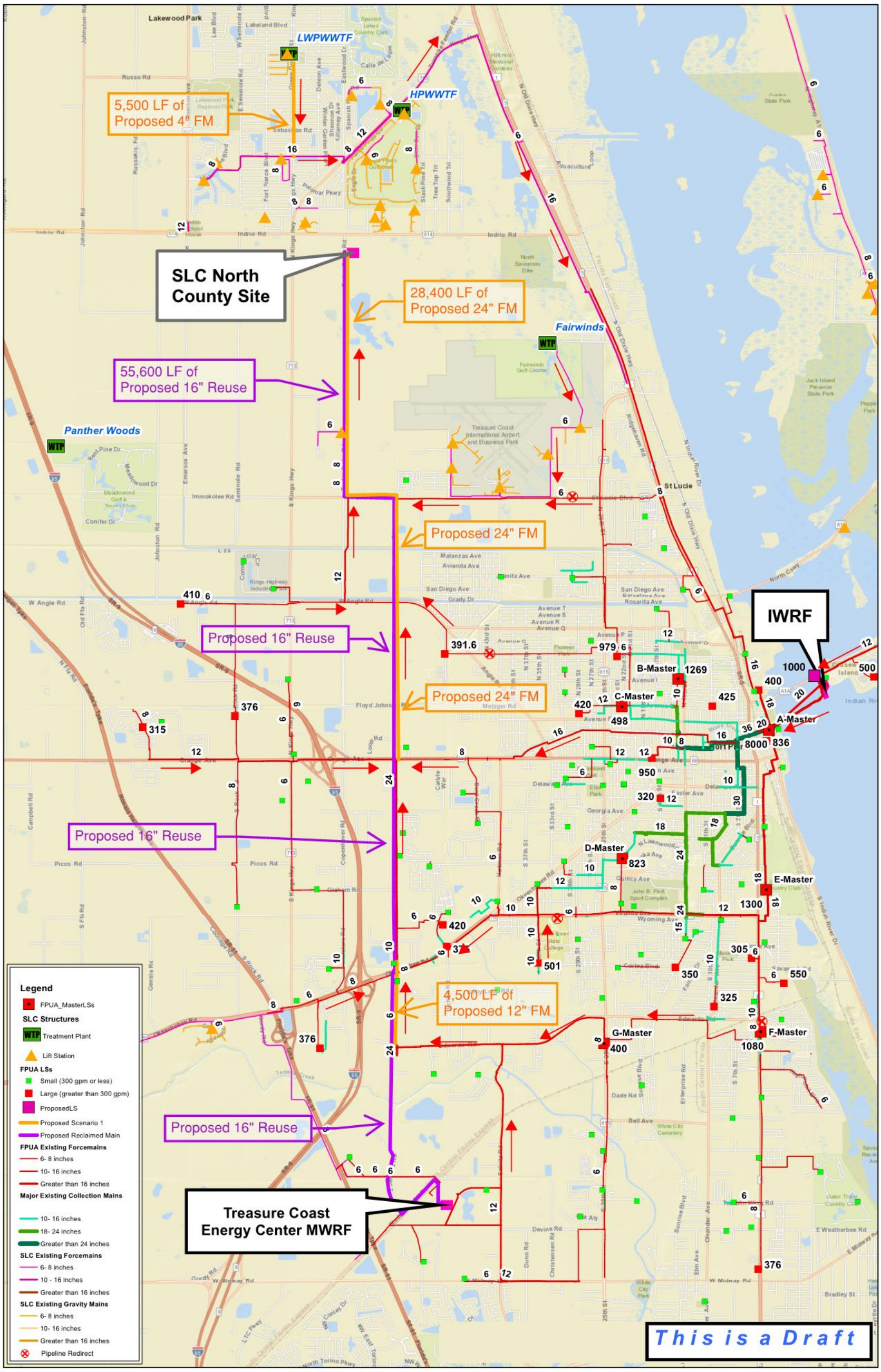


Figure 2-1: Redirect Flow to SCL North County Site

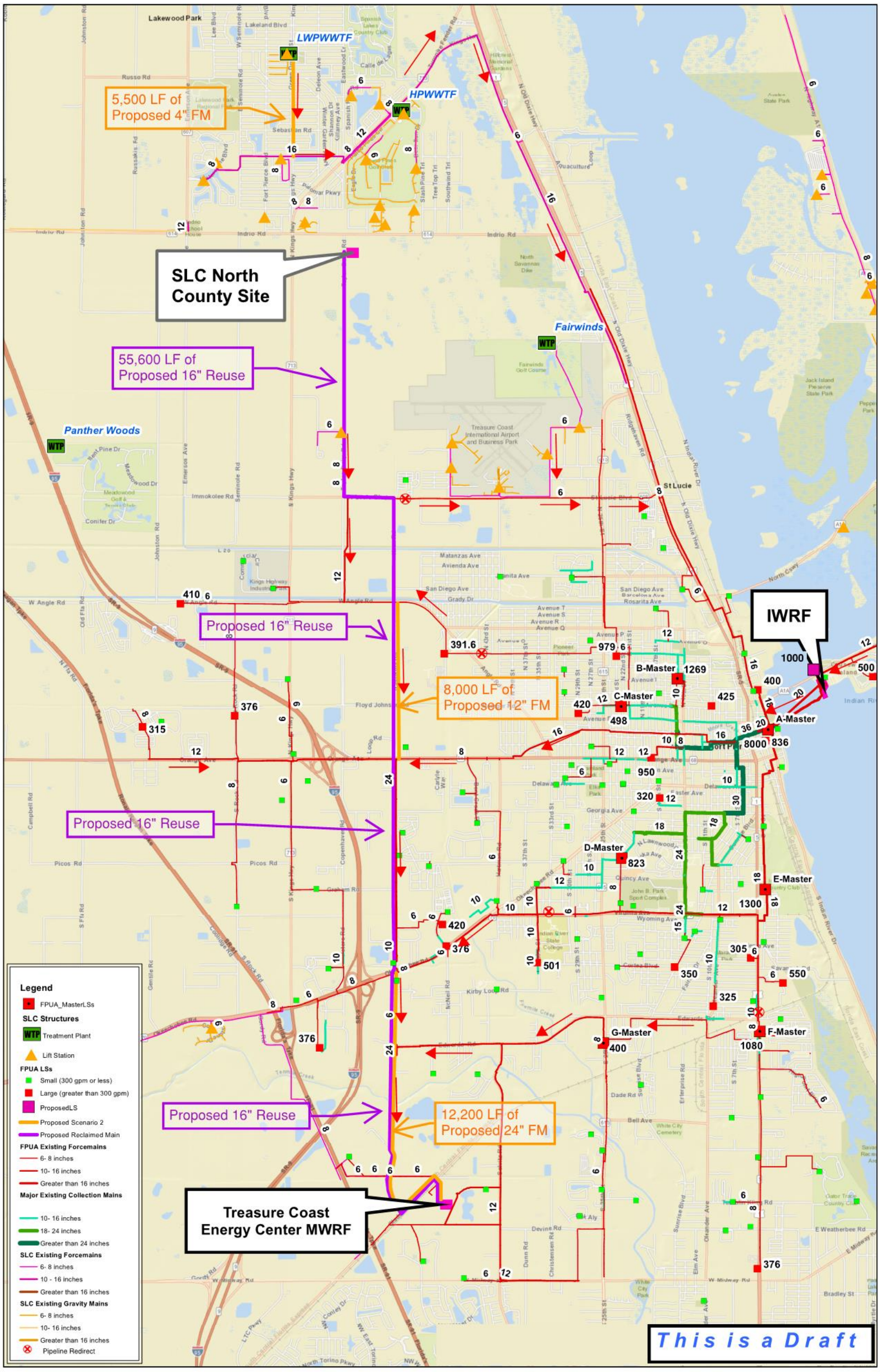


Figure 2-2: Redirect Flow to Treasure Coast Energy Center

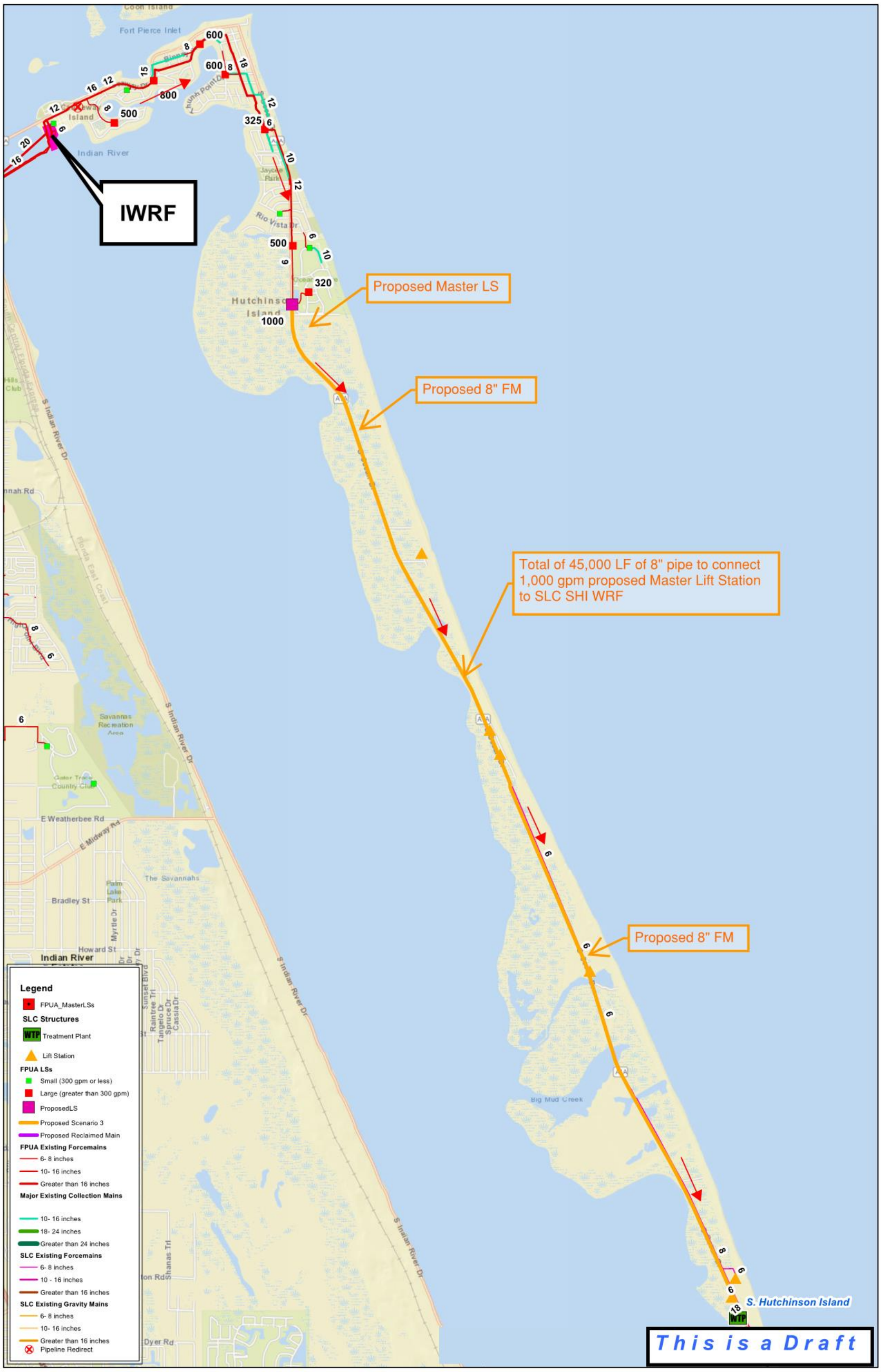


Figure 2-3: Redirect FPUA SHI Flow to SLC SHI WRF

Table 2-4: Scenario 1 Probable Cost – MWRF Located at the SCL North County Site

Item No.	Description	Quantity	Unit	Unit Price	Total
Item 2 - Site Construction					
	Redirect Lift Stations:				
	FPUA and SLC LS	15	LS	$75,000	$1,125,000
	Master LS at Fairwinds, HPWRF and LPWRF	3	LS	$150,000	$450,000
	Master LS A	1	LS	$500,000	$500,000
	New Lift Stations:				
	Master LS at LWRF	1	LS	$1,500,000	$1,500,000
	Force Main Horizontal Directional Drill:				
	Canal 1 Crossing				
	16-inch	350	LF	$425	$148,750
	24-inch	350	LF	$625	$218,750
	Belcher Canal Crossing				
	16-inch	450	LF	$425	$191,250
	24-inch	450	LF	$625	$281,250
	Okeechobee Road				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Ten Mile Creek				
	16-inch	350	LF	$425	$148,750
	Glades & FEC RR				
	16-inch	650	LF	$425	$276,250
	Force Main:				
	4-inch	5,500	LF	$76	$418,000
	12-inch	4,500	LF	$190	$855,000
	16-inch	55,600	LF	$209	$11,620,400
	24-inch	28,400	LF	$285	$8,094,000
	Total				**$26,510,000**

Table 2-5: Scenario 2 Probable Cost – MWRF Located at the FPUA Treasure Coast Energy Center

Item No.	Description	Quantity	Unit	Unit Price	Total
Item 2 - Site Construction					
	Redirect Lift Stations:				
	FPUA and SLC LS	15	LS	$75,000	$1,125,000
	Master LS at Fairwinds, HPWRF and LPWRF	3	LS	$150,000	$450,000
	Master LS A	1	LS	$500,000	$500,000
	New Lift Stations:				
	Master LS at LWRF	1	LS	$1,500,000	$1,500,000
	Force Main Horizontal Directional Drill:				
	Canal 1 Crossing				
	16-inch	350	LF	$425	$148,750
	24-inch	0	LF	$625	$0
	Belcher Canal Crossing				
	16-inch	450	LF	$425	$191,250
	24-inch	0	LF	$625	$0
	Okeechobee Road				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Ten Mile Creek				
	16-inch	350	LF	$425	$148,750
	24-inch	450	LF	$625	$281,250
	Glades & FEC RR				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Force Main:				
	4-inch	5,500	LF	$76	$418,000
	12-inch	8,000	LF	$190	$1,520,000
	16-inch	55,600	LF	$209	$11,620,400
	24-inch	12,200	LF	$285	$3,477,000
	Total				**$22,746,000**

Table 2-6: Scenario 3 Probable Cost – Redirect FPUA SHI Flows to St. Lucie County's SHI WRF

Item No.	Description	Quantity	Unit	Unit Price	Total
Item 2 - Site Construction					
	Redirect Lift Stations:				
	FPUA and SLC LS	0	LS	$75,000	$0
	Master LS at Fairwinds, HPWRF and LPWRF	0	LS	$150,000	$0
	Master LS A	0	LS	$500,000	$0
	New Lift Stations:				
	Master LS at LWRF	1	LS	$1,500,000	$1,500,000
	Force Main Horizontal Directional Drill:				
	FPL Canal Crossing				
	8-inch	2,000	LF	$300	$600,000
	Force Main:				
	4-inch	0	LF	$76	$0
	12-inch	45,000	LF	$152	$6,840,000
	16-inch	0	LF	$190	$0
	24-inch	0	LF	$209.00	$0
	Total				**$8,940,000**

3. Facilities Condition Assessment

This chapter provides a general overview of the St Lucie County and Fort Pierce Utility's facilities that are part of this conceptual analysis.

3.1 Introduction

Condition assessments were based on a review of the most current WRF's Permits, Capacity Analysis Reports (CAR) and Operation and Maintenance Performance Reports (O&MPR) for each participant's facilities. The focus of the review was on the facilities that could be impacted by the construction of a MWRF. Facilities that would not contribute wastewater flow to the MWRF or not have flow redirected to them were not included in the condition assessment.

3.2 St Lucie County

The St Lucie County wastewater collection system is made up of over 22 miles of gravity sewer lines which collect flow and direct it to one of the County's 69 lift stations. These lift stations then pump the wastewater through approximately 35 miles of force mains conveying wastewater to five WWTF's within the County's service area. The combined permitted treatment capacity of the County's five WWTF's is 2.82 million gallons per day (MGD). All the County's WWTF's have public reuse or restricted public access reuse systems. A condition assessment of the County's collection/transmission system is not part of this scope. At the time of this study there were no reported issues with the operation of the County's collection and transmission systems.

The North Hutchinson Island WRF is not considered in this study as flows are not planned to be re-directed from there to the MWRF. The three mainland WWTF's that are consider in this study are Fairwinds Golf Course WWTF, Holiday Pines WWTF, and Lakewood Park WWTF. These three facilities would all be decommissioned, and their flows would be redirected to the MWRF. The South Hutchinson Island WRF is also included in this study as an option to redirect FPUA's South Hutchinson Island service area flows to the County's South Hutchinson Island WRF.

3.2.1 Fairwinds Golf Course WWTF

The Fairwinds Golf Course WWTF (Permit FLA013945, Expiration date of November 15, 2022) has a permitted capacity of 0.05 MGD (TMADF). This facility has recently gone through an expansion from 0.04 MGD to 0.05 MGD. There is no planned expansion beyond the current capacity of 0.05 MGD. The CAR for this facility did not indicate that there were any maintenance issues with the treatment facility.

The was no O&MPR made available at the time of this study so no detailed maintenance information was made available for this study.

3.2.2 Holiday Pines WWTF

The Holiday Pines WWTF (Permit FLA013969, Expiration date of December 21, 2021) has a permitted capacity of 0.3 MGD (AADF). The CAR for this facility did not indicate that there were any maintenance

issues with the treatment facility. The CAR did indicate that the facility is operating well under its design capacity and there is no need to expand the facility. The service area for the facility is essentially built-out with only a few vacant lots that could be developed and contribute flow to the existing WWTF.

The was no O&MPR for this facility made available at the time of this study so no detailed maintenance information was made available for this study.

3.2.3 Lakewood Park WWTF

The Lakewood Park WWTF (Permit FLA03586, Expiration date of January 7, 2019) has a permitted capacity of 0.02 MGD (AADF). The CAR for this facility indicated that the facility is operating well under its design capacity and there is no need to expand the facility. The service area for the facility is essentially built-out with no plan for expansion.

The O&MPR for this facility made available at the time of this study indicated that the facility is operating properly with no major maintenance issues to be addressed. There was a minor issue with the facility's master lift station existing access, but the access hatch was in the process of being replaced. The collection system for the facility's service area has been lined and so have the lift stations. In addition, rain guards have been installed to minimize stormwater runoff into the collection system. These improvements have enhanced the operation and performance of the facility.

3.2.4 South Hutchinson Island WRF

The South Hutchinson Island WRF (Permit FL0139475, Expiration date of August 23, 2022) has a permitted capacity of 1.60 MGD (MMADF). The CAR for this facility indicated that the facility is operating well under its design capacity and there is no need to expand the facility. The service area for the facility has some vacant land for development. However, with development of these areas the facility is expected to reach 42 percent of its permitted capacity. Therefore, there is no plan for expansion of this facility.

The O&MPR for this facility made available at the time of this study indicated that the facility is operating properly with no major maintenance issues to be addressed. The O&MPR noted that the facility's headworks bars screens should be addressed due to the age of the equipment (20 plus year of service).

3.3 Fort Pierce Utilities Authority

The FPUA owns and operates a wastewater collection and transmission system that consists of 110 lift stations and seven master lift stations. The gravity collection system consists of 158 miles of piping ranging in size from 4 to 42 inches. Most of the collection system is vitrified clay pipe (VCP). The gravity collection system has 3,344 manholes located throughout FPUA's service area. The transmission system consists of 98 miles of force mains ranging in size from one and a half inches up to 30 inches. The force mains are predominantly PVC. At the time of this study, FPUA's lift stations, gravity collection system and transmission mains were reported to be in good working order. The FPUA is actively working to identify collection system issues and line those pipelines to help reduce Inflow and Infiltration (I&I) problems within the system. Currently no major I&I issues have been reported in the system.

3.3.1 Island Water Reclamation Facility

The FPUA owns and operates the IWRF (Permit FL0027278, Expiration date of December 10, 2022), which has a permitted capacity of 10.0 MGD (AADF), 11.5 MGD (TMADF), 14.92 MGD (PHF) for deep well injection and 18.6 MGD (PHF) for surface water discharge. The facility has one Class 1 Deep Injection Well (Permit 0180484-006-UO/1M, Expiration date of May 7, 2022). The current CAR indicates that the facility is operating well below its design capacity. Based on these data there is no need to expand the facility. The facility has seen high peak hour flows but those have occurred during tropical storm events and did not exceed the facility's current permitted capacity. The facility receives industrial waste from five customers. These customers follow FPUA's industrial pretreatment program and there have been no reported violations and no adverse impacts on the IWRF.

The O&MPR for this facility describes the condition of the IWRF's treatment processes. The primary components of the facility are influent screening, aerated grit removal, secondary wastewater treatment, chlorine disinfection, and deep well injection. The facility does have a permitted surface water discharge that is to be used during mechanical integrity testing of the deep injection well or an emergency basis only such as a tropical storm event. The facility utilizes their digesters as sludge holding tanks and has a sludge management contract with an operations company to process and dispose of their sludge. Currently FPUA does not accept any septage or Fats, Oils and Grease (FOG) at the IWRF.

The influent screening system is reported to be in good condition. Some of the existing influent screening equipment is at or beyond its useful life expectancy and should be replaced. There were not reported issues with the aerated grit system or the aeration system. These facilities were reported to be in good working condition. The clarifiers are reported to be in poor condition as the internal clarifier mechanisms are at or beyond their useful life and in need of replacement. The chlorine contact tanks, sludge holding tanks and the deep injection well are all reported to be in good condition. The electrical system is also reported to be in good condition.

The mechanical bar screen at the influent screening facility is scheduled to be replaced in 2021. Based on the anticipated schedule to build a mainland WRF, if the project does proceed, the FPUA would most likely have to replace the mechanical bar screen.

The Facility's clarifiers are scheduled for full internal mechanism replacement in 2022 due to age and general condition. If the MWRF is constructed, the FPUA may be able to maintain adequate clarification without the cost of replacing the clarifier mechanisms. This is because the facility has four clarifiers and only needs to utilize two clarifiers at a time due to the current volume of flow received at the facility. Plant staff now rotates operations of their clarifiers so that while two clarifiers are online maintenance staff can inspect the two that are offline and make adjustments or minor repairs as needed to keep them operating properly. This could result in a savings of several million dollars for FPUA if the clarifier mechanisms do not need to be replaced.

3.3.2 Treasure Coast Energy Center

The Treasure Coast Energy Center is equipped with two Class 1 injection wells, IW-1, and IW-2 (Permit 0259734-006-007-UO/1I, Expiration date of August 4, 2020). IW-1 has a permitted capacity of 2.7 MGD. IW-1 receives cooling tower blowdown water and wastewater from floor drains at the Treasure Coast

Energy Center. IW-1 also receives leachate from the St Lucie County bailing and recycling. Currently there are no reported issues with the operation of this injection well.

Injection Well IW-2 was constructed as a municipal injection well. However, this well has not been completed and has not been placed into service. IW-2 is a 24-inches in diameter and should have a capacity of approximately 18.6 MGD at an injection velocity of 10 fps. This well could be utilized for effluent disposal from the MWRF if the facility were constructed at the Treasure Coast Energy Center. The capacity of this well would need to be determined based on injection velocity and pressure. A backup injection well would need to be constructed if the MWRF were located at the Treasure Coast Energy Center.

4. Existing and Future Wastewater Flow Projections

4.1 Introduction

FPUA and St. Lucie County data was reviewed to determine the future population and wastewater projections and water quality characteristics. Provided data included Capacity Analysis Reports, Operation and Maintenance Performance Reports and Monthly Operating Reports. Additional data regarding County wide population projections was obtained from the St. Lucie County Comprehensive Plan.

Flow from FPUA IWRF, Fairwinds WWTF, Holiday Pines WWTF, and Lakewood WWTF would be redirected to the new MWRF. Flows from South Hutchison Island would either be redirected to the new MWRF or to SLC's SHI WRF. Projected flows to the MWRF were calculated by using Monthly Operating Reports and Capacity Analysis Report data for the various facilities in conjunction with County-wide population projection data.

4.2 Population and Flow Projections

The total historical average wastewater flows for Fairwinds, Holiday Pines, and Lakewood facilities is shown in **Table 4-1**. These facilities service fully developed areas and minimal growth is expected within their respective service areas. Flow projections for the three County owned facilities that would be redirected to the MWRF total approximately 0.16 MGD. These three facilities have a permitted capacity of 0.36 MGD. However, the Fairwinds WWTF is in the process of expanding to 0.05 MGD to facilitate increased growth around the St. Lucie County Airport Industrial Park area. Based on meetings with the Project Team, the County has requested the MWRF have 1 MGD of initial capacity reserved for these facilities. **Table 4.2** summarizes the historical average wastewater flows for IWRF for the last 10 years. These numbers were sourced from the Monthly Operating Reports.

Table 4-1: Historical Flow Data in MGD for SLC WWTFs

Year	Fairwinds	Holiday Pines	Lakewood
2017	0.020	0.113	0.018
2018	0.025	0.112	0.019
2019	0.026	0.115	0.012

Table 4-2: Historical Flow Data in MGD for FPUA IWRF

Year	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019
AADF	4.47	3.95	4.29	4.90	3.88	4.32	6.3	4.84	4.31	4.14

Table 4-3 summarizes the St. Lucie County population projections. Two sources were analyzed: the St. Lucie County Comprehensive Plan amended in 2018, and the Bureau of Economic and Business Research (BEBR) Florida Population Studies, released in January 2020. The Comprehensive Plan projections are between the Medium and High projections from BEBR, but closer to Medium. Because these numbers are reasonably conservative, and have the benefit of being approved by SLC, the Comprehensive Plan Projections were selected.

Table 4-3: St. Lucie County Population Projections

Year	St. Lucie County 2018 Comp Plan Population Projection	BEBR 2020 Population Projection (Low)	BEBR 2020 Population Projection (Medium)	BEBR 2020 Population Projection (High)
2020	318,600	302,300	315,200	327,500
2025	349,901	319,300	342,900	364,600
2030	377,998	333,800	367,500	401,700
2035	404,100	344,300	387,400	434,100
2040	428,198	352,000	404,400	464,300

St Lucie County developed a Comprehensive Plan with a Future Land Use Element that was updated in June of 2018. Future Land Use designations indicate compatible zoning districts and can be used to predict expected population densities based on the assigned zoning. The majority of unincorporated SLC is zoned agricultural. Future Land Use indicates that approximately 15% of unincorporated land may be used for residential and Towns, Villages, and Countryside (TCV). The Urban Service Boundary delineates the area to which the county will provide services, as shown by the bold outline in **Figure 4-1**. The new MWRF will serve the citizens of Fort Pierce and may absorb future flows from developments within the Urban Service Area that are outside of the Port St Lucie service area.

To encapsulate the expected county wide growth within the FPUA Service Area and the St. Lucie County Service area, the county wide population growth rates were applied to FPUA IWRF's Equivalent Resident Connections (ERCs) as determined in the 2017 FPUA IWRF Capacity Analysis Report (CAR). Percent growth was determined from the SLC Comprehensive Plan projections.

The AADF from 2018 was used as the initial flow value (4.31 MGD). To derive a projected flow rate, 190 gpd/ ERC was applied to the new growth. The CAR proposed that new development should apply 190 gpd/ ERC. This value was determined based on historical data. **Table 4-4** summarizes the conceptual population growth and projected wastewater flows for the MWRF through year 2040.

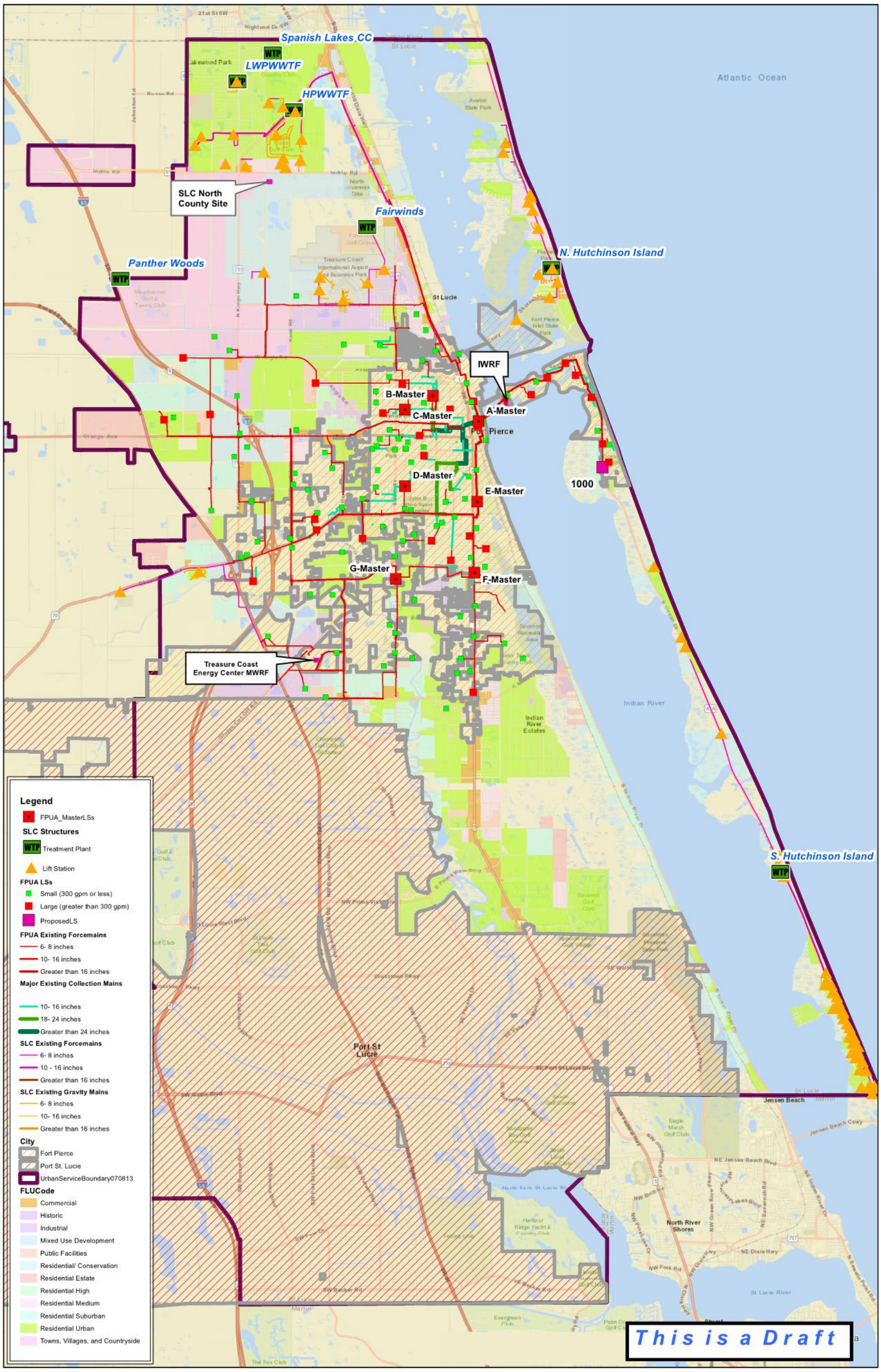


Figure 4-1: SLC Future Land Use Map

Table 4-4: MWRF Flow Projections

	2018	2020	2025	2030	2035	2040
SLC Comp Plan Population Projection	304,623	318,600	349,901	377,998	404,100	428,198
SLC Population Growth %		4.59%	9.82%	8.00%	6.90%	6.00%
FPUA ERC Projection @ SLC Growth Rate	31,742	33,198	36,460	39,377	42,094	44,619
Flow Rate (MGD) @ 190 gpd per additional ERC	4.31	4.59	5.21	5.76	6.28	6.76
Flow Rate (MGD) plus 1 MGD for SLC	5.31	5.59	6.21	6.76	7.28	7.76

Figure 4-2 depicts the historical flows for IWRF and the three combined SLC plants, as well as the projected flows for the future MWRF. Note that the graph shows the project flows with and without the 1 MGD SLC capacity included.

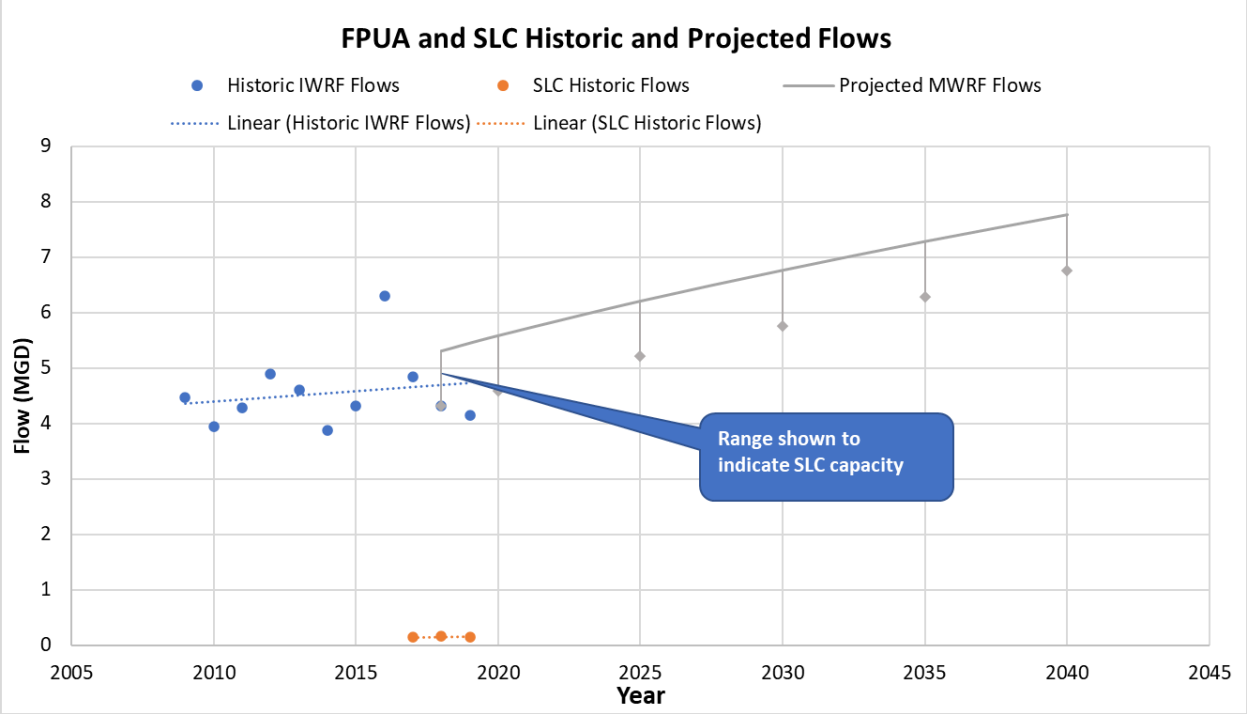


Figure 4-2: FPUA and SLC Historic and Project Flows

A similar method was employed to predict future flows from South Hutchinson Island. The FPUA provided historical customer billing data for 2019 for the accounts on the island. This data was used to determine the number of accounts and the average flow per account, which was 272 gpd per account. **Table 4-5** shows the results of applying the SLC population growth rate to the number of FPUA SHI Service Area accounts.

Table 4-5: FPUA South Hutchinson Island Flow Projections

	2019	2020	2025	2030	2035	2040
SLC Population Growth %		2.19%	9.82%	8.00%	6.90%	6.00%
Number of Wastewater Accounts	1,453	1,485	1,631	1,761	1,883	1,996
Flow Rate (MGD) @ 272 gpd/Account	0.39	0.40	0.44	0.48	0.51	0.54

5. Regulatory Requirements

The purpose of this chapter is to summarize current permitting requirements and identify future permitting requirements as they pertain to the proposed Mainland WRF.

5.1 Existing and Proposed Permit Requirements

The existing IWRF operates under FDEP Permit No. FL0027278. The IWRF has a permitted annual average daily flow (AADF) of 10.0 million gallons per day (mgd) and a permitted 3-month average daily flow (3MADF) of 11.5 mgd. Influent wastewater is treated to secondary effluent standards and disposed to a Class I underground injection well system. The deep injection well system has a permitted capacity of 14.92 mgd (based on 8 feet per second velocity) during normal operation and a permitted capacity of 18.65 mgd (based on 10 feet per second velocity) during emergency operation. During mechanical integrity testing of the deep injection well, secondary effluent can be discharged to surface waters (Indian River Lagoon) for a maximum of 6 days every 5 years. Residuals from the IWRF treatment process are dewatered and transported by a contract operator to an offsite biosolids processing facility that reportedly produces a Class E/EQ product that is then land applied.

In addition to the secondary treatment provided at IWRF, the proposed Mainland WRF would provide tertiary treatment through a high-level disinfection process. Tertiary treatment would be required for the proposed distribution of reclaimed water for cooling water supply to the Treasure Coast Energy Center, as well as restricted Part III reclaimed water distribution to irrigation customers. It is assumed that residuals from the proposed MWRF would continue to be dewatered and transported by a contract operator to the same offsite biosolids processing facility.

Table 5-1 presents a side-by-side comparison of currently permitted effluent limits (left) and proposed effluent limits (right) based on FDEP reclaimed water requirements and additional limits anticipated to meet cooling water quality requirements.

Table 5-1: Existing and Proposed Effluent Water Quality Requirements

Parameter	Current IWRF	Proposed MWRF
Flow (MGD)		
$CBOD_5$ (mg/L), Annual	20.0	20.0
$CBOD_5$ (mg/L), Monthly	30.0	30.0
$CBOD_5$ (mg/L), Weekly	45.0	60.0
$CBOD_5$ (mg/L), Single Sample	60.0	80.0
TSS (mg/L), Annual	20.0	N/A[1]
TSS (mg/L), Monthly	30.0	N/A[1]
TSS (mg/L), Weekly	45.0	N/A[1]

Parameter	Current IWRF	Proposed MWRF
TSS (mg/L), Single Sample	60.0	5.0[2]
TP (mg/L), Single Sample	N/A	1.5[3]
NH_3 (mg/L), Single Sample	N/A	1.0[3]
pH (mg/L)	6.0 to 8.5	6.0 to 8.5
Fecal Coliform, #/100ml, Annual	200	N/A[4]
Fecal Coliform, #/100ml, Monthly	400	N/A[4]
Fecal Coliform, #/100ml, 90% Percentile	600	N/A[4]
Fecal Coliform, #/100ml, Single Sample	800	N/A[4]

Notes:

1. Not applicable based on single sample requirement for proposed high-level disinfection
2. To meet high-level disinfection requirements
3. Estimated limits to meet cooling water quality requirements for Treasure Coast Energy Center
4. Not applicable for MWRF, which will not have a surface water discharge available during deep injection well integrity testing

5.2 Future Regulatory Assessment

The following potential regulatory developments should be monitored and considered during conceptual planning of the Mainland WRF:

5.2.1 Proposed FDEP 62-640 Biosolids Rule Revisions

In 2018, FDEP created the Biosolids Technical Advisory Committee (TAC) to evaluate current biosolids management practices and explore opportunities to better protect Florida's water resources. FDEP also created a separate Blue-Green Algae Task Force to focus on expediting water quality improvements, including expedited nutrient reductions in Lake Okeechobee and downstream estuaries. The Biosolids TAC convened four times between September 2018 and January 2019 to discuss the current options for biosolids management in the state, explore better ways to manage biosolids to improve the protection of the state's ground and surface waters, and identify what research gaps exists and need to be examined and built upon to improve biosolids management.

The primary objectives of the FDEP Biosolids TAC were as follows:

- Mitigate release of nutrients from land applied biosolids to waters of the state.
- Increase FDEP inspection rates at biosolids land application sites.
- Enhance monitoring protocols for detecting nutrient migration from land-applied biosolids.

- Advance research on nutrient runoff from land-applied biosolids and promote innovative technology pilot projects.

As a result of the FDEP Biosolids TAC workshops, a Statement of Estimated Regulatory Costs (SERC) and subsequent input from stakeholders, FDEP proposed final revisions to Rule 62-640 on April 14, 2020. The proposed rule revisions also consider and implement biosolids provisions of this year's Combined Senate-House Bill 712.

Rule revisions relate primarily to the following aspects of land application management:

- Updated nitrogen and phosphorous application limits
- Analysis of crop nutrient demands
- Site-specific soil phosphorous storage capacity indices
- Analytical methods for determining water extractable phosphorous (nutrient migration)
- Requirements for annual soil fertility testing and continuous groundwater monitoring
- Requirements for each land application site's Nutrient Management Plan (NMP) to demonstrate compliance with the corresponding Basin Management Action Plan (BMAP)
- Restriction of land application of biosolids within 2 feet of saturated soils or on soils with high water table elevation within 15 centimeters of soil surface

Rule revisions could result in the following impacts to land application sites and the utilities that utilize land application sites:

- Reduction in allowable land application rates
- Need for additional land to address lower application rates
- Increased hauling distances and costs to reach new/additional land application sites

Proposed rule revisions impact land application of both Class B and Class A biosolids. Class AA biosolids that are marketed and distributed as fertilizer or compost products certified by the U.S. Compost Council are not impacted by the Biosolids Rule revisions. Although the basis of current (IWRF) and future (MWRF) biosolids management is third-party contract processing through a regional facility and Class A/EQ land application, it should be noted that the long-term feasibility of the contract processing operation may be impacted by these proposed rule revisions.

5.2.2 Report on Emerging Pollutants

On November 15, 2018, the EPA's Office of Inspector General (OIG) published a Report questioning the efficacy of the existing EPA Part 503 biosolids regulations to safeguard public health and the environment. The OIG Report identified 352 pollutants to be potential cause of concern. The OIG Report made the following conclusions:

- EPA's controls over land application of biosolids were incomplete or had weaknesses, and may not fully protect human health and the environment.
- The biosolids program is at risk of not achieving its goal to protect public health and the environment.
- EPA does not have the data to determine whether biosolids pollutants (beyond the currently regulated 9 heavy metals) with incomplete risk assessment are safe.
- EPA scientists working on biosolids stated that without completing risk assessments on all of the pollutants found in biosolids they cannot say whether biosolids are safe.
- Identified several gaps in the rule that needed to be addressed by research.

The EPA concluded that it cannot consider the 352 pollutants (including per- and polyfluoroalkyl substances, a.k.a. PFAS) at this time for further regulation due to either a lack of data or risk assessment tools. The EPA Office of Water has agreed to complete development of the probabilistic risk assessment tool and screening tool for biosolids land application scenarios by December 31, 2021 and develop and implement a plan to obtain additional data needed to complete risk assessments and finalize safety determinations on the 352 identified pollutants in biosolids by December 31, 2022. Federal regulations to regulate additional pollutants in biosolids (including PFAS) could likely be promulgated after completion of the risk assessment process. Although Federal regulations for PFAS in biosolids will likely not go into effect for the next 3 to 5 years, state level regulations could emerge. The state-level PFAS regulations for biosolids and wastewater could also likely accelerate due to adoption of drinking water and ambient groundwater quality standards.

It is unclear at this time whether or how this issue will impact biosolids land application programs beyond 2023. However, potential three outcomes can be considered:

- No risk from any of the 352 highlighted pollutants, resulting in business as usual.
- Risk from some pollutants, however, treatment technologies exist and at manageable cost.
- Risk from some pollutants and the treatment technologies do not exist or require high cost.

The City should monitor regulatory developments on this issue of emerging pollutants.

6. Design Criteria and Conceptual Site Plan

The purpose of this chapter is to develop the following conceptual design criteria for the proposed MWRF:

- Influent Flows, Concentrations, Loads and Peaking Factors
- Effluent Limits
- Unit Treatment Process Design Criteria
- Reliability Criteria

6.1 Influent Flows and Loadings

Influent flow projections developed in Chapter 4 are repeated below in **Table 6-1** for the reader's convenience.

Table 6-1: Mainland WRF Flow Projections

	2020	2025	2030	2035	2040
FPUA Flow Rate (MGD)	4.59	5.21	5.76	6.28	6.76
SLC Flow Rate (reserved) (MGD)	1.00	1.00	1.00	1.00	1.00
Total Mainland WRF Flow Rate (MGD)	5.59	6.21	6.76	7.28	7.76

It is assumed that the MWRF will be designed, constructed, and placed into initial operation by the Year 2025. The initial MWRF will be designed with an average annual daily flow (AADF) capacity of 8.0 MGD to meet projected flows in the Year 2035. The facility will be designed to accommodate a future build-out capacity of 10.0 MGD.

The past 5 years of MOR data from the IWRF were analyzed to determine historical minimum day, maximum 30-day, maximum 7-day and peak hour peaking factors for flows and loads. The results of that analysis are summarized in **Table 6-2**.

Table 6-2: Historical IWRF Flows, Loads and Peaking Factors (Years 2016 through 2019)

	Influent Flow		Influent CBOD				Influent TSS			
	Flow MGD	Peaking Factor	Actual Concentration (mg/L)	Load (ppd)	Load Peaking Factor	Calculated Concentration (mg/L)	Actual Concentration (mg/L)	Load (ppd)	Load Peaking Factor	Calculated Concentration (mg/L)
Minimum Day	3.83	0.68	29	1,708	0.25	56	23	1,070	0.10	34
Average Annual	5.89	1.00	152	7,219	1.00	147	218	10,225	1.00	208
Maximum Month	9.18	1.52	206	11,685	1.50	156	297	13,740	1.32	193
Max 30-Day	9.92	1.65	213	11,874	1.53	147	317	14,225	1.37	183
Max 7-Day	11.32	1.88	285	15,026	1.97	170	376	17,530	1.69	197
Maximum Day	12.94	2.15	489	24,660	3.31	261	516	30,232	2.91	288

Historical load concentrations and peaking factors from **Table 6-2** were then applied to projected annual average flows from **Table 6-1** to project minimum day, maximum 30-day, maximum 7-day flows and loads for the Year 2035, as summarized in **Table 6-3**.

Table 6-3: Projected MWRF Flows and Loads for Year 2035

Criteria	Flow MGD	CBOD mg/L	TSS mg/L	CBOD lb/day	TSS lb/day
Minimum Day	5.20	n/a	n/a	n/a	n/a
Average Annual	8.00	150	220	9,790	13,966
Maximum Month	12.16	225	290	14,671	18,679
Maximum 7-Day	15.04	296	372	19,033	23,159
Maximum Day	17.20	497	845	32,000	40,000
Peak Hour	20.00	n/a	n/a	n/a	n/a

6.2 Effluent Limits

Effluent limits presented in Chapter 5 (Regulatory Requirements) are repeated below in **Table 6-4** for the reader's convenience.

Table 6-4: Proposed MWRF Effluent Limits

Parameter	Proposed MWRF
$CBOD_5$ (mg/L), Annual	20.0
$CBOD_5$ (mg/L), Monthly	30.0
$CBOD_5$ (mg/L), Weekly	60.0
$CBOD_5$ (mg/L), Single Sample	80.0
TSS (mg/L), Single Sample	5.0
TP (mg/L), Single Sample	1.5
NH_3 (mg/L), Single Sample	1.0
pH (mg/L)	6.0 to 8.5

6.3 Unit Treatment Process Design Criteria

The proposed MWRF will be designed with the following unit processes and supporting facilities:

- Preliminary Treatment, consisting of screening and grit removal facilities
- Secondary Treatment, consisting of aeration basins with fine-bubble membrane diffusers, multi-stage centrifugal blowers, secondary clarifiers and return activated sludge (RAS) and waste activated sludge (WAS) pumping
- Tertiary Treatment to meet high-level disinfection requirements, including deep-bed filters, chlorine contact basins and bulk sodium hypochlorite storage and dosing facilities
- Reclaimed Water Storage and Pumping
- Two (2) Deep Injection Wells and one (1) monitoring well; for the FPUA Energy Center Site, it is assumed that Injection Well #1 would remain in service to dispose of Energy Center waste streams, that Injection Well #2 (24" diameter, rated capacity of 18.6 MGD at 10 feet per second) would be used for MWRF effluent disposal, and that a new Injection Well #3 would be constructed to serve as a backup well to Injection Well #2
- Aerated WAS Storage Tanks to provide equalization between the secondary sludge wasting process and the sludge dewatering process
- Sludge Dewatering Building, including belt filter presses and truck loading facilities
- Operations (Administration Building)
- Maintenance Building
- Main Electrical Service Building

The purpose of the development of design criteria is to develop a feasible site plan and develop conceptual opinions of probable construction costs for the proposed MWRF. Opinions of probable construction costs for this conceptual evaluation are based on parametric estimating (e.g., $ per MGD for certain treatment processes, $ per gallon for tanks and basins, $ per square foot for buildings). Therefore, detailed design criteria are developed below for the following unit processes to develop proposed dimensions for site planning and cost estimating:

- Aeration Basins
- Secondary Clarifiers
- Deep-Bed Filters
- Chlorine Contact Basins

For remaining unit processes, including Pretreatment, Reclaimed Water Storage and Pumping, WAS Storage, Sludge Dewatering, Operations and Maintenance Buildings and Electrical Service Buildings, site dimensions were established based on similar facilities at other South Florida treatment plants.

6.3.1 Aeration Basins

The main purpose of any activated sludge process is to remove soluble organics and suspended solids from the liquid wastewater stream. Dissolved oxygen in the wastewater stream is consumed as these materials are metabolized by microbes and converted or oxidized to settling microorganisms and waste gases. The oxygen consumed by wastewater over a 5-day period is defined as "biochemical oxygen demand", or BOD_5; In aeration basins, microorganisms convert the organic substrate into new cell mass in the presence of sufficient concentrations of dissolved oxygen (DO) so the larger, heavier cell growth can be settled out downstream in secondary clarifiers. The addition of oxygen to the wastewater to satisfy and remove BOD is an important component of the activated sludge process. In addition to BOD removal, oxygen is also required for nitrification to transform ammonia to nitrate as required to meet ammonia limits associated with the use of effluent for cooling water at the Energy Center.

In a conceptual analysis, parameters for determining total aeration basin volume include hydraulic retention time (in hours) and BOD loading rate (in pounds per day of BOD loading per 1,000 cubic feet of basin volume). Basin depth is established to provide at least 15 feet of submergence over floor-mounted aeration diffusers. For this analysis, a side water depth of 18 feet has been assumed. An anaerobic selector is proposed at the beginning of each aeration basin to provide biological phosphorous removal as required to meet effluent phosphorous limits associated with the use of effluent for cooling water at the Energy Center.

Using these parameters, **Table 6-5** presents a summary of proposed aeration basin dimensions:

Table 6-5: Dimensions of Proposed Aeration Basins

Criteria	Units	Value
Number of aeration basins	#	4
Width per aeration basin	feet	40
Length of anaerobic selector zone, per basin	feet	35
Length of aerated zone, per basin	feet	170
Total length per basin	feet	205
Side Water Depth	feet	18
Total Anaerobic Volume, per basin	gallons	188,496
Total Aerobic Volume, per basin	gallons	915,552
Total Volume, per basin	gallons	1,104,048

Applying Year 2035 design flows and loadings (reference **Table 6-3**) to the proposed aeration basins dimensions (reference **Table 6-5**) results in the following aeration basins design criteria in **Table 6-6**:

Table 6-6: Aeration Basins Design Criteria

Design Criteria	Recommended Values	Proposed Values, All Basins in Service	Proposed Values, One Basin out of Service
Anaerobic hydraulic retention time, hours			
At Annual Average Daily Flow	1-2	2.26	1.70
At Maximum Month Average Daily Flow	1-2	1.49	1.12
Aerobic hydraulic retention time, hours			
At Annual Average Daily Flow	>5	10.99	8.24
At Maximum Month Average Daily Flow	>5	7.23	5.42
BOD Loading Rate, pounds/day/1,000 ft^3			
At Annual Average Daily Flow	<40	20.00	26.66
At Maximum Month Average Daily Flow	<40	29.97	39.95

6.3.2 Secondary Clarifiers

Solids separation is an important step in the production of a well-clarified, stable effluent low in BOD_5 and suspended solids. The process of liquid/solid separation is achieved in large circular basins referred to as secondary clarifiers. The secondary clarifiers have two basic functions:

- To clarify the secondary effluent through solids/liquid separation.
- To rapidly collect and thicken the settled solids for return to the aeration tanks or for wasting to the sludge processing facilities.

In a conceptual analysis, parameters for determining clarifier sizing include hydraulic surface overflow rate (in gallons per day per square foot of clarifier surface area), hydraulic weir loading rate (gallons per day per linear foot of effluent weir), and solids loading rate (in pounds per hour of mixed liquor suspended solids per square foot of clarifier surface area).

Using these parameters, **Table 6-7** presents a summary of proposed secondary clarifiers dimensions:

Table 6-7: Dimensions of Proposed Secondary Clarifiers

Criteria	Units	Value
Number of secondary clarifiers	#	3
Diameter of each clarifier	feet	120
Side Water Depth	feet	15

Applying Year 2035 design flows and loadings (reference Table 6-3) to the proposed secondary clarifiers dimensions (reference **Table 6-7)** results in the following secondary clarifiers design criteria in **Table 6-8**:

Table 6-8: Secondary Clarifiers Design Criteria

Design Criteria	Recommended Values	Proposed Values, All Basins in Service	Proposed Values, One Basin out of Service
Surface Overflow Rate, gpm/ft^2			
At Peak Hour Flow	900	589	884
Weir Loading Rate, gpm/ft			
At Peak Hour Flow	30,000	17,684	26,526
Solids Loading Rate, pounds/day/ft^2			
At Maximum Daily Flow	35	18.58	27.87

6.3.3 Tertiary Filters and Chlorine Contact Basins

High-level disinfection consisting of tertiary filtration and disinfection will be required at the MWRF to meet effluent quality requirements for cooling water supply to the Energy Center as well as for offsite restricted access landscape irrigation. Tertiary filtration removes most of the particulate matter and high-level disinfection incapacitates pathogenic organisms which may be in the treated wastewater. This conceptual evaluation assumes the use of deep-bed filters. Lower cost alternatives such as cloth-disk filters could be further evaluated during preliminary design.

Table 6-9 presents a summary of proposed dimensions for deep-bed filters and chlorine contact basins:

Table 6-9: Dimensions of Proposed Tertiary Filters and Chlorine Contact Basins

Criteria	Units	Value
Number of deep-bed filters	#	7
Width per filter	feet	9.5
Length per filter	feet	40
Area per filter	ft^2	380
Number of chlorine contact basins	#	3
Number of passes per contact basin	#	3
Width per pass	ft	8
Length per pass	ft	11
Side Water Depth	ft	8
Volume per contact basin	ft^3	143,616

Applying Year 2035 design flows and loadings (reference Table 6-3) to the proposed tertiary treatment dimensions (reference **Table 6-9**) results in the following tertiary treatment design criteria in **Table 6-10**:

Table 6-10: Tertiary Treatment Design Criteria

Design Criteria	Recommended Values	Proposed Values, All Basins in Service	Proposed Values, One Basin out of Service
Filter Loading Rate, gpm/ft^2			
At Annual Average Flow	3.0	2.09	2.44
At Peak Hour Flow	6.0	5.22	6.09
Chlorine Contact Time			
For CT of 40 at 2.0 mg/L chlorine residual	20	31	21

6.4 Conceptual Site Plan

Conceptual site plans for locating the proposed MWRF at SLC's North County Site and FPUA's Treasure Coast Energy Center are presented in **Figure 6-1 and Figure 6-2**, respectively. The evaluation scope called for conceptual site plans at the SLC North County Site and the FPUA Treasure Coast Energy Center and a third site located strategically between the first and second sites. The third location would be considered if the data supported locating a facility where heavy growth would be anticipated. The analysis did not support a third location. The site plans are very similar in that all of the process equipment would be the same with different layouts for each facility. The main difference between the two layouts is that the SLC site will require the installation of two injection wells and a monitoring well. **Figure 6-1 SLC North County Proposed Site Plan and Figure 6-2 FPUA Treasure Coast Energy Center Proposed Site Plan** are on the following pages.

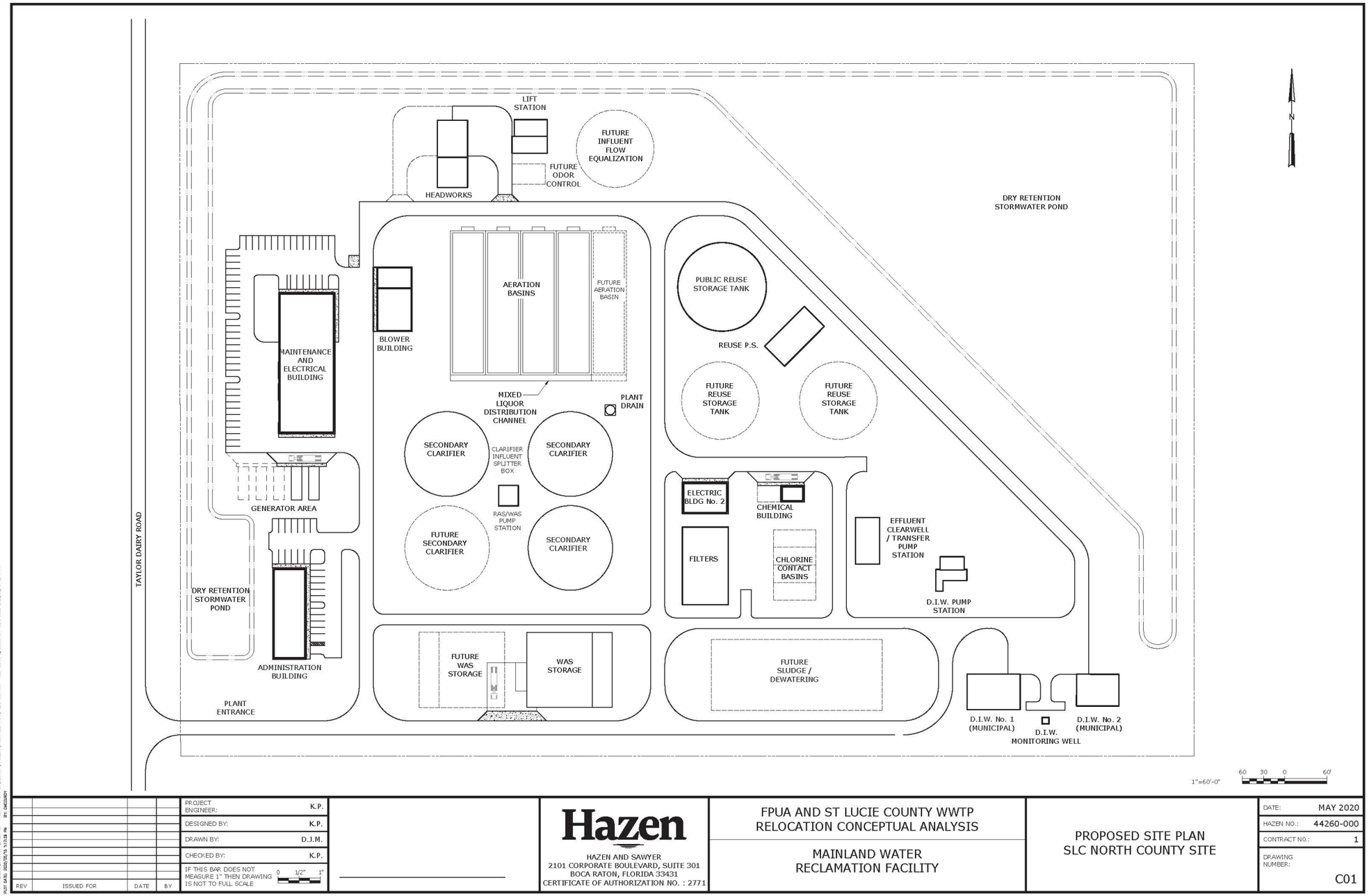


Figure 6-1: SLC North County Proposed Site Plan

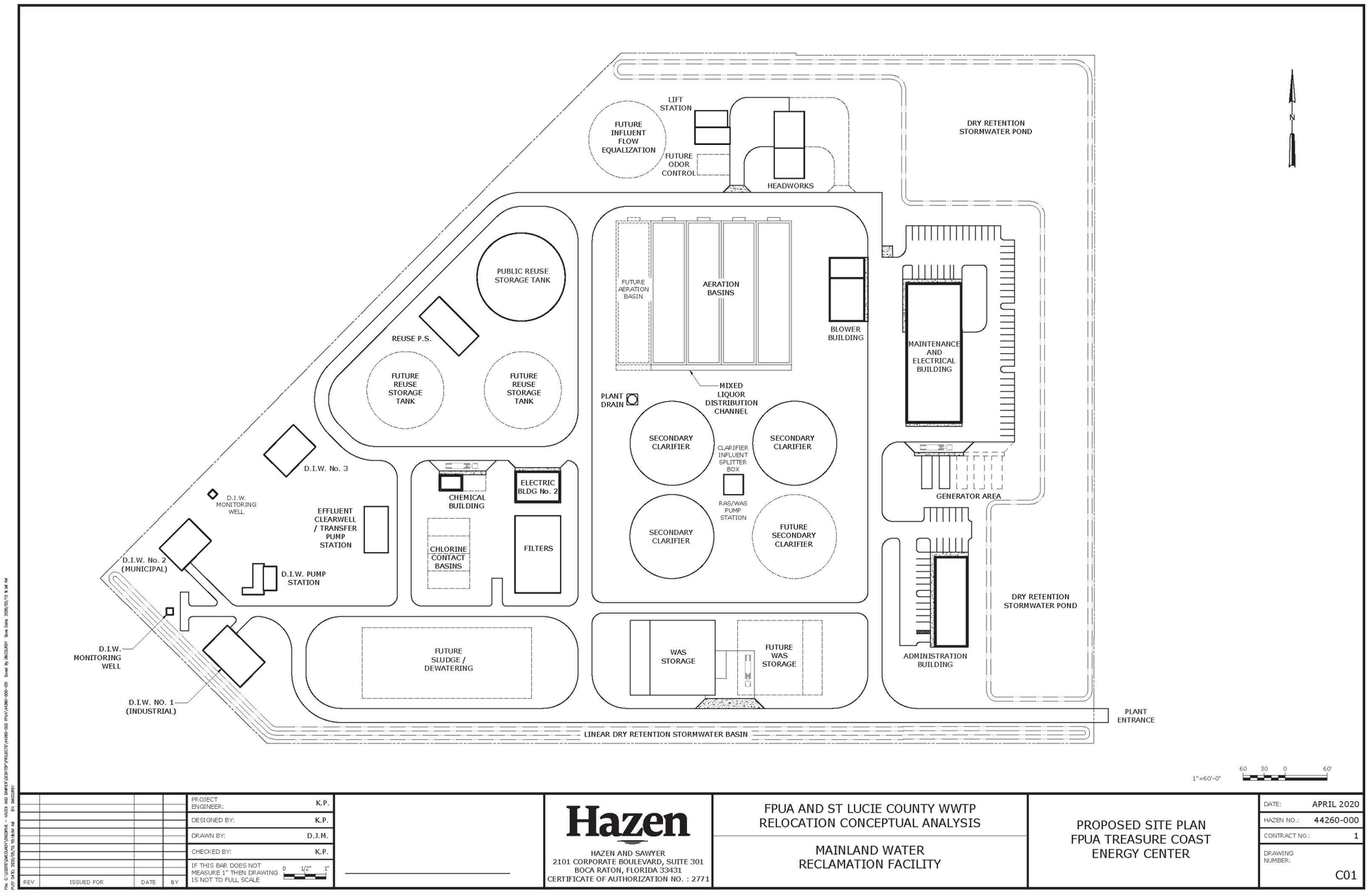


Figure 6-2: FPUA Treasure Coast Energy Center Proposed Site Plan

7. Conceptual Opinion of Probable Capital Costs

Costs for the MWRF were developed using parametric estimating methodology (e.g. $/MGD, $/square foot, $/gallon). Conceptual construction costs for proposed MWRF facilities are based on applying historical costs of similar facilities to design and sizing criteria presented in Section 6. The estimated total construction and ancillary costs for redirecting flows, installing new force mains, lift stations and decommissioning costs were calculated on a per foot basis using information obtained from regional bid tabulations and estimated additional ancillary costs from RS Means CostWorks. The conceptual costs presented herein are consistent with Class 5 Estimates in accordance with the American Association of Cost Engineering (AACE) Recommended Practice No. 18R-97.

The conceptual capital costs for each of the MWRF locations along with their respective rerouting/re-directing scenario costs and associated decommissioning costs are summarized below. Conceptual opinions of probable capital costs for the proposed MWRF located at the SLC North County Site or the FPUA Treasure Coast Energy Center are summarized in **Tables 7-1** and **7-2**, respectively. Detailed cost tables for each of these are included in Section 7.3.

7.1 MWRF located at the SLC North County Site

Table 7-1 summarizes the conceptual capital costs associated with locating the MWRF at the SLC North County Site. This includes the estimated capital costs to construct the MWRF, the cost for proposed routing and redirecting force mains and lift stations, and decommissioning costs associated with the three existing SLC facilities and the IWRF that would be eliminated.

Table 7-1: Conceptual Costs Summary, MWRF Located at the SLC North County Site

Description	Capital Costs
SLC MWRF	$119,440,000
Scenario 1	$26,510,000
Decommissioning Lakewood Park WWTP	$146,000
Decommissioning Holiday Pines WWTP	$1,360,000
Decommissioning Fairwinds WWTP	$227,000
Decommissioning IWRF	$2,382,000
Total Costs	**$150,065,000**

Note: see Section 7.3 for detailed cost tables.

7.2 MWRF located at the FPUA Treasure Coast Energy Center

Table 7-2 summarizes the conceptual capital costs associated with locating the MWRF at the FPUA Treasure Coast Energy Center. This includes the estimated capital costs to construct the MWRF, the cost for proposed routing and redirecting force mains and lift stations, and decommissioning costs associated with the three existing SLC facilities and the IWRF that would be eliminated.

Table 7-2: Conceptual Costs Summary, MWRF Located at the FPUA Treasure Coast Energy Center

Description	Capital Costs
FPUA MWRF	$104,620,000
Scenario 2	$22,746,000
Decommissioning Lakewood Park WWTP	$146,000
Decommissioning Holiday Pines WWTP	$1,360,000
Decommissioning Fairwinds WWTP	$227,000
Decommissioning IWRF	$2,382,000
Total Costs	**$131,481,000**

7.3 Detailed Cost Tables

Listed below are detailed cost tables that are presented as backup for the summary of costs shown in **Tables 7-1 and 7-2** respectively. The scenarios conceptual costs for the piping and lift stations were discussed in Section 2. The conceptual costs for the mainland facilities were discussed in Section 6.

Table 7-3: MWRF Conceptual Opinion of Probable Construction Cost – SLC North County Site

Process	Unit Cost	Unit	MWRF Value	Cost	Rounded Cost
Influent Pump Station	$0.25	$/gal AA flow treated	8,000,000	$2,000,000	$2,000,000
Headworks	$0.29	$/gal treated	10,000,000	$2,900,000	$2,900,000
New Aeration Basins	$2.59	$/gal tankage	4,420,000	$11,447,800	$11,450,000
Blower Building	$0.24	$/gal AA flow treated	8,000,000	$1,920,000	$1,920,000
Secondary Clarifiers	$180	$/sf tankage	33,929	$6,107,256	$6,110,000
RAS Pump Station	$0.21	$/gal AA flow treated	8,000,000	$1,680,000	$1,680,000
Deep Bed Filters (will price cloth-disk for lower $$)	$2,700	$/sf tankage	2,660	$7,182,000	$7,190,000
Disinfection (Hypochlorite Storage/Feed)	$0.05	$/gal AA flow treated	8,000,000	$400,000	$400,000
Chlorine Contact Basins	$1.86	$/gal tankage	431,000	$801,660	$810,000
Reclaimed Water Storage Tank	$0.50	$/gal tankage	3,000,000	$1,500,000	$1,500,000
Reclaimed Water Pump Station (3 MGD)	$500,000	lump sum	1	$500,000	$500,000
Deep Injection Wells	$5,000,000	per well, equipped	2	$10,000,000	$10,000,000
Monitoring Well	$1,750,000	per well, equipped	1	$1,750,000	$1,750,000
Deep Injection Well Pump Station	$2,000,000	lump sum	1	$2,000,000	$2,000,000
WAS Holding Tank	$1.86	$/MG tankage	323,136	$601,033	$610,000
Ops/Admin Building	$200	$/sf building	6,000	$1,200,000	$1,200,000
Maintenance/Shop	$150	$/sf building	16,000	$2,400,000	$2,400,000
Subtotal				**$54,389,749**	**$54,390,000**
Sitework, Yard Piping	10%			$5,438,975	$5,440,000
Electrical	15%			$8,158,462	$8,160,000
Instrumentation & Control	3%			$1,631,692	$1,640,000
Contractors OH&P, Gen. Conditions	25%			$13,597,437	$13,600,000
Contingency	30%			$16,316,925	$16,320,000
Total Construction Costs				**$99,533,241**	**$99,540,000**
Legal, Engineering and Administration	**20%**			**$19,906,648**	**$19,910,000**
Total Capital Costs				**$119,439,889**	**$119,440,000**

Table 7-4: Conceptual Costs for Flow Rerouting Scenario 1 Probable Cost – MWRF Located at the SCL North County Site

Item No.	Description	Quantity	Unit	Unit Price	Total
Item 2 - Site Construction					
	Redirect Lift Stations:				
	FPUA and SLC LS	15	LS	$75,000	$1,125,000
	Master LS at Fairwinds, HPWRF and LPWRF	3	LS	$150,000	$450,000
	Master LS A	1	LS	$500,000	$500,000
	New Lift Stations:				
	Master LS at IWRF	1	LS	$1,500,000	$1,500,000
	Force Main Horizontal Directional Drill:				
	Canal 1 Crossing				
	16-inch	350	LF	$425	$148,750
	24-inch	350	LF	$625	$218,750
	Belcher Canal Crossing				
	16-inch	450	LF	$425	$191,250
	24-inch	450	LF	$625	$281,250
	Okeechobee Road				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Ten Mile Creek				
	16-inch	350	LF	$425	$148,750
	Glades & FEC RR				
	16-inch	650	LF	$425	$276,250
	Force Main:				
	4-inch	5,500	LF	$76	$418,000
	12-inch	4,500	LF	$190	$855,000
	16-inch	55,600	LF	$209	$11,620,400
	24-inch	28,400	LF	$285	$8,094,000
	Total				**$26,510,000**

Table 7-5: SLC Decommissioning Costs

Item No.	Description	Quantity	Unit	Unit Price	Total
Lakewood WWTF					
	Aeration Basins	4	EA	$11,000	$44,000
	Rectangular Clarifier	1	EA	$12,000	$12,000
	Chlorine Contact Chamber	1	EA	$9,000	$9,000
	Aerobic Digester	1	EA	$12,000	$12,000
	Percolation Pond				
	Dewatering	65400	GAL	$0.03	$1,962
	Filling and Compact	1300	CY	$15	$19,500
	Restoration	1500	SY	$9	$13,500
	30% Contingency				**$33,589**
	Total				**$146,000**
Holiday Pines WWTF					
	Aerated EQ Basin	1	EA	$18,000	$18,000
	Aeration Tanks	2	EA	$22,000	$44,000
	Secondary Clarifier (1 square 1 round)	2	EA	$20,000	$40,000
	Tertiary Disk Filter	2	EA	$22,000	$44,000
	Chlorine Contact Basin	2	EA	$17,000	$34,000
	Aerated Sludge Holding Tank	1	EA	$20,000	$20,000
	Percolation ponds				
	Dewatering	1080000	GAL	$0.03	$32,400
	Filling and Compact	42500	CY	$15	$637,500
	Restoration	19500	SY	$9	$175,500
	30% Contingency				**$313,620**
	Total				**$1,360,000**
Fairwinds WWTF					
	Aeration Tank	1	EA	$8,500	$8,500
	Sludge Holding Tank	6	EA	$6,500	$39,000
	Surge Tank	2	EA	$10,000	$20,000
	Settling Tank	2	EA	$9,000	$18,000
	Filters	2	EA	$8,000	$16,000
	Chlorine Contact Basin	2	EA	$7,000	$14,000
	Percolation ponds				
	Dewatering	70000	GAL	$0.03	$2,100
	Filling and Compact	3500	CY	$15	$52,500
	Restoration	450	SY	$9	$4,050
	30% Contingency				**$52,245**
	Total				**$227,000**

Table 7-6: MWRF Conceptual Opinion of Probable Construction Cost – FPUA Treasure Coast Energy Center Site

Process	Unit Cost	Unit	MWRF Value	Cost	Rounded Cost
Influent Pump Station	$0.25	$/gal AA flow treated	8,000,000	$2,000,000	$2,000,000
Headworks	$0.29	$/gal treated	10,000,000	$2,900,000	$2,900,000
New Aeration Basins	$2.59	$/gal tankage	4,420,000	$11,447,800	$11,450,000
Blower Building	$0.24	$/gal AA flow treated	8,000,000	$1,920,000	$1,920,000
Secondary Clarifiers	$180	$/sf tankage	33,929	$6,107,256	$6,110,000
RAS Pump Station	$0.21	$/gal AA flow treated	8,000,000	$1,680,000	$1,680,000
Deep Bed Filters (will price cloth-disk for lower $$)	$2,700	$/sf tankage	2,660	$7,182,000	$7,190,000
Disinfection (Hypochlorite Storage/Feed)	$0.05	$/gal AA flow treated	8,000,000	$400,000	$400,000
Chlorine Contact Basins	$1.86	$/gal tankage	431,000	$801,660	$810,000
Reclaimed Water Storage Tank	$0.50	$/gal tankage	3,000,000	$1,500,000	$1,500,000
Reclaimed Water Pump Station (3 MGD)	$500,000	lump sum	1	$500,000	$500,000
Deep Injection Well #3	$5,000,000	lump sum	1	$5,000,000	$5,000,000
Deep Injection Well Pump Station	$2,000,000	lump sum	1	$2,000,000	$2,000,000
WAS Holding Tank	$1.86	$/MG tankage	323,136	$601,033	$610,000
Ops/Admin Building	$200	$/sf building	6,000	$1,200,000	$1,200,000
Maintenance/Shop	$150	$/sf building	16,000	$2,400,000	$2,400,000
Subtotal				**$47,639,749**	**$47,640,000**
Sitework, Yard Piping	10%			$4,763,975	$4,770,000
Electrical	15%			$7,145,962	$7,150,000
Instrumentation & Control	3%			$1,429,192	$1,430,000
Contractors OH&P, Gen. Conditions	25%			$11,909,937	$11,910,000
Contingency	30%			$14,291,925	$14,300,000
Total Construction Costs				**$87,180,740**	**$87,190,000**
Legal, Engineering and Administration	**20%**			**$17,436,148**	**$17,440,000**
Total Capital Costs				**$104,616,888**	**$104,620,000**

Table 7-7: Scenario 2 Probable Cost – MWRF Located at the FPUA Treasure Coast Energy Center

Item No.	Description	Quantity	Unit	Unit Price	Total
Item 2 - Site Construction					
	Redirect Lift Stations:				
	FPUA and SLC LS	15	LS	$75,000	$1,125,000
	Master LS at Fairwinds, HPWRF and LPWRF	3	LS	$150,000	$450,000
	Master LS A	1	LS	$500,000	$500,000
	New Lift Stations:				
	Master LS at IWRF	1	LS	$1,500,000	$1,500,000
	Force Main Horizontal Directional Drill:				
	Canal 1 Crossing				
	16-inch	350	LF	$425	$148,750
	24-inch	0	LF	$625	$0
	Belcher Canal Crossing				
	16-inch	450	LF	$425	$191,250
	24-inch	0	LF	$625	$0
	Okeechobee Road				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Ten Mile Creek				
	16-inch	350	LF	$425	$148,750
	24-inch	450	LF	$625	$281,250
	Glades & FEC RR				
	16-inch	650	LF	$425	$276,250
	24-inch	650	LF	$625	$406,250
	Force Main:				
	4-inch	5,500	LF	$76	$418,000
	12-inch	8,000	LF	$190	$1,520,000
	16-inch	55,600	LF	$209	$11,620,400
	24-inch	12,200	LF	$285	$3,477,000
	Total				**$22,746,000**

Table 7-8: FPUA Decommissioning Costs

Item No.	Description	Quantity	Unit	Unit Price	Total
IWRF					
	Headworks/ Screening Structure	1	EA	$25,000	$25,000
	Grit Removal Structure	1	EA	$20,000	$20,000
	Aeration Basin	3	EA	$85,000	$255,000
	Clarifier	4	EA	$45,000	$180,000
	Recycle Pump Station	1	LS	$11,000	$11,000
	Chlorine Contact Basin	1	EA	$49,000	$49,000
	Polymer and Chlorine Systems	1	LS	$18,000	$18,000
	Plug and Abandon Deep Injection Well	1	LS	$500,000	$500,000
	Aerobic Digesters	4	EA	$25,000	$100,000
	DAF Thickeners	2	EA	$18,000	$36,000
	Digested Sludge Pump Station	1	LS	$6,000	$6,000
	Effluent Pump Station	1	LS	$7,000	$7,000
	Surge Tank	1	LS	$8,000	$8,000
	Caustic Feed System	1	LS	$10,000	$10,000
	Electrical Building	1	LS	$60,000	$60,000
	Blower Building	1	LS	$50,000	$50,000
	Office/Warehouse	1	LS	$60,000	$60,000
	Admin Bldg	1	LS	$30,000	$30,000
	Electrical Demo	1	LS	$70,000	$70,000
	Yard Piping Demo	1	LS	$40,000	$40,000
	Site Restoration	33000	SY	$9	$297,000
	30% Contingency				**$549,600.00**
	Total				**$2,382,000**

7.4 Summary

The total conceptual capital costs to relocate the IWRF to a mainland location at the SLC North County Site or the FPUA Treasure Coast Energy Center is $150,065,000 and $131,481,000, respectively. The primary difference in costs (approximately $18.5 million) between the two locations for the MWRF relate to deep well injection of treated effluent. The FPUA site includes two existing deep injection wells and a monitoring well. IW-1 is for industrial use and cannot receive Domestic Wastewater. IW-2 is existing but will required a backup well for redundancy. The SLC site is a "Green Field" site that will require two injection wells and a monitoring well to be installed. Therefore, costs for the SLC option reflect two new deep injection wells and a new monitoring well. The costs for the FPUA site are based on the installation of only one additional injection well. There is a slightly higher capital costs associated with the installation of new piping and redirection of flows to the SLC North County Site. This is approximately $3.5 million and is primarily due to the installation of additional 24-inch force main to transmit flow to the SLC North County Site. However, these overall conceptual costs are very comparable for each location. A more detailed analysis is recommended to determine the best location for the MWRF.

8. Impacts on Operation and Maintenance Costs

Table 8-1 presents a summary of annual costs incurred by FPUA and SLC in 2018 for operation and maintenance of their respective wastewater treatment facilities.

Table 8-1: Current FPUA/SLC O&M Costs

	IWRF	Fairwinds Golf Course WWTF	Lakewood Park WWTF	Holiday Pines WWTF	Total
Power	$512,737	See Note 1	See Note 1	See Note 1	$512,737
Labor	$1,247,688	$21,136	$15,811	$170,015	$1,454,650
Maintenance Parts Replacement Costs	$113,443	$5,760	$8,800	$55,800	$183,803
Chemical	$96,887	See Note 1	See Note 1	See Note 1	$96,887
Administrative/ Legal Procurement	$55,145	-	-	-	$55,145
Sludge	$456,943	$1,000	$5,000	$35,000	$497,943
Other	$54,431	-	-	-	$54,431
Total Annual Cost	$2,537,274	$27,896	$29,611	$260,815	$2,855,596
Permitted Capacity, MGD	10.00	0.02	0.02	0.21	10.25
Treated Flow, MGD	4.31	0.03	0.02	0.12	4.47
Treated Flow, MGY	1,573	9	7	42	1,631
Cost, $/ MG Treated	$1,613	$3,057	$4,182	$6,214	$1,750

Note 1: Labor" cost for the three SLC plants are contract operating costs that include power and chemicals

Table 8-2 presents a comparison of annual O&M costs for the FPUA IWRF and three similarly sized Florida facilities, as well as a projection of O&M costs for the proposed MWRF. Costs are presented for major O&M categories in terms of total annual costs and unit costs per million gallons treated or unit costs per million gallons of treatment capacity, as applicable. The proposed MWRF is similar to the existing IWRF in terms of capacity, physical size and treatment facilities. The only fundamental components proposed for the MWRF that do not exist at the IWRF are deep-bed filters and reclaimed water storage/pumping. Those new facilities should not require additional operations staff, as they are an extension of the liquid stream process and are generally monitored by staff that monitors the overall facility. The far-right column in Table 8-2 provides the basis for MWRF cost projections for each of the main unit O&M cost categories. Due to the similarities between the existing IWRF and the proposed MWRF, current IWRF unit costs are used for projected MWRF unit costs for all categories except power and chemicals. It is assumed that the proposed MWRF will utilize more energy-efficient aeration, pumping and electrical power distribution equipment than what exist at IWRF, thus reducing power costs by at least 10%. It is also assumed that the addition of high-level disinfection at MWRF for reclaimed water distribution and supply of cooling water at the Energy Center will increase chemical costs. On balance, projected O&M unit costs for the proposed MWRF are slightly less than current O&M costs at the IWRF.

Table 8-2: Projected O&M Costs for Proposed MWRF

	FPUA IWRF (2018)	Plant City (2018)	Winter Haven (2018)	Boca Raton (2019)	Average of IWRF and References	MWRF Projections (2025)	Basis of MWRF Projections
Permitted Capacity							
MGD	10.00	10.00	7.50	17.50	11.25	8.00	Based on Chapter 6 design criteria
MGY	3,650	3,650	2,738	6,388	4,106	2,920	
Treated Flow							
MGD	4.31	4.80	4.50	12.30	6.48	5.59	Based on Chapter 4 flow projections for Year 2025
MGY	1,573	1,752	1,643	4,490	2,364	2,040	
Power							
Annual Cost	$512,737	$658,000	$400,000	$1,013,000	$645,934	$612,105	
Cost/MG (treated)	$326	$376	$244	$226	$293	$300	10% reduction from IWRF based on more efficient equipment
Labor							
Annual Cost	$1,247,688	$776,000	$1,068,527	$1,420,000	$1,128,054	$1,247,688	Current IWRF costs
Cost/MG (capacity)	$342	$213	$390	$222	$292	$427	
Maintenance Parts Replacement Costs							
Annual Cost	$113,443	$64,691	$976,308	$775,700	$482,536	$90,754	
Cost/MG (capacity)	$31	$18	$357	$121	$132	$31	Current IWRF costs
Chemical							
Annual Cost	$96,887	$202,350	$350,000	$947,340	$399,144	$235,653	
Cost/MG (treated)	$62	$115	$213	$211	$150	$115	Increased from IWRF costs to provide high-level disinfection
Administrative/ Legal Procurement							
Annual Cost	$55,145	$70,538	$29,732	$47,000	$50,604	$30,826	
Cost/MG (capacity)	$15	$19	$11	$7	$13	$15	Current IWRF costs
Sludge							
Annual Cost	$456,943	$500,000	$300,000	$1,172,220	$607,291	$592,648	
Cost/MG (treated)	$290	$285	$183	$261	$255	$290	Current IWRF costs
Other							
Annual Cost	$54,431	$171,887	$198,150	$0	$106,117	$70,596	
Cost/MG (treated)	$35	$98	$121	$0	$63	$35	Current IWRF costs
Total, $							
Annual Cost	$2,537,274	$2,443,466	$3,322,717	$5,375,260	$3,419,679	$2,880,271	
Cost/MG (treated)	$1,613	$1,395	$2,023	$1,197	$1,557	$1,412	

The following observations are based on a comparison of unit O&M costs for IWRF and the reference facilities:

1. IWRF unit power costs ($/MG treated) are within the range of unit power costs from reference facilities.
2. IWRF labor costs are at the high end of unit labor costs from reference facilities.
3. IWRF maintenance part replacement costs are at the low end of unit costs for reference facilities. AWWA benchmarking data indicates that the average utility investment in capital renewal and replacement is approximately 1.5%/year of total plant asset value.
4. IWRF chemical costs are significantly lower than unit chemical costs for reference facilities; this may be attributed to the fact that IWRF disposes effluent to deep injection wells that require lower chlorine dosages than for facilities treating to high-level disinfection standards for reclaimed water distribution.
5. IWRF unit costs for administration, sludge disposal and other categories are within the range of costs from reference facilities.

Table 8-3 presents a side-by-side comparison of total O&M costs at the FPUA IWRF and SLC facilities with projected O&M costs for the proposed MWRF. The first column presents O&M costs for existing FPUA/SLC facilities based on Year 2018 flows. The second cost column adjusts O&M costs for existing FPUA/SLC facilities to projected Year 2025 flows (to reflect flow conditions when the proposed MWRF would be placed into service). The third cost column presents projected O&M costs for the proposed MWRF at the same Year 2025 projected flows.

Table 8-3: Comparison of Current FPUA/SLC O&M Costs to Proposed MWRF O&M Cost

	Combined O&M Costs for I WRF and SLC Facilities (Year 2018 Flows)	Combined O&M Costs for IWRF and SLC Facilities (Year 2025 Flows)	Projected O&M Costs for Proposed MWRF (Year 2025 Flows)
Power	$512,737	$641,294	$612,105
Labor	$1,454,650	$1,454,650	$1,247,688
Maintenance parts replacement costs	$183,803	$183,803	$90,754
Chemical	$96,887	$121,179	$235,653
Administrative/ Legal Procurement	$55,145	$55,145	$30,826
Sludge	$497,943	$622,791	$592,648
Other	$54,431	$68,078	$70,596
Total Annual Cost	$2,855,596	$3,146,940	$2,880,271
Permitted Capacity, MGD	10.25	8.00	8.00
Treated Flow, MGD	4.47	5.59	5.59
Treated Flow, MGY	1,631	2,040	2,040
Cost, $/ MG Treated	**$1,750**	**$1,542**	**$1,412**

Based on the results presented in **Table 8-3**, the projected unit O&M costs (costs per million gallons treated) for the proposed MWRF would be approximately 10% lower than the combined O&M unit costs for the FPUA IWRF and the three SLC package plants, based on a comparison at projected Year 2025 flows. The projected reduction in unit O&M costs would be due to consolidation of operating labor to a single facility and increased energy efficiency inherent with a new facility using state-of-the-art process equipment, electrical power distribution equipment and automated controls.