City of Cooper City Wastewater Treatment Plant New Headworks Facility Plan

CWSRF Project No. WW06251

June 2026

Hazen

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List of Acronyms

Abbreviation	Definition
AADF	Annual Average Daily Flow
BCRED	Broward County Public Works and Environmental Services Department (PWSED)
CIP	Capital Improvement Program
City	City of Cooper City
DIW	Deep Injection Well
FDEP	Florida Department of Environmental Protection
FP	Facility Plan
I&C	Instrumentation and Control
mgd	Million Gallons per Day
MTMADF	Maximum Three Month Average Daily Flow
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PDR	Preliminary Design Report
PV	Present Value
SBDD	South Broward Drainage District
SCADA	Supervisory Control and Data Acquisition
SFWMD	South Florida Water Management District
SRF	State Revolving Fund
TMADF	Three-Month Average Daily Flow
WWMP	Water and Wastewater Master Plant
WWTP	Wastewater Treatment Plant

1. Executive Summary

This Facility Plan (FP) has been prepared for the Florida Department of Environmental Protection (FDEP) by Hazen and Sawyer (Hazen) to meet the requirements of the State Revolving Fund (SRF) loan funding program for the City of Cooper City's (City) Wastewater Treatment Plant (WWTP) Headworks project. This document addresses the WWTP Headworks project identified in the Capital Improvement Program (CIP) Plan. It is anticipated this plan will be amended for future projects that require SRF funding as the City moves forward in implementing the recommended improvements. The proposed project has been identified for implementation within the next five years.

In accordance with Florida Statutes 62-503-751, this FP is the first step in the process of obtaining funding through the Clean Water (CW) SRF program. It is required by the SRF program to have the plan reviewed, advertised for public comment, and adopted by the City's Commission. Adoption of this Plan by the City Commission does not commit the City to construct the project, nor does it commit the City to using SRF funding. Furthermore, it does not commit the FDEP to offer SRF funding. FDEP's mission is to protect, conserve and manage the state's natural resources and enforce its environmental laws. With a vision to advance Florida's position as a world leader in protecting natural resources while growing the state's economy. This document aids the state in meeting its mission and values.

The proposed wastewater project in this FP is the WWTP Headworks project. The project generally includes the construction of a dedicated headworks facility at the WWTP. The headworks facility will include fine screening, odor control, and provisions for a future grit removal system.

The estimated total capital cost for the proposed project is approximately $8,904,000. The estimated present value cost for the proposed wastewater project is approximately $9,800,000.

Documents and resources utilized to develop this FP include the following:

- Cooper City 2024 Water and Wastewater Master Plan Update (WWMP)
- Cooper City Capital Improvement Project Dashboard

2. Introduction

2.1 Background

The City of Cooper City (City) Utilities Department provides clean drinking water, wastewater, stormwater services, safe roads and sidewalks, and highly operational facility and vehicles to its community. **Figure 2-1** shows the water and wastewater service area for the City, **Figure 2-2** shows the service area for the County, and **Figure 2-3** shows the Census Tract map for the service area.

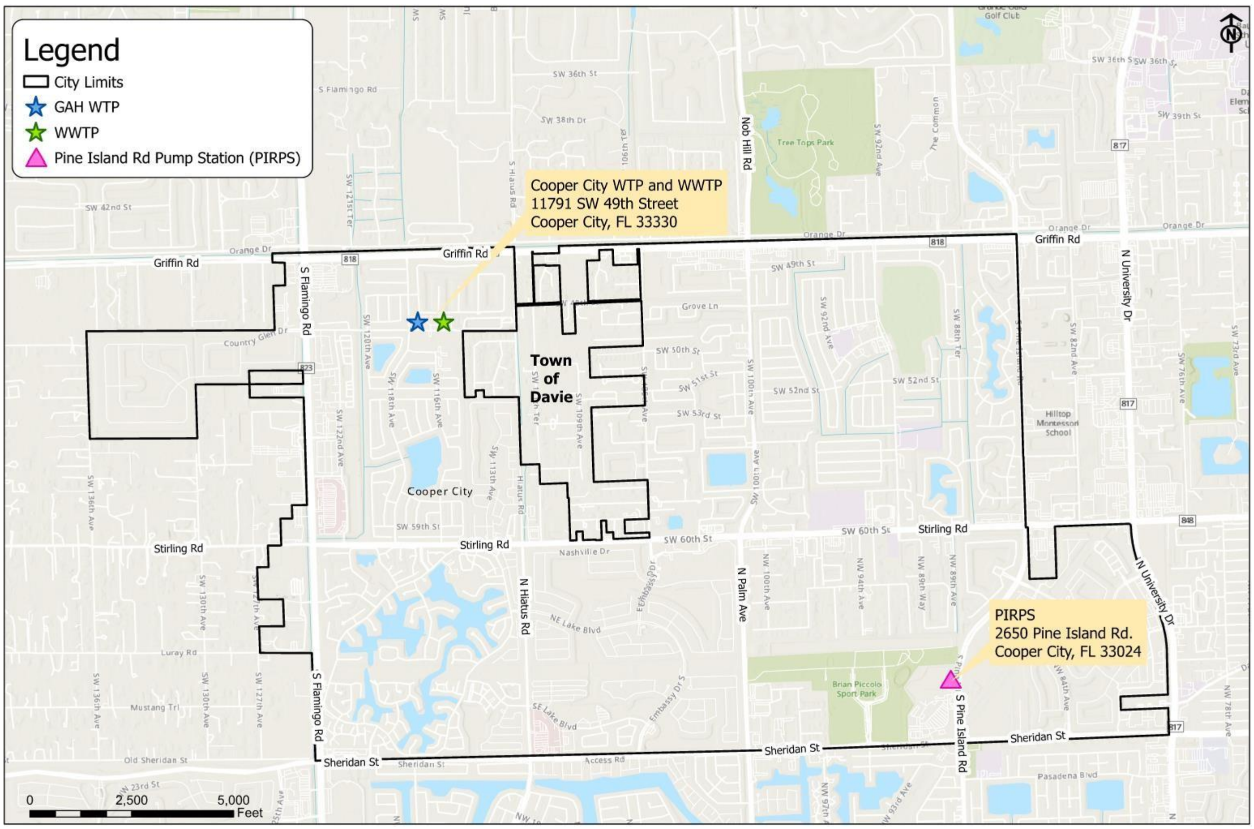

Figure 2-1: Water and Wastewater Service Area

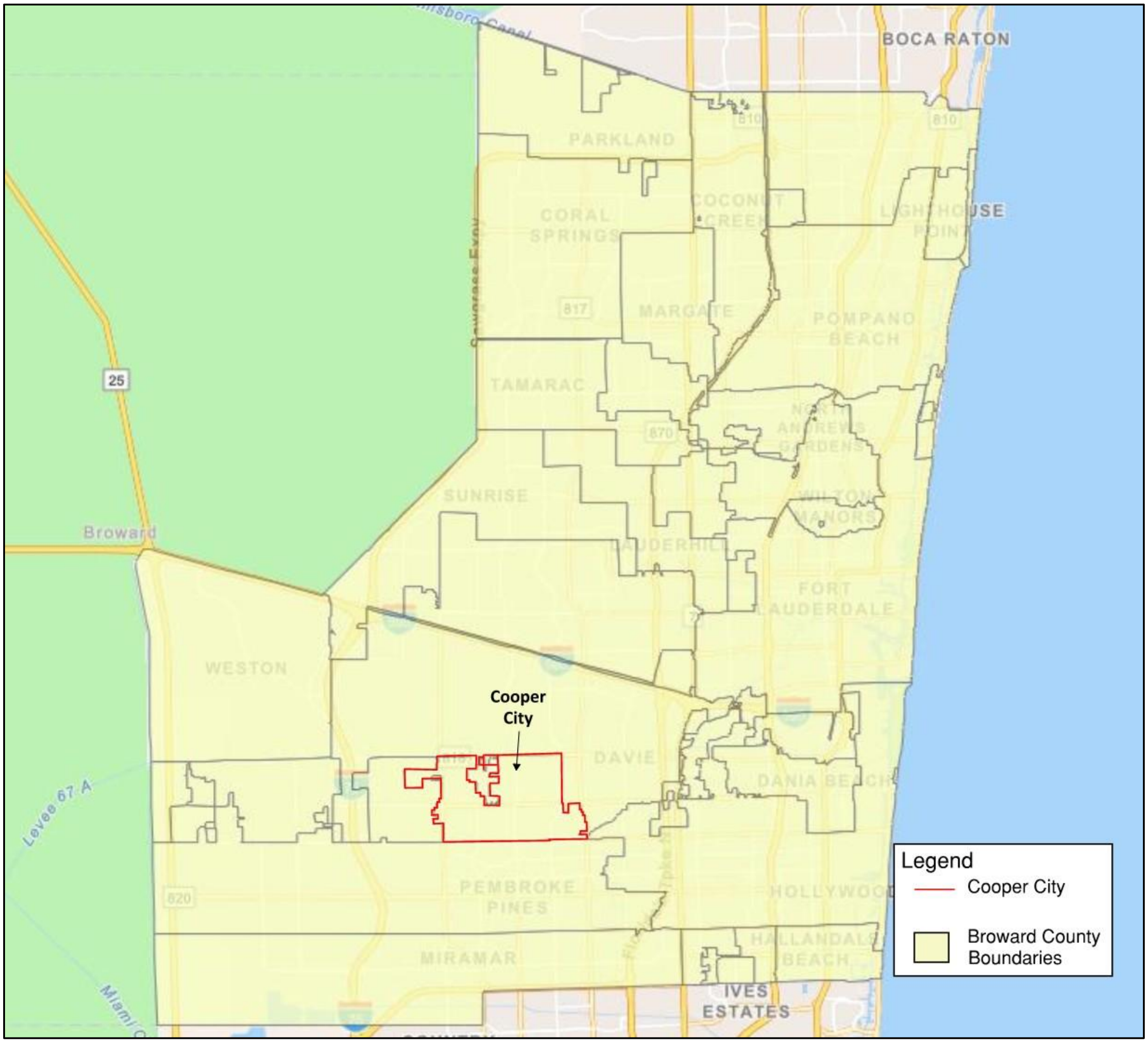

Figure 2-2: Broward County Maps

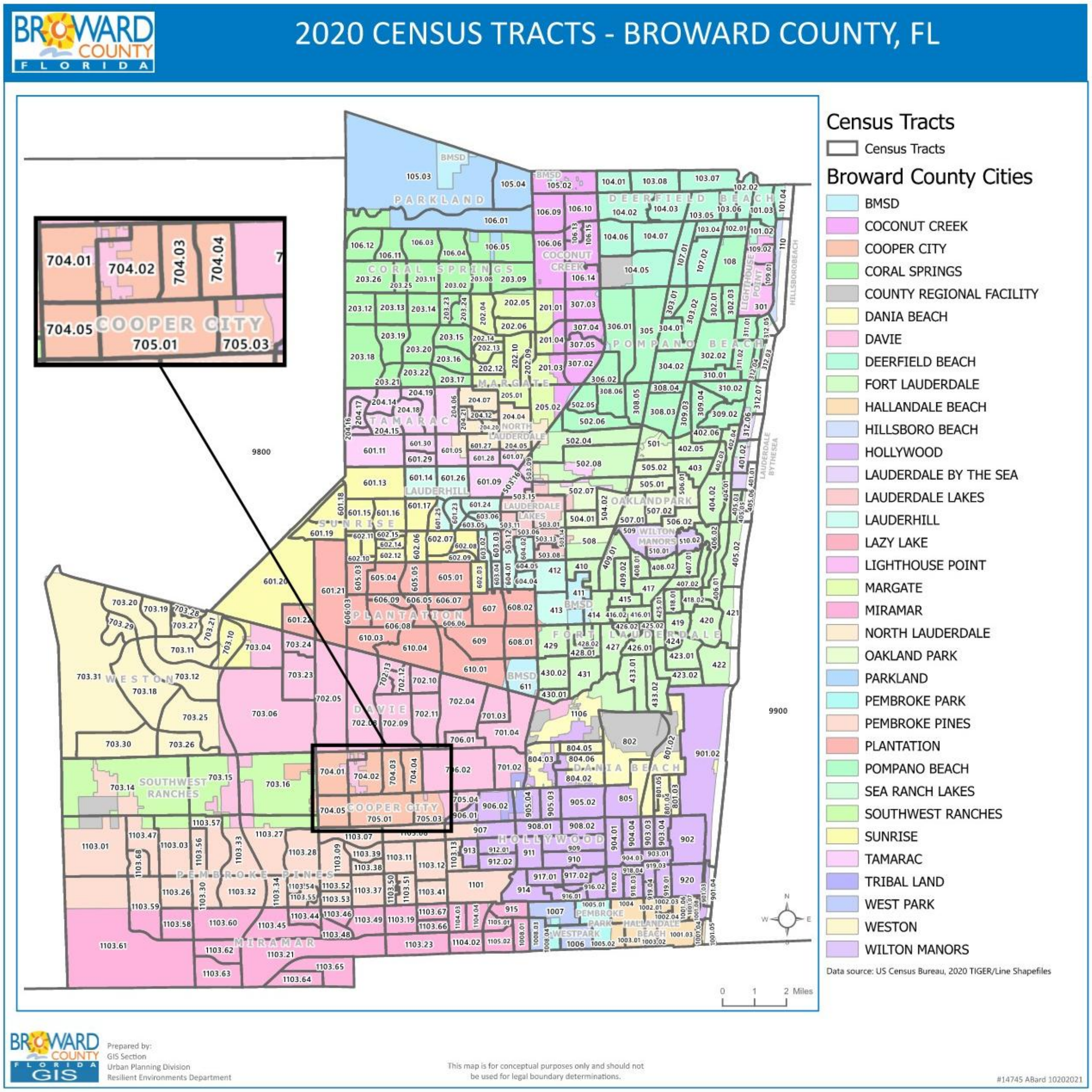

Figure 2-3: 2020 Broward County Census Tract

The City's Wastewater Treatment Plant (WWTP) is owned and operated by the City and was originally constructed in the late 1970s. Since then, it has undergone numerous improvements over the years. The WWTP is located at 11791 SW 49th St, Cooper City, FL 33330, in Broward County. The City operates under Permit Number FL00440398, effective March 6, 2026, until expiration on January 25, 2028. The WWTP consists of three small "package" plants. The rated capacity of the WWTP is 4.27 million gallons per day (mgd) on a maximum three-month average daily flow (MTMADF) basis.

2.2 Need

The Cooper City 2024 Water and Wastewater Master Plan Update (WWMP) identified numerous projects that should be implemented over the next 20 years. The City is seeking assistance with funding for the WWTP Headworks project as defined below. Future projects may also be added as the City continues to implement its Master Plan and as future needs arise.

- **WWTP Headworks Project –** The intent of this project is to construct a Headworks facility at the WWTP. The facility will include mechanical screening and provisions for a future stacked-tray grit removal system. The headworks facility will also include a dedicated odor control system.

The project provides an upgrade to the existing pre-treatment of the influent wastewater. The current pre-treatment process at the WWTP consists of a manual coarse bar screen with ¾-inch spacing located at the surge tank and one coarse manual bar screen with ½-inch spacing at each of the three package plants. As identified in the WWMP, one of the packaged plants is failing and the system is in need of an upgrade to support the functionality and quality of treatment.

The City has experienced sewer overflows at the existing bar screens in the past. Of the three recorded spill incidents, two occurred at or near the influent box area during abnormal rainfall events. In June 2024, approximately 1,500 gallons of raw wastewater spilled at Wastewater Treatment Plant No. 2 due to influent backup during a 6.5-inch rain event; the full volume was recovered. In November 2023, approximately 1,500 gallons of raw wastewater spilled near the WWTP surge tank and influent piping as a result of excessive wet-weather inflow; 1,325 gallons were recovered.

While the severity of these wet-weather events were lessened through manipulation of the upstream collection system, they also highlight hydraulic limitations at the plant influent. The existing preliminary treatment facilities lack sufficient screening capacity, debris handling, and operational flexibility to manage peak flows. The proposed headworks facility will address these limitations by providing mechanical screening and provisions for grit removal and a dedicated bypass channel with a manual bar screen, improving the plant’s ability to manage flow surges and variable influent conditions. This will enhance operational reliability, reduce overflow risk, and complement necessary collection system and lift station improvements by increasing overall system resilience.

Figure 2-4 presents two potential sites that were evaluated for the proposed headworks facility and, if required, a booster pump station. In Location A, the facility is situated closer to residential properties. In Location B, the headworks facility is located along the southern portion of the property, across the street from public baseball fields. Location B has been identified as the preferred location for the headworks facility.

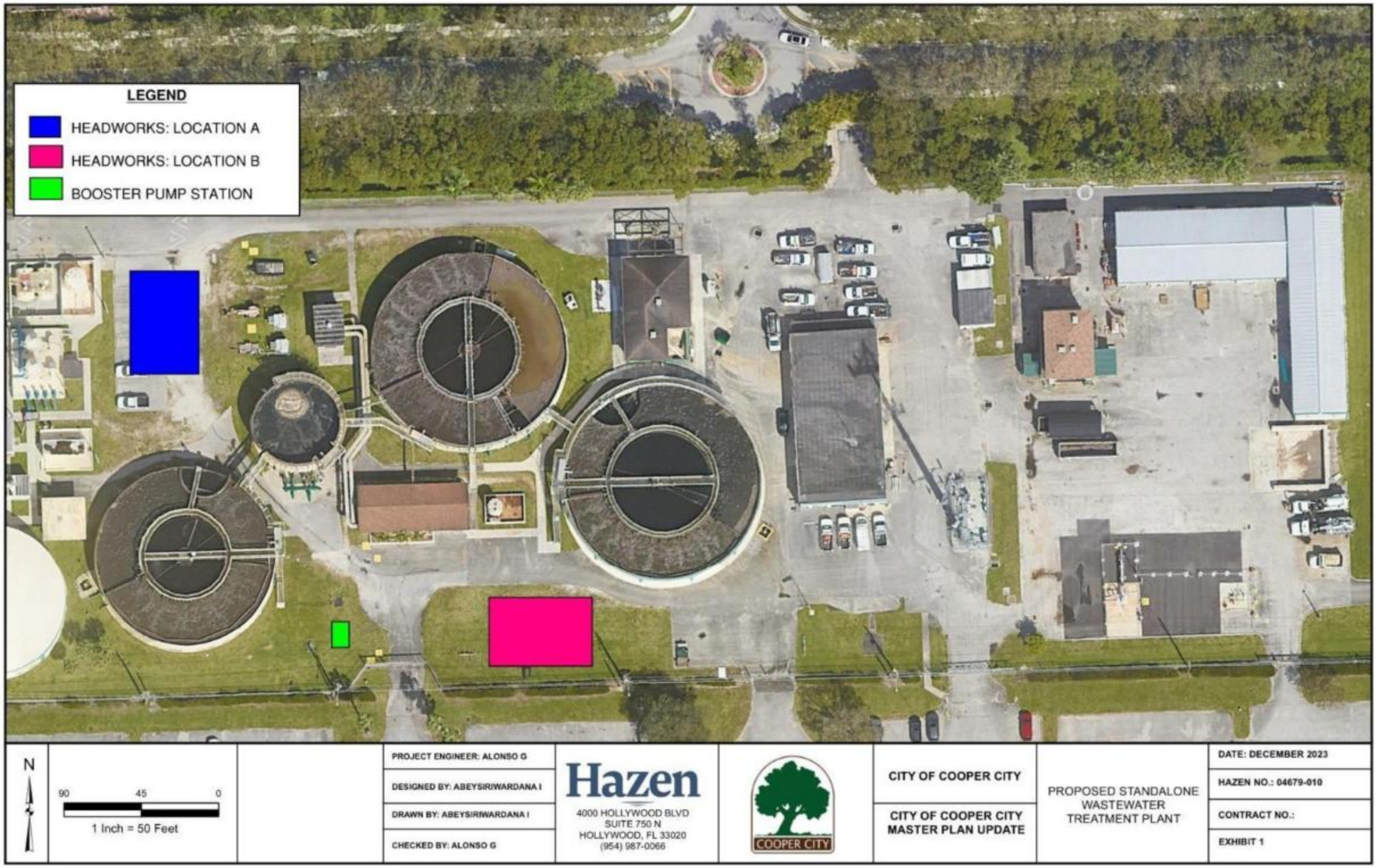

Figure 2-4: Proposed Locations for Cooper City WWTP Headworks

2.3 Scope of Study

The scope of this FP is to provide the information necessary to obtain SRF funding for implementation of the headworks project included in the City's Capital Improvement Plan and identified in this FP. The scope of the plan is described below:

- Inventory of existing wastewater facilities, service area characteristics, and environmental conditions.
- Establish design needs for the planning period.
- Identify and evaluate headworks design alternatives to meet planning-year hydraulic, operational, and regulatory requirements.
- Recommend the most cost-effective, environmentally sound facilities to meet the planning needs.
- Describe recommended facilities and their cost.
- Present a schedule of implementation of the recommended facilities.
- Identify any adverse environmental impacts and propose mitigating measures.

This FP includes the information noted in Clean Water SRF Planning Requirements based on Section 62-503.700(2) FAC. This information is incorporated in the following sections, outlined below:

- Executive Summary – Summary of project and estimated cost.
- Introduction – Background of project and associated need with location map.
- Existing Conditions – Review existing conditions, planning area characteristics, and existing and projected wastewater flows.
- Development of Alternatives and Cost Comparison – Summary of various alternatives and cost for project proposed for funding.
- Selected Alternative– Cost comparison of selected project.
- Implementation and Compliance with Funding Requirements – Review of public participation process, financial feasibility, schedule and adopting resolution.

3. Existing Conditions

3.1 Location and Service Area

The City's WWTP is located at 11791 SW 49th St, Cooper City, FL 33330, in Broward County. The City's wastewater collection system serves residents in 5,337 acres of commercial and residential area using 90.7 miles of gravity sewer mains, 33.4 miles of force mains, 2,201 manholes, 83 City-owned lift stations, and 10 private lift stations. The service area of the City's collection system is shown in **Figure 3-1** on the following page.

3.2 Existing Wastewater Treatment Plant

The WWTP receives raw influent through two influent force mains, a 10-inch force main and a 16-inch force main, which manifold upstream of one magnetic flow meter for continuous flow monitoring. The influent is conveyed to a surge tank with a maximum capacity of approximately 300,000 gallons. Large debris is removed from the raw influent before it enters the surge tank via a coarse manual bar screen with ¾-inch spacing. Captured screenings are manually collected multiple times a day and disposed of in a trash can, which City personnel empties into on-site dumpsters for landfill disposal. This is a major, labor-intensive process that is inefficient and does not align with best practices for a WWTP of this size. A ferric/ferrous sulfate solution is dosed into the surge tank for odor control, as described in Section 3.2.1.

Three package plants located downstream of the surge tank provide biological treatment. Influent is transferred to the package plants via the influent transfer pump station. A bypass is available to transfer influent directly to the package plants using the pressure available in the influent force main when the surge tank is out of service. Each package plant influent line is equipped with a magnetic flow meter for continuous flow monitoring.

The package plants were each originally designed with a capacity of 1.42 mgd maximum three-month average daily flow (MTMADF). Each package plant includes a second manual coarse bar screen with ½-inch spacing, an activated sludge basin capable of operating in extended aeration and contact stabilization modes, a secondary clarifier, and a chlorine contact tank. Similar to the screenings collected at the surge tank, screenings captured at the second manual coarse bar screens are also manually removed and disposed of in on-site dumpsters by City personnel.

Under normal operating conditions, the surge tanks and all three package plants are in service, with flow proportionally distributed among the plants. Effluent from the package plants is routed to the East Lagoon for equalization prior to discharging into either the City of Hollywood WWTP's effluent disposal pump station for filtration to reclaimed water quality or for disposal to the City's on-site deep injection well.

A schematic of the WWTP process flow, including the proposed WWTP process flow diagram is presented in **Figure 3-2**. A labeled aerial view of the existing WWTP site is provided in **Figure 3-3**.

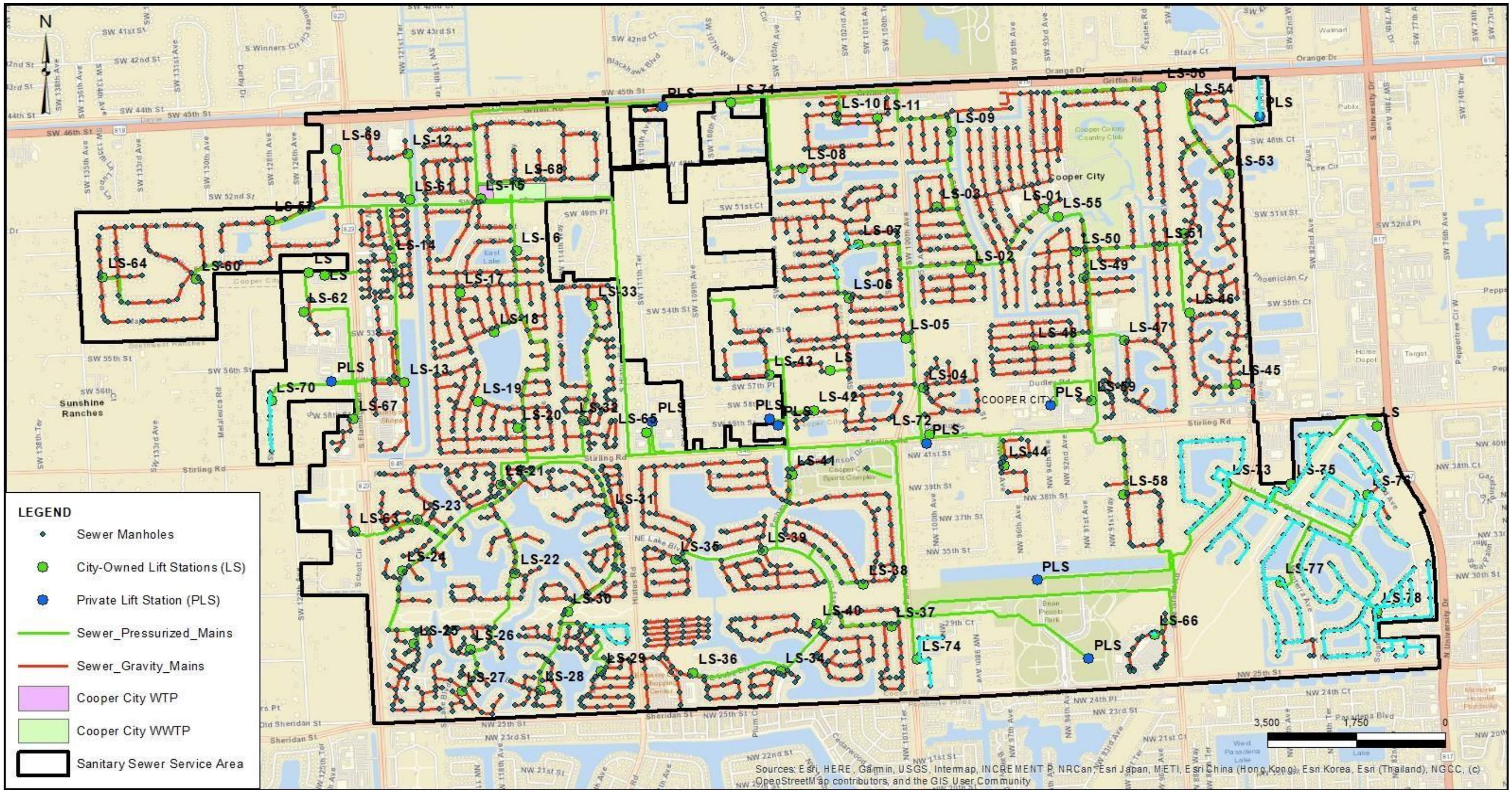

Figure 3-1: Wastewater Service Area Map

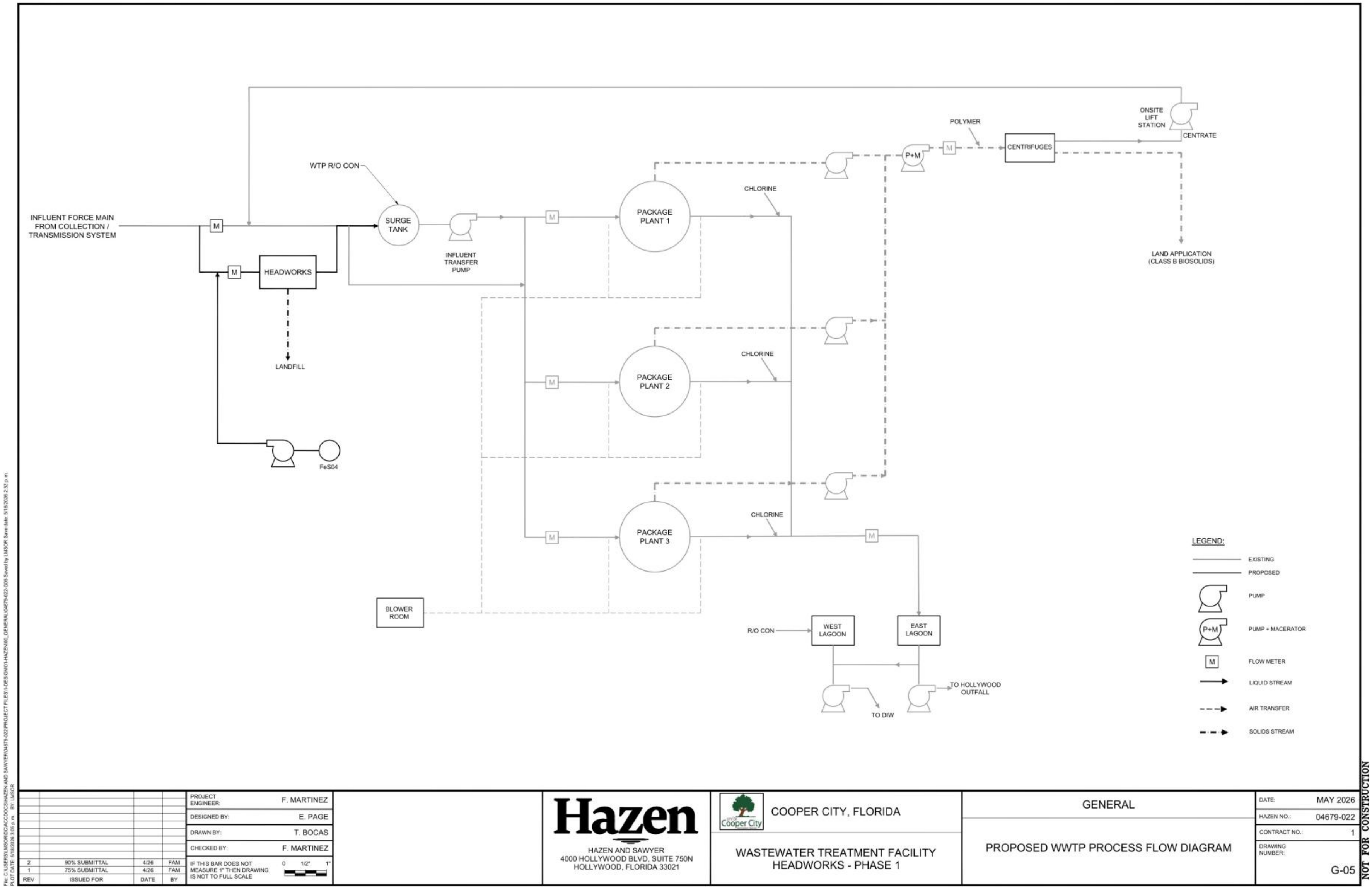

Figure 3-2: Proposed WWTP Process Flow Diagram

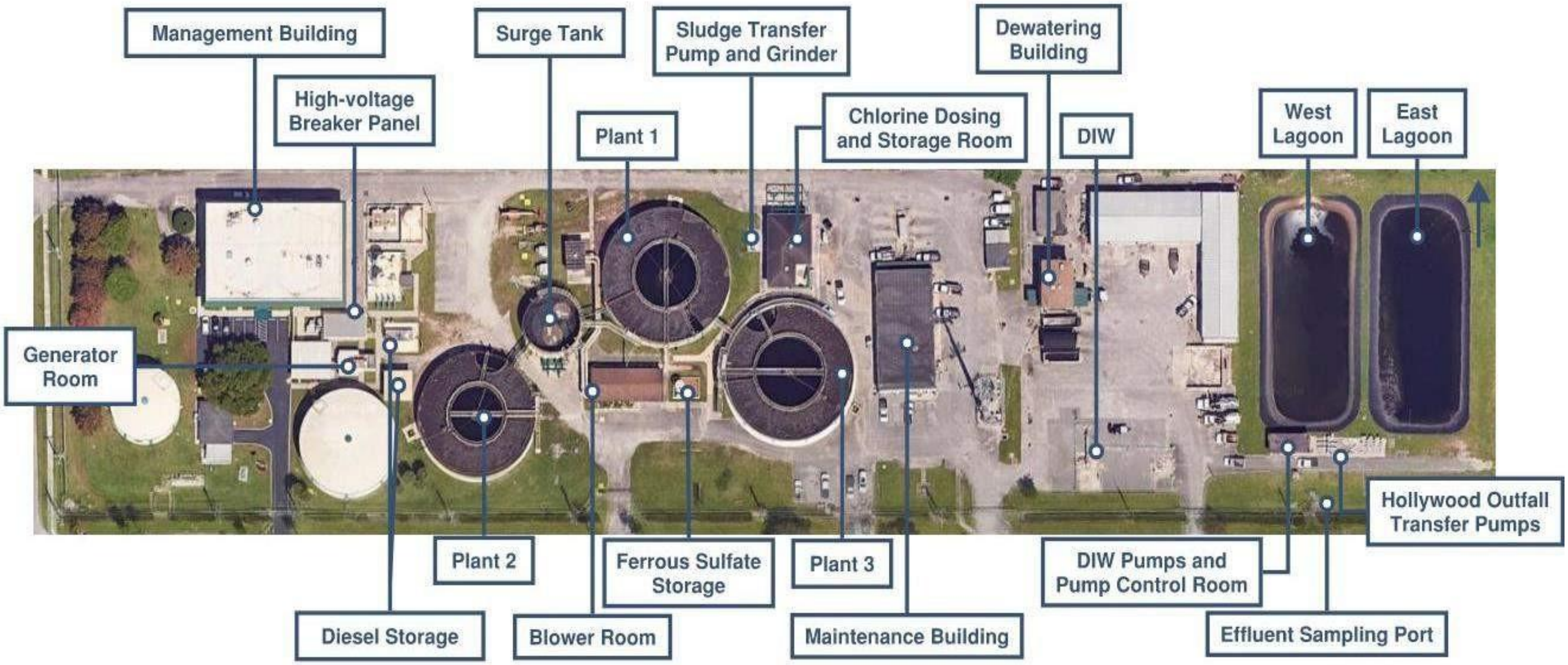

Figure 3-3: Existing WWTP Site Aerial

3.3 Existing Odor Control System

The WWTP currently utilizes a ferric/ferrous sulfate dosing system for odor control, with injection occurring at the surge tank. As shown in **Figure 3-3**, the system includes two chemical metering pumps that are controlled based on influent flow. Each pump operates at two speed settings depending on demand. The location of the feed system, labeled "Ferrous Sulfate Storage," is shown in **Figure 3-3.**

While the WWTP has a long history of ferrous sulfate dosing, the City has outsourced both the supply and maintenance of the system to Kemira. Kemira provides their proprietary ferric/ferrous sulfate solution, Odo-Free, and manages its dosing, which is currently approximately 72 gallons per day.

3.4 Operations and Maintenance

The WWTP is currently operated and maintained by City personnel in accordance with existing operation and maintenance (O&M) manuals and applicable FDEP permit requirements. Routine O&M activities include continuous monitoring of treatment performance, preventative and corrective maintenance of mechanical and electrical equipment, and regulatory reporting to maintain compliance with effluent and operational permit limits.

Coarse screening at the surge tank and package plants is currently performed through routine manual operation and maintenance activities. Debris is manually raked from each of the four bar screens four times per day and placed into a container. The collected screenings are then carried down the stairs and disposed of in an on-site dumpster, which is periodically hauled off-site for disposal at a permitted landfill. The City has the managerial and technical capacity to operate and maintain the WWTP.

3.5 Historical and Projected Population

The baseline population forecasts were determined in the Cooper City 2024 WWMP Update. The City's population was approximately 34,563 in 2020. Using a 2% growth rate per five-year period, the population is projected to increase to nearly 38,143 by 2045. **Table 3-1** presents the historical and predicted population calculations for the City.

Table 3-1: Summary of Population Estimation for 2024 WWMP Update - Cooper City

Source	Year									
	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045
Cooper City - SFWMD 2023 LEC WSP	31,300	31,512	31,682	31,880	32,064	32,248	32,893	33,551	34,222	34,907
Cooper City - Census 2020 (escalated by 2% per 5 years)	34,401	34,951	35,055	35,078	35,083	35,089	35,791	36,507	37,237	37,981
Cooper City - Additional Population Served Outside of City[1]	162	162	162	162	162	162	162	162	162	162
Cooper City - Used in 2024 Water and Wastewater Master Plan Update	34,563	35,113	35,217	35,240	35,245	35,2512	35,953	36,669	37,399	38,143

Notes:

[1] *Based on out of City accounts provided by the City. Assumed single-dwelling units where no data is available on the Broward County Property Appraiser website. Additionally, assumed 3.06 persons per household as per Census data for Cooper City.*

[2] *The 2007 Cooper City 20-Year Water and Wastewater Capital Improvement Master Plan estimated a population of 38,776 in 2025.*

3.6 Historical and Projected Flows

The wastewater flow projections are based on the population projections shown in **Table 3-1** and as developed in the Cooper City 2024 WWMP Update. The per capita wastewater generation from 2019-2022, calculated based on the population in the WWTP's service area and the historic WWTP influent flows, are summarized in **Table 3-2**. The per capita wastewater flows calculated are comprised of the base flow, which is generated from service connections in the collection system, groundwater infiltration, and wet weather flow. A summary of the flow assessment is presented in **Figure 3-4.**

Table 3-2: Historic Per Capita AADF

Year	Population	Historical Data		
		Measured AADF (mgd)	Per Capita AADF (gal/d)	Measured MTMADF (mgd)
2018	33,933	2.49	73.3	2.70
2019	34,024	2.51	73.9	2.58
2020	34,563	2.62	76.0	3.07
2021	35,113	2.63	74.9	2.99
2022	35,217	2.61	72.8	2.89

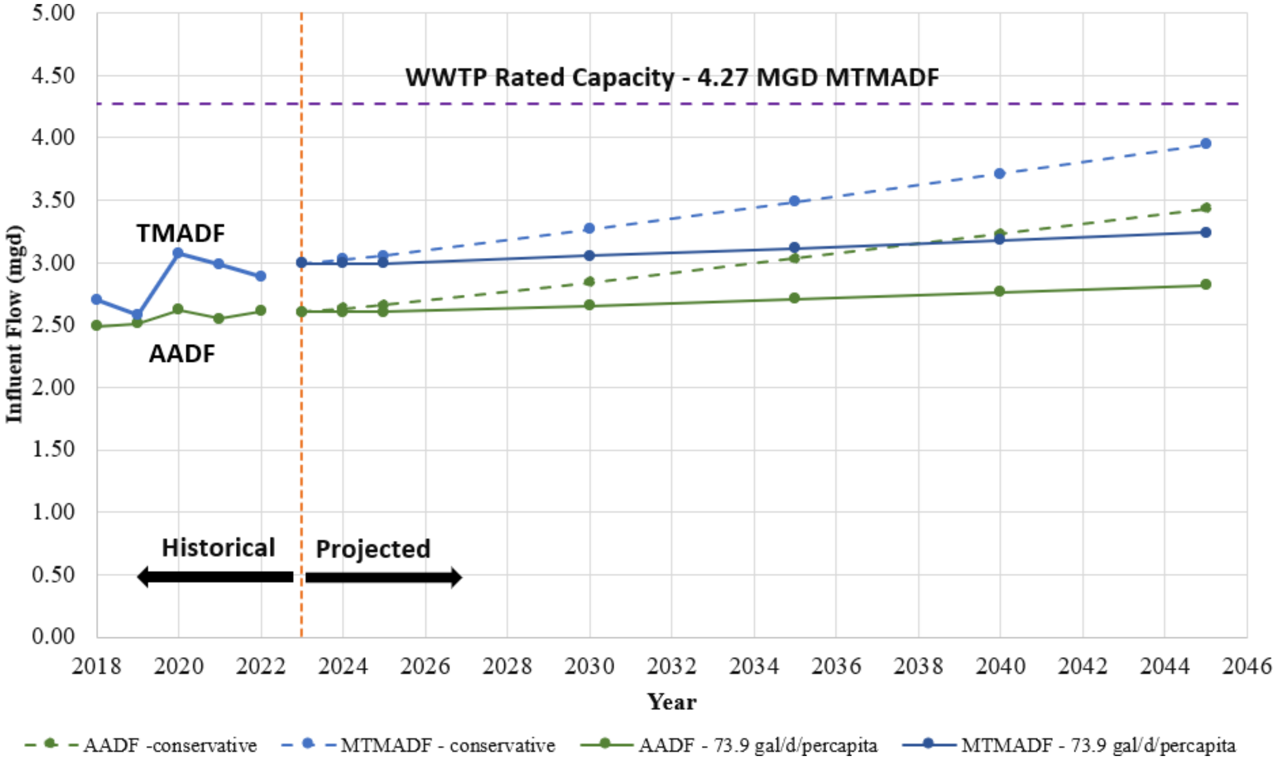

Figure 3-4: Estimated WWTP Flow Projections

4. Development of Alternatives and Cost Comparison

4.1 Purpose

The WWTP has limitations in preliminary treatment due to the absence of a dedicated headworks facility. Coarse screening is currently performed manually using a ¾-inch manual bar screen located upstream of the surge tank and ½-inch manual bar screens located at each package treatment units. Collected debris is removed multiple times per day by WWTP personnel and disposed of in on-site dumpsters, making the process labor-intensive and inefficient for a facility of this size. Effective preliminary treatment is essential for maintaining stable operations, achieving consistent effluent quality, and reducing downstream O&M requirements.

Condition assessments further indicate that Package Treatment Plant No. 1, a 52-year-old welded steel structure, has exceeded its typical service life and exhibits significant corrosion, structural deformation, and aged screening equipment that requires cleaning up to four times per day. The facility has limited instrumentation and controls, with SCADA monitoring available for total airflow and effluent flow but no automated controls to improve operational safety or efficiency.

These limitations result in increased downstream maintenance, higher labor demands, and reduced ability to effectively manage influent solids. Screenings and grit that are not removed accumulate throughout the treatment process, reducing available treatment volume and requiring additional removal and disposal costs by the City. To address these challenges, three alternatives are evaluated in the following section.

4.2 Alternative 1 - No Action

Under Alternative 1, no improvements would be made to the existing preliminary treatment facilities at the Cooper City WWTP, and the current manual coarse screening practices would remain in operation. The WWTP would continue to operate without a dedicated headworks facility, relying on labor-intensive manual bar screens and without grit removal capability. The SCADA monitoring would remain the same. If no action is taken, the existing operational inefficiencies, increased maintenance requirements on downstream processes, and reliance on manual labor would continue and are expected to worsen over time. This alternative does not address the identified deficiencies; therefore, this alternative was not evaluated further.

4.3 Alternative 2 – Headworks with Coarse Screens, Fine Screens and Grit Removal

Alternative 2 includes construction of a new headworks facility incorporating mechanical coarse and fine screening, a grit removal system, influent metering, and odor control provisions. The proposed headworks system would include two multi-rake bar screens for the coarse screening step. The coarse screens would maintain spacing similar to the existing screens but with automated operation to improve reliability and reduce operator effort. Downstream, two center-flow band screens would provide fine screening to enhance removal of rags and smaller debris. Screenings from both processes would be conveyed via enclosed systems for disposal, minimizing odors and operator handling. The proposed headworks facility would also include a dedicated bypass channel to allow flow diversion during maintenance or high-flow conditions, reducing the risk of sanitary sewer overflows. The coarse and fine screens will each have a dedicated vendor-supplied control panel which will be integrated into the existing WWTP SCADA system via fiber-optic Ethernet communication.

The inclusion of a grit removal system would further improve headworks performance by removing sand, gravel, and other dense inorganic materials that would otherwise cause abrasion and accumulate in downstream units. Effective grit removal would reduce wear on pumps and mechanical equipment, minimize deposition in process basins, and preserve available treatment volume. Collectively, these improvements would reduce maintenance requirements, lower lifecycle costs, and enhance overall reliability and operability of the WWTP. A cost estimate for Alternative 2 is included in **Table 4-1**.

Table 4-1: Alternative 2 – Cost Estimate

Description	Total (2026 $)
Yard Piping	$627,200
Headworks Structure	$1,512,500
Multi-Rake Coarse Screens	$1,225,765
Center-Flow Band Screens	$1,512,000
Manual Bar Screen (Bypass Channel)	$112,000
Grit Removal System	$1,176,200
Odor Control System	$1,012,500
Isolation Gates	$365,690
Site Restoration	$281,250
Electrical Modifications	$461,250
Instrumentation and Controls	$393,900
Startup and Testing	$45,000
Direct Cost Subtotal	$8,725,255
Bonds and Insurance (3%)	$261,760
Mobilization / Demobilization (5%)	$436,270
General Conditions (5%)	$436,270
Permit Fee Allowance (5%)	$436,270
Contingency (10%)	$872,525
Construction Subtotal	$11,168,360
Construction, Engineering and Inspection (10%)	$1,116,840
TOTAL PROJECT COST	**$12,285,200**

4.4 Alternative 3 – Headworks with Fine Screens and Provisions for a Future Grit Removal System

Alternative 3 includes the addition of a dedicated headworks facility, incorporating mechanical fine screening with conveyor-fed disposal to dumpsters, flow-metering, odor control measures, a dedicated bypass channel to provide operational redundancy and an odor control system. The installation of mechanical fine screens would allow significantly greater capture of debris entering the WWTP, such as rags, thereby improving downstream process performance and reducing the presence of screenings currently encountered throughout the treatment process. Replacement of the existing labor-intensive manual coarse screens with mechanical fine screens would substantially reduce operator effort and routine O&M requirements. The proposed headworks system will include two mechanical bar screens with a vendor-supplied control panel and a manual emergency bypass screen, all coordinated through a new Main Control Panel integrated into the existing WWTP SCADA system via fiber-optic Ethernet communication.

The proposed headworks facility would also allow for future installation of a grit removal system. Effective grit removal is essential to protect downstream equipment from abrasion and impact damage and to prevent the accumulation of grit in process tanks, which reduces available treatment volume. The City has experienced recurring damage to pump impellers due to grit and currently incurs ongoing costs to remove grit from the surge tank and package treatment plants. Incorporating provisions for grit removal would address these issues and improve long-term operational reliability.

In addition, the headworks facility would include a dedicated bypass capable of routing flow around the screening and future grit removal processes as needed, reducing the potential for sanitary sewer overflows during high-flow events or equipment outages. Combined with odor control improvements, these enhancements would improve operational flexibility, reduce odors, and increase overall reliability of the influent treatment processes. A cost estimate for Alternative 3 is included in **Table 4-2**.

Table 4-2: Alternative 3 – Headworks Cost Estimate

Description	Total (2026 $)
Yard Piping	$627,200
Headworks Structure	$1,512,500
Center-Flow Band Screens	$1,512,000
Manual Bar Screen (Bypass Channel)	$112,000
Odor Control System	$1,012,500
Isolation Gates	$365,690
Site Restoration	$281,250
Electrical Modifications	$461,250
Instrumentation and Controls	$393,900
Startup and Testing	$45,000
Direct Cost Subtotal	$6,323,290
Bonds and Insurance (3%)	$189,700
Mobilization / Demobilization (5%)	$316,170
General Conditions (5%)	$316,170
Permit Fee Allowance (5%)	$316,170
Contingency (10%)	$632,329
Construction Subtotal	$8,093,830
Construction, Engineering and Inspection (10%)	$809,390
TOTAL PROJECT COST	**$8,904,000**

4.5 Alternatives Cost and Life-Cycle Cost Comparison

A life-cycle cost comparison using a present value analysis was conducted for the WWTP Headworks project alternatives (except for the no action alternative, as this would be of no cost). The present value analysis took into consideration capital costs, O&M costs, and salvage value presented on the below formula.

$$Present\ Value = Capital\ Cost + O\&M\ Cost * \frac{(1+i)^n}{i(1+i)^n} + Salvage\ Cost * \frac{1}{(1+i)^n}$$

The assumed interest rate (i) was 4% and the analysis covered a 30-year period. The useful life is estimated to be 50+ years, found by utilizing the American Water Works Association (AWWA) Effective Useful Life Tool. The effective useful life of a structure, such as a headworks facility, is within the low and average range of 40-61 years, respectively. In addition, the salvage value for new or rehabilitated infrastructure alternatives was assumed to be 40% of the capital cost at the end of the 30-year planning period (n) and 0%

for "no action" alternative. The O&M costs were determined by using current O&M cost data and calculating an estimate. Data for the capital cost estimates were based on reference reports and engineering judgement. **Table 4-3** provides a summary of the present value analysis for the different options for the City.

Table 4-3: Present Value Cost

Alternative	Capital Cost	O&M Cost	Salvage Value	PV O&M Cost	PV Salvage Value	Present Value
Headworks with Coarse Screens, Fine Screens and Grit Removal	$12,285,200	$48,000	$20,000	$831,000	$7,000	$13,200,000
Headworks with Fine Screens and Provisions for a Future Grit Removal System	$8,904,000	$48,000	$20,000	$831,000	$7,000	$9,800,000

The current screening system consists of manually cleaned bar screens located at the headworks. Operations staff manually rake the bar screens three (3) times per day, seven (7) days per week, to remove accumulated debris and maintain hydraulic capacity. Debris removed from the bar screens is collected in garbage cans positioned beneath each screen. The collected screenings are subsequently removed using a backhoe and disposed of in onsite dumpsters approximately four (4) times per week. Despite routine cleaning of the bar screens, a significant amount of debris bypasses the screening system and accumulates within the wastewater surge tank. When debris accumulation reaches a level that impacts operations, a specialized subcontractor is retained to perform debris and rag removal from the surge tank. Following subcontractor cleaning activities, City personnel must remove residual sediment and grit that settles within the surge tank. This process requires rental of a skid steer and is typically completed over a four-day period utilizing four (4) employees. **Table 4-4** details the O&M activity, estimated annual hours, and estimated annual cost.

Table 4-4: Current Headworks O&M Annual Labor and Costs

Activity	Annual Labor Hours	Estimated Annual Cost
Manual bar screen raking	728	$21,840
Screenings collection and disposal	208	$6,240
Surge tank debris removal subcontractor	N/A	$30,000
Surge tank sediment removal by City staff	128	$3,840
Total	**1064**	**$61,920**

Under the alternatives, raking of the manual bar screens will be completely eliminated as routine O&M as the proposed screens are automated. The manual bar screen provided will only be used in emergency scenarios; therefore, manual raking will not be part of routine operations. However, the new screens will require routine O&M, including periodic inspection, routine lubrication, and scheduled preventative maintenance of motors, chains, and associated equipment. Operators will conduct regular visual inspections to confirm proper operation, remove any accumulated debris on accessible surfaces, and verify that spray wash systems are functioning effectively. The screening panels will require periodic rinsing to prevent blinding and maintain hydraulic capacity, while routine maintenance of drive components will ensure continued reliability and performance. Based on typical operation of mechanical fine screens, these activities are estimated to require approximately 0.5 to 1.0 hours per day, or on the order of 180 to 365 labor hours annually for both screens combined. Overall, implementation of two mechanical center-flow band screens will significantly reduce the labor intensity associated with screening operations. Automated screening will minimize the volume of debris bypassing the system, thereby reducing accumulation in the surge tank and eliminating the need for frequent manual cleaning and handling of screenings. As a result, downstream debris removal by subcontractors is expected to be reduced substantially. Grit and sediment removal within the surge tank will continue to be required until the proposed grit removal system is placed into service. Once the grit removal facilities are operational, the accumulation of solids within downstream structures will be significantly reduced, and the need for subcontracted cleaning and City-performed sediment removal will be greatly minimized, both in frequency and effort. Once installed, routine O&M will be required for the grit removal system, including periodic inspection, flushing, and removal of incidental debris or sediment accumulation as needed. These activities are estimated to require approximately 50 to 100 labor hours annually. **Table 4-5** details the O&M costs for the alternative projects.

Table 4-5: Current Headworks O&M Annual Labor and Costs

Activity	Annual Labor Hours	Estimated Annual Cost
Screening System O&M	365	$10,950
Surge tank debris removal subcontractor *	N/A	$30,000
Surge tank sediment removal by City staff *	128	$3,840
Future Grit System O&M	100	$3,000
Total	**593**	**$47,790**

Note:

** will be eliminated upon installation of the grit removal system*

5. Selected Plan

5.1 Description

Alternative 3 has been selected as the preferred approach for upgrading the Cooper City WWTP. This Alternative consists of constructing a new, dedicated headworks facility incorporating mechanical fine screening, flow metering, odor control, a dedicated bypass channel for operational redundancy, and provisions for a future grit removal system. The headworks facility will be designed to accommodate the WWTP's permitted treatment capacity of 4.27 mgd TMADF.

The installation of mechanical fine screens will significantly improve the capture of debris such as rags, thereby reducing solids carryover to downstream processes and improving overall treatment performance. Replacement of the existing labor-intensive manual screening processes with automated systems will reduce operator effort and improve reliability. Provisions for future grit removal will allow the City to address ongoing grit-related impacts, including equipment wear and accumulation in process tanks, while supporting long-term operational flexibility. Additional details on the headworks facility design are provided in the Preliminary Design Report (PDR) included in **Appendix C**.

Implementation of a headworks facility is consistent with the City of Cooper City's 2024 WWMP Update, which identifies the need to improve preliminary treatment to protect existing and future wastewater treatment assets. This alternative supports planned improvements to the treatment process, accommodates projected flows, and provides a centralized, maintainable solution that enhances system resiliency while minimizing modifications to the biological treatment infrastructure. The selected alternative will maximize the potential for water and energy efficiency by considering the cost of constructing, operating and maintaining, and replacing the project or activity. The rendering of the proposed headworks facility and the corresponding process flow diagram are provided in **Figure 5-1** and **Figure 5-2**, respectively.

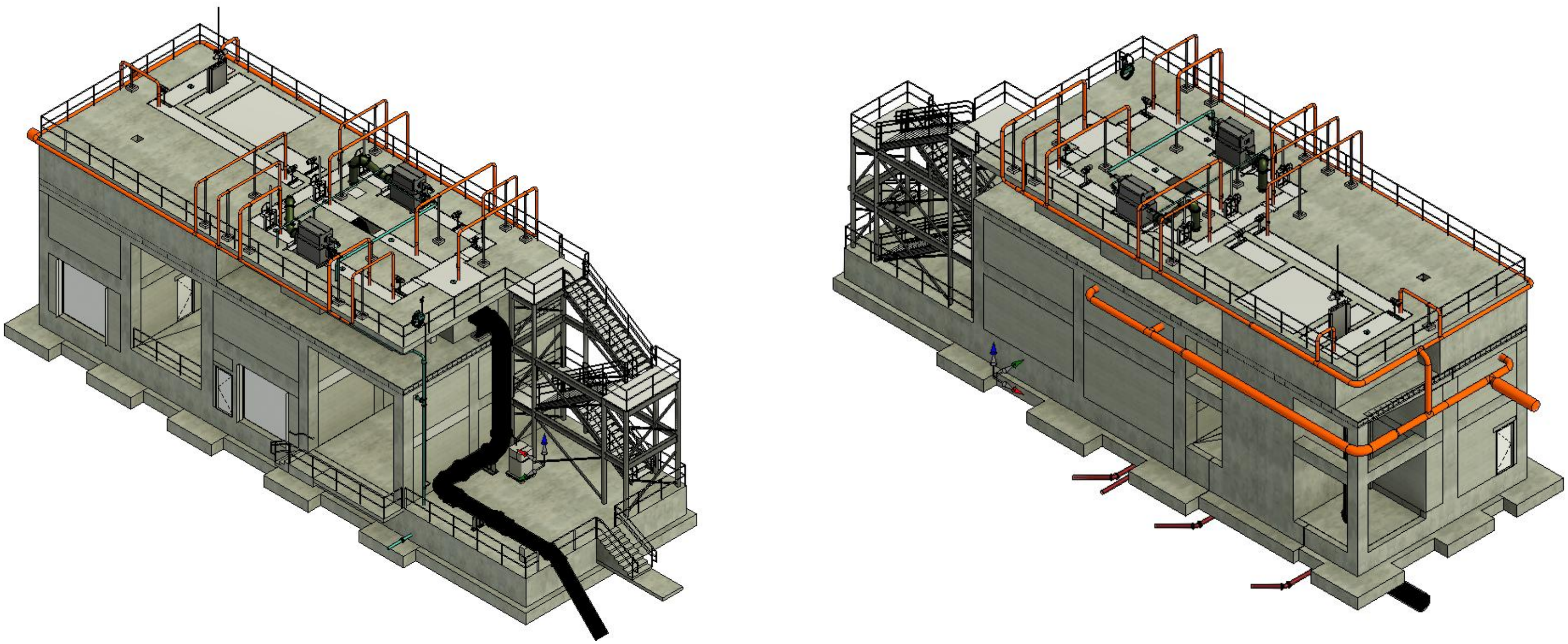

Figure 5-1 Headworks Renderings

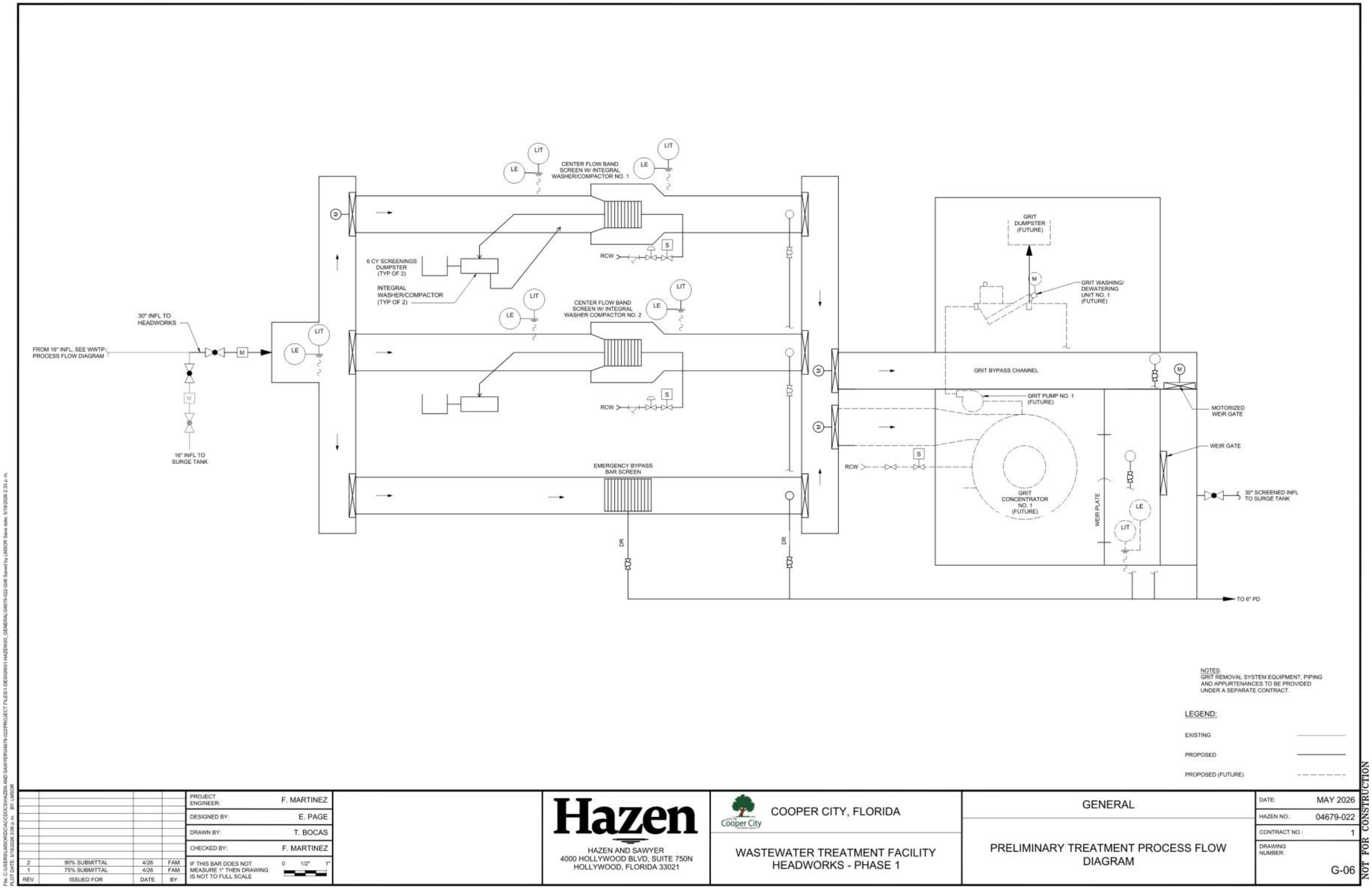

Figure 5-2: Selected Headworks Process Flow Diagram

5.2 Reason For Selection

Alternative 3 provides the best solution to address the WWTP's preliminary treatment limitations. Compared to Alternative 1 (No Action), it eliminates manual screening, improves screenings capture, and reduces the risk of influent-related overflows and operational disruptions during wet-weather events. The City currently experiences reduced treatment capacity due to accumulated grit and increased downstream maintenance from grit-related wear. This alternative also includes provisions for a future grit removal system to address these issues.

Compared to Alternative 2, which includes coarse and fine screening with immediate grit removal, Alternative 3 was selected as a more cost-effective, phased approach that addresses critical deficiencies while maintaining flexibility for future improvements. The key differences are the inclusion of a coarse screening step and installation of grit removal during initial construction under Alternative 2. Installation of two fine center-flow band screens and one channel with a manual bar screen under Alternative 3 provides enhanced screening and improved debris handling, reducing downstream maintenance and improving system reliability. A separate coarse screening step is not necessary, as it is typically recommended where solids larger than 3 inches in diameter are present. This is not expected in a fully pumped municipal collection system. Deferring grit removal allows the City to implement it as needed, optimizing capital expenditures and aligning with long-term planning. Overall, Alternative 3 provides a cost-effective and adaptable solution for current and future treatment needs.

5.3 Operations and Maintenance

Under Alternative 1, existing O&M requirements would remain unchanged, as no modifications to the current facilities are proposed. The City would continue to rely on manual coarse screening at the surge tank and package plants, including frequent manual raking, handling, and disposal of screenings, along with ongoing manual removal of rags and debris throughout downstream treatment processes. Under this Alternative, the City would also need to continue to routinely remove the accumulated screenings and grit within the surge tank and treatment units.

In contrast, Alternatives 2 and 3 would significantly reduce the frequency and labor intensity of O&M activities associated with influent screening. Installation of mechanical fine screens would eliminate the need for manual cleaning of debris from the screens, which is currently performed up to 12 times per day, and will substantially reduce the quantity of rags and debris carried through the treatment process. Typical O&M required for mechanical fine screens include periodic inspection, routine lubrication, and scheduled preventative maintenance of motors, belts, and conveyors. As a result, staff time dedicated to manual screening and downstream debris removal would be minimized, improving operational efficiency, safety, and reliability.

Alternative 3 would require less routine maintenance as compared to Alternative 2 as addition of two coarse screens would involve additional maintenance.

5.4 Environmental Impact

This project will not result in any negative environmental impacts. Since it will be constructed at the existing wastewater facility, inside the fence as presented in **Figure 2-4**. There are no immediate agricultural lands, wetlands, major surface water bodies, or undisturbed natural areas surrounding the plant location.

The proposed project will not have any significant adverse effects upon flora, fauna, threatened or endangered plant or animal species, surface water bodies, prime agricultural lands, wetlands, or undisturbed natural areas. The U.S. Fish and Wildlife Endangered and Threatened Species Report for Broward County is included in **Table 5-1.** The threatened and endangered species are not anticipated to be at the project location, as this is within the wastewater treatment facility.

Table 5-1: Threatened and Endangered Species in Broward County

Scientific Name	Common Name	ESA Listing Status	Lead Region	Group
Calidris canutus rufa	rufa red knot	Threatened	5	Birds
Danaus plexippus	Monarch butterfly	Proposed Threatened	3	Insects
Laterallus jamaicensis	Eastern Black rail	Threatened	4	Birds
Perimyotis subflavus	Tricolored bat	Proposed Endangered	5	Mammals
Charadrius melodus	Piping Plover	Threatened	5	Birds
Charadrius melodus	Piping Plover	Threatened	5	Birds
Eretmochelys imbricata	Hawksbill sea turtle	Endangered	4	Reptiles
Polygala smallii	Tiny polygala	Endangered	4	Flowering Plants
Aphelocoma coerulescens	Florida scrub-jay	Threatened	4	Birds
Mycteria americana	Wood stork	Recovery	4	Birds
Peromyscus polionotus niveiventris	Southeastern beach mouse	Threatened	4	Mammals
Alligator mississippiensis	American alligator	Similarity of Appearance (Threatened)	4	Reptiles
Gopherus polyphemus	Gopher tortoise	Resolved Taxon	4	Reptiles
Puma (=Felis) concolor (all subsp. except coryi)	Puma (=mountain lion)	Similarity of Appearance (Threatened)	4	Mammals
Dermochelys coriacea	Leatherback sea turtle	Endangered	4	Reptiles
Caracara plancus audubonii	Crested caracara (Audubon's) [FL DPS]	Threatened	4	Birds

Scientific Name	Common Name	ESA Listing Status	Lead Region	Group
Crotalus adamanteus	Eastern diamondback rattlesnake	Under Review	4	Reptiles
Crocodylus acutus	American crocodile	Threatened	4	Reptiles
Drymarchon couperi	Eastern indigo snake	Threatened	4	Reptiles
Eumops floridanus	Florida bonneted bat	Endangered	4	Mammals
Dryobates borealis	Red-cockaded woodpecker	Threatened	4	Birds
Caretta caretta	Loggerhead sea turtle	Threatened	4	Reptiles
Puma (=Felis) concolor coryi	Florida panther	Endangered	4	Mammals
Jacquemontia reclinata	Beach jacquemontia	Endangered	4	Flowering Plants
Pterodroma hasitata	Black-capped Petrel	Endangered	4	Birds
Rostrhamus sociabilis plumbeus	Everglade snail kite	Endangered	4	Birds
Trichechus manatus	West Indian Manatee	Threatened	4	Mammals
Chelonia mydas	Green sea turtle	Threatened	4	Reptiles
Dendrophylax lindenii	Ghost orchid	Proposed Endangered	4	Flowering Plants
Lepidochelys kempii	Kemp's ridley sea turtle	Endangered	2	Reptiles

The water surrounding the WWTP is under a Bacteria Pollution Control Plan (BPCP) as seen in **Figure 5-3**, meaning that there are ongoing efforts to restore impaired waters by reducing pollutant loads. The addition of a headworks will help the wastewater system to be more efficient and can help reduce sanitary sewer overflows (SSOs) that lead to pollution. It will not cause more pollution to water bodies.

Figure 5-3: FDEP Bacteria Pollution Control Plan for Cooper City

A review of demographic and socioeconomic conditions was conducted to evaluate whether the proposed project would have adverse human health or environmental effects on minority or low-income communities. Demographic data from the U.S. Census Bureau indicates that Cooper City has a higher median household income at $132,000 and a lower poverty rate of 5%. Using the U.S. Census Tract, the average interest rate is also low at 2.5%. The Cooper City Zoning Map shows that the headworks facility will be built within the public utility zone and is surrounded by single and multi-family zoning area. The construction will stay within the permit requirements. The proposed project will not have any significant adverse human health or environmental effects on minority or low-income communities. Minor short-term impacts may occur during construction, such as increased noise levels and increased airborne particulates, but no long-term adverse effects are anticipated. The long-term impacts of this project are beneficial. The WWTP will be able to meet current and future flow conditions and provide a high-quality effluent.

Two of the most recently recorded SSOs, occurring in 2023 and 2024, were associated with abnormal wet-weather conditions that caused influent flow restrictions at or near the influent box area. These events involved relatively small volumes of raw wastewater discharged to ground within a self-contained facility and did not impact surrounding water bodies. The proposed project directly mitigates these conditions by increasing preliminary treatment capacity and improving hydraulic conveyance at the influent headworks, thereby reducing the risk of influent surcharge and SSOs during peak flow events.

The addition of a centralized headworks facility provides environmental benefits by improving the pretreatment of raw wastewater by removing debris, rags, and grit from the influent wastewater prior to biological treatment. This leads to improving downstream process performance and capacity, and effluent quality. Effective preliminary treatment reduces the potential for process upsets, solids carryover, and unplanned bypasses, which lowers the risk of pollutant releases to receiving waters. By protecting treatment units from excessive wear and accumulation of inert materials, a headworks also supports more consistent biological treatment, improved solids management, and reduced energy and chemical demand. Overall, implementation of a headworks enhances treatment reliability and contributes to improved protection of surface water and groundwater resources.

5.5 Floodplain Management

The proposed project was evaluated for compliance with Executive Order 11988 – Floodplain Management, which requires federal agencies and federally assisted projects to avoid, to the extent practicable, long- and short-term adverse impacts associated with the occupancy and modification of floodplains.

The proposed improvements consist of upgrades to the existing headworks facilities at the City of Cooper City Wastewater Treatment Plant. The project will occur within the existing developed footprint of the wastewater treatment facility and will not involve expansion of the treatment plant beyond its current site boundaries.

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Broward County was conducted to determine whether the project is located within a designated 100-year floodplain. According to FEMA FIRM 12011C0545J, which is provided in **Figure 5-4**, the WWTP is located within Zone X.

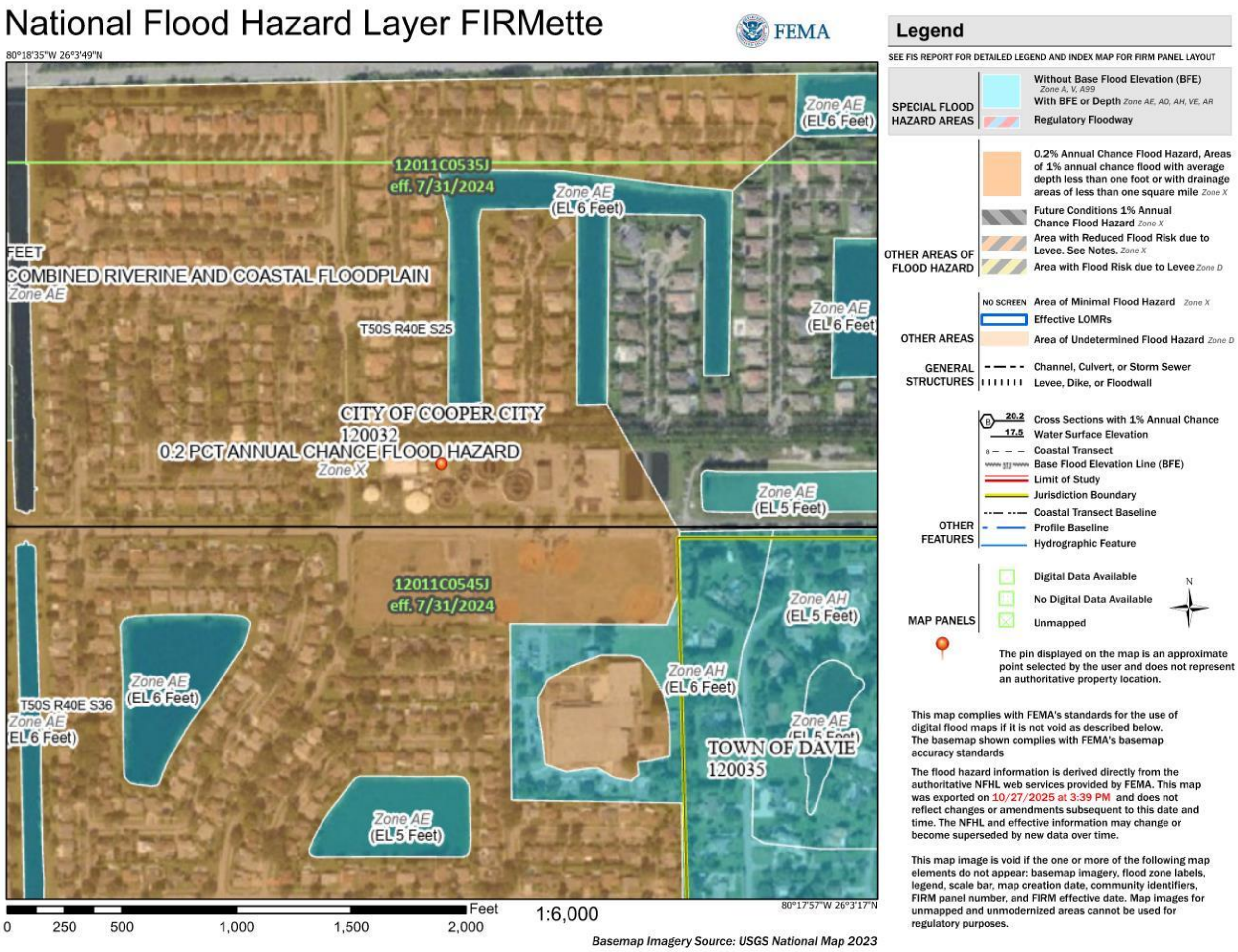

Figure 5-4: FEMA Flood Insurance Map of the Cooper City WWTP Site

Because the project involves improvements to an existing public wastewater facility, relocation outside of the existing site is not considered practicable. The proposed improvements will be designed and constructed in accordance with applicable local floodplain management regulations and building requirements, and the project will not result in significant encroachment into the floodplain or increased flood risk. Therefore, the proposed project is considered consistent with the objectives of Executive Order 11988, and no adverse impacts to floodplain functions are anticipated.

6. Implementation and Compliance

6.1 Public Meeting

A public meeting will be held on June 9, 2026, during a City Commission Meeting to present Resolution Facilities Planning Document. The meeting will be noticed and published on the City's website, 14 days prior to the meeting. Resolution adopts the FP for Wastewater funding and designates the authorized representatives. Discussion topics will include the alternatives analysis, the financial impacts to the public, and potential environmental effects. The public and commission will be given an opportunity to speak and comment prior to the adoption of Resolution. Public notice documentation and meeting minutes will be provided following completion of the meeting. Upon Commission approval, an addendum will be submitted to the FDEP, including the adopted resolution, meeting minutes, and documentation of the public notice.

6.2 Regulatory Agency Review

The City's wastewater system has one treatment facility, the Cooper City Wastewater Treatment Plant. The operating permit number is FL0040398.

As part of the review process for this plan and to qualify for an SRF loan, various governmental agencies must approve the manner in which the City will implement the plan. The following agencies, together with the applicable permits required from each, will have the opportunity to review and comment on the plan include:

- FDEP – Domestic Wastewater Construction Permit
- FDEP – Environmental Resource Permit
- FDEP – PWS Water Main Extension GP Notice
- FDEP – Notification/Application for Constructing a Domestic Wastewater Collection / Transmission System
- Broward County Environmental Permitting Division – Broward County Domestic Wastewater License
- Broward County Environmental Permitting Division – Wastewater Construction Permit
- Broward County Environmental Permitting Division – Construction Approval (Development & Environmental Review)
- City of Cooper City Community Development Department (Building Division) – Building Permit
- City of Cooper City Engineering Division – Site Development Permit/Engineering Application
- City of Cooper City Community Development Department/Planning and Zoning Division – General Application

- City of Cooper City Community Development Department/Planning and Zoning Division – Development Review Committee Permit
- Central Broward Water Control District – Modification of Existing SWM Permit OR New Stormwater Management Permit

6.3 Financial Planning

The FDEP SRF loan program is expected to be the main financing source for this project. The City has prepared a capital financing plan for the wastewater project to show the public and state agencies what the financial impact on the users will be. It is anticipated that the City's Utilities Department will pay the cost for the improvements under the existing rates that are now in service. These plans are provided in the **Appendix A**.

6.4 Implementation Schedule

6.4.1 Introduction

An estimated project schedule has been developed to illustrate the duration of the design, procurement, and construction phases. The estimated project schedule will be updated during detailed design. Project milestones are provided in **Table 6-1**.

Table 6-1: Estimated Overall Project Schedule

Task Description	**Duration (months)**	**Start**	**Finish**
Design Phase	9	September 2025	June 2026
Permitting	3	April 2026	June 2026
Bidding and Award Phase	3	July 2026	October 2026
Construction Phase	24	October 2026	September 2028

6.4.2 Detailed Construction Schedule

The Construction Phase includes the construction, testing, and startup of the new headworks and odor control system. Within the Construction Phase, the contractor will have 120 days to obtain permits, including permits for temporary facilities (if applicable). As presented in **Table 6-2**, the construction duration is anticipated to be up to 22 months from issuance of the Notice to Proceed (including submittal review time and material procurement) to Substantial Completion. It is anticipated that the duration between Substantial Completion and Final Completion will be two months.

Table 6-2: Estimated Construction Schedule

Task Description	Substantial Completion (months)	Final Completion (months)	Total Duration (months)
Construction Phase	22	2	24

Appendix A: Capital Financing Plan

CAPITAL FINANCING PLAN

City of Cooper City
(Project Sponsor)
Alex Rey, City Manager
(Authorized Representative and Title)
Cooper City, FL 33328
(City, State, and Zip Code)

Irwin Williams, CFO 954-434-4300 ext. 228
(Capital Financing Plan Contact, Title and Telephone Number)
9090 SW 50th Place
(Mailing Address)
Cooper City, FL 33328
(City, State, and Zip Code)

The Department needs to know about the financial capabilities of potential State Revolving Fund (SRF) loan applicants. Therefore, a financial capability demonstration (and certification) is required well before the evaluation of the actual loan application.

The sources of revenues being dedicated to repayment of the SRF loan are Utility Revenues
(Note: Projects pledging utility operating revenues should attach a copy of the existing/proposed rate ordinance)

Estimate of Proposed SRF Loan Debt Service

Capital Cost*	$8,904,000
Loan Service Fee (2% of capital cost)	178,080
Subtotal	$9,082,080
Capitalized Interest**	272,462
Total Cost to be Amortized	$9,354,542
Interest Rate***	3%
Annual Debt Service	$622,561
Annual Debt Service Including Coverage Factor****	$715,945

* Capital Cost = Allowance + Construction Cost (including a 10% contingency) + Technical Services after Bid Opening.
** Estimated Capitalized Interest = Subtotal times Interest Rate times construction time in years divided by two.
***20 GO Bond Rate times Affordability Index divided by 200.
**** Coverage Factor is generally 15%. However, it may be higher if other than utility operating revenues are pledged.

SCHEDULE OF PRIOR AND PARITY LIENS

List annual debt service beginning two years before the anticipated loan agreement date and continuing at least fifteen fiscal years. Use additional pages as necessary.

IDENTIFY EACH OBLIGATION

#1 N/A **Coverage %** **Insured (Yes/No)**	**#2** **Coverage %** **Insured (Yes/No)**	**#3** **Coverage %** **Insured (Yes/No)**
#4 **Coverage %** **Insured (Yes/No)**	**#5** **Coverage %** **Insured (Yes/No)**	**#6** **Coverage %** **Insured (Yes/No)**

Fiscal Year	Annual Debt Service (Principal + Interest)						Total Non-SRF Debt Service w/coverage	Total SRF Debt Service w/coverage
	#1	**#2**	**#3**	**#4**	**#5**	**#6**		

SCHEDULE OF ACTUAL REVENUES AND DEBT COVERAGE
FOR PLEDGED REVENUE

(Provide information for the two fiscal years preceding the anticipated date of the SRF loan agreement)

		FY 2024	**FY** 2025
(a)	Operating Revenues (Identify)		
	Charges for services	$14,456,240	$15,516,295
	Miscellaneous	10,192	5
(b)	Interest Income	231,506	72,787
(c)	Other Incomes or Revenues (Identify)		
	State Grant - DEP	0	163,733
	Contributions - Developers	184,899	88,550
(d)	Total Revenues	$14,882,837	$15,841,370
(e)	Operating Expenses (excluding interest on debt, depreciation, and other non-cash items)	9,216,212	10,567,284
(f)	**Net Revenues (f = d – e)**	$5,666,625	$5,274,086
(g)	Debt Service (including coverage) Excluding SRF Loans	0	0
(h)	Debt Service (including coverage) for Outstanding SRF Loans	0	0
(i)	**Net Revenues After Debt Service (i = f – g – h)**	$5,666,625	$5,274,086

Source: Fund 450 Water & Sewer
Notes:

SCHEDULE OF PROJECTED REVENUES AND DEBT COVERAGE
FOR PLEDGED REVENUE

(Begin with the fiscal year preceding first anticipated semiannual loan payment)

		FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
(a)	Operating Revenues (Identify)					
	Charges for services	$17,131,583	$18,502,110	$19,982,278	$21,580,861	$23,307,329
(b)	Interest Income	85,269	87,827	90,462	93,175	95,971
(c)	Other Incomes or Revenues (Identify)					
	Contributions - Developers	60,000	60,000	60,000	60,000	60,000
(d)	Total Revenues	$17,276,852	$18,649,937	$20,132,740	$21,734,036	$23,463,300
(e)	Operating Expenses[1]	13,407,096	13,917,555	14,448,739	15,001,542	15,576,896
(f)	**Net Revenues (f = d - e)**	$3,869,756	$4,732,382	$5,684,001	$6,732,494	$7,886,404
(g)	Existing Debt Service on Non-SRF Projects (including coverage)	0	0	0	0	0
(h)	Existing SRF Loan Debt Service (including coverage)	0	0	0	0	0
(i)	**Total Existing Debt Service (i = g + h)**	0	0	0	0	0
(j)	Projected Debt Service on Non-SRF Future Projects (including coverage)	629,010	1,658,720	2,173,575	2,688,430	3,320,309
(k)	Projected SRF Loan Debt Service (including coverage)	715,945	715,945	715,945	715,945	715,945
(l)	**Total Debt Service (Existing and Projected) (l = i + j + k)**	1,344,955	2,374,665	2,889,520	3,404,375	4,036,254
(m)	**Net Revenues After Debt Service (m = f – l)**	$2,524,801	$2,357,717	$2,794,481	$3,328,119	$3,850,150

Source:

Notes: (i.e. rate increases, explanations, etc.)

1. For existing and proposed facilities, excluding interest on debt, depreciation, and other non-cash items.
2. Anticipating 8% fee increases each year from FY 2028 through FY 2032
3. $7,000,000 borrowing for Design of WWTP starting in FY 2028. Financed over 20 years at 4.84%
4. $32,000,000 Bond Financing for Construction of WWTP starting in FY 2029. Interest payments through FY 2031 with Principal & Interest payments starting mid FY 2031. 30 year bond at 4.84%

CERTIFICATION

I, Irwin Williams, certify that I have reviewed the information
Chief Financial Officer (please print)

included in the preceding capital financing plan worksheets, and to the best of my knowledge, this

information accurately reflects the financial capability of City of Cooper City
Project Sponsor

I further certify that City of Cooper City has the financial capability to ensure
Project Sponsor

adequate construction, operation, and maintenance of the system, including this SRF project.

Irwin Williams
Signature

April 16, 2026
Date

Appendix B: City of Cooper City 2024 Water and Wastewater Master Plan Update

Chapters 1, 2, 7, and 9 are included as the relevant chapters. If additional information is needed a full City of Cooper City 2024 WWMP Update can be provided upon request.

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Cooper City
Someplace Special

2024 Water and Wastewater Master Plan Update

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1. Executive Summary

1.1 Introduction

The 2024 Water and Wastewater Master Plan Update for the City of Cooper City (City) represents a comprehensive evaluation of the City's water and wastewater infrastructure. This update builds upon the foundational work established in the 2007 Master Plan, which provided guidance and recommendations for capital improvements and expansion programs over a 20-year period. The current update extends the planning horizon to 2045, ensuring that City's water and wastewater systems can meet the demands of future growth while maintaining regulatory compliance and operational efficiency.

The primary objectives of this master plan update are to assess the current state of the water and wastewater systems, identify areas for improvement, and develop a strategic plan for future infrastructure investments. This includes evaluating the capacity and condition of existing facilities, forecasting future water demand and wastewater flow, and recommending necessary upgrades and expansions to support the City's long-term goals.

Key components of the master plan update include an analysis of the projected population growth and its impact on water demand and wastewater generation, an evaluation of raw water supply, and an assessment of the water treatment and distribution systems. Additionally, the plan addresses the wastewater collection and treatment facilities, biosolids management, and the development of a capital improvement program to prioritize and implement the recommended projects.

This executive summary highlights the key findings and recommendations from the master plan update, providing a roadmap for the City's future infrastructure development. Through proactive planning and strategic investments, the City can continue to deliver high-quality water and wastewater services to its residents, supporting the community's growth and well-being.

1.2 Service Planning Areas

The Water and Wastewater Service Area for the City encompasses a total of 5,337 acres, providing essential services for both residential and commercial properties. Figure 1-1 illustrates the City’s water and wastewater service area. The water distribution system includes approximately 145 miles of water mains, ensuring a reliable supply of potable water to all customers. The system is supported by various infrastructure components, including storage tanks, high service pumps, and booster stations, which maintain adequate pressure and flow throughout the service area. The wastewater collection system comprises 90.7 miles of gravity sewer mains, 33.4 miles of force mains, and 83 lift stations, including 10 private lift stations connected to the City's network. This infrastructure is designed to meet current demands and accommodate future growth through 2045, based on existing population projections.

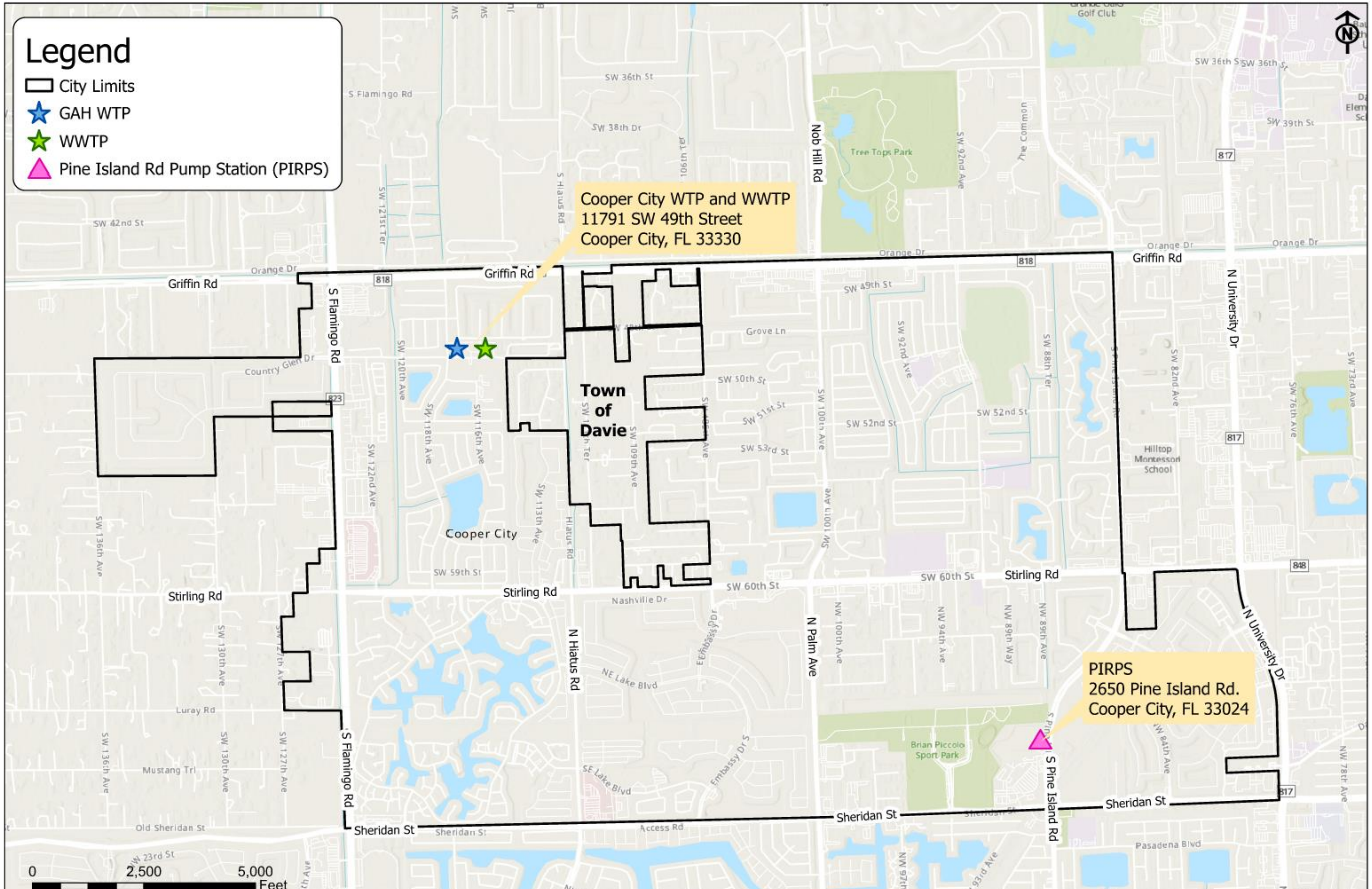


Figure 1-1: Water and Wastewater Service Area

1.3 Report Organization

This report is organized into several chapters to provide a comprehensive evaluation of the water and wastewater systems for the City. Each chapter addresses specific aspects of the master plan, ensuring a thorough analysis and clear presentation of the findings and recommendations.

- **Chapter 1 - Executive Summary:** This chapter provides an overview of the master plan, including the project background, objectives, and scope. It sets the context for the subsequent chapters and outlines the purpose and goals of the master plan.
- **Chapter 2 - Population, Water Demand, and Wastewater Projections:** This chapter presents the population growth projections and their impact on water demand and wastewater generation. It includes an analysis of historical data and future trends to forecast the needs of the City's infrastructure.
- **Chapter 3 - Raw Water Supply Evaluation:** This chapter evaluates the water supply sources, raw water quality, and the capacity and condition of the raw water supply facilities. It provides recommendations for improvements and expansions to meet future demands.
- **Chapter 4 - Water Treatment System Evaluation:** This chapter describes the current water treatment system, including the location, historical review, and key components of the George A. Haughney Water Treatment Plant (GAH WTP). It also includes an assessment of the system's performance and recommendations for enhancements.
- **Chapter 5 - Water Transmission and Distribution System, Pumping and Storage Facility Summary:** This chapter evaluates the City's water transmission and distribution system, as well as the pumping and storage facilities, identifying areas for improvement and offering recommendations to enhance system reliability and efficiency.
- **Chapter 6 - Wastewater Collection, Lift Station, and Force Main Transmission System Summary:** This chapter assesses the wastewater collection system, lift stations, and force mains. It identifies areas requiring upgrades or improvements and provides recommendations for enhancing the system's efficiency and reliability.
- **Chapter 7 - Evaluation of Wastewater Treatment Facilities:** This chapter evaluates the wastewater treatment facilities, including the capacity, performance, and compliance with regulatory requirements. It provides recommendations for necessary upgrades and improvements.
- **Chapter 8 - Biosolids Treatment and Disposal Evaluation:** This chapter assesses the biosolids treatment and disposal system, including the existing sludge disposal system and recommendations for improvements.
- **Chapter 9 - Capital Improvement Program:** This chapter outlines the capital improvement program, including the prioritization and implementation plan for the recommended projects. It provides a detailed breakdown of the costs and timeframes for project completion.

1.4 Population Projections

The baseline population forecasts were developed using 2020 census data and refined based on comprehensive plans, land use amendments, input from the City's Planning Department, and redevelopment and future development projects. These projections were reviewed and forwarded to the South Florida Water Management District (SFWMD) for potential incorporation into the 2023 Lower East Coast (LEC) Water Supply Plan (WSP). Despite being higher than the SFWMD's draft projections, Cooper City requested to continue with these estimates to conservatively plan for future infrastructure needs.

The City's population was approximately 34,563 in 2020. Using a 2% growth rate per five-year period, the population is projected to increase to nearly 38,143 by 2045. These projections are higher than those shown in the SFWMD's LEC 2023 Draft, which used a lower 2020 population baseline. Figure 1-2 illustrates the City’s population projections from 2020 through 2045.

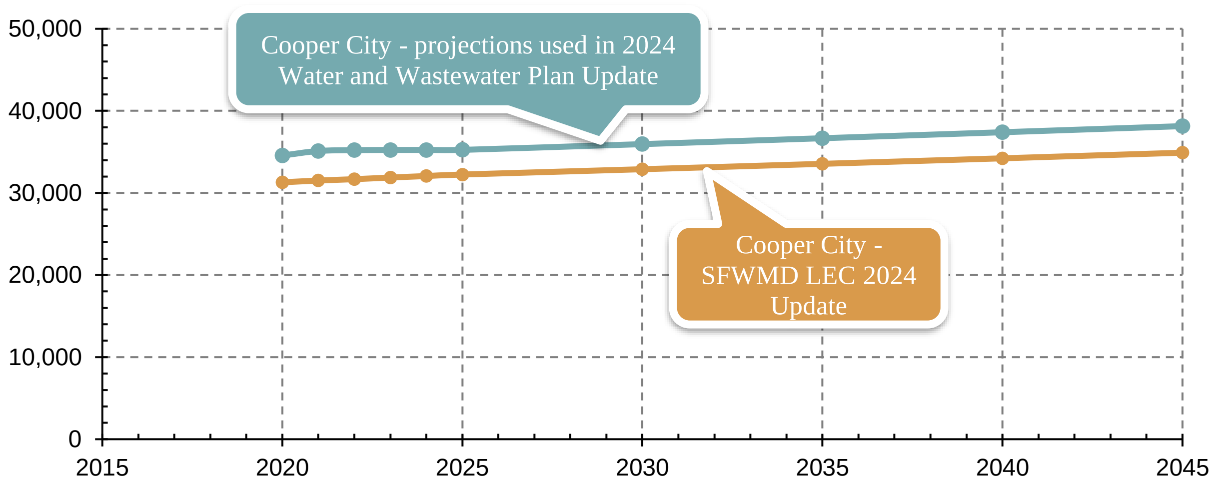


Figure 1-2: Cooper City Population Projections

1.5 Water Demand

The water demand projections for the City were developed using an analysis of historical data and future growth expectations. This analysis included a review of yearly finished water flows, raw water flows, and unaccounted-for water loss from 2018 to 2022. The average finished water demand during this period was 3.02 million gallons per day (mgd), while the average raw water demand was 3.75 mgd.

Projections indicate that the annual average day finished water demand will increase from 3.07 mgd in 2022 to 3.32 mgd by 2045. Similarly, the maximum day finished water demand is expected to rise from 4.21 mgd in 2022 to 4.88 mgd by 2045. These projections are based on historical trends, population growth, and anticipated future developments.

The existing permitted GAH WTP finished water production capacity and the total number of Nanofiltration (NF) treatment trains are adequate to meet the expected average and maximum day water demands for the planning horizon, based on current population projections. Figure 1-3 illustrates the max day finished water demand. Additionally, the annual permitted raw water allocation from the South Florida Water Management District (SFWMD) is sufficient to meet average day raw water demands for the planning horizon. Figure 1-4 illustrates the annual average day raw water demand projections.

Based on the available data, it is anticipated that the City will not need to source additional water supply for the planning period.

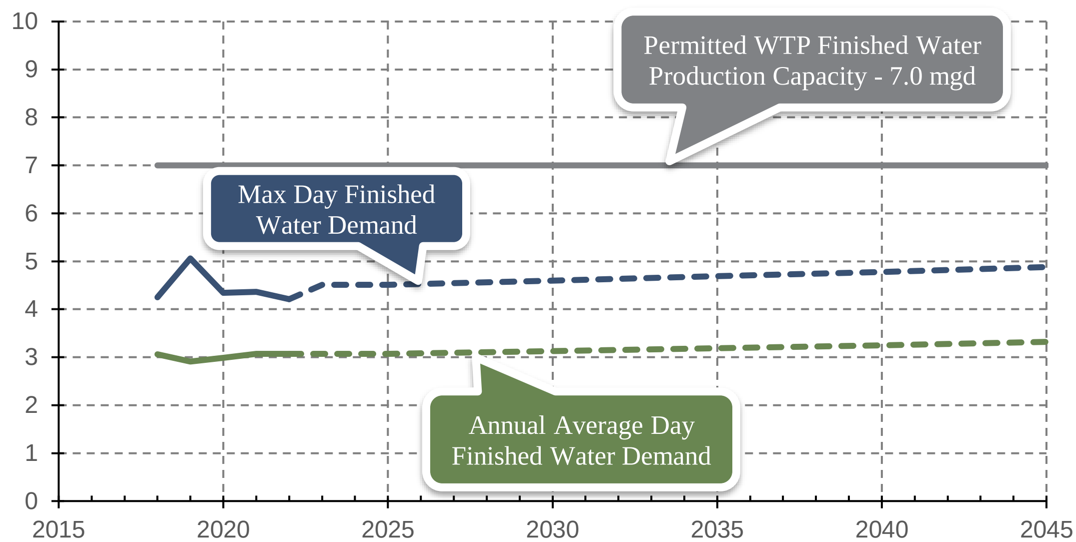


Figure 1-3: Finished Water Demand Forecast (mgd) In Relation to the FDEP Permitted WTP Finished Water Production (mgd)

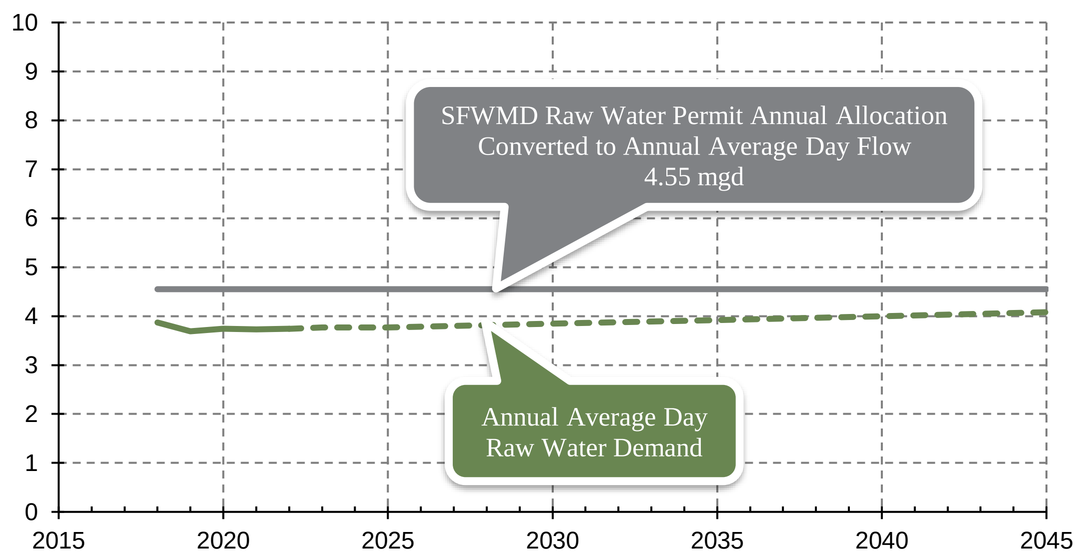


Figure 1-4: Annual Average Day Raw Water Demand Forecast (mgd) in relation to the SFWMD Annual Permitted Biscayne Aquifer Raw Water Allocation (mgd)

1.6 Wastewater Projections

The analysis included a review of yearly wastewater flows, historical per capita wastewater generation, and population projections. The per capita wastewater flow calculated herein consisted of the base flow, which is generated from service connections in the collection system, groundwater infiltration, and wet weather flow. The wastewater flow projections herein are developed using two approaches:

- Assuming the average per capita wastewater generation based on 2018-2022 data (73.9 gal/per person) to remain for the planning horizon.
- Conservatively assuming per capita influent generation to increase linearly to 90 gal/d by FY 2045 from the current average levels of 73.9 gal/per person.

Wastewater projections suggest that the annual average day wastewater flow will increase from 2.60 mgd annual average daily flow (AADF) in 2022 to 2.82-3.43 mgd AADF by 2045. Similarly, the maximum monthly wastewater flow is expected to increase from 2.89 mgd in 2022 to 3.67-4.46 mgd by 2045. Based on the wastewater treatment plant’s (WWTP’s) current discharge permit (permit #: FL00440398 MI), the permitted capacity of the facility is 4.27 mgd maximum three-month average daily flow (MTMADF; 3.71 mgd AADF), which is below flows projected for the planning horizon of this master plan. Since the current permitted capacity is sufficient to treat projected wastewater flows, the current master plan assumed the permitted capacity of the WWTP (4.27 mgd MTMADF) also will be the design capacity.

1.7 Existing Water System

1.7.1 Introduction

The City’s existing water system is designed to provide reliable and high-quality water services to its residents. The system includes a comprehensive network of water supply wells, treatment facilities, and distribution infrastructure. This section provides an overview of the key components and their operational status for the water system.

1.7.2 Raw Water Supply

The City's raw water supply is sourced from the Biscayne Aquifer, a highly productive and federally designated sole source aquifer. The City owns and operates six water supply wells located in the northwest portion of the City along SW 49th St. and SW 118th Ave., serving the GAH WTP. Figure 1-5 illustrates the location of the City’s wells. These wells have a total capacity of approximately 8,700 gallons per minute (gpm) or 12.5 mgd, with a firm capacity of 7,100 gpm or 10.2 mgd when the largest well is out of service.

Figure 1-5: Cooper City Water Supply Well Location

The raw water quality is monitored regularly to ensure compliance with regulatory standards and to maintain the efficiency of the treatment processes. The wells are equipped with submersible and vertical turbine pumps, which are maintained and periodically replaced to ensure reliable operation. The wellheads, well site fencing, piping, valves, instrumentation, and electrical systems are also regularly inspected and maintained.

The raw water conveyance system includes pipelines that transport water from the wells to the WTP. These pipelines are constructed of durable materials and are designed to minimize water loss and maintain water quality.

1.7.3 Water Treatment System

The GAH WTP is the facility responsible for treating the raw water extracted from the Biscayne Aquifer. The WTP is located at 11791 SW 49th Street, Cooper City, FL 33330. The facility has a permitted finished water production capacity of 7.0 mgd and utilizes a nanofiltration (NF) softening process. The plant consists of four NF treatment trains, two with a capacity of 2 mgd each and the other two with a capacity of 1.5 mgd each. The WTP site plan with associated treatment facilities is depicted in Figure 1-6.

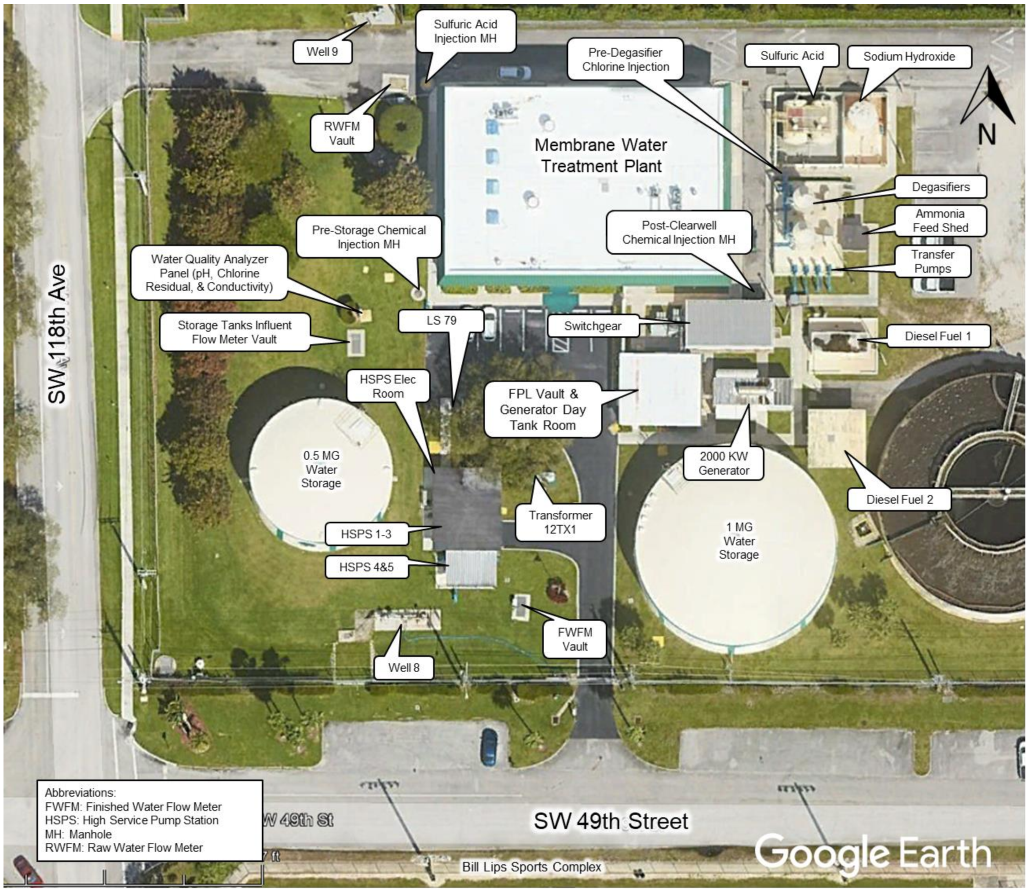


Figure 1-6: The WTP Site Plan

The water treatment process at GAH WTP involves several key chemicals to ensure water quality and regulatory compliance. These chemicals include sulfuric acid and antiscalant for pre-treatment, sodium hypochlorite for disinfection, caustic soda for pH adjustment, hydrofluorosilicic acid for fluoridation, ammonia for chloramination, and a corrosion inhibitor to protect the distribution system.

The facility also features a comprehensive post-treatment system, including two degasifiers, a clearwell, and four transfer pumps. The concentrate disposal system comprises a deep injection well (DIW) with an associated lined storage pond and pump station.

Regular monitoring and maintenance are integral to the plant's operations. The facility is equipped with various instruments for continuous online monitoring of flow, pressure, water level, and water quality parameters such as pH, conductivity, turbidity, and chlorine residual. The primary power supply is provided by Florida Power and Light (FPL), with auxiliary power from a standby emergency generator.

1.7.4 Water Transmission and Distribution System, Pumping and Storage Facilities

The City’s water transmission and distribution system is designed to ensure a reliable supply of potable water to the customers. The system operates at a discharge pressure of 58-65 psi at the GAH WTP high-service pump station to maintain adequate flow and pressure for customers.

The City's potable water distribution system is designed in a looped configuration, which enhances reliability and reduces the risk of service interruptions. The system consists of approximately 762,100 linear feet (145 miles) of water mains ranging from 2 to 16 inches in diameter. The pipe materials include polyvinyl chloride (PVC), high-density polyethylene (HDPE), ductile iron (DI), and a small percentage of cast iron (CI) and unknown materials.

The City has proactively replaced old pipes in high-risk areas with frequent pipe breaks and removed asbestos concrete pipes from the distribution system. The current pipe network primarily consists of PVC, HDPE, and DI, which are known for their durability and longevity.

The water distribution system also includes interconnects with adjacent utilities to provide an emergency water source. There are four emergency interconnecting pipe networks with surrounding utilities, including the Town of Davie, the City of Sunrise, and the City of Pembroke Pines. These interconnects are metered and manually operated, allowing water to flow in either direction during emergencies.

The City's pumping facilities include the GAH WTP high-service pump station and the Pine Island Road Pump Station (PIRPS). The GAH WTP is equipped with five high-service pumps, while the PIRPS has three high-service pumps. These facilities are equipped with multiple pumps that operate in a variable frequency drive (VFD) configuration to maintain consistent water pressure throughout the distribution system. The PIRPS site plan with associated facilities is depicted in Figure 1-7.

Figure 1-7: PIRPS Site Plan

The storage facilities include a 0.5 mg and a 1.0 mg ground storage tank at the GAH WTP, and a 2.0 mg ground storage tank at the PIRPS. These tanks provide additional capacity to meet peak demand periods and ensure a reliable water supply during emergencies. The City has implemented a comprehensive maintenance program for the storage facilities, which includes routine inspections, preventive maintenance, and periodic upgrades to ensure their continued reliability and efficiency.

1.8 Existing Wastewater System

1.8.1 Introduction

The existing WWTP consists of three package treatment plants treating wastewater generated by residents in a total Service Area of 5,337 acres. The WWTP's collection system includes a comprehensive network of gravity sewer mains, force mains, and lift stations. This section provides an overview of the current state of the wastewater system, highlighting key components and their operational status.

1.8.2 Wastewater Collection, Lift Station, and Force Main Transmission System

The City's wastewater collection system serves a service area of 5,337 acres, encompassing both residential and commercial properties. The collection system consists of approximately 90.7 miles of gravity sewer mains, 33.4 miles of force mains, and 83 lift stations, including 10 private lift stations connected to the City's network.

The gravity sewer mains are primarily constructed of vitrified clay, ductile iron, PVC, and HDPE piping. The older sections of the system, installed in the late 1960s, predominantly use vitrified clay pipes, while newer sections have transitioned to more durable materials such as ductile iron, PVC, and HDPE. The City's force main network predominantly consists of ductile iron pipes, with the rest composed of high-density polyethylene (HDPE), PVC pipes, and asbestos cement. The diameters of the pipes used in the force main range up to 24 inches. The wastewater collection system also includes 2,201 manholes and cleanouts that provide access for maintenance and inspection.

The lift stations are located throughout the service area to efficiently transfer wastewater to the WWTP via gravity sewer and force mains. The City utilizes a variety of pumps, including wet-pit submersible pumps, horizontal-shaft and vertical-shaft centrifugal pumps, and compressed air/eductor pumps at different lift stations. The City's ongoing efforts include replacing aging lift-station pumps with wet-pit submersible pumps from Wilo/EMU to provide better standardization. The City has decided to use Wilo/EMU for standardization because of the pump's reliability, ease of maintenance, and availability of spare parts.

1.8.3 Wastewater Treatment System

The City's WWTP, located at 11791 SW 49th St, Cooper City, FL 33330, is an activated sludge-based facility comprising three package treatment plants. Each package plant consists of a liquid treatment train comprising a coarse bar screen, an activated sludge basin capable of operating in extended aeration and contact stabilization modes, a secondary clarifier, and a chlorine contact tank. The aeration basins are presently equipped with coarse bubble diffusers. Following chlorination, the effluent from the package plants is routed to a lagoon for equalization prior to discharging.

The WWTP has two on-site 0.365 MG effluent equalization lagoons constructed in 1986, the East Lagoon and the West Lagoon. The effluent from the WWTP is transferred only to the East Lagoon, which can be discharged to the City of Hollywood's wastewater treatment plant effluent pump station wet well or the on-site DIW. The City conducts regular monitoring and testing of the treated effluent to ensure compliance with all regulatory standards. The WWTP site plan with associated treatment facilities is shown in Figure 1-88.

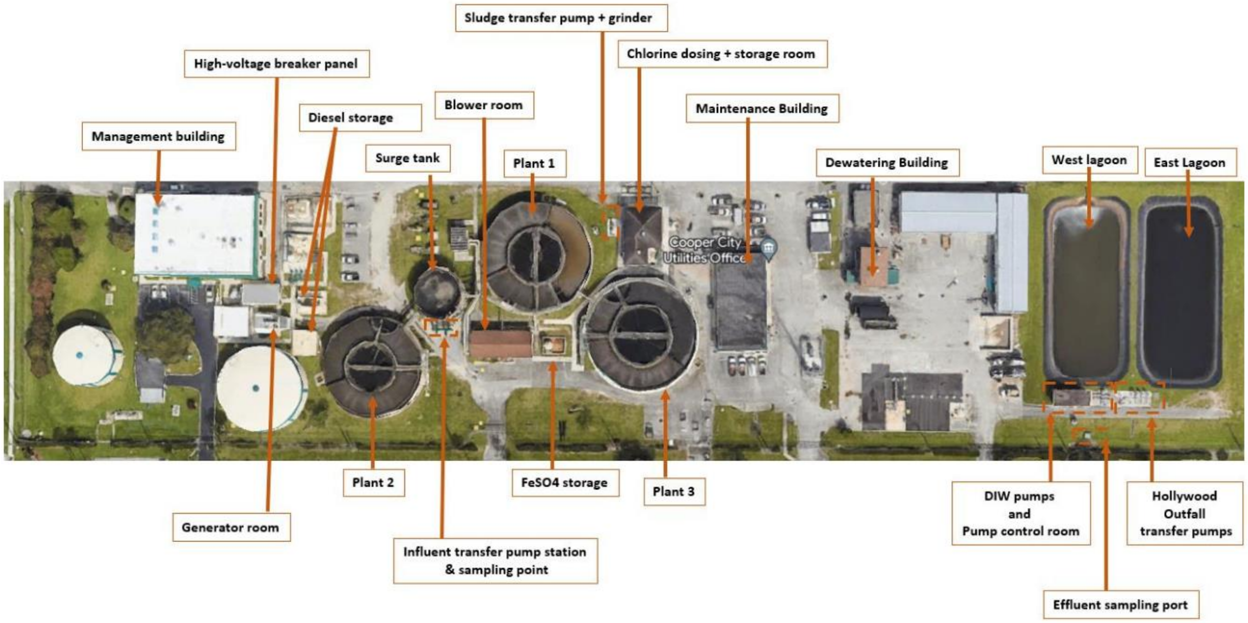


Figure 1-8: WWTP Site Plan

1.8.4 Biosolids Treatment and Disposal

Each of the City’s three package treatment plants is equipped with aerobic digesters to stabilize biosolids. The waste activated sludge (WAS) from the settling basins is transferred to the aerobic digesters using airlift pumps. The digesters are equipped with coarse bubble diffusers that provide aeration for the stabilization process. The digested sludge is then transferred to a dewatering building equipped with two centrifuges and polymer conditioning equipment to produce dewatered sludge with 12-14% solids content. The City has entered an agreement with Synagro South, LLC, to haul dewatered sludge off-site. The centrate from the dewatering process is returned to the surge tank via an in-plant lift station.

At the time of this master plan development, one of the two centrifuges in the City's dewatering facility is out of service due to a control panel failure, and the other is in poor operating condition, with occasional service outages. The City currently rents centrifuges from time to time to dewater digested sludge during service outages of the operating centrifuge. At the time of this master plan development, the City had entered a contract with Alfa Laval to replace the existing centrifuges with two new units via a turnkey project.

1.9 Evaluation of Water System

1.9.1 Introduction

The evaluation of the City's water system is a critical component of the 2024 Water and Wastewater Master Plan Update. This evaluation aims to assess the current state of the water supply, treatment, and distribution systems, identify areas for improvement, and recommend necessary upgrades to ensure reliable and efficient service delivery. The primary findings and recommended actions from this evaluation are summarized in the following sections.

1.9.2 Raw Water Supply

The evaluation of the raw water supply system revealed that while the wells are generally in good condition, some components require immediate attention. Scaling, raw water entrainment, and sand deposition in the raw water pipelines pose challenges for the operators. Sand from specific wells can cause abrasion and wear on pumps and other equipment, leading to increased maintenance costs and potential downtime. Additionally, the deposition of debris in the cartridge filters reduces the efficiency of the filtration process and increases the frequency of filter replacements. The City has been diligent in maintaining and replacing these filters, but further improvements, such as the installation of sand separators or enhanced filtration systems, may be necessary to fully resolve this problem.

To address these issues, the installation and operation of blow-offs at the raw water wells is recommended. These blowoffs help reduce air entrainment and purge oxidized water from the casings and wells upon startup of the pumps.

The well pumps, motors, and wellheads are 22-27 years old and are nearing the end of their useful life. It is recommended to implement a well rehabilitation program that includes regular inspections, maintenance, monitoring and rehabilitation of the wells and associated infrastructure. Additionally, a hydraulic model of the raw water well pump and conveyance system are recommended to facilitate pump selection and optimize system performance.

The raw water quality is monitored regularly to ensure compliance with regulatory standards and to maintain the efficiency of the treatment processes. However, it is recommended to retain a specialty laboratory to conduct well sampling to assess casing water quality and aquifer water quality. This will inform the type of rehabilitation needed based on biofouling or chemical precipitation. Implementing these recommendations will help ensure a consistent and reliable raw water supply for the City's residents.

The evaluation also highlighted the need for improvements in the raw water conveyance system. The pipelines that convey water from the wells to the WTP are constructed of durable materials, but some sections are aging and require replacement to ensure reliable operation. It is recommended to implement a comprehensive pipeline rehabilitation program that includes regular inspections, maintenance (including installation of air release valves), and replacement of aging infrastructure. Additionally, the City should consider pump replacements and pipe cleaning as part of its ongoing maintenance efforts. These actions will help maintain the efficiency and reliability of the raw water supply system.

1.9.3 Water Treatment System

The City has been proactive in maintaining the GAH WTP by implementing a comprehensive maintenance program that includes routine inspections, preventive maintenance, and periodic upgrades. This approach has helped ensure the reliability and efficiency of the water treatment system. However, further investments in infrastructure improvements are necessary to address the identified issues and support the community's growth and well-being.

One of the primary concerns is the need for electrical upgrades. The existing electrical system, including top-end equipment, membrane building electrical rooms, and high-service pump station electrical buildings, requires immediate, near-term, and long-term upgrades. These upgrades are crucial for ensuring the reliability and efficiency of the water treatment processes.

Another critical issue is the need for pilot testing for optimizing sulfuric acid and antiscalant dosages. Conducting a pilot test will help evaluate the performance of various antiscalants and sulfuric acid dosages from different vendors. This will ensure that the City selects the most effective options for maintaining the efficiency of the treatment processes.

The City also may want to certify the WTP for four-log virus removal/inactivation, for compliance with the Ground Water Rule. This certification requires rigorous testing and validation of the treatment processes to meet regulatory standards.

Chemical system replacement is another important aspect that needs attention. The existing chemical systems, including those for sulfuric acid, antiscalant, chlorine, caustic soda, hydrofluorosilicic acid, ammonia, and corrosion inhibitor, need to be regularly maintained and replaced to ensure their effectiveness and compliance with regulatory requirements.

Hatch improvements are also necessary to enhance the safety and accessibility of the water treatment facilities. Upgrading the hatches will help prevent unauthorized access and ensure the safety of the personnel working at the plant.

1.9.4 Water Transmission and Distribution System, Pumping and Storage Facilities

The City has made proactive measures over the years to replace old pipes in high-risk areas and increase the number of fire hydrants due to developments in the City, ensuring a reliable water supply and enhanced fire protection for residents. To maintain the reliability of the pipe distribution system, it is essential to continue the annual replacement of water mains and service lines. Regularly replacing aging water mains will help prevent pipe bursts and ensure a continuous and reliable water supply.

In addition to these efforts, the City has also focused on addressing issues with water meters. The City has experienced problems with failing meters, leading to revenue losses and a spike in unaccounted-for water. Accurate water meters are essential for billing and leak detection. Replacing old and inaccurate meters will help reduce water loss and ensure accurate billing for customers. The City is devoted to replacing all existing water metering infrastructure with Advanced Metering Infrastructure (AMI).

The evaluation indicated that there are several key recommendations that must be addressed to further improve the water distribution, pumping, and storage facilities. Some of these recommendations are listed here:

- Upgrade Existing Pumping Facilities: Enhance the reliability of the water distribution system. Replace high-service pumps and electrical equipment at the GAH WTP, which are approximately 27 years old and critical for maintaining water pressure.

- Pine Island Road Tank Baffle Curtain Replacement: Improve water quality by enhancing mixing and reducing short-circuiting within the tank. Replacing the baffle curtain will ensure the tank operates efficiently and maintains the desired water quality standards.
- Develop a Water Distribution System Hydraulic Model: Understand the behavior of the water distribution system under various conditions. This model will help identify areas with low pressure, potential bottlenecks, and optimize overall system performance.
- Implement a Water Distribution System Failure Prediction Model: Proactive maintenance and prevention of system failures. This model will help predict potential failures in the water distribution system, allowing for timely interventions and reducing the risk of unexpected outages.
- Valve Replacement: Control the flow of water within the distribution system. Replacing old and malfunctioning valves will improve the system's reliability and operational efficiency.
- Implement an Asset Management Program: Ensure the long-term sustainability of the water infrastructure. This program will help systematically manage the City's water assets, ensuring optimal performance and extending the lifespan of the infrastructure.

1.10 Evaluation of Wastewater System

1.10.1 Introduction

This evaluation of existing wastewater treatment systems aims to assess the current operating condition and limitations of the assets and recommend improvements to ensure reliable and efficient service delivery. The primary findings and recommended actions from this evaluation are summarized in the subsequent sections.

1.10.2 Wastewater Collection, Lift Station, and Force Main Transmission System

The recommendations proposed herein for the gravity collection system, lift station, and force main network improvements are based on the information in the previous Master Plan Report, the age of equipment, and the data provided by the City. A condition of the City's existing sewer collection system was not evaluated during the current Master Plan Update.

The City's GIS data shows that at least 16.2 mi of piping (17.8%) in the gravity sewer system were installed on or before 1975. These lines, predominantly of vitrified clay construction, will exceed 50 years of service after 2025. Furthermore, an additional 5.2-20.8 mi of gravity sewer lines will approach/exceed 50 years of service every five years from 2025 to 2045. Therefore, this Master Plan recommends a phased approach spread across the planning horizon of the current Master Plan (FY 2025- FY 2045) to replace/rehabilitate the gravity sewer system as needed. Based on the information available in the previous master plan report, approximately 11,700 ft (2.2 mi) of the vitrified clay gravity sewer lines were lined before 2005, and an additional 8,374 ft (1.59 mi) was lined between March and April 2024. Hazen recommends that the City continue rehabilitation/lining work on the remaining vitrified clay pipes. The GIS database City shared lacked information on the size and material of construction of some gravity sewer and force main lines. Hazen recommends that the City investigate further to identify that information and update its GIS database.

The City's GIS data shows that at least 5.7 mi of force main piping in the system were installed on or before 1975, and an additional 1.2-7.7 mi of force main segments will approach/exceed 50 years of service every five years from 2025 to 2045. Similar to gravity sewer piping, a phased approach spread across the 20-year planning horizon of this Master Plan is recommended to replace/rehabilitate the force main lines as needed. Furthermore, Hazen recommends that the City investigates corrosion control measures for force mains. Similar to forced mains, Hazen recommends that the City investigate corrosion control measures for lift stations, including cathodic protection or corrosion inhibitors, to increase longevity.

Per the information provided, the City currently has an inventory of eight portable generators. Hazen recommends that the City assess the condition of the portable generators in its inventory and budget for additional portable generator purchases. Furthermore, Hazen recommends that the City develop an emergency procedure for bypass pumping in the event of lift station failures and a strategy for ensuring continuous power supply to lift stations. A review of the available bypass equipment and an evaluation of its readiness is also recommended.

1.10.3 Wastewater Treatment System

The condition assessment of WWTP identified that some of the major assets, including Package Treatment Plant 1, Surge Tank, Blower Building, and blowers, are in poor condition, requiring rehabilitation/replacement in the near term (0-5 years). Furthermore, assets, including Package Treatment Plant 2, were identified to be in moderate condition requiring rehabilitation/replacement within 5-15 years. The condition assessment also identified several redundancy and reliability limitations, including in the digested sludge transfer pump and chlorine dosing systems. The capacity assessment conducted identified that the City's WWTP is equipped with sufficient Aeration Basin, Clarifier and Aeration Blower capacities up to its rated capacity of 4.27 mgd maximum three-month average daily flow (MTMADF). The disinfection capacity was identified as insufficient at the rated capacity; however, sufficient disinfection capacity is expected to be available beyond FY 2045 based on the wastewater flowrate projections developed in this master plan.

The WWTP currently disposes of treated effluent via either the DIW or by transferring to the City of Hollywood's transfer pump station. Based on the available information on the agreements between the City of Cooper City and the City of Hollywood and disposal permits, sufficient permitted effluent disposal capacity of up to 4.27 mgd MTMADF is currently available. However, based on the impacts of future regulatory restrictions (including the Ocean Outfall Legislature) and the renewal of the agreement between Cooper City and the City of Hollywood, additional disposal methods may be required. This master plan has outlined three options for the City to maintain sufficient effluent disposal capacity based on these future developments. The proposed options recommend capital improvement projects to add effluent disposal pumps and/or construct a new DIW based on the option selected by the City. Hazen emphasizes that sufficient information is not available at this time to recommend an approach; therefore, the City is advised to closely monitor this future development to ensure sufficient disposal capacity is available.

This master plan outlined three options for the City to conduct capital improvement projects based on whether a new wastewater treatment plant replacing the existing package treatment plants is constructed.

- Option 1 – construction of a new activated sludge-based WWTP at the current WWTP location, with construction completion in FY 2033.

- Option 2 – continue providing wastewater treatment using package treatment plants. Rehabilitate/replace existing equipment provided as needed to ensure reliability.

- Option 3 – prioritize new WWTP construction at the current WWTP location, with construction completion in FY 2030.

The CIPs applicable for each of the above options have been outlined in subsequent sections. It is emphasized that Hazen recommends that the City replace the existing package treatment plants with a new WWTP (Option 1 or Option 3).

1.10.4 Solids Treatment and Disposal

The condition assessment of WWTP's solid disposal system identified major reliability concerns of the existing system, including the availability of only one dewatering centrifuge and one sludge transfer pump. Furthermore, the aerobic digesters in each package treat plant also demonstrated wear and tear that requires rehabilitation in parallel with the package treatment plant rehabilitations recommended herein. The capacity assessment conducted identified that the City's WWTP has sufficient aerobic digester capacity to provide solids retention (SRT) exceeding 40 days at current flow rates; however, the SRT may fall below 40 days at projected flow rates in FY 2045. The City is required to produce biosolids satisfying at least Class B requirements and based on Hazen's experience with the facilities in the region, the City may continue to satisfy these requirements at an SRT slightly below 40 days. However, Hazen recommends establishing a more frequent monitoring protocol to detect non-compliance issues early.

As previously mentioned, the City's dewatering facility is equipped with two centrifuges, of which only one is currently operational. The City has entered into an agreement with Alfa Laval to replace the existing units with two new centrifuges via a turnkey project, including polymer system upgrades. The required dewatering system reliability and redundancy are expected to be established for the City's dewatering facility following the completion of the above project. Furthermore, the City is advised to add a second sludge transfer pump to ensure redundancy.

At the time of this master plan, the City is anticipated to take part in the ongoing Broward County Water and Wastewater Services (BCWWS) regional biosolids project, which focuses on a regional approach to treating biosolids. With the program still in its early stages of development, providing specific pathways for the City to comply with is challenging. However, the following points are highlighted:

- Hazen recommends that the City optimize its dewatering centrifuge performance and identify the dewatered sludge generation under new conditions. We emphasize that sludge generated in similar facilities in the region is dewatered to ~ 18-20% solids content, which far exceeds the performance of the City's existing dewatering process. Centrifuge performance optimization is recommended regardless of the construction of the centralized biosolids facility to lower hauling, land application, and disposal costs.

- The City is advised to identify how the centralized facility capital buy-in, operating, and maintenance costs are split between the participating utilities.

- The centralized biosolids facility may not require Class B sludge from the participating utilities. Therefore, the City may evaluate the feasibility of operating the aerobic digesters as sludge holding tanks with lower air supply and SRT to reduce electricity costs. However, Hazen recommends conducting a feasibility study to evaluate and compare the cost savings from biosolids volume reduction from aerobic digestion vs reduced aeration before deciding. If the new AS-based WWTP is constructed after the BCWWS centralized facility is commissioned, the City may not require investing in a new aerobic digester for the new facility. However, a sludge holding tank will still be required.

- The City is advised to have a comprehensive emergency preparedness plan that includes backup options for biosolids storage and alternative treatment facilities to prevent operational disruptions to dispose of Class B or unclassified sludge should the centralized facility be operated at a reduced capacity. Furthermore, regardless of participation in the BCWWS program, the City is advised to develop a risk management strategy to enhance preparedness and ensure operational resilience during extreme weather events or other emergencies.

1.11 Regulatory Review

1.11.1 Introduction

The regulatory review section of the City’s Water and Wastewater Master Plan provides an overview of the current regulatory landscape affecting the city's water and wastewater systems. This section identifies key regulations, assesses the city's compliance status, and outlines any necessary actions or projects to ensure compliance. The review is essential for maintaining public health, environmental protection, and operational efficiency.

1.11.2 Water System

The water system regulatory review covers several critical regulations, including the Ground Water Rule (GWR) and the Per- and Polyfluoroalkyl Substances (PFAS) Rule.

- **Ground Water Rule (GWR):** The City complies with the triggered monitoring component of the GWR, which aims to protect public health by reducing the risk of microbial contamination in public water systems that use groundwater sources. The City is considering certifying the WTP for compliance with the GWR which will require capital improvements.

- **PFAS Rule:** The City is already in compliance with the PFAS Rule due to the implementation of membrane treatment technology. PFAS are a group of man-made chemicals that have been linked to adverse health effects. The City's proactive approach in using advanced treatment methods ensures that PFAS levels in the water supply remain within safe limits.

- **Other Regulations:** The City also adheres to various other water quality regulations, including those related to disinfection byproducts, lead and copper, and microbial contaminants. Regular monitoring and reporting ensure that the City remains in compliance with these regulations. No new actions are required at this time, as the City has established robust systems to maintain compliance.

- **Future Regulations:** One future regulation of concern is the potential tightening of standards for disinfection byproducts. The City is monitoring developments in this area and is prepared to adjust treatment processes as needed to remain in compliance.

1.11.3 Wastewater System

The wastewater system regulatory review addresses regulations such as the Asset Management and Sanitary Sewer Overflow Prevention Rulemaking and the prohibition of ocean outfall disposal.

- **Asset Management and Sanitary Sewer Overflow Prevention Rulemakings:** The FDEP has proposed revisions to Section 62-604 of the Florida Administrative Code (FAC), focusing on preventing sanitary sewer overflows. The proposed revisions, if adopted, could require a power outage contingency plan and a pipe assessment, repair, and replacement action plan during permit renewal or application for major modification. It is not yet fully understood what the formal rule will require in terms of compliance documentation and reporting

- **Contaminants of Emerging Concern**: While the final rule is only related to drinking water, regulations for treating PFAS, microplastics, or other emerging contaminants of concern may impact wastewater effluents discharged to surface waters or reclaimed water for reuse and biosolids, which are land applied. The Florida Department of Environmental Protection Underground Injection Control (FDEP UIC) has not issued an opinion as of the writing of this master plan. Should FDEP issue an alternative opinion, additional PFAS removal facilities could be required prior to injection.

- **Disposal via Ocean Outfall**: Per "Florida statute 403.086 9(d) – Sewage disposal facilities; advanced and secondary waste treatment", ocean outfall discharge will be unavailable after December 31, 2025, during normal operations. The City is in compliance with ocean outfall legislation through monetary participation in the City of Miramar's reclaimed water expansion project.

- **Other Regulations:** The prospect of requiring effluent nutrient removal has often been proposed at the State level through several efforts, although none currently applies to the City's WWTP. However, the City is advised to monitor future regulatory developments requiring nutrient removal.

The following regulatory restrictions may apply to biosolids disposal.

- **Contaminants of Emerging Concern (CECs) and Other Non-Regulated Pollutants:** CECs are detected only in limited concentrations in surface waters, wastewater, and biosolids; however, they may still pose a potential threat to human health and aquatic life even at these limited concentrations. Based on ongoing research findings, CECs may become regulated for biosolids disposal in the future.

- **Per- and polyfluoroalkyl substances (PFAS):** Per- and polyfluoroalkyl substances (PFAS) are a group of man-made CECS that have been under increasing scrutiny in recent years. The USEPA's ongoing PFAS Strategic Roadmap is committed to conducting a biosolids risk assessment for PFOA and PFOS in biosolids. The results of the PFAS Strategic Roadmap are expected to be published soon. If warranted by the risk assessment, it is anticipated that USEPA will issue a Final Rule in 2025 or 2026, with implementation required by 2030 or 2031 (assuming a 5-year compliance schedule). The proposed risk management process will use the risk assessment results and other factors, including economics and technological feasibility. While regulations pertaining to PFAS in biosolids may be enforced in the future, the State of Florida has not yet taken any action.

1.12 Capital Improvement Program

1.12.1 Introduction

The Capital Improvement Program (CIP) is a critical component of the City’s Water and Wastewater Master Plan. It outlines the planned investments in infrastructure over the planning period through the year 2045, ensuring that the city's water and wastewater systems remain reliable, efficient, and compliant with regulatory requirements. The CIP includes projects aimed at upgrading existing facilities, expanding capacity, and addressing emerging challenges. This section provides an overview of the CIP, its objectives, and the strategic approaches taken to prioritize and implement projects.

1.12.2 Explanation of “Project Driver”

The CIP categorizes projects based on the type of improvement they represent. These categories help in understanding the nature and purpose of each project, as well as in prioritizing and allocating resources effectively. Recommendations for capital improvements were classified into six major Project Drivers:

- Capacity (CAP): Capacity driven projects are improvements that increase the capacity of the water or wastewater collection, transmission, and treatment systems to meet the needs of current customers as well as planned and future growth. Capacity projects include CAP as part of the project identification number.

- Regulatory (REG): Regulatory driven projects are improvements that are considered necessary for compliance with current regulations and possible future regulations. Regulatory projects include REG as part of the project identification number.

- Renewal and Replacement (RRR): Renewal and replacement projects are either intended to rehabilitate (i.e. renew) or replace infrastructure that is at the end of its useful life and maintain the reliability of the existing infrastructure at current capacity. Renewal and replacement projects include RR as part of the project identification number.

- WTP Upgrades (WPU): WTP upgrades are improvement projects intended to enhance operational effectiveness at the WTP. WTP upgrades include WPU as part of the project identification number.
- Water Quality Driven Improvements (WQD): Water quality driven improvement projects are intended to address areas of potential poor water quality in the water distribution system or storage facilities.
- WWTP Upgrades (WWU): WWTP upgrades are improvement projects intended to enhance operational effectiveness at the WWTP. WTP upgrades include WWU as part of the project identification number.

1.12.3 Explanation of "Project Group"

The CIP categorizes projects into specific project groups to facilitate effective resource allocation and prioritization. Each project group represents a distinct area of the water and wastewater systems, ensuring a comprehensive approach to infrastructure improvements.

- **Raw Water Supply:** Projects in this group focus on the development, maintenance, and enhancement of raw water facilities, including wells, pipelines, and related infrastructure.
- **Water Treatment:** This group includes projects aimed at upgrading and maintaining water treatment facilities to ensure the production of safe and high-quality drinking water.
- **DIW:** Projects in this group involve the construction and maintenance of deep injection wells for the disposal of treated wastewater effluent.
- **Water Distribution:** This group encompasses projects related to the distribution of treated water, including the installation, replacement, and rehabilitation of water mains, pumps, and storage facilities.
- **Wastewater Collection:** Projects in this group focus on the collection and conveyance of wastewater, including the construction and maintenance of sewer lines, lift stations, and force mains.
- **Wastewater Treatment:** This group includes projects aimed at upgrading and maintaining wastewater treatment facilities to ensure effective treatment and compliance with regulatory standards.
- **General:** Projects in this group cover a range of general infrastructure improvements, including administrative buildings, control systems, and other support facilities.
- **Utility Fleet:** This group includes projects related to the acquisition and maintenance of vehicles and equipment necessary for the operation and maintenance of the water and wastewater systems.

1.12.4 Opinion of Probable Project Costs

The opinion of probable costs (OPPC) presented herein has been prepared based upon master plan level information. Because of the level of scope development at this stage, the opinion is an "Order Of Magnitude" estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected range of accuracy for this type of opinion is +100 percent to -50 percent. These opinions of probable cost have been prepared for guidance in project evaluation and implementation from the labor and material cost, competitive market conditions, final project scope, implementation schedule, and other variable conditions. As a result, the final project costs will vary from the opinions presented herein. The cost opinions are "project costs" and are inclusive of: construction costs; estimated allowance for permit application fees; 25 percent estimated allowance for engineering services during the design, permitting, construction, and startup of the project; along with a 30 percent contingency. The costs are based upon year 2024 dollars and do not include escalation for inflation.

1.12.5 Budget Allocation by Project Drivers and Groups

1.12.5.1 Introduction

The tables in this section present a summary of the CIP updates over a five-year period for the next 20 years, based on project driver or project group. The project OPPC in this section represents the combined costs for all projects, encompassing both wastewater and water systems. The option selected by the city for specific wastewater projects will significantly influence the overall budget allocation for the next 20 years. The summaries are provided for three options: Option 1 (With New WWTP), Option 2 (Without New WWTP), and Option 3 (Prioritizing the New WWTP Construction). Each option outlines the financial distribution of projects, providing the city with strategic alternatives to address necessary improvements based on the city's needs and available funding.

It is important to note that the annual cash flows for the proposed CIP were derived by escalating project costs to the mid-year of construction. The escalation factors for FY2025-FY2045 were calculated using Construction Cost Index (CCI) data from 2014-2024. The estimated cash flows, based on these assumptions and the suggested CIP timeframes, are detailed in the subsequent sections.

1.12.5.2 Option 1 – With New WWTP

Option 1 involves the construction of a new activated sludge-based WWTP at the current WWTP location, replacing package treatment plants 1, 2, and 3. This option includes 17 applicable projects with a total cost of $83,003,000. The engineering services for the new WWTP, including preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2028 to FY 2033. The new WWTP construction will be conducted from FY 2030 to FY 2033. This option does not significantly affect the cost of water projects, as it primarily focuses on wastewater treatment improvements.

Table 1-1 represents the cost allocated to each project driver every five years, providing a clear overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 1-1 and Table 1-2 amounts to $409,879,000.

Table 1-2 provides a breakdown of the costs by project group, indicating how much money is being allocated to each group. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 1-1: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$2,746,000	$42,490,000	$538,000	$0	**$45,774,000**
Regulatory Compliance	$824,000	$1,603,000	$11,358,000	$670,000	**$14,455,000**
System Reliability	$71,781,000	$161,478,000	$49,278,000	$67,113,000	**$349,650,000**
Total	**$75,351,000**	**$205,571,000**	**$61,174,000**	**$67,783,000**	**$409,879,000**

Table 1-2: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**
Wastewater Treatment	$17,453,000	$72,097,000	$4,301,000	$4,756,000	**$98,607,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$75,351,000**	**$205,571,000**	**$61,174,000**	**$67,783,000**	**$409,879,000**

1.12.5.3 Option 2 – Without New WWTP

Option 2 involves the rehabilitation of the existing package treatment plant-based facility, and the replacement of systems as outlined in the CIP. This option includes 26 applicable projects with a total cost of $51,242,000. The engineering services for these projects, including preliminary and detailed designs and construction management services (CMS), will be conducted over the planning period. This option does not significantly affect the cost of water projects, as it primarily focuses on wastewater treatment improvements.

Table 1-3 represents the cost allocated to each project driver every five years, providing a clear overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 1-3 and Table 1-4 amounts to $375,255,000.

Table 1-4 provides a breakdown of the costs by project groups, indicating how much money is being allocated to each group. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 1-3: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$3,631,000	$43,659,000	$985,000	$0	**$48,275,000**
Regulatory Compliance	$824,000	$1,603,000	$9,914,000	$670,000	**$13,011,000**
System Reliability	$67,683,000	$104,301,000	$59,518,000	$82,467,000	**$313,969,000**
Total	**$72,138,000**	**$149,563,000**	**$70,417,000**	**$83,137,000**	**$375,255,000**

Table 1-4: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**
Wastewater Treatment	$14,240,000	$16,089,000	$13,544,000	$20,110,000	**$63,983,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$72,138,000**	**$149,563,000**	**$70,417,000**	**$83,137,000**	**$375,255,000**

1.12.5.4 Option 3 - Prioritizing the New WWTP Construction

Option 3 focuses on prioritizing the construction of a new activated sludge-based WWTP at the current WWTP location. This option involves replacing package treatment plants 1, 2, and 3. The engineering services for the new WWTP, including preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2025 to FY 2030. The new WWTP construction will be conducted from FY 2027 to FY 2030. Per the City's request, the new WWTP CIP in Option 3 includes the headworks construction project, as the City plans to conduct them simultaneously. This option includes 15 applicable projects with a total cost of $78,530,000.

Table 1-5 represents the cost allocated to each project driver every five years, providing a clear overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 1-5 and Table 1-6 amounts to $398,730,000.

Table 1-61-6 provides a breakdown of the costs by project group, indicating how much money is being allocated to each group. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 1-5: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$2,746,000	$42,490,000	$538,000	$0	**$45,774,000**
Regulatory Compliance	$824,000	$1,603,000	$11,358,000	$670,000	**$14,455,000**
System Reliability	$117,308,000	$107,705,000	$46,375,000	$67,113,000	**$338,501,000**
Total	**$120,878,000**	**$151,798,000**	**$58,271,000**	**$67,783,000**	**$398,730,000**

Table 1-6: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**

Table 1-6: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Wastewater Treatment	$62,980,000	$18,324,000	$1,398,000	$4,756,000	**$87,458,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$120,878,000**	**$151,798,000**	**$58,271,000**	**$67,783,000**	**$398,730,000**

1.13 20-Year CIP Project Cost Schedule

The annual cash flows for the suggested CIPs were derived by escalating project costs to mid-year of construction. The escalation factors for FY2025- FY2045 were calculated using Construction Cost Index (CCI) data from 2014-2024. The estimated cash flows based on the above assumptions and suggested CIP timeframes are shown in subsequent sections.

1.13.1 Water Improvement Projects

Figure 1-9 illustrates the 20-year CIP for water projects (raw water supply, water treatment, water distribution) per FY. In addition, 50% of the costs for DIW and General CIPs were assigned to water projects, since those facilities are shared between the water and wastewater treatment plants.

1.13.2 Wastewater Improvement Projects

Figure 1-10 illustrates the 20-year CIP for wastewater projects (wastewater collections and wastewater treatment projects) per FY. In addition, 50% of the costs for DIW and General CIPs were assigned to wastewater projects, since those facilities are shared between the water and wastewater treatment plants.

1.13.3 Combined Water and Wastewater Improvement Projects

Figure 1-11 illustrates the 20-year CIP for both water and wastewater projects per FY.

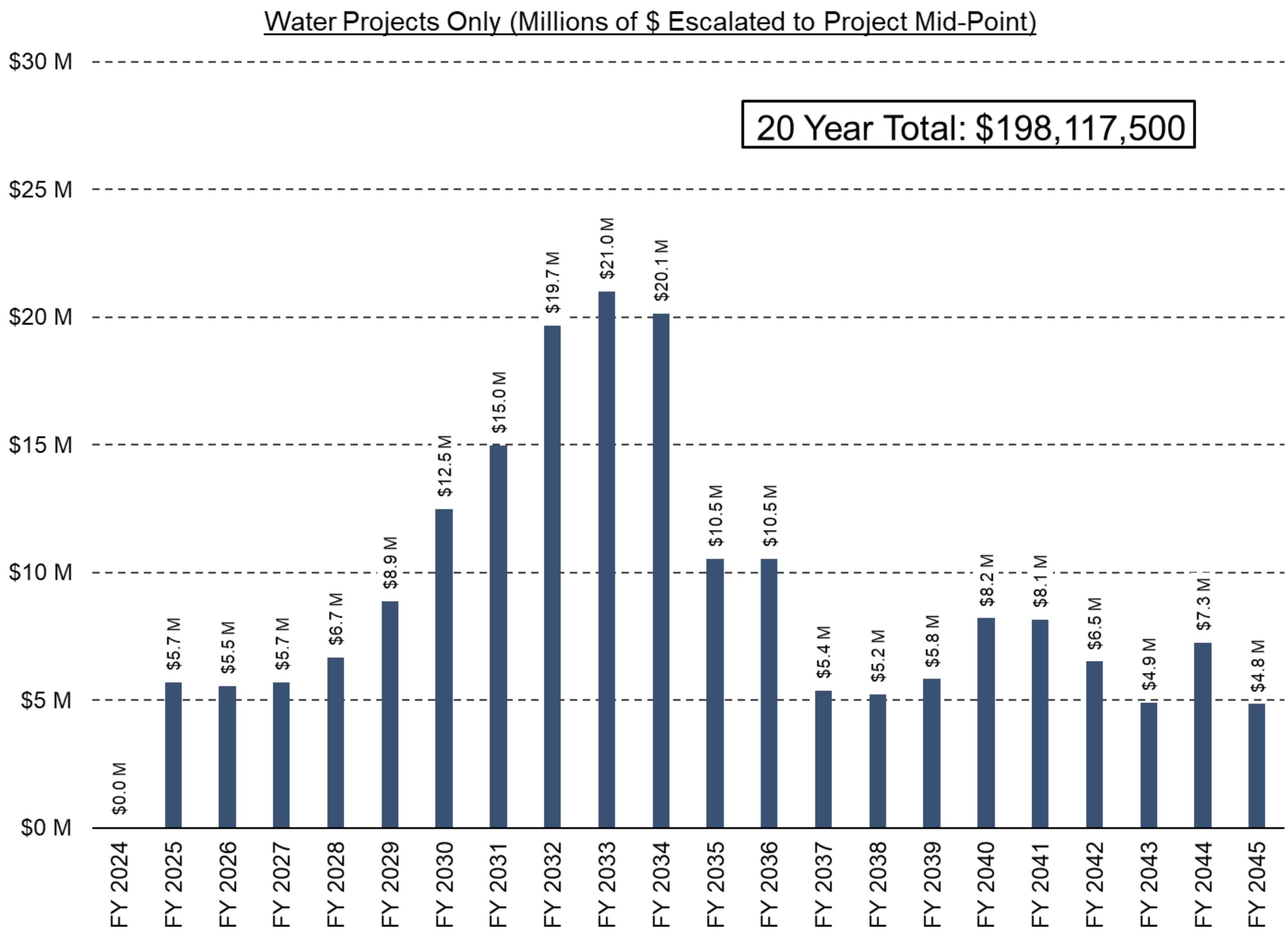


Figure 1-9: 20- Year CIP for Water Projects Only (Millions of $ Escalated to Project Mid-Point)

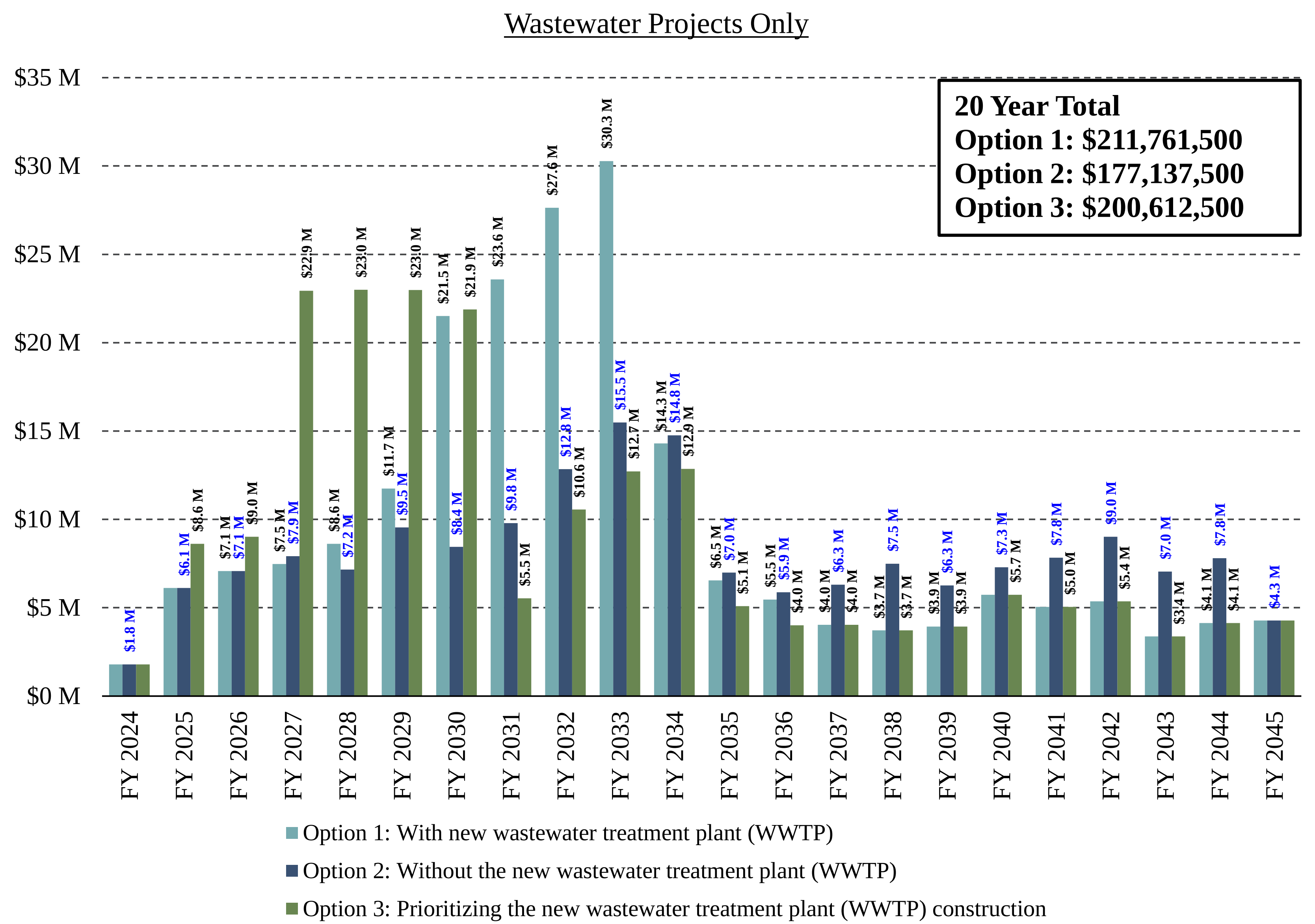


Figure 1-10: 20 Year CIP for Wastewater Projects Only (Millions of $ Escalated to Project Mid-Point)

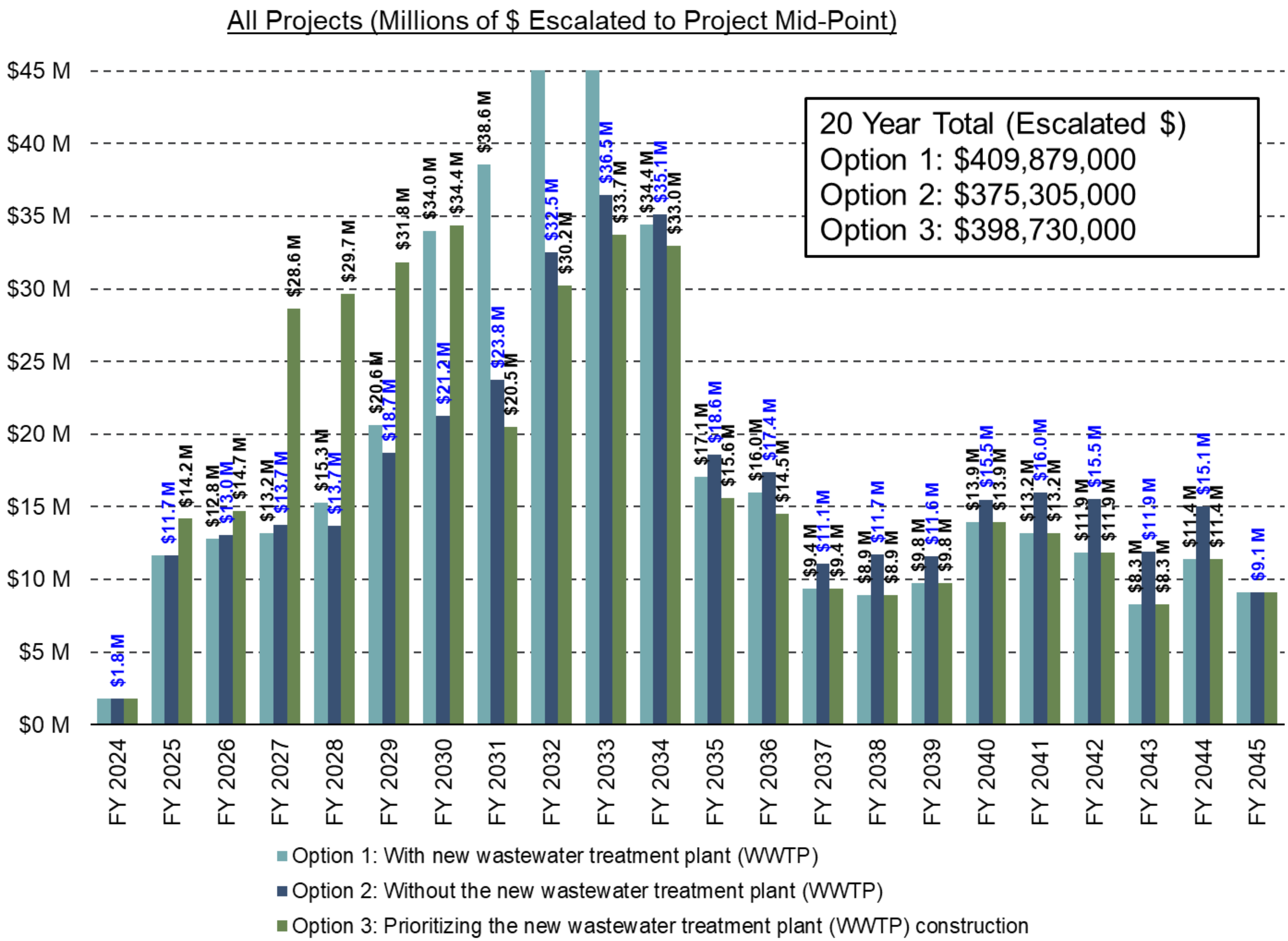


Figure 1-11: 20 Year CIP for All Projects (Millions of $ Escalated to Project Mid-Point)

2. Population, Water Demand, and Wastewater Projections

2.1 Introduction

Population projections for the Cooper City (City) service area were prepared with the City using 2020 United States census data for Cooper City coupled with a 2% per five year period growth rate. This rate of growth is consistent with the rate of growth used by the South Florida Water Management District (SFWMD) for the 2023 Lower East Coast (LEC) Water Supply Plan (WSP). However, since the SFWMD used a 2020 population that was lower than the 2020 census data, the City's baseline population projections are higher than what is shown in the SFWMD 2023 LEC WSP.

2.2 Population Projections

The baseline population forecasts were further developed based on the following additional information:

- Comprehensive plans and land use amendments the City's service area
- Input obtained from the City's Planning Department
- Redevelopment and future development projects and the extensions of the water distribution and
- Wastewater collection systems as identified by City staff.

The City reviewed these projections and forwarded to the SFWMD for discussion and potential incorporation into the SFWMD LEC 2023 WSP. These projections are higher than the projections the SFWMD included in the draft chapter for review. The City requested Hazen continue with the projections as shown herein to conservatively estimate the future infrastructure needs for the City.

Table 2-1: Summary of Population Estimation for 2024 Water and Wastewater Master Plan Update - Cooper City

Source	Year									
	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045
Cooper City - SFWMD 2023 LEC WSP	31,300	31,512	31,682	31,880	32,064	32,248	32,893	33,551	34,222	34,907
Cooper City - Census 2020(escalated by 2% per 5 years)	34,401	34,951	35,055	35,078	35,083	35,089	35,791	36,507	37,237	37,981
Cooper City - Additional Population Served Outside of City[1]	162	162	162	162	162	162	162	162	162	162
Cooper City - Used in 2024 Water and Wastewater Master Plan Update	34,563	35,113	35,217	35,240	35,245	35,251[2]	35,953	36,669	37,399	38,143

Notes:

[1] Based on out of City accounts provided by the City. Assumed single-dwelling units where no data is available on the Broward County Property Appraiser website. Additionally, assumed 3.06 persons per household as per Census data for Cooper City.

[2] The 2007 Cooper City 20-Year Water and Wastewater Capital Improvement Master Plan estimated a population of 38,776 in 2025.

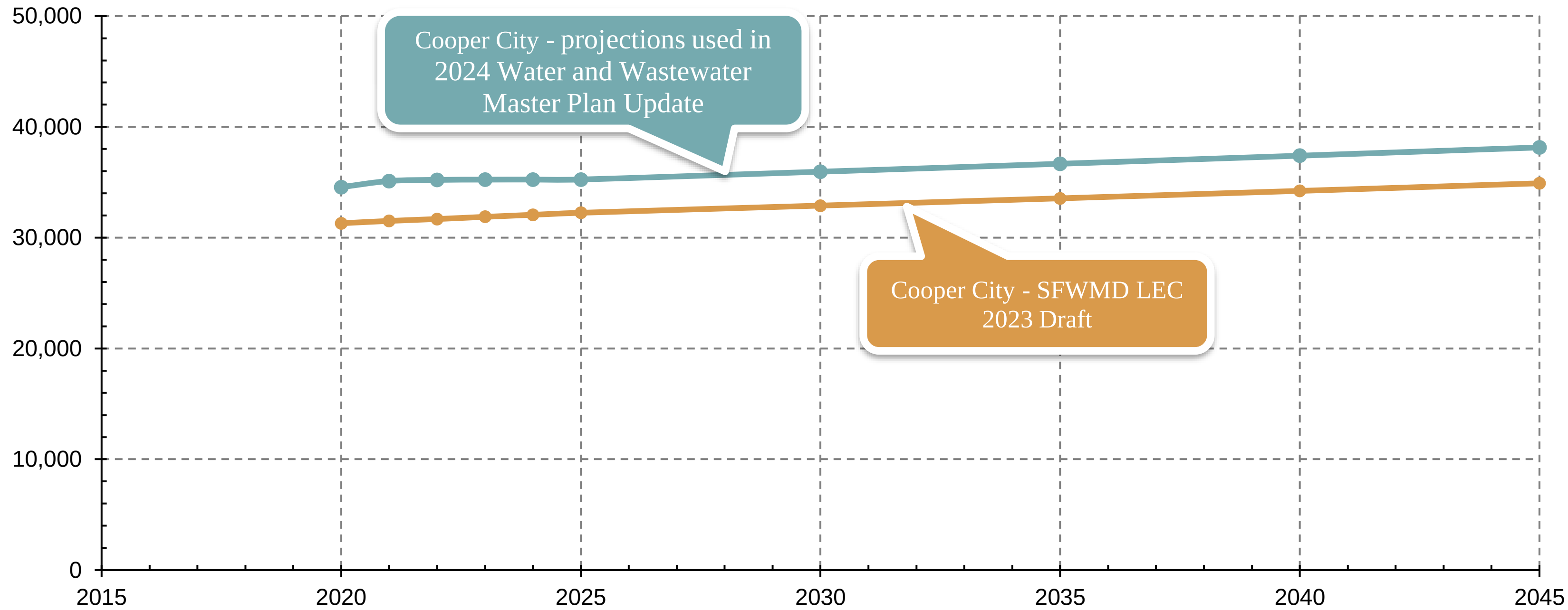


Figure 2-1: Cooper City Population Projections

2.3 Water Demand Projections

Table 2-2: Yearly Finished Water Flows Summary (MGD)

Year	Total	Min	Max	Average	Max Day PF
2018	1,117.22	1.63	4.25	3.06	1.39
2019	1,063.55	2.05	5.08	2.91	1.74
2020	1,093.27	2.09	4.33	2.99	1.45
2021	1,120.38	1.50	4.35	3.07	1.42
2022	1,119.80	1.78	4.20	3.07	1.37
AVG	1,102.84	1.81	4.44	3.02	1.47

Table 2-3: Yearly Raw Water Flows Summary (MGD)

Year	Total	Min	Max	Average	Max Day PF
2018	1,413.38	2.03	5.31	3.87	1.37
2019	1,346.85	2.70	6.25	3.69	1.69
2020	1,368.69	2.63	5.26	3.74	1.41
2021	1,363.04	1.84	5.26	3.73	1.41
2022	1,363.30	2.08	5.11	3.74	1.37
AVG	1,371.05	2.26	5.44	3.75	1.45

Table 2-4: Yearly Unaccounted for Water Loss Summary

Year	Annual Raw Water (Mgal)	Annual Finished Water (Mgal)	Annual Avg Treatment Loss	Annual Finished Water (Mgal)	Annual Metered Water (Mgal)	Annual Average System Loss
2018	1413.38	1119.36	20.8%	1119.36	891.12	20.4%
2019	1347.95	1064.41	21.0%	1064.41	970.45	8.8%
2020	1374.47	1093.27	20.5%	1093.27	980.45	10.3%
2021	1358.87	1120.38	17.6%	1120.38	972.15	13.2%
2022	1362.01	1120.09	17.8%	1120.09	916.83	18.1%
		Avg	19.5%		Avg	14.2%

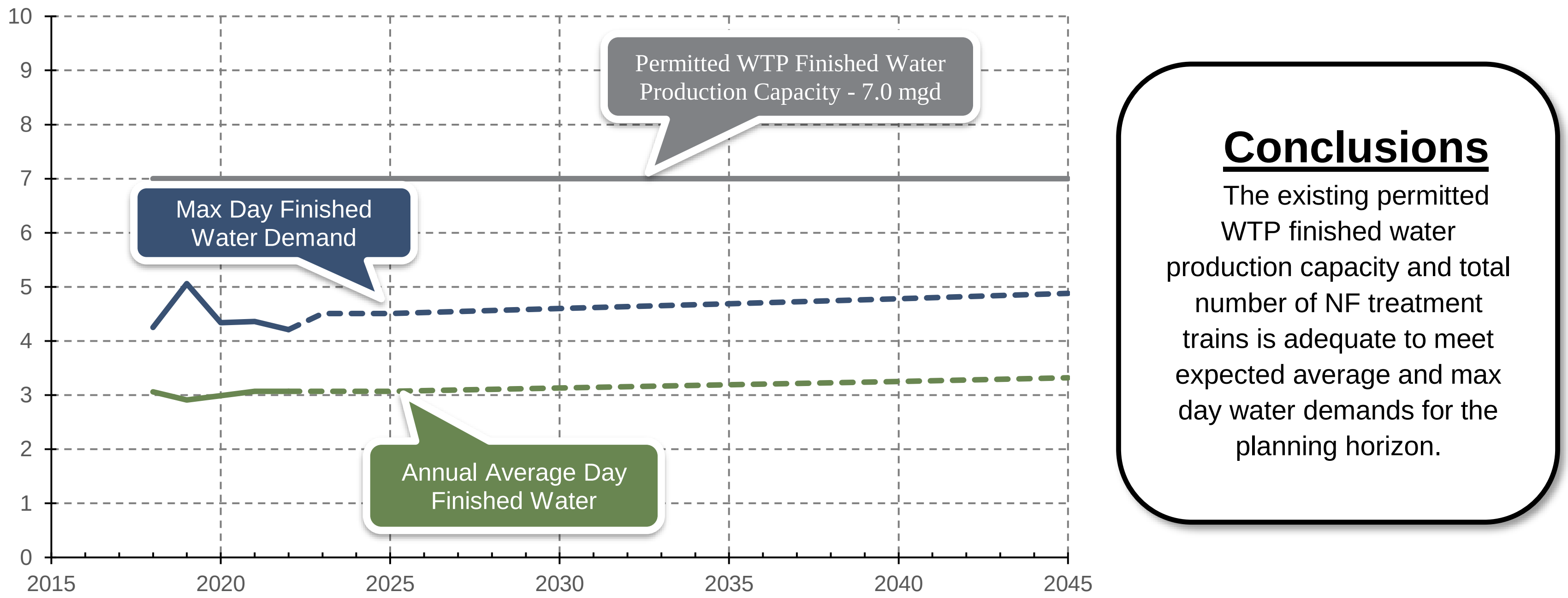
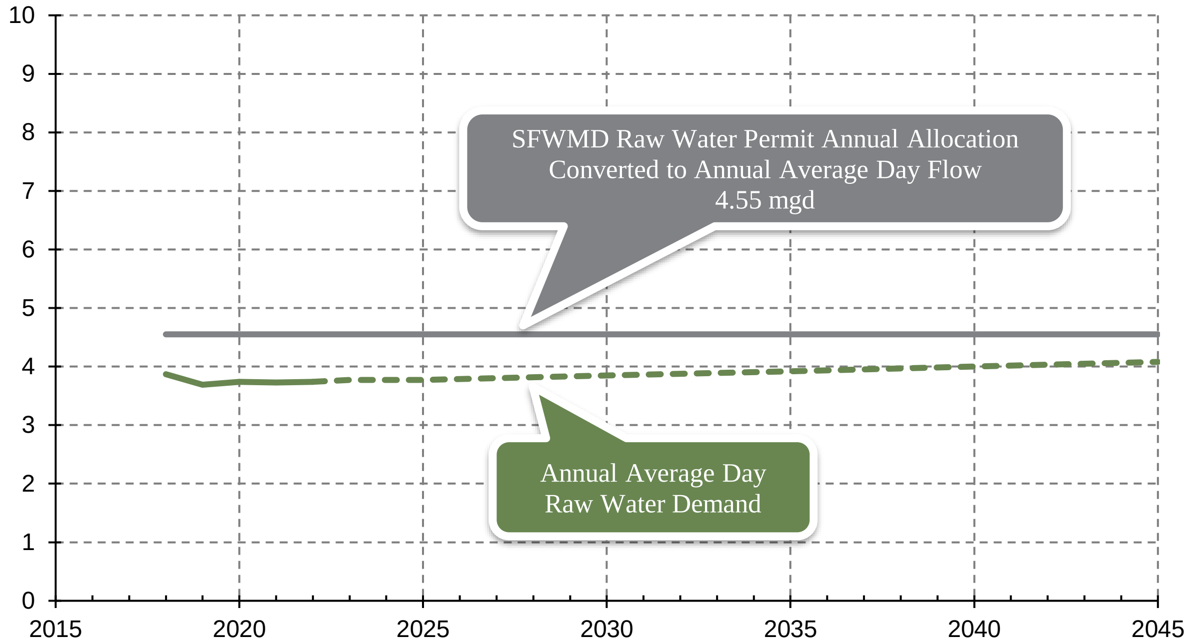


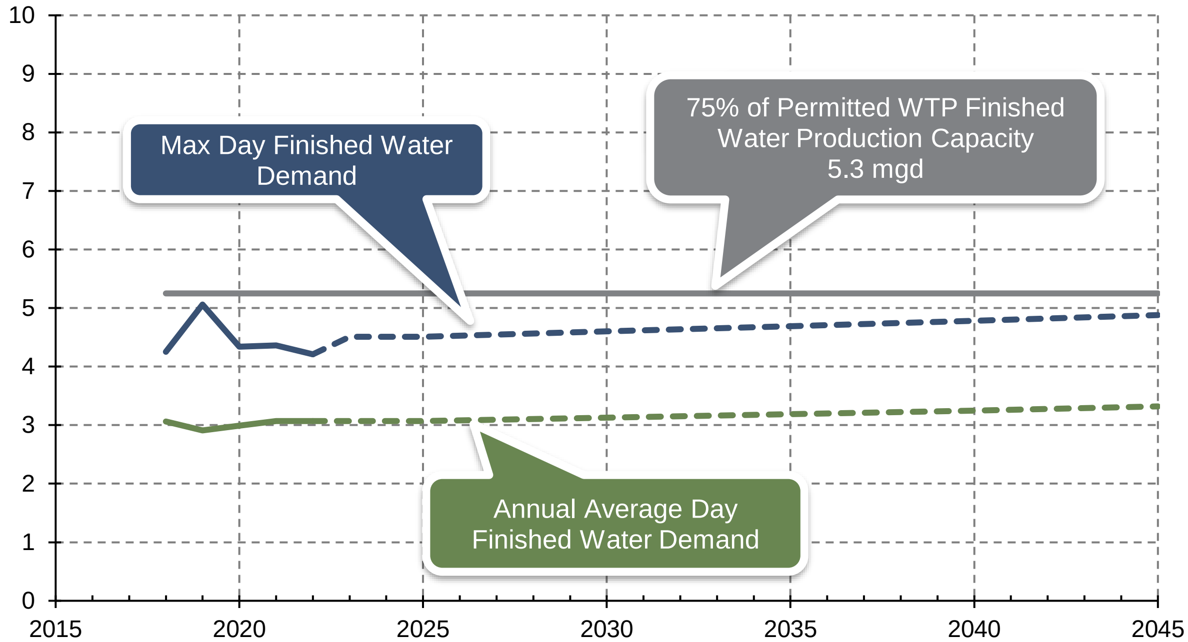
Figure 2-2: Finished Water Demand Forecast (MGD) In Relation to the FDEP Permitted WTP Finished Water Production (MGD)



Conclusions

The annual permitted raw water allocation from SFWMD is sufficient to meet average day raw water demands for the planning horizon.

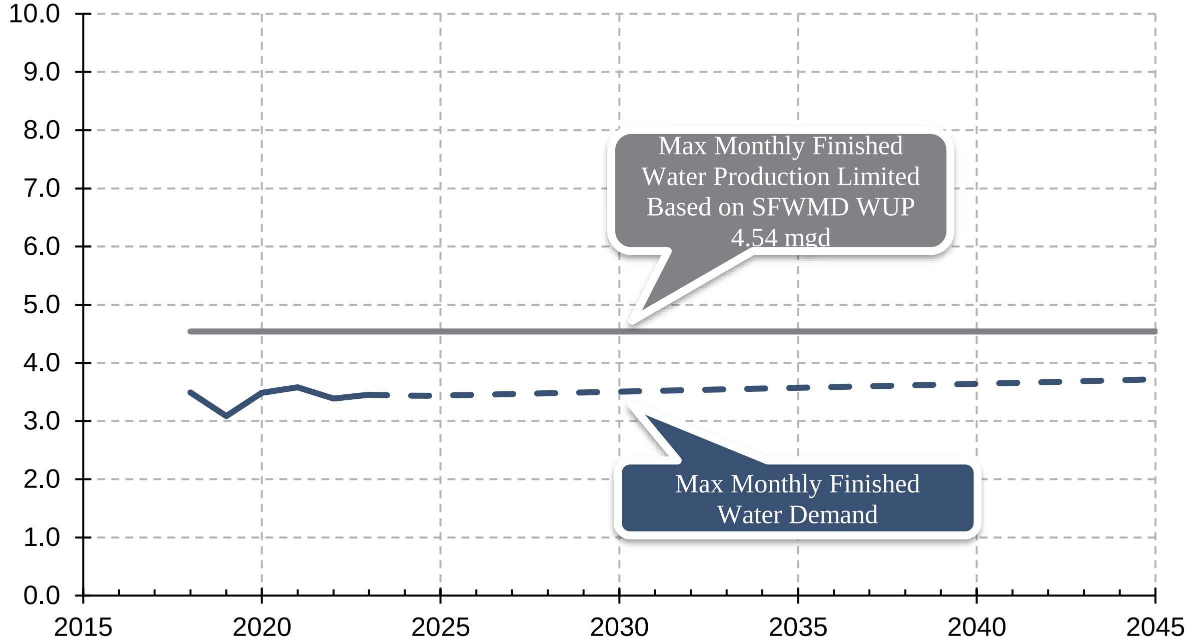
Figure 2-3: Annual Average Day Raw Water Demand Forecast (MGD) in relation to the SFWMD Annual Permitted Biscayne Aquifer Raw Water Allocation (MGD)



Conclusions

A capacity analysis report per 62-555.348, FAC, is not expected to be required for the planning horizon based on the FDEP permitted capacity.

Figure 2-4: Finished Water Demand Forecast (MGD) In Relation to 75% of Permitted WTP Finished Water Production Capacity (MGD)



Conclusions

The max monthly permitted raw water allocation from SFWMD is sufficient to meet max monthly finished water demands for the planning horizon.

Figure 2-5: Finished Water Demand Forecast (MGD) In Relation to SFWMD Max Monthly Finished Water Demand (MGD)

Table 2-5: Projected Finished and Raw Water Demands

Year	Water Service Area Population[1]	Biscayne Aquifer Raw Water Demand					Finished Water Demand					Distribution System Consumption[2]				Consumptive Use Permit Raw Water Withdrawal Limits Converted to mgd		WTP Finished Water Treatment Production Capacity (mgd)			
		AADF Per Capita (gpcd)	AADF Demand (mgd)	Max Day Peaking Factor	Max Day Demand (mgd)	Treatment Loss (%)	AADF Per Capita (gpcd)	AADF Demand (mgd)	Max Day Peaking Factor	Max Day Demand (mgd)	System Loss (%)	AADF Per Capita (gpcd)	AADF Demand (mgd)	Max Day Peaking Factor[3]	Max Day Demand (mgd)	AADF Annual Allocation (mgd)[4]	MDF Monthly Allocation (mgd)[5]	FDEP Permitted Capacity (mgd)	75% of Permitted Capacity (mgd)[6]	Avg Based on SFWMD Annual Allocation (mgd)[7]	Max Based on SFWMD Monthly Allocation (mgd)[7]
2018	Note 1		3.87	1.37	5.30	20.8%		3.06	1.39	4.25	20.4%		2.44	1.39	3.39	4.55	5.64	7.0	5.3	3.66	4.54
2019	Note 1		3.69	1.69	6.24	21.0%		2.91	1.74	5.06	8.8%		2.66	1.74	4.63	4.55	5.64	7.0	5.3	3.66	4.54
2020	34,563	108	3.74	1.41	5.27	20.5%	87	2.99	1.45	4.34	10.3%	78	2.69	1.45	3.9	4.55	5.64	7.0	5.3	3.66	4.54
2021	35,114	106	3.73	1.41	5.26	17.6%	87	3.07	1.42	4.36	13.2%	76	2.66	1.42	3.78	4.55	5.64	7.0	5.3	3.66	4.54
2022	35,217	106	3.74	1.37	5.12	17.8%	87	3.07	1.37	4.21	18.1%	71	2.51	1.37	3.44	4.55	5.64	7.0	5.3	3.66	4.54
2023	35,240	107	3.77	1.45	5.47	19.5%	87	3.07	1.47	4.51	14.2%	75	2.64	1.47	3.88	4.55	5.64	7.0	5.3	3.66	4.54
2024	35,246	107	3.77	1.45	5.47	19.5%	87	3.07	1.47	4.51	14.2%	75	2.64	1.47	3.88	4.55	5.64	7.0	5.3	3.66	4.54
2025	35,252	107	3.77	1.45	5.47	19.5%	87	3.07	1.47	4.51	14.2%	75	2.64	1.47	3.88	4.55	5.64	7.0	5.3	3.66	4.54
2030	35,953	107	3.85	1.45	5.58	19.5%	87	3.13	1.47	4.60	14.2%	75	2.70	1.47	3.97	4.55	5.64	7.0	5.3	3.66	4.54
2035	36,669	107	3.92	1.45	5.69	19.5%	87	3.19	1.47	4.69	14.2%	75	2.75	1.47	4.04	4.55	5.64	7.0	5.3	3.66	4.54
2040	37,399	107	4.00	1.45	5.80	19.5%	87	3.25	1.47	4.78	14.2%	75	2.80	1.47	4.12	4.55	5.64	7.0	5.3	3.66	4.54
2045	38,144	107	4.08	1.45	5.92	19.5%	87	3.32	1.47	4.88	14.2%	75	2.86	1.47	4.20	4.55	5.64	7.0	5.3	3.66	4.54

Notes:

[1] Population for 2018 and 2019 was not provided.

[2] Daily consumption was not provided; monthly totals were provided in SFWMD Water Loss Reports.

[3] Consumption peaking factor is assumed to be equivalent to finished water demand peaking factor.

[4] SFWMD annual allocation = 1,661 MG; permit expires April 26, 2030.

[5] SFWMD maximum monthly allocation = 171.5 MGM; permit expires April 26, 2030.

[6] Ch. 62-555.348 FAC requires a capacity analysis report when the finished water flow exceeds 75% of permitted capacity.

[7] Assumes average treatment loss of 19.5% based on historical losses.

[8] Calculated raw water demand exceeds permitted maximum raw water. An additional raw water source may be required.

2.4 Wastewater Projections

Table 2-6: Flow Peaking Factors

Parameter	2018		2019		2020		2021		2022		PF	
	Flow	PF	Flow	PF	Flow	PF	Flow	PF	Flow	PF	Average	Selected
Minimum Day Flow[1]	1.49	0.60	1.88	0.75	1.85	0.71	2.14	0.84	2.09	0.80	0.74	0.75
Average Annual Daily Flow (AADF)[2]	2.49	1.00	2.51	1.00	2.62	1.00	2.55	1.00	2.61	1.00	1.00	1.00
Maximum Three Month Average Daily Flow (MTMADF)[3]	2.70	1.09	2.58	1.03	3.07	1.17	2.99	1.17	2.89	1.11	1.11	1.15
Maximum Monthly Average Daily Flow (MMADF)[4]	2.89	1.16	2.76	1.10	3.42	1.31	3.02	1.18	3.16	1.21	1.19	1.30
Maximum 7-Day Flow (M7DF)[5]	3.64	1.47	3.12	1.24	5.16	1.97	3.10	1.22	4.05	1.55	1.49	1.90
Maximum Day Flow (Max-DF)[6]	4.88	1.96	4.04	1.61	6.44	2.46	3.49	1.37	5.51	2.11	1.90	2.50
Peak Hour Flow[7]	--	--	--	--	6.47	2.47	6.55	2.57	6.59	2.53	2.56	3.00

Notes:

[1] All flows are in units of millions of gallons per day (mgd). Minimum Day Flow = Minimum daily flow event in a year

[2] Average Annual Daily Flow = Total influent volume flowing into a facility during a calendar year, divided by the number of days in that calendar year

[3] Maximum Three Month Average Daily Flow = Maximum TMADF in a calendar year, where TMADF is the cumulative influent volume flowing to the facility in three consecutive months divided by the number of days in the three-month period

[4] Maximum Monthly Average Daily Flow = Maximum MADF in a calendar year, where MDAF is the total influent volume flowing into the facility during a calendar month divided by the number of days in that month

[5] Maximum 7-Day Flow = Maximum 7DF, where 7DF is the cumulative influent volume flowing into the facility during seven consecutive days divided by seven

[6] Maximum Day Flow = Maximum daily flow event in a year

[7] Peak Hour Flow = The highest influent volume during any one hour in a given year

Table 2-7: Loading Peaking Factors

Parameter	BOD			cBOD			TSS		
	Flow (mgd)	PF	Selected	Flow (mgd)	PF	Selected	Flow (mgd)	PF	Selected
Minimum Day Flow[1]	2,140	0.56	0.60	1,800	0.56	0.60	987	0.26	0.60
Average Annual Daily Flow (AADF)[2]	3,780	1.00	1.00	3,180	1.00	1.00	3,860	1.00	1.00
Maximum Three Month Average Daily Flow (MTMADF)[3]	4,250	1.12	1.20	3,580	1.12	1.20	5,550	1.16	1.20
Maximum Monthly Average Daily Flow (MMADF)[4]	4,750	1.25	1.30	4,020	1.26	1.30	5,150	1.33	1.30
Maximum 7-Day Flow (M7DF)[5]	6,360	1.68	1.80	5,240	1.65	1.80	7,020	1.82	1.80
Maximum Day Flow (Max-DF)[6]	6,360	1.68	2.50	5,240	1.65	2.50	7,020	1.82	2.50

Notes:

[1] All flows are in units of millions of gallons per day (mgd). Minimum Day Flow = Minimum daily flow event in a year

[2] Average Annual Daily Flow = Total influent volume flowing into a facility during a calendar year, divided by the number of days in that calendar year

[3] Maximum Three Month Average Daily Flow = Maximum TMADF in a calendar year, where TMADF is the cumulative influent volume flowing to the facility in three consecutive months divided by the number of days in the three-month period

[4] Maximum Monthly Average Daily Flow = Maximum MADF in a calendar year, where MDAF is the total influent volume flowing into the facility during a calendar month divided by the number of days in that month

[5] Maximum 7-Day Flow = Maximum 7DF, where 7DF is the cumulative influent volume flowing into the facility during seven consecutive days divided by seven

[6] Maximum Day Flow = Maximum daily flow event in a year
[7] Peak Hour Flow = The highest influent volume during any one hour in a given year

Table 2-8: Annual Average Influent Concentrations

Criteria	Historical	Primary Effluent	Primary Effluent	Calculated
	AA Concentration	AA Concentration	Percent Removal	AA Concentration
BOD, mg/L	180.2	6.0	96.57%	176.0
CBOD, mg/L	151.4	5.1	96.54%	147.9
COD, mg/L	N/A[1]	N/A	N/A	N/A
TSS, mg/L	182.1	5.0	96.68%	180.6
VSS, mg/L	N/A	N/A	N/A	N/A
TKN, mg/L	N/A	14.6	N/A	N/A
NH3, mg/L	N/A	N/A	N/A	N/A
TP, mg/L	N/A	2.3	N/A	N/A
Ortho-P, mg/L	N/A	2.5	N/A	N/A
Alkalinity, mg/L	N/A	N/A	N/A	N/A

Notes:

[1] Not Available.

Table 2-9: Wastewater Historical Data and Flow Projections

Year[3]	Projected Population	Historical Data			Projected Data		
		Measured AADF (mgd)	Per Capita Flow (gpd)	Measured MTMADF (mgd)	Per Capita Flow (gpd)	AADF (mgd)	MTMADF (mgd)
2018	33,933[4]	2.49	73.3	2.70	-	-	-
2019	34,024[4]	2.51	73.9	2.58	-	-	-
2020	34,563	2.62	75.8	3.07	73.9	-	-
2021	35,113	2.63	75.0	2.99	73.9	-	-
2022	35,217	2.61	74.1	2.89	73.9	-	-
2023	35,240	-	-	-	73.9	2.61	3.00
2024	35,245	-	-	-	73.9[1]-74.7[2]	2.6[1]-2.63[2]	3[1]-3.03[2]
2025	35,251	-	-	-	73.9[1]-75.4[2]	2.61[1]-2.66[2]	3[1]-3.06[2]
2030	35,953	-	-	-	73.9[1]-79.0[2]	2.66[1]-2.84[2]	3.06[1]-3.27[2]
2035	36,669	-	-	-	73.9[1]-82.7[2]	2.71[1]-3.03[2]	3.12[1]-3.49[2]
2040	37,399	-	-	-	73.9[1]-86.3[2]	2.76[1]-3.23[2]	3.18[1]-3.71[2]
2045	38,143	-	-	-	73.9[1]-90.0[2]	2.82[1]-3.43[2]	3.24[1]-3.95[2]

Notes:

[1] Assuming the per capita wastewater generation to remain at the current average of 73.9 gpd

[2] Assuming the per capita wastewater generation to linearly increase from the current average of 73.9 gpd in FY 2025 to 90 gpd in FY 2045

[3] Calendar Year

[4] Population with sewer service as reported in "*Updated Capacity Analysis Report for the City of Cooper City Wastewater Treatment Plant*" prepared by the City for FDEP Permit Renewal in 2022

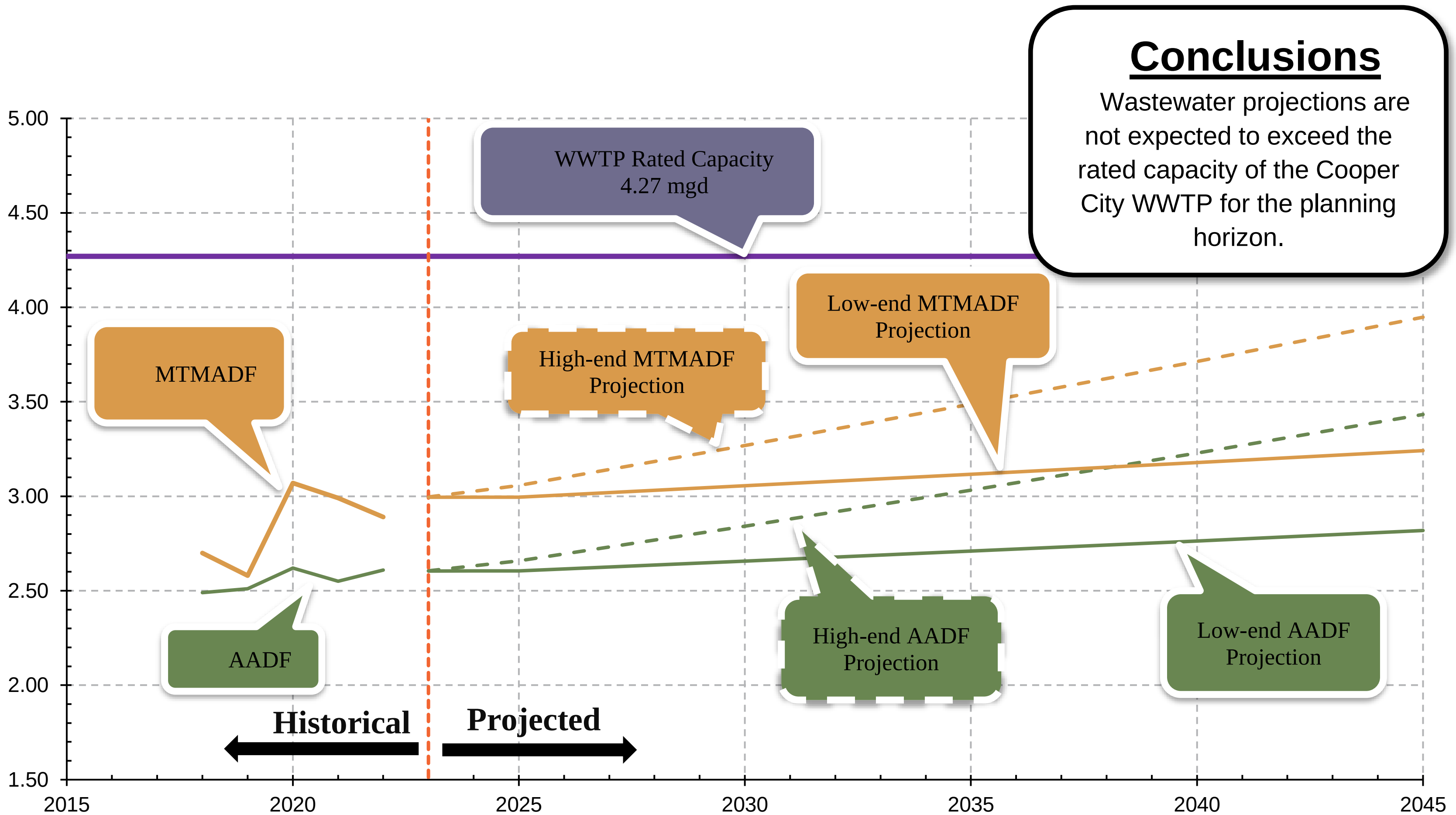


Figure 2-6: Historic Influent Flow (MGD) vs Projected Influent Flow (MGD)

7. Evaluation of Wastewater Treatment Facilities

7.1 Existing Wastewater Treatment System

7.1.1 Wastewater Treatment Plant Location

The Cooper City Wastewater Treatment Plant (WWTP) is an activated sludge-based facility composed of three package treatment plants. The WWTP is located at 11791 SW 49th St, Cooper City, FL 33330, in Broward County.

7.1.2 Existing Treatment Process

The WWTP consists of three package plants. The rated capacity of the WWTP is 4.27 mgd maximum three-month average daily flow (MTMADF) per the 5-year permit (permit #: FL00440398 MI), effective January 26, 2023.

Cooper City WWTP receives raw influent via a 16-inch force main (FM). The WWTP's influent flow is continuously measured using a magnetic flow meter. The influent received is first transferred into a surge tank after removing large debris via a coarse bar screen (spacing ¾"). Ferrous sulfate is introduced to the surge tank for odor control. A photo of the surge tank at the WWTP is shown in Figure 7-1.

Figure 7-1: Surge Tank at the WWTP

Downstream of the surge tank are three package plants providing biological treatment, labeled 1-3 chronologically based on the construction date. Each package plant was designed with a capacity of 1.42

mgd maximum three-month average daily flow (MTMADF) at the time of construction. Influent from the surge tank is transferred to the three package plants via a pumping station consisting of four centrifugal pumps (two-speed) operating in lead-lag mode. Each package plant consists of a liquid treatment train comprising a second coarse bar screen (spacing 1/2"), an activated sludge basin capable of operating in extended aeration and contact stabilization modes, a secondary clarifier, and a chlorine contact tank. Sodium hypochlorite for chlorination is supplied to each package plant using a dedicated dosing pump that operates at a rate set by the operator.

Following chlorination, the effluents from the package plants are routed to a lagoon for equalization prior to discharging. The WWTP has two on-site 0.365 MG effluent equalization lagoons constructed in 1986, the East Lagoon and the West Lagoon. The effluent from WWTP is transferred only to the East Lagoon, which can be discharged to the City of Hollywood's wastewater treatment plant effluent pump station wet well or the on-site deep injection well (DIW). The City of Cooper City WWTP is allowed to discharge into the City of Hollywood WWTP's effluent disposal pump station per a contract entered in 1985. The existing force main discharging the City of Cooper City's effluent to the City of Hollywood's WWTP effluent pump station is shown in Figure 7-5. The West Lagoon receives Nanofiltration (NF) concentrate from the adjacent water treatment facility. However, unlike treated effluent from the WWTP, NF concentrate in the West Lagoon is exclusively injected into the DIW. NF concentrate could also be pumped to the surge tank or Package Plants 1 and 2 headworks for treatment if required. A photo of the effluent transfer pump station is shown in Figure 7-2.

Figure 7-2: Effluent Transfer Pump Station

All package plants are equipped with aerobic digesters to stabilize biosolids to Class B requirements. The thickened filter cake, currently meeting Class B requirements, is hauled offsite for land application by a private contractor. The debris removed via bar screens is sent to a landfill. A schematic representation of the process flow at the wastewater treatment plant and a labeled aerial of the WWTP site are shown in Figure 7-3 and Figure 7-4. The details of all major components/equipment in the WWTP are summarized in Table 7-1.

Table 7-1: WWTP Components

Process	**Unit Size / Description**
Influent Conveyance	
Pipe Size	16”
Flow Meter Type (Manufacturer)	Magnetic flow meter (ABB Ltd., Sweden)
Range (gpm)	0-6944
Surge Tank	
Year Built	1986
Volume	301,000 gal
Tank Depth	20’-4’’
Tank Diameter	51’
Package Plant 1	
Manufacturer and Model	Smith and Loveless, Oxigest 113P1250
Building Material	Steel
Year Built	1972
Overall Diameter	113’ 6”
Contact Basin Volume	156,600 gal
Stabilization Basin Volume	306,240 gal
Settling Basin	
Volume	266,500 gal
Diameter	60’
Surface Area	2,640 sqft
Side Water Depth	14’
Chlorine Contact Tank	
Volume	25,600 gal

Process	Unit Size / Description
Aerobic Digester Volume	
Volume	284,500 gal
Package Plant 2	
Manufacturer and Model	Davco, 857-1-0-0-6-AD
Year Built	1986
Overall Diameter	104’
Aeration Side Water Depth	15’
Contact Basin Volume	151,120 gal
Stabilization Basin Volume	302,230 gal
Settling basing	
Volume	205,510 gal
Diameter	50’
Surface Area	1,960 sqft
Side Water Depth	14’
Chlorine Contact Tank	
Volume	32,630 gal
Aerobic Digester Volume	
Volume	243,060 gal
Digester Side Water Depth	15’
Package Plant 3	
Manufacturer	Smith and Loveless
Year Built	1994
Overall Diameter	113’
Contact Basin Volume	105,970 gal
Stabilization Basin Volume	300,210 gal
Settling basing	
Volume	370,000 gal

Process	Unit Size / Description
Diameter	65’
Surface Area	3,310 sqft
Side Water Depth	15’
Chlorine Contact Tank	
Chlorine Contact Tank	32,500 gal
Aerobic Digester Volume	
Aerobic Digester Volume	301,940 gal
Process Aeration Blowers	
Manufacturer	Lamson
No. Blowers	
250 hp units	4
100 hp units	2
Units Type	Multistage centrifugal
Units Capacity	4,200 scfm @ 8.8 psig
	1,960 scfm @ 8.8 psig
Year Installed	1986 (3); 1994 (4)
Sludge Handling	
No. Sludge Transfer Pumps	1
Transfer Pump Capacity	35 – 120 gpm @ 16 – 45ft TDH
Transfer Pump Manufacturer and model	Penn Valley model 4DDSX24
Transfer pump HP	10 hp
Grinders Manufacturer and model	Muffin Monster model 30001-0012 and Vogelsang RotaCut in series
Sludge Dewatering	
No. Polymer Tanks	2
Polymer Used	Clarifloc SE-1385 C
No of Centrifuges	2
Manufacturer and Model	Sharples, 38000

Process	Unit Size / Description
Built Year	1994, 1992 (installed as a used unit in 2006)
Flow (gpm)	20-110
Centrifuge Motor Horsepower	40
Chemical Transfer Units	
Chlorination	
No. of Dosing Pumps	3
Ferrous sulfate	
No. of Dosing Pumps	2
Effluent Equalization	
No. of Equalization Lagoons	2
Year of Construction	1986
Size per Lagoon (MG)	0.365
Effluent Transfer Pump Station	
Year of Construction	1986
No. of Pumps	
100/30 hp pumps[1]	1
200/60 hp pumps[1]	2
Flow	100/30 HP: 1400/2540 gpm
	200/60 HP: 1910/3055
Maximum Permitted Discharge	3.1 mgd AADF
Deep Injection Well (DIW)	
No. of Wells	1
Internal Diameter	14.48''
Permitted Well Capacity	5.95 Maximum Day Flow (Max-DF)
No. of Pumps	2
Pump Horsepower	125 hp

Note: *[1] Pumps have two-speed settings.*

7.1.3 Historical Review

The WWTP was constructed in the late 1970s as a 1.42 mgd MTMADF package treatment plant (Package Plant 1) encompassing a bar screen, an aeration basin for the activated sludge process, and a secondary clarifier for liquid stream treatment; an aerobic digestor was provided for biosolids stabilization. Package Plant 1, manufactured by Smith and Loveless using welded steel, was installed in Lauderhill, FL, in 1972 before being moved and rewelded at the Cooper City WWTP in 1979. As the influent flow increased, the City added a second 1.42 mgd package plant (Package Plant 2) in 1986. The second package plant, manufactured by Davco, was also of steel construction. Both liquid and solids treatment trains of Package Plant 2 were similar to Plant 1. In addition, the blowers aerating Package Plant 1 were also replaced with three 100 hp multistage centrifugal blowers in 1986. Besides the second Package Plant and blower modifications, a 301,000 gal surge tank was also added to the WWTP treatment train in 1986 to equalize influent flows.

The City constructed a third 1.42 mgd Package Plant (Package Plant 3) to increase its treatment capacity in 1994. Unlike Package Plants 1 and 2, Plant 3 was constructed of prestressed concrete. The City also added four 250 hp blowers to increase the aeration capacity across the WWTP at the time of Package Plant 3 construction. Package Plant 3 also consisted of solids and liquid treatment processes similar to those of the other two plants. Of the three, Package Plants 1 and 2 were designed to receive NF concentrate from the neighboring water treatment facility owned by the City. The City installed a centrifuge in 1994 to thicken digested sludge. A second centrifuge of similar capacity was added in 2006.

The City disposes effluent from the WWTP via a DIW and effluent transfer pumps discharging to Hollywood WWTP. The DIW (IW-1) was constructed in 2001 and encompassed a 3400 ft deep well, a surge control system, two horizontal split case pumps, surface piping, and a dual-zone monitoring well (MW-1). The DIW was used as the primary route for the disposal of NF concentrate, with the capability of discharging WWTP's treated effluent as needed. However, in 2003, the City observed increased injection pressure requirements. Subsequent video surveys conducted in 2006 and 2011 demonstrated scaling inside the carbon steel injection tubing. Chemical treatment and backwashes were not effective in reestablishing the flows. In 2018, the City experienced a loss in the annular pressure in the DIW, which may have occurred due to injection tubing or packer seal issues. City rehabilitated the DIW and increased capacity in 2020-2021 to address these problems. A subsequent investigation identified that DIW pumps were undersized and recommended upsizing them.

The effluent transfer pumping station was constructed in 1986, along with the construction of Package Plant 2. At the time of construction, the pump station was equipped with two 15 hp, two 100 hp, and two 200 hp pumps. However, only one 100 hp and the two 200 hp pumps are currently operational. The City has an ongoing project in the preconstruction stage to replace the other 100 hp pump with a new 250 hp pump.

7.1.4 Condition assessment summary and recommendations from the 2005 Master Plan

The existing facility evaluation conducted for the 2005 Master Plan update noted corrosion damage on Package Plant 1's steel tank exterior wall, interior compartment separation walls, air header pipes and diffuser laterals, and walkway supports. The package plant was taken out of service several times prior to 2005 for emergency maintenance. A bow in the steel tank walls and an active leak between the concrete slab were also noted. The Master Plan Update in 2005 recommended replacing the corroded components in the short term with the plan to replace the package plant with a new stand-alone plant in mid- to long-term timeframe.

The 2005 Master Plan concluded satisfactory operating conditions in Package Plant 2. Besides the corrosion damage in the influent pipe, no notable damage was seen in the steel tank, mechanisms, or related appurtenance. The master plan recommended replacing the influent pipe in mid-to-long terms. Package Plant 3 was also identified to be in satisfactory operating condition. Condition evaluation, however, noted the water level in Package Plant 3's aeration zone submerged the air header. The 2005 Master Plan update recommended identifying the root cause for this issue and resolving it. Adding a separate lift pump between the contact and stabilization zones was recommended to facilitate operating Package Plant 3 in contact stabilization mode.

The 2005 Master Plan Update noted that three 100-hp blowers installed in 1986 were approaching their service life, and recommended replacing those as needed. Also, providing separate air headers for the activated sludge processes and aerobic digesters, switching to fine bubble aeration, and automating air supply controls based on the demand were proposed for the City to conserve aeration energy.

The 2005 Master Plan Update noted the WWTP's sludge transfer system as a critical point of failure due to the availability of only one transfer pump. Therefore, adding a second pump and a grinder was recommended to ensure process redundancy. Similarly, the availability of only one centrifuge was identified as a point of failure. However, the second centrifuge installed in 2006 was identified to resolve this issue.

7.1.5 City's Maintenance Records

The WWTP maintenance records the City provided are summarized in Table 7-2.

Table 7-2: Maintenance Records

Process	Year
Influent Flow Meter	
Meter Replaced	2007, 2017 and 2019
Surge Tank	
Tank Cleanouts	2015, 2016, 2019
Pipe to Bar Screen Replaced	2016
New Feed pipe	2016
Odor Control Line Replaced	2016
Package Plant 1	
Air Header Rebuilt	1997
Air Header Feed Pipe Repair	2002
Digester Leak Repair	2003

Process	Year
Reinforced Tank Walls	2004
New Weirs	2007
Painted	2008
New Flow Meter	2016
New Down Pipes	2018
New Air Flow Meter	2016
New Feed Pipe	2016
New Flow Meter Added	2018
Package Plant 2	
Air Header Rebuilt	2002
New Gear Drive Added	2008
Gear Drive Failure	2009
Air Diffuser Cleaning	2017
Supernatant Pipe Repair	2020
New Air Flow Meter	2016
New Feed Pipe	2016
New Flow Meter Added	2018
Package Plant 3	
New Overflow on Bar Screen	2007
Extended Aeration Line Replaced and Plant Rehabilitated	2015
New Air Flow Meter	2016
New Flow Meter Added	2019
Process Aeration Blowers	
100 hp Blowers: Blower #3 Rebuilt	2008-2009
100 hp Blowers: Blower #1 Bearings Replaced	2009
100 hp Blowers: Blower #2 Failure	2009
100 hp Blowers: Blower #1 High Temperature and Oil Leak Detected	2009
100 hp Blowers: Blower # 1 and 2 Replaced with #3 and a New Blower	2010
100 hp Blowers: New Blower Failure	2010
100 hp Blowers: Blower #3 Rebuilt	2023
250 hp Blowers: Blower #7 Replaced	2013
250 hp Blowers: Blower #5 Bearings Replaced	2019

Process	Year
Effluent and Concentrate Equalization Lagoons	
Effluent Lagoon Relined	2009
Concentrate Lagoon Relined	2008
Effluent Lagoon Cleaned	2019
Effluent Transfer Pump Station	
100/30 hp Pump: Pump 3 Rebuilt	2007
Deep Injection Well (DIW)	
Pump #1 Replaced	2019
Pump #2 Replaced	2017
Odor Control System	
New Pump Installed	2020

7.1.6 Process Flow Diagram

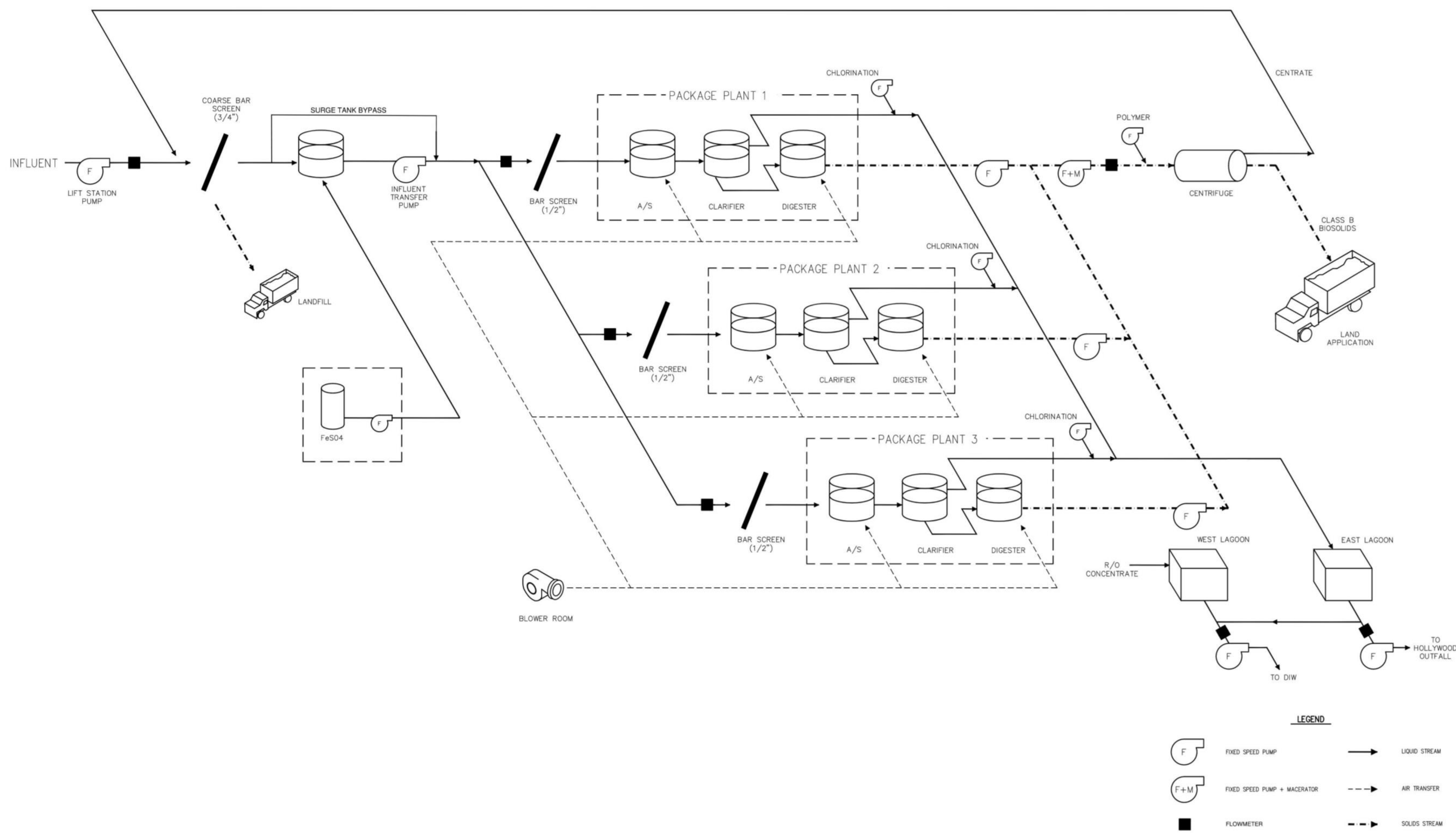


Figure 7-3: Process Flow Diagram of the Cooper City WWTP

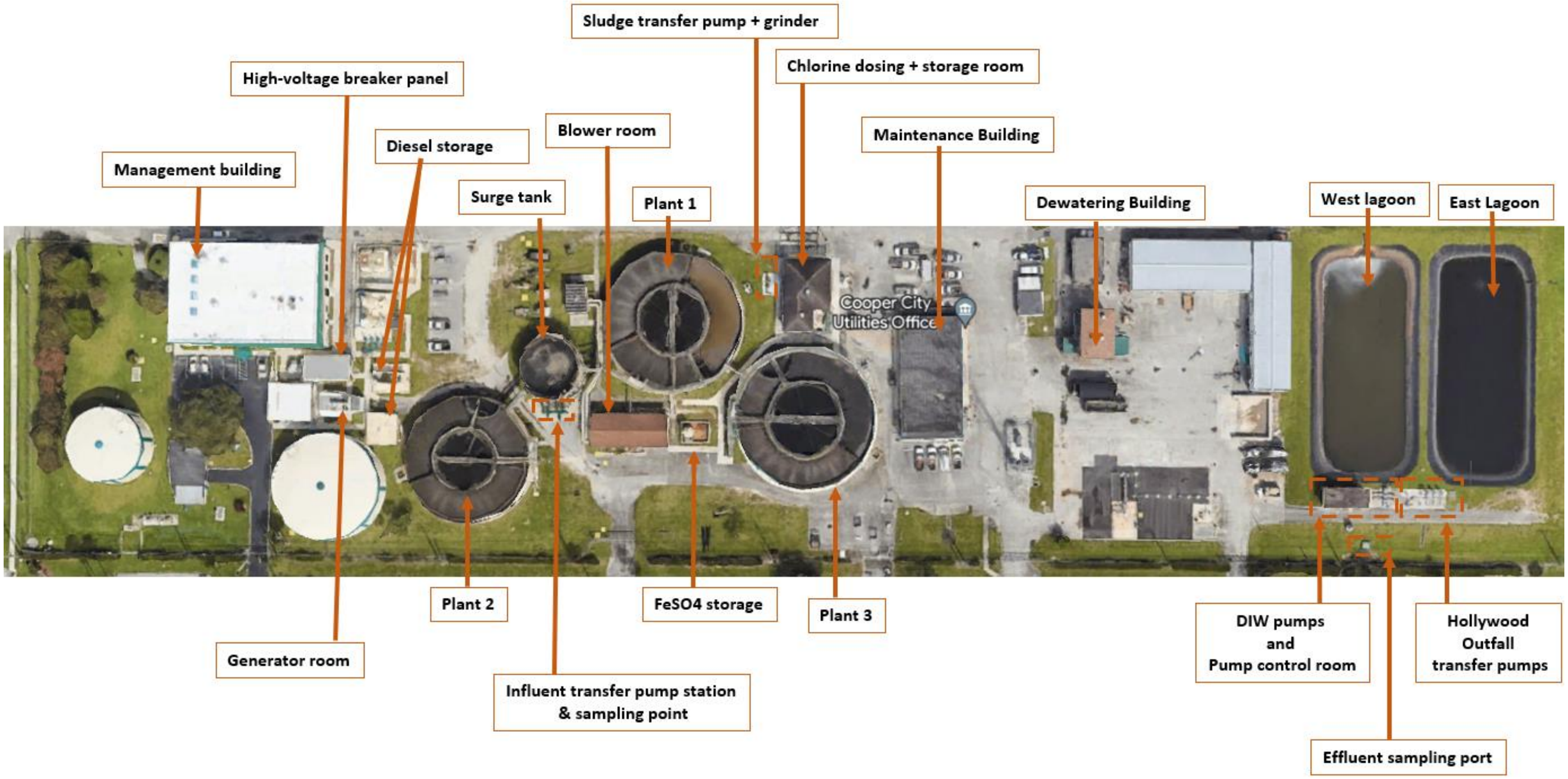


Figure 7-4: Aerial of the Cooper City WWTP

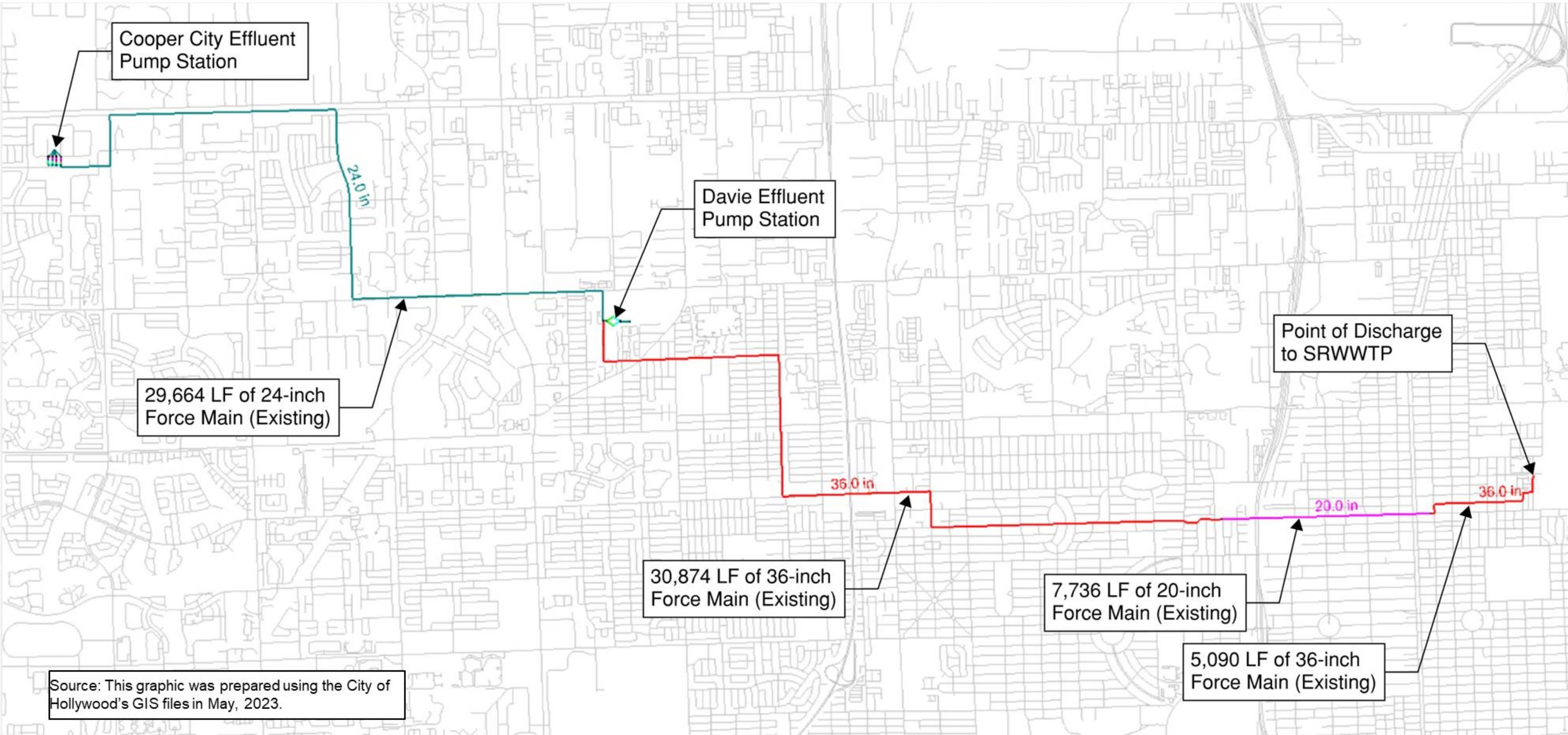


Figure 7-5: Cooper City WWTP Effluent Force Main to City of Hollywood South Regional WWTP (SRWWTP)

7.2 Operational Data Review

7.2.1 Flow Definitions

The design flows used in this section are defined as follows:

Monthly Average Daily Flow (MADF): The total influent volume flowing into the facility during a calendar month divided by the number of days in that month.

Maximum Month Average Daily Flow (MMADF): Highest MADF in a calendar year.

Average 7-day Flow (7DF): The cumulative influent volume flowing into the facility during seven consecutive days divided by seven.

Maximum 7-day Flow (M7DF): Highest 7DF in a calendar year.

Three-Month Average Daily Flow (TMADF): Cumulative influent volume flowing to the facility in three consecutive months divided by the number of days in the three-month period. The three-month average daily flow is a rolling average calculated for every month of the year.

Maximum Three Month Average Daily Flow (MTMADF): The maximum TMADF in a given year.

Annual Average Daily Flow (AADF): Total influent volume flowing into a facility during any consecutive 365 days, divided by 365 days. In the context of this analysis, the consecutive 365 days selected coincide with calendar years.

Maximum Day Flow (Max-DF): Maximum daily flow event in a year or over the period that measurements are taken. In the context of this analysis, Max-DF is expressed per calendar year.

Maximum or Peak Hour Flow (PHF): The highest influent volume during any one hour in a given year.

Minimum Day Flow (Min-DF): Minimum daily flow event in a year or over the period that measurements are taken. In the context of this analysis, Min-DF is expressed per calendar year.

7.2.2 Historical Influent Flows

The SCADA system at the WWTP records influent and effluent flows measured via magnetic flow meters. Based on those, the SCADA system also calculates and records the daily influent and effluent flows through the WWTP. The magnetic flow meter measuring influent flows is upstream of the surge tank. The effluent flows are measured separately using two magnetic flow meters in the DIW header and in the transfer pump station header. As mentioned, transfer pumps exclusively discharge WWTP effluent to the Hollywood ocean outfall. The historical flows at the WWTP from January 2018 to December 2022 are presented in Figure 7-6. The City reported the DIW discharge as a combined flow of WWTP effluent and WTP concentrate in the dataset shared with Hazen. Therefore, the effluent flows in Figure 7-6 represent the total WWTP effluent and WTP concentrate discharged daily via the City's effluent transfer pumps and DIW.

At Hazen's request, the City provided hourly flow data recorded in the SCADA system for 2020-2022. The City's hourly flow data consistently demonstrated fixed high (~4500 gpm) and fixed low (~1000 gpm) flow rate ceilings across the period, which is typically unusual for a WWTP. This could indicate that the WWTP's influent flowmeter is pegged at those high and low flow rates. Hazen recommends that the City check the flow meter calibration and recalibrate it for a broader flow range should the meter be pegged. Per City's records, the magnetic flowmeter in the influent, replaced in 2019, can record flows up to 10 mgd (6944 gpm).

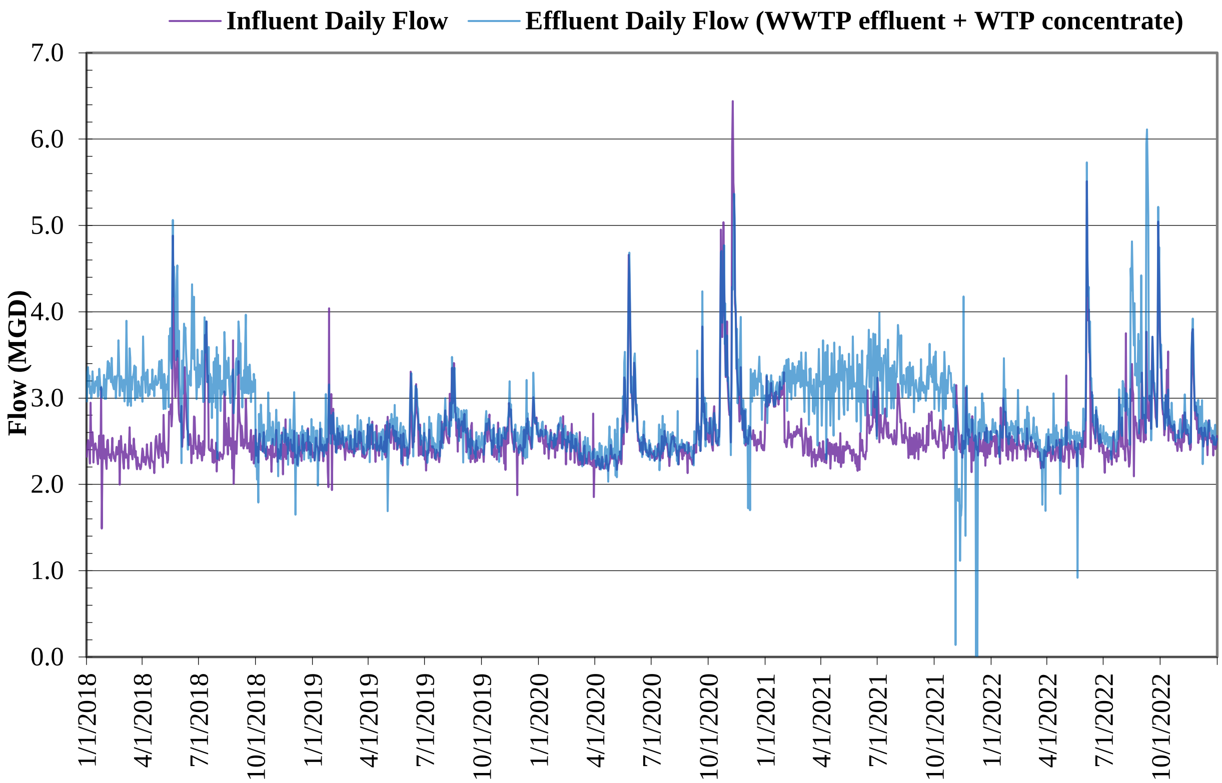


Figure 7-6: Historical Flow of WWTP Influent and Effluent

The average hourly influent flows the WWTP received in 2022 are shown in Figure 7-7. As shown in this figure, on average, the WWTP received the peaks between 4 PM-8PM.

The flow peaking factors selected in the current Master Plan Update are summarized in Table 7-3. As shown in Table 7-3, the Min-DF and MTMADF were determined by rounding up the average for those across 2018-2022. As emphasized in Chapter 6, at least 64.4 miles of the City's 91-mile gravity sewer network will exceed a 50-year service life by FY 2045, thus leading to higher infiltration and inflow (I&I). Therefore, the MMADF, Max-DF, and M7DF PFs were selected to represent their highest values during 2018-2022. The average peak hour flow PF (2.56) shown in Table 7-3 was calculated based on the hourly flow data the City provided at Hazen's request. However, because of the potential flow meter pegging issue identified before, a conservative PHF of 3.0 was selected in the current Master Plan Update.

The MTMADF of 1.15 chosen in this analysis is somewhat higher than the average MTMADF of 1.09 reported in the City's capacity analysis report submitted for permit renewal in 2022 based on 2012-2021 data. Furthermore, the average MTMADF of 1.06 reported in the 2005 Master Plan Report using 2004-2005 data was also lower than the average during 2018-2022. The higher MTMADF in the current analysis can be attributed to the higher I&I from aging gravity sewer lines in the City's collection system. However, the MTMADF selected in this analysis was similar to other facilities surrounding the Cooper City WWTP. Cooper City WWTP's AADF increased by 4.9% between 2018 and 2022. The MTMADF of the WWTP in 2022 was 2.89 mgd, only 67.6% of the rated capacity of 4.27 mgd.

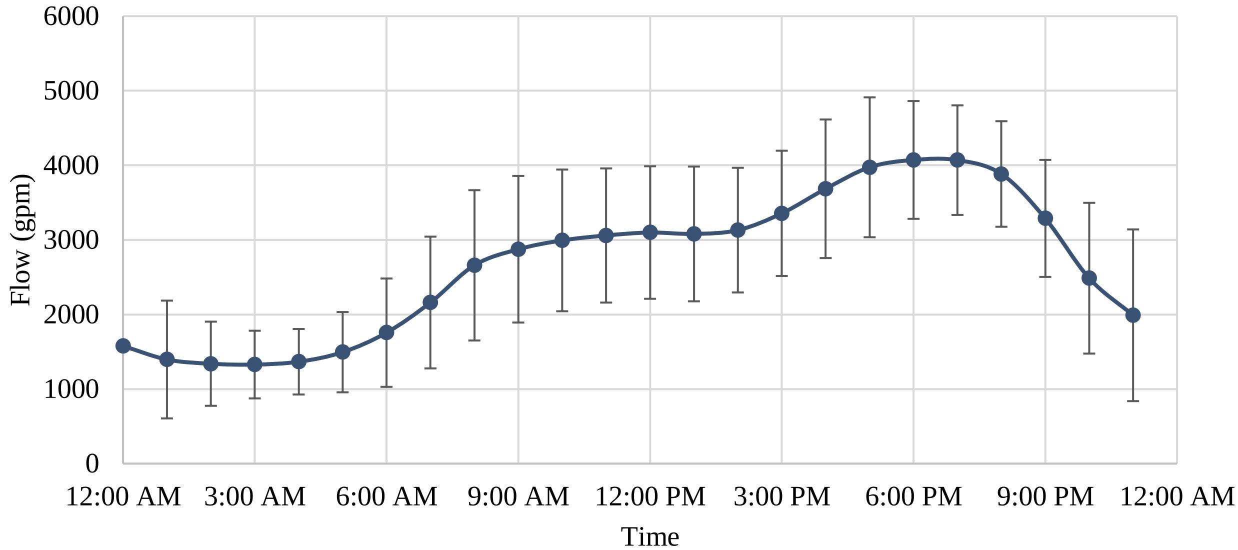


Figure 7-7: WWTP Average Hourly Flow

Table 7-3: Flow Peaking Factors

PF	2018		2019		2020		2021		2022		PF	
	Flow (mgd)	PF	Flow (mgd)	PF	Flow (mgd)	PF	Flow (mgd)	PF	Flow (mgd)	PF	Avg	Selected
Minimum Day[1]	1.49	0.60	1.88	0.75	1.85	0.71	2.14	0.84	2.09	0.80	**0.75**	**0.75**
Average Annual[1]	2.49	1.00	2.51	1.00	2.62	1.00	2.55	1.00	2.61	1.00	**1.00**	**1.00**
Maximum Three Month[1]	2.70	1.09	2.58	1.03	3.07	1.17	2.99	1.17	2.89	1.11	**1.15**	**1.15**
Maximum Month[1]	2.89	1.16	2.76	1.10	3.42	1.31	3.02	1.18	3.16	1.21	**1.19**	**1.30**
Maximum 7-Day[1]	3.64	1.47	3.12	1.24	5.16	1.97	3.10	1.22	4.05	1.55	**1.90**	**1.90**
Maximum Day[1]	4.88	1.96	4.04	1.61	6.44	2.46	3.49	1.37	5.51	2.11	**2.50**	**2.50**
Peak Hour[1]	--	--	--	--	6.47	2.47	6.55	2.57	6.59	2.53	**2.56**	**3.00**

Note:

[1] Based on 2018-2022 Monthly Operating Report (MOR) data provided by the City of Cooper City.

7.2.3 Historical Influent Characteristics and Loads

The 5-year data set provided by the City to characterize wastewater included weekly measurements of influent carbonaceous 5-day biochemical oxygen demand (cBOD) and total suspended solids (TSS). The 5-day biochemical oxygen demand was calculated using a cBOD to BOD ratio of 0.84. The BOD, cBOD, and TSS data obtained from the City, along with the corresponding loads, are shown in Figure 7-8, Figure 7-9, and Figure 7-10. Compared to 2018, the average annual cBOD and TSS loads in 2022 increased by 11.9% and 15.3%. The increase in influent cBOD and TSS loads during that time can be attributed to both the increases in AADF and in the strength of the influent wastewater. The average characteristics of the influent the WWTP received are summarized in Table 7-4.

Table 7-4: Influent Characteristics

Parameter	Value
BOD5 (mg/L)	180
cBOD (mg/L)	151
TSS (mg/L)	182
pH	6.97

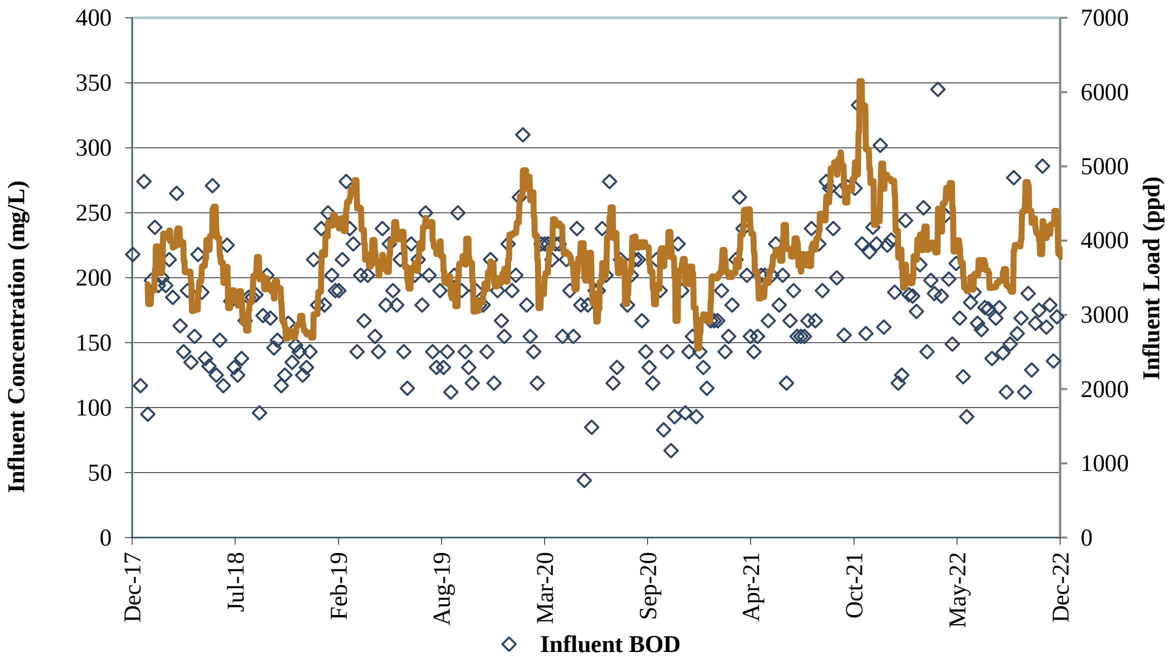


Figure 7-8: Influent BOD Concentrations and Loads

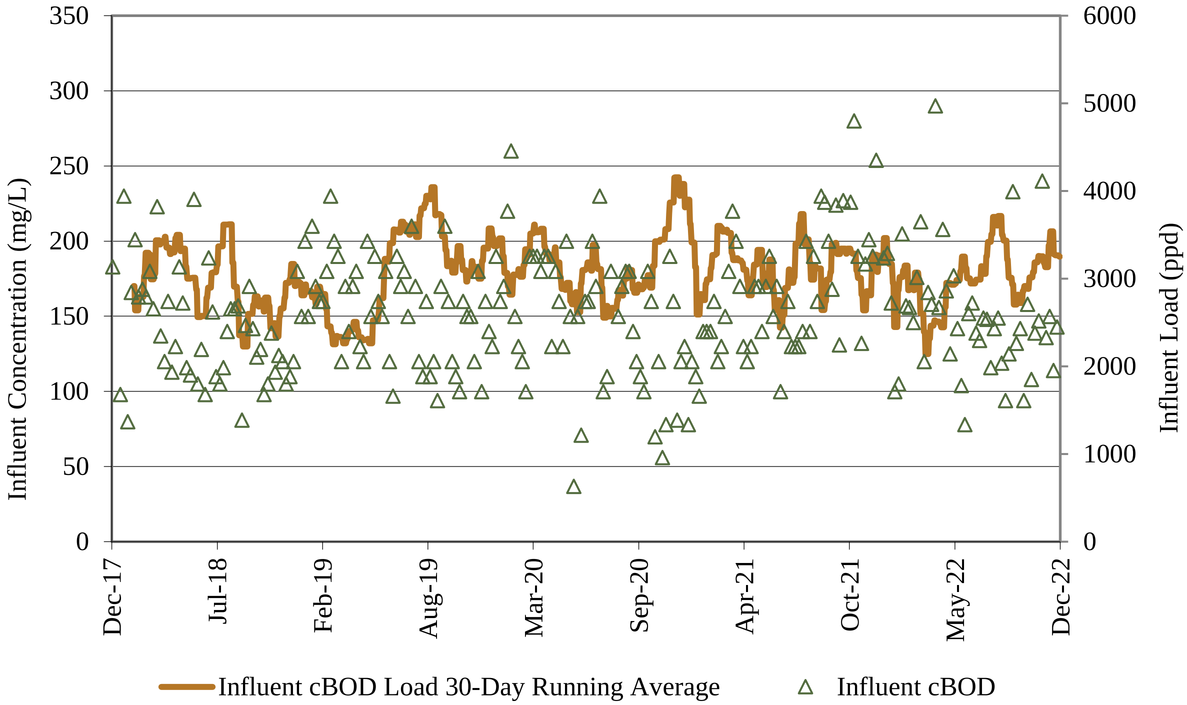


Figure 7-9: Influent cBOD Concentrations and Loads

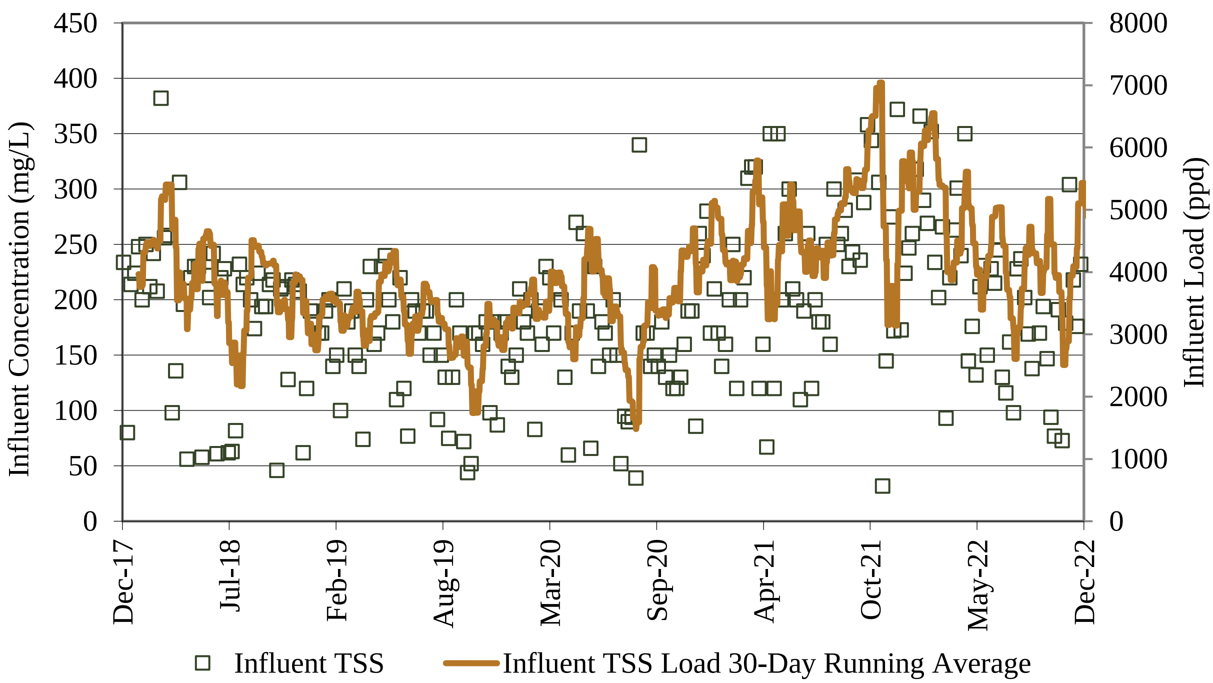


Figure 7-10: Influent TSS Concentrations and Loads

Utilizing the data provided by the City, load peaking factors were calculated at AADF, MTMAFD, MMADF, M7DF, Max-DF, and Min-DF conditions. Load peaking factors for Max-DF could not be estimated accurately as the influent BOD, cBOD, and TSS concentrations were reported weekly in the dataset the City provided. Therefore, the Max-DF flow peaking factors were also used for the Max-DF load peaking factors. The selected load PFs are outlined in Table 7-5.

Table 7-5: Load Peaking Factors

PF	BOD			cBOD			TSS		
	Load (ppd)	PF	Selected	Load (ppd)	PF	Selected	Load (ppd)	PF	Selected
Minimum Day[1]	2,140	0.56	0.60	1,800	0.56	0.60	987	0.26	0.60
Average Annual[1]	3,780	1.00	1.00	3,180	1.00	1.00	3,860	1.00	1.00
Maximum Month[1]	4,750	1.25	1.40	4,020	1.26	1.40	5,150	1.33	1.40
Maximum 30-Day[1]	5,050	1.33	1.50	4,220	1.33	1.50	5,550	1.44	1.50
Maximum 7-Day[1]	6,360	1.68	2.00	5,240	1.65	2.00	7,020	1.82	2.00
Maximum Day[1,2]	6,360	1.68	2.50[2]	5,240	1.65	2.50[2]	7,020	1.82	2.50[2]

Note:

[1] Based on 2018-2022 Monthly Operating Report (MOR) data provided by the City of Cooper City.

[2] MMADF cannot be established accurately because WWTP provided only weekly measurements of BOD, cBOD and TSS. For conservatism, the Max-DF flow PF was assumed for load PF.

7.2.4 Future Flow and Load Projections

The wastewater flow projections shown herein are based on the population projection developed in Chapter 2. The per capita wastewater generation from 2019-2022 calculated based on the population in the WWTP's service area and the historic WWTP influent flows are summarized in Table 7-6. It should be noted that the per capita wastewater flow calculated herein comprise of the base flow, which is generated from service connections in the collection system, groundwater infiltration, and wet weather flow. As shown in Table 7-6, the per capita wastewater flow fluctuated between 73-76 gal/per person during the 2018-2022 period. The projected influent flowrates through FY 2045 were estimated using two methods:

- Assuming the average per capita WW generation based on 2018-2022 data.
- Assuming per capita influent generation to increase linearly to 90 gal/d by FY 2045 from the current average levels.

A summary of the above assessment is presented in Figure 7-11. Per the data provided and the assumption made herein, the WWTP's current permit capacity of 4.27 mgd MTMADF may be sufficient through FY 2045. Therefore, the current Master Plan utilizes the rated capacity of the WWTP (4.27 mgd MTMADF) as the design capacity. Per FAC 62-600.405, a Capacity Analysis Report must be submitted to the Florida Department of Environmental Protection (FDEP) once a WWTP's MTMADF exceeds 50% of the rated capacity (2.14 MGD MTMADF), which is the case for Cooper City. Because the City's WWTP is not expected to exceed rated capacity in the next 10 years (by 2034), the City is only required to provide a Capacity Analysis Report every five years.

Table 7-6: Historic Per capita AADF

Year	Population	Historical Data		
		Measured AADF (mgd)	Per Capita AADF (gal/d)	Measured MTMADF (mgd)
2018	33,933[1]	2.49	73.3	2.70
2019	34,024[1]	2.51	73.9	2.58
2020	34,563[2]	2.62	76.0	3.07
2021	35,113[2]	2.63	74.9	2.99
2022	35,217[2]	2.61	72.8	2.89

Note:

[1] Based on WWTP's capacity analysis report submitted for permit renewal in 2023.

[2] Based on population projection in Chapter 2.

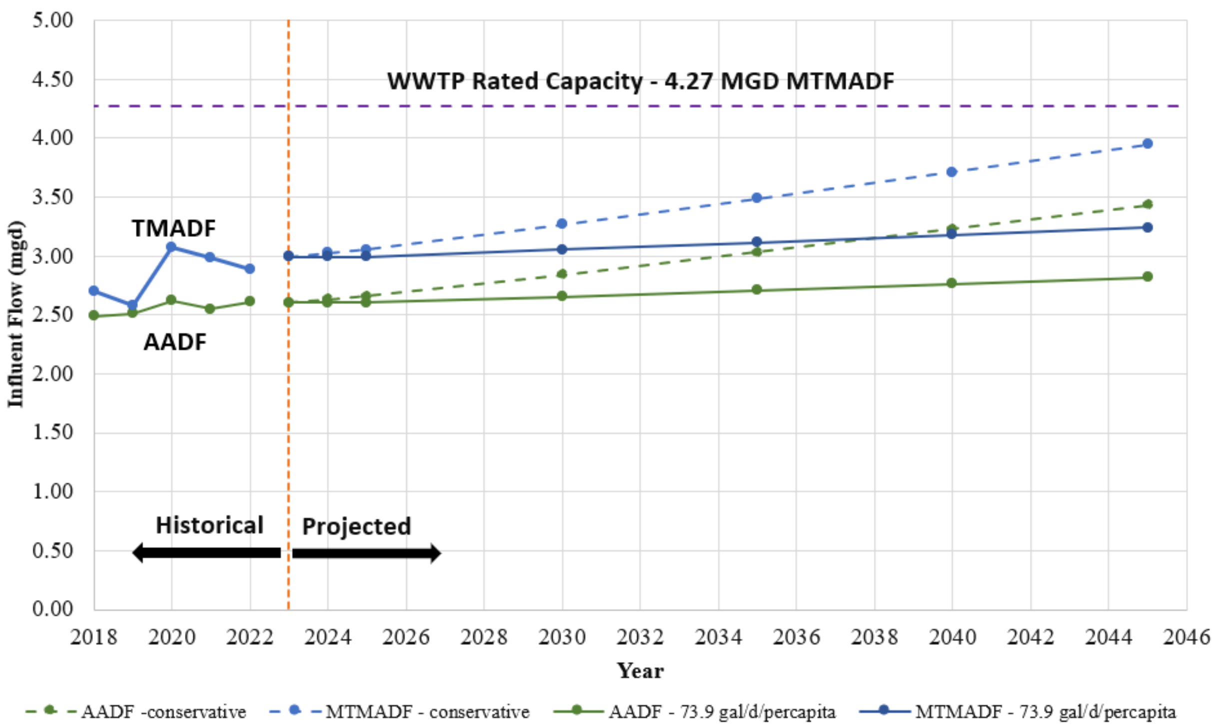


Figure 7-11: Estimated WWTP Flow Projections

7.2.5 Design Flows and Loads

This analysis assumed the WWTP's current rated capacity of 4.27 mgd MTMADF as the design capacity. The design loads used in the current assessment assumed that the WWTP's current influent characteristics, shown in Table 7-7, remained unchanged through FY 2045. TKN and TP concentrations were assumed as 35 mg/L and 5.0 mg/L, respectively, which are typical in the region. The WWTP's design flows and loads based on the selected peaking factors and the assumptions stated above are summarized in Table 7-7.

Table 7-7: Design Flows and Loads

Condition	2018-2022 Flow (2.94 mgd MTMADF)						Design Flow (4.27 mgd MTMADF)					
	AADF	MTMADF	MMADF	M7DF	Max-DF	PHF	AADF	MTMADF	MMADF	M7DF	Max-DF	PHF
Flow PF	1.00	1.15	1.30	1.90	2.50	3.00	1.00	1.15	1.30	1.90	2.50	3.00
Load PF	1.00	1.20	1.40	2.00	2.50	-	1.00	1.20	1.40	2.00	2.50	-
Flows (mgd)	2.56	2.94	3.32	4.86	6.39	7.7	3.71	4.27	4.8	7.1	9.3	11.1
BOD (ppd)	3,780	4,540	5,290	7,560	9,450	-	5,580	6,700	7,810	11,160	13,950	-
cBOD (ppd)	3,180	3,820	4,450	6,360	7,950	-	4,690	5,630	6,570	9,380	11,730	-
TSS (ppd)	3,860	4,630	5,400	7,720	9,650	-	5,640	6,770	7,900	11,280	14,100	-

7.3 Wastewater Treatment Plant Performance

7.3.1 Regulatory Overview

The City's effluent discharge permit (FL00440398 MI) is effective from January 26, 2023, until expiration on January 25, 2028. The permit, included in Appendix F, stipulates 4.27 mgd MTMADF as the rated capacity of the WWTP. The permit allows the discharging of WWTP effluent to monitoring groups D-001 (to Hollywood WWTP effluent pump station) and U-001 (DIW). The nanofiltration concentrate from the City's water treatment facility can only be discharged to the monitoring group U-001.

The City is permitted to discharge WWTP effluent up to 3.1 mgd AADF via the outfall D-001 into the City of Hollywood effluent pump station. The effluent transferred to the Hollywood effluent pump station, could either be repumped into the Atlantic Ocean outfall, located approximately at latitude 26°0' 44" N, longitude 80°10' 36" W, is approximately 10,000 ft long, and discharges at a depth of approximately 90 ft; or used in the City of Hollywood's Public Access Reuse (PAR) program. Of the 3.1 mgd discharged via D-001, Cooper City has contracted with the City of Hollywood's WWTP to provide treated effluent up to 1.7 mgd for use in the City of Hollywood's PAR program. The effluent water quality and flow requirements identified in the Permit to discharge into outfall D-001 are summarized in Table 7-8. Per the Cooper City WWTP Updated Capacity Analysis Report dated August 28, 2022, the City currently transfers approximately 1.72 mgd of treated effluent to the City of Hollywood's PAR program. It is highlighted that discharging into ocean outfall may become unavailable after 2025, per Florida statute 403.086 9(d) – Sewage disposal facilities; advanced and secondary waste treatment.

Table 7-8: Effluent Water Qualities and Flows Requirements for Hollywood Effluent Pumps Station D-001 Discharge

Parameter[3]	Units	Effluent Limitation[3]			
		AA[4]	MA[4]	WA[4]	SS[4]
Flow (max)	mgd	3.1			
$cBOD_5$ (max)	mg/L	25	25	40	60
$cBOD_5$ removal (min)	%		85		
TSS (max)	mg/L	30	30	45	60
TSS removal (min)	%		85		
Fecal Coliform(max)	#/100 ml	200	2001		800
pH	s.u.				6.5-8
Total residual chlorine (min)[2]	mg/L				0.5

Note:

[1] *Effluent limit in monthly geometric mean.*

[2] *Minimum contact time of 15 minutes required at peak flow.*

[3] *In addition to the summarized parameters, the City must also report total nitrogen and phosphorus measurements weekly.*

[4] *AA- Average Annual; MA- Monthly Average, WA – Weekly Average; SS – Single Sample.*

Under the active Permit, Cooper City is permitted to discharge WWTP effluent and nanofiltration concentrate up to 5.95 mgd MMADF to one Class I DIW discharging to Class G-IV groundwater (Deep Injection Well U-001). The effluent water quality and flow requirements for discharging into the deep injection well U-001 are summarized in Table 7-9.

Table 7-9: Effluent Water Qualities and Flows Requirements for Deep Injection Well System U-001 Discharge

Parameter	Units	Effluent Limitation				
		MD[2]	AA[2]	MA[2]	WA[2]	SS[2]
Total Flow (max)[1]	mgd			5.95		
$cBOD_5$ (max)	mg/L		20	30	45	60
TSS (max)	mg/L		20	30	45	60
pH	s.u.					6.5-8.0

Note:

[1] *Monthly average WWTP effluent flow to the DIW must be reported monthly.*

[2] *MD – Maximum Daily; AA- Average Annual; MA- Monthly Average, WA – Weekly Average; SS – Single Sample.*

7.3.2 Historical Performance

The average WWTP effluent characteristics of the Cooper City WWTP are summarized in Table 7-10. The key results from WWTP's historical performance evaluation are summarized below:

- The average annual cBOD, TSS, and Fecal Coliform concentrations, as shown in Table 7-10, were below the Average Annual (AA) requirements in the discharge permit for U-001 and D-001. Therefore, the WWTP satisfied the AA requirements in the permit.
- The Monthly Average (MA) cBOD, TSS, and Fecal Coliform concentrations were 18.4 mg/L, 11.6 mg/L, and 59.9 cfu/100 ml, well below the MA requirements in the discharge permit for U-001 and D-001. The average cBOD and TSS removals via treatment in 2022 are outlined in Table 7-11. On a monthly average, Cooper City WWTP reduced cBOD and TSS concentrations by 96.5±1.9% and 96.7±2.3% following treatment, well above the MM Permit requirements**.** Therefore, the WWTP satisfied the MA requirements in the permit.
- Based on the 2018-2022 dataset provided by the City, the single sample (SS) concentrations of cBOD and TSS were below the respective Permit levels. Therefore, the WWTP satisfied the SS requirements in the permit.
- Single sample chlorine concentrations across the five years were well above 0.5 mg/L at all times, which is the requirement identified by the Permit for discharging into D-001.
- The pH of the effluent during the five years satisfied the permit requirements specified for discharge into D-001 and U-001.
- The Maximum Weekly Average (WA) cBOD and TSS concentrations were 35 mg/L and 21 mg/L, well below the WA requirements in the permit to discharge into D-001 and U-001. Cooper City's effluent quality fully satisfied the permit requirements for discharging into D-001 and U-001 over the five years from 2018 to 2022. It should be noted that the weekly averages of TSS and cBOD concentrations are based only on 1 data point, as the WWTP analyzed samples weekly.
- As shown in Table 7-10, more than 80% of treated effluent nitrogen constituted of ammonia or organic nitrogen. This is indicative of proper aeration in the WWTP.

Table 7-10: Effluent Characterization

Parameter	Units	Value
BOD_5[2]	mg/L	6.8±5.1
cBOD[1]	mg/L	5.7±4.3
TSS[1]	mg/L	5.3±2.3
TKN[3]	mg/L	14.5±3.4
Ammonia[3]	mg/L	12.6±3.2
Nitrate[3]	mg/L	4.1±1.7
Nitrite[3]	mg/L	0.8±0.5
Total Nitrogen[3]	mg/L	17.5±3.4
Total Phosphorus[3]	mg/L	2.4±1.0
Orthophosphate[3]	mg/L	2.6±1.1
Coliform[2]	cfu/100 ml	11.6±27.7
Total Residual Chlorine[2]	mg/L	1.3±0.2
pH[1]	SU	6.95-7.12

Note:

[1] *Based on 2018-2022 data.*
[2] *Calculated Based on cBOD/BOD = 0.84.*
[3] *Based on 2022 data.*

Table 7-11: Average $cBOD_5$ and TSS removal

Year/Month	Average $cBOD_5$			Average TSS		
	Influent (mg/L)	Effluent (mg/L)	Removal (%)	Influent (mg/L)	Effluent (mg/L)	Removal (%)
Jan-21	116.8	2.7	97.7	172.5	4.3	97.5
Feb-21	140.0	3.0	97.9	182.5	5.4	97.1
Mar-21	176.0	2.1	98.8	274.0	2.5	99.1
Apr-21	137.5	2.7	98.0	174.3	4.1	97.6
May-21	162.5	2.4	98.5	232.5	4.9	97.9
Jun-21	150.0	2.6	98.3	202.0	5.0	97.5
Jul-21	137.5	3.3	97.6	190.0	3.8	98.0
Aug-21	166.0	3.0	98.2	228.0	3.8	98.3
Sep-21	206.0	2.5	98.8	253.5	3.5	98.6
Oct-21	222.0	4.3	98.1	297.5	3.0	99.0
Nov-21	202.6	5.0	97.5	249.4	6.6	97.3
Dec-21	215.0	5.0	97.7	248.0	6.3	97.4
Jan-22	160.0	4.5	97.2	262.3	7.8	97.0
Feb-22	155.8	6.0	96.1	319.3	11.6	96.4
Mar-22	164.2	6.0	96.4	203.0	6.7	96.7
Apr-22	203.0	4.9	97.6	288.5	5.0	98.3
May-22	143.0	5.8	95.9	179.2	7.6	95.7
Jun-22	132.0	4.3	96.7	209.5	2.9	98.6
Jul-22	136.8	5.0	96.4	126.5	5.8	95.4
Aug-22	125.8	3.7	97.1	194.8	3.4	98.3
Sep-22	150.3	4.7	96.9	232.3	5.4	97.7
Oct-22	138.0	4.8	96.6	108.8	7.5	93.1
Nov-22	156.6	4.6	97.0	221.8	5.9	97.3
Dec-22	177.0	4.2	97.6	206.8	5.9	97.2

7.3.3 Future Regulatory Requirements

The following potential regulations could impact the WWTP in the future.

7.3.3.1 Asset Management and Sanitary Sewer Overflow Prevention Rulemakings

The FDEP has proposed revisions to Section 62-604 of the Florida Administrative Code (FAC), focusing on preventing sanitary sewer overflows. The proposed revisions, if adopted, could potentially have the following impacts on the city's WWTP:

- Requirements for providing a power outage contingency plan describing the City's protocols for mitigating power outage impacts on the collection system and pump stations.
- Requirements to develop a pipe assessment, repair, and replacement action plan with at least a 5-year planning horizon to mitigate sanitary sewer overflows and underground pipe leaks.

It is not yet fully understood what the formal rule will require in terms of compliance documentation and reporting. If adopted, it is not expected to impact the City until permit renewal or application for major modification.

7.3.3.2 Contaminants of Emerging Concern

On April 10, 2024, the U.S. Environmental Protection Agency (EPA) announced the final National Primary Drinking Water Regulation (NPDWR) for Per- and Polyfluoroalkyl Substances (PFAS). While the final rule is only related to drinking water, regulations for treating PFAS, microplastics, or other emerging contaminants of concern may impact wastewater effluents discharged to surface waters or reclaimed water for reuse and biosolids, which are land applied. An effective liquid treatment for these contaminants is understood to be difficult and may include advanced membrane processes or non-membrane-based approaches such as ozone, biofiltration, granular activated carbon (GAC), and PFAS-selective adsorbents. For biosolids, if terminal treatment of PFAS, microplastics, or other emerging compounds is required, advanced thermal processing may be required to ensure complete destruction. Implementation of a source control program may also be necessary. As the development of wastewater treatment strategies is not currently warranted, no budget estimate is presently included in the Capital Improvement Program. The US EPA is presently supportive of deep well injection as an appropriate means of disposal. The Florida Department of Environmental Protection Underground Injection Control (FDEP UIC) has not issued an opinion as of the writing of this chapter. Should FDEP issue an alternative opinion, additional PFAS removal facilities could be required prior to injection.

7.3.3.3 Effluent Nutrient Removal

The prospect of requiring effluent nutrient removal has often been proposed at the State level through several efforts, as listed below.

- Clean Waterways Act - Senate Bill 712 (2020) specified that local governments (counties and municipalities) within a basin management action plan (BMAP) must develop a wastewater treatment plan and/or an onsite sewage treatment and disposal system (OSTDS) remediation plan containing certain information, if the Florida Department of Environmental Protection (department) identifies the WWTP or OSTDS as contributors of at least 20 percent of point source or nonpoint source nutrient pollution or if the department determines remediation is necessary to achieve the total maximum daily load (TMDL). As the City WWTP is not in a BMAP, this is not applicable to Cooper City.

- A recently proposed amendment to the Florida constitution, entitled Right to Clean and Healthy Waters, provided individuals with the right to sue State executive agencies and collect reasonable fees for the introduction of pathogens, contaminants, or toxins into waters or the disruption of natural hydrological or ecological processes or functions of waters due to action or inaction on the part of the State. If adopted, this amendment could encourage State regulatory agencies to craft more restrictive discharge permit requirements.

- Florida House Bill 1153 had its first reading and was planned to become effective July 1, 2024. The bill recognized that the discharge of inadequately treated wastewater and aging sewage disposal facilities compromise the quality of freshwater, brackish water, and nearshore and offshore salt waters and threaten the quality of life and local economies in the state that depend on those resources. It aimed to require advanced wastewater treatment (AWT) or better at all sewage disposal facilities, with a permitted capacity greater than 1 mgd that discharges to any receiving waterbodies. The bill also required the FDEP to report on the pollutant rate and impairment status of any receiving waterbodies within the watershed, the progress of disposal facilities to upgrade their aged infrastructure and meet AWT standards, and the resulting benefits to the environment. The bill, however, did not progress further and ultimately died in the Water Quality, Supply & Treatment Subcommittee on March 8, 2024.

As summarized above, several efforts have been made to tighten nutrient removal requirements for WWTPs in recent years. The City is advised to monitor future regulatory developments requiring nutrient removal.

7.3.3.4 Prohibition of Deep Well Injection

The latest version of a bill prohibiting the utilization of deep wells was filed in October 2019 as Florida Senate Bill 454. As with previous attempts, the intent is to further increase reuse in the state by amending the prohibitions placed on ocean outfalls. As such, the legislation proposed prohibiting the construction of new deep wells, expanding existing deep wells, and using deep wells after December 31, 2025. The bill died in the Environment and Natural Resources committee in March 2020; therefore, no impacts on the WWTP operations are envisioned. However, the City is advised to monitor future regulatory developments prohibiting or restricting the use of deep well disposal.

7.3.3.5 Disposal into Ocean Outfall

Per “Florida statute 403.086 9(d) – Sewage disposal facilities; advanced and secondary waste treatment”, ocean outfall discharge will be unavailable after December 31, 2025, during normal operations. This statute may impact the City’s available disposal capacity, as the current permitted disposal capacity based on the WWTP Operating Permit considers ocean outfall as an available disposal method. Details of available options for the City after December 31, 2025, to maintain disposal capacity are discussed in Section 7.4.2.6.

7.3.3.6 Use of Reclaimed Water

Florida House Bill 1557, also known as the Department of Environmental Protection Act, was passed during the 2024 legislative session on March 5, 2024, and will become effective on July 1, 2024. Per the bill, the applicants for wastewater treatment plant construction or operation permits will be required to prepare a reuse feasibility study. Wastewater treatment plants disposing of treated effluent via Class I deep well injection, surface water discharge, or other methods must implement reuse to the degree feasible based on the reuse feasibility study. As outlined in the bill, the reuse feasibility study should include but not be limited to:

- Evaluation of monetary costs and benefits for several levels and types of reuse.
- Evaluation of the estimated water savings resulting from different types of reuse if it's implemented.
- Evaluation of rates and fees necessary to implement reuse.
- Evaluation of environmental and water resource benefits associated with the different types of reuse.
- Evaluation of economic, environmental, and technical constraints associated with the different types of reuse, including any constraints caused by potential water quality impacts.
- A schedule for implementation of reuse. The schedule must consider phased implementation.

Furthermore, "CS/SB 64: Reclaimed Water" requires WWTPs discharging into surface waters to submit a plan to FDEP to eliminate nonbeneficial surface water discharge within a specified timeframe. The bill became effective on June 6, 2021, and requires all WWTPs that do not have an approved plan as of November 1, 2021, to eliminate all non-beneficial effluent discharges by January 1, 2028. This will likely not impact Cooper City.

7.4 Evaluation of Wastewater Treatment System

7.4.1 Wastewater Treatment Plant Condition

7.4.1.1 Key Assumptions

The condition assessment of the existing infrastructure at the Cooper City WWTP herein is based on a site visit conducted on May 15, 2023. The investigation was limited to visual observation of the units and interviews with WWTP staff regarding the performance, reliability, and condition of the existing equipment. The assessment herein investigated the condition of mechanical, structural, I&C, and electrical components and equipment at the WWTP. Only the above-ground WWTP units and equipment listed below were assessed.

- Flow meters
- Surge tank

- Influent transfer station from the surge tank to package plants
- Package plants
- Digested sludge transfer system
- Dewatering system
- Chlorine feed system
- Ferrous sulfate feed system
- Odor control system

Based on literature and engineering judgment, the selected expected useful life for assets for this project are summarized in Appendix G. The findings from the unit-by-unit assessment conducted under this task are summarized below.

7.4.1.2 Flow Meters

This section covers the Magnetic flow meter in the 16-inch force main (FM) transferring influent to the WWTP from the collection system. The flow meter, as shown in Figure 7-12, is located underground within the WWTP premises. It is accessible via two on-grade floor doors. The observed mechanical, structural, instrumentation and electrical conditions of the flow meter are summarized below.

Structural and Mechanical: The underground flow meter had mud stains, possibly due to water submergence. The bottom of the pit had a stagnant water layer. The FM and flow meter flange connection bolts demonstrated corrosion damage and signs of complete water submergence. The underground pit was marked clearly, and the access floor doors were in good condition.

Instrumentation: The flow meter is connected to the WWTP's SCADA system. City Staff stated that the influent flow meter was replaced six years ago, and a spare influent flow meter is available in the City's storage. The flow meter appeared to be in good condition, although its exposure to submergence could impact its performance and lifespan. Hazen recommends an improvement of the drainage, preventive maintenance on the instrument, inspection or replacement of the compression fittings, and cleaning up the grounding points.

Electrical: The flow transmitter connected inside the blower building is plugged directly into a regular wall outlet without a 120 VAC surge suppression system. The wires connecting the flow meter were installed with excess slack and were not adequately covered for water protection. The wires showed signs of direct water submergence.

Figure 7-12: Ultrasonic Flow Meter in the Influent Transfer Line

7.4.1.3 Surge Tank

This section covers the surge tank receiving influent flows from the collection system. The surge tank is a 38-year-old welded steel structure with a 301,000 gal capacity located downstream of the influent flow meter. The Surge tank's observed mechanical, structural, and instrumentation conditions are summarized below.

Structural and Mechanical: The surge tank provides ~100 minutes of hydraulic residence time (HRT) to equalize WWTP influent flows. The contents in the holding tank are not mixed. The odor from the surge tank is controlled by dosing ferrous sulfate. Notable corrosion damage was seen on the top of the surge tank, particularly on the top two plates. Inspections conducted by the City also found that the top two of the four plates in the tank were corroded, requiring rehabilitation.

Instrumentation: The Surge Tank has minimal monitor and control signals, most of which are not connected to the WWTP's SCADA system. The Surge Tank is not provided with any mixing mechanism or equipment to avoid heavy buildups on the surface. In addition, a level monitoring station integrated into the SCADA is unavailable to alert operations in advance to prevent overflows.

Figure 7-13 shows the corrosion damage on the surge tank wall. City staff stated that the surge tank overflows via the provided overflow during rain events; however, the surge tank has also spilled on-site during extreme rain events.

Influent wastewater is screened using a 0.75” manually cleaned bar screen upstream of the surge tank, which requires cleaning around eight times daily. The bar screen appeared to be in good condition visually—however, its age was well beyond a bar screen service life of 20 years assumed in this assessment. The debris raked from the bar screen is sent to a landfill. This screen is partially ineffective, as evidenced by the significant rags accumulation in the surge tank. Wastewater is not currently degritted. A bypass is available to transfer influent directly to the package treatment plants using the pressure in FM when the surge tank is out of service.

Figure 7-13: Corrosion Damage on the Surge Tank

7.4.1.4 Influent transfer pump station

This section covers the influent transfer pump station’s structural, mechanical, instrumentation, and electrical conditions. As shown in Figure 7-14, four vertically mounted centrifugal pumps are available to transfer influent from the surge tank to the three package plants. The pump station is located adjacent to the surge tank. The observed mechanical, structural, instrumentation and electrical conditions of the pump station are summarized below.

Structural and Mechanical: The pumps operate in a lead-lag mode, with additional pumps assigned to duty based on the surge tank level. Each pump has 2-speed settings, offering some operation flexibility. The City staff stated that all four pumps typically operate during the peak flows. The impellers of the pumps were replaced three years prior. The pumps showed no notable corrosion damage and appeared in good condition. The pump station had manually operated valves to isolate pumps when needed.

Instrumentation: This station operates with minimal monitoring and control instruments. The Station provides start and stop controls to the duty and standby pumps based on capacitive switches mounted on a sight gauge by Gems Instruments. Some of the recommended improvements for this station include adopting a PLC-based control system, using suction and discharge instrumentation, installing a redundant level control system, and fully integrating with the existing SCADA system.

Electrical: Poor lightning protection system groundings and illumination.

Figure 7-14: Transfer Pump Station

7.4.1.5 Package Plant 1

This section covers the condition assessment of Package Plant 1. Package Plant 1 is a 52-year-old welded steel structure located East of the surge tank with 1.42 mgd MTMADF rated capacity. Package Plant 1's observed mechanical, structural, and instrumentation conditions are summarized below.

Structural and Mechanical: The welded steel tank in Package Plant 1 demonstrated corrosion damage on the interior and exterior walls along the tank's water line. The tank wall was visibly bowed/bulged due to the age of the tank or improper welding. Overall, the tank was in service, exceeding the typical life. City staff stated that coarse bubble air diffusers used in Package Plant 1 were replaced around three years ago. Corrosion damage was seen on some walkway railing supports. The corrosion damage to the tank wall and tank bulging/bowing in Package Plant 1 are shown in Figure 7-15.

Influent wastewater transferred to Package Plant 1 from the surge tank is rescreened using a manually cleaned bar screen, which requires cleaning around four times daily. Similar to the bar screen at the surge tank, the bar screen at Package Plant 1 is also well beyond its 20-year service life assumed in this assessment.

Instrumentation: Package Plant No.1 has minimal instrumentation and control elements. The system offers SCADA monitoring for total airflow and effluent flow but no controls to improve safety and efficiency. Some of the recommendations for this package plant include an automatic aeration control strategy with appropriate analytical and process instrumentation and new control valves. Retrofitting the clarifier section to monitor for gear runtime, common faults, and alarms is recommended. City staff stated that some clarifier components, including the gearbox (typical service life is 20 years) in the clarifier driver assembly, have never been replaced. It is also necessary to actively monitor the level to avoid unexpected overflow events. Additionally, all these improvements mentioned above are recommended to be fully integrated into the SCADA.

Figure 7-15: Package Plant 1 Tank Bowing/Bulging and Corrosion Damage

7.4.1.6 Package Plant 2

Package Plant 2 is a 38-year-old welded steel structure with an activated sludge basin capable of operating in contact stabilization mode, a settling tank, a chlorine contact chamber, and an aerobic digester. The rated capacity of Package Plant 2 is 1.42 mgd MTMADF. The mechanical, structural, instrumentation and electrical conditions of Package Plant 2 are summarized below.

Structural and Mechanical: The welded steel tank in Package Plant 2 demonstrated some corrosion damage on the tank's interior wall along the water line and walkway supports, as shown in Figure 7-16. However, the corrosion damage in Package Plant 2 was considerably lesser than in Package Plant 1. As shown in Figure 7-17, the pipe transferring clarified effluent to the chlorine contact chamber was also notably corroded. Because this pipe is submerged in the activated sludge basin by design, severe rusting could shortcircuit activated sludge into the pipe, rendering the treatment ineffective. Similar to Package Plant 2, influent wastewater transferred to Package Plant 1 from the surge tank is also rescreened using a manually cleaned bar screen, which requires cleaning around four times daily.

Instrumentation: Package Plant No.2 has minimal instrumentation and control elements as Plant No.1 and No.3. Although they are similar in terms of instrumentation and controls, this unit seems to receive less air than the other two package systems. The system offers SCADA monitoring for total airflow and effluent flow but lacks the controls to improve safety and efficiency. Some of the recommendations for this Package Plant include an automatic aeration control strategy with appropriate analytical and process instrumentation and new control valves. Retrofitting the clarifier section to monitor for gear runtime, common faults, and alarms is recommended. It is also necessary to actively monitor the level to avoid unexpected overflow events. Additionally, all these improvements mentioned above are recommended to be fully integrated into the SCADA.

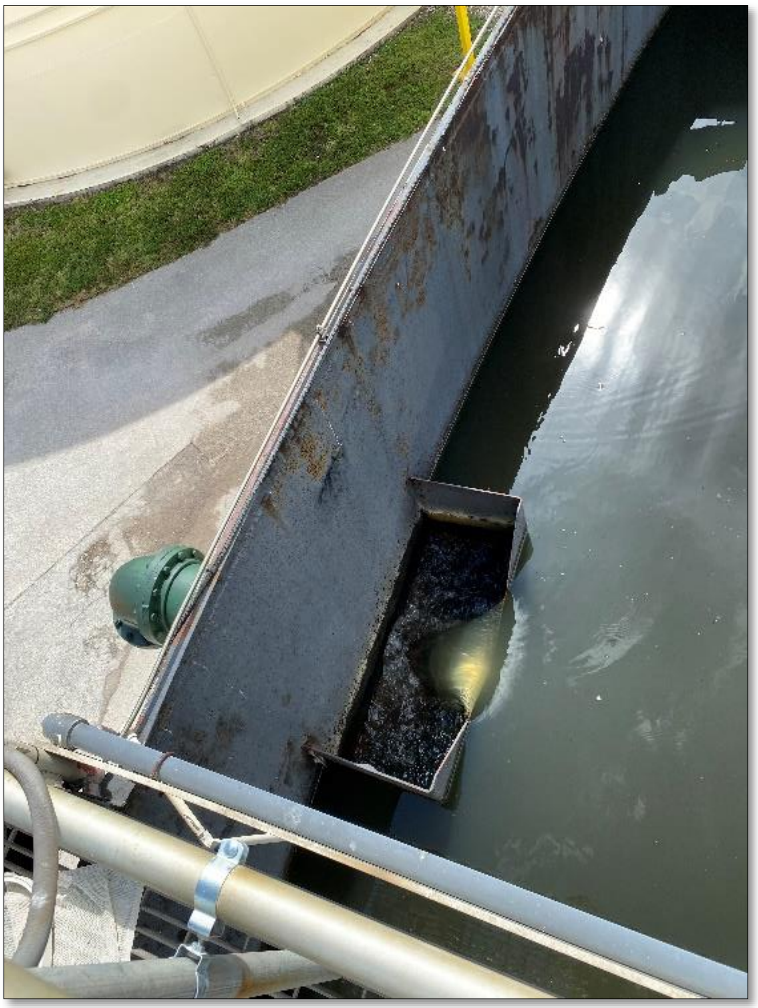


Figure 7-16: Corrosion Damage on the Package Plant 2 Wall

Figure 7-17: Corrosion Damage on the Secondary Effluent Transfer Line

7.4.1.7 Package Plant 3

Package Plant 3 is a 30-year-old structure utilizing the same treatment process train used in the other two package plants. The plant's main structure is made of prestressed concrete, with the interior walls made of steel. The rated capacity of Package Plant 3 is 1.42 mgd MTMADF. The mechanical, structural, and instrumentation conditions of Package Plant 3 are summarized below.

Structural and Mechanical: No structural or mechanical issues were observed in the Package Plant 3.

Instrumentation: Package Plant 3 has minimal instrumentation and control elements. Although the structural condition of Package Plant 3 appears better than Package Plants 1 and 2, its instrumentation and controls are in a similar condition. The existing system offers SCADA monitoring for total airflow and effluent flow but lacks the controls to improve safety and efficiency. Some of the recommendations for this package plant include an automatic aeration control strategy with appropriate analytical and process instrumentation and new control valves. Retrofitting the clarifier section to monitor for gear runtime, common faults, and alarms is recommended. During the site inspection, the clarifier control panel and gear appeared old and poorly maintained. It is also necessary to actively monitor the level to avoid unexpected overflow events. Additionally, all the above improvements mentioned are recommended to be integrated fully into the SCADA.

7.4.1.8 Blowers and Aeration System

Cooper City WWTP utilizes two 100 hp and four 250 hp multistage blowers housed in an enclosed building to supply air for the aeration basin and aerobic digesters. The impellers of the blowers are of durable cast iron construction. Mechanical, structural, instrumentation, and electrical conditions of the blowers and aeration system are summarized below.

Structural and Mechanical: Cooper City WWTP operates two 250-hp blowers during AADF, with two 100-hp blowers assigned duty during peak flow. Combined air flow from all blowers is conveyed to the three package plants through a common header.

Each package plant has an airflow meter to manually measure and adjust the flow. However, the airflow in the common header cannot be regulated other than at each branch in package plants. Therefore, airflow to the aeration basin and aerobic digester cannot be adjusted independently to conserve energy. The photo of the blowers inside the aeration building is shown in Figure 7-18.

Instrumentation: The two 100 hp and the four 250 hp centrifugal blowers, installed in 1986 and 1994, have operated beyond their typical service life of 20 years. As shown in the maintenance records in Table 7-2, the City experienced several blower failures between 2008-2023. Blowers are less reliable and more costly to maintain when used beyond their intended service life. The Blower system has minimal instrumentation and control elements. The existing system is not fully integrated into the existing SCADA system, thus making the aeration process inefficient and expensive. Some of the recommendations for this system include new MCCs, new package blowers, and new blower local control panels with the availability for monitoring typical blower parameters. It is highly recommended that the City adopt a PLC-based control system and fully integrate all instruments and control elements into SCADA.

Electrical: Although functional, the blower MCCs are beyond their service life and may require replacement. Furthermore, Hazen noted that power was supplied via open wiring mounted in trays, making it accessible to rodents.

Figure 7-18: Multistage Centrifugal Blowers Used in the Cooper City WWTP

7.4.1.9 Digested Sludge Transfer and Dewatering

Cooper City WWTP uses one double-disk diaphragm pump and grinder setup to transfer digested sludge to dewatering centrifuges. The mechanical, structural, and instrumentation conditions of the sludge transfer pump system are summarized below.

Structural and Mechanical: The digested sludge transfer system has only one diaphragm pump and grinder connected in series. Rust was noted on the casing of the digested sludge transfer pump motor, as shown in Figure 7-19.

Instrumentation: The existing Sludge Transfer Pump is connected to an outdated control panel. All panel accessories are faded and severely impacted by the elements. Upgrade the control panel and full SCADA integration are recommended.

Figure 7-19: Corrosion Damage on the Digested Sludge Transfer Pump Casing

7.4.1.10 Chemical Dosing Systems

Ferrous sulfate is added to the influent wastewater to mitigate odor. As shown in Figure 7-20, Cooper City WWTP operates two ferrous sulfate metering pumps based on the influent flow. Currently, the City has outsourced ferrous sulfate supply and dosing system maintenance. Each metering pump can be operated at two-speed settings based on the requirement.

The WWTP utilizes sodium hypochlorite to provide chlorination at each package plant. Unlike ferrous sulfate, the City staff supplies chemicals and provides required maintenance for the hypochlorite dosing system. Three 130 W constant speed chlorine metering pumps are in service, one per package plant. Instrumentation conditions of the chemical dosing systems are summarized below:

Instrumentation: The ferrous sulfate storage and feed system is outdoors with limited SCADA monitoring and controls. Exposure of instrumentation and control equipment to the elements impacts the useful life of such devices, increasing maintenance costs. Although the system's overall condition is acceptable, there are major areas for improvement as follows.

- Implement a full-scale System integration with SCADA.

- Incorporate a standard unloading alarm system.
- Adopt a redundant level monitoring approach with the rate of change drain monitoring for leak detection.
- Convert the existing two-speed control system to a feed-forward control with flow trim feedback for a fully dynamic control approach. This would help save ferrous sulfate as the feed system via continuous optimization.

Hazen proposes the following approach for the sodium hypochlorite storage and feed system, with some extra features needed to provide a safe and fully functional storage and feed system. Some of the features recommended include, but are not limited to, the following:

- Rehabilitating damaged walls in the room.
- Purchasing Isolated metering pump skids.
- Installation of double containment piping.
- Improvement of the ventilation system for the room.

Figure 7-20: Ferrous Sulfate Dosing Skid

7.4.1.11 Dewatering

The City uses two 75 gal tanks connected in series to batch Clarifloc SE-1385 C emulsified cationic polymer. The prepared polymer is added to digested sludge via a ½ HP pump for polymer-assisted dewatering. Polymer is batched in one tank and transferred to the other as needed. City staff stated that ~10-15 gal of polymer is consumed per 40 yd^3 dewatered sludge. Two centrifuges are available at the WWTP to dewater sludge, of which one is out of service. The structural, mechanical, and instrumentation conditions of the City's sludge dewatering system are summarized below:

Structural and Mechanical: One polymer transfer pump casing demonstrated corrosion damage, as shown in Figure 7-21. The shaft and casing of one mixer also presented notable corrosion damage, as shown in Figure 7-22. The operating centrifuge, a previously used unit added in 2006, was loud in service. As the WWTP staff mentioned, the centrifuges are operated 3-4 times weekly.

Instrumentation: The polymer Room was poorly ventilated and lacked safety. All High-Level alarming instruments were removed from the tanks, making the system vulnerable to spills. The polymer feed system was not automatically coordinated with the centrifuges or SCADA.

Figure 7-21: Corrosion Damage on a Polymer Transfer Pump

Figure 7-22: Corrosion Damage on Polymer Mixer Shaft

7.4.1.12 Effluent Disposal

Chlorinated effluent from the WWTP is transferred to the East Lagoon, which can be discharged to the Hollywood effluent pump station or the DIW. In contrast, the contents in the West Lagoon are pumped only to the DIW. Currently, two 250 HP and one 100 HP vertical turbine pumps are available to transfer chlorinated effluent to the Hollywood effluent pump station; two 125 HP horizontal split-case centrifugal pumps with vacuum priming system are available to transfer concentrate and WWTP effluent to a DIW (IW-1). Only one DIW pump is operated regularly, with the second pump added into service only when the West Lagoon level is high. The DIW is equipped with a surge control system and associated instrumentation to mitigate any surge damage. A dual-zone monitoring well is also available. The structural, mechanical, and instrumentational conditions of the City's effluent disposal system are summarized below:

7.4.1.13 Effluent Equalization Lagoons

Structural and Mechanical: Both East and West Lagoons appeared in good condition. Per the City's maintenance records, East and West lagoon liners were replaced between 2008 and 2009.

7.4.1.14 DIW

Structural and Mechanical: The DIW pumps, pump priming system, and control panel appeared to be in acceptable condition.

Instrumentation: The effluent pump station's overall condition is acceptable. As the Injection Well undergoes a study to increase its capacity, upgrades, including fully integrating the controls, might be necessary to stay current.

7.4.1.15 Effluent Transfer Pumps

Structural and Mechanical: Pumps discharging to the City of Hollywood's effluent pump station appeared to be in acceptable condition. At the time of the visit, one 100 HP pump was removed for replacement with a new 250 HP vertical turbine pump.

7.4.1.16 Odor Control System

The WWTP operates an odor control system with mist diffusers distributed across the facility to control odors. No structural, mechanical, electrical, or instrumentation issues were noted during the field visit.

7.4.2 Capacity Analysis

7.4.2.1 Key Assumptions

The capacity analysis was limited to the processes listed below:

- Aeration basin
- Secondary clarifiers
- Aerators/blowers
- Chlorine contact tanks
- Effluent discharging

The assumptions made to complete the capacity analysis are listed in Appendix G. The capacity evaluation of the existing wastewater biosolids handling system is discussed in Chapter 8.

7.4.2.2 Aeration Basin

Aeration basins were evaluated based on volumetric BOD_5 loading rate and food-to-microorganisms (F:M) ratio. Generally, a conventional activated sludge system must provide an adequate F:M ratio to remove soluble biochemical oxygen demand (BOD) and maintain a mixed liquor with good settling characteristics. The City's three package treatment plant aeration basins have the flexibility to operate in extended aeration and contact stabilization modes. When operating at extended aeration mode, the desired BOD_5 loading rate and F:M ratio are 5-15 lb/day/1,000 cf and 0.05-0.15 lb BOD_5/d/lb MLVSS, respectively. In contact stabilization mode, the desired ranges for BOD_5 loading rate and F:M ratio are 60-75 lb/day/1,000 cf and 0.2-0.6 lb BOD5/d/lb MLVSS.

This analysis evaluated the aeration basin capacity at the current flow condition, the projected flow conditions in FY 2045, and the design flow condition. The projected flow in FY 2045 was provided as a range based on the current average wastewater generation of 73.9 gpd/per capita based on 2018-2022 data and a conservative per capita wastewater generation of 90 gpd/per capita. The results from the existing aeration basin capacity evaluation are summarized in Table 7-12. As shown in the table, substrate loading rates and F:M ratios are considerably below the desired ranges when operating the aeration basin in contact stabilization mode. However, this is acceptable because of the operation flexibility of the three package treatment plants. Therefore, the Cooper City WWTP is concluded to have sufficient aeration basin capacity to operate at the design capacity of 3.71 mgd AADF (4.27 mgd MTMADF).

Table 7-12: Aeration Basin Capacity Evaluation Summary

Criteria	Typical	Current AADF (2.61 mgd)	Projected FY 2045 AADF (2.82[a]-3.43[b] mgd)	Design AADF (3.71 mgd)
BOD_5 Loading Rate, lb/day/1,000 cf	60– 75 [c]	22.2	24 [a] -29.2 [b]	31.6
F:M, lb BOD_5/d/lb MLVSS	0.2 – 0.6 [c]	0.1	0.11 [a] -0.13 [b]	0.14

Note:
[a] *At the 2.82 mgd AADF flowrate assuming a per capita wastewater generation of 73.9 gpd.*
[b] *At the 3.43 mgd AADF flowrate assuming a per capita wastewater generation of 90 gpd.*
[c] *Provided range applicable with contact stabilization mode.*

Per the Class I reliability requirements identified by EPA, a minimum of two equally sized aeration basins are required. Because the WWTP is equipped with three package treatment plants, each with one aeration basin, three aeration basins in total are available, providing over 50% capacity, with the largest basin out of service. Therefore, the WWTP aeration basins are provided with Class I reliability.

7.4.2.3 Secondary Clarifiers

The primary function of secondary clarification is to capture suspended solids and provide an overflow with low TSS and BOD_5 concentrations. The two criteria commonly used for evaluating secondary clarifier capacity are surface overflow rate (SOR) and solids loading rate (SLR). These two criteria were assessed for AADF and PHF flow conditions, and the results from this analysis are outlined in Table 7-13. As shown in the table below, SLR and SOR are within range for AADF and PHF flow conditions at the design AADF. Therefore, the Cooper City WWTP clarifiers are adequately sized to operate at the design capacity of 3.71 mgd AADF (4.27 mgd MTMADF).

Per the Class I reliability requirements, clarifiers should be sized to treat a minimum of 75% of the flow with the largest unit out of service. With the Package Plant 3 clarifier (the largest unit) out of service, the WWTP's available capacity is 3.22 mgd AADF, which is more than 75% of the design capacity (2.78 mgd AADF). Therefore, the WWTP clarifiers are provided with Class I reliability.

Table 7-13: Secondary Clarifier Capacity Evaluation Summary

Criteria	Typical	Current AADF (2.61 mgd)	Projected FY 2045 AADF (2.82[a]-3.43[b] mgd)	Design AADF (3.71 mgd)
SLR, Avg Day, lb/day/sf	20 – 30	16.4	17.1 a -19.1 b	20.1
SLR, Max. Day, lb/day/sf	35 - 40	29.6	31.3 a -36.5 b	38.8
SOR, AADF, gpd/sf	400 – 700	330	357 a -434 b	470
SOR, PHF, gpd/sf	1,000 – 1,600	825	891 a -1080 b	1,170

Note:
[a] *At the 2.82 mgd AADF flowrate assuming a per capita wastewater generation of 73.9 gpd.*
[b] *At the 3.43 mgd AADF flowrate assuming a per capita wastewater generation of 90 gpd.*

7.4.2.4 Blowers and Aerators

The City's WWTP is equipped with four 250 HP blowers and two 100 HP blowers, providing up to 16,520 scfm and 20,720 scfm of firm and total capacities. The results from the capacity evaluation for WWTP's blowers are summarized in Table 7-14. The assumptions made in estimating the aeration demand at current, future, and design flows are summarized in Appendix G. As shown, the WWTP's blowers have sufficient capacity to handle MDF loads at the design condition.

Per the Class I reliability requirements, blowers should be able to deliver air without measurably impairing the aeration basin DO concentrations. Per the requirements, blowers should be able to handle MMADF loads with the largest units out of service and MDF loads with all units in service. As shown in Table 7-14, the existing blowers satisfy this requirement in all conditions. Therefore, the WWTP blowers meet the Class I reliability standard.

Table 7-14: Aeration Equipment Capacity Evaluation Summary

Criteria	Available (Firm/Total capacity)	Required Capacity		
		Current AADF (2.61 mgd)	Projected FY 2045 AADF (2.82[a]-3.43[b] mgd)	Design AADF (3.71 mgd)
Blower Capacity (Max Mo. / Max Day), SCFM	(16,500/20,700)	(10,400/13,500)	(11,000/ 14,300)[a] - (12,600/ 16,500)[b]	(13,300/ 17,600)

Note:
[a] *At the 2.82 mgd AADF flowrate assuming a per capita wastewater generation of 73.9 gpd.*
[b] *At the 3.43 mgd AADF flowrate assuming a per capita wastewater generation of 90 gpd.*

7.4.2.5 Disinfection

Per the Permit Number FL0040398 MI, expiring on January 25, 2028, the WWTP must provide a minimum of 15 minutes of contact time at the peak hour flow condition to discharge into outfall D-001 (surface discharge). The contact times provided by the three package treatment plants at each of the flow conditions considered in this analysis are summarized in Table 7-15. The WWTP satisfies the permitted chlorine contact requirement at the current and projected flow rates. Therefore, sufficient disinfection capacity through FY 2045 is available. However, an additional chlorine contact tank volume of around 6,000 gal will be required to satisfy the contact time requirement at the design flow rate. Because the projected flow rate in FY 2045 is below the design capacity, the WWTP may not be required to add this additional chlorination capacity by FY 2045. However, if the influent flows increase, a capital improvement project may be required after FY 2045 to satisfy the permitted minimum chlorine contact time.

Per the Class I reliability requirements, the disinfection units should be sized to provide the required contact time for flows exceeding 50% of the design capacity with the largest tank out of service. With the Package Plant 2 chlorine contact tank (the largest unit) out of service, the WWTP can operate at 2.23 mgd AADF, which exceeds 50% of the design capacity. Therefore, the WWTP chlorine contact tanks provide Class I reliability for disinfection.

Table 7-15: Disinfection Capacity Evaluation Summary

Criteria	Minimum Contact Time	Provided Contact Time		
		Current AADF (2.61 mgd)	Projected FY 2045 AADF (2.82[a]-3.43[b] mgd)	Design AADF (3.71 mgd)
Contact time at peak hour flow[c] (minutes)	15	20	15.2[b] - 18.5[a]	14.1

Note:

[a] At the 2.82 mgd AADF flowrate assuming a per capita wastewater generation of 73.9 gpd.

[b] At the 3.43 mgd AADF flowrate assuming a per capita wastewater generation of 90 gpd.

[c] Peak hour flows were converted to AADF using a peaking factor of 3.0, as outlined in Table 7-3.

7.4.2.6 Effluent Discharge

The assessment herein evaluates the effluent disposal capacity of the WWTP based on the City's Wastewater Permit and the existing effluent disposal pump capacity. As mentioned earlier, the treated effluent is initially transferred into the East Lagoon, which equalizes the peak hour flow (PHF) to reduce the PHF to 2.5 from 3.0. Therefore, PHF of 2.5 is used in this effluent discharge capacity assessment instead of 3.0 PHF used earlier. Per the City's Permit, effluent can be discharged to monitoring groups D-001 (to Hollywood WWTP effluent pump station) and U-001 (DIW) from the East Lagoon, which have permitted capacities of 3.1 mgd AADF and 5.95 mgd MMADF (4.6 mgd AADF), respectively. Per the City's underground injection control permit (0153012-008-UO/1X; WACS ID: 84230), the peak flow rate allowed into U-001 is also 5.95 mgd (4,132 gpm).

The pipeline disposing of Cooper City's effluent to Hollywood effluent pump station (D-001) was constructed following a 50-year agreement signed by the two cities in 1985. This agreement was amended in 1992 to allow the City of Hollywood to utilize up to 1.7 mgd of Cooper City's effluent in its Public Access Reuse (PAR) program. The agreement between the City of Cooper City and the City of Hollywood expires in 2035.

Based on the information available, the available peak capacities to discharge into monitoring groups D-001 and U-001 were identified as follows:

- D-001: The WWTP Discharge Permit does not identify limitations on the peak discharge flow. However, based on the 1985 contract between the City of Cooper City and the City of Hollywood, the peak four-hour average flow from Cooper City WWTP to Hollywood effluent pump station should not exceed 250% of the WWTP's AADF, which limits the maximum D-001 disposal to 9.3 mgd at the WWTP's design condition (3.71 mgd AADF).
- U-001: Waste disposal to the U-001 monitoring group consists of WWTP effluent and NF concentrate. Based on the 2018-2022 dataset provided by the City, the maximum daily and average annual NF concentrate discharged into U-001 were 1.71 mgd and 0.29 mgd, respectively. Although the maximum NF concentrate disposal requirement to U-001 may increase in the future with the demand, it was assumed that NF concentrate disposal would be capped at 1.71 mgd during WWTP's peak flow conditions and any excess flows would be equalized using the West Lagoon with 365,000 gal capacity.

The results from this assessment are outlined in Table 7-16 and Table 7-17, and the conclusions are summarized below. It is emphasized that the conclusions below assume that the agreement between the City of Cooper City and the City of Hollywood remains in place for both AADF and peak flow discharges until it expires in 2035.

- The available effluent disposal capacity at AADF condition to D-001 and U-001 monitoring groups is 5.99 mgd (Permitted D-001 [3.1 mgd AADF] + Permitted DIW flow [4.60 mgd] AADF - NF Capped flow [1.71 mgd] = 5.99 mgd), which is above the WWTP's design flow of 3.71 mgd AADF. It is emphasized that the maximum daily NF concentrate flow of 1.71 mgd utilized herein for AADF effluent flow conditions provides a conservative estimate. Therefore, sufficient permitted discharge capacity is available at AADF conditions.
- The combined peak discharge capacities available for disposal into U-001 and D-001 monitoring groups is 13.54 mgd (see Table 7-17). This is above the WWTP's peak flow of 9.3 mgd at the design condition. Therefore, sufficient permitted discharge capacity is available at peak flow conditions (required effluent disposal capacity is shown in Table 7-16).
- The permitted peak discharge capacity with disposal to U-001 unavailable is 9.3 mgd, which is similar to the WWTP's peak flow at the design flow condition (3.71 mgd AADF). Therefore, redundancy for the permitted U-001 monitoring group disposal is available. However, no redundancy exists for the D-001 monitoring group disposal capacity.

Table 7-16: Required Effluent Disposal Capacity

Criteria	Required Capacity – With Flow Equalization from East Lagoon			Required Capacity – Without Flow Equalization from East Lagoon
	Current AADF (2.6 mgd)	Projected FY 2045 AADF (2.8[a]-3.4[b] mgd)	Design AADF (3.7 mgd)	Design AADF (3.7 mgd)
Disposal Capacity (PHF, mgd)[d]	6.5[c]	7.1[a,c]-8.6[b,c]	9.3[c]	11.1[d]

Note:

[a] At the 2.82 mgd AADF flowrate, assuming a per capita wastewater generation of 73.9 gpd.
[b] At the 3.4 mgd AADF flowrate, assuming a per capita wastewater generation of 90 gpd.
[c] Based on the capacity assessment, the effluent lagoon is expected to equalize the peak hour flow rate and reduce the PHF from 3.0 to 2.5. Therefore, 2.5 was used as the PHF peaking factor to estimate the required capacity. The surge tank capacity was not considered in the flow equalization calculations; however, it could also be used to equalize the flow further if required.
[d] Assuming no flow equalization from the East Lagoon or the surge tanks.

Table 7-17: Available Effluent Disposal Capacity without Re-rating the DIW

Criteria	Available Capacity [c]
Peak Disposal into D-001	9.30 [a]
Peak Disposal into U-001	5.95[b]
Peak Disposal of NF Concentrate into U-001	(1.71)
Total Peak Effluent Disposal Capacity (PHF, mgd)	**13.54[c]**

Note:

[a] By agreement between the City of Cooper City and the City of Hollywood gpd.
[b] By UIC permit.
[c] This disposal capacity is contingent upon the future of the agreement between the City of Cooper City and the City of Hollywood.

Furthermore, per the Deep Injection Well Pump System Evaluation Report submitted to the City by AECOM on June 30, 2023, the DIW could be re-rated to 7.41 mgd (peak flow rate) following the rehabilitation work completed in 2021. The capacity available if the DIW is re-rated is outlined in Table 7-18.

Table 7-18: Available Effluent Disposal Capacity Following DIW Re-rating

Criteria	Available Capacity [c]
Peak Disposal into D-001	9.30[a]
Peak Disposal into U-001	7.41[b]
Peak Disposal of NF Concentrate into U-001	(1.71)

Total Peak Effluent Disposal Capacity (PHF, mgd)	**15.0[c]**

Note:

[a] By agreement between the City of Cooper City and the City of Hollywood.
[b] Deep Injection Well Pump System Evaluation Report submitted to the City by AECOM.
[c] This disposal capacity is contingent upon the future of the agreement between the City of Cooper City and the City of Hollywood.

The effluent disposal assessment described herein assumes that the agreement between the City of Cooper City and the City of Hollywood will remain in place until 2035, allowing Cooper City the flexibility to discharge up to 3.1 mgd AADF (this limit is based on the WW Discharge Permit) and up to 9.3 mgd peak flow (this is based on the agreement between Cooper City and Hollywood), regardless of any future limitations in the usage of the ocean outfall in compliance with the requirements in Florida statute 403.086 9(d) – Sewage disposal facilities; advanced and secondary waste treatment (Ocean Outfall Legislation). Hazen identifies the following options for the City to avoid insufficient effluent disposal capacity following the expiration of the 1985 agreement:

- Option 1: Renew the agreement to retain the peak effluent disposal capacity into D-001 as stated in the current agreement and rerate the existing DIW to 7.41 mgd.
- Option 2: Re-rate the DIW to 7.41 mgd and renew the agreement to retain at least 3.6 mgd peak flow via transfer pumps into D-001. For this option, NF concentrate flow may need to be capped at 1.71 mgd (Re-rate U-001 [7.41 mgd] + Disposal to D-001[3.6 mgd]- NF Concentrate disposal cap [1.71 mgd] = 9.30 mgd).
- Option 3: If the agreement is not renewed, re-rate the DIW and construct a new DIW with at least 3.6 mgd peak flow capacity, assuming that NF concentrate flow will be capped at 1.71 mgd. [Re-rate U-001 [7.41 mgd] + New DIW [3.6 mgd]- NF Concentrate disposal cap [1.71 mgd] = 9.30 mgd). The new well could be constructed as a Class I non-municipal well (commonly called an industrial well) with tubing and packer. Assuming NF concentrate will also be discharged into the new DIW, the exceptions identified in C.F.R. 146.16 for Rule 62.528 F.A.C will apply to the new DIW. Therefore, the high-level disinfection requirements listed in Rule 62-600 F.A.C for WWTP effluent will not need to be satisfied to construct the new DIW. However, it is emphasized that if an upward migration of disposed waste to a drinking water source is detected, the DIWs must be terminated or repermitted as municipal wells. Furthermore, the WWTP will be required to provide high-level disinfection at this time if the DIWs are to be permitted as municipal wells for continued use. Hazen notes that the historical data collected from the City’s existing monitoring well does not show such upward migration, so such repermitting requirements may not be of immediate risk to the City. Furthermore, it is emphasized that should the new DIW be constructed outside of 150 ft from the existing monitoring well, a new monitoring well will also be needed for the new DIW.

7.4.3 Installed Pump Capacity

The City’s onsite effluent transfer pump station is equipped with two 200 HP pumps and one 100 HP pump to transfer flows from the East Lagoon to the City of Hollywood effluent pump station (D-001). In addition, the City has an ongoing project to add one 250 HP transfer pump equipped with a variable frequency drive

(Effluent Transfer Pump Replacement Project) with expected construction completion in 2025. The following information on the effluent transfer pump station capacity was available for this analysis:

- Discharge piping from the City of Cooper City transfer pump station ties into a common force main discharging the Town of Davie's and City of Cooper City's treated effluent to the City of Hollywood (see Figure 7-5). Results of the hydraulic model developed during the Effluent Transfer Pump Replacement Project identified that flows up to 6.41 mgd may be delivered with all four pumps running (one 250HP, two 200 HP, and one 100 HP) when the Town of Davie WWTP effluent is disposed simultaneously at 4.85 mgd into the same header. Here, 4.85 mgd AADF is the Town of Davie WWTP's total permitted disposal capacity to the Hollywood Transfer Pump Station per permit number FL0040541 MI.
- Based on the above hydraulic model, flow rates up to 8.5 mgd may be pumped using all four pumps without simultaneous effluent disposal from the Town of Davie WWTP Effluent Pump Station.

The DIW is currently equipped with two 125 HP pumps. Per the Injection Well Pump System Evaluation Report submitted by AECOM, the maximum injection rate between January 2022 and December 2022 following well rehabilitation was 5.30 mgd, which is below the permitted discharge rate of 5.95 mgd.

This assessment evaluated the total capacity of the existing pumps in Cooper City's effluent disposal systems D-001 and U-001. The results, based on the assumptions listed below, are summarized in Table 7-19:

- Cooper City is permitted to discharge up to 9.3 mgd peak disposals into D-001.
- Cooper City's effluent pump capacity was assessed assuming the Town of Davie WWTP's simultaneous disposal is 4.85 mgd AADF, which is its permitted capacity.
- Peak Disposal flow rate of NF Concentrate into U-001 is capped at 1.71 mgd.
- The maximum capacity of the DIW pumps is 5.30 mgd, which is the maximum injection rate reported between January 2022 and December 2022 after DIW rehabilitation.

Contingent upon the above assumptions, Cooper City's total effluent pumping is sufficient to discharge effluent at the design peak flow conditions.

Table 7-19: Effluent Discharge Capacity Evaluation Summary with Discharge to Hollywood SRWWTP Available

Criteria	Available Capacity [c]
Peak Pumping Capacity into U-001 (mgd)	5.30 [a]
Peak Pumping Capacity into D-001 (mgd)	6.41 [b]
Peak Disposal of NF Concentrate into U-001	(1.71)
Total Peak Effluent Pumping Capacity (PHF, mgd)	10.00

Note:

[a] Based on Deep Injection Well Pump System Evaluation Report submitted to the City by AECOM on June 30, 2023.

[b] Based on historical hourly flow data provided by the City.

Per the Class I reliability requirements, effluent pump stations should have the capacity to operate with the largest pump out of service. This analysis evaluated Class I reliability with the largest pump from each disposal method (D-001 and U-001) out of service simultaneously for a conservative assessment. Table 7-20 shows the available effluent disposal capacities with the largest pump of D-001 and U-001 disposal systems offline. Contingent to the assumptions above, the City's WWTP has adequate redundancy per Class I reliability requirements for the current flows. However, based on this assessment, sufficient pumping capacity may not be at the design capacity with one DIW pump out of service.

Table 7-20: Effluent Discharge Capacity with Largest Pump Offline

Criteria	With Largest D-001 Pump Offline	With Largest U-001 Pump Offline	With Largest D-001 and U-001 Pump Offline c
Peak Pumping Capacity into U-001 (mgd)	5.30[a]	2.65[a]	2.65[a]
Peak Pumping Capacity into D-001 (mgd)	5.98[a]	6.41[b]	5.98[b]
Peak Disposal of NF Concentrate into U-001	(1.71)	(1.71)	(1.71)
Total Peak Effluent Pumping Capacity (PHF, mgd)	9.57	7.31	6.92

Note:

[a] Assuming the maximum discharge rate with one DIW pump is half of the combined capacity.

[b] Based on the hydraulic model developed during the ongoing Effluent Transfer Pump Replacement Project. The maximum flow is estimated assuming Town of Davie will simultaneously dispose effluent to Hollywood Transfer Pump Station at 5 mgd flowrate.

[c] Class I reliability is assessed based on this condition, with the largest pump out of service for D-001 and U-001 simultaneously.

As shown in Table 7-20, the installed pumps in U-001 and D-001 disposal systems limit the City from fully utilizing the permitted discharge allocations. The following is required to build the required pumping capacity to utilize the permitted disposal allocation for U-001 and D-001 fully:

- D-001 - Installing additional transfer pumps or replacing the exiting 100 HP pump with a larger size to increase the peak disposal capacity to 9.3 mgd.
- U -001 – Based on the *Deep Injection Well Pump System Evaluation Report* completed by AECOM in 2023, upsizing the existing pump impellers or replacing the existing pumps have been provided as options. The above report recommended replacing the existing pumps as the most viable option.

Assuming that the agreement between the City of Cooper City and the City of Hollywood will remain in place until 2035, Hazen identifies the following CIPs for each option described above to maintain permitted disposal capacity after 2035.

Option 1

- As previously mentioned, the *Deep Injection Well Pump System Evaluation Report* recommended installing new pumps instead of adding new impellers to existing DIW pumps, considering their age and lack of spare parts. Therefore, a CIP to install two new pumps with a combined capacity of 7.41 mgd and re-rating the DIWs is recommended.
- A CIP to install new transfer pump/pumps to retain at least 7.31 mgd with the largest pump out of service and 9.30 mgd with all pumps in service is recommended.
- Once complete, Option 1 will provide Class I reliability as shown in Table 7-21:

Table 7-21: Effluent Discharge Pump Capacity with Option 1

Criteria	With Largest D-001 Pump Offline	With Largest U-001 Pump Offline	With Largest D-001 and U-001 Pumps Offline a
Peak Pumping Capacity into U-001 (mgd)	7.41	3.71	3.71
Peak Pumping Capacity into D-001 (mgd)	7.31	9.30	7.31
Peak Disposal of NF Concentrate into U-001	(1.71)	(1.71)	(1.71)
Total Peak Effluent Pumping Capacity (PHF, mgd)	13.01	11.30	9.31

Note: *[a] Class I reliability is assessed based on this condition, with the largest pump out of service for D-001 and U-001 simultaneously.*

Option 2

- D-001 peak disposal capacity caps for Options 2 and 4 are 3.60 mgd and 1.71 mgd, respectively. After adding the new 250 HP pump, the D-001 pump station will have sufficient capacity to provide flows up to 5.98 mgd, with the largest pump out of service.
- A CIP to install two new pumps with a capacity of 7.41 mgd each and re-rating the DIWs is recommended for both options.
- Once complete, Option 2 will provide Class I reliability as shown in Table 7-22:

Table 7-22: Effluent Discharge Pump Capacity with Option 2

Criteria	With Largest D-001 Pump Offline	With Largest U-001 Pump Offline	With Largest D-001 and U-001 Pumps Offline [c]
Peak Pumping Capacity into U-001 (mgd)	7.41[a]	7.41[a]	7.41[a]
Peak Pumping Capacity into D-001 (mgd)	3.60[b]	3.60[b]	3.60[b]
Peak Disposal of NF Concentrate into U-001	(1.71)	(1.71)	(1.71)
Total Peak Effluent Pumping Capacity (PHF, mgd)	9.30	9.30	9.30

Note:
[a] Each DIW pump has 7.41 mgd capacity. Only one will operate at a time.

[b] Peak D-001 pumping capacity is limited by the agreement in Option 2. The existing D-001 pump station is capable of providing 3.6 mgd with the largest unit out of service.

[b] Class I reliability is assessed based on this condition, with the largest pump out of service for D-001 and U-001 simultaneously.

Option 3

- A CIP to install two new pumps with a capacity of 7.41 mgd each and re-rating the DIWs is recommended.
- A CIP to construct a new well is required for this option. Since the minimum required new DIW capacity is 3.60 mgd, a well of at least 10.11 inch internal diameter is required for this option (per FDEP's 10 fps downhole velocity limit). Based on Hazen's experience, constructing a DIW of the same size as the existing DIW (14.48 in internal diameter) is not expected to increase construction costs drastically. Therefore, Hazen recommends a CIP to construct a new DIW of the same size as the existing well under this option. The new DIW drill site should be selected so that a new monitoring well would not be required.
- It is recommended that two new pumps with a capacity of 7.41 mgd each be installed for the new DIW. Only one pump will be operated at a given time.
- Once complete, option 3 will provide Class I reliability, as shown in Table 7-23:

Table 7-23: Effluent Discharge Pump Capacity With Option 3

Criteria	With Largest Pump in new DIW Offline	With Largest U-001 Pump Offline	With Largest D-001 and U-001 Pumps Offline [b]
Peak Pumping Capacity into U-001 (mgd)	7.41[a]	7.41[a]	7.41[a]
Peak Pumping Capacity into new DIW (mgd)	7.41[a]	7.41[a]	7.41[a]
Peak Disposal of NF Concentrate into U-001	(1.71)	(1.71)	(1.71)
Total Peak Effluent Pumping Capacity (PHF, mgd)	13.11	13.11	13.11

Note:
[a] Each DIW pump has 7.41 mgd capacity. Only one will operate at a time.
[b] Class I reliability is assessed based on this condition, with the largest pump out of service for D-001 and U-001 simultaneously

7.5 Design Criteria for the New Headworks Facility

7.5.1 Project Description

Screening is performed in wastewater treatment to remove floating and suspended large particle debris, hair, rags, and trash (herein referred to as "screening") in the influent wastewater. Screening helps alleviate issues associated with "ragging up" of downstream equipment (an event characterized by rotating equipment binding up with entangled rags), physical damage from impact, abrasion, or clogging, and unsightly and disrupting buildup of floatables within the process tanks. Screening removal is typically accomplished by automated mechanically cleaned screens made of either perforated plates or vertically slotted bars.

Grit removal is performed to remove entrained and suspended solids, such as sand, corn kernels, nuts, and debris that readily settle out in the treatment processes (herein referred to as “grit”). Degritting influent wastewater helps protect downstream equipment from physical impact and abrasion damages and avoids the build-up of grit materials in process tanks, reducing treatment volume. Grit particles are small and typically pass through screening removal equipment. Grit removal is typically accomplished by providing a process area that sufficiently slows the process stream velocity to allow heavier particles to settle while keeping the organic material necessary for the treatment process in suspension.

The City plans to integrate screening and grit removal systems into the headworks of the existing wastewater treatment plant or the new WWTP in phases, with screening constructed in Phase 1. Per the information the City provided, it considers a phased approach due to budget availability. The section below details the design criteria, proposed locations, and overall requirements for the proposed headworks. Should the City desire, screening and grit removal systems can be constructed simultaneously with the existing or new facility.

7.5.2 Headworks construction - Screening

The selection of an appropriate screening technology is a critical design consideration for the WWTP and must consider the following constraints:

- The ratio of average design flow to peak wet weather flows
- Desired screening capture rate
- Available hydraulic head
- Available footprint space
- Wastewater characteristics

The following reliability and redundancy requirements should be considered.

- Provide two units with each unit total capacity to treat the peak hour flow (11.1 mgd).
- Provide isolation so each unit can be taken off-line independently.
- Provide a manual bar screen with passive overflow protection to direct high upstream flows to the bar screen.
- Provide emergency passive overflow protection bypassing both the automated band screens and the manual bar screen.

Since all wet weather flow will be directly conveyed to the screens, each screen must be sized for that condition. Due to the high peaking factor for the facility, it is recommended that mixing be provided within the channels. This could be achieved by using a weir at the headworks influent channel. The desired screening capture rate is typically the main parameter considered when selecting screening technology. Higher capture rates provide the best protection for downstream processes. However, higher capture rates are associated with higher head losses and require higher capacity screening conditioning equipment for disposal. Based on Hazen's experience, a preliminary design utilizing center flow band screens is provided below as an example in Table 7-24. Details and benefits/limitations of using center flow band screens are briefly provided below. It is highlighted that other screening technologies may also be available for the City's headwork. Further site conditions and economic and technology feasibility assessments will be required before the appropriate technology is selected.

- Single-pass / center flow band screens will incur less headloss than a double-pass band screen.
- Center flow band screens typically demonstrated a higher screening capture rate, particularly for the removal of hair and other stringy materials.
- The center feed type can process higher flows than a double pass screen due to the larger screening area.
- Center flow band screens eliminate carryover (only other technology with no carryover is a step screen), and captured debris is removed via wash water (no mechanical brush needed).
- Disadvantages of using center flow band screens include difficulty removing large debris (captured debris falls back into the channel from the top of the screen rotation), higher capital costs, and the center band screen requiring a wider screen channel.
- For corrosion resistance, 316SS is recommended for the main frame construction.

Table 7-24: Headworks Screen Design Criteria

Parameter	Value
Design Capacity of Equipment with One Unit Out of Service	3.71 mgd AADF, 11.1 mgd PHF
Proposed Screen Type	Center Flow Band
Grid Size	6 mm
Number of Mechanical Screens	2
Screen Motor[1]	2 hp, fixed speed
Channel Width[1]	1' 6"
Screen Width[1]	2' 2"
Headloss (50% Blinded)[1]	4.77"
Wash Water Supply[1]	35 gpm @ 60 psi
Number of Manual Bar Screens (Bypass)	1

Note:

[1] Based on a Hydro-Dyne unit proposed for a similar-sized project in Florida.

Center flow band screens require a sluice trough internal to the unit to receive and convey collected debris that is washed off the upper arch of the screen face. The sluice trough can be extended to accommodate the location of a compactor, but it is recommended that the sluice trough be a short run without bends to avoid debris buildup. It is recommended that a washer/compactor be provided for each center flow band screen to receive the discharge from the sluice trough. Each washer/compactor will wash the capture screens to remove organic material using non-potable water, then compact the captured materials for dewatering. Table 7-25 lists the design criteria for the screening conditioning equipment.

Table 7-25: Screening Conditioning Design Criteria

Parameter	Value
Number of Washer Compactors	2 (1 Duty, 1 Standby)
Washer Compactor Motor [1]	5 hp, fixed speed
Wash Water Supply[1]	10 gpm @ 60 psi
Number of Dumpster Containers	2
Dumpster Container Capacity, Each	4 cy
Dumpster Container Type	Front-Load, Rolling

Note:

[1] Based on a Hydro-Dyne unit proposed for a similar-sized project in Florida.

Based on the site footprint, combining screening and grit removal into the same concrete structure may be preferable for the City's headworks. Although the City initially plans to construct screening and grit removal in phases, building the complete concrete structure for both systems simultaneously could save costs. Based on the site constraints, two locations, as shown Figure 7-23, are proposed for the WWTP headworks. Both locations are near the blower room; therefore, foul air from the headworks can relatively easily be routed to the blower intake and be used in activated sludge basin aeration to mitigate odor, if desired. Furthermore, both locations are near the surge tank, which avoids major yard piping changes.

The location of the headworks must be selected considering the layout of the existing WWTP and the potential layout for a new WWTP, as Cooper City may consider building a new facility in the future. At current conditions, only one package treatment plant can be decommissioned until a new facility is constructed, without additional temporary treatment systems; therefore, most of the units in the new facility will need to be built west of Package Treatment Plant 3. Of the two locations, B is closer to the property boundary and could cause odor nuisances to the neighboring property. Therefore, Hazen suggests location A as the preferred location for the new headworks.

Based on Hazen's previous experience with similar-sized projects, a conceptual-level design was completed for the City's WWTP using a center flow band screen manufactured by Hydro-dyne. Each of the two mechanical screens used in the design was sized to provide treatment at PHF conditions with one unit out of service. A bypass bar screen is also provided for emergency situations. The design provides two washer compactors, one per mechanical screen. The bypass bar screen and two mechanical screens are each installed in separate influent channels with in-channel slide gates provided for isolation. As mentioned before, Hazen recommends constructing the complete headworks concrete structure (for screens and grit removal) while installing the screens. Any underground piping under the headworks structure for screens and grit removal system will also need to be installed at this time. This conceptual design was developed to bypass and isolate the grit removal system using slide gates. Therefore, when the budget is available for constructing the grit removal system, the City can build it and integrate it into the headworks without service interruptions to the WWTP operations.

Because of the site constraints, other structures required for the new WWTP (except headworks) should be constructed in phases. This conceptual design also provides a spitter box immediately downstream of the headworks to distribute flow between the package treatment plants and the new facility during the phased construction of the new WWTP. Once a new facility is constructed, the entire flow can be diverted to the new facility from this splitter box. Piping downstream of the headworks was sized to 24-in to accommodate design peak hour flows. The conceptual design completed for the City's headworks is included in Appendix I.

A preliminary hydraulic profile was developed for the proposed headworks (for screens and grit removal combined) based on a Hydro-Dyne center flow band screen and a Fluidyne Hydro-Grit Grit Removal System to complete the conceptual design. Per the hydraulic calculations herein, approximately 9 ft of additional head upstream of the existing surge tank will be required at peak hour flow to integrate headworks into the existing WWTP process. It is recommended that further evaluation be conducted to identify if this additional head could be provided using the existing pressure in the force main collection system or the lift station pumps. If not, a booster pump station may be required. A proposed location for this booster pump station is also shown in Figure 7-23.

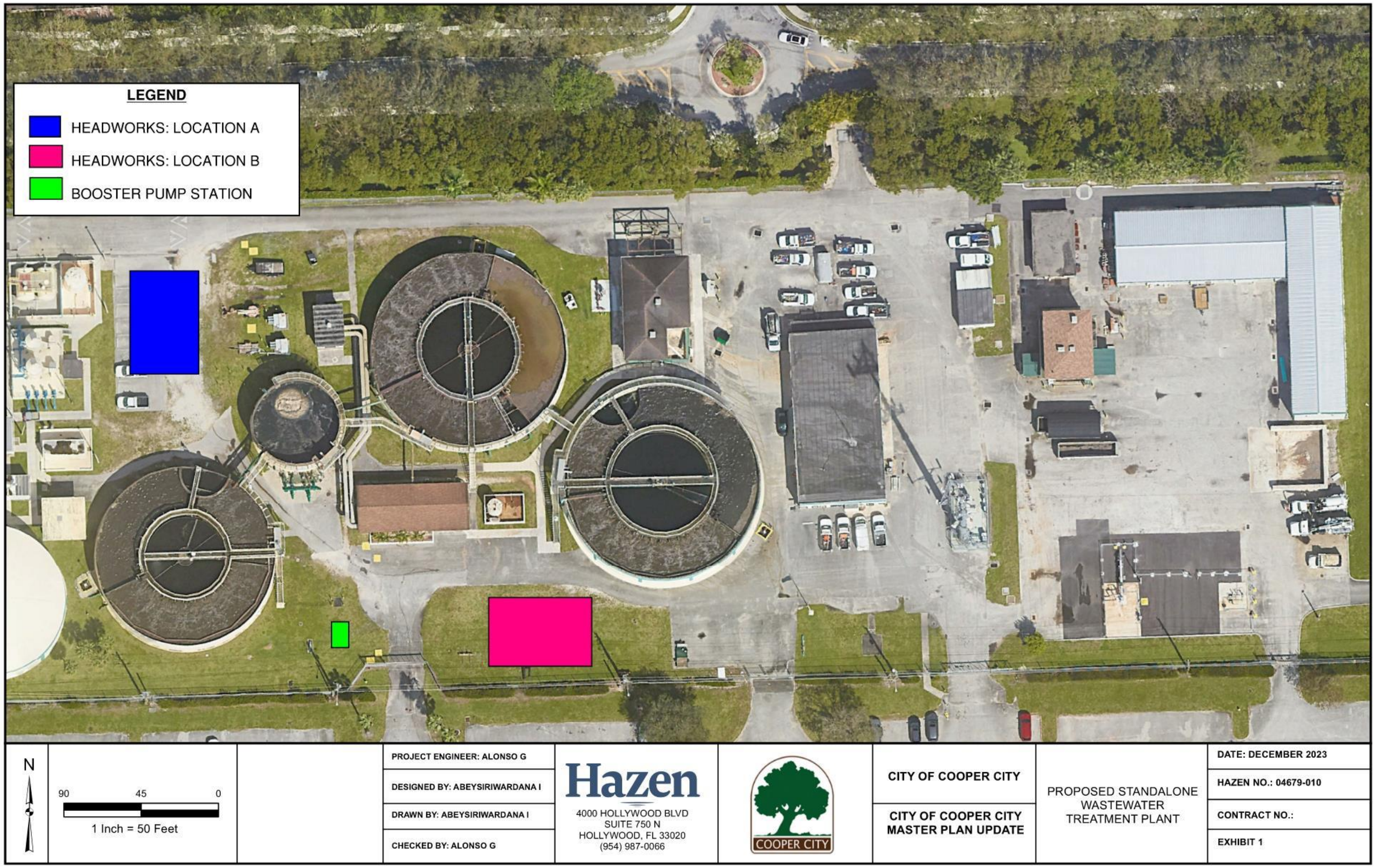


Figure 7-23: Proposed Locations for Cooper City WWTP Headworks

7.5.3 Headworks Construction – Grit Removal

The City plans to integrate grit removal into the headworks following the construction of the screens. Because all required concrete structures and major underground piping will be completed in Phase 1 (discussed in Section 7.1), the work herein will be limited to equipment installation and above-ground piping. The following is recommended for the reliability and redundancy of the grit removal system.

- Provide two grit removal units with 11.1 mgd capacity at PHF with one unit in service.
- Provide isolation so each unit can be taken off-line independently.
- Provide a grit pump dedicated to each unit with a standby.

Some grit removal technologies available for the City's headworks are listed below.

7.5.3.1 Stacked Trays

- Stacked tray gravity-type grit removal systems manufactured by Hydro International, referred to as the Headcell™, have been shown to successfully remove fine sugar sands prevalent in Florida wastewater collection systems (, particularly those located near the coast.
- The systems have no moving parts and require low maintenance.
- The primary disadvantages of this type of system include procurement concerns about sole sourcing and cost. A Headcell™ unit is often notably more expensive than a comparably sized vortex-type unit.

7.5.3.2 Aerated Grit Chamber

- Air is introduced along one wall parallel to the flow produces a spiral flow pattern perpendicular to the flow through the tank, allowing the heavier grit particles to settle to the tank bottom while the lighter organic particles remain in suspension and pass through the tank.
- The spiral flow and the sloping tank bottom move the settled grit particles to collection troughs located on the tank bottom below the air diffusers.
- Aerated grit chambers have larger footprints than other grit technologies.

7.5.3.3 Horizontal Flow Grit Chamber

- Designed to distribute the influent flow evenly over the shallow tank(s) cross-section with sloping corners. A rotating mechanism with scraping blades similar to a center well clarifier mechanism removes grit.
- Grit is collected in a sump on one side of the tank, where it can be further processed.

- This technology has been successfully used for a long time in the municipal wastewater industry.

7.5.3.4 Stirred and Forced Vortex Systems

- These systems create a vortex by tangentially introducing the flow to the circular chamber and from a propeller located at the center of the chamber.
- There are two basic design types.
  1. Sloping bottom with a large opening to a center hopper, referred to as a stirred vortex system. This type of design has been available for decades from several suppliers.
  2. Flat bottom, strategic baffles, and a small opening to the center grit hopper. The grit settles in the sloped influent channel to the grit chamber so that grit is concentrated near the floor of the chamber upon entry. The forced vortex in the chamber then creates a hydraulic flow along the surface, down the face of the chamber at the outer edge, then in toward the center, essentially pushing concentrated grit at the bottom toward the center where it enters the hopper.

Assessing the available technologies and selecting the appropriate grit removal system for the City is beyond the scope of this master plan. Therefore, further site conditions, and economic and technology feasibility assessments are required before identifying the appropriate technology. Based on Hazen's experience, a preliminary design utilizing a vortex grit removal system is provided below as an example in Table 7-26. It is recommended that grit removal equipment with grit classifiers be equipped to dewater screenings and discharge grit into dumpster containers. A conceptual layout of the headworks is provided in Appendix I.

Table 7-26: Grit Removal System Design Criteria

Parameter	Value
Design Capacity of Equipment with One Unit Out of Service	3.71 mgd AADF, 11.1 mgd PHF
Proposed Screen Type	Vortex
Chamber Diameter	11 feet
Internal Fixed Weir Elevation	31.5 feet
AirCirc Blower	3 hp, fixed speed
AirLift/Grit/Circ Blowe	4 hp, fixed speed
Grit Fluidizing Wash Water	1,200 gpd @ 60 psi

7.6 Design Criteria for the Fine Bubble Aeration System

7.6.1 Project Description

Fine bubble aeration systems are more efficient in transferring oxygen to liquid than coarse bubble aeration systems because of the higher surface area-to-volume ratio. The higher oxygen transfer efficiencies that fine bubble aeration systems offer translate into lower blower capacity requirements and operating costs because of the lower air demand. The City's WWTP currently utilizes coarse bubble aeration.

This section discusses the incorporation of fine bubble diffusers into the existing WWTP aeration system and a new treatment plant. Subsequent sections present design criteria and the overall design requirements for coarse to fine bubble conversions in these scenarios. The assumptions made in completing preliminary aeration calculations are included in Appendix H.

7.6.2 Alternative 1 - Fine Bubble Conversion of the Existing Package Plants

The design criteria and conceptual schematics for integrating fine bubble aeration into the existing Package Plant-based wastewater treatment system are discussed in this section. The City's WWTP utilizes forced air to aerate basins and digesters in the three package plants. In addition, forced air is also used for the airlift pumps to return activated sludge from the secondary clarifiers to the aeration basins. Details of the package treatment plant aeration basins, digesters, available blowers, and other equipment have been summarized previously in Table 7-12. Oxygen demand was utilized to project airflow requirements for the aeration basins and size the equipment. The combined estimated aeration requirement for the aeration basin and the digesters at AADF and MDF flow conditions are summarized in Table 7-27.

Table 7-27: Combined Estimated Aeration Requirements for Alternative 1

Parameter	Design AADF		Design MDF	
	Aeration Basins	Aerobic Digesters1	Aeration Basins	Aerobic Digesters1
Flow (mgd)	3.71		9.28	
Total Volume (gal)		829,501		829,501
BOD_5 influent (mg/L)	180	-	150	-
TKN influent (mg/L)	35	-	35	-
NH_3-N effluent (mg/L)	10	-	20	-
VSS destroyed (lbs)	-	-	-	2,233
lb O_2 / lb VSS Destroyed	-	-	-	1.4
lb O_2 / lb NH_3-N nitrified	-	-	-	4.6
DO (mg/L)	2	-	1	-
Alpha	0.55	-	0.55	-
AOR[3] (lb O_2/d)	8,766	-	16,174	3,947
AOR / SOR	0.41	-	0.47	0.15

Table 7-27: Combined Estimated Aeration Requirements for Alternative 1

Parameter	Design AADF		Design MDF	
	Aeration Basins	Aerobic Digesters1	Aeration Basins	Aerobic Digesters1
SOR[4] (lb O_2/d)	21,380	-	34,367	27,140
Total Number of Diffusers	1,800	750	1,800	750
Diffuser Flow, (scfm/diffuser)	1.8	4.4	3.00	4.4
SOTE	0.27-0.294	-	0.254-0.276	-
Airlift Pumps (scfm)	378		378	
Total Airflow (scfm)	3,454	3,327	5,629	3,327
bhp	139	151	238	151
Total Airflow (scfm)	6,780		8,956	
Total bhp	290		388	

***Note**:*
[1] Aerobic digester airflow criteria, 30 cfm / 1,000 cf for projecting average energy consumption.
[2] AOR = Actual Oxygen Requirement.
[3] SOR = Standard Oxygen Requirement.

The following strategy is proposed for converting the package treatment plants to fine bubble aeration:

- Utilize flexible 9" membrane disc diffusers in a preliminary layout of 200 diffusers in the contact zone and 400 diffusers in the stabilization zone of each plant, for a total of 600 diffusers per plant.
- Utilize flexible 9" membrane disc diffusers in the aerobic digesters in a preliminary layout of 250 diffusers per aerobic digester.

The fine bubble diffuser system should be comprised of new fine bubble membrane diffused aeration equipment, including stainless steel drop legs, PVC manifold and distributor pipes, diffusers, a flow meter, flow conditioner, air control valve, dissolved oxygen probe, and dissolved oxygen controller and related items in the aeration basins The flow control assembly should function to vary airflow to each aeration zone based on maintaining an adjustable dissolved oxygen setpoint.

7.6.3 Alternative 2 – Providing Fine Bubble Aeration for the Basins in the New Facility

The design criteria and conceptual schematics for the fine bubble aeration system of the proposed stand-alone wastewater treatment plant are discussed in this section. The estimated air demands for the new activated sludge basins and the aerobic digester of the proposed treatment plant are summarized in Table 7-28. Details of the plant, including the conceptual layout, are included in Section 7.7.

Table 7-28: Combined Estimated Aeration Requirements for Alternative 2

Parameter	Design AADF		Design MDF	
	Aeration Basins	Aerobic Digesters[1]	Aeration Basins	Aerobic Digesters[1]
Flow (mgd)	3.71		9.28	4.27
Total Volume (gal)		740,619		740,619
BOD_5 influent (mg/L)	180	-	150	-
TKN influent (mg/L)	35	-	35	-
NH_3-N effluent (mg/L)	10	-	20	-
VSS destroyed (lbs)	-	-	-	2,233
lb O_2 / lb VSS destroyed	-	-	-	1.4
lb O_2 / lb NH_3-N nitrified	-	-	-	4.6
DO (mg/L)	2	-	1	-
Alpha	0.55	-	0.55	-
AOR[3] (lb O_2/d)	8,766	-	16,174	3,947
AOR / SOR	0.42	-	0.47	0.15
SOR[4] (lb O_2/d)	21,021	-	34,114	27,140
Total Number of Diffusers	1,230	850	1,230	850
Diffuser Flow, (scfm/diffuser)	1.7	3.5	2.97	3.49
SOTE (%)	39.70%	-	37.30%	-
Airlift Pumps (scfm)		126		126
Total Airflow (scfm)	2,113	2,970	3,647	2,970
bhp	96	134	165	134
Total Airflow (scfm)	5,209		6,743	
Total bhp	230		300	

Note:

[1] Aerobic digester airflow criteria, 30 cfm / 1,000 cf for projecting average energy consumption.

[2] AOR = Actual Oxygen Requirement.

[3] SOR = Standard Oxygen Requirement.

The following strategy is proposed for converting the package treatment plants to fine bubble aeration. It is emphasized that the strategy below is based on a conceptual design:

- Utilize flexible 9" membrane disc diffusers in a preliminary layout of 410 diffusers in the aerobic zone of each proposed aeration basin, with a total of 1230 diffusers for all three basins.
- As described in section 7.2, 850 diffusers may be installed in each package treatment plant during the fine bubble conversion. If the new wastewater treatment plant was constructed after Package Plant 3 fine bubble aeration conversion, the available flexible 9" membrane disc

diffusers in Package Plant 3 (850 diffusers) may be utilized. However, only 700 may be needed to convert package treatment plant 3 into an aerobic digester when the new WWTP is constructed (detailed in section 7.7). Therefore, if package treatment plant 3 hadn't been converted to fine bubble aeration at the time of the new WWTP construction, 700 flexible 9" membrane disc diffusers distributed equally in the contact zone, stabilization zone, chlorine contact chamber and existing aerobic digester chamber may be installed to convert it to an aerobic digester.

- The fine bubble diffuser system should be comprised of new fine bubble membrane diffused aeration equipment, including stainless steel drop legs, PVC manifold and distributor pipes, diffusers, a flow meter, flow conditioner, air control valve, dissolved oxygen probe, and dissolved oxygen controller and related items in the aeration basins The flow control assembly should function to vary airflow to each aeration zone based on maintaining an adjustable dissolved oxygen setpoint.

7.6.4 Blower Design Criteria for Fine Bubble Aeration System

Preliminary blower design criteria for a new blower system were developed based on the maximum day flow rate identified in Table 7-27 and Table 7-28, and typical South Florida temperature and relative humidity design conditions shown in Table 7-29. Preliminary blower design criteria for a new blower system are provided in Table 7-30. It is recommended to dedicate one large blower and one small blower to aerate the basins and the digesters, respectively. Swinging one small blower between the aeration basins and the digesters is recommended to handle peak aeration demands. The second large blower could be operated as a backup to provide sufficient process redundancy.

Table 7-29: Blower Design Conditions

Parameter	Existing Facility Conversion		New Facility	
	Std. Cond.	Design	Std. Cond.	Design
Inlet Temperature (°F):	68	92	68	92
Relative Humidity:	36%	41%	36%	41%
Barometric Pressure (psi):	14.7	14.53	14.7	14.53
Density Correction Factor (icfm/scfm):	1	1.07	1	1.07
Approximate Site Discharge Pressure (psig):	8.5	9	10.7	11.5
Maximum Day Air Flow (scfm)	7,850	8,400	5,750	6,150

Table 7-30: Minimum Blower Design Criteria for New Blowers

Parameter	Design Criteria	
Ambient Conditions		
Site Elevation (ft amsl)	10	
Ambient Barometric Pressure (psia)	14.7	
Ambient Temperature Range (°F)	42 - 98	
Ambient Relative Humidity Range (%)	40 - 100	
Design Inlet Conditions		
Minimum Inlet Pressure (psia)	14.4	
Design Maximum Air Temperature (°F)	98	
Relative Humidity at Design Max. Temperature (%)	42%	
Design Minimum Air Temperature (°F)	42	
Relative Humidity at Design Min. Temperature (%)	100%	
Capacity Requirements	**Small Blowers**	**Large Blowers**
Number of Blowers	2	2
Minimum Rise To Surge Pressure, unthrottled (psig)	1	1
Motor Requirements		
Voltage (V)	460	460
Enclosure Type	TEFC	TEFC

7.7 Conceptual Site Layout for the New Facility

Considering the service life of the existing package treatment plants 1 and 2, a new activated sludge plant is recommended in the mid-to-long term. The conceptual sizing and layout for the proposed facility are detailed below. The preliminary layout and sizing proposed herein were developed to provide Class I reliability.

WWTP's active permit, expiring on January 28, 2028, does not require nutrient removal to discharge treated effluent via DIW or to the City of Hollywood PAR program. Therefore, the conceptual activated sludge system described here was designed to achieve carbon removal only. Based on the above consideration, an activated sludge system with three equally sized basins is proposed conceptually to replace the biological treatment provided by the existing package treatment plants. The conceptual layout proposes a selector zone before each aeration basin to achieve better sludge settleability. Platform-mounted vertical mixers or wall-mounted mixers with non-ragging impellers can be used to mix each anaerobic zone. It is suggested to design the raw influent piping with the capability to either discharge directly to the influent box and mix with RAS (normal operation) or bypass one or more zones of each basin so that RAS can be stored in one or more upfront zones (step feed wet weather operation).

The conceptual activated sludge system layout includes an influent box to completely mix RAS with raw wastewater influent before distribution to the aeration basins. Influent channels must be designed to distribute mixed liquor evenly to the aeration basins. Adjustable and accessible influent weir gates are proposed to distribute mixed liquor evenly to each basin in service. Furthermore, the activated sludge basins are proposed to be constructed with sufficient provisions for expansion/modification should nutrient removal become a permit requirement in the future. Design criteria for the conceptual activated sludge basins herein are summarized in Table 7-31.

Table 7-31: Minimum Design Criteria for Aeration Basins

Element	Value
Number	3
Side water depth (ft)	20
Diffuser submergence (ft)	18.8
Minimum Freeboard (ft)	3
Minimum Volume (per tank) (MG)	0.6
Minimum Total Volume (MG)	1.8
Minimum Anaerobic Zone Cells (per tank)	2
Minimum Anaerobic Zone Total Volume (per tank) (MG)	0.1
Anaerobic Cell 1 vs Cell 2 Volume Ratio	1: 1

The conceptual new facility utilizes two 90 ft clarifiers for settling mixed liquor. Although the preliminary analysis identified three 65 ft clarifiers may also provide sufficient treatment, constructing two 90 ft clarifiers instead provides a higher settling area in a similar footprint. Preliminary design criteria for the conceptual clarifiers are outlined in Table 7-32.

Per the conceptual design, the new RAS/WAS pump station is proposed to be constructed between the two clarifiers for transferring RAS to the proposed influent box and WAS to the aerobic digester. The RAS/WAS pump station should be designed with sufficient redundancy to provide Class I reliability. The conceptual design herein suggests constructing a scum pump station also at a centralized location between the two secondary clarifiers. Scum from the existing clarifiers should be routed to the aerobic digesters for further treatment.

Plant 3 is in the best structural condition compared to all package plants. Therefore, this conceptual new facility design proposes converting Package Plant 3 to an aerobic digester with supernatant discharge. The inner tank of Package Plant 3 can be retained as a settling basin to accommodate supernatant discharge. The outer tanks, currently encompassing the contact zone, stabilization zone, chlorine contact chamber, and aerobic digester, are proposed to be converted into aerobic digester tanks. Class I reliability requirements do not require operating multiple aerobic digesters; therefore, the separation walls between the contact zone, stabilization zone, chlorine contact chamber, and aerobic digester can be demolished if desired. Furthermore, the City currently plans to participate in the Broward County regional biosolids program, where a regional dryer/digestion facility is considered. Should the plan materialize, the City could build the new facility without the onsite aerobic digesters.

The City's active permit requires 15 minutes of chlorine contact time at peak hour flow conditions. The conceptual plan suggests two equally sized chlorine contact chambers per Class I reliability requirements. It is recommended to evaluate whether the existing metering pumps can be repurposed and if sufficient hypochlorite bulk storage is available.

The proposed layout for the new structures in the conceptual new facility is included in Appendix D. As discussed in section 7.6, the headworks structure is proposed northwest of the existing surge tank. The existing location of Package Plant 1 and the maintenance building are proposed for the aeration basins and the clarifiers, respectively. The new chlorine contact tanks are suggested to be constructed south of the clarifiers. A minimum separation of 20 ft between the property fence and all new structures is suggested.

Table 7-32: Conceptual Design Criteria for the Clarifiers

Clarifier Parameter	Value
Number of Units	2
Existing Tank Dimensions[1]	
Inside Tank Diameter (ft)	90
Side Water Depth (ft)	14
Tank Bottom Slope (in/ft)	1/1
Hydraulic Design Requirements	
Average Flow/Clarifier	
Clarifier Effluent Flow/unit (mgd) – at AADF	1.9
Combined RAS Flow (mgd) – From Both Clarifiers	2.2[1]
Maximum Flow/Clarifier	
Clarifier Effluent Flow/unit (mgd) - at PHF	5.6
Combined RAS Flow (mgd) – From Both Clarifiers	3.8[2]

Note:
[1] 60% RAS Rate of AADF.
[2] 80% RAS Rate of MMADF.

7.7.1 Proposed Sequence of Construction

Critical events in the construction sequence for the conceptual new WWTP are specified in this section. The outlined sequence of construction does not include all items necessary to complete the work but is intended to identify the sequence of critical events necessary to minimize disruption to the ongoing treatment plant process and to ensure compliance with discharge requirements. It is proposed to construct the conceptual new facility in two phases.

7.7.1.1 Phase 1:

- Decommission and demolish Package Plant 1. Because the current wastewater flow rates are only 67% of the package plant design capacity, the influent flows could potentially be treated using Package Plants 2 and 3 during construction. Package treatment plants 2 and 3 can be operated in contact stabilization mode to gain more capacity during this time. When commencing construction, the City may need to rent a temporary treatment unit if the influent flows exceed 67% of rated capacity.
- Demolish the existing operations and maintenance building. If required, a temporary building can be set up south of the sulfide dosing system building.
- Construction of the headworks, aeration basins, clarifiers, RAS/WAS pump station, process splitter boxes, and yard piping.
- Install new blowers and appurtenances as required. Conduct all required electrical upgrades.

The new activated sludge system shall start once Phase 1 work is completed. After that, Package Plants 2 and 3 will be assigned out of service, and the new AS system will be brought into service. Phase 2 work proposed below would start once all package treatment plants are out of service. Sludge produced from the activated sludge basins would need to be dewatered with centrifuges and then hauled off-site while Package Plant 3 is repurposed as an aerobic digester:

7.7.1.2 Phase 2:

- Decommission and demolish Package Plant 2 and the surge tank.
- Construction of the new operations and maintenance building at the existing package treatment plant 2 location.

7.8 Wastewater Treatment System Improvements Summary and Cost Opinion

The proposed Capital Improvement Projects (CIPs) for the City's WWTP and the DIW are outlined in Table 7-33 and Table 7-34. The cost opinions and proposed timelines for the projects shown below are presented in Chapter 9.

Table 7-33: Wastewater Treatment Plant Capital Improvement Projects Summary

Project ID	Project Name	Description
RRR6062	Dewatering System Rehabilitation: Centrifuge and Polymer System Replacement - Phase 1	This project is intended to replace two existing centrifuges with two 50-60 gpm centrifuges from Alfa Laval. The project also includes replacing the existing polymer system with a new unit that provides N+1 redundancy. The project will be a turnkey project based on a quote the City received from Alfa Laval. This project's scope will strictly be limited to the scope of work in Alfa's proposal. The cost provided in the turnkey proposal is $1,500,000. The entire turnkey proposal cost is allocated for FY2024.
WWU5963	Sludge Transfer System improvement	The existing sludge transfer pump does not have capacity to provide the maximum operating flowrate of the proposed new Alfa Centrifuges. Therefore, this project is intended to replace the sludge transfer pump with a new unit with adequate capacity, and install another pump and grinder setup to provide redundancy .
RRR5364	Surge Tank Rehabilitation	This project is intended to remove and replace the top two plates of the Surge tank and coat the two new plates with epoxy to prevent structural failures. The bottom two plates will be sandblasted and re-coated with epoxy under the same project. The overflow pipe sizing will be increased to avoid any future on-site surge tank spillage. A mixing system will be installed in the surge tank to prevent heavy buildup of floatables above the surge tank water level. A new level sensor connected to the SCADA system to continuously monitor the tank level and alarm operators at high tank levels will also be added.
RRR5465	Package Treatment Plant 1 Rehabilitation	This project is intended to ensure the structural stability of Package Treatment Plant 1. Under the project, all internal and external walls of the tanks will be sandblasted, welded and re-coated with epoxy. Any existing holes/punctures should be patched with new steel. The walkway railing and the supports should be replaced to ensure the safety of plant personnel on-site. All equipment beyond the service life should be removed and replaced with in-kind equipment.
RRR6366	Blower Room Electrical system rehabilitation	This project is intended to reinstall the blower building MCC wiring.

Project ID	Project Name	Description
WWU5867	Chlorine dosing skid improvement	This project is intended to provide redundancy for the exiting chlorine dosing system and the addition of an in-line chlorine analyzer to flow-pace hypochlorite flow to each package treatment plant. The chlorine analyzer will be utilized to track any potential permit violations and accommodate flow pacing. Damaged walls in the chlorine system building will be repaired, and ventilation of the building will also be improved under this project. This project is contingent upon building the new WWTP.
RRR5168	Flow meter electrical and I&C improvement	This project is intended to rewire the existing influent flow meter per accepted electrical wiring standards. The electrical wiring should be protected, rated for submerged applications and insulated as the flow meter appears to be submerged periodically from groundwater or wet weather flows. The flow transmitter will be connected to a 120 VAC surge suppression system.
WWU6569	New Blower Building and Blower Replacement	This project is intended to replace the existing Blower Building south of the existing Building. The proposed work will include the construction of a new building, installing new air piping and wiring, and installation of new process blowers. Based on the preliminary air demand calculations in the WWTP's capacity analysis, four 250 HP multistage centrifugal blowers with coarse bubble aeration should supply sufficient aeration capacity to the existing package treatment plants. However, blowers should be selected so that they can be repurposed once the new standalone facility is constructed and once the existing package treatment plants are converted to fine bubble aeration. This project is contingent upon building the new WWTP.
REG6570	WWTP Regulatory Compliance - FY 2027	This project is aimed at preparing documentation required ahead of permit renewal
CAP6372	Blower Room MCC replacement	This project is intended to replace the existing MCC in the Blower Building. The new MCC will be installed in the New Blower Building. This project is contingent upon building the new WWTP.
WWU5273	Headworks Construction: Phase 1	This project is intended to construct a new Headworks facility equipped with mechanical bar screens at Cooper City WWTP premises. The complete concrete structure for screens and grit removal should be complete at this stage.

Project ID	Project Name	Description
		Sufficient provisions should be left for the future integration of the grit removal facility to WWTP headworks at a later stage.
WWU6574	New Wastewater Treatment Facility	This project is intended to construct a new WWTP to replace existing Package treatment plants 1, 2, and 3. The proposed plant is a conventional activated sludge-based facility with a design capacity of 4.27 mgd MTMADF. This project cost does not include the cost of headworks, installation of centrifuges, generator rehabilitation, or maintenance building relocation. The following were assumed for each structure: Aeration Basins - Conventional activated sludge basins are designed for 3.7 MGD AADF (4.27 MGD MTMADF). Basins will be equipped with fine bubble aeration. Treatment process will target carbon removal only. Process Air Blowers (Liquid) - Blowers sized for 6000 SCFM at MMADF. Secondary Clarifiers -Two 90 ft clarifiers RAS/WAS pumps station - Equipped with 3 RAS pumps and 2 WAS pumps between 2 clarifiers, with a total motor capacity of 150 HP Aerobic digestion - Package Treatment Plant 3 will be retrofitted as an aerobic digester Chlorine Contact Chamber - Per Assumption 1 Yard Piping - 13.5% of cost of structures, which inline with building at an existing facility Site work - 10% Overall Scada Integration is included as a separate project
WWU5275	Headworks Construction: Phase 2	This project is intended to integrate the grit removal system into WWTP headworks constructed under phase 1. This project will be initiated along with the construction of the new facility or prior.
REG6576	WWTP Regulatory Compliance - FY 2032	This project is aimed at preparing documentation required ahead of permit renewal
CAP5377	Influent transfer pump station improvement	This project is intended to increase the size of surge tank transfer pumps with sufficient capacity and redundancy to handle peak flow conditions. Furthermore, the scope of this project will include adopting a PLC-based control system, using suction and discharge instrumentation, and installing a redundant level control system. This project is contingent upon building the new WWTP.
WWU6578	Maintenance Building Relocation/Rehabilitation	This project is intended to relocate the maintenance building at the existing Package Treatment Plant 2 location. This is a follow-up project to the new WWTP

Project ID	Project Name	Description
		construction project, as the existing location of the maintenance building will be utilized by the new wastewater treatment plant structures. This project will be constructed at its existing location if the new WWTP is not constructed. Under this project, the existing package treatment plant 2 (if new WWTP is constructed) or maintenance building (if new WWTP is not constructed) will be demolished first. The new maintenance building, sized to match the size of the existing maintenance building, will then be constructed at the existing package treatment plant 2 location.
RRR6280	Effluent Transfer Pump Replacement	This project is intended to replace the existing pumps installed in 1986 with one new 250 HP vertical turbine pump
CAP6281	New Effluent Transfer Pumps	Cooper City's effluent disposal pump station may not be provided with Class I reliability approximately after FY 2036- FY 2040. This project is intended to add one vertical turbine pump such that the Total and Firm capacity of the effluent disposal transfer pump station is increased to 9.3 mgd and 7.31 mgd, respectively.
WWU5582	Package Treatment Plant 2 Rehabilitation and Fine Bubble Conversion	This project is intended to ensure the structural stability of Package Treatment Plant 2, and convert it to fine bubble aeration. Under the project, the Package Treatment Plant 2 tank will be cleaned, and all internal and external walls of the tank will be sandblasted, welded, and re-coated with epoxy. Any existing holes/punctures will be patched with new steel. All equipment beyond the service life will be removed and replaced with in-kind equipment. The existing coarse bubble diffusers, drop pipes, and related apparatus will be demolished. As a part of this upgrade, dissolved oxygen-based aeration controls will be provided to regulate airflow to each package plant. Control valves will be added at each package treatment plant to control the airflow to the aeration basin and to the digester independently to conserve energy. All ductwork modifications for fine bubble conversion will be completed in this project (Package Plants 1 and 3 will be converted to fine bubble aeration in the future). Currently, air is supplied to aeration basins and digesters via a common header. New blowers are not included in this cost estimate. The corroded secondary effluent transfer pipe will also be replaced with similar

Project ID	Project Name	Description
		piping. A part of the secondary effluent pipe is submerged in the aeration basin during normal operations, and further corrosion may short-circuit activated sludge to the chlorine contact chamber. This project is contingent upon building the new WWTP.
REG6583	WWTP Regulatory Compliance - FY 2037	This project is aimed at preparing documentation required ahead of permit renewal
WWU5884	Ferrous Sulfate Dosing System Modification	This project is intended to convert the existing ferrous sulfate dual-speed metering pump skid system to an adjustable pump skid for flow-pacing chemical dosing to the surge tank. The scope includes adopting a redundant level monitoring approach with the rate of change drain monitoring for leak detection. This project is an alternative project to the new facility construction project unless the surge tank is retained as a part of the new WWTP. This project is intended to conserve ferrous sulfate usage, as the chemical feed to the surge tank will continuously be optimized. This project is contingent upon building the new WWTP.
RRR5685	Package Treatment Plant 3 Rehabilitation and Fine Bubble Conversion	This project is intended to ensure the structural stability of Package Treatment Plant 3 and convert it to fine bubble aeration. This is an alternative project to the new WWTP construction project. Under the project, Package Treatment Plant 3 tank will be cleaned; all internal tank separation walls will be sandblasted, welded as required, and recoated with epoxy. Any existing holes/punctures will be patched with new steel. Any damage to the outer prestressed concrete tank will be patched/repaired as required and recoated. All equipment beyond the service life will be removed and replaced with in-kind equipment. All piping will be inspected and replaced/restored if corroded. The existing coarse bubble diffusers, drop pipes, and related apparatus will be demolished. As a part of this upgrade, dissolved oxygen-based aeration controls will be provided to regulate airflow to each package plant. This project is contingent upon building the new WWTP.
RRR5186	Influent main improvements	This project is intended to install a bypass around the influent flow meter to accommodate flow meter maintenance/replacements without interrupting plant operations/service outages.
RRR5387	Surge Tank Replacement	This project is intended to demolish the existing surge tank and construct a new covered concrete tank of the same size at the existing surge tank location. Mixing should be provided for the proposed surge tank. This project is an alternative project to the new standalone facility construction. However, it should be considered if the new facility's activated sludge process is not equipped to handle

Project ID	Project Name	Description
		the peak flows. This project is contingent upon building the new WWTP.
RRR6588	Package Treatment Plant 1 Replacement/Including Fine Bubble	This project is intended to replace Package Treatment Plant 1 in its existing location. The scope includes demolishing the existing Package Treatment Plant 1 tank, construction of a new prestressed concrete tank, and installing all required equipment. This project is contingent upon building the new WWTP.
REG6589	WWTP Regulatory Compliance - FY 2042	This project is aimed at preparing documentation required ahead of permit renewal.
WWU6590	New Dewatering Building	This project is intended to replace the existing dewatering building. The proposed work will include demolishing the existing building, safely storing the centrifuges and other equipment while the new building is under construction, constructing a new dewatering building, and relocating the centrifuges and other equipment at the new structure. A sludge dewatering contract will be in place during construction.

Table 7-34: Deep Injection Well Capital Improvement Projects Summary

Project ID	Project Name	Description
REG1021	Mechanical Integrity Testing - 2026 (Every 5 Years)	Performing mechanical integrity testing (MIT) on the injection well. Required to be performed once every five years by the injection well operating permit. The next MIT has to be completed by May 2026.
REG1022	Injection Well Operating Permit - 2026 (Every 5 Years)	Preparing a permit application renewal for the injection well from FDEP. Permit fee required to be submitted with the application is $10,000. Required to be renewed every five years. The next injection well permit application is required to be submitted in June 2026.
CAP1023	Injection Well Pump Station Pump Replacement	Implement the recommendations included in the June 2023 AECOM TM "Deep Injection Well Pump System Evaluation". The recommended option includes the replacement of the existing injection well PS pumps with new higher capacity pumps to meet the current permitted and future permitted injection well capacity. Work will include a new vacuum priming system and electrical upgrades.
CAP1024	Injection Well Rerating	Injection well rerating, including an FDEP Underground Injection Control (UIC) approved plan, fee, testing, reporting and permit minor modification request. This cost assumes that a contractor is not needed. Pumping and data collection will be performed by the City. This project

Project ID	Project Name	Description
		will need to follow the injection well pump station pump replacement project.
REG1025	Mechanical Integrity Testing - 2031 (Every 5 Years)	Performing mechanical integrity testing (MIT) on the injection well. Required to be performed once every five years by the injection well operating permit. This MIT is expected to be completed in 2031.
REG1026	Injection Well Operating Permit - 2031 (Every 5 Years)	Preparing a permit application renewal for the injection well from FDEP. Permit fee required to be submitted with the application is $10,000. Required to be renewed every five years. This injection well permit application is expected to be required to be submitted in 2031.
CAP1027	New Deep Injection Well	Depending on renewal of the effluent disposal agreement between Cooper City and City of Hollywood, a new deep injection well (DIW) would be required to disposed of Cooper City WWTP effluent. The recommended option includes drilling a new non-municipal tubing and packer DIW similar in size to the existing DIW, obtaining relevant permits, installing new injection well PS pumps, a new vacuum priming system and electrical upgrades. It is assumed that the existing monitoring can also be utilized for the new DIW.
REG1028	Mechanical Integrity Testing - 2036 (Every 5 Years)	Performing mechanical integrity testing (MIT) on the injection well. Required to be performed once every five years by the injection well operating permit. This MIT is expected to be completed in 2036.
REG1029	Injection Well Operating Permit - 2036 (Every 5 Years)	Preparing a permit application renewal for the injection well from FDEP. Permit fee required to be submitted with the application is $10,000. Required to be renewed every five years. This injection well permit application is expected to be required to be submitted in 2036.
RRR1030	Injection Well Rehabilitation	This potential project is for restoring capacity to the injection well system. If capacity of the well is deteriorating due to scale build up and/or clogging, capacity could be restored through mechanical and/or chemical rehabilitation.

Project ID	Project Name	Description
REG1031	Mechanical Integrity Testing - 2041 (Every 5 Years)	Performing mechanical integrity testing (MIT) on the injection well. Required to be performed once every five years by the injection well operating permit. This MIT is expected to be completed in 2041.
RRR1032	Monitoring Well Replacement	Dual-zone monitoring well replacement project to address monitoring interval water quality concerns and/or monitoring well integrity. Additionally, the wellhead is projected to have 15 more years of useful life.
REG1033	Injection Well Operating Permit - 2041 (Every 5 Years)	Preparing a permit application renewal for the injection well from FDEP. Permit fee required to be submitted with the application is $10,000. Required to be renewed every five years. This injection well permit application is expected to be required to be submitted in 2041.

9. Capital Improvement Program Updates

9.1 Introduction

The Capital Improvement Program (CIP) summarizes opinions of probable project costs (OPPCs) for the improvements recommended through the planning year 2045 as part of the Water and Wastewater Master Plan Update. These improvements address future growth, renewal and replacement needs, regulatory requirements, and other operational concerns for the water and wastewater system. The recommendations include funding sources for each project.

9.2 Capital Improvement Project Classification

Each project included in the CIP was assigned a unique identification code to facilitate tracking. Figure 9-1 illustrates the numbering scheme for these project codes. The first three letters indicate the project type, reflecting the primary driver for the project. Given that the master plan evaluates the City's water and wastewater systems, the next two letters denote the project area for easy identification. The final two digits represent the sequential project number.

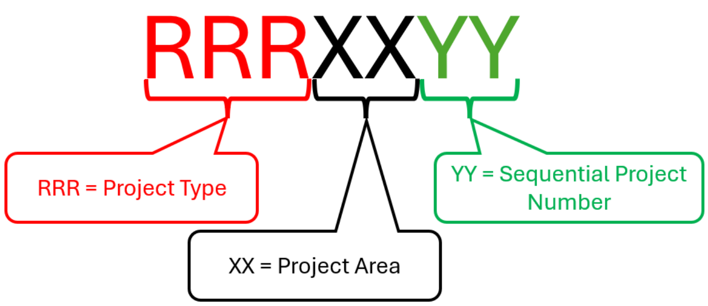


Figure 9-1: Number Scheme for CIP Projects

9.2.1 Project Types

Recommendations for capital improvements were classified into six major Project Types:

- Capacity (CAP): Capacity driven projects are improvements that increase the capacity of the water or wastewater collection, transmission, and treatment systems to meet the needs of current customers as well as planned and future growth. Capacity projects include CAP as part of the project identification number.
- Regulatory (REG): Regulatory driven projects are improvements that are considered necessary for compliance with current regulations and possible future regulations. Regulatory projects include REG as part of the project identification number.
- Renewal and Replacement (RRR): Renewal and replacement projects are either intended to rehabilitate (i.e. renew) or replace infrastructure that is at the end of its useful life and

maintain the reliability of the existing infrastructure at current capacity. Renewal and replacement projects include RR as part of the project identification number.

- WTP Upgrades (WPU): WTP upgrades are improvement projects intended to enhance operational effectiveness at the WTP. WTP upgrades include WPU as part of the project identification number.
- Water Quality Driven Improvements (WQD): Water quality driven improvement projects are intended to address areas of potential poor water quality in the water distribution system or storage facilities.
- WWTP Upgrades (WWU): WWTP upgrades are improvement projects intended to enhance operational effectiveness at the WWTP. WTP upgrades include WWU as part of the project identification number.

9.2.2 Project Areas

Table 9-1 illustrates the project area codes used in the naming convention.

Table 9-1: Project Area Codes

Code	Description
Water Projects	
01	Water Supply Wells
02	Raw Water Piping
03	Water Treatment Plant
04	Yard Piping
05	Pretreatment
06	Membrane Process
07	Post Treatment and Disinfection
08	Membrane Cleaning
09	WTP Storage and High Service Pumping
10	Deep Injection Well
11	Water Distribution System
12	Pine Island Road Pump Station (PIRPS)
Wastewater Projects	
50	WWTP Yard Piping
51	WWTP Influent Piping
52	Headworks
53	Surge Tank
54	Package Treatment Plant 1
55	Package Treatment Plant 2
56	Package Treatment Plant 3
57	Aeration System

Table 9-1: Project Area Codes

Code	Description
58	Chemical Systems
59	Digested Sludge Transfer Pump Station
60	Dewatering System
61	Effluent Storage Ponds
62	Effluent Transfer Pump Station
63	WWTP Electrical
64	WWTP Instrumentation
65	WWTP Overall
66	Collection System
67	Lift Stations
General Projects	
80	Facility Electrical
81	Facility Instrumentation
82	Utility Fleet

9.2.3 Sequential Project Number

The order that the projects are presented is neither an indication of the sequence that the projects should be implemented nor a ranking of their priority.

9.3 Opinion of Probable Project Costs

The opinion of probable costs presented herein has been prepared based upon master plan level information. Because of the level of scope development at this stage the opinion is an "Order Of Magnitude" estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected range of accuracy for this type of opinion is +100 percent to -50 percent. These opinions of probable cost have been prepared for guidance in project evaluation and implementation from the labor and material cost, competitive market conditions, final project scope, implementation schedule, and other variable conditions. As a result, the final project costs will vary from the opinions presented herein. The cost opinions are "project costs" and are inclusive of: construction costs; estimated allowance for permit application fees; 25 percent estimated allowance for engineering services during the design, permitting, construction and startup of the project; along with a 30 percent contingency. The costs are based upon year 2024 dollars and do not include escalation for inflation.

Several state and federal funding option are available to facilitate the CIPs proposed in this master plan, based on the project type. Details of these funding options are summarized in Table 9-2. Of those listed in Table 9-2, the funding options available for each CIP are outlined in subsequent tables along with respective project information.

Table 9-2: Available Funding Sources

Abbreviation	Fund Name	Type of Funding	Funding Source
STAG	State and Tribal Assistance Grant	Grant	Federal
LPA	Legislative Project Appropriations	Grant	State
SRF	State Revolving Funding	Low-Interest Loan	State
S&G	Sand and Grit Funding	Grant	State
FL[DS]	Cybersecurity	Grant	State
HMGP	Hazard Mitigation Grant Program	Grant	State / Federal
STORM	Safeguarding Tomorrow through Ongoing Risk Mitigation Revolving Loan Fund	Low-Interest Loan	State / Federal
BRIC	Building Resilient Infrastructure Communities	Grant	Federal
RFGP P / I	Resilient Florida Grant Program Planning / Implementation	Grant	State
WIFIA	Water Infrastructure Financing and Innovation Act	Low-Interest Loan	Federal
ITC	Investment Tax Credit	Tax Credit	Federal

9.4 Capital Improvement Program

9.4.1 Raw Water Supply Projects

The opinion of probable cost for raw water supply related projects is presented in Table 9-3. A total of seven projects have been identified at a total cost of $11,604,000.

Table 9-3: Opinion of Probable Cost for Raw Water Supply

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR0101	Wellfield Hydraulic Model	System Reliability	STAG LPA	2025	1	$50,000
RRR0102	Wells Rehabilitation Planning and Assessment	System Reliability		2025	1	$200,000
RRR0203	Wellfield Pipeline Cleaning	System Reliability	STAG LPA	2025	1	$64,000
RRR0104	Wells Rehabilitation	System Reliability	STAG LPA SRF	2027	3	$600,000
REG0105	Water Use Permit	Regulatory Compliance		2029	1	$310,000
RRR0106	Wellfield Pumps Replacement	System Reliability	STAG LPA SRF	2030	3	$9,080,000

Table 9-3: Opinion of Probable Cost for Raw Water Supply

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR0207	Raw Water Sand Strainer Improvements	System Reliability	STAG LPA SRF	2035	2	$1,300,000
Total - Raw Water Supply Projects						**$11,604,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.2 Water Treatment Projects

The opinion of probable cost for water treatment related projects is presented in Table 9-4. A total of 10 projects have been identified at a total cost of $35,420,000.

Table 9-4: Opinion of Probable Cost for Water Treatment Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[2] (FY)	Project Duratio[3] (FY)	Total Project Cost (FY 2024 $)
RRR0308	WTP Video Camera and Access Control Improvements	System Reliability		2025	1	$400,000
RRR0309	Degasifiers and Transfer Pumps Replacement	System Reliability		2028	2	$2,230,000
RRR0310	Chemical Systems Replacement	System Reliability	STAG LPA SRF	2030	4	$13,800,000
RRR0311	Meter Vault Improvements	System Reliability		2031	1	$240,000
RRR0312	Cartridge Filter Vessel Replacement	System Reliability		2031	1	$500,000
RRR0313	HSPS & Electrical System Replacement	System Reliability		2033	2	$4,400,000
RRR0314	WTP Fiber Optic Cable Condition Assessment and Replacement	System Reliability	STAG LPA	2033	3	$300,000
RRR0315	Roof Replacement	System Reliability		2033	2	$200,000
RRR0316	Nanofiltration Membrane Element Replacement (FY 2034)[1]	System Reliability		2034	1	$1,500,000

Table 9-4: Opinion of Probable Cost for Water Treatment Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[2] (FY)	Project Duratio[3] (FY)	Total Project Cost (FY 2024 $)
REG0317	Four-Log Virus Treatment Infrastructure Improvements	Regulatory Compliance	STAG LPA SRF	2035	2	$7,750,000
RRR0318	Miscellaneous Risk Reduction and Resiliency Improvements	System Reliability	STAG LPA FL[DS]	2036	2	$200,000
RRR0319	WTP HSPS Replacement (Pumps 1-3)	System Reliability		2040	2	$2,400,000
RRR0320	Nanofiltration Membrane Element Replacement (FY 2044)[1]	System Reliability		2044	1	$1,500,000
Total - Water Treatment Projects						**$35,420,000**

Notes:

[1] Future membrane installations should include procurement of the membrane pilot test skid and pilot testing of two membrane elements. Additionally, pilot testing should include selection of antiscalant chemical and optimization of sulfuric acid dosage.

[2] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[3] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.3 Deep Injection Well Projects

The opinion of probable cost for deep injection well related projects is presented in Table 9-5. A total of 13 projects have been identified at a total cost of $45,562,000.

Table 9-5: Opinion of Probable Cost for Deep Injection Well Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration [2] (FY)	Total Project Cost (FY 2024 $)
REG1021	Mechanical Integrity Testing - 2026 (Every 5 Years)	Regulatory Compliance		2025	1	$177,000
REG1022	Injection Well Operating Permit - 2026 (Every 5 Years)	Regulatory Compliance		2026	1	$60,000
CAP1023	Injection Well Pump Station Pump Replacement	Capacity	STAG LPA SRF	2026	2	$2,480,000
CAP1024	Injection Well Rerating	Capacity		2028	1	$84,000

Table 9-5: Opinion of Probable Cost for Deep Injection Well Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration [2] (FY)	Total Project Cost (FY 2024 $)
REG1025	Mechanical Integrity Testing - 2031 (Every 5 Years)	Regulatory Compliance		2030	1	$177,000
REG1026	Injection Well Operating Permit - 2031 (Every 5 Years)	Regulatory Compliance		2031	1	$60,000
CAP1027	New Deep Injection Well	Capacity	STAG LPA SRF	2032	3	$33,750,000
REG1028	Mechanical Integrity Testing - 2036 (Every 5 Years)	Regulatory Compliance		2035	1	$177,000
REG1029	Injection Well Operating Permit - 2036 (Every 5 Years)	Regulatory Compliance		2036	1	$60,000
RRR1030	Injection Well Rehabilitation	System Reliability	STAG LPA	2037	2	$1,040,000
REG1031	Mechanical Integrity Testing - 2041 (Every 5 Years)	Regulatory Compliance		2040	1	$177,000
RRR1032	Monitoring Well Replacement	System Reliability	STAG LPA SRF	2040	3	$7,260,000
REG1033	Injection Well Operating Permit - 2041 (Every 5 Years)	Regulatory Compliance		2041	1	$60,000
Total - Deep Injection Well Projects						**$45,562,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.4 Water Distribution Projects

The opinion of probable cost for water distribution related projects is presented in Table 9-5. A total of 13 projects have been identified at a total cost of $73,080,000.

Table 9-5: Opinion of Probable Cost for Water Distribution Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR1134	Water Meter Replacement Phase 1 (Replacing 1,300 SSR digital meters)	System Reliability		2025	1	$550,000

Table 9-5: Opinion of Probable Cost for Water Distribution Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR1135	Water Meter Replacement Phase 2 (Replacing remaining outdated manual meters)	System Reliability		2025	2	$2,450,000
RRR1136	Prepare Water Distribution System Hydraulic Model	System Reliability		2025	1	$100,000
RRR1137	Annual Distribution System Valve Replacement	System Reliability	STAG LPA	2025	21	$1,000,000
RRR1138	Annual Water Service Line Replacement	System Reliability	STAG LPA	2025	21	$42,180,000
RRR1139	Pine Island Road Tank Baffle Curtain Replacement	System Reliability		2026	1	$100,000
RRR1140	Miscellaneous Interconnect Improvements - Phase 1	System Reliability		2026	1	$300,000
RRR1141	Miscellaneous Interconnect Improvements – Phase 2	System Reliability		2028	1	$600,000
RRR1142	Water Main Annual Replacement	System Reliability		2030	16	$25,200,000
RRR1143	Miscellaneous Interconnect Improvements - Phase 3	System Reliability	STAG LPA SRF - WIFIA - RFGP P / I	2030	1	$300,000
RRR1144	Asset Management Program	System Reliability		2032	1	$150,000
RRR1145	Water Distribution System Failure Prediction Model	System Reliability		2033	1	$150,000
Total - Water Distribution Projects						**$73,080,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.5 Wastewater Collection Projects

The opinion of probable cost for wastewater collection related projects is presented in Table 9-6. A total of 16 projects have been identified at a total cost of $54,146,000.

Table 9-6: Opinion of Probable Cost for Wastewater Collection Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR6746	Lift Station Control Module Migration/Upgrade	System Reliability	STAG LPA SRF	2024	2	$550,000
RRR6747	Lift Station Rehabilitation - FY 2025	System Reliability	STAG LPA SRF	2025	1	$498,000
RRR6648	Wastewater Force Main Rehabilitation (FY 2025-FY 2045)	System Reliability	STAG LPA SRF	2025	20	$16,757,000
RRR6649	Gravity Sewer and Manhole Assessment and Rehabilitation - (FY 2025-FY 2045)	System Reliability	STAG LPA SRF	2025	20	$23,056,000
RRR6650	Portable Generator Purchase (FY 2025)	System Reliability	STAG LPA SRF	2025	1	$422,000
RRR6651	Lift Station-41 Permanent Generator	System Reliability	STAG LPA SRF	2025	1	$206,000
RRR6752	Lift Station Rehabilitation - FY 2026	System Reliability	STAG LPA SRF	2026	1	$538,000
RRR6753	Lift Station Rehabilitation - FY 2027	System Reliability	STAG LPA SRF	2027	1	$479,000
RRR6754	Lift Station Rehabilitation - FY 2028	System Reliability	STAG LPA SRF	2028	1	$479,000
RRR6755	Lift Station Rehabilitation - FY 2029	System Reliability	STAG LPA SRF	2029	1	$479,000
RRR6756	Lift Station Rehabilitation (FY2030-FY2045)	System Reliability	STAG LPA SRF	2030	15	$8,603,000
RRR6657	Portable Generator Maintenance and Replacement (FY 2030)	System Reliability	STAG LPA HMGP	2030	1	$422,000
RRR6758	Collection System Condition Assessment	System Reliability		2035	1	$391,000
RRR6659	Portable Generator Maintenance and Replacement (FY 2035)	System Reliability	STAG LPA HMGP	2035	1	$422,000
RRR6660	Portable Generator Maintenance and Replacement (FY 2040)	System Reliability	STAG LPA	2040	1	$422,000

Table 9-6: Opinion of Probable Cost for Wastewater Collection Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
			HMGP			
RRR6661	Portable Generator Maintenance and Replacement (FY 2045)	System Reliability	STAG LPA HMGP	2045	1	$422,000
Total - Wastewater Collection Projects						**$54,146,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.6 Wastewater Treatment Projects

The opinion of probable cost for wastewater treatment-related projects is presented in Table 9-7 and Table 9-8. A total of 27 projects have been identified. At the City's request, Hazen identified three options for the City to conduct wastewater treatment plant CIPs.

- **Option 1—With new wastewater treatment plant (WWTP)**: A new activated sludge-based WWTP at the current WWTP location, replacing Package Treatment Plants 1, 2, and 3 will be constructed. The engineering services for the new WWTP, which include preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2028- FY 2033; the new WWTP construction will be conducted from FY 2030- FY 2033. Details of the facilities included in the new WWTP are discussed in Chapter 7. Of the 27 WWTP CIPs identified in this master plan, 17 are applicable with this option at a cost of $83,183,000.

- **Option 2—Without the new wastewater treatment plant (WWTP)**: The existing Package Treatment Plant-based facility will be rehabilitated, and systems will be replaced as outlined in Table 9-7. Of the 27 WWTP CIPs identified in this master plan, 26 are applicable with this option at a cost of $51,242,000.

- **Option 3— Prioritizing the new wastewater treatment plant (WWTP) construction**: A new activated sludge-based WWTP at the current WWTP location, replacing Package Treatment Plants 1, 2, and 3 will be constructed. The engineering services for the new WWTP, which include preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2025- FY 2030; the new WWTP construction will be conducted from FY 2027- FY 2030. Per the City's request, the new WWTP CIP in option 3 (WWU6574 in Table 9-8) includes the headworks construction project, since the City plans to conduct them at the same time. Of the 27 WWTP CIPs identified in this master plan, 15 are applicable with this option at a cost of $78,530,000.

Details of the facilities included in the new WWTP are discussed in Chapter 7.

Table 9-7: Opinion of Probable Cost for Wastewater Treatment Projects (Option 1 and 2)

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start (FY)[3]	Project Duration (FY)[4]	Total Project Cost (FY 2024 $)
RRR6062	Dewatering System Rehabilitation: Centrifuge and Polymer System Replacement - Phase 1[1,2]	System Reliability	STAG LPA SRF	2024	1	$1,500,000[1,2]
WWU5963	Sludge Transfer System Improvement[1,2]	System Reliability	STAG LPA SRF	2025	1	$459,000[1,2]
RRR5364	Surge Tank Rehabilitation[1,2]	System Reliability	STAG LPA SRF	2026	1	$933,000[1,2]
RRR5465	Package Treatment Plant 1 Rehabilitation[1,2]	System Reliability	STAG LPA SRF	2026	2	$3,340,000[1,2]
RRR6366	Blower Room Electrical System Rehabilitation[1,2]	System Reliability	STAG LPA BRIC	2026	1	$145,000[1,2]
WWU5867	Chlorine Dosing Skid Improvement[1,2]	System Reliability	STAG LPA	2026	1	$279,000[1,2]
RRR5168	Flow Meter Electrical and I&C Improvement[1,2]	System Reliability	STAG LPA	2027	1	$47,000[1,2]
WWU6569	New Blower Building and Blower Replacement[2]	System Reliability	STAG LPA SRF	2028	4	$3,900,000[2]
REG6570	WWTP Regulatory Compliance - FY 2027[1,2]	Regulatory Compliance		2027	1	$180,000[1,2]
CAP6372	Blower Room MCC Replacement[2]	Capacity	STAG LPA SRF	2029	2	$1,389,000[2]
WWU5273	Headworks Construction: Phase 1[1,2]	System Reliability	STAG LPA SRF	2029	3	$7,800,000[1,2]
WWU6574	New Wastewater Treatment Facility[1]	System Reliability	STAG LPA SRF WIFIA	2030	4	$54,200,000[1]
WWU5275	Headworks Construction: Phase 2[1,2]	System Reliability	STAG LPA SRF S&G	2032	2	$4,080,000[1,2]

Table 9-7: Opinion of Probable Cost for Wastewater Treatment Projects (Option 1 and 2)

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start (FY)[3]	Project Duration (FY)[4]	Total Project Cost (FY 2024 $)
REG6576	WWTP Regulatory Compliance - FY 2032[1,2]	Regulatory Compliance		2032	1	$234,000[1,2]
CAP5377	Influent Transfer Pump Station improvement[2]	Capacity	STAG LPA SRF	2034	2	$687,000[2]
WWU6578	Maintenance Building Relocation/Rehabilitation[1,2]	System Reliability	STAG LPA SRF	2034	3	$3,680,000[1,2]
RRR6280	Effluent Transfer Pump Replacement[1,2]	System Reliability	STAG LPA SRF	2035	2	$449,000[1,2]
CAP6281	New Effluent Transfer Pumps[1,2]	Capacity	STAG LPA SRF	2035	2	$449,000[1,2]
WWU5582	Package Treatment Plant 2 Rehabilitation and Fine Bubble Conversion[2]	System Reliability	STAG LPA SRF	2037	2	$3,030,000[2]
REG6583	WWTP Regulatory Compliance - FY 2037[1,2]	Regulatory Compliance		2037	1	$234,000[1,2]
WWU5884	Ferrous Sulfate Dosing System Modification[2]	System Reliability		2038	1	$123,000[2]
RRR5685	Package Treatment Plant 3 Rehabilitation and Fine Bubble Conversion[2]	System Reliability	STAG LPA SRF	2038	2	$2,690,000[2]
RRR5186	Influent Main Improvements[2]	System Reliability	STAG LPA SRF	2039	1	$180,000[2]
RRR5387	Surge Tank Replacement[2]	System Reliability	STAG LPA SRF	2040	2	$2,360,000[2]
RRR6588	Package Treatment Plant 1 Replacement/Including Fine Bubble[2]	System Reliability	STAG LPA SRF	2042	3	$7,900,000[2]
REG6589	WWTP Regulatory Compliance - FY 2042[1,2]	Regulatory Compliance		2042	1	$234,000[1,2]
WWU6590	New Dewatering Building[1,2]	System Reliability	STAG LPA SRF	2045	2	$4,940,000[1,2]

Table 9-7: Opinion of Probable Cost for Wastewater Treatment Projects (Option 1 and 2)

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start (FY)[3]	Project Duration (FY)[4]	Total Project Cost (FY 2024 $)
Total – Wastewater Treatment Projects with Option 1						**$83,183,000**
Total – Wastewater Treatment Projects with Option 2						**$51,242,000**

Notes:

[1] *CIPs applicable with Option 1.*

[2] *CIPs applicable with Option 2.*

[3] *Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.*

[4] *This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.*

Table 9-8: Opinion of Probable Cost for Wastewater Treatment Projects (Option 3)

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1](FY)	Project Duration [2] (FY)	Total Project Cost (FY 2024 $)
RRR6062	Dewatering System Rehabilitation: Centrifuge and Polymer System Replacement - Phase 1	System Reliability	STAG LPA SRF	2024	1	$1,500,000
WWU5963	Sludge Transfer System Improvement	System Reliability	STAG LPA SRF	2025	1	$459,000
RRR6366	Blower Room Electrical System Rehabilitation	System Reliability	STAG LPA BRIC	2026	1	$145,000
WWU5867	Chlorine Dosing Skid Improvement	System Reliability	STAG LPA	2026	1	$279,000
RRR5168	Flow Meter Electrical and I&C Improvement	System Reliability	STAG LPA	2027	1	$47,000
REG6570	WWTP Regulatory Compliance - FY 2027	Regulatory Compliance		2027	1	$180,000
WWU6574	New Wastewater Treatment Facility	System Reliability	STAG LPA SRF WIFIA	2027	4	$65,700,000
REG6576	WWTP Regulatory Compliance - FY 2032	Regulatory Compliance		2032	1	$234,000
WWU6578	Maintenance Building Relocation/ Rehabilitation	System Reliability	STAG LPA SRF	2028	3	$3,680,000

Table 9-8: Opinion of Probable Cost for Wastewater Treatment Projects (Option 3)

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1](FY)	Project Duration [2] (FY)	Total Project Cost (FY 2024 $)
RRR6280	Effluent Transfer Pump Replacement	System Reliability	STAG LPA SRF	2035	2	$449,000
CAP6281	New Effluent Transfer Pumps	Capacity	STAG LPA SRF	2035	2	$449,000
REG6583	WWTP Regulatory Compliance - FY 2037	Regulatory Compliance		2037	1	$234,000
REG6589	WWTP Regulatory Compliance - FY 2042	Regulatory Compliance		2042	1	$234,000
WWU6590	New Dewatering Building	System Reliability	STAG LPA SRF	2045	2	$4,940,000
Total – Wastewater Treatment Projects with Option 3						**$78,530,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.7 General Projects

The opinion of probable cost for general related projects is presented in Table 9-9. One project has been identified at a total cost of $21,647,000.

Table 9-9: Opinion of Probable Cost for General Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR8091	Grounding Assessment	System Reliability		2025	1	$25,000
RRR8092	Electrical System Upgrades - Phase 1	System Reliability	HMGP STORM STAG LPA	2025	2	$201,680
RRR8093	Electrical System Upgrades - Phase 2	System Reliability	HMGP STORM STAG LPA	2027	3	$11,237,751
RRR8194	SCADA Improvements	System Reliability	STAG LPA	2033	2	$917,000

Table 9-9: Opinion of Probable Cost for General Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
			SRF			
RRR8095	Electrical System Upgrades - Phase 3	System Reliability	HMGP STORM STAG LPA	2033	2	$9,265,167
Total - General Projects						**$21,647,000**

Notes:

[1] Year of starting project construction. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

[2] This field outlines the duration of the construction phase for CIP with separate design and construction phases. Design is estimated to start 1-2 years prior for CIPs requiring a considerable design effort before construction. See the CIP spreadsheet for further details.

9.4.8 Utility Fleet Projects

The opinion of probable cost for projects related to the utility fleet is presented in Table 9-10. One project has been identified at a total cost of $650,000.

Table 9-10: Opinion of Probable Cost for Utility Fleet Projects

Project No.	Project Name	Driver	Available Funding Sources	Earliest Start[1] (FY)	Project Duration[2] (FY)	Total Project Cost (FY 2024 $)
RRR8296	New Vactor Truck Purchase	System Reliability		2025	1	$650,000
Total – Utility Fleet Projects						**$650,000**

9.5 Additional Recommended Projects for Future Inclusion in the CIP

9.5.1 Introduction

Should additional funding become available, it is recommended that the City consider implementing the projects outlined in the following subsections in future updates of the CIP. Initially, these projects were excluded from the CIP due to budgetary constraints. However, they are presented here for future consideration if supplementary funds are secured.

9.5.2 Raw Water Supply Projects

The opinion of probable cost for raw water supply related projects is presented in Table 9-11. A total of four additional projects have been identified at a total cost of $2,920,000.

Table 9-11: Additional Projects for Raw Water Supply

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Water Wells Blowoff Automation	2026	Existing well four is equipped with a flushing branch connection that conveys water via a 6-inch diameter pipeline to discharge above ground at a stormwater inlet (located west of well four). The stormwater inlet reportedly conveys the well water south of 49th Street and discharges to the lake. Existing wells five through nine are equipped with a flushing tee and 6-inch diameter valve and outlet that terminates in a quick connect coupling. Wells five through nine are not equipped with permanent pipelines for conveyance of blowoff water. Under this project, the blowoffs would be automated using a solenoid timer device at the wellhead (no SCADA necessary). Additionally, permanent piping would be designed and constructed to convey the blowoff water to disposal locations. The scope of this project assumes that the existing stormwater piping near the wells can convey the blowoff water. The capability of the existing stormwater piping to convey blowoff water is unknown. Hence, this project also includes engineering analysis to determine the capacity of the existing stormwater piping to convey the blowoff water. The findings of that analysis may result in a significant cost escalation.	$1,190,000
Wellfield Hydraulic Model	2031	Water distribution system operation and maintenance (O&M) logs are required by FAC Rule 62-602.650(5). The City does not maintain the required log. Under this project, the City would retain an engineering consultant (if needed) to assist it to create management tools to ensure the required log is developed and maintained.	$50,000

Table 9-11: Additional Projects for Raw Water Supply

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Wells Air Removal Improvements	2031	A common challenge reported by other membrane water treatment plants is turbidity spikes when a water well is turned on. This occurs because the air in the pump discharge reacts with dissolved iron to form a solid. The City staff reported that they do not have issues with air entering the raw water lines when the pumps turn on. Staff reported that they do not detect turbidity spikes when the well pumps turn on. Based on discussion with the City it was decided to include a project titled "Wells Air Removal Improvements" of an unspecified scope to provide a contingency budget to implement improvements in the event that turbidity spikes due to air entrainment in the well pumps became a challenge. It is noted that other planned improvements, such as the project titled "Wellfield Hydraulic Model" will evaluate certain improvements that mitigate against air entering the raw water piping. Additionally, implementing the project titled "Wellfield Pumps Replacement" would include capital improvements that mitigate air entering the raw water piping.	$1,190,000
Wellfield Pig Launching and Receiving Facilities	2034	This project will include preparing bidding documents, cost opinions, preparing and submitting of needed permit applications, providing procurement support and oversight of construction activities for the addition of pig launching and receiving facilities, or other permanent infrastructure to facilitate future raw water pipeline cleaning. The project will be bid to a single contractor for construction. Construction of the improvements is included in this item.	$490,000
Total – Additional Raw Water Supply Projects			**$2,920,000**

9.5.3 Water Treatment Projects

The opinion of probable cost for water treatment related projects is presented in Table 9-12. A total of 21 additional projects have been identified at a total cost of $51,249,000.

Table 9-12: Additional Projects for Water Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Water Plant Storm Shutter Improvements	2025	The existing storm shutters at the water treatment plant are aging. This project would retain a contractor to evaluate the condition of the existing storm shutters, recommend improvements and then implement the improvements.	$200,000

Table 9-12: Additional Projects for Water Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Storage Tank Preventive Maintenance	2025	This project is for maintenance type improvements at Pine Island Road Water Storage Tank and Storage Tank No. 1. This project would include the following: 1. Post "Warning, Tampering with this Facility is a Federal Offense" sign at the facility entrance 2. Post "No Trespassing" sign at the facility entrance 3. Post "Confined Space Entry" sign at the tank manways 4. Post "Confined Space Entry" sign at the tank roof hatch 5. Post "Fall Protection Required" sign at the ladder 6. Clean and lubricate all moving parts of the liquid level indicator 7. Adjust and calibrate the liquid level indicator 8. Install a lock on the roof hatch 9. Install anti-skid rung covers on the exterior shell access ladder 10. Install anti-skid rung covers on the interior access ladder 11. Drain tank and remove all sediment 12. Clean tank interior surface, prepare surface in accordance with SSPC 13, repair surface voids, and coat interior (this item was not recommended by Pittsburgh Tank & Tower Group, however, Hazen recommends including this item for budgeting purposes given the age of the tank)	$830,000
Building Code Compliance Assessment	2025	This project entails conducting condition assessments of the water treatment infrastructure to ensure building code compliance. Key aspects to be reviewed include structural integrity, electrical systems, energy code adherence, ventilation, and occupancy standards. The assessment may involve in-situ material testing, photographic documentation, and diver inspections.	$700,000
HSPS NETA Electrical Inspection	2026	Issue a contract to an International Electrical Testing Association (NETA) certified contractor to inspect the electrical equipment within the next two years. The NETA inspector should provide a detailed report documenting its inspection and recommended maintenance. Perform all maintenance recommended by the NETA inspection.	$363,000
Cybersecurity Review	2026	This project is to provide a cybersecurity review of the City of Cooper City (CITY) Water Treatment Plant (WTP), raw water wells, wastewater treatment plant (WWTP), sanitary lift stations, and water storage/pump station. Additionally, in compliance with the America's Water Infrastructure Act of 2018, the CITY has updated its Emergency Response Plan (ERP) with eight specific response protocols. To enhance emergency preparedness, this project will also develop and integrate in the existing ERP, new Incident Specific Response Procedures (ISRPs) for Loss of Communication, Active Shooter, and Bomb Threat.	$286,000

Table 9-12: Additional Projects for Water Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
NELAP Laboratory Certification	2026	The City's current laboratory is not certified under the Florida Department of Health (DOH) National Environmental Laboratory Accreditation Program (NELAP). Under this project, the City's Water Treatment Plant Laboratory would obtain NELAP certification.	$625,000
Pretreatment Pilot Test	2026	This project aims to conduct a pilot test evaluating the performance of different antiscalant and sulfuric acid dosages on the pretreatment cartridge filters. Additionally, multiple antiscalants will be tested to ensure that the City selects the most effective option.	$100,000
Cleaning Chemical Test	2026	This project involves conducting a pilot test with different cleaning chemicals to determine their effectiveness in cleaning membrane elements. A report will be prepared that documents the findings of the chemical test and provides recommendations based on the result.	$100,000
Membrane Performance Testing	2027	The objective of this project is to conduct a membrane pilot test for the Water Treatment Plant (WTP). The project involves constructing a membrane pilot test unit to evaluate the performance of various antiscalants and sulfuric acid dosages from different vendors on pretreatment cartridge filters. Additionally, chemical cleaning tests will be conducted to assess the effectiveness of cleaning the membrane elements. A final report will be prepared to document findings and provide recommendations based on the results.	$1,110,000
Miscellaneous SCADA, IT & HR CIP Projects	2030	Miscellaneous SCADA CIP improvements identified is the City's Risk and Resiliency Assessment report. It is assumed these projects would be implemented by City staff and do not require engineering consultant support to implement.	$1,450,000
Miscellaneous SCADA IT, HR Operational Improvements	2030	Miscellaneous SCADA IT, HR Operational Improvements identified is the City's Risk and Resiliency Assessment report. It is assumed these projects would be implemented by City staff and do not require engineering consultant support to implement.	$1,075,000
Energy Assessment and Program	2031	This project aims to enhance energy efficiency within the City’s water and wastewater infrastructure, encompassing treatment plants and pump stations. The following tasks will be undertaken: 1. Energy usage analysis 2. Energy project planning and prioritization 3. Establish framework for energy management program 4. Energy management master plan 5. Energy project preliminary design 6. Energy project final design 7. Energy project bidding and construction services	$500,000

Table 9-12: Additional Projects for Water Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Membrane Element Test 2034	2034	This project would conduct nanofiltration membrane element testing to evaluate the system's performance, integrity, and overall effectiveness.	$50,000
Four-Log Virus Treatment Infrastructure Improvements	2035	This project includes infrastructure improvements to obtain four-log virus treatment certification.	$7,750,000
Replace Anhydrous Ammonia with Liquid Ammonium Sulfate	2035	The WTP uses anhydrous ammonia in the disinfection process to form chloramines to maintain distribution system disinfectant residual. The City typically has two 200 pound capacity cylinders on scales in service. Additionally, the City typically stores another three 200 pound cylinders within the ammonia building. Under this project, the anhydrous ammonia system would be demolished and replaced with an liquid ammonium sulfate (LAS) storage and feed system within a pre-engineered fiberglass reinforced plastic building. It is noted that LAS typically has a concentration of 40% by weight active ingredient.	$2,250,000
Degasifier Condition Assessment	2035	This project is to conduct a degasifier condition assessment. The assessment will include taking each individual degasifier offline for inspection to identify any signs of deterioration. A report will be prepared that documents the findings of the inspection and provides actionable recommendations based on the assessment result.	$50,000
Offsite Water Well Security Improvements	2037	Implement security monitoring system at offsite wells. Improvements would include installation of CCTV camera for surveillance at each offsite well.	$290,000
Membrane WTP Concentrate Pump Addition	2037	Consider adding redundant concentrate pump to enhance system reliability. It is assumed that the City would design and construct this project.	$270,000
Membrane Building Roof Replacement	2040	This project involves the replacement of the roof for the membrane building. Additionally, it includes engaging a roofing contractor to conduct an inspection and provide a detailed report on their findings.	$1,400,000
Membrane Element Test 2042	2042	This project would conduct nanofiltration membrane element testing to evaluate the system's performance, integrity, and overall effectiveness.	$50,000

Table 9-12: Additional Projects for Water Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Plant Capacity Expansion	2045	*Only anticipated to be necessary if the City plans to expand their service area.* This project is to expand the finished water capacity by the addition of one reverse osmosis (RO) treatment train. For this master plan, it is assumed that the production capacity would increase by 2 mgd. This project would include construction of a Floridian Aquifer well, raw water conveyance piping, and RO treatment train. The RO treatment train will be constructed within a new building. All necessary infrastructure (i.e., chemical systems, electrical, controls, etc.) to support expansion are included.	$31,800,000
Total – Additional Water Treatment Projects			**$51,249,000**

9.5.4 Water Distribution Projects

The opinion of probable cost for water distribution related projects is presented in Table 9-13. A total of seven additional projects have been identified at a total cost of $2,250,000.

Table 9-13: Additional Projects for Water Distribution

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Lead and Copper Rule Revisions Compliance	2025	The City is required to comply with the Lead and Copper Rule Revisions (LCRR) by October 16, 2024. This project provides a "place holder" budget for retaining an engineering consultant to assist the City continue its LCRR compliance efforts beyond the regulatory deadline if needed.	$1,000,000
Fire Hydrant Management Program	2027	The purpose of a Fire Hydrant Management Program is to define the City's policies relative to the annual inspection and testing of existing fire hydrants. Additionally, this document would define the City's record keeping procedures relative to fire hydrant mapping along with results from inspections and tests. It is assumed that the City would retain an engineering consultant to prepare this document. The program document should comply with NFPA guidelines.	$50,000
Water Distribution System Valve Exercise Program	2030	AC 62-555.350(12)(c) requires that the City keep records documenting that their isolation valves are being exercised. It is recommended that the City create a Valve Exercise Program that documents its procedures and policies to ensure compliance with FAC 62-555.350(12)(c). Under this project, the City would retain an engineering consultant to prepare a Water Distribution System Valve Exercise Program Manual. American Water Works Association (AWWA) provides guidelines in Manual M44 for preparation of a valve exercise program.	$100,000

Table 9-13: Additional Projects for Water Distribution

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Update Water Distribution System Model and Water System Master Plan	2030	It is standard industry practice to update the City's water distribution system and associated master plan on a periodic basis. It is assumed that the City would complete the update on a ten year cycle. This project includes retaining an engineering consultant to update the water distribution system hydraulic model and associated master plan.	$400,000
Distribution System Unidirectional Flushing Plan Development	2035	Distribution System Unidirectional Flushing Plan Development	$300,000
UDF Training and First Implementation	2036	Implementing the Unidirectional Flushing (UDF) Plan is a complex process. Hence, the City staff require expert assistance to be trained to execute the UDF. Therefore, under this project, the City would retain a contractor – such as HydroMax USA – to execute the first UDF along with training City staff in UDF implementation.	$300,000
Distribution System Water Quality Monitoring	2037	Enhance distribution system monitoring: through pressure monitoring system and/or water quality monitoring to promote early detection of potential contamination events. It is assumed that the City would design and construct this project.	$100,000
Total – Additional Water Distribution Projects			**$2,250,000**

9.5.5 Wastewater Collection Projects

The opinion of probable cost for wastewater collection related projects is presented in Table 9-14. A total of two additional projects have been identified at a total cost of $1,027,000.

Table 9-14: Additional Projects for Wastewater Collection

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Rehabilitation of LS-3	2024	Rehabilitation of LS#3- Above Ground Can lift station.	$342,000
Portable Generator Maintenance and Replacement (2025-2030)	2025	This project is intended to purchase 2 new generators per year between 2025-2029 and maintain existing generators in the City's inventory.	$685,000
Total – Additional Wastewater Collection Projects			**$1,027,000**

9.5.6 Wastewater Treatment Projects

The opinion of probable cost for wastewater treatment related projects is presented in Table 9-15. A total of three additional projects have been identified at a total cost of $2,826,000.

Table 9-15: Additional Projects for Wastewater Treatment

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
SCADA Masterplan	2025	This Project is intended to develop a SCADA master plan for Cooper City Wastewater Treatment Plant and the lift stations and integrating it with the water treatment plant.	$233,000
Dewatering System Rehabilitation: Centrifuge and Polymer System Replacement - Phase 1	2025	This project is intended to replace two existing centrifuges with an in-kind 70-100 GPM centrifuge. The new centrifuge should be operated with the existing centrifuge as a backup to establish Class I reliability. A new control panel should be provided with the new centrifuges. The project also includes replacing the existing polymer mixer and dosing pump with in-kind equipment.	$2,520,000
Influent Transfer Pump Station Electrical Improvements	2028	This project is intended to provide sufficient lighting at the influent transfer pump station for the safe operation of equipment at night and improve the lightning protection system and groundings.	$73,000
Total – Additional Wastewater Treatment Projects			**$2,826,000**

9.5.7 Utility Fleet Projects

The opinion of probable cost for projects related to the utility fleet is presented in Table 9-16. One additional project has been identified at a total cost of $1,00,000.

Table 9-16: Additional Projects for Utility Fleet

Project Name	Potential Start Year	Description	Total Project Cost (FY 2024 $)
Utility Fleet Upgrade /Maintenance	2025	Replacement of the older vehicles in the City's fleet with new units.	$1,000,000
Total – Additional Utility Fleet Projects			**$1,000,000**

9.6 Capital Improvement Program Summary

9.6.1 Introduction

The tables in this section provide a comprehensive summary of the Capital Improvement Program (CIP) updates over a five-year period, extending for the next 20 years. These summaries are categorized based on project drivers or project groups and are presented for three distinct options: Option 1 (With New WWTP), Option 2 (Without New WWTP), and Option 3 (Prioritizing the New WWTP Construction).

It is important to note that the annual cash flows for the proposed CIP were derived by escalating project costs to the mid-year of construction. The escalation factors for FY2025-FY2045 were calculated using Construction Cost Index (CCI) data from 2014-2024. The estimated cash flows, based on these assumptions and the suggested CIP timeframes, are detailed in the subsequent sections.

9.6.2 Option 1 – With New WWTP

As described earlier, Option 1 involves the construction of a new activated sludge-based WWTP at the current WWTP location, replacing Package Treatment Plants 1, 2, and 3. Based on this option, engineering services for the new WWTP, including preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2028 to FY 2033, and the new WWTP construction will be conducted from FY 2030 to FY 2033.

Table 9-17 represents the cost allocated to each project driver every five years, providing an overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 9-17 and Table 9-18 amounts to $409,879,000 in escalated dollars.

Table 9-18 provides a breakdown of the costs by project group, indicating how funding will be allocated to each group with Option 1. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 9-17: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$2,746,000	$42,490,000	$538,000	$0	**$45,774,000**
Regulatory Compliance	$824,000	$1,603,000	$11,358,000	$670,000	**$14,455,000**
System Reliability	$71,781,000	$161,478,000	$49,278,000	$67,113,000	**$349,650,000**
Total	**$75,351,000**	**$205,571,000**	**$61,174,000**	**$67,783,000**	**$409,879,000**

Table 9-18: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**
Wastewater Treatment	$17,453,000	$72,097,000	$4,301,000	$4,756,000	**$98,607,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$75,351,000**	**$205,571,000**	**$61,174,000**	**$67,783,000**	**$409,879,000**

9.6.3 Option 2 – Without New WWTP

Option 2 involves the rehabilitation of the existing Package Treatment Plant-based facility and the replacement of systems as outlined in the CIP. Table 9-19 represents the cost allocated to each project driver every five years, providing a clear overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 9-19 and Table 9-20 amounts to $375,255,000 in escalated dollars.

Table 9-20 provides a breakdown of the costs by project groups, indicating how much money is being allocated to each group. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 9-19: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$3,631,000	$43,659,000	$985,000	$0	**$48,275,000**
Regulatory Compliance	$824,000	$1,603,000	$9,914,000	$670,000	**$13,011,000**
System Reliability	$67,683,000	$104,301,000	$59,518,000	$82,467,000	**$313,969,000**
Total	**$72,138,000**	**$149,563,000**	**$70,417,000**	**$83,137,000**	**$375,255,000**

Table 9-20: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**
Wastewater Treatment	$14,240,000	$16,089,000	$13,544,000	$20,110,000	**$63,983,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$72,138,000**	**$149,563,000**	**$70,417,000**	**$83,137,000**	**$375,255,000**

9.6.4 Option 3 - Prioritizing the New WWTP Construction

Option 3 focuses on prioritizing the construction of a new activated sludge-based Wastewater Treatment Plant (WWTP) at the current WWTP location. Based on this option, the engineering services for the new WWTP, including preliminary and detailed designs and construction management services (CMS), will be conducted from FY 2025 to FY 2030 and the new WWTP construction will be conducted from FY 2027 to FY 2030. Table 9-21 represents the cost allocated to each project driver every five years, providing an overview of the financial distribution over the planning period. The project drivers encompass all water and wastewater-related projects, ensuring a comprehensive approach to addressing the system's needs. The total cost for the projects listed in Table 9-21 and Table 9-22 amounts to $398,730,000 in escalated dollars.

Table 9-22 provides a breakdown of the costs by project group, indicating how much money is being allocated to each group. This detailed breakdown helps in understanding the financial commitment required for each category of projects, ensuring that the necessary funds are allocated appropriately to meet the project's objectives.

Table 9-21: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Capacity	$2,746,000	$42,490,000	$538,000	$0	**$45,774,000**
Regulatory Compliance	$824,000	$1,603,000	$11,358,000	$670,000	**$14,455,000**

Table 9-21: Capital Improvement Program Summarized by Project Driver

Project Driver	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
System Reliability	$117,308,000	$107,705,000	$46,375,000	$67,113,000	**$338,501,000**
Total	**$120,878,000**	**$151,798,000**	**$58,271,000**	**$67,783,000**	**$398,730,000**

Table 9-22: Capital Improvement Program Summarized by Project Group

Project Group	Planning Period				Total (Escalated Cost)
	2024-2030	2030-2035	2035-2040	2040-2045	
Raw Water Supply	$2,438,000	$9,971,000	$1,556,000	$0	**$13,965,000**
Water Treatment	$4,370,000	$25,264,000	$10,043,000	$5,535,000	**$45,212,000**
DIW	$3,021,000	$42,714,000	$2,849,000	$10,038,000	**$58,622,000**
Water Distribution	$17,831,000	$25,186,000	$24,460,000	$29,309,000	**$96,786,000**
Wastewater Collection	$16,834,000	$17,389,000	$17,965,000	$18,145,000	**$70,333,000**
Wastewater Treatment	$62,980,000	$18,324,000	$1,398,000	$4,756,000	**$87,458,000**
General	$12,737,000	$12,950,000	$0	$0	**$25,687,000**
Utility Fleet	$667,000	$0	$0	$0	**$667,000**
Total	**$120,878,000**	**$151,798,000**	**$58,271,000**	**$67,783,000**	**$398,730,000**

9.7 20-Year CIP Project Cost Schedule

9.7.1 Introduction

The charts in this section provide a comprehensive summary of the 20-Year CIP Project Cost Schedule, outlining the financial framework for planned water and wastewater infrastructure projects over the next 20 years on an annual basis. The summaries are categorized into three main subsections: Water Improvement Projects, Wastewater Improvement Projects, and Combined Water and Wastewater Improvement Projects.

As described earlier, the annual cash flows for the suggested CIP were derived by escalating project costs to the mid-year of construction. Escalation factors for FY2025-FY2045 were calculated using Construction Cost Index (CCI) data from 2014-2024. The estimated cash flows, based on these assumptions and the suggested CIP timeframes, are detailed in the subsequent sections.

9.7.2 Water Improvement Projects

Figure 9-2 illustrates the 20-year CIP for water projects (Raw Water Supply, Water Treatment, Water Distribution) per FY based on the start years presented in section 9.4. In addition, 50% of the costs for Deep Injection Well and General CIPs were assigned to water projects, since those facilities are shared between the water and wastewater treatment plants.

9.7.3 Wastewater Improvement Projects

Figure 9-3 illustrates the 20-year CIP for wastewater projects (wastewater collections and wastewater treatment projects) per FY based on the start years presented in section 9.4. In addition, 50% of the costs for Deep Injection Well and General CIPs were assigned to wastewater projects, since those facilities are shared between the water and wastewater treatment plants.

9.7.4 Combined Water and Wastewater Improvement Projects

Figure 9-4 illustrates the 20-year CIP for both water and wastewater projects per FY based on the project start years presented in section 9.4.

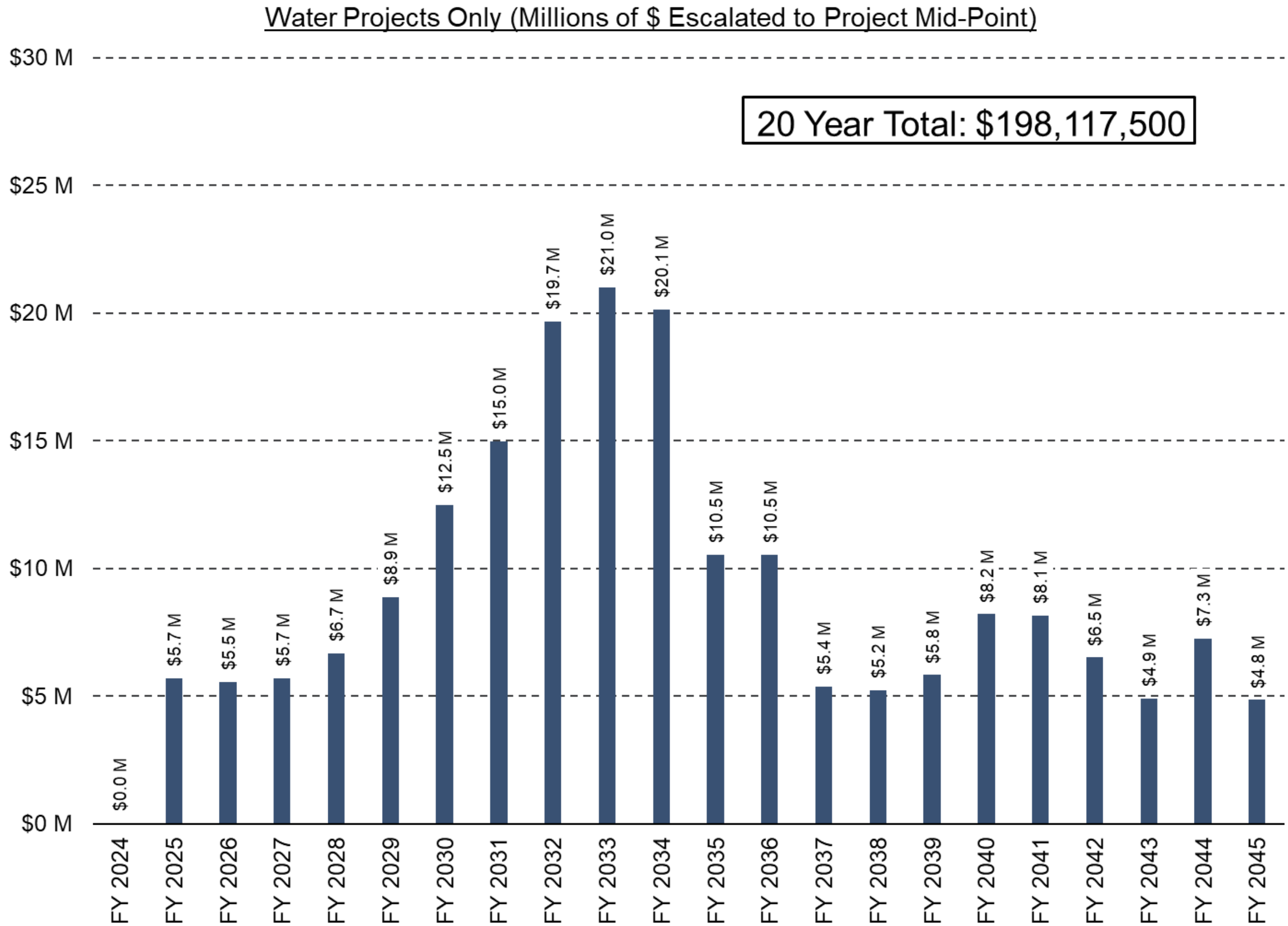


Figure 9-2: 20- Year CIP for Water Projects Only (Millions of $ Escalated to Project Mid-Point)

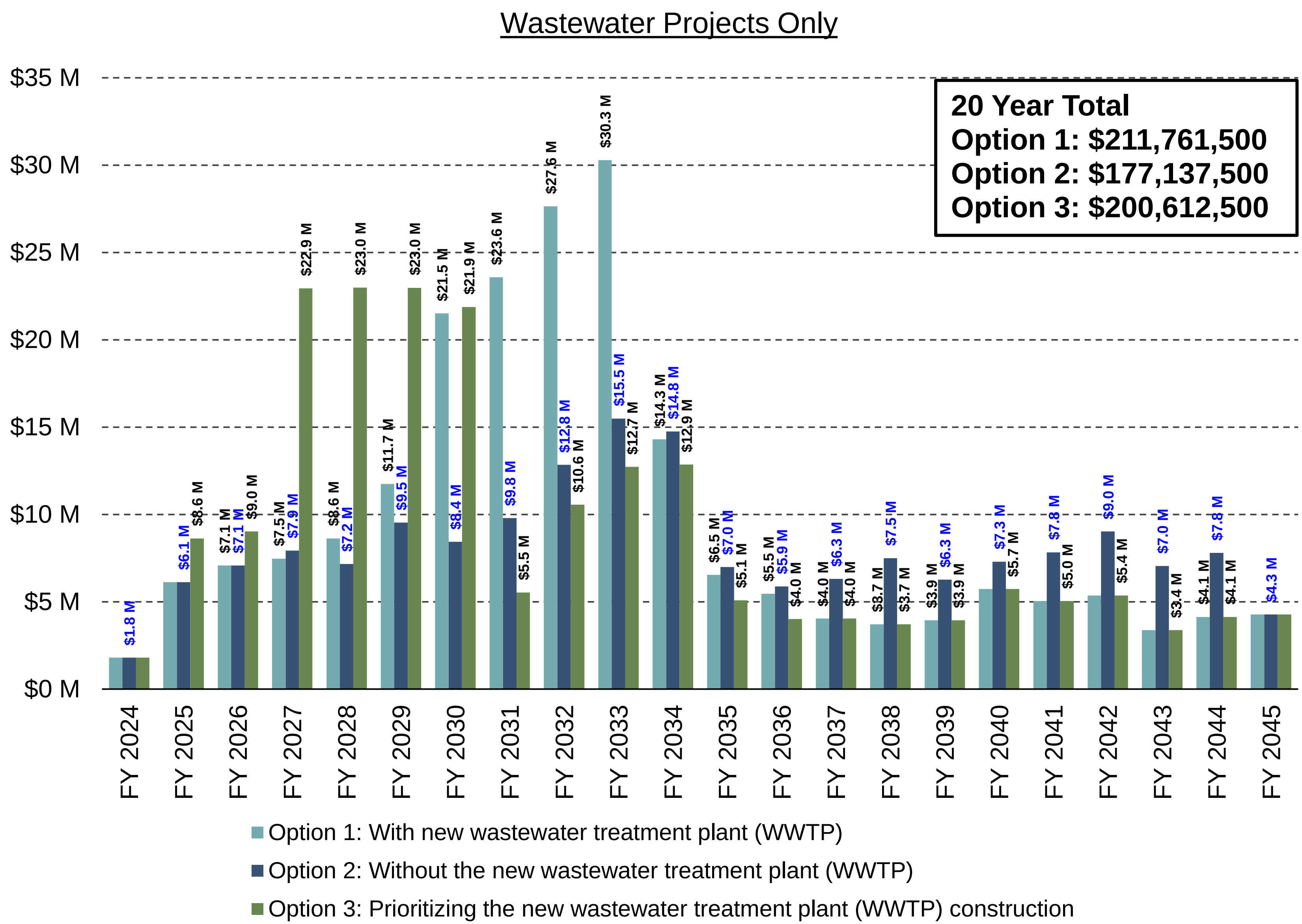


Figure 9-3: 20 Year CIP for Wastewater Projects Only (Millions of $ Escalated to Project Mid-Point)

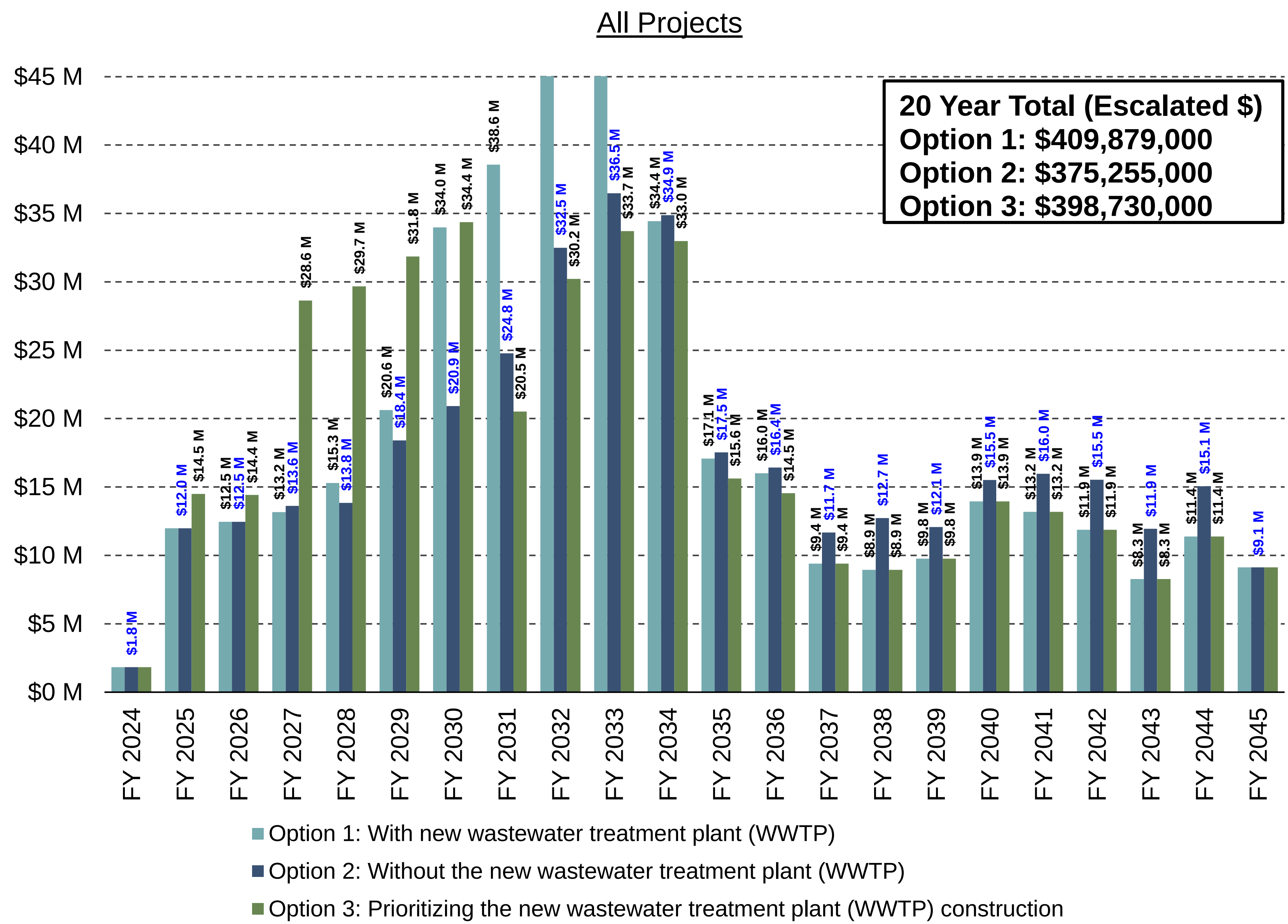
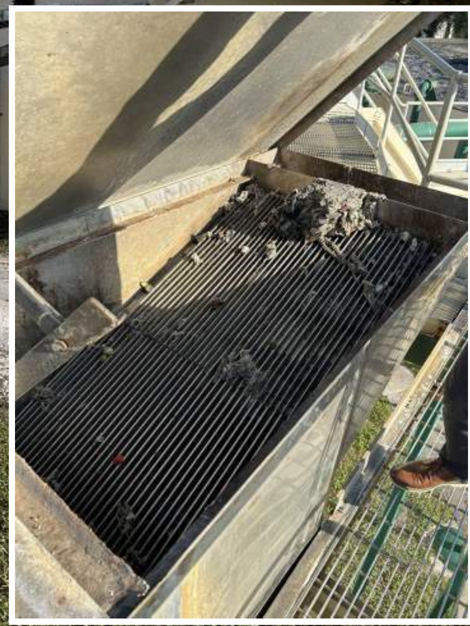


Figure 9-4: 20 Year CIP for All Projects (Millions of $ Escalated to Project Mid-Point

Appendix C: City of Cooper City Wastewater Treatment Facility Headworks Design Preliminary Design Report

CITY OF
Cooper City
Someplace Special

City of Cooper City
Wastewater Treatment Facility Headworks Design

Preliminary Design Report (Final)

April 2026

Hazen 75 YEARS

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List of Acronyms

Abbreviation	Definition
AADF	Annual Average Daily Flow
ATS	Automatic Transfer Switch
ACH	Air Exchanges per Hour
ATS	Automatic Transfer Switch
BCRED	Broward County Resilient Environment Department
BFE	Base Flood Elevation
BOD	Biological Oxygen Demand
CBOD	Carbonaceous Biochemical Oxygen Demand
cfm	Cubic Feet Per Minute
City	City of Cooper City
DIP	Ductile Iron Pipe
DRC	Design Review Committee
FBC	Florida Building Code
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FeS	Iron Sulfide
FIRM	Flood Insurance Rate Map
FPL	Florida Power & Light
fps	Feet per second
FRP	Fiberglass Reinforced Plastic
gpd	Gallons per day
H_2S	Hydrogen Sulfide
HSS	Hollow Structural Steel
I&C	Instrumentation and Control
ICM	Integrated Catchment Modeling
MCP	Main Control Panel

Abbreviation	Definition
MG	Million Gallons
mgd	Million Gallons per Day
MDF	Maximum Daily Flow
MM	Methyl Mercaptan
MOR	Monthly Operating Report
MSL	Mean Sea Level
MTMADF	Maximum Three Month Average Daily Flow
MTS	Manual Transfer Switch
NaOH	Sodium Hydroxide
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
O&M	Operation and Maintenance
OIU	Operator Interface Unit
OPCC	Opinion of Probable Construction Cost
OSHA	Occupational Safety and Health Administration
P&IDs	Process and Instrumentation Drawings
PDR	Preliminary Design Report
PHF	Peak Hour Flow
PLC	Program Logistic Controller
RSCs	Reduced Sulfur Compounds
SCADA	Supervisory Control and Data Acquisition
SDI	Steel Deck Institute
SES	Sand Equivalent Size
SFHA	Special Flood Hazard Area
SFWMD	South Florida Water Management District
SBDD	South Broward Drainage District
TMADF	Three-Month Average Daily Flow

Abbreviation	Definition
TSS	Total Suspended Solids
VCP	Vendor-supplied Control Panel
VOCs	Volatile Organic Compounds
WSE	Water Surface Elevation
WWTP	Wastewater Treatment Plant

Executive Summary

The City of Cooper City (City) owns and operates the Cooper City Wastewater Treatment Plant (WWTP), a conventional activated sludge facility permitted for a three-month average daily flow (TMADF) of 4.27 million gallons per day (mgd). The WWTP includes a surge tank, transfer pump station, three package plant units, two equalization lagoons, and an injection well for effluent disposal. Currently, the facility lacks a dedicated headworks system; coarse screening is performed manually using manual bar screens located before the surge tank and each package plant. Captured screenings are manually collected multiple times a day and disposed of in a trash can, which City personnel empties into on-site dumpsters for landfill disposal. This is a major, labor-intensive process that is inefficient and does not align with best practices for a WWTP of this size.

To enhance preliminary treatment capabilities, the City plans to construct a new headworks facility incorporating screening and grit removal systems. As outlined in the 2024 Master Plan, implementation will occur in two phases, beginning with the screening system design under the current contract, Phase I. Phase II will include implementation of a grit removal system. Hazen and Sawyer (Hazen) has been retained to design the screening facility as part of Phase I, and this Preliminary Design Report (PDR) includes design criteria for the screening, grit removal, and odor control systems. Although the design of the grit removal system is not included in Phase I, the headworks structure is being designed to accommodate both systems. The grit removal equipment will be installed in a future project.

A siting analysis was performed to determine the optimal location for the headworks facility. Two potential sites were assessed. In Alternative 1, the headworks facility is located adjacent to the south side of the property, across the street from public baseball fields. In Alternative 2, the facility is located closer to residential properties. Alternative 1 is identified as the preferred location for the headworks facility.

The new headworks facility will be designed to accommodate the WWTP's permitted treatment capacity of 4.27 mgd TMADF. Proposed design flows and associated peaking factors were developed based on a detailed analysis of influent flow data collected between 2022 and 2024. These values are summarized in **Table E-1**.

Table E-1: Design Flow Rates and Peaking Factors

Flow Criteria	Design Flow at Rated Capacity (mgd)	Design Peaking Factor1
Minimum Day	1.7	0.50
Annual Average Daily Flow (AADF)	3.3	1.00
TMADF	4.27	1.29
Maximum 30-Day	4.9	1.47
Maximum 7-Day	7.2	2.19
Maximum Daily Flow (MDF)	9.0	2.72
Peak Hour Flow (PHF)	12.1	3.67

[1] Based on the AADF.

A hydraulic analysis was conducted using a HazenPro hydraulic model to assess three headworks configurations: (1) a combined screening and grit facility with future stacked tray grit installation, (2) a combined facility with a bypass channel for grit removal, and (3) a screening-only facility with provisions for future grit removal. Two models for each configuration were developed – one with a 20-inch ductile iron (DIP) force main and the other with a 24-inch DIP force main. The resulting WSE during PHF conditions for each proposed headworks configuration is included in **Table E-2**.

Table E-2: Required Upstream WSE at Headworks

Configuration No.	Required WSE During PHF Condition with 24” DIP FM (feet NAVD 88)	Required WSE During PHF Condition with 20” DIP FM (feet NAVD 88)
1	35.6	38.2
2	32.8	35.4
3	32.6	35.3

Pressure data collected from the upstream collection system indicated an available system head of approximately 28.2 feet (NAVD 88). As summarized in Table E-2, all three headworks configurations require higher water surface elevations (WSE) during peak hour flow (PHF). During the Draft PDR Workshop held on January 8, 2026, the City confirmed that the upstream collection system should be able to meet the new pressure requirements for the Headworks facility and that construction of a booster pump station at the WWTP is not anticipated to be required.

As design has progressed, the HazenPro hydraulic model for the selected Headworks configuration has been updated. The required WSE at the point of connection to the existing 16-inch influent forcemain are summarized in **Table E-3**.

Table E-3: Required Upstream WSE at Connection to Existing 16-inch Influent Force Main

Flow Condition	**Flow Rate (mgd)**	**Required WSE During (feet NAVD 88)**
Minimum Day	1.7	33.1
AADF	3.3	33.5
TMADF	4.27	33.8
PHF	12.1	36.8

A comprehensive evaluation of screening and grit removal technologies was conducted to identify the most suitable solutions for the new headworks facility. Screening options considered included perforated plate screens, center flow band screens, and continuous belt mechanically cleaned bar screens. For grit removal, the evaluation focused on stacked multi-tray systems and stirred vortex systems. Based on technical performance, site-specific considerations, and operator feedback gathered during site visits, the City selected center flow band screens and stacked tray grit removal systems as the preferred technologies. The City will sole source Hydro-Dyne Center Flow Band Screens based on positive operator feedback and the fact that Hydro-Dyne has the most installations of center flow band screens for wastewater treatment in Florida. The City will also sole source the Hydro International HeadCell® Grit Removal System based on efficient capture rates, positive operator feedback, and the limited number of manufacturers of these systems.

The proposed screening facility will include three screening channels: two equipped with fine mechanical center-flow band screens and one designated for emergency bypass, featuring a manual bar screen. Each center-flow band screen will be sized to handle 100% of the PHF. The center flow band screens will be specified with a minimum perforation size of 4 mm. The headworks structure will include one influent grit channel for future use, and a dedicated bypass channel to bypass the future grit removal system.

An evaluation of odor control technologies was conducted, considering options such as ferric/ferrous sulfate dosing systems, chemical scrubbers, biological oxidation systems (including biofilters and biotowers), and dry media adsorption using activated carbon. The City's selected a biotower system for odor control. The ferric/ferrous sulfate dosing system, currently dosed within the surge tank, will be maintained. However, the chemical injection point will be relocated to the 30-inch influent force main upstream of the Headworks.

1. Introduction

1.1 Background

The City owns and operates the Cooper City WWTP located at 11791 SW 49th Street, Cooper City, FL 33330. The WWTP comprises three package treatment plants constructed between the mid-1970s and mid-1990s and is currently permitted for 4.27 mgd TMADF under Florida Department of Environmental Protection (FDEP) Permit No. FL0040398-015-DW1.

The WWTP was constructed without a dedicated headworks facility. The City has retained Hazen to design a new headworks facility, generally consisting of influent flow monitoring, mechanical fine screening equipment, an odor control system, and provisions for a future grit removal system. The design will also evaluate the need for a booster pump station upstream of the headworks.

1.2 Project Scope and Objectives

The objective of the PDR is to establish design criteria for the new headworks facility. The facility will include a mechanical screening system and an odor control system, with provisions for a future grit removal system. The PDR includes a review and evaluation of the following technologies under consideration for the proposed headworks and documents the technologies selected by the City:

1. **Screening Technologies**
   - Perforated plate screens
   - Center flow band screens
   - Step screens
   - Continuous belt screens
2. **Grit Removal Technologies**
   - Vortex grit collectors
   - Stacked multi-tray grit removal systems
3. **Odor Control Technologies**
   - Ferric/Ferrous Sulfate Liquid Phase Dosing System
   - Chemical scrubbers
   - Biological oxidation
   - Dry media adsorption.

The selected equipment will then be incorporated into a hydraulic analysis of the WWTP's hydraulic profile, which will determine whether a booster pump station is necessary to accommodate additional headloss through the system. Hazen will develop design documents, obtain permits, and prepare bid documents for construction. In addition, the PDR will document key decisions made throughout the development process.

2. Existing Facilities

The WWTP receives raw influent through a 16-inch force main, which is continuously monitored by a magnetic flow meter. The influent is conveyed to a surge tank with a maximum capacity of approximately 300,000 gallons. Large debris is removed from the raw influent before it enters the surge tank via a coarse manual bar screen with ¾-inch openings. **Figure 2-1** illustrates the existing bar screen located on top of the surge tank. Captured screenings are manually collected multiple times a day and disposed of in a trash can, which City personnel empties into on-site dumpsters for landfill disposal. This is a major, labor-intensive process that is inefficient and does not align with best practices for a WWTP of this size. A ferric/ferrous sulfate solution is dosed into the surge tank for odor control, as described in **Section 2.1**.

Figure 2-1: Existing Coarse Screen

Three package plants located downstream of the surge tank provide biological treatment. Influent is transferred to the package plants via the influent transfer pump station. A bypass is available to transfer influent directly to the package plants using the pressure available in the influent force main when the surge tank is out of service. Each package plant influent line is equipped with a magnetic flow meter for continuous flow monitoring.

The package plants were each originally designed with a capacity of 1.42 mgd maximum three-month average daily flow (MTMADF). Each package plant includes a second manual coarse bar screen with ½-inch spacing, an activated sludge basin capable of operating in extended aeration and contact stabilization mods, a secondary clarifier, and a chlorine contact tank. Similar to the screenings collected at the surge tank, screenings captured at the second manual coarse bar screens are also manually removed and disposed of in on-site dumpsters by City personnel.

Under normal operating conditions, the surge tanks and all three package plants are in service, with flow distributed among the plants. Effluent from the package plants is routed to the East Lagoon for equalization prior to discharging into either the City of Hollywood WWTP's effluent disposal pump station for filtration to reclaimed water quality or for disposal to the City's on-site deep injection well.

A schematic of the wastewater process flow at the WWTP is included in **Figure 2-2**, and a labeled aerial view of the WWTP is included in **Figure 2-3**.

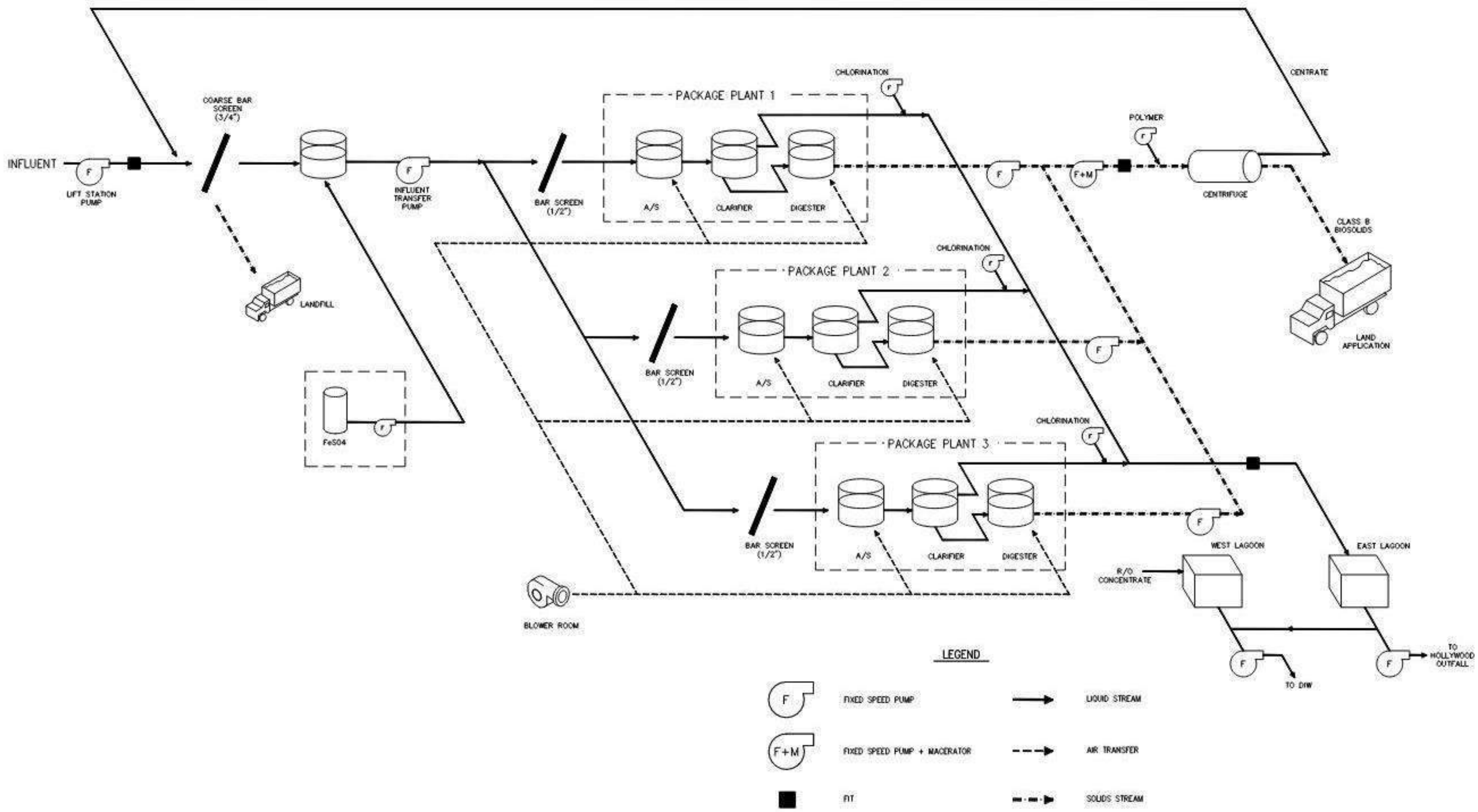


Figure 2-2: Existing WWTP Process Flow Diagram

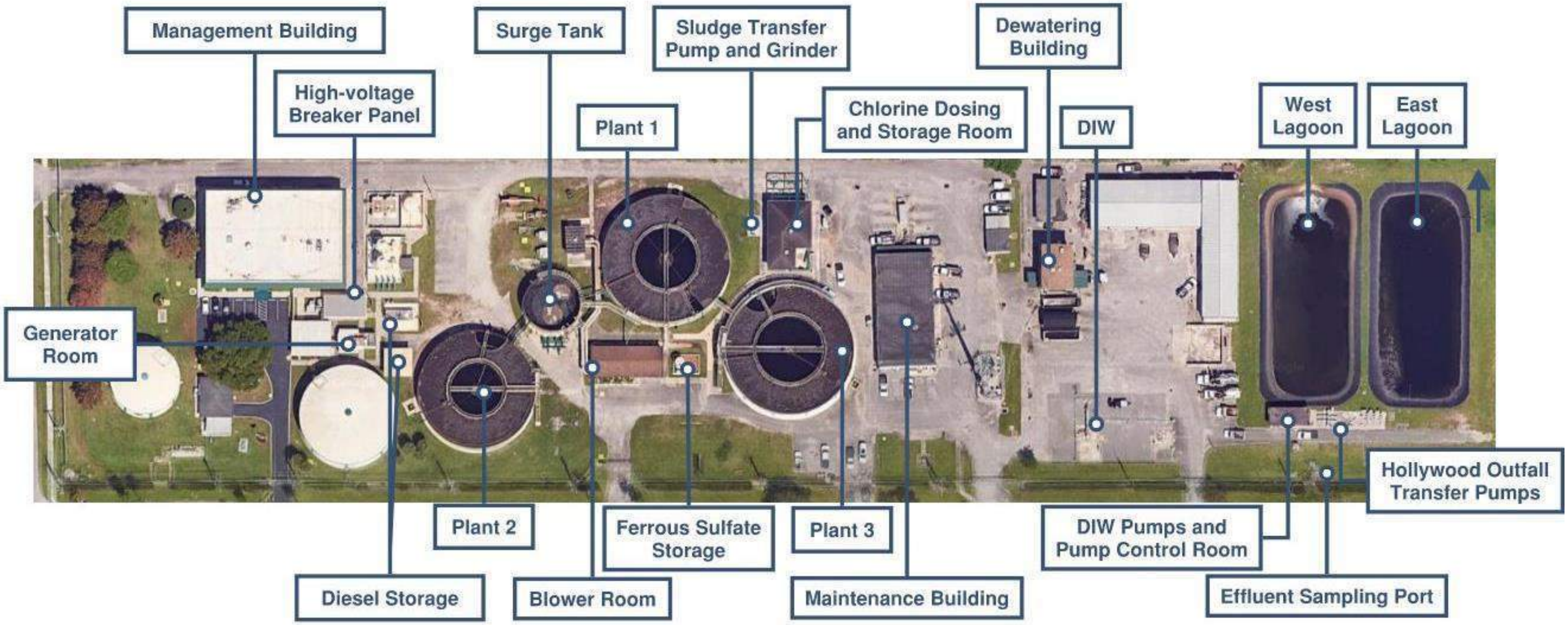


Figure 2-3: Existing WWTP Site Aerial

2.1 Existing Odor Control System

The WWTP currently utilizes a ferric/ferrous sulfate dosing system for odor control, with injection occurring at the surge tank. As shown in **Figure 2-4**, the system includes two chemical metering pumps controlled based on influent flow. Each pump operates at two speed settings depending on demand. The location of the feed system, labeled “Ferrous Sulfate Storage,” is shown in Figure 2-3.

Figure 2-4: Existing Ferric/Ferrous Sulfate Dosing System

While the WWTP has a long history of ferrous sulfate dosing, the City has outsourced both the supply and maintenance of the system to Kemira. Kemira provides their proprietary ferric/ferrous sulfate solution, Odo-Free, and manages its dosing, which is currently approximately 72 gallons per day.

3. Design Criteria

3.1 Design Flows

A flow evaluation was performed to establish the design flow criteria for the proposed headworks facility. The following flow data, representing a three-year historical period (2022–2024), were compiled for evaluation:

- 15-minute interval SCADA data from the WWTP's influent meter
- 15-minute interval SCADA data from the three package plant influent meters
- Monthly Operating Reports (MORs)

Based on the flow analysis, the SCADA data from the influent meter were determined to most accurately reflect the anticipated plant flows and provided the more conservative conditions. The dataset was reviewed and cleaned to remove any extraneous or erroneous data points prior to use in the flow analysis. A summary of the historical 2022–2024 flow data and associated peaking factors is presented in **Table 3-1**.

Table 3-1: Historical Flow Data Analysis Summary (2022-2024)

Flow Criteria	Historical Flow (mgd)[1]	Historical Peaking Factor[2]
Minimum Day	1.06	0.47
AADF	2.27	1.00
TMADF	3.34	1.29
Maximum 30-Day	2.92	1.47
Maximum 7-Day	4.97	2.19
Maximum Daily Flow	6.18	2.72
Peak Hour Flow	8.32	3.67

[1] Based on SCADA data from the WWTP's Influent Meter
2 Based on the AADF

The TMADF for the analyzed period was 3.34 mgd, indicating that the plant has been operating at approximately 78% of its permitted TMADF capacity of 4.27 mgd. Wastewater flow projections through 2045 were evaluated in the 2024 Water and Wastewater Master Plan Update, which concluded that the WWTP's permitted capacity exceeds the projected flows for that period. For a conservative design, the permitted TMADF will be used to develop design flows.

Although the WWTP remains under its permitted capacity, it experienced significant peak flows, with the PHF and associated peaking factor recorded as 8.32 mgd and 3.67 mgd, respectively. The PHF occurred on July 12, 2024, following a tropical disturbance that moved across the Florida peninsula on that same day. Several days of heavy rainfall during this event caused major flash flooding in parts of South Florida, primarily in northern Miami-Dade and southern Broward counties, where 2-day rainfall totals of 15 to 20 inches were observed.

Consequently, the historical peaking factors shown in Table 3-1 are considered to accurately reflect realistic plant flow behavior during extreme events and will also be used to develop design flows for the proposed headworks. The design flow rates, calculated using the historical peaking factors and the permitted TMADF of 4.27 mgd, are summarized in **Table 3-2**.

Table 3-2: Design Flowrates and Peaking Factors

Flow Criteria	Design Flow at Rated Capacity (mgd)	Design Peaking Factor
Minimum Day	1.7	0.50
AADF	3.3	1.00
TMADF	4.27	1.29
Maximum 30-Day	4.9	1.47
Maximum 7-Day	7.2	2.19
Maximum Daily Flow	9.0	2.72
Peak Hour Flow	12.1	3.67

3.2 Hydraulic Evaluation

Using a HazenPro model, preliminary hydraulic profile calculations were developed for three headworks configurations. These configurations are as follows:

1. **Combined Screening and Grit Facility (Grit Installation)** – A common structure with screening equipment and a stacked tray grit removal system.
2. **Combined Screening and Grit Facility (Bypass of the Grit Removal System)** – Utilizes the screening equipment and a dedicated grit bypass channel, with provisions for future installation of a stacked tray grit removal system.
3. **Screening-Only Facility** – A facility with screening equipment only, designed to accommodate grit removal as a separate structure to be implemented in a future phase.

The evaluated configurations are summarized in **Table 3-3**.

Table 3-3: Headworks Configurations

Configuration No.	Screening Equipment[1]	Grit Removal Equipment[2]	Headworks Location[3]
1	Center Flow Band Screen	Stacked Tray Grit (Future)	Location 1
2	Center Flow Band Screen	Stacked Tray Grit (Bypass) Bypass Channel	Location 1
3	Center Flow Band Screen	None	Location 1

[1]Refer to Section 4 for the screening technology assessment.
[2]Refer to Section 5 for the grit removal technology assessment.
[3]Refer to Section 7.2 for the proposed Headworks location analysis and results.

3.2.1 Hydraulic Evaluation Results

Pressure data for the upstream collection system were recorded between April 14 and April 18, 2025, using a pressure gauge installed by the City on the surge tank influent pipe. The gauge recorded multiple readings each day, with observed pressures ranging from 6 to 7 psi. Given the approximate elevation of the pressure gauge and the observed pressure readings, the available system head in the collection system was calculated to be approximately 28.2 feet (NAVD 88). A photo of the pressure gauge, and the elevations used to determine the available system head, are depicted in **Figure 3-1**.

Figure 3-1: Available System Head – Pressure Guage Location and Elevations

To determine whether the proposed headworks can be incorporated into the existing WWTP hydraulic profile without adjustments to the upstream pumping stations or if the addition of a booster pump station is required, the modeled maximum water surface elevation (WSE) for each headworks configuration was compared to the maximum observed pressure in the collection system.

The resulting WSE during PHF conditions for each proposed headworks configuration is included in **Table 3-4**.

Table 3-4: Required Upstream WSE for the Proposed Headworks Configurations

Configuration No.	Screening Equipment	Grit Removal Equipment	Required WSE During PHF Condition (feet NAVD 88)[1]
1	Center Flow Band Screen	Stacked Tray Grit (Future)	35.6
2	Center Flow Band Screen	Stacked Tray Grit (Bypass) Bypass Channel	32.8
3	Center Flow Band Screen	None	32.6

[1]Based on a 24-inch force main upstream and downstream of the headworks facility.

Given the observed system pressure of 28.2 feet (NAVD 88), all three proposed headworks configurations will likely require a booster pump station to meet the head required during PHF conditions. Hazen recommended that the City perform further evaluation of the existing collection system to determine whether the system can provide the additional head required or if a booster pump station is required.

3.2.2 Update to Upstream Collection System Hydraulic Evaluation

The results of the initial analysis were presented to the City on January 8, 2026, during the Draft PDR Review Workshop. During this meeting, the City confirmed that many lift station pumps within the City's collection and transmission system have been replaced with higher-horsepower units in recent years and currently operate at pressures ranging from approximately 27 to 46 psi. The City also noted that some older lift stations remain in service, with phased upgrades planned to increase pump sizes (from 7.5-hp to 10-hp units). Based on these system conditions, the City indicated that most lift stations are expected to be capable of accommodating the additional head associated with the proposed Headworks. The City further noted that an existing offsite booster pump station, which is currently offline, is available for use if necessary. Based on these considerations, the City confirmed that the upstream collection system should be able to meet the new pressure requirements for the Headworks facility and that construction of a booster pump station at the WWTP is not anticipated to be required.

As the design has progressed, the HazenPro hydraulic model for the selected Headworks configuration has been updated. The HazenPro model calculations are included in **Appendix A**. Using the preliminary drawings included in **Appendix B**, the required upstream WSEs at the point of connection to the existing 16-inch influent force main, are summarized in **Table 3-6**. A hydraulic profile for the Headworks facility is included in Appendix B.

As noted previously, the WSEs presented in Table 3-6 are not representative of the full upstream collection system or the existing 16-inch influent force main segment entering the WWTP. Therefore, it is recommended that the City perform a detailed evaluation of the existing collection system to confirm its ability to provide the additional head required at the point of connection between the existing 16-inch influent force main and the proposed Headworks facility.

Table 3-6: Required Upstream WSE at Connection to Existing 16-inch Influent Force Main

Flow Condition	Flow Rate (mgd)	Required WSE During (feet NAVD 88)
Minimum Day	1.7	33.1
AADF	3.3	33.5
TMADF	4.27	33.8
PHF	12.1	36.8

3.3 Process Description

Raw sewage will continue to enter the WWTP through the existing 16-inch DIP force main; however, prior to reaching the surge tank, the flow will be diverted to the proposed headworks facility through a new 24-inch DIP force main connection. An inline magnetic flow meter located upstream of the proposed headworks will quantify the influent flow.

The proposed headworks will include three screening channels: two fitted with fine center flow band screens and one with a manual bar screen. Flow will enter an influent distribution box, which will direct the flow to the mechanical fine screen channels under normal operation, while the manual bar screen channel will remain available for emergency bypass scenarios. Each channel will be equipped with gates, allowing for isolation of the bypass channel under normal operating conditions. Debris from both mechanical screens will be sluiced to an integral screening washer/compactor, which will empty into a common dumpster downstairs for disposal to landfill.

After screening, the combined screened flow will be conveyed to one of two grit removal process channels; one serving as the influent channel to the grit concentrator unit and one serving as a bypass of the entire grit removal process. Each channel will be equipped with isolation gates. In the future, grit collected from the bottom of the grit concentrator will be pumped to a grit washing and dewatering unit. The cleaned grit will then be conveyed to a dumpster and sent to a landfill for disposal. Both grit channels will discharge to a common effluent splitter box, where influent will flow by gravity back into a new 30-inch main and subsequently the existing 16-inch DIP force main serving the surge tank and/or package treatment units.

A process flow diagram and preliminary drawings depicting the proposed headworks are included in **Appendix B**. A hydraulic profile is also included in Appendix B.

4. Screening System Design

The first step of preliminary treatment system is the screening process, which is comprised of screenings capture, screening conveyance, and typically includes the compaction and washing of screenings. Screens capture debris such as trash, plastics, paper, rags, hair, scum/floatables, tree leaves, and rocks. Effective screenings capture protects downstream equipment such as pumps, valves, and aeration diffusers.

Screening removal is typically accomplished by automated mechanically cleaned screens made of either perforated plates or vertically slotted bars. In general, there are three classifications of screens:

1. Coarse screens which have larger openings (1/4-inch and above)
2. Fine screens have smaller opening sizes (from 2 mm up to 6 mm)
3. Extremely fine screens have the smallest opening sizes (less than 2 mm) and are typically used to protect advanced water treatment applications, such as membrane bioreactors

Fine screens are proposed for the WWTP as these screens are effective in protecting conventional treatment systems. Coarse screens would be recommended when solids 3-inches in diameter and larger are present. It is noted that solids over 3-inches in diameter are not common in municipal collection systems where 100% of the influent flow is pumped.

4.1 Technology Assessment

An overview of available screening technologies, design considerations, and advantages and disadvantages of each was presented to the City during the Screenings, Grit Removal and Odor Control Technologies Workshop (Workshop No. 1) on May 28, 2025. The screening technologies presented included the following:

1. Perforated plate screens
2. Center flow band screens
3. Step screens
4. Continuous belt mechanically cleaned bar screens

A radar chart for each of the fine screen technologies was presented during Workshop No. 1 to visually depict the strengths and weaknesses of each alternative as they relate to the following parameters: footprint, headroom, operation and maintenance considerations, capture rate, competition, experience, capital cost, and capacity. At the request of the City, an additional parameter for headloss was added for each screen type. Each of the parameters was rated on a scale from 1 to 5, with 5 being the best and 1 being the worst. A copy of the Workshop No. 1 presentation is included in **Appendix C.** Each of the screening technologies are detailed in the following subsections.

4.1.1 Perforated Plate Screens

Perforated plate screens provide higher screenings capture rates than other screen types due to having less open area across the screen surface. However, perforated plate screens typically require higher hydraulic energy and frequently incorporate a rotating brush and spray header to remove screenings into a discharge chute. Carryover is possible if the brush and spray header are not effective at removing all screenings. Trapping of grease between ascending and descending panels is not considered an issue, as the rear screen frame is provided with flow relief openings. Access to the interior space between ascending and descending panels is provided through side panels on the screen frame. It is noted that the hardware mounting the perforated plate panels to the support chain must be accessed through these panels, making long term maintenance somewhat cumbersome. **Figure 4-1** shows the Huber Technology Belt Screen EscaMax® which is illustrates the typical configuration of a perforated plate screen.

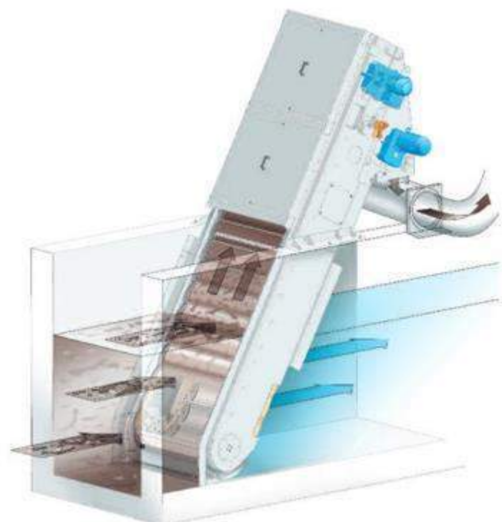


Figure 4-1: Perforated Plate Screen (courtesy of Huber Technology)

4.1.2 Center Flow Band Screens

Center flow band screens are a relatively newer technology in the United States and are currently a leading-edge technology in terms of providing superior screenings removal without excessive headloss. Center flow band screens have been successfully operating in Europe for over 20 years, and in the U.S. for over 18 years. Center flow band screens minimize carryover of material. Appropriate channel velocities can be maintained without a dramatic increase in headloss through the screens. A motorized gate, or passive overflow port, can be added to the center flow band screens to allow for screen bypass within the screen channel. Allowing for some bypass in the screen channels can reduce the required size of a bypass channel. Spray water or deluge systems are incorporated into the center flow band screens to facilitate screenings removal from the screen and into an internal launder trough to be directed to a screenings compactor or equipped with an integral washer/compactor to save space. **Figure 4-2** shows an illustration of a typical center flow band screen.

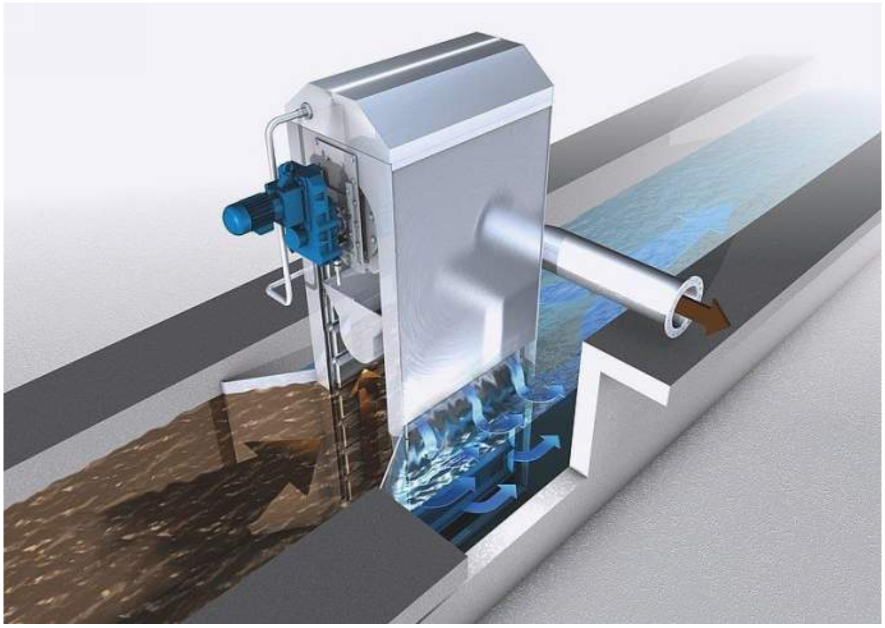


Figure 4-2: Center Flow Band Screen (courtesy of Huber Technology)

4.1.3 Step Screens

Step screens provide simple operation as well as lower maintenance requirements, hydraulic energy loss, and equipment cost compared with other screen types. Screening disposal is provided by a simple gravity discharge of screenings into a discharge chute. Step screens have low screenings capture rates when compared to other screen types due to a greater open area across the screen surface. Screenings amass on the steps and form a layer. Rotation of the movable steps lift the screenings "carpet," or "mat," and transport the mass to the next step. The screenings mat is a configuration of pores, which retain smaller particles than the slot width would typically catch. Step screens operate by lifting screenings step by step from the bottom of the channel. **Figure 4-3** shows an illustration of a typical step screen.

Figure 4-3: Step Screen (courtesy of Huber Technology)

4.1.4 Continuous Belt Mechanically Cleaned Bar Screens

Continuous belt mechanically cleaned bar screens incorporate a continuous self-cleaning screening belt that removes fine and coarse solids. The screening media consists of a unique filter element system, formed by interwoven screening elements mounted on a stainless-steel shaft. The screening elements include "teeth" which provide additional lifting capacity of screenings.

Continuous belt screens have no submerged sprockets; all sprockets are located above the channel. These screens require medium-to-low headroom and feature a pivoting design that allows the unit to be serviced from above the channel. However, these screens have many moving components, including brushes for removal, which are subject to wear and tear and critical to maintain good screenings removal. If the equipment is not properly maintained, carryover is possible when solids do not release and are conveyed to the downstream process. A photo of a Parkson Aqua Guard® screen is provided in **Figure 4-4**. Continuous belt screens typically require wash water to enhance screenings removal and maintain high capture efficiency; however, screen models that rely solely on mechanical brush cleaning without the use of spray water are also available.

Figure 4-4: Continuous Belt Screen (courtesy of Parkson Corporation)

4.1.5 Screening Technology Advantages and Disadvantages

In general, each screen technology has advantages and disadvantages. **Table 4-1** summarizes the advantages and disadvantages of each screening technology.

Table 4-1: Summary of Screening Technologies

Technology	Advantages	Disadvantages
Perforated Plate Screen	• Handles large leaf and debris quantities • Two-dimensional screen better captures hair and fibers • Lower head space requirements dimensionally • Relatively simple to enclose • Simple mechanism with no drive parts below the water level	• Higher head loss than bar screens • Restriction on channel width and height • Can be damaged by large heavy debris, upstream trash rack may be needed • Requires automatic wash water and cleaning brush • Prone to hair pinning • Higher potential for screenings roll-back, requiring manual removal
Center Flow Band Screens	• Low screening carryover • Well suited for expanding capacity without increasing channel size • Small screen openings of 2-12 mm • Highest solids capture ratio • Vertical configuration means screens require smaller footprint • Lower headspace requirements • Relatively simple to enclose • Simple mechanism with no drive parts below the water level	• May need coarse screens upstream for protection depending on whether the plant influent is pumped or not • Large solids can build up at base of screen; occasional entry into the channel may be required if debris cannot be removed through top access hatches • Higher potential for screenings roll-back, requiring manual removal • Prone to hair pinning
Step Screen	• Screening mat increases removal efficiency compared to other 6 mm bar screens • Screen better captures hair and fibers • No wash water or brushes required • Allows a pivot design for servicing units above the channel	• Stringy solids can pass through the screen • Not recommended when rocks or excessive grit loads are expected • Requires considerable footprint for installation compared to others • Higher headloss than other bar screens with a bar screen upstream of the fine screens • Can wear thin members by grit for some units
Continuous Belt Screens	• Higher capture rates possible with finer screens • No submerged sprockets • Medium to low headroom required • Allows a pivot design for servicing the unit above the channel	• Components subject to wear and tear or breakage, impacting removal performance • Prone to screenings carryover if debris is not properly removed from the screen • Often includes a submerged brush at the channel invert

A qualitative comparison of the four fine screening technologies was conducted based on available literature, industry knowledge and manufacturer provided data.

Table 4-2 provides a ranking of the fine screen technologies with respect to the following parameters: footprint, headroom, operation and maintenance considerations, capture rate, competition, experience, capital cost, capacity, and headloss. The ranking methodology was initially presented during Workshop No. 1 and subsequently refined based on further evaluation of the technologies. Each of the parameters is ranked on a scale of 1 to 5, with 5 being the best and 1 being the worst.

Table 4-2: Screening Technology Comparison (Unweighted)

Parameter	Technology			
	Perforated Plate Screens	Center Flow Band Screens	Step Screens	Continuous Belt Screens
Footprint	3	3	3	3
Headroom	4	4	5	3
O&M	4	4	2	2
Capture Rate	4	5	3	3
Competition	5	4	3	2
Experience	4	4	3	5
Capital Cost	3	3	3	3
Capacity	3	3	3	2
Headloss	3	5	3	3
Total (Unweighted)	**33**	**35**	**28**	**26**

A weighted comparison of the same parameters is provided in **Table 4-3**.

Table 4-3: Screening Technology Comparison (Weighted)

Parameter	Weight	Technology			
		Perforated Plate Screens	Center Flow Band Screens	Step Screens	Continuous Belt Screens
Footprint	4%	3	3	3	3
Headroom	4%	4	4	5	3
O&M	25%	4	4	2	2
Capture Rate	30%	4	5	3	3
Competition	5%	5	4	3	2
Experience	3%	4	4	3	5
Capital Cost	15%	3	3	3	3
Capacity	4%	3	3	3	2
Headloss	10%	3	5	3	3
Total (Weighted)		**3.72**	**4.17**	**2.83**	**2.72**

4.2 Screening System Selection and Recommendations

4.2.1 Screen Selection and Sizing

Following Workshop No. 1, the City conducted multiple site visits and telephone conferences with nearby utilities to observe the screening technologies discussed and gather operator feedback. Based on the insights gained during these visits and the information presented during Workshop No. 1, the City decided to implement center flow band screens for the new headworks facility.

Center flow band screens used in wastewater treatment facilities are manufactured by Huber, Hydro-Dyne Engineering and Ovivo (Brackett Green). Among these, Hydro-Dyne has the most installations of center flow band screens for wastewater treatment in Florida. Hydro-Dyne manufactures all screening equipment in Clearwater, Florida while competing manufacturers manufacture screening equipment outside of Florida. Based on positive operator feedback and these factors, the City is considering sole-sourcing Hydro-Dyne as the center flow band screen manufacturer for this project.

Preliminary drawings depicting the proposed headworks layout and screening equipment are provided in **Appendix B**. The preliminary list of technical specifications are included in **Appendix C**.

4.2.1.1 Screen Opening Size

Fine screens with 6mm openings were initially recommended during Workshop No. 1. However, feedback obtained during site visits suggested that finer screens with 3mm openings would offer improved performance. The City currently doses ferrous sulfate upstream of the surge tank. If this dosing point were to be relocated upstream of the new headworks, precipitation of iron compounds could potentially clog finer screen openings, leading to increased headloss. Therefore, it is recommended that the center flow band screens be specified with a minimum perforation size of 4 mm to mitigate this risk, as relocating the ferric sulfate dosing point upstream of the headworks is likely. A manual bar screen with 6mm spacing is recommended for the dedicated bypass channel.

4.2.2 Reliability and Redundancy

It is recommended that the headworks facility include two channels equipped with center flow band screens and a third bypass channel with a manual bar screen to maintain Class I reliability. The City evaluated the two following design options:

- **Option 1**: Two center flow band screens, each designed to handle 100% of the PHF, with a third bypass channel designed for 100% PHF.
- **Option 2**: Two center flow band screens, each designed to handle, with a third bypass channel designed for 100% PHF.

Based on preliminary pricing information provided by Hydro-Dyne, the cost differential between the equipment identified in Option 1 and Option 2 above is approximately $35,000 per screen. During the Draft PDR Review Workshop held on January 8, 2026, the City selected to proceed with Option 1.

Additional reliability and redundancy criteria include:

- Provide isolation so each unit can be taken off-line independently.
- Provide passive overflow capability.

4.2.3 Captured Screenings for Disposal

Both screens will be provided with an integral washer/compactor that will discharge into the dumpster located on the first floor in an enclosed room provided with odor control. Integral washer/compactor units typically consist of a screw auger followed by a compression friction tube.

The washer/compactor will wash the captured screenings to return organic material to the flow stream using non-potable water, then compact the captured screenings to reduce volume and remove excess water. The washed and compacted materials sent to the dumpster will have minimal water content limiting standing water in the dumpster and should help reduce odor emissions and vector attracters as compared to unwashed material. It will also reduce the volume and weight of disposed screenings, reducing hauling frequency and cost. **Table 4-4** lists the design criteria for the screenings conditioning equipment.

Table 4-4: Screenings Conditioning

	Parameter	Design Criteria
Screenings	Quantity (assumed)* Volume Collected @ AADF (uncompacted) Production @ AADF (compacted between 20% - 70%) Volume Collected @ PHF (uncompacted) Production @ PHF (compacted between 20% - 70%)	11.0 CF/MG 1.5 CF/hr 0.4 – 1.1 CF/hr 5.5 CF/hr 1.5 – 3.9 CF/hr
Conveyance	Type Quantity	Sluice One per Screen
Washer / Compactor	Quantity Type Capacity	1 Integral Compactor per Screen Screw 5.5 CF/hr
Storage Containers	Quantity Capacity, each Available Storage per Container	2 6 CY Between 2 and 7+ days

5. Grit Removal Design

Grit is generally classified as entrained and suspended inorganic solids, such as sand, eggshells, seeds, and debris that readily settle out during the treatment process. Effective grit removal is essential to protect downstream equipment from abrasion and impact damage, and to prevent the accumulation of grit in process tanks which reduces treatment volume. During Workshop No. 1, the City noted that grit accumulation in the surge tank and package plant units have led to reduced treatment capacity. The City also noted the need for frequent impeller replacements due to abrasion and impact damage caused by grit.

Grit removal equipment is designed to physically separate heavy grit particles from lighter organic solids. Once removed from the raw sewage stream, the collected grit solution, or “grit slurry,” is transferred to a grit separation and washing process to remove lighter, organic material which can be returned to the process stream. While grit conveyance, separation, and washing systems are addressed in this section, the specific equipment and configurations are dependent on the selected grit removal technology.

Grit particles are typically measured in microns, and the industry standard is to compare the settling characteristics of the grit particles to a sand equivalent size (SES). A site-specific grit characterization study was not performed for the WWTP; therefore, the evaluation is based on the characteristics of grit common to South Florida.

5.1 Technology Assessment

Two technologies were presented during Workshop No. 1 (**Appendix C**). These technologies include:

- Vortex grit collectors (mechanically and hydraulically induced vortex type)
- Stacked multi-tray type system

The two technologies were evaluated based on the typical grit removal efficiencies and applicability to the WWTP. The two technologies are described below.

5.1.1 Vortex Grit Collectors

5.1.1.1 Mechanically Induced Vortex Type Systems

Mechanically induced vortex systems typically consist of a cast-in-place concrete tank that houses a motorized propeller. Screened influent enters the tank tangentially and flows around the upper chamber. The inlet velocity forms a vortex without mechanical equipment. A motorized propeller is provided to assist with separation of organics from the settled material. The settled grit is collected in the bottom of the collection sump and is pumped out for washing and dewatering. There are two basic design types: stirred vortex and forced vortex systems.

The stirred vortex system design has a sloping bottom with a large opening to a center hopper. This type of design is available from several manufacturers and has been used for decades. A stirred vortex system generally cannot remove particles below 300 microns unless baffling is provided. When baffling is provided, these systems can remove 95% of particles 106 micron and larger. **Figure 5-1** depicts a typical stirred vortex grit removal system.

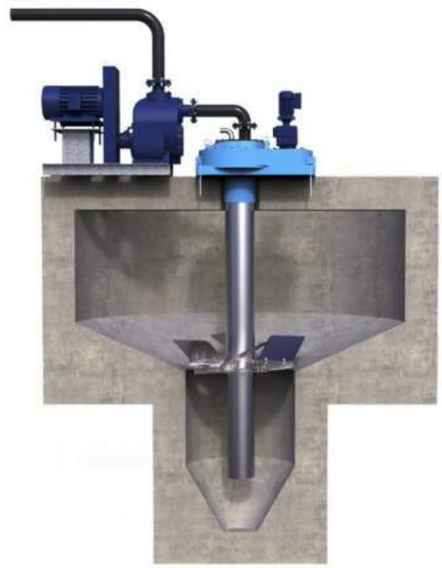


Figure 5-1: Stirred Vortex Grit Removal System (Ovivo J+A Jeta® Grit Trap)

The forced vortex design has a flat bottom, strategic baffles, and a small opening to the center grit hopper. This vortex system is only available from the Smith & Loveless (S&L) PISTA® brand. The design is based on grit settling in the sloped influent channel to the grit chamber so that grit is concentrated near the floor of the chamber upon entry. The forced vortex in the chamber then creates a hydraulic flow along the surface, down the face of the chamber at the outer edge, then in toward the center essentially pushing the grit already concentrated at the bottom toward the center where it enters the hopper. Sizing of a forced vortex system is proprietary in nature and is provided by the equipment manufacturer. When equipped with baffles, the PISTA® VIO and PISTA® V-FORCE BAFFLE™ grit removal systems claim to achieve removal efficiencies of 95% of particles 106 microns and larger. An illustration of the S&L PISTA® VIO is provided in **Figure 5-2**.

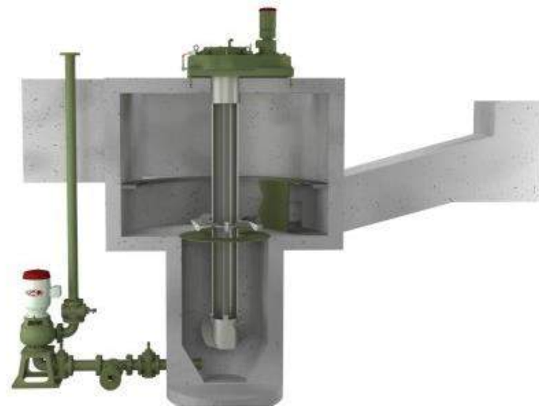


Figure 5-2: Forced Vortex Grit Removal System (S&L PISTA® VIO)

A newer technology by S&L, the INVORSOR®, claims to remove 95% of particles 75 microns and larger. This higher removal efficiency is attributed to the use of inclined cones (or plates) in the upper chamber which enhance settling by increasing surface area. As of mid-2025, there are no full-scale municipal installations to date and only a limited number of units currently in production. An illustration of the S&L PISTA® INVORSOR is provided in **Figure 5-3**.

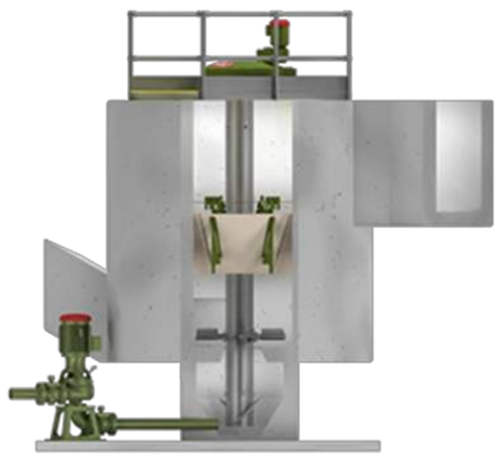


Figure 5-3: Hydraulically Induced Vortex Grit Removal System (S&L INVORSOR®)

The main advantages of the mechanically induced vortex type system include lower capital costs and low headloss during peak flows. Disadvantages of these systems include having multiple mechanical components, the potential for rags to accumulate on the propeller (EPA 1999), and lower removal efficiencies.

5.1.1.2 Hydraulically Induced Vortex Type Systems

The hydraulically induced vortex type system is similar to the mechanically induced vortex type system in that the system creates a vortex from introducing tangential flow to the circular chamber. Instead of using a propeller to add additional energy, this system uses a smaller radius chamber to concentrate the influent energy and a circulation jet to provide additional separation potential. These systems are typically fabricated from FRP or stainless steel and include support legs for elevation. The sizing of the hydraulically induced vortex type system is proprietary in nature and is provided by the equipment manufacturer. **Figure 5-4** presents component descriptions provided by the manufacturer for the Hydro-Grit™ system manufactured by Fluidyne.

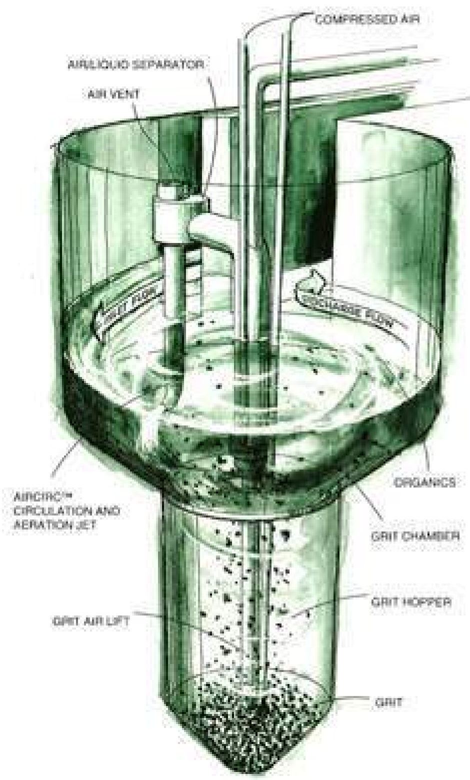


Figure 5-4: Hydraulically Induced Vortex System (Fluidyne)

5.1.2 Stacked Multi-Tray Type System

The stacked multi-tray type system was introduced in the early 2000s and is a conical, stacked-tray system that utilizes a multitude of integral, cylindrical flow paths in plastic trays to increase surface area inside the grit tank. Hydro International is the main manufacturer of this type of equipment, and it is referred to as the HeadCell®. The system relies on gravity settling for grit removal and sizing of the system is based on conventional empirical formulas.

One Headcell Grit Concentrator unit consisting of twelve 9-foot diameter trays housed in a 12-foot square concrete tank is recommended for the headworks facility (refer to Section 5.4 additional equipment specifications). A single HeadCell unit of this size can process up to 13 mgd at a 106-micron grit removal cut point, making a second unit unnecessary from a hydraulic design perspective. Its low-maintenance, all-hydraulic design allows for planned maintenance with minimal operational downtime. Because removal efficiency is dependent on the overall surface loading rate, removal efficiency will decrease during peak flow conditions. **Table 5-1** summarizes the removal efficiencies and associated headloss at varying design flow rates for the new headworks facility.

Table 5-1: Stacked Multi-Tray Removal Efficiencies

Flow Condition	Flow (mgd)	Removal Efficiency
Minimum	1.7	95% removal of 75 micron and larger
AADF	3.3	95% removal of 75 micron and larger
TMADF	4.27	95% removal of 75 micron and larger
PHF	12.1	95% removal of 106 micron and larger1

[1]Removal of 95% of 75 micron and larger up to 7.6 mgd

Grit slurry is typically pumped from each unit to either a SlurryCup® or GritCleanse®, Hydro International's proprietary grit washer/classifier systems. The GritCleanse® is a standalone system whereas the SlurryCup® is typically paired with the GritSnail®, a cleated belt system, for dewatering.

The main advantage of these systems is the ability to remove fine sugar sand prevalent in South Florida wastewater collection systems. The manufacturer claims that the HeadCell® system is able to remove grit particles down to 200 mesh (75 microns) while maintaining a low organic material content in the removed grit. The systems also have no moving parts and require minimal maintenance.

One primary disadvantage of this type of system is that it has historically required sole-sourcing due to proprietary designs. While other manufacturers are beginning to offer similar equipment, only one manufacturer currently has proven installation experience, and the performance of alternative systems remains unverified. A second disadvantage is that these systems are often more expensive than comparably sized vortex type units. Also, some facilities with these units have reported the need to clean the units of grease and screenings on a regular basis. The grit conditioning system downstream of the stacked tray system typically runs continuously and non-potable water usage is higher than other technologies. **Figure 5-5** presents a schematic depicting a typical HeadCell® system.

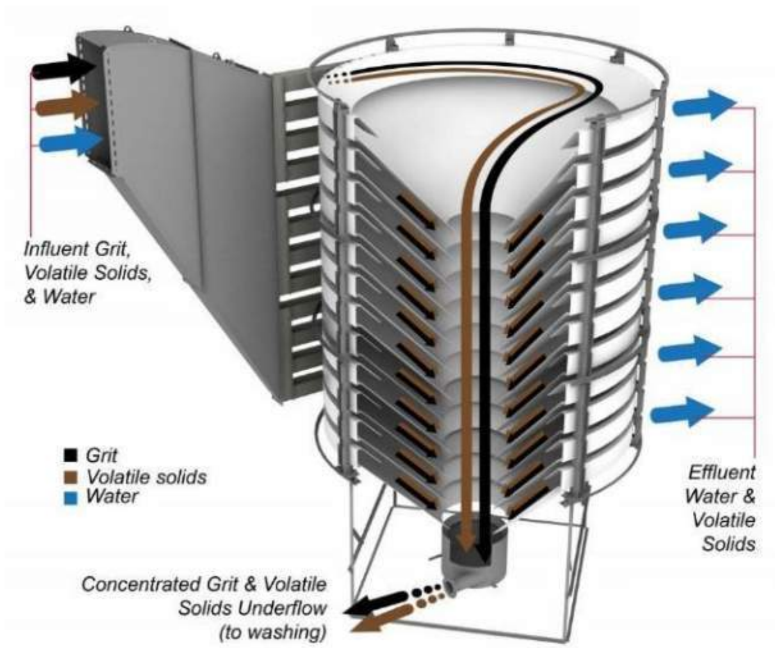


Figure 5-5: Stacked Tray Grit Removal System (Hydro International)

5.2 Grit Cyclones, Classifiers and Washers

Once the grit is removed from the screened wastewater flow stream, the collected grit slurry must be transferred to a grit separation and washing process. Captured grit is separated from organics and liquid prior to its disposal in a waste dumpster. Organics and liquids are returned to the treatment process. The grit separation design is as critical as the grit removal technology, since if not done properly, grit is returned to the process stream, negating the intent of the system.

Grit slurry is processed using either cyclone/classifier systems or grit washers. Cyclone/classifier systems utilize centrifugal force to separate heavier grit from lighter organics. Grit settles along the cyclone walls and is directed to a classifier, while lighter material exits through the top. Washed grit is then conveyed from the classifier by an inclined screw or escalator, with continuous, consistent slurry flow required for optimal performance.

Grit washers remove organics from grit by agitating the grit slurry within a controlled chamber, allowing heavier inorganic particles to settle while lighter organics are suspended and removed. The system typically includes an internal wash mechanism and inclined screw conveyor, producing a cleaner, dewatered grit product with low organic content. Grit washers can remove a higher percentage of organics when compared to typical cyclone/classifier systems, resulting in a final organic content of less than 5% (WEF MOP 8). However, grit washers require additional water.

The specific grit conditioning equipment and configurations are dependent on the selected grit removal technology.

5.3 Grit Removal Technologies Advantages and Disadvantages

In general, each grit removal technology has advantages and disadvantages. A comparison of the two technologies was conducted based on available literature, industry experience and manufacturer provided data. **Table 5-2** identifies advantages and disadvantages for each technology.

Table 5-2: Summary of Grit Removal Technologies

Technology	Advantages	Disadvantages
Vortex Grit Collectors	• Extensive experience • Less pump operating time • Lower headloss during peak flows • Lower capital cost	• More O&M requirements • More mechanical equipment • Lower capture rates
Stacked Multi-Tray Type System	• Higher overall capture rates, with increased capture rates at low flows • Smaller footprint • Less mechanical equipment	• One manufacturer with proven installation experience • Relatively newer technology • May not handle grease loads as effectively as other technologies • Continuous water required for grit washer

Table 5-3 provides a ranking of both grit removal technologies with respect to the following parameters: footprint, pump operating time, operation and maintenance considerations, capture rate, experience, competition, capital cost, headloss and capacity. Each of the parameters is ranked on a scale of 1 to 5, with 5 being the best and 1 being the worst.

Table 5-3: Grit Removal System Quantitative Comparison (Unweighted)

Parameter	Technology	
	Vortex Grit Collectors	Stacked Multi-Tray Type System
Footprint	3	4
Pumping Operating Time	4	3
O&M	3	4
Capture Rates	4	5
Experience	4	4
Competition	3	1
Capital Cost	4	3
Headloss	4	3
Capacity	4	4
Total (Unweighted)	**33**	**31**

A weighted comparison of the same parameters is provided in **Table 5-4**.

Table 5-4: Grit Removal System Quantitative Comparison (Weighted)

Parameter	Weight	Technology	
		Vortex Grit Collectors	Stacked Multi-Tray Type System
Footprint	10%	3	4
Pumping Operating Time	5%	4	3
O&M	20%	3	4
Capture Rates	20%	4	5
Experience	10%	4	4
Competition	10%	3	1
Capital Cost	10%	4	3
Headloss	10%	4	3
Capacity	5%	4	4
	Total (Weighted)	**3.48**	**3.78**

5.4 Grit Removal Selection and Recommendations

Following Workshop No. 1, the City conducted multiple site visits and telephone conferences with nearby utilities to observe the grit removal technologies discussed and gather operator feedback. Based on the insights gained during these visits, the City decided to select stacked tray grit removal system for the headworks facility. Based on efficient capture rates, positive operator feedback, and the limited number of manufacturers of these systems, the City will be sole-sourcing Hydro International's Headcell® grit removal, washing, and dewatering systems. Although the grit removal system will be designed and installed under separate future contracts, the Headworks structure will be designed to accommodate this system. Preliminary drawings depicting the proposed headworks layout and associated grit removal equipment are provided in **Appendix B**. The preliminary list of technical specifications are included in **Appendix C**

5.4.1 Reliability and Redundancy

It is recommended that the following design elements be incorporated into the new headworks facility to provide operational flexibility and system redundancy:

- Provide one grit removal unit with a hydraulic capacity of 12.1 mgd.
- Provide a dedicated bypass channel which supplies the influent splitter box.
- Provide isolation so the unit can be taken off-line independently.
- Provide and install one grit pump dedicated to the unit and one shelf spare grit pump that can be installed if the grit pump needs to be serviced.
- Provide one washer/compactor or classifier unit.

5.4.2 Equipment Sizing

The Hydro International Headcell® Grit Concentrator Unit will consist of twelve (12) 9-foot diameter trays housed in a 12-foot by 12-foot concrete tank. The unit will be sized to handle the design PHF of 12.1 mgd.

5.4.3 Collected Grit Separation and Conditioning

The grit slurry will be pumped to a Hydro GritCleanse™ system. The Hydro GritCleanse™ system is a high efficiency unit that removes, washes, and dewaters fine grit and sugar sand from grit slurries. It produces dry grit with extremely low organic content. The GritSnail is Hydro International's other grit washing/dewatering unit. Both systems are similar with high efficiencies of removal. The Hydro GritCleanse is optimized to work specifically with the HeadCell system. **Table 5-6** shows the specifications for the Hydro GritCleanse system.

Table 5-6: Hydro GritCleanse Specifications

Specification	Value
Design Flow/Unit	200 gpm with 2" headloss
Capacity	Up to 1.5 cy/hr
Operation	Continuous or a minimum of 10-15 minutes
Body Material	316 SS
Performance	95% removal of all grit (SG 2.65) ≥ 75 microns with less than 5% volatile solids and greater than 90% total solids w/ standard intermittent screw operation and <0.5% influent solids concentration

6. Odor Control System

Wastewater generates odorous compounds that can impact the surrounding community, as well as operator health, safety, and comfort. In addition, odorous compounds contribute to the corrosion of equipment and infrastructure. As part of this project, the City intends to evaluate alternative odor control systems to treat foul air from the proposed headworks.

6.1 Odorous Compounds

6.1.1 Hydrogen Sulfide

Hydrogen sulfide (H_2S), recognized by its characteristic rotten egg odor, is the primary odor-causing compound in wastewater systems and is typically the design-driving contaminant for odor control strategies. H_2S is produced through the biological reduction of sulfate to sulfide under anaerobic conditions.

Once formed, H_2S can diffuse into the bulk wastewater. This dissolved H_2S can then volatilize into the vapor phase, where it is further oxidized by microorganisms on moist surfaces such as concrete walls. This biological oxidation converts H_2S into sulfuric acid, which contributes significantly to the corrosion of wastewater infrastructure.

6.1.2 Reduced Sulfur Compounds

Sulfur-based compounds are the primary contributors to odors in wastewater, with hydrogen sulfide being the most prevalent. In addition to H_2S, other reduced sulfur compounds (RSCs) such as mercaptans, dimethyl sulfide, dimethyl disulfide and others are also present. These compounds are commonly associated with nuisance odors resembling rotting vegetables or cabbage. RSCs are produced when organic matter in wastewater undergoes anaerobic decomposition, typically in low-oxygen environments found in collection and conveyance systems.

6.2 Odor Control System Parameters

6.2.1 Ventilation

Ventilation requirements were determined based on the proposed headworks layout (**Appendix B**). Two conditions were assessed: (Condition 1) the immediate condition, in which the grit system is bypassed/not installed, and (Condition 2) the future condition, in which the grit system is installed, and additional demand will be added to the system.

In Condition 1, ventilation is required for the influent, fine screen, effluent, and bypass channels, as well as the dumpster rooms, totaling approximately 20,000 cubic feet of airspace. In Condition 2, the addition of the grit system introduces ventilation requirements for the grit channels and chamber, contributing an additional 1,400 cubic feet of airspace. In total, the proposed headworks will require ventilation of approximately 21,400 cubic feet of airspace across both conditions.

Table 6-1 summarizes the areas within the proposed headworks that require ventilation under both conditions

Table 6-1: Air Volumes

Area Description	Total Volume of Air Requiring Treatment (cubic feet)
Condition 1: Immediate (Grit System is Bypassed/Not Installed)	
Influent Box	250
Fine Screen Channels	1,150
Grit Bypass Channel	400
Effluent Box	200
Dumpster Enclosures	18,000
Total	**20,000**
Condition 2: Future (Additional Demand from Grit System Installation)	
Grit Channels	1,150
Grit Chamber	250
Total	**1,400**
Overall Total	**21,400**

The total air exchange rate, expressed as air changes per hour (ACH), was determined to support odor control system sizing. ACH values varied across the different headworks areas requiring treatment. Worker-accessible enclosed spaces within the headworks building, including dumpster enclosures and the grit chamber, were assigned 12 ACH in compliance with NFPA 820 Class I, Division 1 requirements.

Due to the nature of headworks and preliminary treatment processes, which typically experience elevated H_2S concentrations, industry practice has shifted toward higher ventilation rates than that required by NFPA 820, specifically in areas such as headworks treatment channels. These channels represent the first location where H_2S and other odorous compounds are released from influent wastewater. Turbulence within the channels promotes off-gassing of H_2S, and experience has shown improved odor and corrosion mitigation when significantly higher ventilation rates (approximately 12 to 40 ACH) are applied at preliminary treatment structures.

Each channel within the proposed headworks was assigned an ACH based on the air velocity required to achieve a sweeping (no-stagnation) condition, defined as the minimum velocity needed to continuously move air through a space and prevent stagnant zones where odorous, corrosive, or hazardous compounds may accumulate. A volume-weighted average ACH was then calculated across all channels, including future grit channels, to establish an overall channel ventilation rate of 20 ACH.

Table 6-2 summarizes the ACH defined for each area within the proposed headworks to be treated.

Table 6-2: Air Exchanges Per Hour

Area Description	Air Exchanges Per Hour (ACH)
Channels	**20**
Grit Chamber	**12**
Dumpster Enclosures	**12**

Note: *Includes provisions for the future grit channels*

Using the calculated air volumes and ACH criteria, the required ventilation airflow rates were determined for both headworks configuration scenarios. In Condition 1, ventilation is required for the influent, fine screen, effluent, and bypass channels, as well as the dumpster rooms, resulting in a total airflow requirement of approximately 4,600 cubic feet per minute (cfm). In Condition 2, the addition of the grit system contributes an additional 350 cfm, bringing the total airflow requirement to approximately 4,950 cfm.

Table 6-3 summarizes the airflow requirements for both conditions.

Table 6-3: Airflow

Area Description	Airflow (cfm)
Condition 1: Immediate (Grit System is Bypassed/Not Installed)	
Influent Box	150
Fine Screen Channels	750
Grit Bypass Channel	50
Effluent Box	50
Dumpster Enclosures	3,600
Total	**4,600**
Condition 2: Future (Additional Demand from Grit System Installation)	
Grit Channels	100
Grit Chamber	250
Total	**350**
Overall Total	**4,950**

6.2.2 Characterization of WWTP Odor Compounds

The WWTP currently implements a ferric/ferrous sulfate liquid-phase dosing system (Kemira OdoFree) at the influent surge tank, as described in **Section 2.1**, at a reported average dosage rate of 72 gpm at 100% operation. To establish a comprehensive understanding of the impacts of the ferric/ferrous sulfate system on odor compound concentrations at the WWTP, a series of field tests was conducted to characterize H_2S and RSC concentrations under the following three scenarios:

- Scenario 1 (Baseline) – Kemira OdoFree System **Off**
- Scenario 2 – Kemira OdoFree System Dosing at **50%**
- Scenario 3 – Kemira OdoFree System Dosing at **100%**

All field-testing measurements were taken at the existing bar screen located on top of the surge tank.

6.2.2.1 Hydrogen Sulfide Concentrations

H_2S concentrations were measured in the field using Acrulog® data loggers under the three dosing scenarios. The results are summarized in **Table 6-4**. With the Kemira OdoFree system off (Scenario 1), average H_2S loading reached 142.7 ppm with a maximum of 475.0 ppm, confirming elevated H_2S generation in the absence of chemical dosing. At 50% dosing (Scenario 2), average concentrations dropped to 6.0 ppm with a maximum of 35.0 ppm, representing a reduction of approximately 96% in average concentrations. At full dosing capacity (Scenario 3, 100%), H_2S was nearly eliminated, with an average concentration of 0.1 ppm and a maximum of 2.0 ppm.

Table 6-4: Hydrogen Sulfide Field Measurements

Scenario	Kemira OdoFree Dosage*	H_2S Loading (ppm)			Start Date	End Date
		Avg	Min	Max		
Scenario 1	Off	142.7	9.0	475.0	1/5/2026	1/8/2026
Scenario 2	50% (36 gpm)	6.0	0.0	35.0	1/9/2026	1/12/2026
Scenario 3	100 % (72 gpm)	0.1	0.0	2.0	7/8/2025	7/17/2025

*Note: *Dosages are based on the reported average dosage rate at 100% Kemira OdoFree dosing (72 gpm)*

6.2.2.2 Reduced Sulfur Compound Concentrations

RSC concentrations were measured in the field using 6-liter Silonite® canisters and analyzed following ASTM D5504-20 at an independent laboratory. The results are summarized in **Table 6-5**. With the Kemira OdoFree system off (Scenario 1), elevated RSC concentrations were detected, with Dimethyl Disulfide at 300 ppb, Dimethyl Sulfide at 102 ppb, Carbonyl Sulfide at 71 ppb, and Carbon Disulfide at 40.5 ppb. At 50% dosing (Scenario 2), concentrations decreased notably across all detected constituents, with Dimethyl Disulfide dropping to 57.5 ppb, Dimethyl Sulfide to 21 ppb, Carbon Disulfide to 9.5 ppb, and Carbonyl Sulfide to 0.0 ppb. RSC measurements were not taken for Scenario 3 (100%); concentrations were assumed to be negligible for all constituents based on the rate of concentration reduction between Off and 50%.

Table 6-5: Reduced Sulfur Compound Concentrations

Scenario	Kemira OdoFree Dosage*	Reduced Sulfer Compounds (ppb)				Test Date
		Carbonyl Sulfide	Dimethyl Sulfide	Carbon Disulfide	Dimethyl Disulfide	
Scenario 1	Off	71	102	40.5	300	1/5/2026
Scenario 2	50% (36 gpm)	0.0	21	9.5	57.5	1/9/2026
Scenario 3	100 % (72 gpm)	N/A	N/A	N/A	N/A	N/A

*Note: *Dosages are based on the reported average dosage rate at 100% Kemira OdoFree dosing (72 gpm)*
** RSC field measurements were not taken for Scenario 3; values assumed to be negligible for all reported constituents

6.3 Odor Control Technology Evaluation

The odor control technologies that will be evaluated include the existing odor control system at the WWTP and those presented during Workshop No. 1 (**Appendix C**). The technologies considered are summarized below:

- Ferric/Ferrous Sulfate Liquid Phase Dosing System (Existing)
- Chemical Scrubbers
- Biological Oxidation
  - Biofilters
  - Biotowers
- Dry Media Adsorption with Activated Carbon

6.3.1 Ferric/Ferrous Sulfate

Ferric or ferrous sulfate addition is a liquid-phase odor control strategy commonly used to mitigate the release of H_2S in wastewater systems. These iron salts react with dissolved sulfide to form insoluble iron sulfide (FeS), thereby reducing the transfer of H_2S from the liquid phase into the vapor phase. This approach is typically implemented at key locations in the collection system or at the treatment plant headworks where sulfides are present in the wastewater. Dosing can be applied at a constant rate or controlled through feedback loops using instrumentation such as vapor-phase hydrogen sulfide analyzers. **Figure 6-1** illustrates an example of this type of system.

Figure 6-1: Ferric/Ferrous Sulfate Dosing System

Although the addition of iron salts effectively reduces both liquid-phase and atmospheric hydrogen sulfide concentrations, several operational considerations should be noted. Overfeeding can lower pH, potentially leading to corrosion of equipment and infrastructure, while underperforming aeration systems or insufficient hydraulic detention time can promote colloidal iron formation. These particles may accumulate on screens, causing blockages, carryover into secondary effluent, and increased turbidity and total suspended solids (TSS). To mitigate these risks, automated feedback control using online H_2S or residual iron sensors, flow-proportional dosing, and pH-based adjustments is recommended, along with routine monitoring and regular screen maintenance to maintain treatment efficiency.

6.3.2 Chemical Scrubbers

Packed tower chemical scrubbers are a well-established and reliable technology used for odor control in wastewater treatment facilities. These systems operate by absorbing and oxidizing odorous compounds from air streams using a recirculated chemical solution. They are particularly effective at removing hydrogen sulfide and are commonly used in areas with high odor potential, such as headworks, surge tanks, and sludge handling facilities, as reflected with the existing system.

The most common configuration is a vertical counter-current tower, as seen in **Figure 6-2**, although horizontal scrubbers, concurrent flow systems, and low-profile multi-stage designs are also used when site-specific constraints require alternative layouts. In a typical counter-current system, odorous air enters the base of the scrubber vessel through a plenum via a fan. The air is then forced upward through a bed of plastic packing media, which is coated with a chemically treated liquid film. At the same time, potable water mixed with chemicals such as sodium hydroxide and sodium hypochlorite is pumped through a recirculation loop and sprayed over the media from the top of the tower. This creates a continuous downward flow of scrubbing solution moving in the opposite direction of the upward-moving air.

Figure 6-2: Chemical Scrubber

As the foul air rises through the wetted packing, odor compounds are absorbed into the high pH liquid film. H_2S is transferred from the gas phase into the liquid, where it is oxidized by sodium hypochlorite into non-odorous sulfate. The cleaned air exits through the top of the tower and is discharged through an exhaust stack. The scrubbing liquid collects in a sump at the base of the unit and is recirculated to maintain performance. Makeup water is introduced as needed to sustain proper chemical concentration and flow.

The plastic packing media is a critical component of the system. It provides a large surface area and enhances turbulence, facilitating efficient mass transfer from the gas phase to the liquid phase. Several factors influence the overall removal efficiency, including gas velocity, packing type and depth, pH of the scrubbing solution, strength and dosage of the oxidizing agent, and system hydraulics. Sodium hydroxide is typically used to maintain an elevated pH, which promotes the transfer of H_2S into the liquid phase. Sodium hypochlorite is then used to chemically oxidize the sulfide.

Chemical scrubbers offer high odor removal efficiency. Their compact design allows for a small physical footprint (although chemical storage tanks and feed equipment are required with an associated footprint impact), and they have a long-standing track record of effectiveness under variable odor loading conditions. They are especially suited to applications with high concentrations of reduced sulfur compounds. However, these systems are operator intensive and require consistent oversight. Operational demands include maintaining proper chemical balance within the scrubber, monitoring the chemical feed system, and performing routine maintenance on the mechanical components. Regular acid washing is necessary to prevent scaling within the packing media. The complexity and constant feed of chemicals contribute to relatively high operation and maintenance considerations and costs.

6.3.3 Biological Oxidation (Biotowers)

Biological oxidation is an odor control method that uses naturally occurring microorganisms to convert H_2S and other reduced sulfur compounds into non-odorous byproducts, such as sulfuric acid. These systems serve as an alternative to chemical scrubbers and rely on biological activity for oxidation rather than chemical reagents. The two primary types of biological systems used in wastewater odor control are biofilters and biotowers, with biotowers further categorized into bioscrubbers and biological trickling filters. While biological systems can be effective for H_2S removal under stable loading conditions and may reduce chemical costs and operational intensity, they generally require equipment associated with the nutrient feed system. In some cases, they may also require a supplemental treatment stage to meet more stringent odor control requirements or to manage variable odor profiles.

6.3.3.1 Biofilters

Biofilters use either organic or inorganic engineered media as a substrate to support microbial growth that biologically oxidizes odorous compounds, primarily H_2S, as contaminated air passes through. Older systems often used organic media such as pine bark or wood mulch, which tend to break down due to the generation of sulfuric acid from the biological oxidation process, requiring periodic replacement which can be operationally intensive. More recently, vendors are offering inert, inorganic, mineral-based media options that do not break down over time from sulfuric acid (15+ year media life). Both organic and inorganic biofilters operate with long retention times, typically thirty-five to sixty seconds, and as a result, require a relatively large footprint.

6.3.3.2 Biotowers

Biotowers are vertical cylindrical systems that use synthetic, chemically-resistant media to support microbial activity, as seen in **Figure 6-3**. They are designed to be compact in footprint but taller in height, making them a more space-efficient option compared to biofilters. Biotowers are divided into two categories: bioscrubbers and biological trickling filters.

Figure 6-3: Biotower

- **Bioscrubbers:** Bioscrubbers are counter-current systems where odorous air is introduced at the bottom of the tower and flows upward through synthetic packing media. A low pH liquid ("blow down"), typically containing nutrients, is recirculated from a sump and sprayed over the media at the top of the vessel to maintain a moist biological film layer. H_2S is absorbed into this film and biologically oxidized by resident microorganisms such as *Thiobacillus*. The clean air exits the top of the tower, while the liquid collects in a sump at the base and is recirculated. These systems are designed to maintain a low pH and require a consistent nutrient supply. Typical retention times are between eight and fifteen seconds.

- **Biological Trickling Filters:** Biological trickling filters operate similarly to bioscrubbers but typically do not use continuous low pH recirculation. Instead, water and nutrients are delivered intermittently over the media, allowing for microbial growth and odor oxidation to occur in a less saturated environment. These systems rely on synthetic media with high surface area and long service life, typically over ten years. Trickling filters are less complex in operation compared to bioscrubbers but consume more water. Like bioscrubbers, they are better suited to somewhat consistent odor loading conditions and may be less effective during very high and short-duration odor peaks.

6.3.4 Dry Media Adsorption with Activated Carbon

Dry media odor control systems can remove H_2S, RSCs, volatile organic compounds (VOCs), and other odorous gases, depending on the type of carbon utilized. These systems most often use activated carbon as the primary media, but other engineered specialty media can also be used depending on the compounds targeted. The process involves passing odorous air through a packed bed of media where contaminants are adsorbed onto the surface or chemically oxidized. A picture of a single, deep bed dry media system is presented in **Figure 6-4**.

Figure 6-4: Dry Media Adsorption Deep Bed Unit

Activated carbon is the most commonly used media and is engineered to provide a high surface area to volume ratio to enhance adsorption capacity. Contaminants are captured as air flows through the carbon bed, creating zones of mass transfer. Once the carbon becomes saturated, it must be replaced. Several types of carbon are available for specific applications, including virgin coconut shell carbon for a broad range of compound removal, catalytic carbon for enhanced H_2S removal, and permanganate-impregnated media for polishing more complex organic RSCs. For example, caustic impregnated carbon improves RSC removal but can pose a fire hazard, while permanganate impregnated activated alumina oxidizes a broad spectrum of compounds but can be consumed more rapidly.

Dry media systems are best suited for lower contaminant concentrations, typically less than 10 ppm H_2S on average. At higher concentrations, the media depletes quickly, requiring more frequent replacement and increased operational costs. In some applications, a layered bed approach may be used such as placing a high-capacity activated carbon layer upstream of a polishing layer containing permanganate impregnated media. This configuration can extend performance life and broaden the system's effectiveness across multiple odor-causing compounds.

Overall, dry media systems are a proven and low-maintenance technology for odor control, especially in situations with moderate or intermittent odor loading. Media selection must be matched to the specific contaminant profile, and used media must be disposed of in accordance with local environmental regulations.

6.4 Shortlisted Odor Control Technologies

Following Workshop No. 1, the City shortlisted the odor control technologies for the proposed headworks. These technologies were further evaluated and considered as part of this assessment:

- Ferric/Ferrous Sulfate Liquid Phase Dosing System (Existing)
- Chemical Scrubbers
- Biotowers (Biological Oxidation System)

6.4.1 Technology Advantages and Disadvantages

Table 6-6 provides a summary of the advantages and disadvantages of the odor control technologies evaluated:

Table 6-6: Odor Control Technologies Advantages and Disadvantages

Technology	Advantages	Disadvantages
Ferric/Ferrous Sulfate Liquid Phase Dosing System	• Effective at reducing both liquid and vapor phase H_2S • Targets odor release at the source • Optimizable with feedback controls • Can help with sludge settling and Phosphorus removal	• Overdosing can cause corrosion • May impact effluent quality due to the formation of colloidal iron particles, which can accumulate on screens, increasing the need for weekly maintenance and cleaning, and potentially carry over into downstream processes. • High O&M cost
Chemical Scrubber	• High odor removal efficiency (>99%) • Proven technology • Suitable for high odor loads	• High O&M cost • Operator intensive • Requires hazardous chemical handling and storage • Scaling potential requires routine acid washing
Biotower	• Compact footprint • High Hydrogen Sulfide removal efficiency (>99%) • Low operating costs	• Moderate capital cost • Requires nutrient feed and recirculation • Can be less effective with RSCs

6.4.2 Life Cycle Cost Analysis

A life cycle cost analysis was conducted for the shortlisted odor control technologies. Capital costs were developed using vendor pricing for representative equipment, while preliminary footprint requirements were established by Hazen based on design experience and manufacturer data. Operation and maintenance (O&M) costs were then projected over a 20-year equipment life to estimate total life cycle costs and corresponding net present values (NPVs), enabling a consistent comparison among the technologies.

All capital and O&M cost estimates were developed in October 2025 based on preliminary design data and include contingencies to account for uncertainty. The analysis was intended to provide a relative cost comparison, with a final overall project cost provided in **Section 15**. A summary of the results, based on manufacturer data, available information, and engineering judgment, is provided in **Table 6-7**.

Table 6-7: Odor Control Life Cycle Cost Analysis

Technology	Estimated System Capital Cost	Estimated System O&M Cost	Estimated System Life Cycle Cost
Ferric/Ferrous Sulfate Liquid Phase Dosing System (Existing)	$100,000	$1,220,000	**$1,320,000**
Chemical Scrubber	$2,400,000	$11,750,000	**$14,150,000**
Biotower	$2,640,000	$1,260,000	**$3,900,000**

6.4.3 Design Considerations

In addition to cost, design considerations such as space, equipment requirements, O&M, and redundancy were evaluated for each shortlisted technology.

1. **Ferric/Ferrous Sulfate Liquid Phase Dosing System (Existing)**

   The existing Kemira Odo-Free dosing system on site could be repurposed for the proposed headworks. Relocating the injection point from the surge tank to upstream of the headworks is technically feasible, compatible with the proposed configuration, and requires minimal additional footprint and cost. Based on chemical behavior and experience at similar facilities, H_2S converted to FeS is expected to remain bound throughout the main headworks process areas. Additionally, continued ferric dosing is likely needed to maintain the existing downstream treatment processes at the package plants, as ferric ions carried through the system contribute to phosphorus precipitation and coagulation.

   The following limitations and design considerations were identified:

   - A secondary odor control system may be required:
     - NFPA 820 Compliance: NFPA 820 requires mechanical ventilation in enclosed areas where flammable or toxic gases may accumulate. Such spaces are classified based on the likelihood of hazardous concentrations of H_2S being present, and adequate air changes per hour (12 ACH for occupied spaces) must be maintained.
     - H_2S Revolatilization: While upstream chemical injection can reduce H_2S in screened waste, H_2S can revolatilize from dumpster contents under certain conditions, including:
       - Prolonged retention time of screened material

    - Elevated temperatures
    - Low pH
    - Physical disturbance of material during handling
    - Incomplete FeS conversion due to insufficient chemical dose

- Very dry or alkaline material (pH above approximately 8.5) can inhibit FeS formation by limiting the availability of free sulfide ions and reducing reaction efficiency, potentially requiring higher ferric or ferrous sulfate doses to achieve the same level of odor control.
- Ferric or ferrous sulfate addition targets H_2S but does not as effectively address other RSCs that are commonly present in organics and screened waste. As a result, some odors may persist even with effective H_2S control.
- Ferric or ferrous sulfate addition can lead to the formation of precipitates within the wastestream that can accumulate on headworks screens, potentially reducing opening sizes and increasing cleaning frequency, which should be accounted for in screen selection and O&M planning.

2. Chemical Scrubbers

Of the shortlisted technologies, a chemical scrubber system requires the largest footprint, as it encompasses both an odor control system and a dedicated chemical feed system. Equipment and space requirements include, but are not limited to:

- Odor Control System:
    - Scrubbing tower(s) with associated packing
    - Blower/fan with sound enclosure
    - Interconnecting ductwork
    - Recirculation pumps and piping
    - Control panel
- Chemical Feed System:
    - Chemical storage tanks with secondary containment structures
    - Chemical metering pumps and piping

The following limitations and design considerations were identified:

- As described in **Section 6.3.2**, chemical scrubber systems require more intensive O&M compared to the other shortlisted technologies. The chemical feed system must be continuously monitored to maintain the proper conditions within the scrubber, in addition to routine mechanical maintenance.

- A water connection is required for scrubber operation. Reuse water is typically sufficient, though water quality should be confirmed to ensure compatibility with scrubber internals and chemical dosing.

3. Biotowers

A biotower system requires a moderate footprint but has the greatest vertical height of the shortlisted technologies. Equipment and space requirements include, but are not limited to:

- Odor Control System:
  - Biotower(s) and associated packing
  - Blower/fan
  - Interconnecting ductwork
  - Recirculation pumps and piping
  - Control panel

The following limitations and design considerations were identified:

- As described in **Section 6.3.3**, biotowers require moderate to low O&M, as they are generally self-sustaining under a consistent odor load. However, performance can be sensitive to sudden changes in odor loading or composition, which may require periodic reseeding of the biological media.
- A water connection may be required; however, recirculated system water is typically sufficient, with reuse water being acceptable depending on quality.
- The greater vertical height of a biotower relative to the other shortlisted technologies should be considered in the context of site constraints, structural requirements, and any applicable height restrictions.

6.5 Odor Control Technology Selection and Recommendations

Following the Draft PDR Review Workshop, the City confirmed the selection of a hybrid odor control system for the proposed headworks, utilizing the existing Kemira system alongside a new biotower.

A series of field tests were conducted to measure odor control constituents at the surge tank under various OdoFree dosing levels. The findings are detailed in **Section 6.2.2**. The field testing confirmed that varying dosing levels was adequate in maintaining sufficient constituent concentrations downstream, and that optimizing the OdoFree dosing to a level at which a meaningful reduction in H_2S is achieved while retaining enough H_2S and other compounds to sustain a biotower system represented the most cost-effective and optimal odor control solution for the proposed headworks.

This combined approach offers several key advantages:

- Minimizes footprint, addressing site constraints

- Provides redundancy in odor control coverage
- Satisfies ventilation and odor control requirements for enclosed spaces at the headworks
- Maintains downstream treatment processes through continued ferric/ferrous sulfate dosing
- Offers low O&M requirements for both systems, allowing plant staff to operate them efficiently while maintaining familiarity with the existing Kemira system.

6.5.1 Kemira System Operation

As described in **Section 6.2.2**, odor control testing was conducted at three (3) Kemira OdoFree dosing levels: off, 50%, and 100% (with 100% corresponding to an average dosage of 72 gpm). Using the test results, H_2S and RSC concentrations were interpolated across the full range of dosing percentages to characterize constituent behavior at intermediate dosing levels. **Figure 6-5** illustrates the interpolated average and maximum H_2S concentrations, and **Figure 6-6** illustrates the interpolated RSC concentrations across varying OdoFree doses.

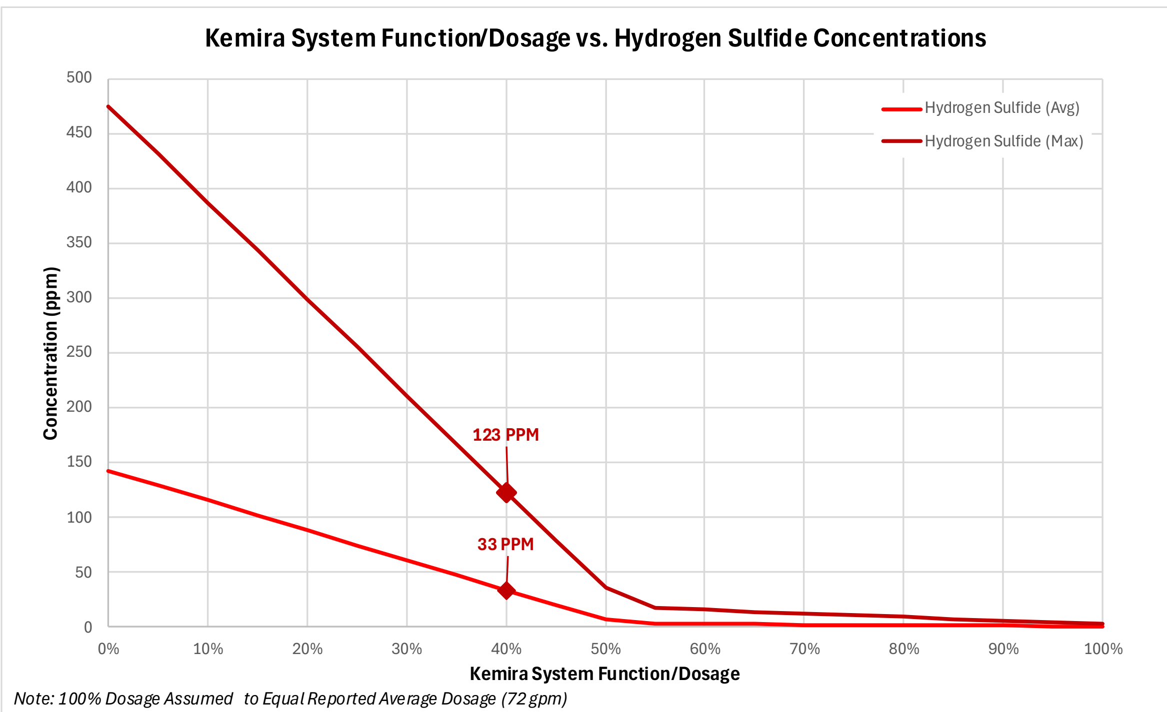


Figure 6-5: Kemira System Function/Dosage vs. H_2S Concentrations

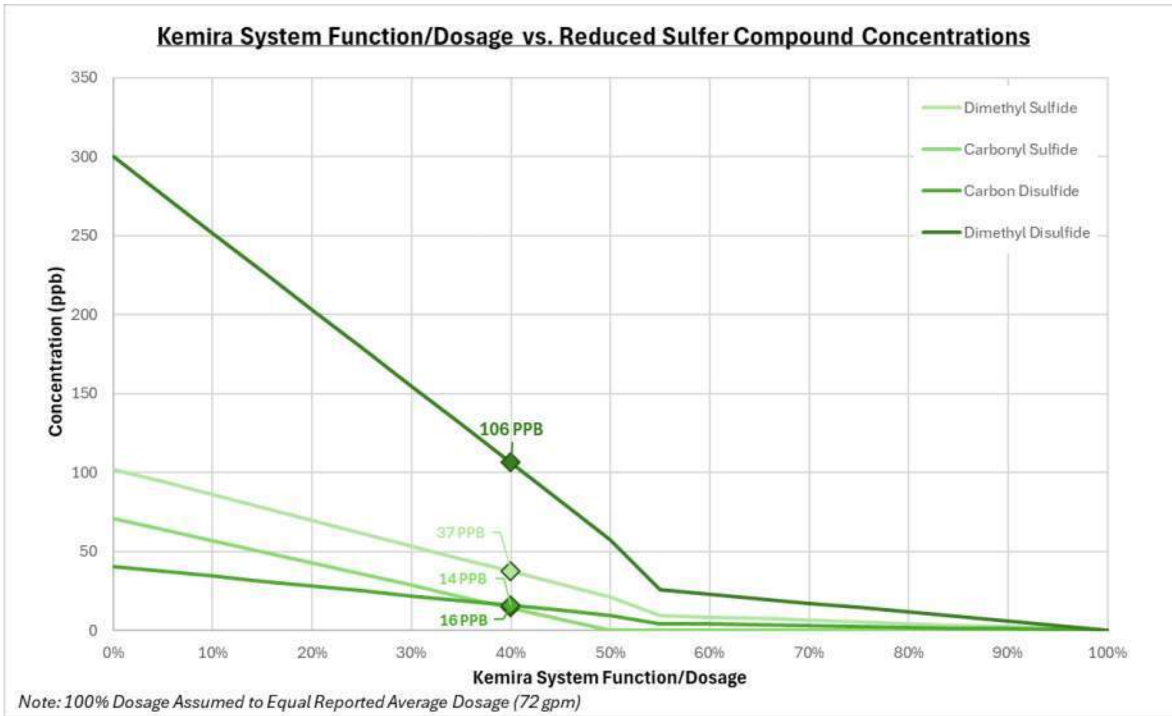


Figure 6-6: Kemira System Function/Dosage vs. RSC Concentrations

The objective of the dosing optimization was to identify a dosage that meaningfully reduces H_2S concentrations while retaining sufficient constituent loading to sustain the biotower biomass. Review of Figures 6-5 and 6-6 indicated the following:

- Between off and 50% dosing, constituent concentrations decreased in a relatively linear fashion, with a sizable portion of the H_2S removed by the time the system reached 50% dosing
- A 40% dosing rate fell at the point on the curve immediately preceding a dramatic concentration drop-off, retaining enough constituent concentration to support biotower activity while still achieving substantial H_2S reduction

Based on this analysis, the design dosing point for the Kemira system is approximately 40% of its current operating rate, equating to a target dosage of approximately 29 gpm.

It should be noted that these dosage values were estimated based on average system activity as reported by the City. During start-up, it will be critical to finalize the OdoFree dosing rate to ensure influent constituent concentrations remain as close as possible to the design values presented in the figures above and detailed further in **Section 6.5.2**.

6.5.2 Biotower Design Parameters

The proposed biotower will be designed to accommodate the future headworks condition (Condition 2), in which the grit system is installed, and ventilation is required for all influent, effluent, screen and grit channels, the grit chamber, and the enclosed dumpster rooms. This condition represents the maximum system demand and, as a result, the biotower will also have adequate capacity under Condition 1, in which the grit system is bypassed and not yet installed.

The system is expected to perform well under both conditions. The difference in airflow between Condition 1 and Condition 2 is 350 cfm, representing approximately 7% of the total required airflow of 4,950 cfm, a variation that is not expected to significantly impact biotower performance, as biotowers are capable of handling H_2S concentration variability. However, the grit chamber itself introduces a moderate volume of air with relatively low H_2S concentrations, which could dilute the overall influent H_2S concentration to the biotower upon transition to Condition 2. Given the influence of upstream Ferric/Ferrous Sulfate (OdoFree) dosing on influent H_2S concentrations, the Kemira dosing rate should be carefully reviewed during this transition. H_2S concentrations should be monitored to confirm that dosing is optimized and that influent concentrations remain sufficient to sustain the biotower biomass.

The biotower design parameters are summarized below:

1. **Airflow**
   - The system will be designed to accommodate the maximum total airflow of **4,950 cfm** under Condition 2.
   - Refer to **Section 6.2.1** for airflow value determinations.
2. **Design Concentrations for Odorous Compounds**
   - The anticipated H_2S and RSC concentrations for the channels are assumed to equal the constituent concentrations measured at the design (40%) Kemira OdoFree dosing, as presented in **Section 6.5.1**.

     The anticipated concentrations within the enclosed spaces (dumpster enclosures and grit chamber) are estimated to be approximately 10% of the channel concentrations. **Table 6-8** lists the total airflow and anticipated constituent concentrations for all channels and enclosed spaces.

Table 6-8: Design H2S and RSC Concentrations at Channels and Enclosed Spaces

Area	Total Airflow (cfm)	H2S Avg (ppm)	H2S Peak (ppm)	Carbonyl Sulfide (ppb)	Dimethyl Sulfide (ppb)	Carbon Disulfide (ppb)	Dimethyl Disulfide (ppb)
Channels	**1,100**	33	123	14	37	16	106
Enclosed Spaces	**3,850**	3.3	12.3	1.4	3.7	1.6	10.6

   - The design H_2S and RSC concentrations were calculated as a weighted average of the concentrations across all ventilated spaces. The design concentrations are summarized in **Table 6-9**.

Table 6-9: Overall System Design H2S and RSC Concentrations

Constituent	Overall System Design Concentration
H2S Avg (ppm)	10
H2S Peak (ppm)	36
Carbonyl Sulfide (ppb)	4
Dimethyl Sulfide (ppb)	11
Carbon Disulfide (ppb)	5
Dimethyl Disulfide (ppb)	31

3. **System Components**

- The biotower system will generally consist of the following:
  - (1) 10-ft diameter 25-ft height biotower vessel with synthetic media
  - (1) 20-hp blower/fan
  - (1) Recirculation pump
  - (1) Nutrient Feed Tank
  - (1) Electrical Panel
  - (1) Water Panel/Box *(Consolidates Water-Related Connections)*
  - *Interconnected duct work routed from each channel and enclosed space to the vessel*

7. Site/Civil

7.1 Floodplain and Elevation Assessment

The WWTP is located within Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) 12011C0545J. As depicted in **Figure 7-1**, the WWTP site lies within Zone X, outside of a Special Flood Hazard Area (SFHA).

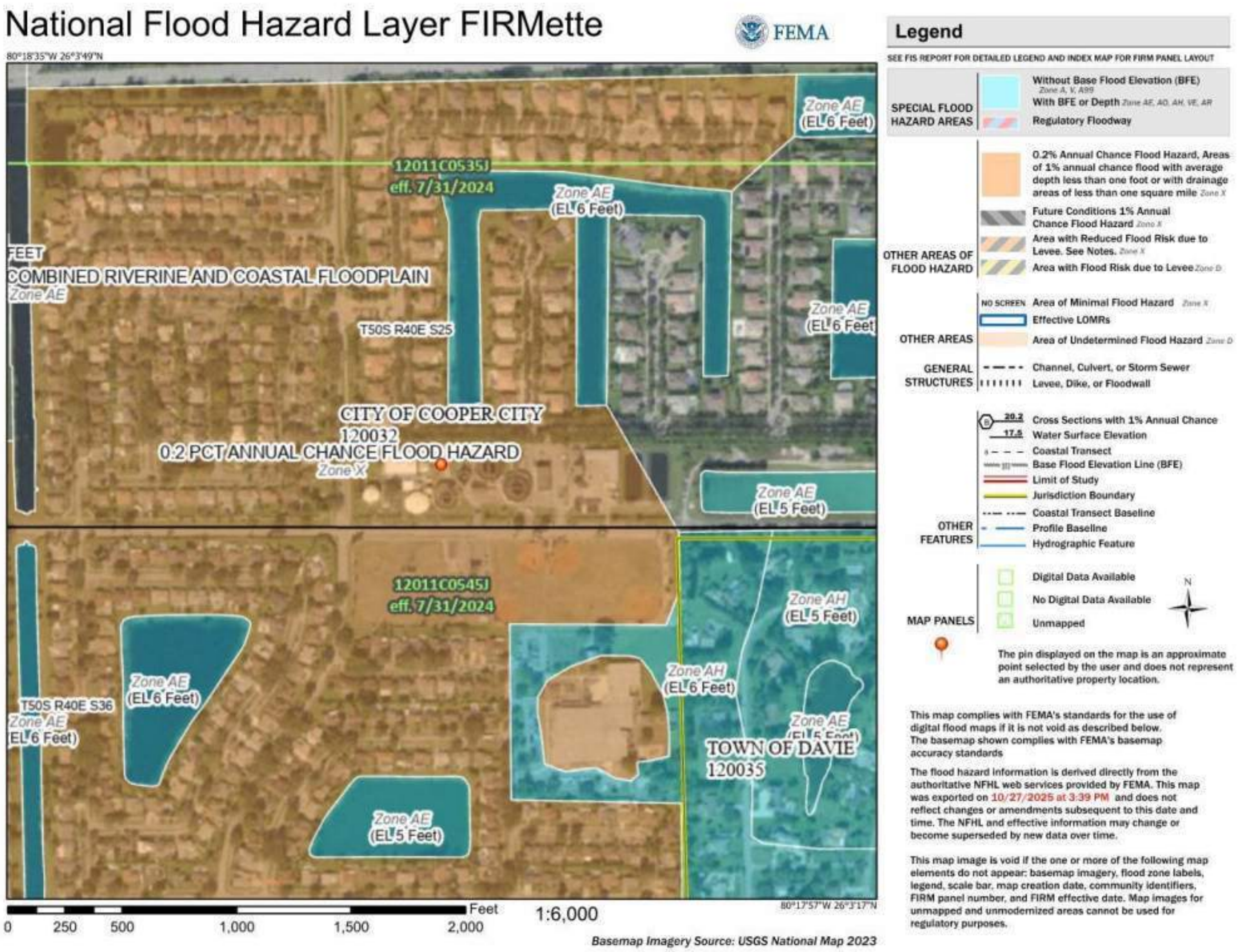


Figure 7-1: FEMA Flood Insurance Rate Map of the Cooper City WWTP Site

Although the Florida Building Code (FBC) does not impose mandatory flood elevation requirements for new buildings or substantial improvements in Zone X, the City Code of Ordinances requires compliance with ASCE 24. Per ASCE 24-24, Flood Design Class 3 facilities, including structures associated with sewage treatment plants, should be designed for a minimum design flood elevation 2 feet above the base flood elevation (BFE). The nearest 100-year flood elevation to the project site on the FEMA FIRM is 6.0 (NAVD 1988). Therefore, a design flood elevation of 8.0 feet (NAVD 1988) is recommended for compliance with ASCE 24-24. **Table 7-1** summarizes the flood elevation design parameters.

Table 7-1: Flood Hazard Design Considerations

Parameter	Value	Notes
FEMA Flood Map	12011C0545J	-
FEMA Base (100-Year Flood Elevation)	N/A	-
Flood Zone	ZONE X	-
BFE (NAVD 1988)	6.00	Nearest 100-year flood elevation to the project site on FIRM (NAVD 1988)
Flood Design Class	3	ASCE 24-24 Table 1-1
Crown of Road Elevation Adjacent to Project Site (NAVD 88)	7.00	SW 49th Street
Minimum Design Flood El. **Criterion** **Required Value (NAVD 88)**	BFE+2 8.0	ASCE 24-24 Tabe 1-2

7.2 Siting Analysis

The proposed structure will have an approximate footprint of 80 feet in length by 35 feet in width. The structure will be designed with an open-air configuration. The conceptual layout incorporates the major process components and channel arrangements consistent with those shown in **Appendix B**.

The preliminary location of the odor control system has also been incorporated. At this stage, the odor control system is conservatively estimated at 30 feet in length by 20 feet in width, based on a biotower system. This layout is preliminary and will be refined once the City confirms the preferred odor control technology, at which point the footprint will be updated to reflect the final configuration.

Two potential site locations for the headworks, and odor control system were evaluated, as depicted in **Figure 7-2**.

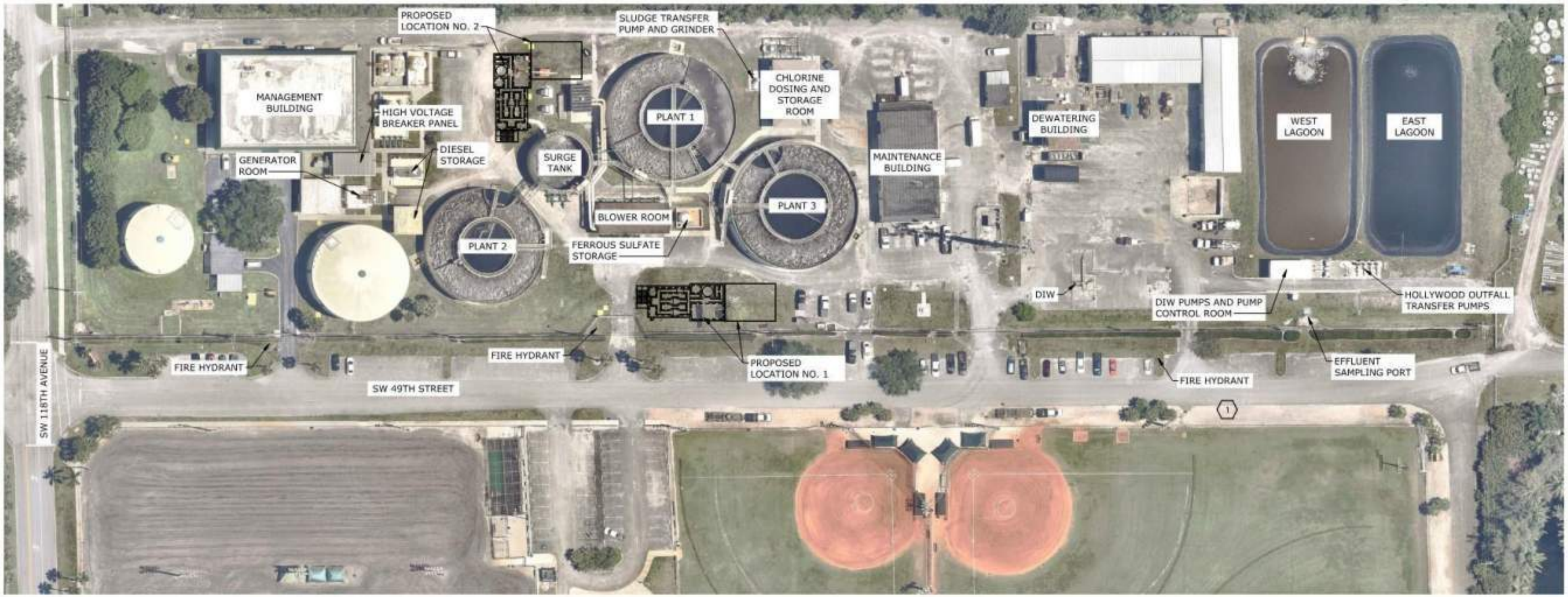


Figure 7-2: Headworks Facility Site Alternatives

As part of the siting analysis, the following decision-support criteria were applied to assess the suitability of the proposed locations.

1. **Length of New Pipe**: Refers to the length of force main required between the existing flow meter and headworks facility as well as the length required between the headworks facility and existing surge tank. Site alternatives requiring shorter lengths of pipe are generally preferred due to lower construction cost and reduced complexity.

2. **Constructability/Conflicts with Existing Infrastructure**: Adequate space must be available around the proposed headworks and odor control system to accommodate construction activities. If existing infrastructure is present within the selected area, it may require relocation, which could result in increased costs, extended construction duration, and additional implementation risk.

3. **Truck Access**: Reliable truck access to the headworks and odor control facilities is essential for operation, including the frequent removal of screenings and grit dumpsters, as well as ongoing maintenance and monitoring of the odor control system.

4. **Cost**: Includes costs associated with construction requirements, infrastructure relocation, and site-specific challenges that may arise during construction.

5. **Hydraulic Integration**: A centrally located headworks facility near the existing influent force main and surge tank is preferred to optimize hydraulic conditions and minimize headloss.

A qualitative comparison of the site locations was performed. Each location was rated using a numerical scale from 1 to 3, with “3’ the most favorable and “1” representing the least desirable condition. The results are summarized in **Table 7-2**.

Table 7-2: Site Location Matrix

Site Location	Upstream, Downstream Total FM Length (ft)	Constructability / Conflicts with Existing Infrastructure	Truck Access	Cost	Hydraulic Integration	Total Score
Alternative 1	2	3	2	3	3	**13**
Alternative 2	2	2	3	2	2	**11**

In addition to the criteria outlined above, proximity to adjacent properties and potential impacts to community stakeholders were also considered in the evaluation. In Alternative 1, the headworks facility is located adjacent to the south side of the property, across the street from public baseball fields. In Alternative 2, the facility is located closer to residential properties. Although the WWTP is situated within Cooper City’s U-1 zoning district, which does not specify a minimum setback distance, both alternatives will require approval from the City’s Development Review Committee (DRC). Therefore, Alternative 1 is recommended for the headworks facility based on the evaluation criteria outlined in Table 7-2 and the fact that both site alternatives will require approval through the City’s DRC process.

7.3 Yard Piping

Flow is currently conveyed to the surge tank through a 16-inch force main. Although as-built drawings for the influent force main were not available, it is assumed that the pipeline was constructed in 1986, concurrent with the installation of the surge tank. It is further assumed that the force main is ductile iron pipe (DIP), as this material comprises the majority of the City's force main infrastructure.

In addition to conveying the primary influent flow, the existing 16-inch DIP force main interconnects with other yard piping to provide operational flexibility, such as bypassing the surge tank when necessary. Influent will be directed to the proposed headworks facility via a new 30-inch DIP force main connected to the existing 16-inch DIP force main. To maintain recommended wastewater velocities within the 16-inch force main at the design PHF of 12.1 mgd, the existing 16-inch force main will likely require upsizing in the future. It is recommended that the City perform further evaluation of the existing collection system to confirm this requirement.

During construction, temporary bypass piping may be required to maintain uninterrupted raw flow to the surge tank and prevent disruptions to plant operations.

7.4 Storm Water Management

After site selection, the impervious area of the proposed development must be calculated, and associated permit requirements must be assessed. The drainage and stormwater management design shall comply with applicable laws, rules, and regulations of the following agencies, including but not limited to:

- City of Cooper City Community Development Department – Building Division
- Broward County Resilient Environment Department (BCRED)
- Florida Department of Environmental Protection – Stormwater Management
- Central Broward Water Control District - Stormwater Management

8. Structural

8.1 Introduction

This report section sets out the structural design criteria as it applies to the new Headworks structure. The design criteria includes the design philosophy, standards, and principles to be utilized for the design. The new headworks structure will be an above grade cast-in-place concrete structure.

8.2 Design Codes and References

The structural design will comply with the Eighth Edition of the 2023 Florida Building Code and applicable sections of the following referenced codes and standards:

- 2023 Florida Building Code, 8th Edition
- ACI 318-19: Building Code Requirements for Reinforced Concrete
- ACI 350-20: Code Requirements for Environmental Engineering Concrete Structures
- TMS 402-16 Code Requirements and Specifications for Masonry Structures
- Geotechnical Reports (report is pending)
- AISC 360-16: Specification for Structural Steel Buildings
- ASCE 7-22: Minimum Design Loads for Buildings and Other Structures
- ADM1-2020: Aluminum Design Manual Part 1, Specifications for Aluminum Structures, 2022

8.2.1 Design Loads

Design loads are based on the minimum values in 2023 Florida Building Code and ASCE 7-22 Minimum Design Loads for Buildings and Structures.

8.2.2 Dead Loads

Dead loads are those resulting from the weight of all permanent non-removable stationary construction, such as walls, floors, roofs, permanent partitions, framing, ceilings, cladding, and equipment bases. Dead loads will be as shown in **Table 8-1.**

Table 8-1: Summary of Design Criteria for Structural Dead Loads

Dead Loads	
Concrete	150 pounds per cubic foot (pcf)
Steel and Stainless Steel	490 pcf
Aluminum	169 pcf
Masonry, CMU, 8” Lightweight (Measured over the vertical surface of the wall)	77 psf (grouted solid) 50 psf (grouted at 32” oc) 38 psf (hollow)
Masonry, CMU, 12” Lightweight (Measured over the vertical surface of the wall)	118 psf (grouted solid) 73 psf (grouted at 32” oc) 55 psf (hollow)

8.2.3 Live Loads

Live loads technically include all nonpermanent loadings that can occur, in addition to the dead loads. Live loads are those resulting from occupancy, furnishings, and equipment. Unless deemed otherwise by the Florida Building Code for the specific project, Live Loads will be as shown in **Table 8-2**.

Table 8-2: Summary of Design Criteria for Live Loads

Area	Live Loads
Process Area Floors	300 psf
Working roofs	100 psf
Non-working roof loads	As per code, including wind
Corridors and stairways (Process Areas)	100 psf
Light storage	150 psf
Heavy storage	300 psf
Grated access platforms and walkways	150 psf
Catwalks and stairs at Grated Access Platforms	100 psf
Truck accessible areas	HS-20 loading per AASHTO

8.2.4 Equipment Loads

Operating floor slabs are designed for the load case resulting in the maximum stresses from the following live load conditions:

- 300 psf on the entire area, with no additional load from equipment included.

- 150 psf on the areas not directly under equipment, plus actual equipment loads.

Equipment loads obtained from manufacturers will be used when available, and other equipment loads will be assumed for the interim design milestones. These loads will be confirmed prior to completion of design. In addition to the equipment's operating weight (including any fluids contained), other loads due to moving parts, malfunction, and maintenance will be considered. Examples of these other loads include, but are not limited to:

- Loads from rotating equipment will include moment, torque, and lateral thrust.
- Loads from all equipment will include those loads induced for required maintenance, such as the removal of large components that may be temporarily placed on the adjacent areas of the structure.

The load option which creates the highest stress conditions shall control the design. The weight of equipment components, which could be placed on or transported across the structure, shall be located to create maximum stress conditions.

8.2.5 Piping Loads

For purposes of preliminary design, the live loads listed above will be considered to include the loads from process piping that are supported by the floor below the piping. On floors and roofs that will support process piping suspended below, an additional live load allowance will be included for the preliminary design. This allowance ranges from 25 psf to 100 psf, depending on the size and quantity of piping, anticipated to be suspended below the floor or roof.

Upon completion of piping layout, these allowances will be reviewed for accuracy with the actual pipe configurations for pipes less than 18 inches in diameter, and the actual concentrated loads from pipes 18 inches and larger will be considered.

8.2.6 Wind Loads

Wind loads on any above grade structures will be in accordance with the Florida Building Code and ASCE 7. Based on project location, ultimate wind speed would be 185 MPH (Ultimate), Risk Category IV, Exposure C.

8.2.7 Process Liquid Loads

Process liquid loads are based on a density of 63 and 70 pcf for water and sludge, respectively. For liquids in chemical storage tanks the actual density of the stored chemical will be used.

Static loads from process liquids and from chemicals are determined for the worst case of the following two conditions:

- Liquid surface at normal maximum operating level, or at the design overflow level where overflow is controlled (such as at overflow pipes or weirs).

- Liquid surface at the maximum level possible before liquid spills out of the structure (uncontrolled overflow conditions). For this condition, a 33 percent increase in allowable stresses is used, or the load factor for live loads (excluding the environmental durability factor of ACI 350 for concrete structures) is used if design is done by the ultimate strength method.

8.2.8 External Soil and Groundwater Loads

External soil and groundwater loads shall be based on data and recommendations to be furnished by the geotechnical engineer. A Geotechnical Investigation will be carried out during the design phase to obtain geotechnical information for the project site. For preliminary design purposes, density of soils may be assumed to be 120 pcf and density of aggregate fills may be assumed to be 135 pcf.

Static Loads from external soil and groundwater include the following:

- Soil Pressure "At-Rest" - The Soil Pressure "At-Rest" on the external walls is the static distribution of the soil based on the soil parameters and ground water levels.
- Surcharge Pressure Live Load - The Surcharge Pressure is based upon 300 psf live load on top of final grade.
- Surcharge Pressure of Soil/Foundations - The surcharge pressure of soil/foundations is based upon soil cover over tanks and spread footings of adjacent structures, where applicable
- Hydrostatic Pressure - The Hydrostatic Pressure on external walls is the static pressure distribution that the ground water level produces.

8.3 Loading Combinations

The load combinations listed in **Table 8-3** will be used in the design of structures. Additional load combinations that may produce a maximum stress condition will also be considered as appropriate. Combinations that clearly do not govern will not need to be fully analyzed.

Table 8-3: Summary of Structural Load Combinations for Design

Load Combinations
Dead Load + Construction (if unusual construction loads occur)
Dead Load + Live Load + Permanent Equipment Load
Dead Load + Normal Operating Equipment Load + Flood
Dead Load + Normal Operating Equipment Load + Wind
Dead load + live load + liquid (to overflow maximum). Assume no backfill in place.

8.4 Design Criteria – Structural Factors of Safety

Structures are designed based on determining the service loads and obtaining a suitable ratio of material or soil strength to these loads termed a safety factor. Either the service loads are multiplied by a suitable set of load factors and compared with the ultimate strength of the structural material or yield strength is divided by a suitable safety factor. Safety factors will be as shown in **Table 8-4**.

Table 8-4: Summary of Structural Safety Factors for Design

Safety Factors	
Overturning	1.5
Sliding	1.5
Buoyancy for Groundwater, Normal Groundwater Design Elevation	1.25
Buoyancy for Groundwater, 100-yr Flood Elev.	1.20
Buoyancy for Groundwater, 500-yr Flood Elev.	1.10

Forces resisting buoyancy shall be a combination of structure dead load (not including partitions and equipment), weight of soil directly over footings (considering buoyant soil weight).

8.5 Design Criteria – Serviceability Considerations

In addition to the design requirements in the Governing Code and specific material codes, additional design requirements to ensure serviceability of the structures will be considered. Serviceability of a structure is defined as its ability to behave under load in a manner that does not adversely affect the intended use of the structure or provide discomfort to its occupants. Deflections and vibrations are behaviors of a structure that do not necessarily cause damage to the structure itself, but if excessive it can cause minor damage or wear to equipment or discomfort and annoyance to occupants.

8.5.1 Deflections

Structures will be designed to limit deflections and vibrations as stated below such that the intended use and performance of the structures are not adversely affected. Maximum allowable deflections used for design are shown in **Table 8-5**. An asterisk (*) indicates the deflection limit applies to live loads only.

Table 8-5: Summary of Design Criteria for Structural Deflections

Structures	Maximum Allowable Deflections
Floors and Roofs, concrete	Per ACI 318 or 350, as applicable
Floors, structural metal framed *	L/360
Grated access platforms *	L/240
Roofs, structural metal framed *	L/240
Beams, Lintels, or Floors supporting masonry	L/600

8.6 Materials of Construction – Concrete

The minimum required amounts of reinforcing would be per ACI 318 and ACI 350 recommendations depending on the spacing of movement joints provided. Amounts of reinforcing used will be as required for structural strength, but not less than these minimum amounts. Maximum spacing of reinforcing bars will be 12 inches on center for environmental concrete structures designed per ACI 350, and 18 inches on-center for all other structures. A summary of the design criteria for structural concrete is shown in **Table 8-6**.

Table 8-6: Summary of Design Criteria for Structural Concrete

Concrete Class A1 – Structural: (All structures unless otherwise noted)	
28-day compressive strength (f'c)	4500 psi
Cementitious Materials	ASTM C150 Type II or Type IL plus mandatory addition of pozzolan such as Class F fly ash or Slag Cement.
Maximum water/cementitious materials ratio	0.42
Concrete Class B: (thrust blocks, encasements, concrete fill)	
28-day compressive strength (f'c)	3000 psi
Cementitious Materials	ASTM C150 Type II or Type IL. Addition of pozzolan such as Class F fly ash or Slag Cement is optional unless required to meet other durability requirements for concrete mix.
Maximum water/cementitious materials ratio	0.50
Reinforcing Steel	
Deformed reinforcing bars (unless otherwise noted)	ASTM A615 Grade 60
Welded wire fabric	ASTM A185

8.7 Materials of Construction – Structural Metals

Structural steel will be designed in accordance with AISC 360 Specification for Structural Steel Buildings – Allowable Stress Design or Load Resistance Factor Design, with modifications as stated in the governing code. Steel decking will be designed in accordance with the Steel Deck Institute (SDI) Design Manual. Materials for use as structural metals will be specified to have the minimum properties shown in **Table 8-7.**

Table 8-7: Summary of Design Criteria for Structural Metals

Minimum Properties for Structural Metals	
Structural Steel W shapes	ASTM A992
Structural Steel HP shapes	ASTM A572, Grade 50
Structural Steel M, S, C and MC shapes, angles, plates, and bars	ASTM A36
Hollow Structural Steel (HSS)	ASTM A500, Grade C
Structural Steel pipe	ASTM A53, Type E or S, Grade B
High strength Steel bolts	ASTM F3125, Grade 120 or 150
Steel anchor bolts and threaded rods	ASTM F1554 Grade 36
SS shapes	ASTM A276, Type 316L
SS plates and sheet	ASTM A167 or A666 Grade A, Type 304L or 316L
SS bolts	ASTM F593, Type 304 or 316

8.8 Materials of Construction – Masonry

Masonry will be designed in accordance with ACI 530 and ACI 530.1. Materials for use in masonry design are specified in **Table 8-8**.

Table 8-8: Minimum Properties for Masonry Design

Minimum Properties for Masonry Design	
Compressive strength of masonry (f'm)	2000 psi
Concrete masonry units	ASTM C90 Type I
Compressive strength of masonry units	2000 psi
Mortar	ASTM C270 Type S
Grout	ASTM C476
Compressive strength of grout	2000 psi
Deformed reinforcing bars	ASTM A615, Grade 60
Horizontal joint reinforcing	ASTM A82

Minimum required amounts of reinforcing for seismic loads shall be provided in accordance with ACI 530 and ACI 530.1. Amounts of reinforcing used will be as required for structural strength, but not less than these minimum amounts. All cells containing reinforcing will be grouted. Maximum spacing of horizontal joint reinforcing will be 16 inches on-center vertically.

8.9 Materials of Construction – Finishes

Finishes on concrete surfaces will be provided in accordance with ACI 301, and as is appropriate for their use and exposure. Exterior exposed walls above grade will receive a grout-cleaned finish. Floors in areas that are likely to be intermittently wet due to washdown or maintenance of equipment will receive a floated finish.

All steel framing shall be either galvanized or painted in accordance with specifications.

8.10 Safety Provisions

Structural design shall also include stipulations to ensure safety provisions are considered in design and construction, as well as service of the structures. Design shall include mandatory compliance with the requirements of the Occupational Safety and Health Administration (OSHA) Regulations (Standards – 29 CFR) including Part 1910 – Occupational Safety and Health Standards and Part 1926 – Safety and Health Standards for Construction. While construction safety provisions are the exclusive responsibility of the Contractor, the design and specifications will mandate adherence to applicable safety requirements and provide consideration of these requirements in the design documents. Adherence to these requirements shall also be implemented in any site access required to accommodate the design including field visits and condition assessments. Among the items that will be considered include use of personal protective and life safety equipment, fall protection requirements, ladder installation and use, underground construction and excavation safety including caissons and cofferdam construction, blasting and use of explosives, and confined space entry, etc. The Contract Documents and Specifications shall include provisions for safety related items including mandatory compliance with OSHA regulations.

8.11 Specialty Design Guidelines

This document covers the basic components and guidelines for structural analysis and design. Specialty design guidelines for certain applications have been written as more comprehensive guidelines for specialty design and construction. Among the specialty design guidelines currently available for specific applications include the following:

- Adhesive Anchor and Dowel Structural Design Guide
- Cold Formed Steel Trusses
- Concrete Coatings at Covered Wastewater Treatment Processes
- FRP Odor Control Duct Supports
- Metal Building Design Guide
- Pipe Supports
- Steel Joist Guide
- Structural Condition Assessment – General
- Support of Dynamic Loads

9. Architectural

9.1 General

The following sections outline the approaches to the architectural design for the proposed Headworks facility. The section includes building code compliance related to occupancy, type of construction, interior and exterior finishes, accessibility, exterior wall construction, roof construction, and exterior appearance.

9.2 Building Code Requirements

9.2.1 Governing Code

The design will comply with the 2023 Florida Building Code, 8TH Edition and applicable sections of the following referenced codes and standards:

- 2023 Florida Building Code, 8th Edition
- 2023 Florida Fire Prevention Code, 8th Edition:
    - 2023 NFPA 1 Fire Code, 8th Edition
    - 2023 NFPA 101 Life Safety Code, 8th Edition
- 2024 NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities
- ASCE 7-22: Minimum Design Loads for Buildings and Other Structures

9.2.2 Architectural Code Requirements

The primary occupancy and use of the proposed structure will be Low Hazard Factory Industrial (F-1). Occupancy Classification and Construction Type will be governed by Chapters 3 – Use and Occupancy Classification and Chapter 6 – Types of Construction.

9.2.3 Supplemental Codes, Standards and References

Additional codes, standards, and references will be used for the architectural modifications including, but not limited to the following:

- OSHA Standards for New Building Construction
- 29 CFR 1910 – Occupational Safety and Health Standards
- NFPA 10 – Portable Fire Extinguishers
- Cooper City Code of Ordinances

- 2023 Florida Building Code, Building - Chapter 16 Section 1609 - Wind Loads

9.3 Architectural Design Concept of Proposed Work

This section sets out the architectural design criteria as it applies to the new headworks. The design criteria include the design, standards, and sources to be utilized for the project. The building will be constructed of non-combustible materials primarily consisting of concrete, masonry, or steel. This type of construction is considered non-combustible Type I or Type II construction.

9.3.1 Headworks Facility

The exterior of the building will be concrete masonry units, painted to match nearby buildings.

The building will be designed in accordance with the codes to provide proper emergency exits from the building. The doors will be of size as required for equipment movement. Exits will open directly to the exterior. Illuminated exit signage and emergency lighting will be placed throughout the structure. Travel distance to the nearest exit from any point in the building will not exceed 75 feet and will consider travel clearances around fixed pieces of equipment.

Fire extinguishers will be placed in accordance with NFPA 10.

Interior CMU and concrete will be filled and coated with acrylic coatings. Doors will receive epoxy with an aliphatic or acrylic polyurethane topcoat. The building roof will serve as an outdoor equipment platform and will be sloped for stormwater drainage. A slip resistant pedestrian coating on the top deck, adequate clearance space around roof top equipment, and fall protection, will ensure a safe workspace.

10. Electrical

10.1 Design Codes and References

The electrical design will comply with the applicable sections of the following referenced codes and standards:

- NFPA 70 – National Electrical Code, 2020 Edition
- NFPA 70E – Standard for Electrical Safety in the Workplace, 2024 Edition
- NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2020 Edition
- Florida Building Code, 8th Edition (2023)

10.2 Existing Electrical System

Existing power for the Headworks area is available from 480V, 800A MCCs 3MCC1 and 3MCC2 located in the Blower Building. Both MCCs currently serve existing process equipment throughout the facility. The MCCs do not include a tie breaker between each other.

Load calculations were performed to evaluate whether the existing MCCs could support the new Headworks Structure, Odor Control System, and future Grit Removal System loads. Results determined that MCC 3MCC1 does not have sufficient capacity to serve the new electrical loads. Existing MCC 3MCC2 will remain available to serve as the backup power source for the new system.

10.3 Proposed Electrical Equipment

Primary power for the new Headworks Structure, Odor Control System, and future Grit Removal System is proposed to be supplied through a new utility service. Existing MCC 3MCC2 in the Blower Building will serve as the backup power source through concrete-encased ductbanks.

A designated electrical equipment area within the Headworks Building will be provided to house the primary electrical distribution equipment. This equipment will consist of the following:

1. Manual transfer switch (MTS) to allow source selection between the new utility service and MCC 3MCC2

- 480V panelboard
- Dry-type transformer
- 208/120V panelboard
- Screening System Control Panel
- Other miscellaneous equipment such as receptacles and lighting controls

The distribution equipment listed above will supply power to the Headworks Structure, Odor Control System, and future Grit Removal System loads. Locating the equipment within the designated electrical area allows the main distribution equipment to be centralized while maintaining separation from hazardous process areas. The Headworks Structure is classified as a hazardous location in accordance with NFPA 820. Local control stations will be proposed within sight of the process equipment and will have enclosures suitable for the location in which they are installed.

The Grit Removal System is currently not in the scope of this project. However, the electrical distribution equipment will be designed with capacity for the connection of this future load. In addition, enough space will be allocated for the installation of the future control panel, and empty conduits will be installed from the distribution equipment to it.

10.4 Lighting Approach

Lighting for the Headworks Structure and Odor Control Area will be designed to provide safe and adequate illumination for all work areas, access platforms, and equipment locations. Photometric calculations will be performed to determine appropriate fixture types, mounting heights, and spacing to achieve uniform lighting levels in accordance with applicable industry standards.

The lighting system will utilize a telescoping safety light pole equal to the V65 Series by Crouse-Hinds. This pole allows luminaires to be safely lowered to a working height of 5 feet, eliminating the need for lifts or specialized equipment. The V65 Series pole is rated for outdoors and hazardous locations when installed with a hazardous location-rated light fixture.

The light fixtures will be controlled via a lighting contactor installed within the electrical equipment area.

11. Instrumentation and Control

11.1 System Requirements/Design Criteria

The purpose of this section is to present the preliminary engineering information and design concepts for the proposed headworks facility instrumentation and control (I&C) system. The I&C will include process instrumentation, programmable logic controllers (PLCs), signal interfaces, networks, computer systems, and software that collectively facilitate real-time monitoring and control of plant processes and equipment, remote manual and automatic control of these processes and equipment, data gathering, storage, retrieval, and reporting function.

The design requirements will include preliminary instrument selection to accommodate the mechanical process system and associate ancillary equipment to facilitate operation of the facility. The I&C design will follow the Cooper City standards where applicable. The I&C design discussed in this section is limited to the headworks facility and does not include the I&C systems required at other areas of the plant. Proposed network architecture and HMI/SCADA system information along with Process and Instrumentation Drawings (P&IDs) will be provided as part of the design. Preliminary I&C drawings are included in **Appendix B** and referenced herein.

11.1.1 Proposed System

The headworks facility will be provided with a control system capable of fully automating the provided systems. The preliminary control narratives for each major process are included here below. To accomplish the described control approach, automatic controls will be implemented using PLCs with control settings adjustable from the SCADA software. Remote-manual control from the SCADA software will be provided where appropriate. Hardwired local control interlocks will be provided where needed to protect personnel and equipment (e.g., emergency stop pushbuttons, low suction pressure switches to stop pumps). These hardwired controls will stop the equipment using electromechanical relays in the motor control circuitry regardless of whether the equipment is being controlled locally or by the PLC. Local manual controls will be provided for all equipment to allow operation of the plant in an emergency if the automatic controls are not available for any reason. Wherever possible, operation of the plant processes and equipment will be fail-safe to ensure both personnel safety and process continuity in the event of equipment failure.

The Headworks system will consist of two mechanical bar screens controlled from a vendor-supplied control panel (VCP) equipped with a PLC and Operator Interface Unit (OIU), as well as a manual emergency bypass bar screen. A new Main Control Panel (MCP) will also be provided to control and monitor the overall headworks operation. The MCP will communicate with the vendor-supplied bar screen control panel via fiber-optic Ethernet communication for integration into the existing facility SCADA system.

Drawing I-04 illustrates the future grit removal system, consisting of a grit removal unit, grit pump, and grit washing/dewatering unit. This system is not included in the current project scope and is shown for reference only to illustrate the complete headworks process and facilitate future integration with the SCADA system.

11.1.2 SCADA System Architecture

A new MCP, equipped with a PLC and OIU, will be provided to control the headworks system. The new MCP will be connected to the existing WWTP SCADA network via fiber optic Ethernet communication as shown on Drawing I-02. The new bar screen system will include a VCP with its own PLC that performs all local automatic control of the bar screens and associated equipment. The VCP will communicate with the MCP via fiber-optic Ethernet for monitoring and control by the plant SCADA. A proposed network diagram illustrating the recommended arrangement of the vendor provided panels and the new Headworks control panel is provided in Drawing I-02. No enhancements or changes will be performed to other portions of the SCADA, Security, and Business as the scope is strictly limited to the new headwork systems.

11.1.3 Programable Logic Controllers

The PLCs will perform all real-time monitoring, control, and interlocking functions for the Headworks system. The new Headworks system will include:

- One (1) Main PLC, located in the Blower Electrical Building, housed within the new MCP.
- One (1) Vendor PLC, furnished within the VCP for the bar screen system.

The Main PLC will be provided under this project as part of the Headworks Control System and will coordinate overall operation, interlocks, and communication with the facility's SCADA network. The Vendor PLC within the VCP will provide full automatic control of the bar screens and compactors, including all logic and protections necessary for reliable operation.

The vendor-supplied PLCs will communicate with the Main PLC via fiber-optic Ethernet for supervisory monitoring and control. This architecture allows the vendor to retain full responsibility for the functionality and warranty of their packaged system, while still providing complete visibility and control integration through the facility SCADA system.

The following vendor-supplied PLCs are currently anticipated:

- Bar Screen System PLC

11.2 Process Control Strategy Narrative

11.2.1 Screenings Conveyance, Washing, Compacting & Storage Equipment

Under normal operations, the screening equipment will be operated automatically. The screens can be operated using one of the following modes of operation:

- Differential Level Mode: The operator sets a differential level setpoint for the screens either via the Screen System Main Control Panel or SCADA. Once the differential level is reached, the screen will be called to run. As the screen operates, and the water level decreases to the preset stop level, a cycle timer will continue to run the screen for a short duration to ensure a clean screening surface. The water elevation/level set points shall be operator adjustable.

- Timer Mode: The operator sets on and off adjustable timer setpoints, which repeatedly start and stop the screens at adjustable intervals for preset periods of time. High differential will override the timer and turn on the screen.

The washer/compactor equipment will also normally be operated automatically. After the screens have run for a pre-defined duration of time, the washers/compactors and sluicing water will be called to run based on a pre-defined sequence of operation. The sluicing water and washers/compactors will be automatically called to operate during and after the screens runs. When a screen is called to stop running, the screen motor will stop, but the washing compactor and its wash water will continue to run for a short, operator-adjustable duration, after which the wash water solenoid valve will close, and the compactor will continue to run for a short operator-adjustable duration before powering down. The washers/compactors will be configured to automatically alternate between each washer/compactor as required to keep cycling the equipment at a pre-defined interval recommended by the manufacturer to prevent plugging of the equipment.

The headworks facility includes an emergency bypass channel equipped with a manually cleaned trash rack. This channel provides hydraulic relief in the event of extreme influent levels or if both mechanical bar screens are out of service. If the upstream influent level exceeds the bypass high-level setpoint, a portion of the unscreened wastewater will overtop the static weir and flow through the bypass channel, thereby maintaining plant hydraulic capacity. The emergency bypass does not include any powered or automated components and is intended solely for emergency conditions or maintenance periods.

11.2.2 Influent Flow Measurement

The City currently utilizes an electromagnetic flow meter (magnetic flow meter) on the existing influent force main. It is recommended that a new magnetic flow meter be installed on the influent force main associated with the new proposed headworks.

For wastewater applications, magnetic flow meters generally require a minimum flow velocity of 2 feet per second and full-pipe flow. To ensure accurate measurement, a straight run of approximately five pipe diameters upstream and three pipe diameters downstream is typically recommended.

12. Maintenance of Plant Operations

The new headworks facility design shall incorporate provisions to minimize operational impact to the existing WWTP. Project Drawings and Specifications shall clearly define Maintenance of Plant Operations requirements, including allowable durations for service interruptions related to but not limited to the following activities:

- Startup and testing of the new headworks and odor control facilities
- Tie-in for influent and screened/degritted influent piping
- SCADA system integration
- Electrical power connection for new facilities

13. Regulatory Requirements

This section outlines permits and agencies that may be applicable to design, construction, and project closeout, including, but not limited to, those discussed in the following section.

13.1 Introduction

Permits will be required from the following agencies:

1. FDEP – Domestic Wastewater Program
2. FDEP – Source & Drinking Water Program
3. FDEP –NPDES Stormwater Program
4. City of Cooper City Community Development Department – Building Division
5. City of Cooper City Community Development Department/Planning and Zoning Division – General Application
6. Broward County Resilient Environment Department (BCRED)
7. Broward County Urban Planning Division / Environmental Review
8. Central Broward Water Control District (CBWCD)
9. South Florida Water Management District (SFWMD)

13.2 Design Permitting Requirements

Permits applications that must be reviewed and/or completed during design include the following:

1. **FDEP – Domestic Wastewater Program:** Required for construction or modification of domestic wastewater facilities.
    - FDEP Form 62-620.910(1) – Wastewater Facility or Activity Permit Application Form 1
    - FDEP Form 62-620.910(2) – Wastewater Permit Application Form 2A for Domestic Wastewater Facilities
2. **FDEP – Domestic Wastewater Collection and Transmission System Permitting Program:** Required for construction, modification, operation, and placement into service of domestic wastewater collection and transmission systems.
    - Form 62-604.300(3)(a) - Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System
3. **FDEP – Source & Drinking Water Program:** Required for construction or modification of water main extensions for Public Water Systems.
    - FDEP Form 62-555.900(7) – Notice of Intent to Use the General Permit

4. **FDEP –NPDES Stormwater Program:** Required if land disturbance equals or exceeds 1 acre or triggers NPDES construction stormwater requirements.
   - FDEP Form 62-621.300(4)(a) – NPDES Generic Permit Application Form for Stormwater Discharge from Large and Small Construction Activities
   - FDEP Form 62-621.300(4)(b) – Notice of Intent to Use NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities
5. **City of Cooper City Community Development Department – Building Division:** Required for structural construction of the new building.
   - Building Permit Application – Preliminary Plan Review
   - Site Development Permit
6. **City of Cooper City Community Development Department/Planning and Zoning Division**
   - General Application
   - Development Review Committee (DRC) Review
7. **Broward County Urban Planning Division / Environmental Review:** Required for environmental compliance and general site impacts.
   - Development and Environmental Review Approval Permit Application
8. **Broward County Resilient Environment Department (BCRED) – Domestic Wastewater Program:** Required for review, permit, and inspection of domestic wastewater collection and transmission systems.
   - Broward County Wastewater Construction Application
9. **CBWCD:** Required for projects affecting CBWCD easements, canals, or drainage facilities.
   - Modification of Existing Stormwater Management Permit
10. **SFWMD Dewatering General Permit by Rule**: May be required for dewatering and is dependent on duration, pumping rate, total volume, and discharge location.
    - Short-Term Dewatering (Rule 40E-2.061, F.A.C.)

13.3 Construction Permitting Requirements

Permits that must be procured during construction include the following:

1. **FDEP – Domestic Wastewater Program**
   - FDEP Domestic Wastewater Permit
2. **FDEP – NPDES Stormwater Program**
   - FDEP NPDES Stormwater Permit

3. **City of Cooper City Community Development Department – Building Division**
    - City of Cooper City Building Permit
4. **Broward County Urban Planning Division / Environmental Review**
    - Development and Environmental Review Permit Approval
5. **CBWCD**
    - Modification of Existing Stormwater Management Permit
6. **SFWMD**
    - Dewatering Permit

13.4 Project Closeout Requirements

Project closeout permits, certifications, and/or documents required include the following:

1. **FDEP – Domestic Wastewater Program**
    - Form 62-620.910(12) – Notification of Completion of Construction for Wastewater Facilities or Activities
    - Form 62-620.910(13) – Notification of Availability of Record Drawings and Final Operations and Maintenance Manuals
2. **FDEP – Domestic Wastewater Collection and Transmission System Permitting Program:**
    - Form 62-604.300(8)(b) – Domestic Wastewater Collection/Transmission System Certification of Completion of Construction
3. **FDEP – Source & Drinking Water Program**
    - Form 62-555.900(9) – Certification of Construction Completion and Request for Clearance to Place Permitted Public Water System Components into Operations
4. **FDEP – NPDES Stormwater Program**
    - Form 62-621.300(6) – NPDES Stormwater Notice of Termination
5. **City of Cooper City Community Development Department – Building Division**
    - Building Completion / Final Inspection Certification
    - Final Engineering Approval / As-Built Certification
6. **CBWCD**
    - Project Certification and As-Builts

14. Implementation Schedule

14.1 Introduction

An estimated project schedule has been developed to illustrate the duration of the design, procurement, and construction phases. The estimated project schedule will be updated during detailed design. Project milestones are provided in **Table 14-1**.

Table 14-1: Estimated Overall Project Schedule

Task Description	Duration (months)	Start	Finish
Design Phase	6	January 2026	June 2026
Permitting	4	April 2026	July 2026
Bidding and Award Phase	5	July 2026	December 2026
Construction Phase	24	December 2026	December 2028

14.2 Detailed Construction Schedule

The Construction Phase includes the construction, testing, and startup of the new headworks and odor control system. Within the Construction Phase, the contractor will have 120 days to obtain permits, including permits for temporary facilities (if applicable). As presented in **Table 14-2**, the construction duration is anticipated to be up to 22 months from issuance of the Notice to Proceed (including submittal review time and material procurement) to Substantial Completion. It is anticipated that the duration between Substantial Completion and Final Completion will be 2 months.

Table 14-2: Estimated Construction Schedule

Task Description	Substantial Completion (months)	Final Completion (months)	Total Duration (months)
Construction Phase[1]	22	2	24

[1]A detailed Gantt Chart is provided in **Appendix E.**

15. Opinion of Probable Construction Costs

An Opinion of Probable Construction Cost (OPCC) has been prepared based upon the preliminary design report information described herein. The expected range of accuracy of this estimate is +50 percent to -30 percent. The final cost of the project will depend on actual labor and material cost, competitive market conditions, final project scope, implementation schedule, and other variable conditions.

As a result, final project costs may vary from the opinions presented herein. Cost opinions are inclusive of construction costs, estimated allowance for permit application fees, and a 30 percent contingency for. Costs are based upon year 2026 dollars and do not include escalation for inflation. **Table 15-1** presents the OPCC for Cooper City Wastewater Treatment Facility Headworks Design – Phase I.

Table 16-1: Opinion of Probable Construction Costs

Description	Estimated Cost
Mobilization and Demobilization	$340,000
Structural	$1,740,000
Civil/Site Work	$890,000
Mechanical Equipment and Instrumentation and Controls	$2,620,000
Electrical	$880,000
Subtotal	$6,500,000
Contingency (30%)	$1,950,000
Permit Fees (10%)	$650,000
Total Construction Cost	$9,100,000
High End (+50%)	$13,650,000
Low End (-30%)	$6,370,000

Appendix A: Preliminary Hydraulic Model Results

HAZENPRO - Hydraulic Profile Calculations

Owner	City of Cooper City
Project	Cooper City WWTP Headworks PER
Hydraulic Profile	Headworks Influent Force Main Tie-in --> Headworks --> Surge Tank
Conditions	Screen: Center Flow Band Screen
	Grit Removal: Stacked Multi-Tray System (Removal of 95% of grit 75 micron and larger)

		Minimum Flow	Average Daily Flow	TMADF	Peak Flow
Plant Influent Flow	**mgd**	1.7	3.3	4.3	12.1
Downstream Controlling WSEL		**28.30**	**28.30**	**28.30**	**28.30**

SG-1 Surge Tank Coarse Manual Bar Screen

Module BSCR *Bar Screen*

Invert El =	26.3	ft	Q (mgd) =	1.70	3.30	4.27	12.10
Screen Width =	3	ft	Depth ds (ft) =	2.00	2.00	2.00	2.00
Bar Spacing =	0.75	in	V ds (fps) =	0.44	0.85	1.10	3.12
Bar Thkness =	0.25	in	V bars (fps) =	0.78	1.51	1.96	5.55
k =	1.5		HL (ft) =	0.01	0.04	0.06	0.49
% Blind =	25%						
	EGL	**= HGL**		**28.31**	**28.34**	**28.36**	**28.79**

EF-1 Effluent Piping

Module PIP1 *Piping by Hazen-Williams Equation*

Diameter =	**30.00**	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	285	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =	130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's : Exit (1)	1		Hf (ft) =	0.01	0.04	0.06	0.43
Entry (1)	0.5		Hm (ft) =	0.02	0.09	0.16	1.26
90-deg Bend (4)	1.2		HL (ft) =	0.04	0.13	0.22	1.69
Tee (1) - Flow Branch	0.75						
Tee (4) - Flow Straight	1.2						
Plug Valve (1)	0.92						
Sum K =	5.57						
EGL	**= HGL**			**28.35**	**28.47**	**28.58**	**30.48**

HW-1 Headworks Effluent Box

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.70	3.30	4.27	12.10
Width =	12.50	ft	Backwater (ft) =	-1.15	-1.03	-0.92	0.98
Length =	2.00	ft	Yc (ft) =	0.11	0.17	0.21	0.41
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	0.11	0.17	0.21	0.98
			Area (sf) =	1.39	2.17	2.57	12.24
			V (fps) =	1.89	2.36	2.57	1.53
			Sf (ft/ft) =	0.0069	0.0061	0.0058	0.0003
Upstream Conditions			Upstrm Depth (ft) =	0.14	0.21	0.24	0.98
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	1.79	2.63	3.06	12.25
			V (fps) =	1.47	1.94	2.16	1.53
			Sf (ft/ft)=	0.0030	0.0032	0.0033	0.0003
			Hm (ft) =	0.02	0.03	0.04	0.02
EGL	**= HGL**			**29.69**	**29.80**	**29.85**	**30.53**

HW-2 Weir Gate to Effluent Channel

Module WS — *Sharp Crested Weir*

Weir Elev =	31.03 ft	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	6 ft	Nominal H_w (ft) =	0.26	0.40	0.48	0.96
C_w =	3.3	Effective Weir Length =	5.95	5.92	5.90	5.81
No. of End Contractions=	2	H_w (ft) =	0.26	0.41	0.49	0.98
		Weir Submergence (H_2)=	0.00	0.00	0.00	0.00
		<If Subm> H_1 (ft) =	0.40	0.66	0.83	2.21
		<If Subm> Iterate 0 >>>	0.000	0.000	0.000	0.000
		Check >>>	Not Subm	Not Subm	Not Subm	Not Subm
	EGL = HGL		**31.30**	**31.44**	**31.52**	**32.02**

HW-3 Headworks Effluent Channel after Grit Chamber

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50	Q (mgd) =	1.70	3.30	4.27	12.10
Width =	11.00 ft	Backwater (ft) =	1.80	1.94	2.02	2.52
Length =	2.00 ft	Yc (ft) =	0.12	0.19	0.22	0.45
Manning n =	0.015	Yn (ft) =				
Slope =	0.0000 ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50	Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions		Actual Depth (ft) =	1.80	1.94	2.02	2.52
		Area (sf) =	19.76	21.38	22.23	27.71
		V (fps) =	0.13	0.24	0.30	0.68
		Sf (ft/ft) =	0.0000	0.0000	0.0000	0.0000
Upstream Conditions		Upstrm Depth (ft) =	1.80	1.94	2.02	2.52
		Iterate 0 >>>	0.000	-0.001	0.000	0.000
		Check >>>	ok	ok	ok	ok
		Area (sf) =	19.76	21.38	22.23	27.71
		V (fps) =	0.13	0.24	0.30	0.68
		Sf (ft/ft)=	0.0000	0.0000	0.0000	0.0000
		Hm (ft) =	0.00	0.00	0.00	0.00
	EGL = HGL		**31.30**	**31.44**	**31.52**	**32.03**

HW-4 Grit Removal System Effluent Weir

Module WS — *Sharp Crested Weir*

Weir Elev =	32.53 ft	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	11 ft	Nominal H_w (ft) =	0.17	0.27	0.32	0.64
C_w =	3.3	Effective Weir Length =	10.97	10.95	10.94	10.87
No. of End Contractions=	2	H_w (ft) =	0.17	0.27	0.32	0.65
		Weir Submergence (H_2)=	0.00	0.00	0.00	0.00
		<If Subm> H_1 (ft) =	0.53	0.83	0.98	1.74
		<If Subm> Iterate 0 >>>	0.000	0.000	0.000	0.000
		Check >>>	Not Subm	Not Subm	Not Subm	Not Subm
	EGL = HGL		**32.70**	**32.80**	**32.85**	**33.18**

HW-5 Grit Removal System (Stacked Tray)

Module MFR — *Manufacturer Head Loss Info*

Reference Q =	12.1 mgd	Q (mgd) =	1.7	3.3	4.3	12.1
Reference HL =	1 ft	HL (ft) =	0.05	0.14	0.21	1.00
Exponent Factor =	1.5					
	EGL = HGL		**32.76**	**32.94**	**33.06**	**34.18**

HW-6 Grit Chamber Influent Channel

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	2.00	ft	Backwater (ft) =	3.26	3.44	3.56	4.68
Length =	9.00	ft	Yc (ft) =	0.38	0.59	0.70	1.40
Manning n =	0.015		Yn (ft) =	0.06	0.08	0.10	0.18
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.11	0.17	0.19	0.37
Downstream Conditions			Actual Depth (ft) =	3.26	3.44	3.56	4.68
			Area (sf) =	6.51	6.89	7.12	9.36
			V (fps) =	0.40	0.74	0.93	2.00
			Sf (ft/ft) =	0.0000	0.0001	0.0001	0.0005
Upstream Conditions			Upstrm Depth (ft) =	3.26	3.44	3.56	4.68
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	6.51	6.89	7.13	9.37
			V (fps) =	0.40	0.74	0.93	2.00
			Sf (ft/ft)=	0.0000	0.0001	0.0001	0.0005
			Hm (ft) =	0.00	0.00	0.01	0.03
	EGL = HGL			**32.76**	**32.96**	**33.08**	**34.28**

HW-7 Grit Chamber Influent Channel Isolation Gate

Module FSPR *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft	Q (mgd) =	1.7	3.3	4.3	12.1
Height =	8.25	ft	Backwater (ft) =	3.26	3.46	3.58	4.78
Width=	2	ft		Free Surface	Free Surface	Free Surface	Free Surface
Length =	12	in	Yc (ft) =	0.38	0.59	0.70	1.40
			Act. Depth (ft) =	3.26	3.46	3.58	4.78
			Wetted P (ft) =	8.52	8.91	9.17	11.55
			L/P =	0.12	0.11	0.11	0.09
			No. Suppressed Contr (0-3) =	0	0	0	0
			C_d =	0.67	0.66	0.66	0.65
			Area (sf) =	6.52	6.91	7.17	9.55
			V (fps) =	0.40	0.74	0.92	1.96
			HL (ft) =	0.01	0.02	0.03	0.14
	EGL = HGL			**32.77**	**32.98**	**33.11**	**34.42**

HW-8 Common Screen Effluent Channel

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	2.00	ft	Backwater (ft) =	3.27	3.48	3.61	4.92
Length =	16.67	ft	Yc (ft) =	0.38	0.59	0.70	1.40
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	3.27	3.48	3.61	4.92
			Area (sf) =	6.53	6.95	7.23	9.83
			V (fps) =	0.40	0.73	0.91	1.90
			Sf (ft/ft) =	0.0000	0.0001	0.0001	0.0005
Upstream Conditions			Upstrm Depth (ft) =	3.27	3.48	3.61	4.93
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	6.53	6.95	7.23	9.85
			V (fps) =	0.40	0.73	0.91	1.90
			Sf (ft/ft)=	0.0000	0.0001	0.0001	0.0005
			Hm (ft) =	0.00	0.00	0.01	0.03
	EGL = HGL			**32.77**	**32.99**	**33.13**	**34.51**

HW-9 Screen Channel Effluent Isolation Gate

Module FSPR — *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft
Height =	8.25	ft
Width=	2	ft
Length =	12	in

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	3.27	3.49	3.63	5.01
	Free Surface	Free Surface	Free Surface	Free Surface
Yc (ft) =	0.38	0.59	0.70	1.40
Act. Depth (ft) =	3.27	3.49	3.63	5.01
Wetted P (ft) =	8.54	8.98	9.27	12.02
L/P =	0.12	0.11	0.11	0.08
No. Suppressed Contr (0-3) =	0	0	0	0
C_d =	0.67	0.66	0.66	0.65
Area (sf) =	6.54	6.98	7.27	10.02
V (fps) =	0.40	0.73	0.91	1.87
HL (ft) =	0.01	0.02	0.03	0.13
EGL = HGL	**32.78**	**33.01**	**33.16**	**34.64**

HW-10 Screen Channel (Downstream of Screen)

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	7.50	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	3.28	3.51	3.66	5.14
Yc (ft) =	0.38	0.59	0.70	1.40
Yn (ft) =	1.17	1.50	2.50	1.54
Iterate 0 >>>	N/A	N/A	N/A	N/A
Area (sf) =	2.35	2.99	4.99	3.08
Downstream Conditions				
Actual Depth (ft) =	3.28	3.51	3.66	5.14
Area (sf) =	6.55	7.02	7.33	10.28
V (fps) =	0.40	0.73	0.90	1.82
Sf (ft/ft) =	0.0000	0.0001	0.0001	0.0004
Upstream Conditions				
Upstrm Depth (ft) =	3.28	3.51	3.66	5.14
Iterate 0 >>>	0.000	0.000	0.000	-0.001
Check >>>	ok	ok	ok	ok
Area (sf) =	6.55	7.02	7.33	10.28
V (fps) =	0.40	0.73	0.90	1.82
Sf (ft/ft)=	0.0000	0.0001	0.0001	0.0004
Hm (ft) =	0.00	0.00	0.01	0.03
EGL = HGL	**32.78**	**33.02**	**33.18**	**34.72**

HW-11 Mechanical Bar Screen (Center Flow Band Screen)

Module MFR — *Manufacturer Head Loss Info*

Reference Q =	12.1	mgd
Reference HL =	0.68	ft
Exponent Factor =	0.5	

Q (mgd) =	1.7	3.3	4.3	12.1
HL (ft) =	0.26	0.36	0.41	0.68
EGL = HGL	**33.04**	**33.38**	**33.59**	**35.40**

HW-12 Screen Channel (Upstream of Screen)

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	10.75	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

	Q (mgd) =	1.7	3.3	4.3	12.1
	Backwater (ft) =	3.54	3.88	4.09	5.90
	Yc (ft) =	0.38	0.59	0.70	1.40
	Yn (ft) =				
	Iterate 0 >>>	N/A	N/A	N/A	N/A
	Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions	Actual Depth (ft) =	3.54	3.88	4.09	5.90
	Area (sf) =	7.07	7.76	8.18	11.81
	V (fps) =	0.37	0.66	0.81	1.59
	Sf (ft/ft) =	0.0000	0.0001	0.0001	0.0003
Upstream Conditions	Upstrm Depth (ft) =	3.54	3.88	4.09	5.91
	Iterate 0 >>>	-0.001	0.000	0.000	0.000
	Check >>>	ok	ok	ok	ok
	Area (sf) =	7.07	7.76	8.18	11.81
	V (fps) =	0.37	0.66	0.81	1.58
	Sf (ft/ft)=	0.0000	0.0001	0.0001	0.0003
	Hm (ft) =	0.00	0.00	0.01	0.02
EGL = HGL		**33.04**	**33.39**	**33.61**	**35.46**

HW-13 Screen Channel Isolation Gate

Module FSPR *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft
Height =	8.25	ft
Width=	2	ft
Length =	12	in

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	3.54	3.89	4.11	5.96
	Free Surface	Free Surface	Free Surface	Free Surface
Yc (ft) =	0.38	0.59	0.70	1.40
Act. Depth (ft) =	3.54	3.89	4.11	5.96
Wetted P (ft) =	9.08	9.78	10.21	13.93
L/P =	0.11	0.10	0.10	0.07
No. Suppressed Contr (0-3) =	0	0	0	1
C_d =	0.66	0.66	0.66	0.65
Area (sf) =	7.08	7.78	8.21	11.93
V (fps) =	0.37	0.66	0.80	1.57
HL (ft) =	0.00	0.02	0.02	0.09
EGL = HGL	**33.04**	**33.40**	**33.63**	**35.55**

HW-14 Influent Channel

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	14.42	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

	Q (mgd) =	1.7	3.3	4.3	12.1
	Backwater (ft) =	3.54	3.90	4.13	6.05
	Yc (ft) =	0.38	0.59	0.70	1.40
	Yn (ft) =				
	Iterate 0 >>>	N/A	N/A	N/A	N/A
	Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions	Actual Depth (ft) =	3.54	3.90	4.13	6.05
	Area (sf) =	7.09	7.81	8.26	12.11
	V (fps) =	0.37	0.65	0.80	1.55
	Sf (ft/ft) =	0.0000	0.0001	0.0001	0.0003
Upstream Conditions	Upstrm Depth (ft) =	3.54	3.91	4.13	6.06
	Iterate 0 >>>	-0.001	0.000	0.000	0.000
	Check >>>	ok	ok	ok	ok
	Area (sf) =	7.09	7.81	8.26	12.12
	V (fps) =	0.37	0.65	0.80	1.54
	Sf (ft/ft)=	0.0000	0.0001	0.0001	0.0003
	Hm (ft) =	0.00	0.00	0.00	0.02
EGL = HGL		**33.05**	**33.42**	**33.64**	**35.61**

HW-15 Influent Box

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	7.00	ft	Backwater (ft) =	3.55	3.92	4.14	6.11
Length =	5.00	ft	Yc (ft) =	0.16	0.26	0.30	0.61
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	3.55	3.92	4.14	6.11
			Area (sf) =	24.83	27.41	29.01	42.80
			V (fps) =	0.11	0.19	0.23	0.44
			Sf (ft/ft) =	0.0000	0.0000	0.0000	0.0000
Upstream Conditions			Upstrm Depth (ft) =	3.55	3.92	4.14	6.11
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	24.83	27.41	29.01	42.80
			V (fps) =	0.11	0.19	0.23	0.44
			Sf (ft/ft)=	0.0000	0.0000	0.0000	0.0000
			Hm (ft) =	0.00	0.00	0.00	0.00
EGL = HGL				**33.05**	**33.42**	**33.65**	**35.62**

INF-1 Influent Piping (30")

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =		30	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =		8	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =		130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's :	Exit (1)	1		Hf (ft) =	0.00	0.00	0.00	0.01
	90-deg Bend (3)	0.9		Hm (ft) =	0.01	0.03	0.05	0.43
				HL (ft) =	0.01	0.03	0.06	0.44
	Sum K =	1.9						
EGL = HGL					**33.06**	**33.45**	**33.70**	**36.06**

INF-2 Influent Piping (24" Mag Meter)

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =		24	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =		16	ft	V (fps) =	0.84	1.63	2.10	5.96
Hazen & Will. C =		130		Hv (ft) =	0.01	0.04	0.07	0.55
Minor Loss K's :	Reducer (1)	0.05		Hf (ft) =	0.00	0.01	0.01	0.07
	Expander (1)	0.1		Hm (ft) =	0.00	0.01	0.01	0.08
				HL (ft) =	0.00	0.01	0.02	0.15
	Sum K =	0.15						
EGL = HGL					**33.06**	**33.46**	**33.72**	**36.22**

INF-3 Influent Piping (30")

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =		30	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =		60	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =		130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's :	45-deg Bend (2)	0.4		Hf (ft) =	0.00	0.01	0.01	0.09
	Tee (1)	0.75		Hm (ft) =	0.01	0.03	0.06	0.47
	Plug Valve (1)	0.92		HL (ft) =	0.01	0.04	0.07	0.56
	Sum K =	2.07						
EGL = HGL					**33.07**	**33.50**	**33.79**	**36.77**

HAZENPRO - Hydraulic Profile Calculations

Owner	City of Cooper City
Project	Cooper City WWTP Headworks PER
Hydraulic Profile	Headworks Influent Force Main Tie-in --> Headworks --> Surge Tank
Conditions	Screen: Center Flow Band Screen
	No Grit Removal

		Minimum Flow	Average Daily Flow	TMADF	Peak Flow
Plant Influent Flow	mgd	1.7	3.3	4.3	12.1
Downstream Controlling WSEL		**28.30**	**28.30**	**28.30**	**28.30**

SG-1 Surge Tank Coarse Manual Bar Screen

Module BSCR *Bar Screen*

Invert El =	26.3	ft	Q (mgd) =	1.70	3.30	4.27	12.10
Screen Width =	3	ft	Depth ds (ft) =	2.00	2.00	2.00	2.00
Bar Spacing =	0.75	in	V ds (fps) =	0.44	0.85	1.10	3.12
Bar Thkness =	0.25	in	V bars (fps) =	0.78	1.51	1.96	5.55
k =	1.5		HL (ft) =	0.01	0.04	0.06	0.49
% Blind =	25%						
	EGL	**= HGL**		**28.31**	**28.34**	**28.36**	**28.79**

EF-1 Effluent Piping

Module PIP1 *Piping by Hazen-Williams Equation*

Diameter =	**30.00**	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	285	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =	130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's : Exit (1)	1		Hf (ft) =	0.01	0.04	0.06	0.43
Entry (1)	0.5		Hm (ft) =	0.02	0.09	0.16	1.26
90-deg Bend (4)	1.2		HL (ft) =	0.04	0.13	0.22	1.69
Tee (1) - Flow Branch	0.75						
Tee (4) - Flow Straight	1.2						
Plug Valve (1)	0.92						
Sum K =	5.57						
EGL	**= HGL**			**28.35**	**28.47**	**28.58**	**30.48**

HW-1 Headworks Effluent Box

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.70	3.30	4.27	12.10
Width =	2.00	ft	Backwater (ft) =	-1.15	-1.03	-0.92	0.98
Length =	12.50	ft	Yc (ft) =	0.38	0.59	0.70	1.40
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	0.38	0.59	0.70	1.40
			Area (sf) =	0.76	1.17	1.39	2.79
			V (fps) =	3.48	4.35	4.74	6.71
			Sf (ft/ft) =	0.0069	0.0072	0.0075	0.0094
Upstream Conditions			Upstrm Depth (ft) =	0.53	0.78	0.91	1.73
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	1.06	1.56	1.82	3.47
			V (fps) =	2.48	3.27	3.63	5.40
			Sf (ft/ft)=	0.0026	0.0033	0.0036	0.0054
			Hm (ft) =	0.05	0.08	0.10	0.23
EGL	**= HGL**			**30.17**	**30.53**	**30.72**	**31.91**

HW-2 Effluent Box Isolation Gate

Module FSPR — *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft
Height =	8.25	ft
Width=	2	ft
Length =	12	in

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	0.67	1.03	1.22	2.41
	Free Surface	Free Surface	Free Surface	Free Surface
Yc (ft) =	0.38	0.59	0.70	1.40
Act. Depth (ft) =	0.67	1.03	1.22	2.41
Wetted P (ft) =	3.35	4.06	4.43	6.83
L/P =	0.30	0.25	0.23	0.15
No. Suppressed Contr (0-3) =	0	0	0	0
C_d =	0.77	0.74	0.73	0.68
Area (sf) =	1.35	2.06	2.43	4.83
V (fps) =	1.95	2.48	2.71	3.88
HL (ft) =	0.10	0.17	0.22	0.50
EGL = HGL	**30.27**	**30.70**	**30.93**	**32.41**

HW-3 Grit Bypass Channel

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	29.67	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

Q (mgd) =	1.70	3.30	4.27	12.10
Backwater (ft) =	0.77	1.20	1.43	2.91
Yc (ft) =	0.38	0.59	0.70	1.40
Yn (ft) =				
Iterate 0 >>>	N/A	N/A	N/A	N/A
Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions				
Actual Depth (ft) =	0.77	1.20	1.43	2.91
Area (sf) =	1.55	2.41	2.87	5.83
V (fps) =	1.70	2.12	2.30	3.21
Sf (ft/ft) =	0.0009	0.0010	0.0011	0.0016
Upstream Conditions				
Upstrm Depth (ft) =	0.80	1.24	1.47	2.96
Iterate 0 >>>	0.000	0.000	0.000	0.000
Check >>>	ok	ok	ok	ok
Area (sf) =	1.60	2.47	2.94	5.93
V (fps) =	1.64	2.06	2.25	3.16
Sf (ft/ft)=	0.0008	0.0010	0.0010	0.0015
Hm (ft) =	0.02	0.03	0.04	0.08
EGL = HGL	**30.36**	**30.84**	**31.09**	**32.70**

HW-4 Grit Bypass Channel Channel Isolation Gate

Module FSPR — *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft
Height =	8.25	ft
Width=	2	ft
Length =	12	in

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	0.86	1.34	1.59	3.20
	Free Surface	Free Surface	Free Surface	Free Surface
Yc (ft) =	0.38	0.59	0.70	1.40
Act. Depth (ft) =	0.86	1.34	1.59	3.20
Wetted P (ft) =	3.73	4.67	5.17	8.39
L/P =	0.27	0.21	0.19	0.12
No. Suppressed Contr (0-3) =	0	0	0	0
C_d =	0.75	0.72	0.71	0.67
Area (sf) =	1.73	2.67	3.17	6.39
V (fps) =	1.52	1.91	2.08	2.93
HL (ft) =	0.06	0.11	0.13	0.30
EGL = HGL	**30.43**	**30.95**	**31.22**	**33.00**

HW-5 Common Screen Effluent Channel

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	12.17	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	0.93	1.45	1.72	3.50
Yc (ft) =	0.38	0.59	0.70	1.40
Yn (ft) =				
Iterate 0 >>>	N/A	N/A	N/A	N/A
Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions				
Actual Depth (ft) =	0.93	1.45	1.72	3.50
Area (sf) =	1.86	2.89	3.44	6.99
V (fps) =	1.42	1.77	1.92	2.68
Sf (ft/ft) =	0.0005	0.0006	0.0007	0.0010
Upstream Conditions				
Upstrm Depth (ft) =	0.93	1.45	1.73	3.51
Iterate 0 >>>	0.000	0.000	0.000	0.000
Check >>>	ok	ok	ok	ok
Area (sf) =	1.87	2.91	3.46	7.02
V (fps) =	1.41	1.76	1.91	2.67
Sf (ft/ft)=	0.0005	0.0006	0.0007	0.0010
Hm (ft) =	0.02	0.02	0.03	0.06
EGL = HGL	**30.48**	**31.03**	**31.31**	**33.17**

HW-6 Screen Channel Effluent Isolation Gate

Module FSPR — *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft
Height =	8.25	ft
Width=	2	ft
Length =	12	in

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	0.98	1.53	1.81	3.67
	Free Surface	Free Surface	Free Surface	Free Surface
Yc (ft) =	0.38	0.59	0.70	1.40
Act. Depth (ft) =	0.98	1.53	1.81	3.67
Wetted P (ft) =	3.96	5.05	5.63	9.35
L/P =	0.25	0.20	0.18	0.11
No. Suppressed Contr (0-3) =	0	0	0	0
C_d =	0.74	0.71	0.70	0.66
Area (sf) =	1.96	3.05	3.63	7.35
V (fps) =	1.34	1.67	1.82	2.55
HL (ft) =	0.05	0.09	0.10	0.23
EGL = HGL	**30.53**	**31.11**	**31.42**	**33.41**

HW-7 Screen Channel (Downstream of Screen)

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50	
Width =	2.00	ft
Length =	7.50	ft
Manning n =	0.015	
Slope =	0.0000	ft/ft
K-ent =	0.50	

Q (mgd) =	1.7	3.3	4.3	12.1
Backwater (ft) =	1.03	1.61	1.92	3.91
Yc (ft) =	0.38	0.59	0.70	1.40
Yn (ft) =	1.17	1.50	2.50	1.54
Iterate 0 >>>	N/A	N/A	N/A	N/A
Area (sf) =	2.35	2.99	4.99	3.08
Downstream Conditions				
Actual Depth (ft) =	1.03	1.61	1.92	3.91
Area (sf) =	2.06	3.22	3.84	7.81
V (fps) =	1.27	1.58	1.72	2.40
Sf (ft/ft) =	0.0004	0.0005	0.0005	0.0008
Upstream Conditions				
Upstrm Depth (ft) =	1.03	1.61	1.92	3.91
Iterate 0 >>>	0.000	0.000	0.000	0.000
Check >>>	ok	ok	ok	ok
Area (sf) =	2.07	3.23	3.85	7.82
V (fps) =	1.27	1.58	1.72	2.39
Sf (ft/ft)=	0.0004	0.0005	0.0005	0.0008
Hm (ft) =	0.01	0.02	0.02	0.04
EGL = HGL	**30.57**	**31.17**	**31.49**	**33.54**

HW-8 Mechanical Bar Screen (Center Flow Band Screen)

Module MFR — *Manufacturer Head Loss Info*

Reference Q =	12.1	mgd
Reference HL =	0.68	ft
Exponent Factor =	0.5	

Q (mgd) =	1.7	3.3	4.3	12.1
HL (ft) =	0.26	0.36	0.41	0.68
EGL = HGL	**30.83**	**31.53**	**31.90**	**34.23**

HW-9 **Screen Channel (Upstream of Screen)**

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	2.00	ft	Backwater (ft) =	1.33	2.03	2.40	4.73
Length =	10.75	ft	Yc (ft) =	0.38	0.59	0.70	1.40
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	1.33	2.03	2.40	4.73
			Area (sf) =	2.66	4.06	4.80	9.46
			V (fps) =	0.99	1.26	1.38	1.98
			Sf (ft/ft) =	0.0002	0.0003	0.0003	0.0005
Upstream Conditions			Upstrm Depth (ft) =	1.33	2.03	2.40	4.73
			Iterate 0 >>>	0.000	0.000	0.000	-0.001
			Check >>>	ok	ok	ok	ok
			Area (sf) =	2.66	4.07	4.80	9.47
			V (fps) =	0.99	1.26	1.38	1.98
			Sf (ft/ft)=	0.0002	0.0003	0.0003	0.0005
			Hm (ft) =	0.01	0.01	0.01	0.03
	EGL	**= HGL**		**30.85**	**31.57**	**31.95**	**34.32**

HW-10 **Screen Channel Isolation Gate**

Module FSPR *Rectangular Port (Submerged or Free Surface)*

Invert El =	29.50	ft	Q (mgd) =	1.7	3.3	4.3	12.1
Height =	8.25	ft	Backwater (ft) =	1.35	2.07	2.45	4.82
Width=	2	ft		Free Surface	Free Surface	Free Surface	Free Surface
Length =	12	in	Yc (ft) =	0.38	0.59	0.70	1.40
			Act. Depth (ft) =	1.35	2.07	2.45	4.82
			Wetted P (ft) =	4.71	6.14	6.89	11.65
			L/P =	0.21	0.16	0.15	0.09
			No. Suppressed Contr (0-3) =	0	0	0	1
			C_d =	0.72	0.69	0.68	0.66
			Area (sf) =	2.71	4.14	4.89	9.65
			V (fps) =	0.97	1.23	1.35	1.94
			HL (ft) =	0.03	0.05	0.06	0.13
	EGL	**= HGL**		**30.88**	**31.62**	**32.01**	**34.46**

HW-11 **Influent Channel**

Module OCR *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	2.00	ft	Backwater (ft) =	1.38	2.12	2.51	4.96
Length =	14.42	ft	Yc (ft) =	0.38	0.59	0.70	1.40
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	1.38	2.12	2.51	4.96
			Area (sf) =	2.76	4.24	5.01	9.92
			V (fps) =	0.95	1.20	1.32	1.89
			Sf (ft/ft) =	0.0002	0.0002	0.0003	0.0005
Upstream Conditions			Upstrm Depth (ft) =	1.38	2.12	2.51	4.97
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	2.77	4.25	5.02	9.93
			V (fps) =	0.95	1.20	1.32	1.88
			Sf (ft/ft)=	0.0002	0.0002	0.0003	0.0005
			Hm (ft) =	0.01	0.01	0.01	0.03
	EGL	**= HGL**		**30.91**	**31.66**	**32.05**	**34.55**

HW-12 Influent Box

Module OCR — *Short Rectangular Open Channel*

Invert El =	29.50		Q (mgd) =	1.7	3.3	4.3	12.1
Width =	7.00	ft	Backwater (ft) =	1.41	2.16	2.55	5.05
Length =	5.00	ft	Yc (ft) =	0.16	0.26	0.30	0.61
Manning n =	0.015		Yn (ft) =				
Slope =	0.0000	ft/ft	Iterate 0 >>>	N/A	N/A	N/A	N/A
K-ent =	0.50		Area (sf) =	0.00	0.00	0.00	0.00
Downstream Conditions			Actual Depth (ft) =	1.41	2.16	2.55	5.05
			Area (sf) =	9.84	15.09	17.85	35.34
			V (fps) =	0.27	0.34	0.37	0.53
			Sf (ft/ft) =	0.0000	0.0000	0.0000	0.0000
Upstream Conditions			Upstrm Depth (ft) =	1.41	2.16	2.55	5.05
			Iterate 0 >>>	0.000	0.000	0.000	0.000
			Check >>>	ok	ok	ok	ok
			Area (sf) =	9.84	15.09	17.85	35.34
			V (fps) =	0.27	0.34	0.37	0.53
			Sf (ft/ft)=	0.0000	0.0000	0.0000	0.0000
			Hm (ft) =	0.00	0.00	0.00	0.00
EGL = HGL				**30.91**	**31.66**	**32.05**	**34.56**

INF-1 Influent Piping (30")

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =	30	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	8	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =	130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's : Exit (1)	1		Hf (ft) =	0.00	0.00	0.00	0.01
90-deg Bend (3)	0.9		Hm (ft) =	0.01	0.03	0.05	0.43
			HL (ft) =	0.01	0.03	0.06	0.44
Sum K =	1.9						
EGL = HGL				**30.92**	**31.69**	**32.11**	**35.00**

INF-2 Influent Piping (24" Mag Meter)

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =	24	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	16	ft	V (fps) =	0.84	1.63	2.10	5.96
Hazen & Will. C =	130		Hv (ft) =	0.01	0.04	0.07	0.55
Minor Loss K's : Reducer (1)	0.05		Hf (ft) =	0.00	0.01	0.01	0.07
Expander (1)	0.1		Hm (ft) =	0.00	0.01	0.01	0.08
			HL (ft) =	0.00	0.01	0.02	0.15
Sum K =	0.15						
EGL = HGL				**30.93**	**31.75**	**32.20**	**35.71**

INF-3 Influent Piping (30")

Module PIP1 — *Piping by Hazen-Williams Equation*

Diameter =	30	in	Q (mgd) =	1.70	3.30	4.27	12.10
Length =	60	ft	V (fps) =	0.54	1.04	1.35	3.82
Hazen & Will. C =	130		Hv (ft) =	0.00	0.02	0.03	0.23
Minor Loss K's : 45-deg Bend (2)	0.4		Hf (ft) =	0.00	0.01	0.01	0.09
Tee (1)	0.75		Hm (ft) =	0.01	0.03	0.06	0.47
Plug Valve (1)	0.92		HL (ft) =	0.01	0.04	0.07	0.56
Sum K =	2.07						
EGL = HGL				**30.94**	**31.79**	**32.27**	**36.27**

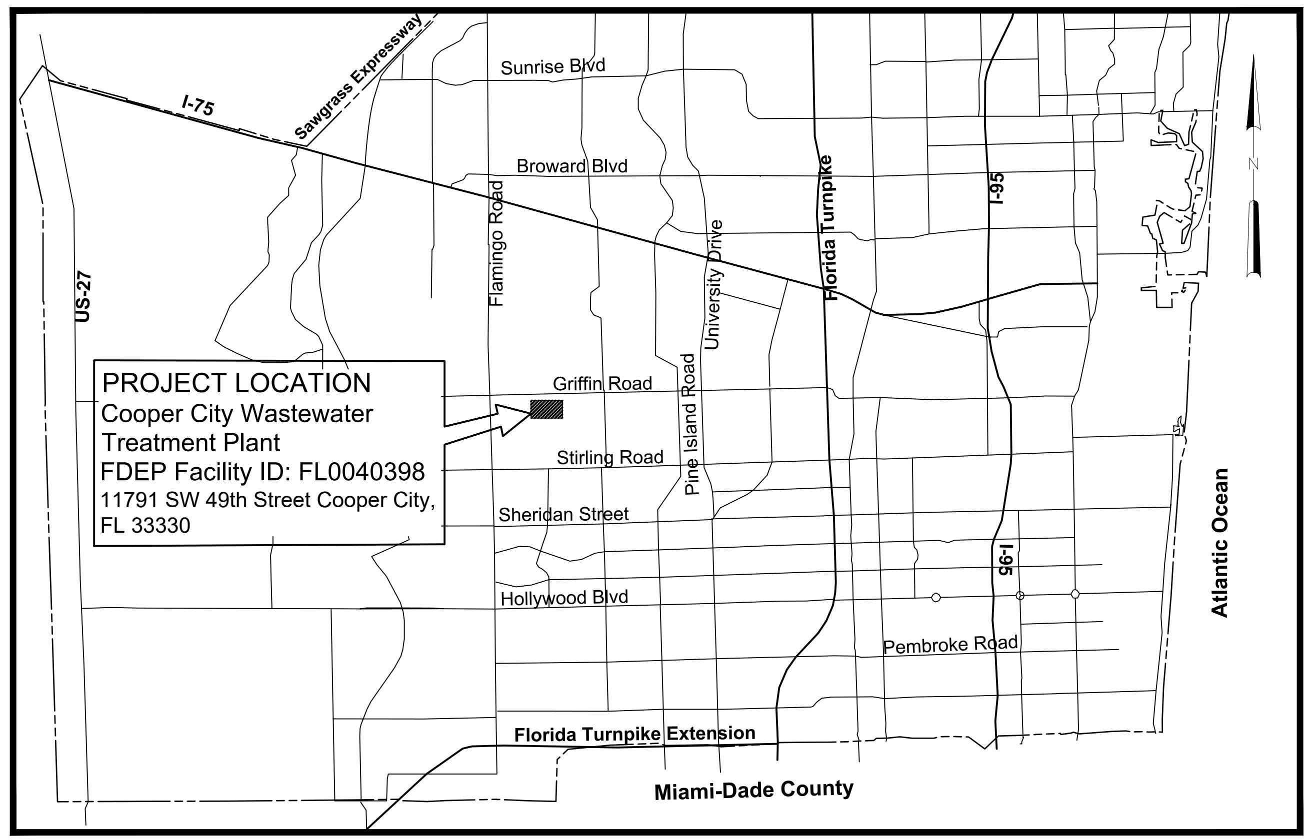
Appendix B: Preliminary Drawings

WASTEWATER TREATMENT FACILITY
HEADWORKS DESIGN - PHASE I
11791 SW 49th STREET

PREPARED FOR THE

COOPER CITY UTILITIES DEPARTMENT

CITY OF
Cooper City
Someplace Special



LOCATION MAP

SECTION 25; TOWNSHIP 50; RANGE 40
BROWARD, COUNTY, FLORIDA

APRIL 2026

FOR PERMITTING PURPOSES
NOT FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
4000 HOLLYWOOD BOULEVARD, SUITE 750N
HOLLYWOOD, FLORIDA 33021

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COVER SHEET AND LOCATION MAP
DRAWING No. G-01

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

PLOT DATE: 4/29/2026 11:17 a.m. BY: LAURA SORIANO

XREFs=

File = C:\Users\Laura Soriano\DC\ACCDocs\Hazen and Sawyer\04679-022\Project Files\1-Design\01-Hazen\Permit\04679-022-COVER Saved by Laura Soriano Save date = 4/29/2026 11:16 a.m.

LIST OF DRAWINGS

SHEET NUMBER	SHEET TITLE
	GENERAL
G-01	COVER SHEET AND LOCATION MAP
G-02	LIST OF DRAWINGS
G-03	ABBREVIATIONS, SYMBOLS AND LEGEND
G-04	GENERAL NOTES
G-05	PROPOSED WWTP PROCESS FLOW DIAGRAM
G-06	PRELIMINARY TREATMENT PROCESS FLOW DIAGRAM
G-07	HYDRAULIC PROFILE (WITH GRIT REMOVAL BYPASS)
G-08	HYDRAULIC PROFILE (WITH GRIT REMOVAL SYSTEM)
	SURVEY
V-1	SHEET - 1
V-2	SHEET - 2
V-3	SHEET - 3
	CIVIL
C-01	EXISTING SITE, SOIL, BORING LOCATIONS, AND STAGING PLAN
C-02	PROPOSED SITE PLAN
C-03	DEMOLITION SITE PLAN
C-04	YARD PIPING
C-05	OFF-SITE SANITARY SEWER PLAN AND PROFILE
C-06	PAVING, GRADING AND DRAINAGE PLAN
C-07	POLLUTION PREVENTION PLAN
C-08	POLLUTION PREVENTION DETAILS - CIVIL DETAILS - SHEET 1
C-09	ROAD & STORM DRAINAGE DETAILS CITY OF COOPER CITY STD DETAILS 2
C-10	WATER SUPPLY DETAILS CITY OF COOPER CITY STD DETAILS 3
C-11	SANITARY SEWER DETAILS CITY OF COOPER CITY STD DETAILS 4
C-12	SANITARY SEWER DETAILS CITY OF COOPER CITY STD DETAILS 5
C-13	MISCELANEOUS CONSTRUCTION DETAILS - SHEET 1
C-14	MISCELANEOUS CONSTRUCTION DETAILS - SHEET 2
C-15	MISCELANEOUS CONSTRUCTION DETAILS - SHEET 3
	MECHANICAL
M-01	ISOMETRIC VIEWS
M-02	HEADWORKS BOTTOM PLAN
M-03	HEADWORKS INTERMEDIATE PLAN
M-04	HEADWORKS UPPER PLAN
M-05	HEADWORKS SECTIONS - SHEET 1
M-06	HEADWORKS SECTIONS - SHEET 2
M-07	HEADWORKS SECTIONS - SHEET 3
M-08	HEADWORKS DETAILS - SHEET 1
M-09	ODOR CONTROL ISOMETRIC VIEW
M-10	ODOR CONTROL PLAN AND SECTION
M-11	ODOR CONTROL SECTIONS
M-12	ODOR CONTROL DUCTWORK PLAN AND ISOMETRIC
M-13	STANDARD DETAILS - SHEET 1
	STRUCTURAL
S-01	STRUCTURAL NOTES - SHEET 1
S-02	STRUCTURAL NOTES - SHEET 2
S-03	HEADWORKS BOTTOM PLAN
S-04	HEADWORKS INTERMEDIATE PLAN
S-05	HEADWORKS UPPER PLAN
S-06	HEADWORKS SECTIONS - SHEET 1
S-07	HEADWORKS SECTIONS - SHEET 2
S-08	HEADWORKS SECTIONS - SHEET 3
S-09	HEADWORKS ENLARGED SECTIONS
S-10	HEADWORKS ENLARGED STAIRS PLANS
S-11	HEADWORKS STAIRS DETAILS
S-12	HEADWORKS ELECTRICAL PLATFORM PLAN, SECTION AND DETAILS
S-13	ODOR CONTROL PLAN, SECTION AND DETAILS
S-14	STANDARD DETAILS - SHEET 1

SHEET NUMBER	SHEET TITLE
	ARCHITECTURAL
A-01	GENRAL NOTES
A-02	HEADWORKS LIFE SAFETY PLAN, CODE ANALYSISI, AND DOOR SCHEDULE
	INSTRUMENTATION
I-01	INSTRUMENTATION SYMBOLS AND LEGEND
I-02	NETWORK BLOCK DIAGRAM
I-03	COARSE SCREENS P&ID
I-04	GRIT REMOVAL SYSTEM P&ID
I-05	ODOR COTROL SYSTEM P&ID
I-06	STANDARD DETAILS - SHEET 1
	ELECTRICAL
E-01	LEGENDS AND SYMBOLS
E-02	ABBREVIATIONS AND GENERAL NOTES
E-03	ELECTRICAL SITE PLAN
E-04	HEADWORKS BOTTOM AREA CLASSIFICATION PLAN
E-05	HEADWORKS UPPER AREA CLASSIFICATION PLAN
E-06	HEADWORKS BOTTOM AREA POWER AND LIGHTING PLAN
E-07	HEADWORKS UPPER AREA POWER AND LIGHTING PLAN
E-08	HEADWORKS GROUNDING PLAN
E-09	ODOR CONTROL SYSTEM CLASSIFICATION PLAN
E-10	ODOR CONTROL SYSTEM POWER, LIGHTING AND GROUNDING PLAN
E-11	SINGLE LINE DIAGRAM
E-12	PANEL SCHEDULES AND RISER DIAGRAMS - SHEET 1
E-13	PANEL SCHEDULES AND RISER DIAGRAMS - SHEET 2
E-14	CONTROL ONE LINE DIAGRAM
E-15	CONDUIT AND WIRE SCHEDULES
E-16	STANDARD DETAILS - SHEET 1
E-17	STANDARD DETAILS - SHEET 2
E-18	STANDARD DETAILS - SHEET 3
E-19	STANDARD DETAILS - SHEET 4

1/32"=1'-0" 32 16 0 32'

REV	ISSUED FOR	DATE	BY
2	90% SUBMITTAL	4/26	FAM
1	75% SUBMITTAL	4/26	FAM

PROJECT ENGINEER: F. MARTINEZ
DESIGNED BY: E. PAGE
DRAWN BY: T. BOCAS
CHECKED BY: F. MARTINEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PRELIMINARY DRAWING DO NOT USE FOR CONSTRUCTION

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HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

COOPER CITY, FLORIDA

WASTEWATER TREATMENT FACILITY HEADWORKS - PHASE 1

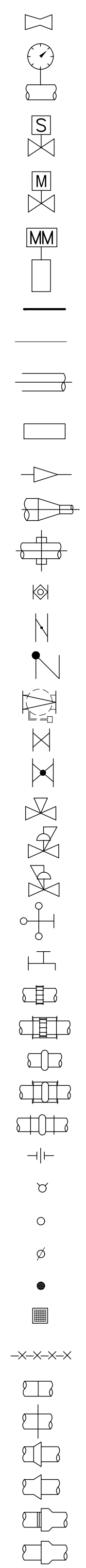
GENERAL

LIST OF DRAWINGS

DATE: APRIL 2026
HAZEN NO.: 04679-022
CONTRACT NO.: 1
DRAWING NUMBER: G-02

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

SYMBOLS



VENTURI METER
GAUGE
SOLENOID
MOTOR OPERATED
MAGNETIC METER
PROPOSED PIPELINE/STRUCTURE
EXISTING UTILITIES/STRUCTURE
PROPOSED PIPELINE (DOUBLE LINE IF SCALE OF DRAWING PERMITS)
PROPOSED STRUCTURE OR FACILITY
REDUCER (SINGLE LINE)
REDUCER (DOUBLE LINE)
CONCRETE PIPE SUPPORT
BALL VALVE
BUTTERFLY VALVE / DAMPER
CHECK BALL VALVE
CHECK VALVE
GATE VALVE
PLUG VALVE
THREE WAY VALVE
PRESSURE REDUCING/RELIEF VALVE
PRESSURE REGULATING VALVE
HOSE BIBB (PLAN)
HOSE BIBB (ELEVATION)
MECHANICAL COUPLING
HARNESSED MECHANICAL COUPLING
GROOVED COUPLING
HARNESSED EXPANSION JOINT
EXPANSION JOINT
UNION
FIRE HYDRANT
MAINTENANCE HOLE
POWER POLE
SEALED MAINTENANCE HOLE
CATCH BASIN
FENCE
WELDED JOINT
FLANGED JOINT
MECHANICAL JOINT
PUSH-ON JOINT
THREADED JOINT
SOCKET WELDED JOINT

ABBREVIATIONS

VALVES, FITTINGS, ETC.

ARV	AIR RELIEF VALVE
BA V	BALL VALVE
BF	BLIND FLANGE
BF V	BUTTERFLY VALVE
CV	CHECK VALVE
CPLG	COUPLING
ED	EQUIPMENT DRAIN
EXP JT	EXPANSION JOINT
FH	FIRE HYDRANT
FTG	FITTING
FLG	FLANGE
FD	FLOOR DRAIN
GC	GROOVED COUPLING
GV	GATE VALVE
HB	HOSE BIBB
MJ	MECHANICAL JOINT
MOV	MOTOR OPERATED VALVE
NPT	NATIONAL PIPE THREAD
PE	PLAIN END
PV	PLUG VALVE
PRV	PRESSURE RELIEF VALVE
PS	PUMP STATION
RD	ROOF DRAIN
SOV	SOLENOID OPERATED VALVE
THD	THREADED

PIPING

CIP	CAST IRON PIPE
DI/DIP	DUCTILE IRON PIPE
ERCP	ELLIPTICAL REINFORCED CONCRETE PIPE
FM	FORCE MAIN
FRP	FIBERGLASS REINFORCED PIPE
GSP	GALVANIZED STEEL PIPE
RCP	REINFORCED CONCRETE PIPE
SSP	STAINLESS STEEL PIPE
IPS	IRON PIPE SIZE
PVC	POLYVINYLCHLORIDE
PCCP	PRESTRESSED CONCRETE CYLINDER PIPE

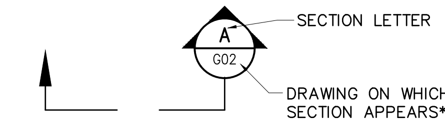
GENERAL

AA	AERATION AIR
A/C	AIR CONDITIONER
AL, ALUM	ALUMINUM
AB	ANCHOR BOLT
∠	ANGLE
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
BLK	BLOCK
BLDG	BUILDING
BOTT	BOTTOM
BP	BID PACKAGE
CB	CATCH BASIN
CC	CENTER TO CENTER
CHK'D	CHECKERED
CHLOR, CL_2	CHLORINE
CL, ℄	CENTER LINE
CLR	CLEAR
CL_2S	CHLORINE SOLUTION
CL_2G	CHLORINE GAS
CL_2V	CHLORINE GAS UNDER VACCUM
CO	COMPANY
CO	CLEAN OUT
COL	COLUMN
CONC	CONCRETE
CON	CONCENTRATE
CONST	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
CU	COPPER OR CUBIC
DEC	DECANT
DET	DETAIL
DIAG	DIAGONAL
DIA	DIAMETER
DIM	DIMENSION
DISCH	DISCHARGE
DIW	DEEP INJECTION WELL
DN	DOWN
DR	DRAINS
DWG(S)	DRAWING(S)
DWL	DOWEL
EA	EACH
ECC	ECCENTRIC
EE	EACH END
EF	EACH FACE
EFF	EFFLUENT
ELEC	ELECTRIC
EL, ELEV	ELEVATION
EMH	ELECTRICAL MAINTENANCE HOLE
EOP	EDGE OF PAVEMENT
EQUIP	EQUIPMENT
EW	EACH WAY
EXIST	EXISTING
EXP	EXPANSION
EXH	EXHAUST
EXT	EXTERIOR
FA	FOUL AIR
FE	FIRE EXTINGUISHER
FIG	FIGURE
FIN	FINISH
FL	FLOOR
FM	FORCE MAIN
FPL, FP&L	FLORIDA POWER AND LIGHT CO.
FTG	FOOTING
G	GRIT
GALV	GALVANIZED
GR	GRADE
H	HIGH
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HP	HIGH POINT
HR	HANDRAIL
HWL	HIGH WATER LEVEL
IE	INVERT ELEVATION
INFL	INFLUENT
INJ	INJECTION
ID	INSIDE DIAMETER
IF	INSIDE FACE
INSUL	INSULATION
INT	INTERIOR
ISO	ISOLATION
IQ	IRRIGATION QUALITY
INV	INVERT
JT	JOINT
LF	LINEAL FEET
LG	LONG
LN	LINE
LP	LOW POINT
LR	LONG RADIUS
LS	LIF STATION
LWL	LOW WATER LEVEL
MH	MAINTENANCE HOLE/MANHOLE
MANUF	MANUFACTURER
MO	MASONRY OPENING
MAX	MAXIMUM
MECH	MECHANICAL
ML	MIXED LIQUOR
MIN	MINIMUM
NF	NANOFILTRATION
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
No	NUMBER
OC	ON CENTER
OHW	OVERHEAD WIRE
OPNG	OPENING
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
PE	PLAIN END
PI	PLANT INFLUENT
PD	PLANT DRAIN
PO	POND OVERFLOW
PW	POTABLE WATER
POT	POTABLE
PS	PUMP STATION
LBS/FT	POUNDS PER FOOT
P/L	PROPERTY LINE
RAD, R	RADIUS
RAS	RETURN ACTIVATED SLUDGE
RECIR	RECIRCULATION
RED	REDUCING
REHAB	REHABILITATION
REINF	REINFORCING
REQ'D	REQUIRED
R/W, ROW	RIGHT OF WAY
RW	REUSE WATER
SAN	SANITARY
SC	SCUM
SE	SECONDARY EFFLUENT
SECT	SECTION
SHT	SHEET
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STL	STEEL
STRUC	STRUCTURAL
SPD	SUMP PUMP DISCHARGE
SYMM	SYMMETRICAL
TI	TEMPERATURE INDICATOR
TEMP	TEMPORARY
THK	THICK
TO	TANK OVERFLOW
TO	THROUGHOUT
T & B	TOP AND BOTTOM
TOC	TOP OF CONCRETE
TOS	TOP OF STEEL/TOP OF SLAB
TYP	TYPICAL
UGC	UNDERGROUND CONDUIT
VAC	VACUUM
VERT	VERTICAL
VTR	VENT THROUGH ROOF
WAS	WASTE ACTIVATED SLUDGE
WF	WOOD FENCE
WTP	WATER TREATMENT PLANT
WTR	WATER
W/L	WATER LEVEL
WWF	WELDED WIRE FABRIC
W	WIDE
W/	WITH
W/O	WITHOUT

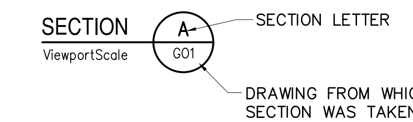
SECTION AND DETAIL IDENTIFICATION

SECTION IDENTIFICATION

(1) SECTION CUT ON DRAWING G-1:

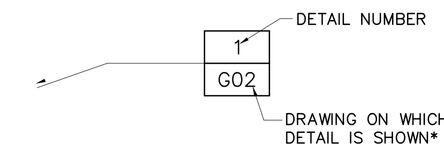


(2) ON DRAWING G-2 THIS SECTION IS IDENTIFIED AS:

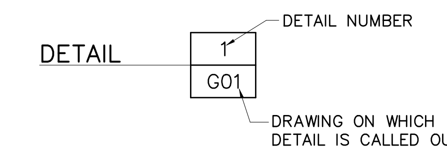


DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON DRAWING G-1 AS:

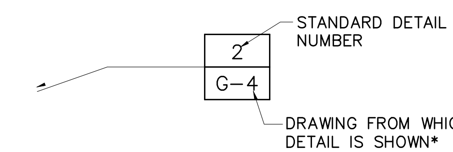


(2) ON DRAWING G-2 THIS DETAIL IDENTIFIED AS:

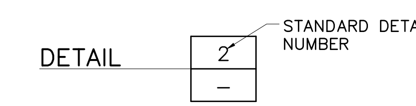


STANDARD DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON PLAN OR SECTION:



(2) ON DRAWING G-4 THIS DETAIL IDENTIFIED AS:



* NOTE: IF PLAN, SECTION AND DETAIL (OR DETAIL CALL-OUT) ARE SHOWN ON SAME DRAWING, DRAWING NUMBER IS REPLACE BY A LINE.

NOTES:

(1) ELECTRICAL SYMBOLS SHOWN ON ELECTRICAL SHEETS.

(2) FOR WELDING SYMBOLS USE AMERICAN WELDING SOCIETY STANDARD SYMBOLS. SEE AMERICAN INSTITUTE OF STEEL CONSTRUCTION MANUAL.

REV	ISSUED FOR	DATE	BY
2	90% SUBMITTAL	4/26	FAM
1	75% SUBMITTAL	4/26	FAM

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	T. BOCAS
CHECKED BY:	F. MARTINEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

PRELIMINARY DRAWING DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

COOPER CITY, FLORIDA

WASTEWATER TREATMENT FACILITY HEADWORKS - PHASE 1

GENERAL

ABBREVIATIONS, SYMBOLS AND LEGEND

DATE:	APRIL 2026
HAZEN NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	G-03

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

File: C:\USERS\LAURA SORIANO\DC\ACCDOCS\HAZEN AND SAWYER\04679-022\PROJECT FILES\1-DESIGN\01-HAZEN\00_GENERAL\04679-022-G03 Saved by LAURA SORIANO Save date: 4/28/2026 10:48 a.m.
PLOT DATE: 4/29/2026 12:53 p.m. BY: LAURA SORIANO

GENERAL NOTES

1. CONTRACTOR SHALL MAINTAIN ACCESS TO PRIVATE PROPERTY AT ALL TIMES.
2. CONTRACTOR SHALL MAINTAIN HIS WORK WITHIN THE LIMITS SHOWN ON THE STAGING PLAN.
3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES TO PROTECT EXISTING PIPELINES OR UTILITIES WHETHER SHOWN OR NOT.
4. THE CONTRACTOR SHALL ENSURE THAT ALL NECESSARY PERMITS ARE IN HAND BEFORE COMMENCEMENT OF CONSTRUCTION.
5. PROTECT EXISTING TREES AND SHRUBS FROM DAMAGE. DO NOT REMOVE EXISTING TREES AND SHRUBS UNLESS SHOWN OTHERWISE ON THE CIVIL DRAWINGS.
6. THE LOCATION OF EXISTING UTILITIES HAS BEEN PREPARED FROM THE MOST RELIABLE INFORMATION AVAILABLE TO THE ENGINEER. THE INFORMATION IS NOT GUARANTEED. THEREFORE THE CONTRACTOR SHALL VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES IN THE FIELD PRIOR TO THE START OF ANY CONSTRUCTION ACTIVITIES.
7. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES IN THE AREA 48 HOURS MINIMUM PRIOR TO START OF CONSTRUCTION, AND SHALL HAVE ALL SERVICE LINES (FPL, WATER, CABLE, TELEPHONE, SANITARY SEWER, IRRIGATION, FORCE MAIN AND OTHERS) LOCATED AND FLAGGED PRIOR TO ANY EXCAVATION.
8. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRING ALL UTILITY LINES AND SERVICES DAMAGED DURING CONSTRUCTION, INCLUDING IRRIGATION LINES AND SERVICES. THE APPROPRIATE UTILITY SHALL BE NOTIFIED OF ALL DAMAGED LINES PRIOR TO REPAIR. ALL NECESSARY REPAIRS SHALL BE PERFORMED IMMEDIATELY UPON DAMAGE TO THE LINE.
9. ALL ELEVATIONS ARE BASED ON THE NORTH AMERICA VERTICAL DATUM OF 1988 DATUM (NAVD88).
10. THE CONTRACTOR IS REQUIRED TO OBTAIN WRITTEN APPROVAL FROM THE ENGINEER FOR ANY DEVIATIONS FROM THE PLANS AND/OR SPECIFICATIONS.
11. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO COMMENCEMENT OF CONSTRUCTION AND NOTIFY THE ENGINEER IMMEDIATELY OF ANY REQUIRED PLAN DEVIATIONS.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A DEWATERING PERMIT FROM THE SOUTH FLORIDA MANAGEMENT DISTRICT IF NECESSARY.
13. CONTRACTOR SHALL PROVIDE A MINIMUM VERTICAL CLEARANCE OF 18" BETWEEN ALL UTILITY LINES THAT CROSS.
14. RESTRAINED JOINT PIPE SHALL BE USED FOR ALL PIPING ON THIS PROJECT. THRUST BLOCKS WILL NOT BE ALLOWED.
15. ALL CONNECTIONS TO EXISTING MAINS SHALL BE MADE UNDER THE DIRECTION OF THE CITY OF COOPER CITY.
16. THE MINIMUM DEPTH OF COVER OVER WATER MAINS IS 36" EXCEPT WHERE SHOWN DIFFERENTLY ON PLANS.
17. DISINFECTION OF MAINS SHALL COMPLY WITH A.N.S.I./A.W.W.A. C-651(LATEST REVISION) STANDARD. BACTERIOLOGICAL SAMPLING POINTS SHALL BE DESIGNATED ON THE ENGINEERING PLANS. MINIMUM ONE SAMPLING POINT AT EACH END.
18. THERE SHALL BE NO CONNECTION TO AN EXISTING WATER MAIN UNTIL PRESSURE AND BACTERIOLOGICAL TESTS HAVE BEEN CONDUCTED AND THE RESULTS ARE APPROVED AND ACCEPTED BY THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION.
19. PIPE DEFLECTION SHALL NOT EXCEED 75% OF THE MAXIMUM DEFLECTION RECOMMENDED BY THE MANUFACTURER.
20. CONTRACTOR SHALL COMPLY WITH ALL LOCAL CITY, COUNTY AND STATE REGULATIONS PERTAINING TO THE CLOSING OF PUBLIC STREETS FOR USE OF TRAFFIC DURING CONSTRUCTION.
21. ALL OPEN TRENCHES AND HOLES ADJACENT TO ROADWAY OR WALKWAY SHALL BE PROPERLY MARKED AND BARRICADED TO ASSURE THE SAFETY OF BOTH VEHICULAR AND PEDESTRIAN TRAFFIC.
22. TRENCHES OR HOLES NEAR WALKWAYS, IN ROADWAYS OR THEIR SHOULDERS SHALL NOT BE LEFT OPEN DURING NIGHT TIME HOURS WITHOUT ADEQUATE PROTECTION.
23. CONTRACTOR SHALL PROMPTLY REPAIR AND RESTORE EXISTING PAVEMENT, SIDEWALKS, CURBS, DRIVEWAYS, PIPES, RESIDENTIAL AND COMMERCIAL SPRINKLER LINES, CONDUIT, CABLES, ETC. AND LANDSCAPE AREAS DAMAGED AS A RESULT OF CONSTRUCTION ACTIVITIES.
24. CONTRACTOR SHALL PROVIDE TEMPORARY FENCING AS REQUIRED BY AGENCIES HAVING JURISDICTION OVER THE PROJECT AND/OR WHEN REQUIRED FOR PUBLIC SAFETY.
25. THE CONTRACTOR SHALL BE RESPONSIBLE AT ALL TIMES THROUGHOUT THE DURATION OF CONSTRUCTION AND UNTIL ACCEPTANCE OF WORK, FOR THE PROTECTION OF EXISTING AND NEWLY INSTALLED UTILITIES FROM DAMAGE OR DISRUPTION OF SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING SUCH MEASURES AS NECESSARY TO PROTECT THE HEALTH, SAFETY AND WELFARE OF THOSE PERSONS HAVING ACCESS TO THE WORK SITE.
26. CONTRACTOR SHALL ADJUST TO FINAL GRADE ALL EXISTING UTILITY CASTINGS INCLUDED VALVE BOXES, MANHOLES, HAND HOLES, PULL BOXES, INLETS AND SIMILAR STRUCTURES IN CONSTRUCTION AREA TO BE OVERLAID WITH ASPHALT.
27. 27. ALL EXISTING UTILITIES SHOWN ON THESE PLANS ARE TO BE CONSIDERED APPROXIMATE AND SHOULD BE VERIFIED BY THE CONTRACTOR PRIOR TO START OF WORK OPERATIONS.

EROSION AND SEDIMENT CONTROL NOTES

1. CONTRACTOR TO EMPLOY BEST MANAGEMENT PRACTICES THROUGHOUT CONSTRUCTION IN ORDER TO ENSURE POLLUTION PREVENTION. CONTRACTOR TO COMPLY WITH ALL LOCAL STATE AND OTHER GOVERNMENTAL ENVIRONMENTAL REGULATIONS THROUGHOUT CONSTRUCTION.
2. DURING CONSTRUCTION ALL CATCH BASIN INLETS SHALL BE PROTECTED TO PREVENT SEDIMENT AND DEBRIS FROM ENTERING THE CATCH BASIN.
3. SILT FENCES SHALL BE INSTALLED AS NECESSARY TO CONTROL OR PREVENT DISCHARGE OF SEDIMENT ONTO ADJACENT UNDISTURBED AREAS, OR OFF-SITE AREAS.
4. ALL AREAS DISTURBED DURING CONSTRUCTION SHALL BE STABILIZED WITHIN A REASONABLE PERIOD OF TIME TO ASSURE MINIMUM EROSION OF SOILS.
5. NO LAND CLEARING OR GRADING SHALL BEGIN UNTIL ALL EROSION CONTROL MEASURES HAVE BEEN INSTALLED.
6. ALL EXPOSED AREAS SHALL BE SODDED AS SPECIFIED WITHIN 30 DAYS OF FINAL GRADING.
7. MAINTAIN EROSION CONTROL MEASURES AFTER EACH RAIN AND AT LEAST ONCE A WEEK.
8. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT SOIL SEDIMENT FROM LEAVING THE SITE.
9. CONTRACTOR SHALL COMPLY WITH ALL STATE AND LOCAL ORDINANCES THAT APPLY.
10. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSTALLED IF DEEMED NECESSARY BY CITY, COUNTY, AND STATE OF FLORIDA ON SITE INSPECTION, AT NO ADDITIONAL COST TO THE OWNER.
11. LAND DISTURBING ACTIVITIES SHALL NOT COMMENCE UNTIL APPROVAL TO DO SO HAS BEEN RECEIVED BY GOVERNING AUTHORITIES.
12. IF INSTALLATION OF STORM DRAINAGE SYSTEM SHOULD BE INTERRUPTED BY WEATHER OR NIGHTFALL, THE PIPE ENDS SHALL BE COVERED WITH FILTER FABRIC.
13. BURNING OF DEBRIS WILL NOT BE ALLOWED.
14. CONTRACTOR SHALL BE RESPONSIBLE TO TAKE WHATEVER MEANS NECESSARY TO ESTABLISH PERMANENT SOIL STABILIZATION.
15. CONTRACTOR IS TO PROVIDE EROSION CONTROL/SEDIMENTATION BARRIER (HAY BALES OR SILTATION CURTAIN) TO PREVENT SILTATION OF ADJACENT PROPERTY, STREETS, STORM SEWERS AND WATER WAYS. IN ADDITION CONTRACTOR SHALL PLACE STRAW, MULCH OR OTHER SUITABLE MATERIAL ON GROUND IN AREAS WHERE CONSTRUCTION RELATED TRAFFIC IS TO ENTER AND EXIT SITE IF IN THE OPINION OF THE ENGINEER AND/OR LOCAL AUTHORITIES IF EXCESSIVE QUANTITIES OF EARTH ARE TRANSPORTED OFF-SITE EITHER BY NATURAL DRAINAGE OR BY VEHICULAR TRAFFIC. THE CONTRACTOR IS TO REMOVE AND CLEAN SAID EARTH TO THE SATISFACTION OF THE ENGINEER AND/OR AUTHORITIES. EROSION CONTROL BARRIER SHALL BE ESTABLISHED AS THE FIRST ITEM OF WORK.
16. THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S STORMWATER PERMITTING PROGRAM APPLIES TO ALL CONSTRUCTION ACTIVITY THAT: 1) CONTRIBUTE STORMWATER DISCHARGES TO SURFACE WATER OF THE STATE OR INTO A MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4); 2) DISTURBS ONE OR MORE ACRES OF LAND; OR 3) LESS THAN ONE ACRE IS INCLUDED IF THE ACTIVITY IS PART OF A LARGER COMMON PLAN OF DEVELOPMENT THAT WILL MEET OR EXCEED THE ONE ACRE THRESHOLD. DISTURB INCLUDES CLEARING, GRADING AND EXCAVATING.
17. FOR CONSTRUCTION ACTIVITY THAT IS SUBJECT TO THE NPDES FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S STORMWATER PERMITTING PROGRAM, THE CONTRACTOR SHALL:
   - 17.1. OBTAIN A GENERIC PERMIT FOR STORMWATER DISCHARGE FROM LARGE AND SMALL CONSTRUCTION ACTIVITIES FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION DOCUMENT 62-621.300(4)(A).
   - 17.2. COMPLY WITH ALL REQUIREMENTS OF THE GENERIC PERMIT.
   - 17.3. DEVELOP AND IMPLEMENT A STORMWATER POLLUTION PREVENTION PLAN (SWPPP).
   - 17.4. COMPLETE A NOTICE OF INTENT (NOI) FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION FORM 62-621.300(4)(B) IN ITS ENTIRETY USING THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S WEBSITE.
18. SUBMIT COPIES OF THE SWPPP AND THE NOI TO THE ENGINEER AS INFORMATIONAL RECORDS. THESE SUBMITTALS WILL NOT BE REVIEWED BY THE ENGINEER.
19. CONTRACTOR TO CLEAN AND REPAIR ALL EXISTING STORMWATER INFRASTRUCTURE THAT IS IMPACTED BY CONSTRUCTION ACTIVITIES, BEFORE LEAVING THE JOBSITE.
20. CONTRACTOR TO REMOVE ALL FILTER FABRIC AND POLLUTION PREVENTION ITEMS BEFORE THE FINAL WALK-THROUGH.

PROJECT SCOPE NARRATIVE

1. THIS PROJECT IS LOCATED AT THE CITY OF COOPER CITY WASTEWATER TREATMENT PLANT.
2. THIS PROJECT WILL INSTALL A NEW HEADWORKS FACILITY GENERAL CONSISTING OF TWO (2) CENTER FLOW BAND SCREENS AND COMPACTORS, AND PROVISIONS FOR A FUTURE HYDRO INTERNATIONAL HEADCELL GRIT REMOVAL SYSTEM. YARD PIPING REQUIRED FOR THE NEW HEADWORKS FACILITY IS ALSO INCLUDED.
3. THIS PROJECT ALSO INCLUDES INSTALLATION OF A BIOLOGICAL TOWER ODOR CONTROL SYSTEM AND MODIFICATIONS TO THE EXISTING FERRIC/FERROUS SULFATE SYSTEM.
4. THE CONTRACTOR SHALL FURNISH ALL NECESSARY LABOR, EQUIPMENT AND MATERIALS FOR A COMPLETE AND OPERABLE SYSTEM.

FLOODPLAIN COMPLIANCE:

PARAMAETER	VALUE	NOTES
FEMA FLOOD MAP	120110545J	
FEMA BASE (100-YEAR) FLOOD ELEVATION	NOT APPLICABLE	SITE IS NOT WITHIN 100-YEAR FLOOD ZONE
FLOOD ZONE	ZONE X (UNSHADED)	AREA OF MINIMAL FLOOD HAZARD
IS PROJECT SITE HIGHER THAN THE 100-YEAR FLOOD ELEVATION?	YES	-
IS PROJECT SITE HIGHER THAN THE 500-YEAR FLOOD PLAIN?	YES	-
BASE FLOOD ELEVATION, BFE (NAVD1988):	6.00	NEAREST 100-YR FLOOD ELEVATION TO THE PROJECT SITE ON FIRM MAP (NAVD1988)
FLOOD DESIGN CLASS	3	ASCE 24-24 TABLE 1-1
CROWN OF ROAD ELEVATION ADJACENT TO PROJECT SITE (NAVD1988)	7.00	SW 49TH STREET
HEADWORKS AREA FINISHED FLOOR EL. (NAVD1988)	VARIES- 8.00 (MINIMUM)	
MINIMUM FINISHED FLOOR EL. REQUIRED VALUE (NAVD1988) DESIGN VALUE (NAVD1988) COMPLIES	BFE+2 8.00 8.00 YES	ASCE 24-24 TABLE 2-1
MINIMUM EQUIPMENT EL. REQUIRED VALUE (NAVD1988) DESIGN VALUE (NAVD1988) COMPLIES	BFE+2 8.00 8.00 YES	ASCE 24-24 TABLE 7-1
ASCE 24-24: AMERICAN SOCIETY OF CIVIL ENGINEERS STANDARD TITLED "FLOOD RESISTANT DESIGN AND CONSTRUCTION".		

NAVD: NORTH AMERICAN VERTICAL DATUM.

NGVD: NATIONAL GEODETIC VERTICAL DATUM.

BFE: BASE FLOOD ELEVATION.

1/32"=1'-0" 32 16 0 32'

REV	ISSUED FOR	DATE	BY
2	90% SUBMITTAL	4/26	FAM
1	75% SUBMITTAL	4/26	FAM

PROJECT ENGINEER: F. MARTINEZ
DESIGNED BY: E. PAGE
DRAWN BY: T. BOCAS
CHECKED BY: F. MARTINEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PRELIMINARY DRAWING DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

COOPER CITY, FLORIDA

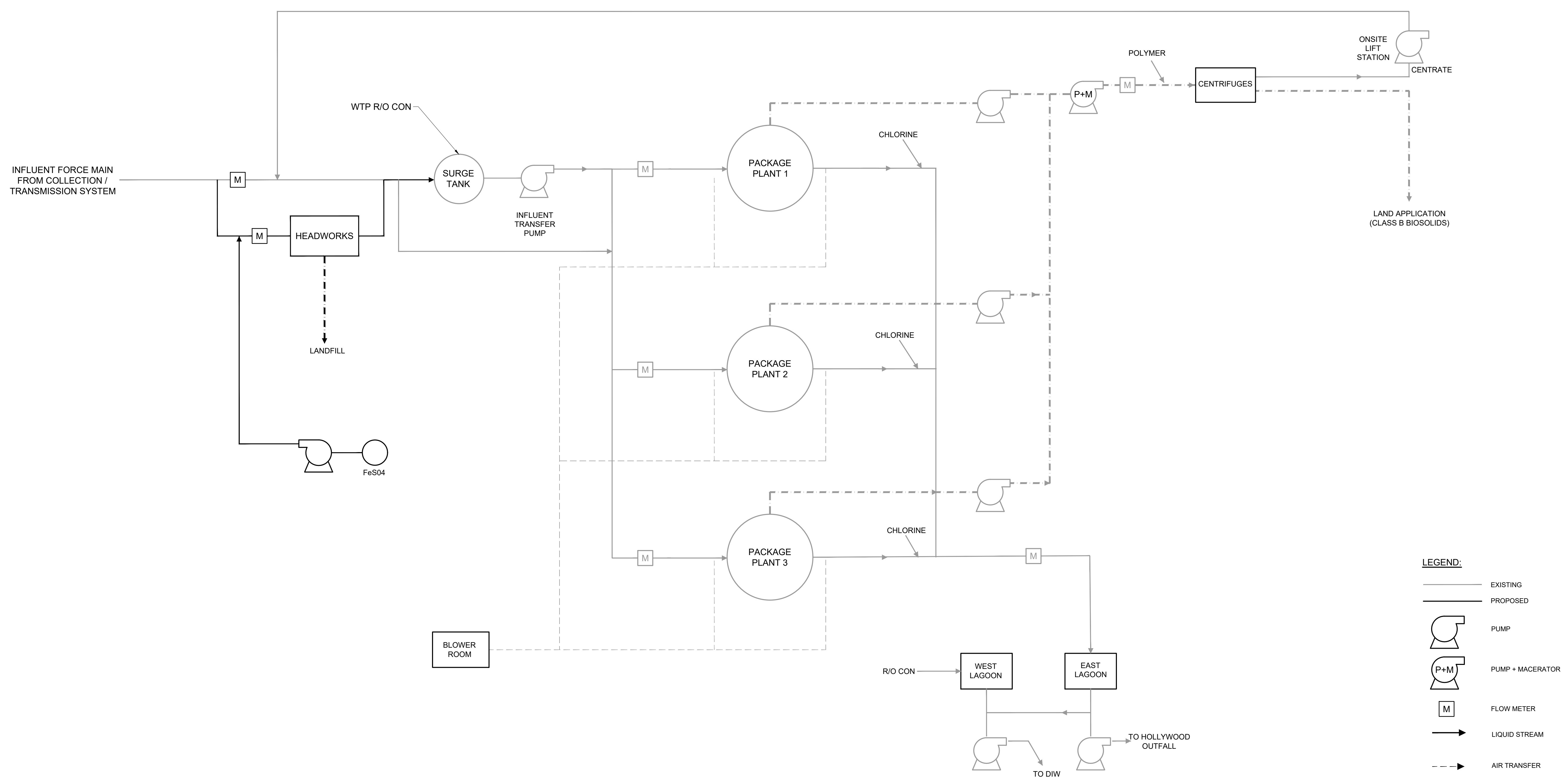
WASTEWATER TREATMENT FACILITY
HEADWORKS - PHASE 1

GENERAL

GENERAL NOTES

DATE: APRIL 2026
HAZEN NO.: 04679-022
CONTRACT NO.: 1
DRAWING NUMBER: G-04

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION



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498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

COOPER CITY, FLORIDA

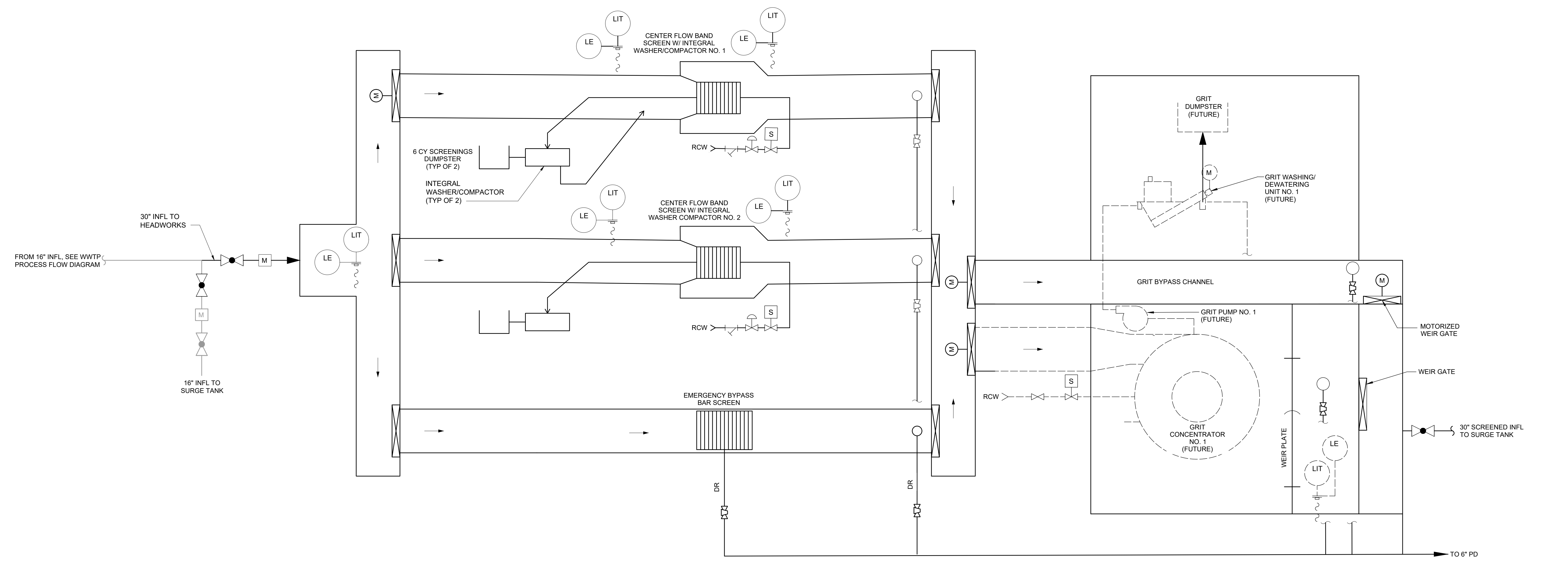
WASTEWATER TREATMENT FACILITY
HEADWORKS - PHASE 1

GENERAL

PROPOSED WWTP PROCESS FLOW DIAGRAM

DATE:	APRIL 2026
HAZEN NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	G-05

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION



NOTES:
GRIT REMOVAL SYSTEM EQUIPMENT, PIPING AND APPURTENANCES TO BE PROVIDED UNDER A SEPARATE CONTRACT.

LEGEND:

EXISTING

PROPOSED

PROPOSED (FUTURE)

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY
2	90% SUBMITTAL	4/26	FAM
1	75% SUBMITTAL	4/26	FAM

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 1/2" 1")

PRELIMINARY DRAWING DO NOT USE FOR CONSTRUCTION

Hazen

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498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

COOPER CITY, FLORIDA

WASTEWATER TREATMENT FACILITY HEADWORKS - PHASE 1

GENERAL

PRELIMINARY TREATMENT PROCESS FLOW DIAGRAM

DATE:	APRIL 2026
HAZEN NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	G-06

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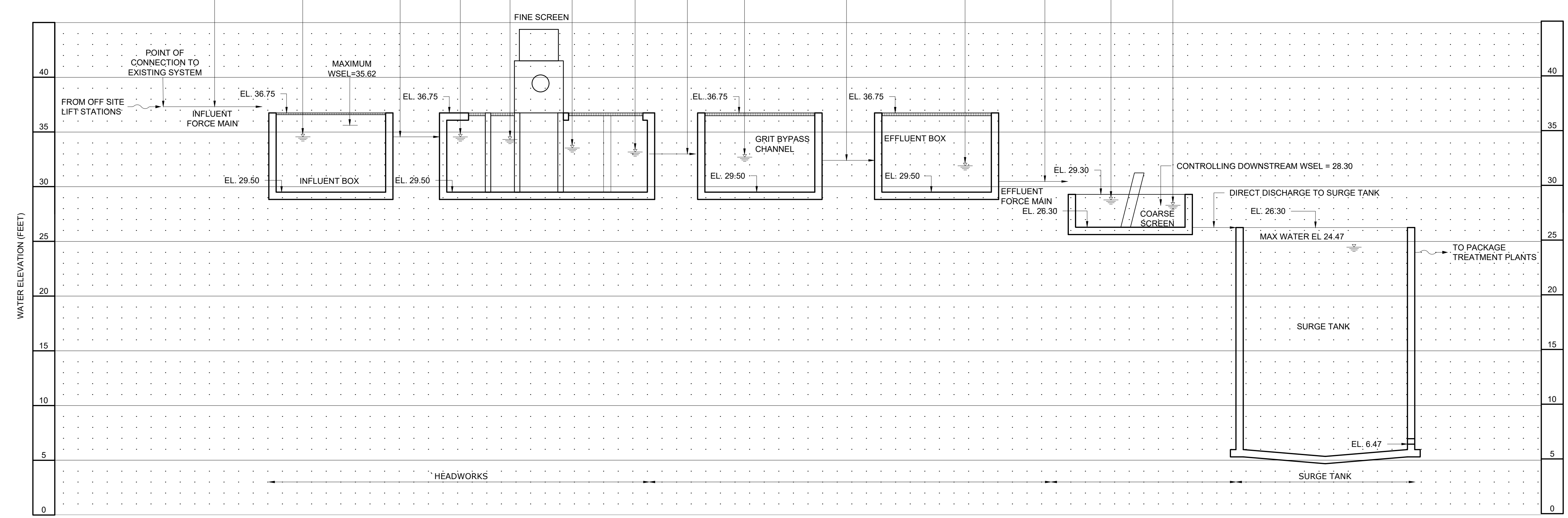
PLOT DATE: 4/29/2026 12:53 p.m. BY: LAURA SORIANO

FLOWRATE CONDITION	FLOW RATE (MGD)	HYDRAULIC GRADE LINE ELEVATIONS (FEET)													
AVERAGE DAY	3.3	31.79	31.66	31.66	31.66	31.57	31.17	31.03	30.95	30.84	30.70	30.53	28.47	28.34	28.30
THREE MONTH AVERAGE DAY	4.3	32.27	32.05	32.05	32.05	31.95	31.49	31.31	31.22	31.09	30.93	30.72	28.58	28.36	28.30
PEAK HOUR	12.1	36.27	34.56	34.56	34.55	34.32	33.54	33.17	33.00	32.70	32.41	31.91	30.48	28.79	28.30



WSEL - Water Surface Elevation

REV	ISSUED FOR	DATE	BY
1	PERMITTING	4/26	FAM

PROJECT ENGINEER: F. MARTINEZ
DESIGNED BY: E. PAGE
DRAWN BY: T. BOCAS
CHECKED BY: F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

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WASTEWATER TREATMENT FACILITY
HEADWORKS - PHASE 1

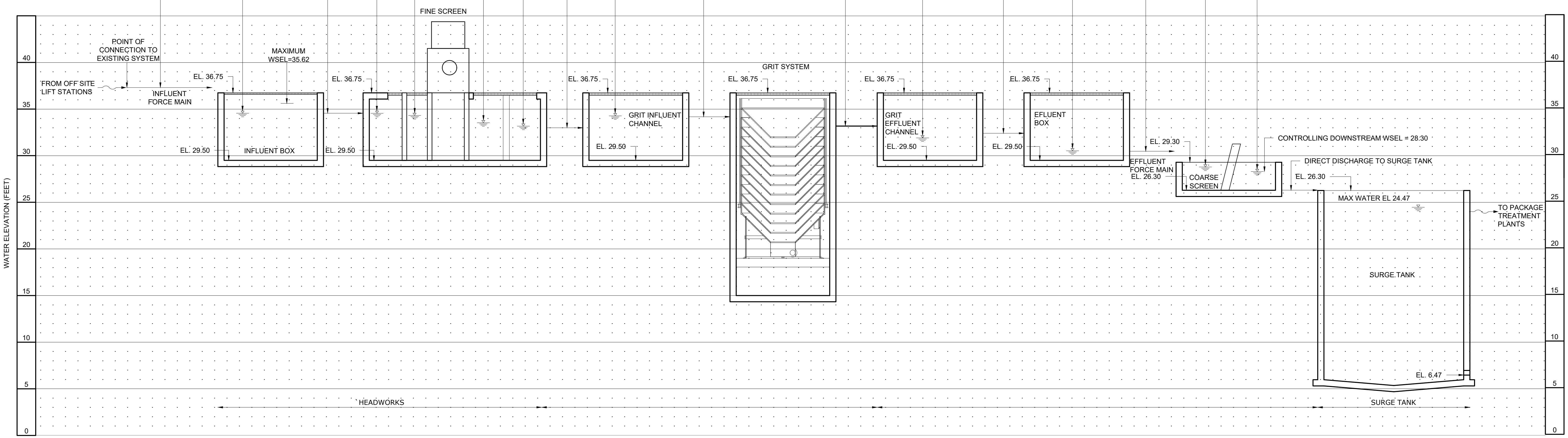
GENERAL

HYDRAULIC PROFILE
(WITH GRIT REMOVAL BYPASS)

DATE: APRIL 2026
HAZEN NO.: 04679-022
CONTRACT NO.: 1
DRAWING NUMBER: G-07

FOR PERMITTING PURPOSES – NOT FOR CONSTRUCTION

FLOWRATE CONDITION	FLOW RATE (MGD)	HYDRAULIC GRADE LINE ELEVATIONS (FEET)																
AVERAGE DAY	3.3	33.50	33.42	33.42	33.42	33.39	33.02	32.99	32.98	32.96	32.94	32.80	31.44	31.44	29.80	28.47	28.34	28.30
THREE MONTH AVERAGE DAY	4.3	33.79	33.65	33.65	33.64	33.61	33.18	33.13	33.11	33.08	33.06	32.85	31.52	31.52	29.85	28.58	28.36	28.30
PEAK HOUR	12.1	36.77	35.62	35.62	35.61	35.46	34.72	34.51	34.42	34.28	34.18	33.18	32.03	32.02	30.53	30.48	28.79	28.30



WSEL - Water Surface Elevation

REV	ISSUED FOR	DATE	BY
1	PERMITTING	4/26	FAM

PROJECT ENGINEER: F. MARTINEZ
DESIGNED BY: E. PAGE
DRAWN BY: T. BOCAS
CHECKED BY: F. MARTINEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

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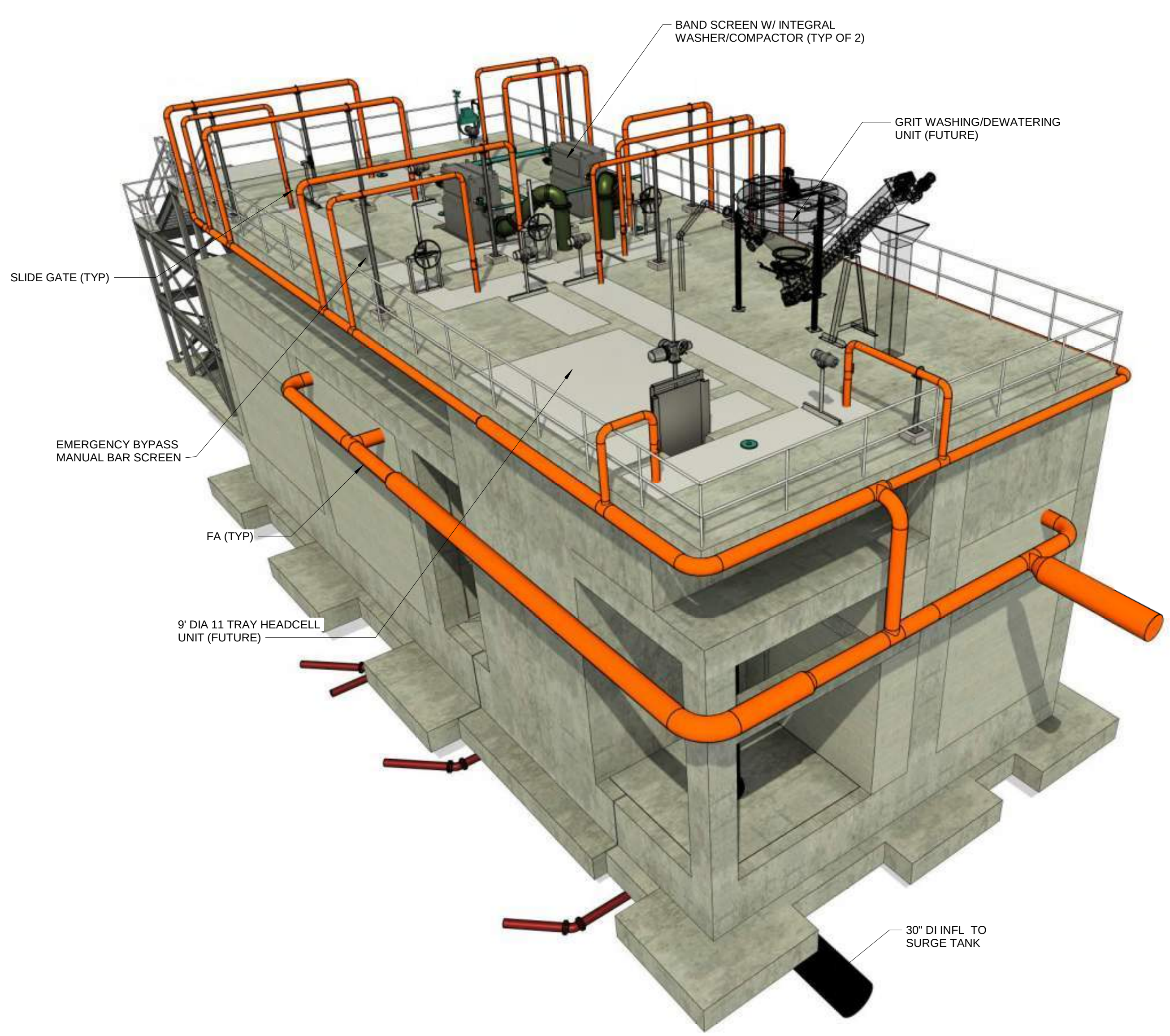
HEADWORKS - PHASE 1

GENERAL

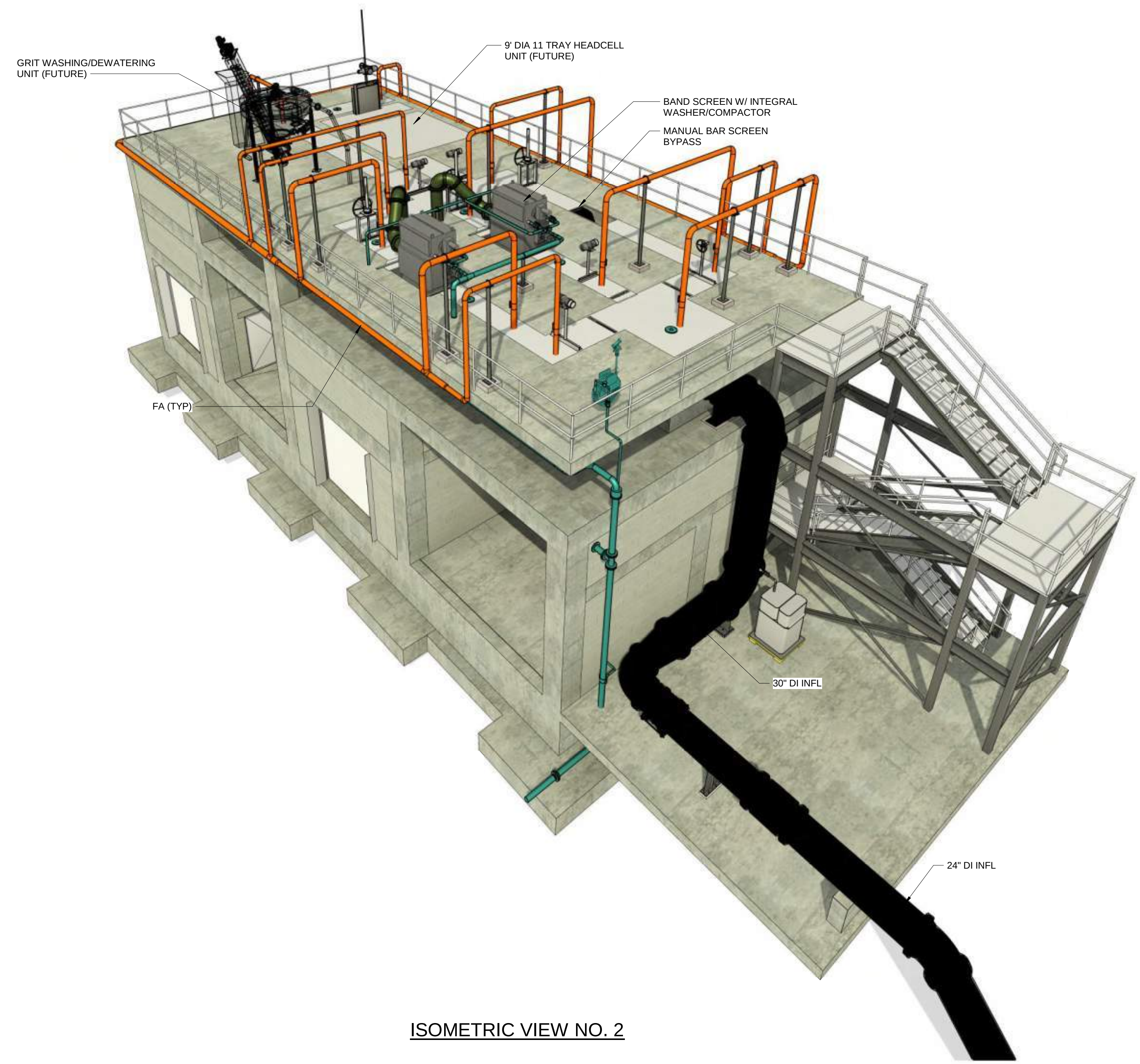
HYDRAULIC PROFILE
(WITH FUTURE GRIT REMOVAL SYSTEM)

DATE: APRIL 2026
HAZEN NO.: 04679-022
CONTRACT NO.: 1
DRAWING NUMBER: G-08

FOR PERMITTING PURPOSES – NOT FOR CONSTRUCTION



ISOMETRIC VIEW NO. 1



ISOMETRIC VIEW NO. 2

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PRELIMINARY DRAWING
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CONSTRUCTION

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HEADWORKS DESIGN - PHASE I

MECHANICAL

HEADWORKS
ISOMETRIC VIEWS

DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-01

Autodesk Docs://04679-022/04679-022-10-M.rvt
26/04/2026 12:37:38 p.m.

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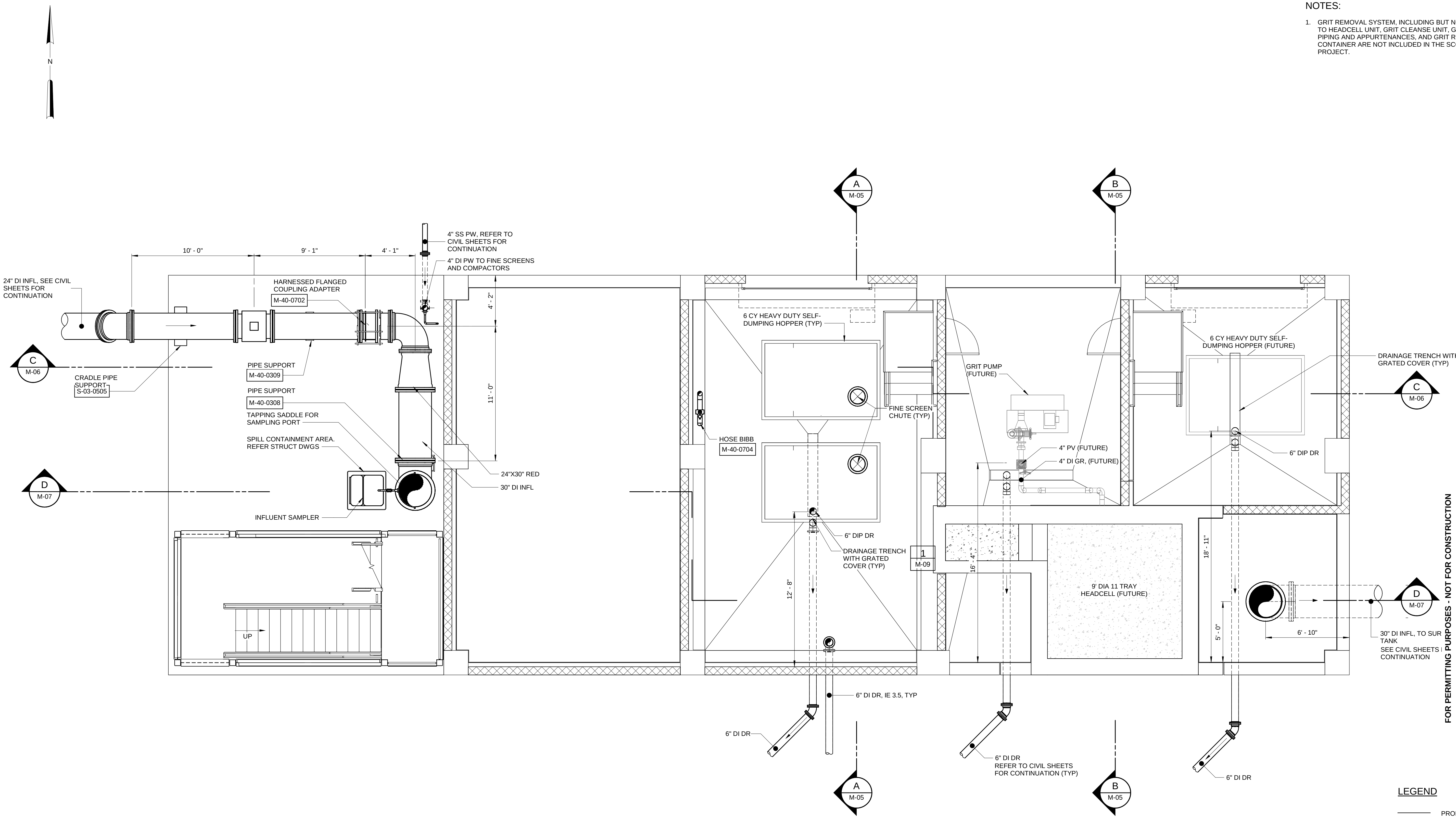
NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.



BOTTOM PLAN (EL 11.00)

1/4" = 1'-0"

LEGEND

- PROPOSED
- PROPOSED (BELOW)
- PROPOSED BY OTHERS (NIC)

1/4" = 1'-0" 1 0 1 2 3 7'

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PRELIMINARY DRAWING DO NOT USED FOR CONSTRUCTION

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MECHANICAL

HEADWORKS
BOTTOM PLAN

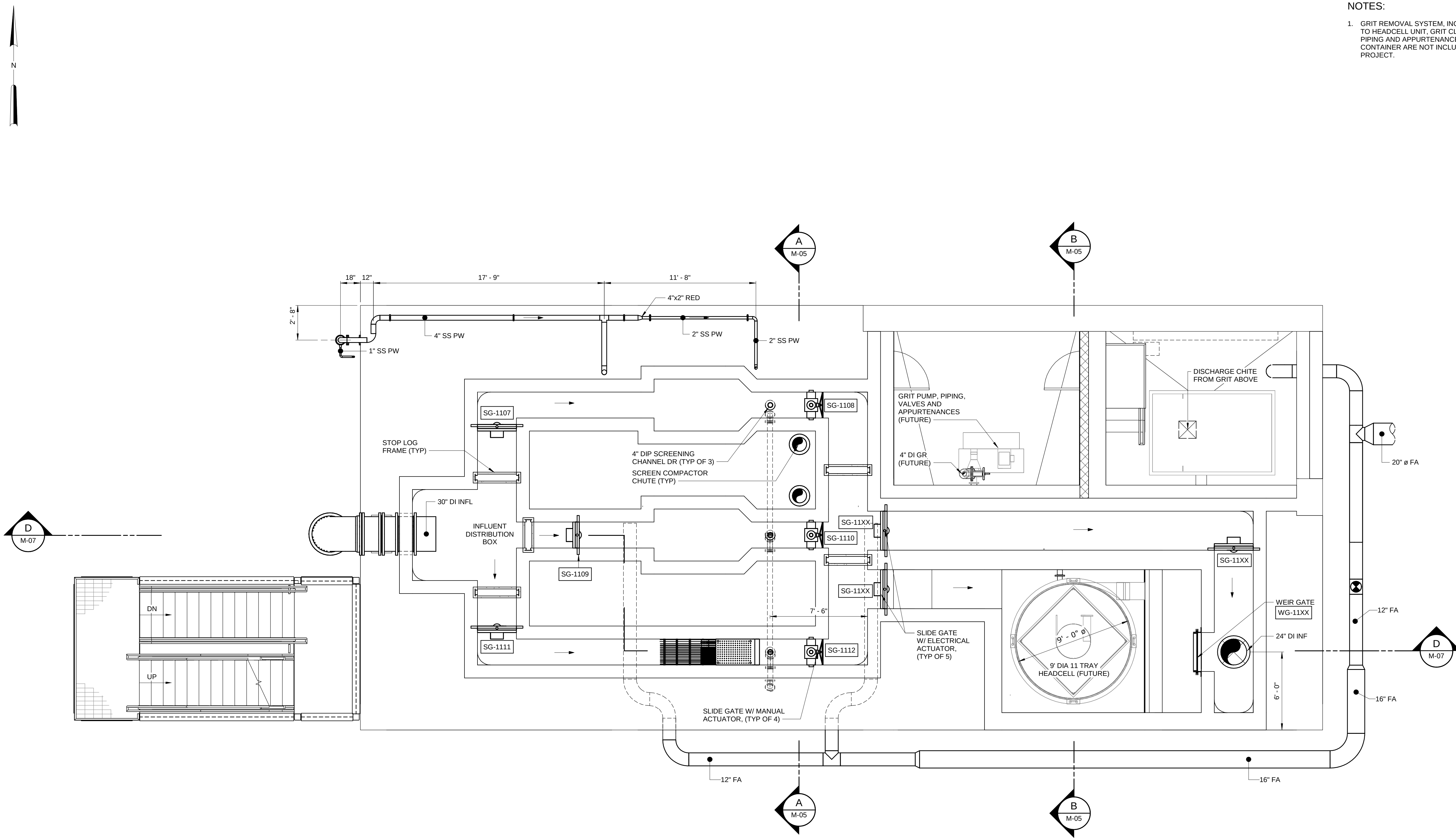
DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-02

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

Autodesk Docs://04679-022/04679-022-10-M.rvt
28/04/2026 12:38:06 p. m.

NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.



INTERMEDIATE PLAN (EL 25.00)

1/4" = 1'-0"

LEGEND

- PROPOSED
- PROPOSED (BELOW)
- PROPOSED BY OTHERS (NIC)

1 0 1 2 3 7'

1/4" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PRELIMINARY DRAWING DO NOT USED FOR CONSTRUCTION

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HEADWORKS DESIGN - PHASE I

MECHANICAL

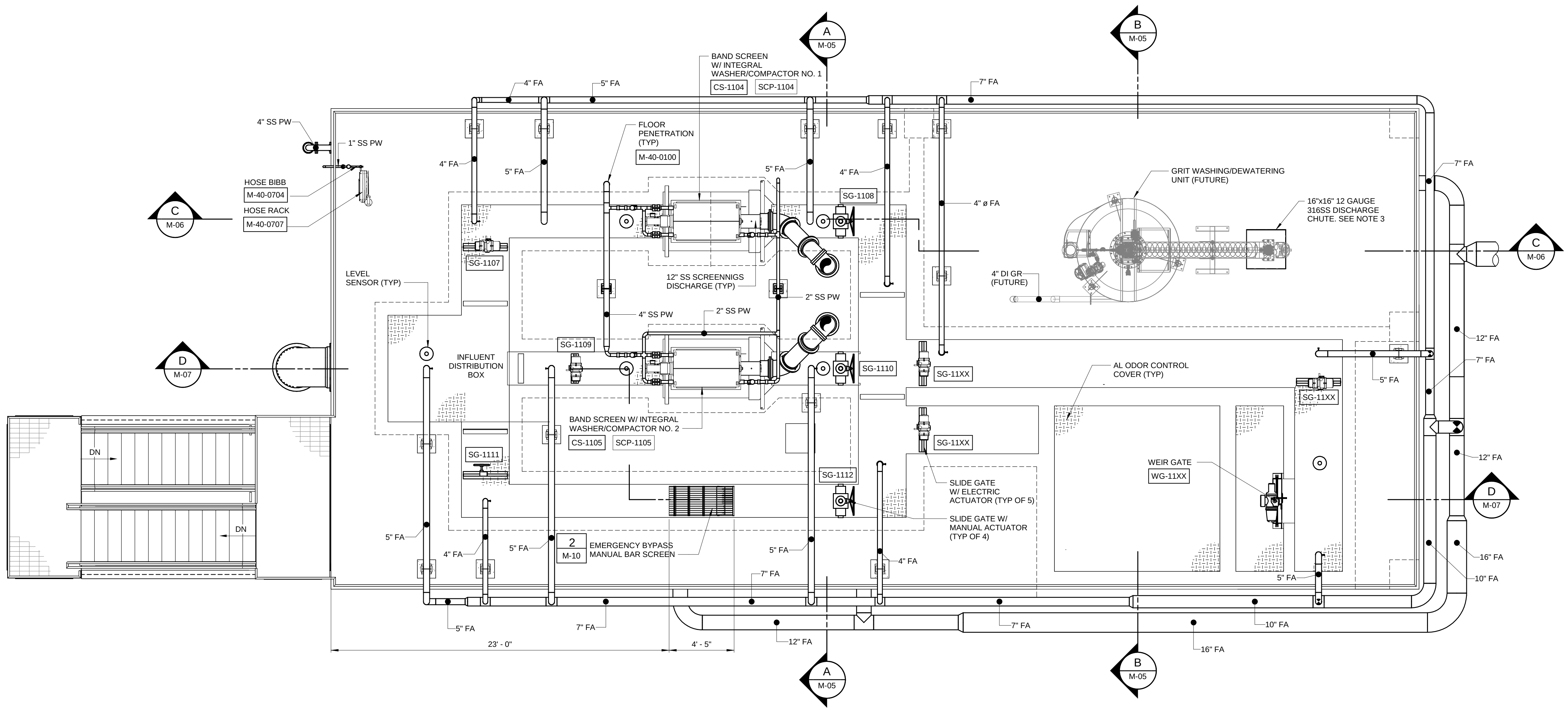
HEADWORKS
INTERMEDIATE PLAN

DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-03

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.
2. FIELD RUN AND ADJUST SCREEN AND GRIT SYSTEM WASH WATER SYSTEMS AS NEED TO BEST SUIT THE FUSRNISHED EQUIPMENT AND OWNER'S PREFERENCE.
3. CONTRACTOR SHALL INSTALL PENETRATION FOR FUTURE GRIT DISCHARGE CHUTE. OPENING SHALL BE COVERED. REFER TO STRUCTURAL DRAWINGS.



UPPER PLAN (EL 28.00)

1/4" = 1'-0"

LEGEND

————	PROPOSED
– – – –	PROPOSED (BELOW)
————	PROPOSED BY OTHERS (NIC)

1 0 1 2 3 7'

1/4" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ

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HEADWORKS DESIGN - PHASE I

MECHANICAL

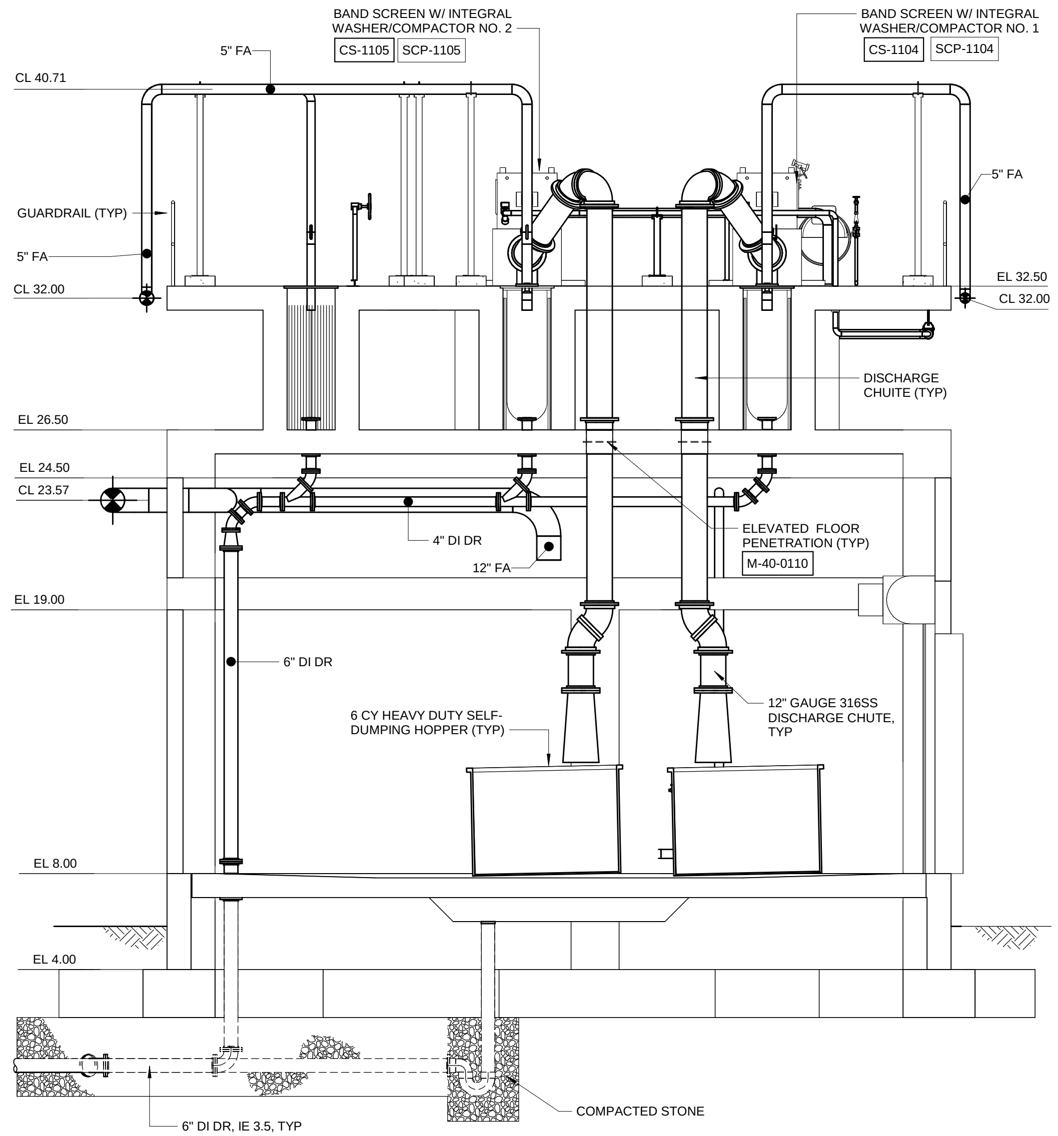
HEADWORKS
UPPER PLAN

DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-04

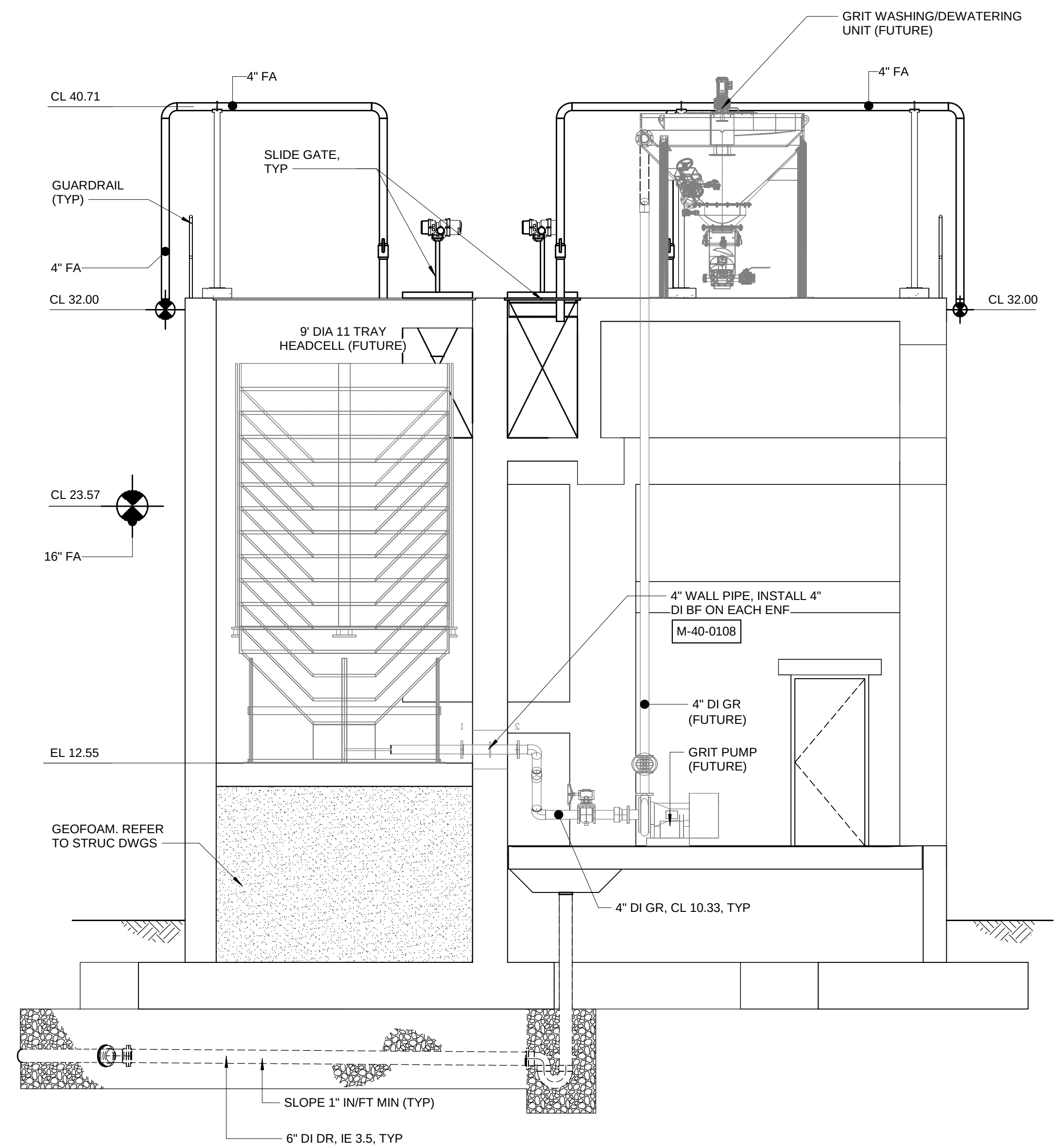
FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.
2. TYPICAL CLEARANCE FROM THE DUMPSTER SHOULD BE 12". FIELD ADJUST FINAL CLEAREANCE BASED ON OWNER'S SELECTEED DUMPSTER AND PREFERENCE.
3. FIELD RUN AND ADJUST SCREEN AND GRIT SYSTEM WASH WATER SYSTEMS AS NEED TO BEST SUIT THE FUSRNISHED EQUIPMENT AND OWNER'S PREFERENCE.



SECTION A
M-02
1/4" = 1'-0"



SECTION B
M-02
1/4" = 1'-0"

LEGEND

————	PROPOSED
– – – –	PROPOSED (BELOW)
————	PROPOSED BY OTHERS (NIC)

1/4" = 1'-0" 1 0 1 2 3 7'

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PRELIMINARY DRAWING DO NOT USED FOR CONSTRUCTION

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HEADWORKS DESIGN - PHASE I

MECHANICAL

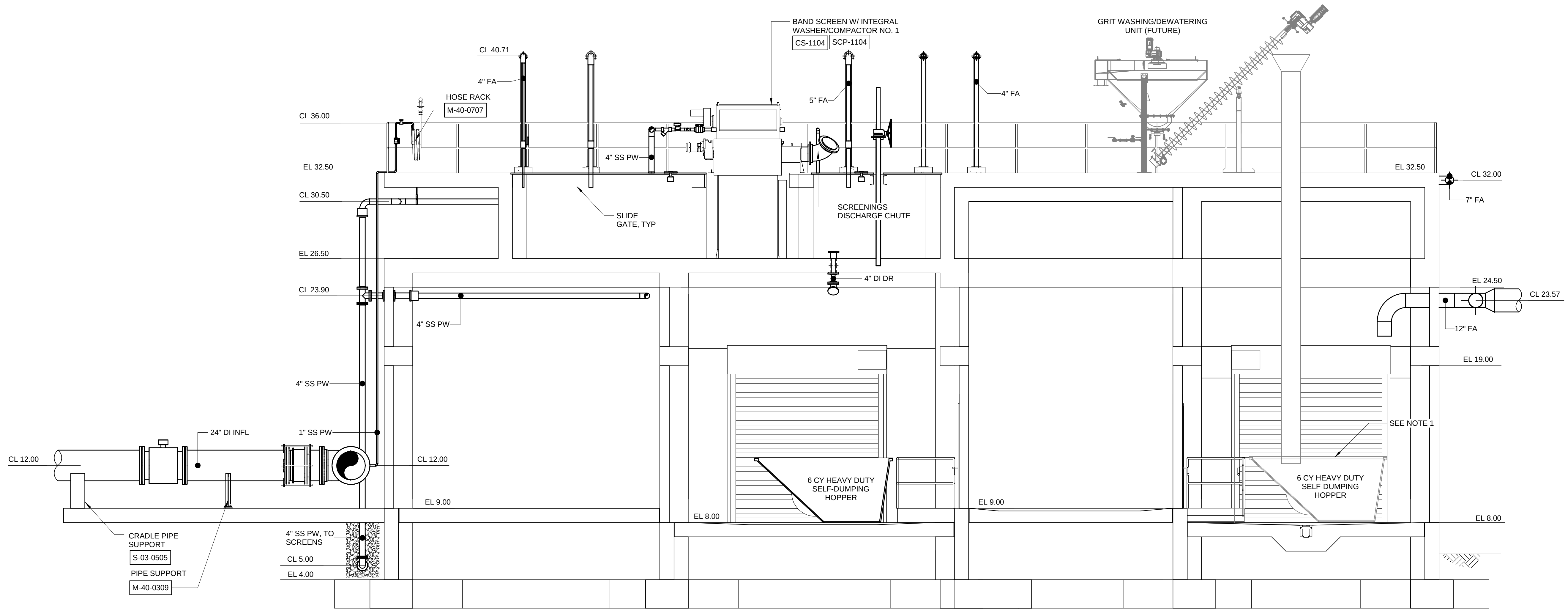
HEADWORKS
SECTIONS - SHEET 1

DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-05

Autodesk Docs://04679-022/04679-022-10-M.rvt
29/04/2026 12:36:18 p. m.

NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.
2. IELD RUN AND ADJUST SCREEN AND GRIT SYSTEM WASH WATER SYSTEMS AS NEED TO BEST SUIT THE FUSRNISHED EQUIPMENT AND OWNER'S PREFERENCE.



SECTION C / M-02

1/4" = 1'-0"

LEGEND

———	PROPOSED
– – – –	PROPOSED (BELOW)
———	PROPOSED BY OTHERS (NIC)

1/4" = 1'-0" 1 0 1 2 3 7'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

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CITY OF Cooper City

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WASTEWATER TREATMENT FACILITY
HEADWORKS DESIGN - PHASE I

MECHANICAL

HEADWORKS
SECTIONS - SHEET 2

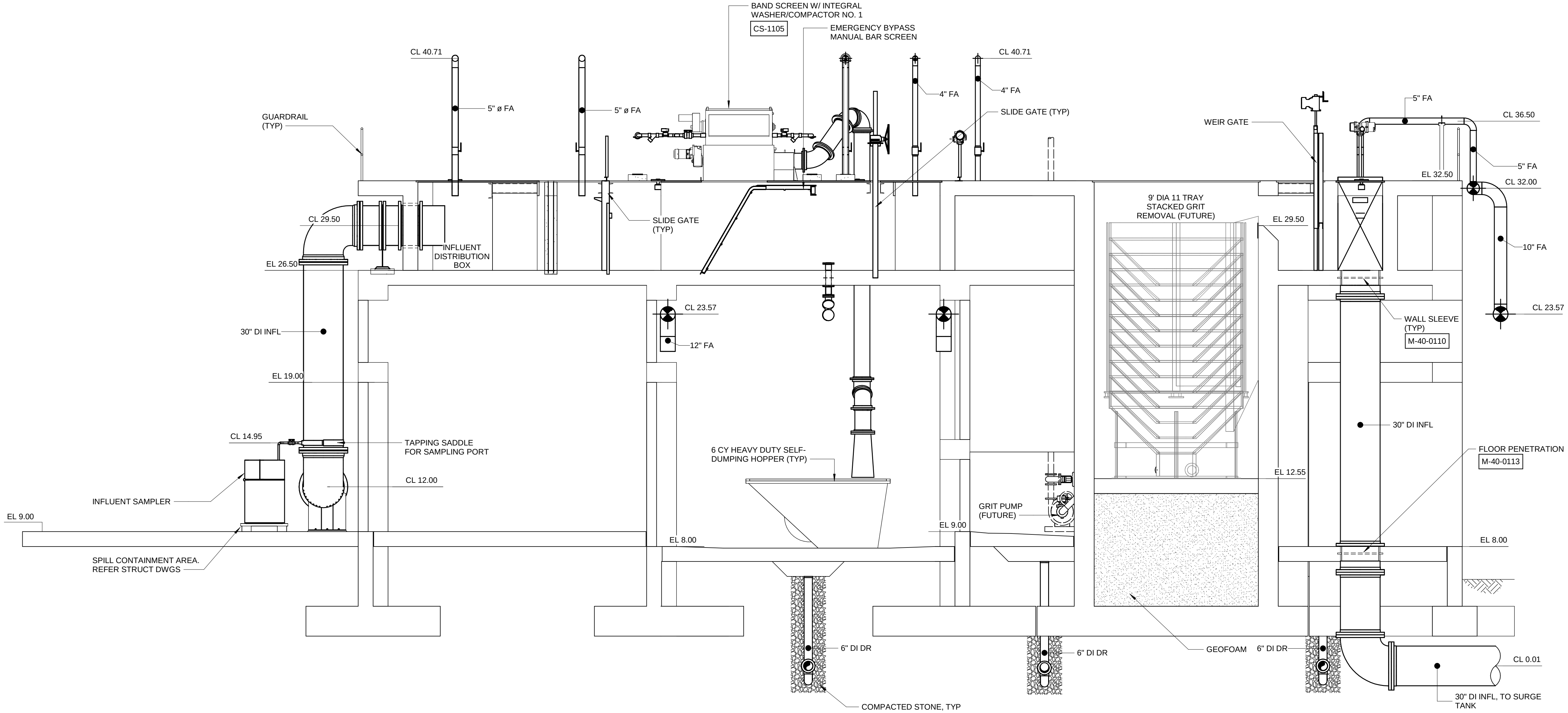
DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-06

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

Autodesk Docs://04679-022/04679-022-10-M.rvt
29/04/2026 12:36:26 p. m.

NOTES:

1. GRIT REMOVAL SYSTEM, INCLUDING BUT NOT LIMITED TO HEADCELL UNIT, GRIT CLEANSE UNIT, GRIT PUMP, PIPING AND APPURTENANCES, AND GRIT ROLL OFF CONTAINER ARE NOT INCLUDED IN THE SCOPE OF THIS PROJECT.
2. TYPICAL CLEARANCE FROM THE DUMPSTER SHOULD BE 12". FIELD ADJUST FINAL CLEAREANCE BASED ON OWNER'S SELECTEED DUMPSTER AND PREFERENCE.
3. FIELD RUN AND ADJUST SCREEN AND GRIT SYSTEM WASH WATER SYSTEMS AS NEED TO BEST SUIT THE FUSRNISHED EQUIPMENT AND OWNER'S PREFERENCE.



SECTION D M-02
1/4" = 1'-0"

LEGEND

PROPOSED
PROPOSED (BELOW)
PROPOSED BY OTHERS (NIC)

1 0 1 2 3 7'
1/4" = 1'-0"

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: F. MARTINEZ
DESIGNED BY: E. PAGE
DRAWN BY: L. SORIANO
CHECKED BY: F. MARTINEZ
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PRELIMINARY DRAWING DO NOT USED FOR CONSTRUCTION

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WASTEWATER TREATMENT FACILITY
HEADWORKS DESIGN - PHASE I

MECHANICAL

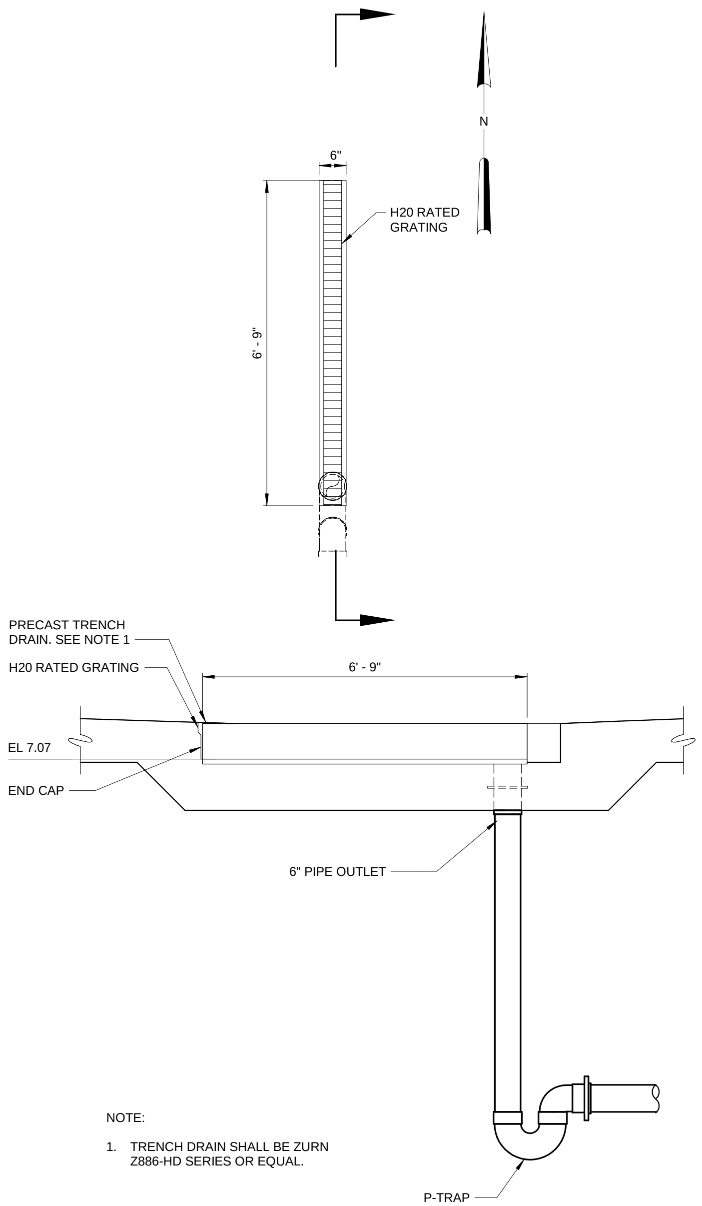
HEADWORKS
SECTIONS - SHEET 3

DATE: APRIL 2026
PROJECT NO.: 04679-022
CONTRACT NO.: 1
DRAWING NUMBER: M-07

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

NOTES:

1. CLEARANCE FROM THE SUMPSTER SHOULD BE 12". FIELD ADJUST FINAL CLEARANCE BASED ON OWNER'S SELECTED DUMPSTER AND PREFERENCE.
2. CHAIN WHEEL OPERATORS FOR CHANNEL DRAIN VALVES SHALL BE SUPPLIED PER THE SPECIFICATIONS.
3. NOT ALL PIPE SUPPORTS ARE SHOWN, PIPE SUPPORTS SHALL BE INSTALLED AS REQUIRED PER THE DRAWINGS AND TYPICAL DETAIL REQUIREMENTS AND SPACING PER SPECS.
4. FIELD RUN AND ADJUST SCREEN AND GRIT SYSTEM WASH WATER SYSTEMS AS NEEED TO BEST SUIT THE FURNISHED EQUIPMENT AND THE OWNER'S PREFERENCE.
5. ADJUST HEIGHT AND ALIGNMENT OF GRIT EQUIPMENT AND PIPING BASED ON MANUFACTURERS FURNISHED EQUIPMENT.

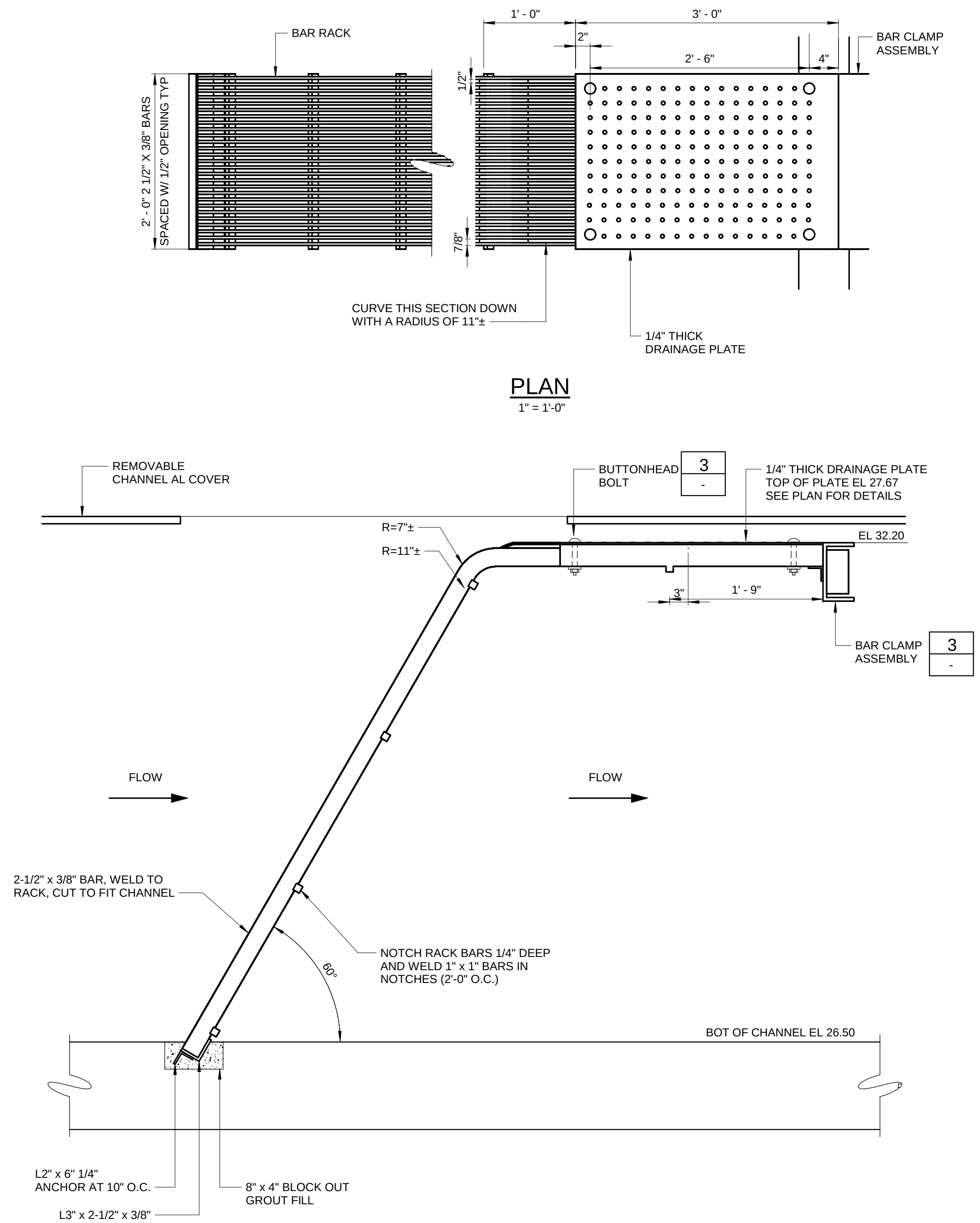


NOTE:

1. TRENCH DRAIN SHALL BE ZURN Z886-HD SERIES OR EQUAL.

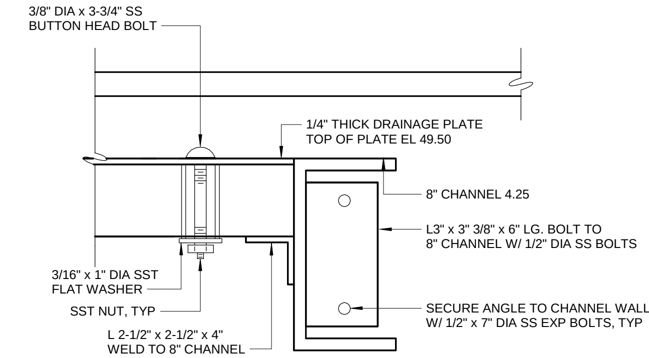
SECTION A-A
1/2" = 1'-0"

DETAIL 1
1/2" = 1'-0"



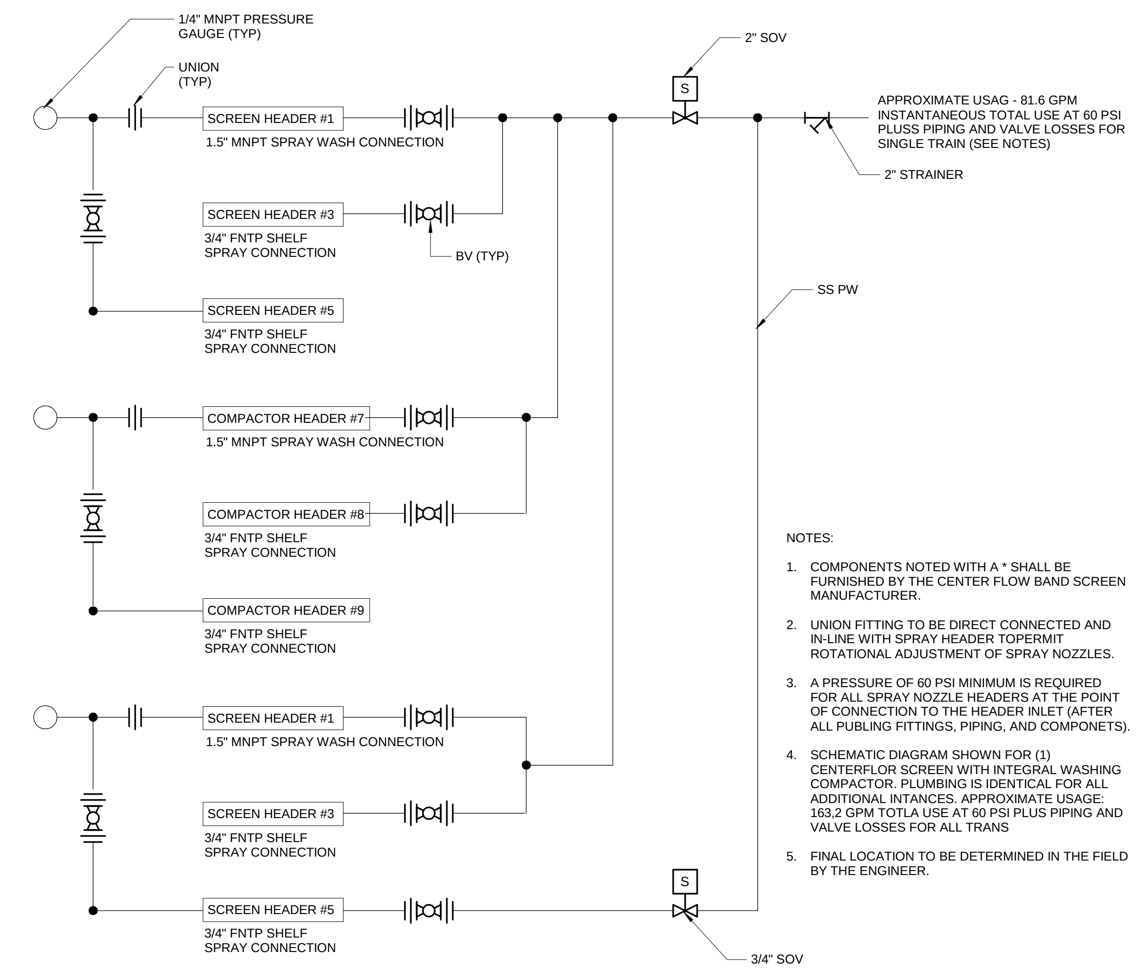
MANUAL BAR SCREEN

DETAIL 2
1" = 1'-0"



BOLT AND BAR CLAMP ASSEMBLY

DETAIL 3
3" = 1'-0"



NOTES:

1. COMPONENTS NOTED WITH A * SHALL BE FURNISHED BY THE CENTER FLOW BAND SCREEN MANUFACTURER.
2. UNION FITTING TO BE DIRECT CONNECTED AND IN-LINE WITH SPRAY HEADER TOPERMIT ROTATIONAL ADJUSTMENT OF SPRAY NOZZLES.
3. A PRESSURE OF 60 PSI MINIMUM IS REQUIRED FOR ALL SPRAY NOZZLE HEADERS AT THE POINT OF CONNECTION TO THE HEADER INLET (AFTER ALL PUBLING FITTINGS, PIPING, AND COMPONETS).
4. SCHEMATIC DIAGRAM SHOWN FOR (1) CENTERFLOR SCREEN WITH INTEGRAL WASHING COMPACTOR. PLUMBING IS IDENTICAL FOR ALL ADDITIONAL INTANCES. APPROXIMATE USAGE: 163.2 GPM TOTLA USE AT 60 PSI PLUS PIPING AND VALVE LOSSES FOR ALL TRANS
5. FINAL LOCATION TO BE DETERMINED IN THE FIELD BY THE ENGINEER.

PLANT WATER SCHEMATIC FOR CENTER FLOW BAND SCREENS

DETAIL 4
NTS

1" = 1'-0" (12" 6 0 1')
1/2" = 1'-0" (12" 0 1 3')

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	F. MARTINEZ
DESIGNED BY:	E. PAGE
DRAWN BY:	L. SORIANO
CHECKED BY:	F. MARTINEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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COOPER CITY, FLORIDA

WASTEWATER TREATMENT FACILITY
HEADWORKS DESIGN - PHASE I

MECHANICAL

HEADWORKS
DETAILS SHEET 1

DATE:	APRIL 2026
PROJECT NO.:	04679-022
CONTRACT NO.:	1
DRAWING NUMBER:	M-08

FOR PERMITTING PURPOSES - NOT FOR CONSTRUCTION

Appendix C: Screenings, Grit Removal and Odor Control Technologies Workshop (Workshop No. 1) Slides

Screening, Grit Removal, and Odor Control Technologies Workshop

May 28, 2025

1

Workshop Outline

1. Project Background
2. Design Flows
3. Screening Technology Comparison
4. Grit Removal Technology Comparison
5. Odor Control Technology Comparison
6. Next Steps

2

Project Background

3

Project Background

George A. Haughney WWTP

Existing WWTP Capacity per FDEP Permit No. FL0040398:

- 4.27 mgd TMADF

Existing WWTP Process Overview

- Manually cleaned bar screen and 0.30 MG influent surge tank
- Three contact stabilization type treatment units
- Two effluent surge/storage ponds
- Disposal via deep injection wells and to City of Hollywood Southern Regional WWTP

Hazen 4

4

Design Flows

5

Influent Flow Analysis

Existing Flows		
Flow Criteria	Permitted Capacity	
	Rated Flow (mgd)	Peaking Factor (based on Rated Flow)
Minimum Day	2.78	0.75
AADF	3.71	1
MTMDAF	4.27	1.15
Maximum 30-Day	4.83	1.3
Maximum 7-Day	7.05	1.9
Max Daily Flow (MDF)	9.28	2.5
Peak Hour Flow (PHF)	11.14	3

*Based on peaking factors provided in Master Plan; will be compared to historical data collected from 2022 thru 2024

6

Typical Headworks Arrangement

7

7

Typical Headworks Arrangement

Coarse Screen
Protect downstream pumps and share screen load for removal of large debris

→

Fine Screen
Maximize removal of influent debris to protect downstream rotating equipment

→

Grit Removal
Remove small, abrasive material from the influent stream to protect equipment and process volume

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8

8

Existing Headworks Equipment

Manual Bar Screen at Surge Tank and Treatment Units

9

Screenings Removal

10

Why Do We Screen?

Remove trash, debris, and other coarse material from the flow stream to protect downstream infrastructure from wear and tear

- Pumps
- Mixers
- Surface Aerators
- Gates
- Valves
- Diffusers

Hazen

11

What Do We Remove?

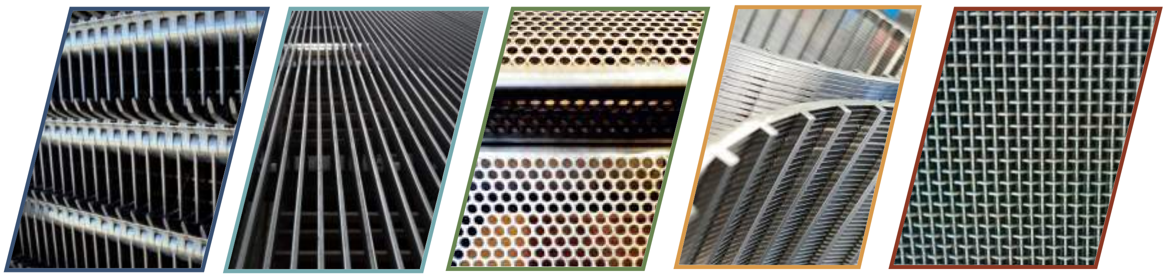
- Rags and Flushable Wipes
- Rocks
- Food
- Trash
- Sticks
- Leaves
- Hygiene Products

Quantity and type of screenings is dependent upon the specific system

Hazen

12

How Do We Screen?



Plastic Tooth Filter | Vertical Bar | Perforated Plate | Wedgewire | Wire Mesh

Images Courtesy of Parkson Corporation and Sereco

Screen Selection Criteria

1. Downstream Process
2. Flow Rates
3. Hydraulic and Space Limitations
4. Maintenance Considerations
5. Operational Considerations

1 Downstream Process

Coarse Screening
- Pump Protection
- Raw Intake

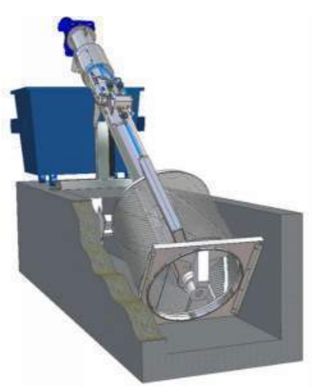
Fine Screening
- Conventional WWTP

Extremely Fine Screening
- Membranes

15

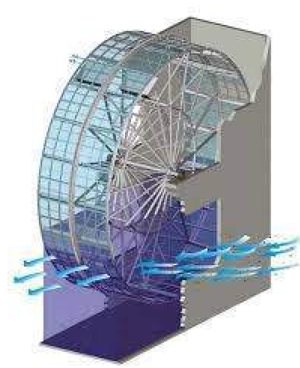
2 Flow Rates

Small Flows



Size for AADF and wet weather peak

Large Flows



16

3 Hydraulic, Space and Performance Limitations

Hydraulic and Space Limitations:

- Head availability
- Footprint availability
- Piping and channel configuration
- Headworks dimensions
- Screenings removal/disposal

Performance Limitations:

- Headloss
- Carry-Over
- Pass-Through
- Bypass
- Balling

Hazen

18

Headloss

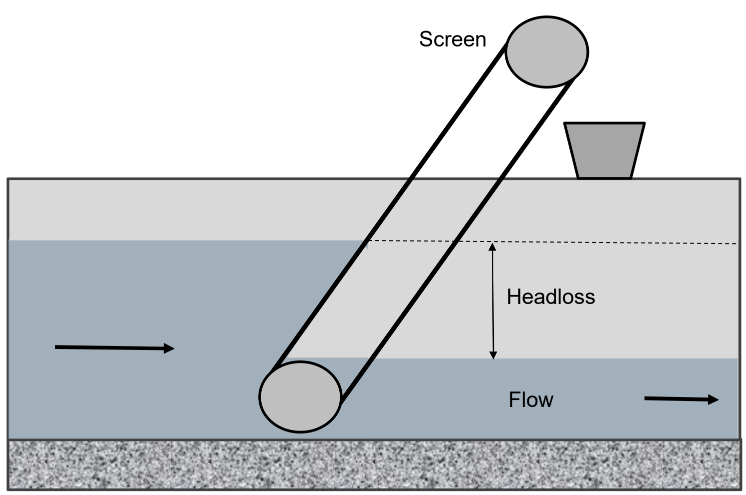
Common Performance Impacts to:

- All screen types

Factors

- Opening Type and Size
- Cleaning Frequency
- Total Blinding

Manufacturers can provide maximum allowable headloss as well as anticipated headloss based upon flow and % blind



Hazen

19

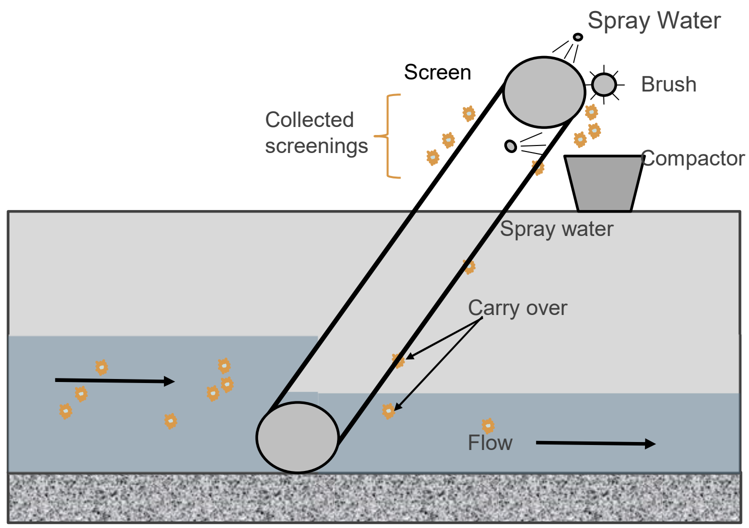
Carry-over

Common Performance Impacts to:

- Flow through perforated plate screens
- Plastic tooth filter screens
- Multi-rake bar screens

Factors

- Routine Maintenance
- Spray water Pressure



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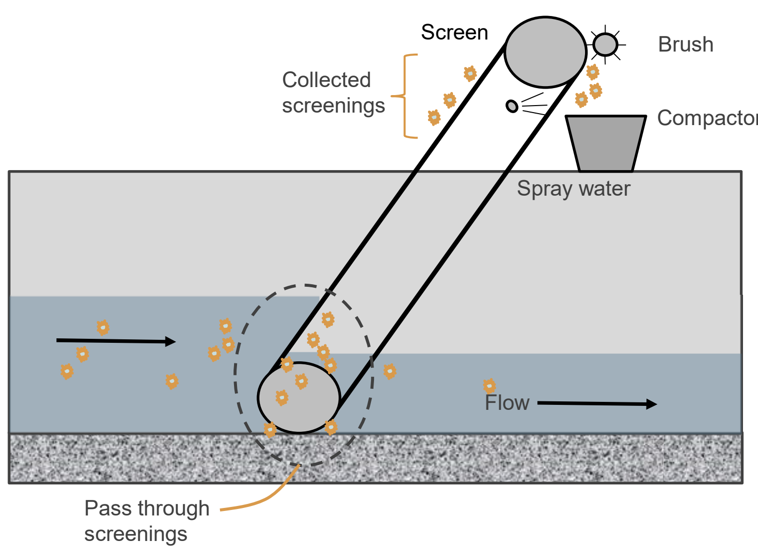
Pass-through

Common Performance Impacts to:

- Plastic tooth filter screens
- Multi-rake bar screens
- Step screens
- Most others

Factors

- High velocities
- High differential pressures
- Lack of matting



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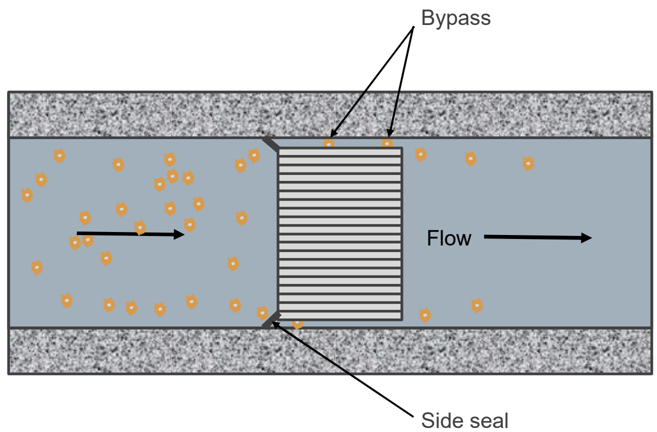
Bypass

Common Performance Impacts to:

- Flow through perforated plate screens
- Plastic tooth filter screens
- Multi-rake bar screens
- Step screens

Factors

- Blinding
- High velocities
- High differential pressures
- Broken side seals
- Wide gap between screen plates



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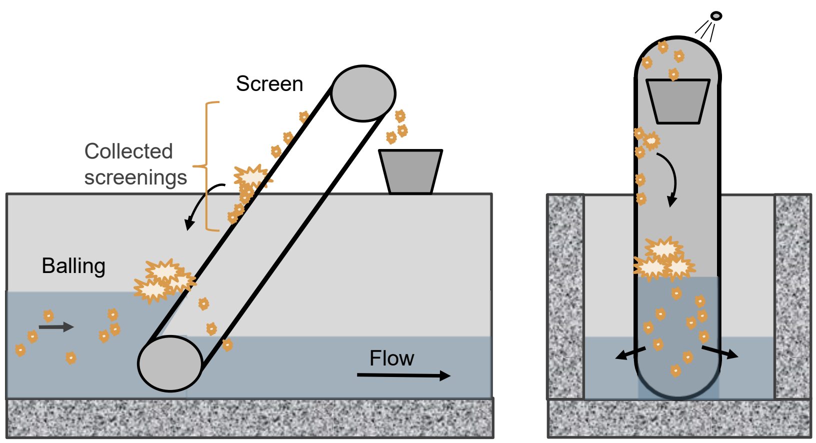
Balling

Common Performance Impacts to:

- Center flow band screens
- Drum screens
- (Steep) flow-through screens

Factors

- Slow cycling (heavy, dry matting)
- Heavy grease balls



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(4) (5) Operation and Maintenance Considerations

Operation Considerations

1. PW/NPW requirements (~30 to 50 gpm)
2. Screenings conveyance
3. Control requirements
   - Timer
   - Differential Head
   - VFD driven
   - Active bypass

Maintenance Considerations

1. Minimize maintenance below the water line
2. Maximize life of wear parts
3. Common Wear Points:
   - Chains
   - Bearings/Sprockets
   - Tracks
   - Rakes
   - Scrapers/Brushes
   - Others…..

Time a screen is out of service is time with reduced capacity and performance

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Screen Types

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Screen Types

Coarse Screen > 6 mm (1/4 inch)	Fine Screens ≤ 6 mm (1/4 inch)
Bar Screens	Multi-Rake Screens
Climber Screens	**Perforated Plate**
Multi-Rake Screens	Rotary Drum Screens
Locking Chain Bar Screens	**Band Screens**
	Step Screens
	Filter Screens
	Plastic Tooth Filter Screen

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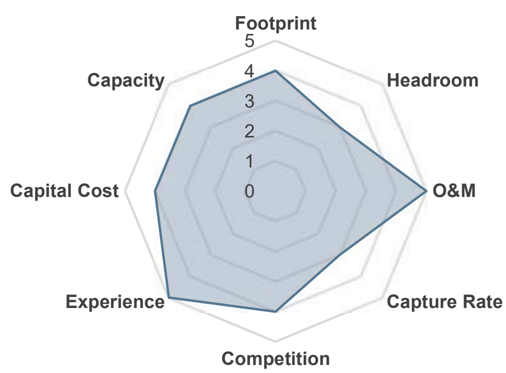
Screen Type Comparison Parameters

1. **Footprint**: Amount of horizontal space required for installation
2. **Headroom**: Vertical space required for screenings removal
3. **O&M**: Operational and maintenance considerations
4. **Capture Rate**: Amount of material removed
5. **Competition**: Quantity of reputable manufacturers
6. **Experience**: Number of installations and years in service
7. **Capital Cost**: Total cost
8. **Capacity**: Available volume of wastewater that screen can effectively treat



Ranked on a scale of 1 to 5 with
5 being the best and 1 being the worst

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Perforated Plate Filter Screen

Performance

- Available in small openings (1/24 in - 1 mm)
- Higher capture rate than plastic tooth or multi-rake bar screens
- Reduction in capture rate losses due to "carryover" of screenings
- Screenings removed with a brush and/or spray water

Image Courtesy of Headworks

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Perforated Plate Filter Screen

Capacity

- 25% more open area than comparable slotted screen
- Additional throughput due to increased open area
- Openings from 1/24-inch (1 mm) to 1/2-inch (12 mm)
- Additional headlosses and higher potential for blinding due to smaller openings
- Headloss can increase as a result of hairpinning

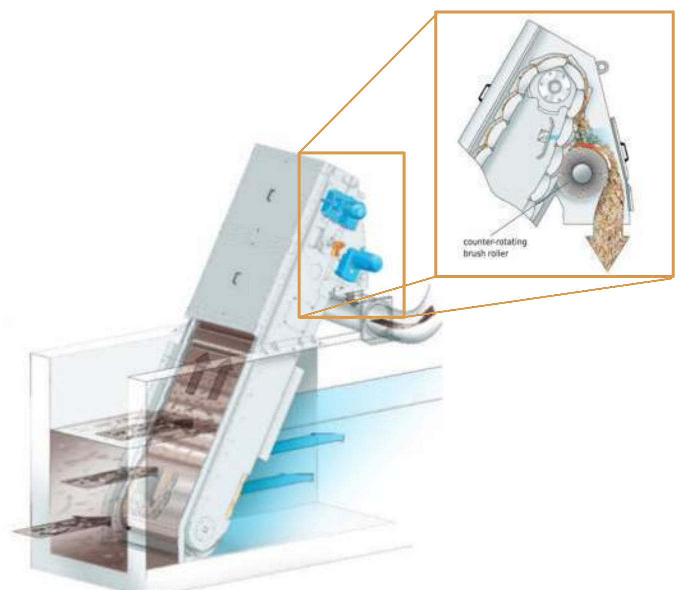

Image Courtesy of Huber

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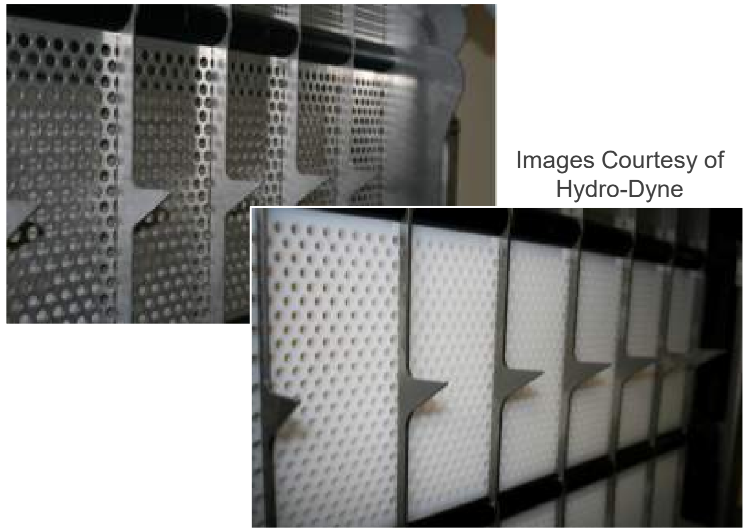
Perforated Plate Filter Screen

Materials

- Constructed of stainless steel or plastic perforated plates (panels) that can be replaced
- Polyester cleaning brush
- Higher head differential than plastic tooth screens
- Hairpinning
  - Stainless Steel Panels are susceptible to hairpinning
  - Thicker plastic panels are more resistant to hairpinning



Images Courtesy of Hydro-Dyne

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Perforated Plate Filter Screen

Maintenance

- Common points of maintenance similar to Plastic-Tooth
- Perforated Panels (Replaceable)
- Channel Seating
- Bottom Guide Rail
- Cleaning Brush
- Discharge Chute
- Travelling Chain and Rollers
- Chain follows track allowing bearings to remain unsubmerged

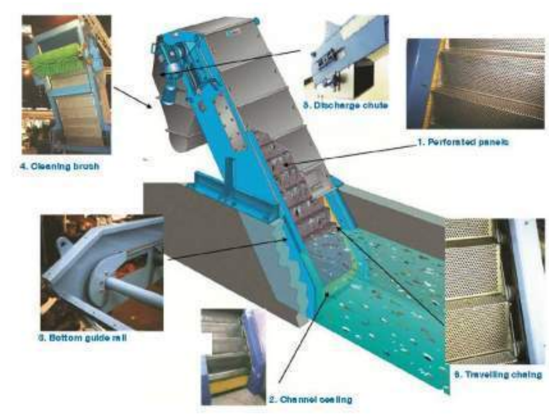

Image Courtesy of Andritz

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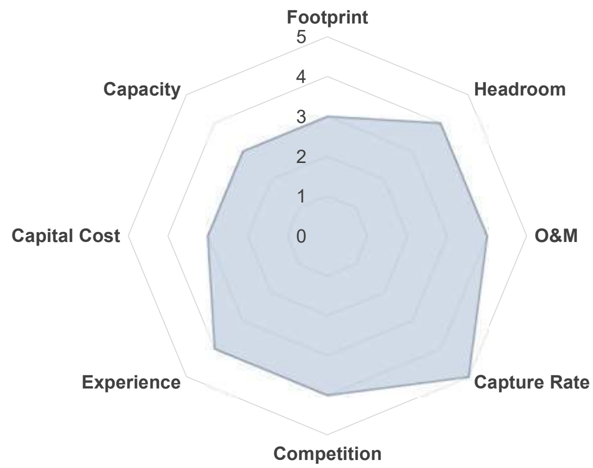
Perforated Plate Filter Screen

Manufacturers

- Ovivo (Brackett-Green)
- Parkson
- Headworks
- Hydro-Dyne
- Andritz
- Huber Technology



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Center-Flow Band Screen

Performance

- Flow enters through the front and is screened through the sides and bottom
- Screenings are carried vertically 180º
- Lost screenings fall into center of screen and are contained

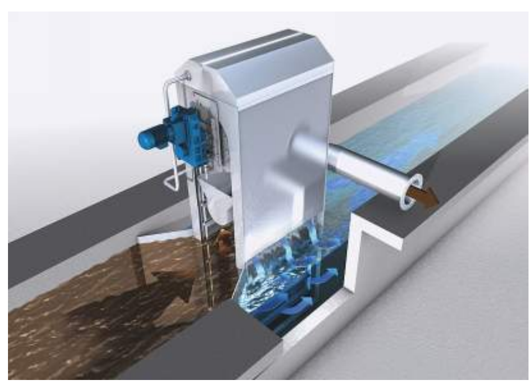

Image Courtesy of Huber

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Center-Flow Band Screen

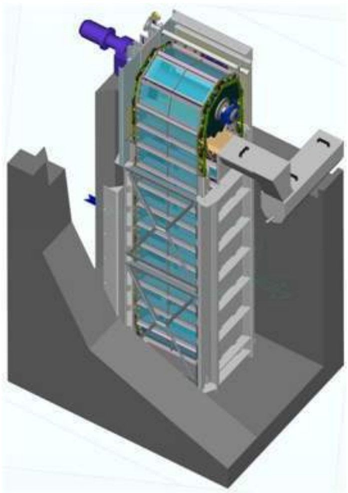

Image Courtesy of Brackett Green

Maintenance

- Drive and sprockets are located above the deck for easy access
- Panels are replaceable (dependent upon manufacturer)
- Chain stretch requires adjustment

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Center-Flow Band Screen

Capacity

- Flow enters through the front and is screened through the sides and bottom
- 1 mm to 1-inch openings
- Higher headloss and potential for blinding

Materials

- Stainless Steel Construction
- Panels available in Stainless Steel or UHMWPE

Image Courtesy of Brackett Green (Ovivo Water)

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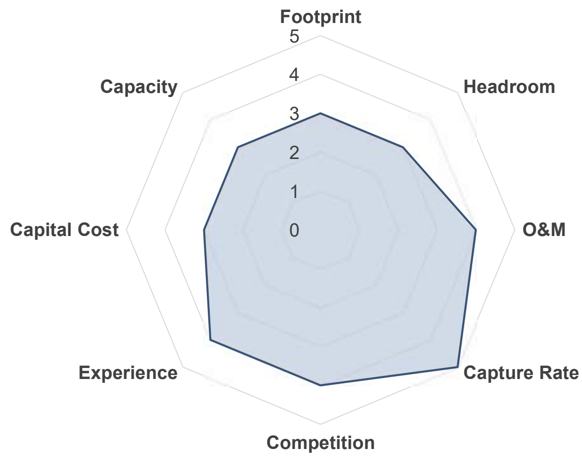
Center-Flow Band Screen

Manufacturers

- Ovivo (Brackett-Green)*
- Hydro-Dyne*
- Huber
- JWC

*UHMWPE Panels Available



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Plastic-Tooth Filter Screen

"Continuous Belt Mechanically Cleaned Bar Screens"

Performance

- Utilizes a belt constructed of a series of spaced plastic teeth forming a screen
- Belt moves to lift screenings out of channel
- Similar to step screens, a mat of screened material builds to catch finer screenings (hair, fibrous material)
- High potential for screenings carryover and reduction in capture rate

Images Courtesy of Parkson Corporation

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Plastic-Tooth Filter Screen

Capacity

- Available from 1/24 in (1 mm) to 4 in (100 mm) openings
- High headlosses with low allowable head differential
- May require additional capacity or bypass

Materials

- Ultra-High Molecular Weight Polyethylene (UHWMPE) – Hydrodyne
- “High-impact Plastic” - Parkson
- Stainless Steel Frame and Support Rods
- Polyester cleaning brush (if required)

Installation of Parkson AquaGuard at Broward County NRWWTP

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Plastic-Tooth Filter Screen

Maintenance

- Bearings above water level
- Plastic teeth can break and require replacement
- Brush (see image)
- Maintenance can be reduced with spray water bar installation
- Hydrodyne has eliminated the need for brushes (spray water only)
- Submerged brush seal can wear. As brush continues to wear larger material can get through the screen.

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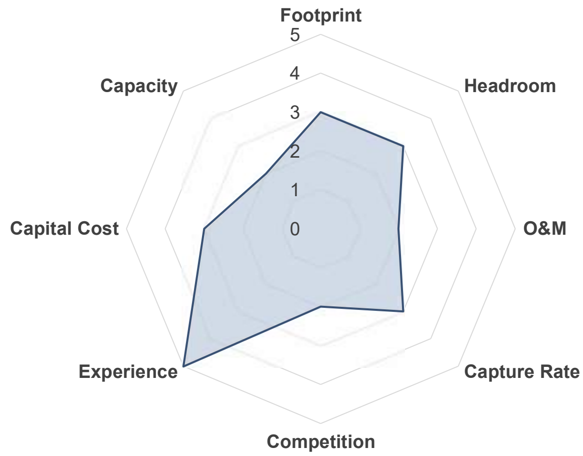
Plastic-Tooth Filter Screens

Manufacturers Include:
- Parkson (AquaGuard)
- Hydro-Dyne (Triden)
- Andritz



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Step Screens

Performance
- Utilizes stepped plates to lift screenings to discharge
- Mat of screened material builds to catch finer screenings (hair, fibrous material)
- Clean bottom portion of screen creates high velocity to flush channel of grit
- Excessive material can roll-back “Balling” to the front of the screen and never be removed

Capacity
- Mat of material creates higher chance for blinding and higher headlosses
- Additional headloss reduces screened area and capacity
- Raises water level and reduces velocity which can reduce effectiveness of screen
- Rock can be entrapped under bottom step

Image Courtesy of Vulcan

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Step Screens

Maintenance

- Bearings below water line require lubrication
- Replacement of wear parts requires removal of screen from channel

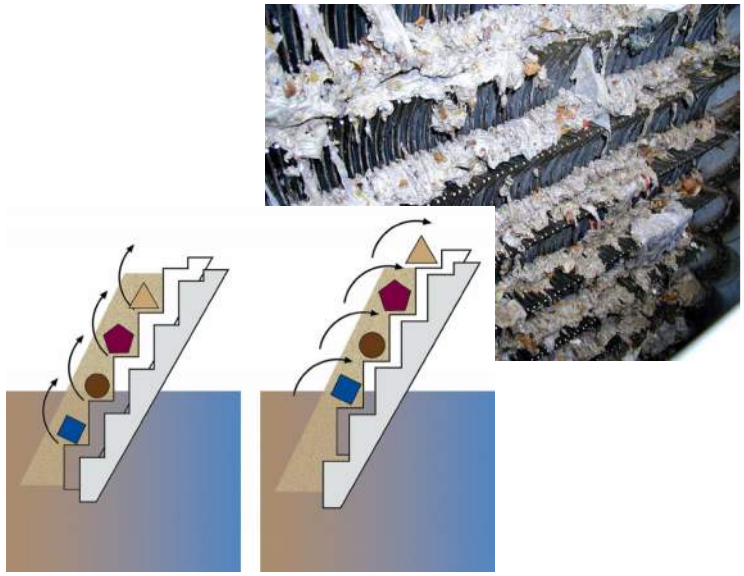

Image courtesy of Huber Technology

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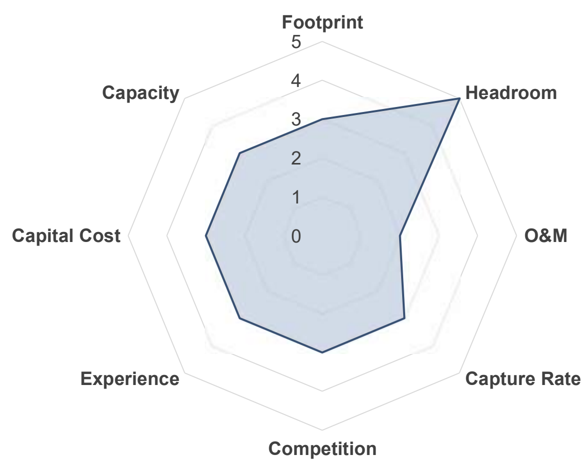
Step Screens

Materials

- Variety of available materials, including 304 and 316 stainless steel

Manufacturers

- Huber
- Vulcan
- Kusters



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Screenings Handling and Disposal

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Screenings Handling and Disposal

Conveyance	Washing / Compaction	Maceration

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Screening Technology Comparison

Screening Technology Comparison Matrix

Screen Type	Footprint	Headroom	O&M	Capture Rate	Competition	Experience	Capital Cost	Capacity	Total Score
Perforated Plate Screens	3	4	4	4	5	4	3	3	30
Center Flow Band Screens	3	3	4	5	4	4	3	3	29
Step Screens	3	5	2	3	3	3	3	3	25
Plastic Tooth Filter Screens	3	3	2	3	2	5	3	2	23

Screening Technology Comparison Matrix

Example Weighting Factors

Footprint	5%
Headroom	5%
O&M	30%
Capture Rate	30%
Competition	5%
Experience	10%
Capital Cost	10%
Capacity	5%
	100%

Screen Type	Footprint	Headroom	O&M	Capture Rate	Competition	Experience	Capital Cost	Capacity	Weighted Score
Perforated Plate Screens	3	4	4	4	5	4	3	3	3.85
Center Flow Band Screens	3	3	4	5	4	4	3	3	4.05
Step Screens	3	5	2	3	3	3	3	3	2.80
Plastic Tooth Filter Screens	3	3	2	3	2	5	3	2	2.90

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Grit Removal

Common Components

Removal efficiencies are typically covered in 95% of ***X*** micron and larger

Manufacturers utilize Sand Equivalent Size (SES) for standardization of material

Large variations exist between SES and Physical Size as shown here

Compare SES removals at each step of the grit removal process

You're only as strong as your weakest link

Image courtesy of Hydro International

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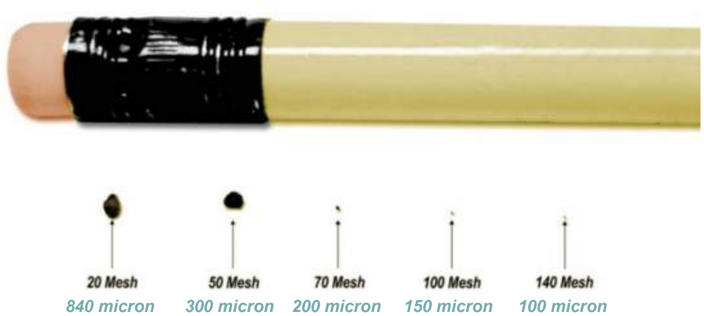
What is Sand Equivalent Size?

Physical size is a common characterization method for grit, but more important is how the particle behaves.



Fine "sugar sand" type grit with an SES of 106-75 micron is common to South Florida

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What is Sand Equivalent Size?

Particle size is important….but settling velocity is a more dependable method for understanding solids

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Industry Standards Concentrate on SES

Settling Velocity (ft/min)	Corresponding Sand Equivalent Size (microns)
6.5	234
2.2	118
1.2	88
0.65	69
0.33	58
0.19	54
0.11	51

Similar spherical particle size for corresponding settling velocity

Settling Velocity of a standard sand particle based on Stokes' Law

How do we Characterize Grit?

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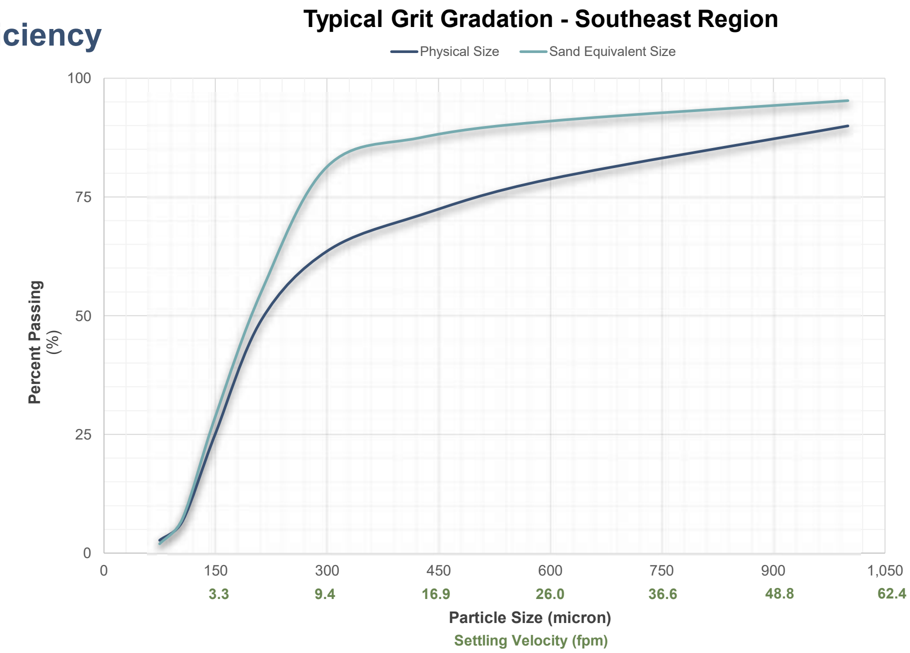
Grit Removal Efficiency

- Removal efficiencies are typically covered in 95% of *??* micron and larger
- Manufacturers utilize Sand Equivalent Size (SES) for standardization of material
- Large variations exist between SES and Physical Size as shown here



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Grit Removal Systems

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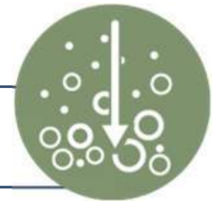
Grit Removal Technologies



- Aerated Grit Tanks
- Stirred Vortex
- Stacked Tray
- Grit Wolf

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Stirred Vortex

Operation

- Utilize tangential intake with propeller to induce vortex motion to separate solids from liquids
- Vortex system allows for continuous operation under variable flows

Critical Components

- Tank Geometry: Higher removal requires larger diameter
- Propeller: Produces vortex to promote particle setting
- Conveyance: Multiple configuration available
- Additional Baffling: Improves removal efficiencies
- Maintain Backwater: Ensure adequate backwater to maintain velocities between 1.6 and 3.5 fps

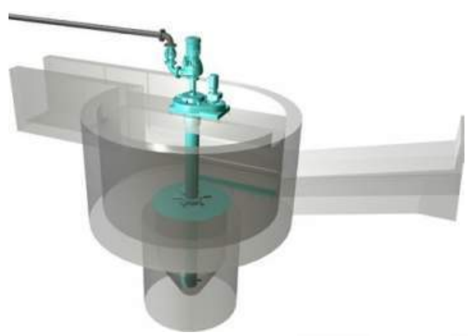

Image courtesy of Smith & Loveless

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Stirred Vortex

Screening Removal Efficiency

- 95% of 300 micron and larger
- ~18% removal

Manufacturers

- Fluidyne
- Smith & Loveless
- Jones + Attwood (Ovivo)

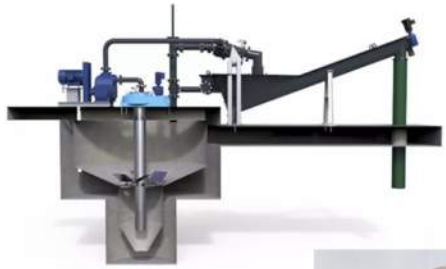


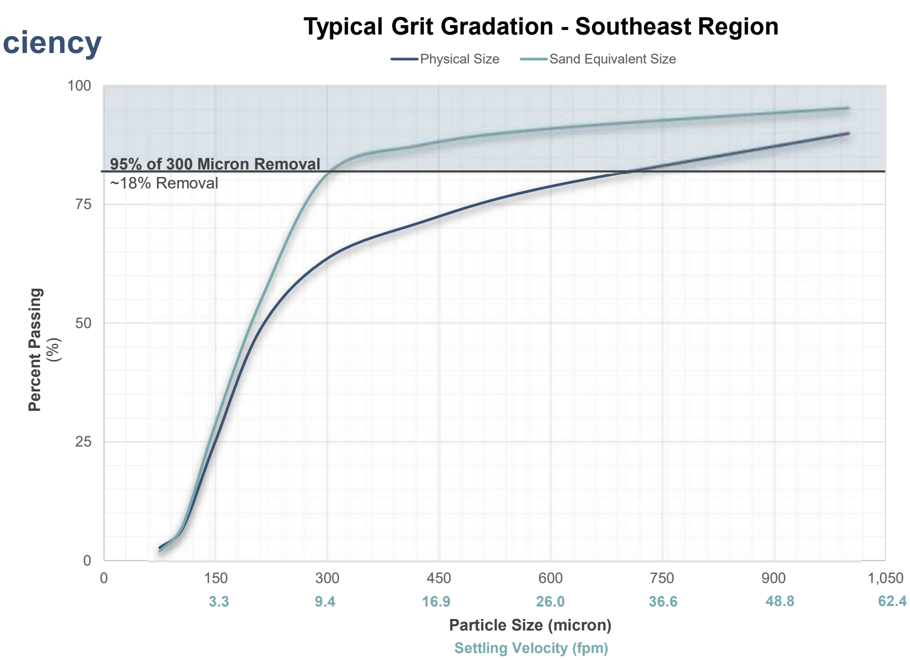
Image Courtesy of Ovivo

Image Courtesy of Fluidyne

Grit Removal Efficiency

Stirred Vortex

- Removal efficiencies are typically covered in 95% of ***300*** micron and larger
- Manufacturers utilize Sand Equivalent Size (SES) for standardization of material
- Large variations exist between SES and Physical Size as shown here



Stacked Tray

Operation

- Utilize tangential influent to induce a vortex across several stacked tracks for additional settling area
- Critical Components
- Diameter / Quantity of Trays: More area equals more flow or better removal
- Fluidizing Water: Ensures resuspension of material prior to tank startup
- Accessibility: Covered tanks limit accessibility, but can be provided with hatches

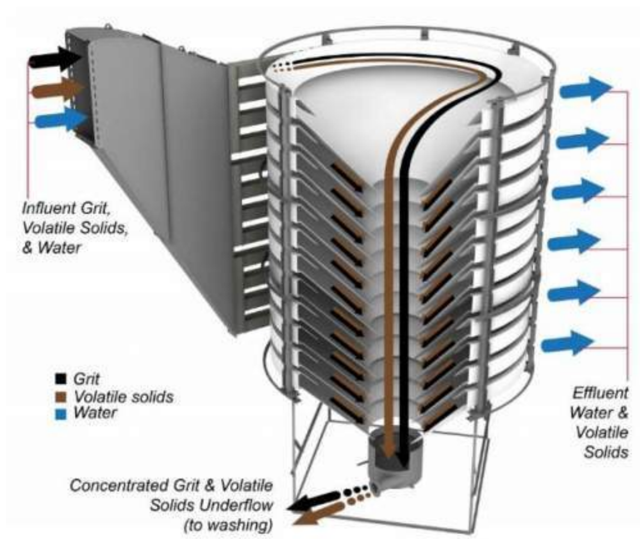


Image courtesy of Hydro International

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Stacked Tray

Screening Removal Efficiency

- 95% of 106 micron and larger
- ~95% removal

Manufacturers

- Hydro International

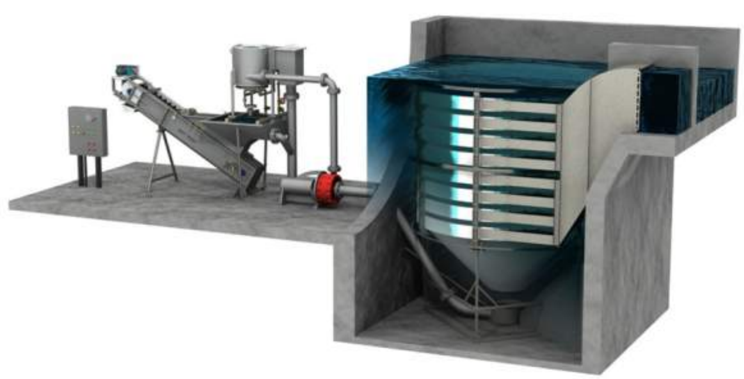

Image Courtesy of Hydro International

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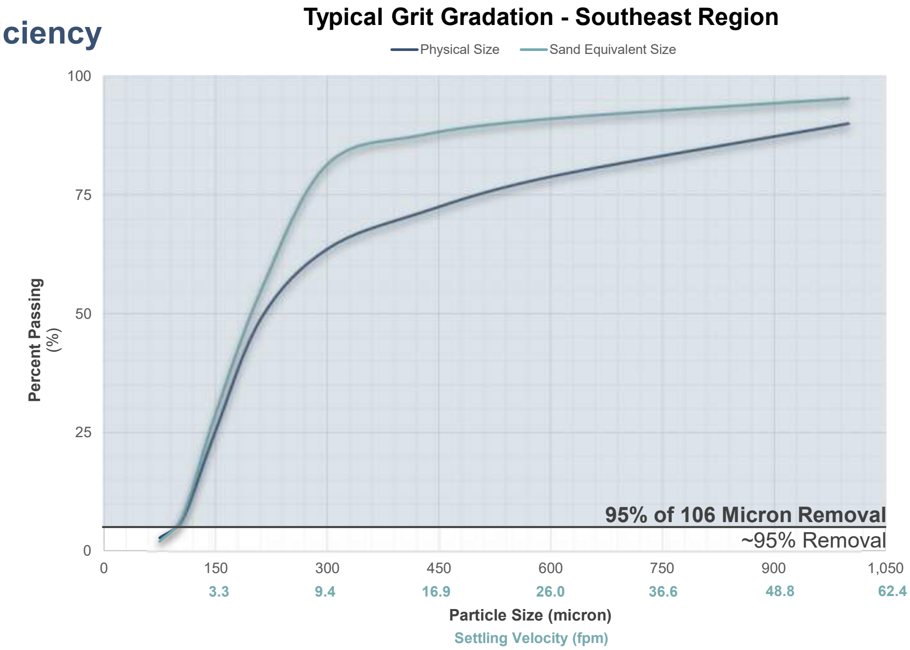
Grit Removal Efficiency

Stacked Tray

- Removal efficiencies are typically covered in 95% of ***106*** micron and larger
- Manufacturers utilize Sand Equivalent Size (SES) for standardization of material
- Large variations exist between SES and Physical Size as shown here



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Grit Conveyance

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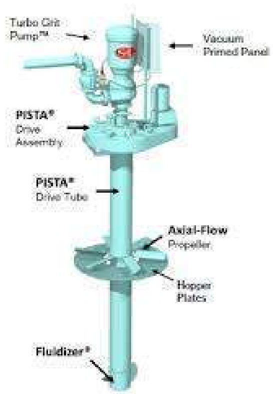
Grit Conveyance

Suction Lift	Vacuum Primed	Flooded Suction
		

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Grit Classification / Washing

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Grit Classifiers and Washers

Classifiers and Cyclones

Washers

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Classifier & Cyclones

Common Components

Image courtesy of Compatible Components Corp.

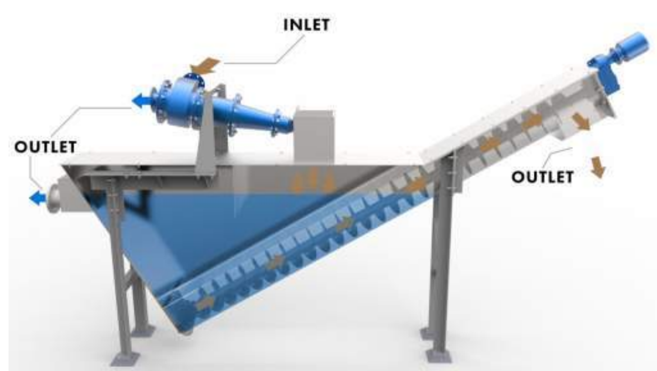

Image courtesy of JMS

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Grit Washer

Common Components

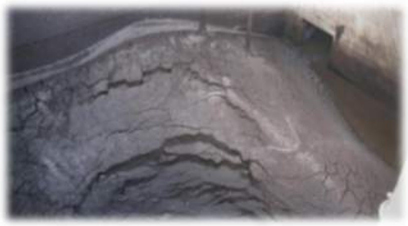

Image courtesy of Huber

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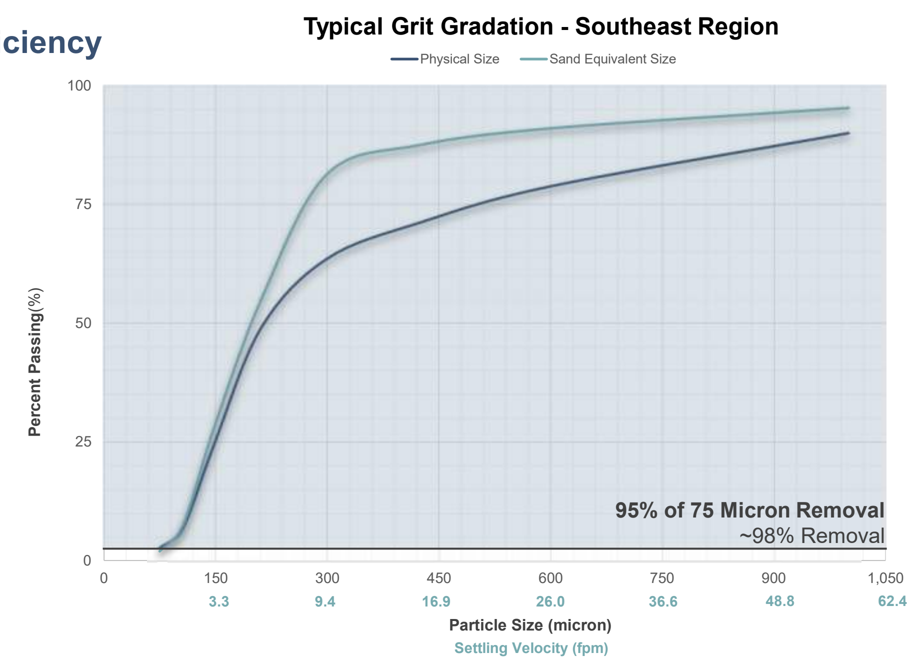
Grit Removal Efficiency

Grit Classification / Washing

- Removal efficiencies are typically covered in 95% of *75* micron and larger
- Manufacturers utilize Sand Equivalent Size (SES) for standardization of material
- Large variations exist between SES and Physical Size as shown here



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Layout Examples

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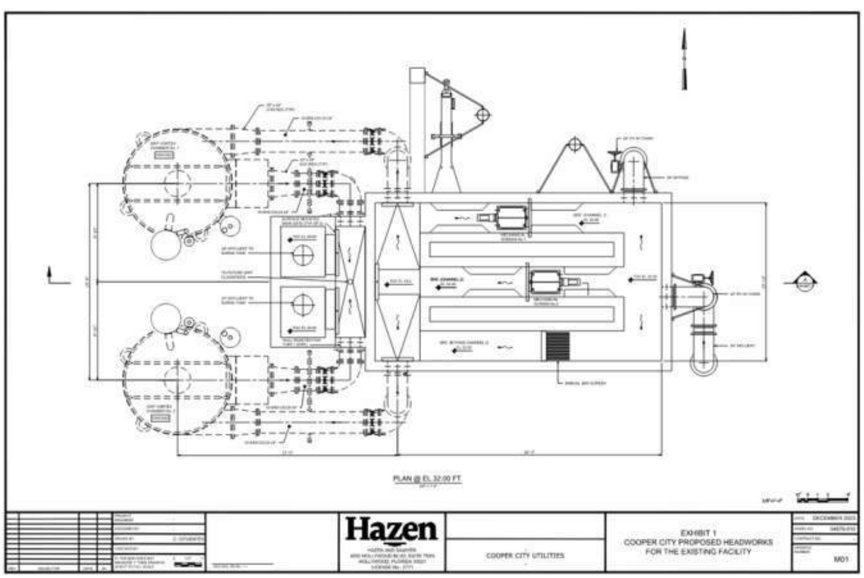
Proposed Layout – Master Plan



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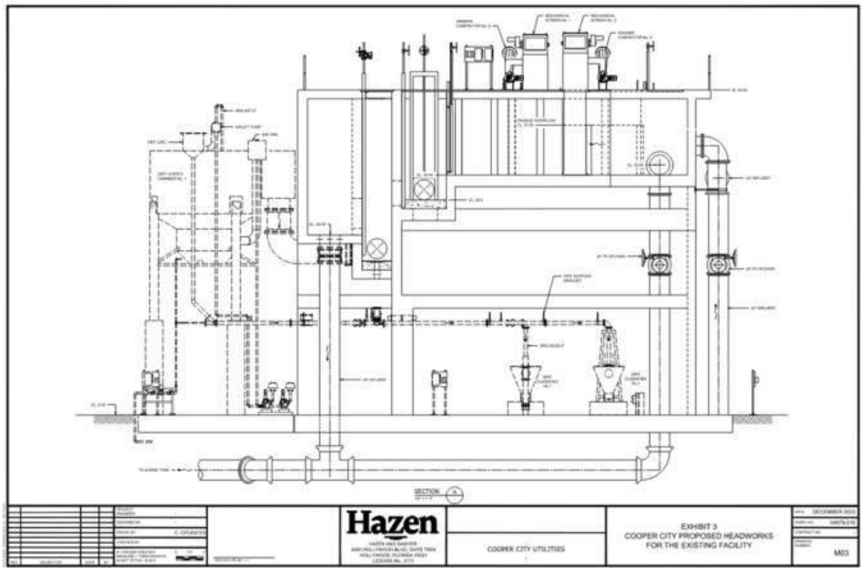
Proposed Layout – Master Plan



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Proposed Layout Examples

City of Port St. Lucie Glades WWTP
Screening and Grit Facility

Broward NRWWTP
Grit Structure and Grit Building

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Odor Control

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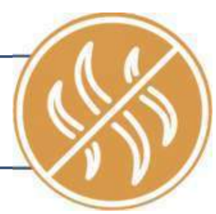
Odor Control Technologies



- Wet (Chemical) Scrubbers
- Biological Oxidation Systems
- Dry Media Adsorption (Activated Carbon)

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Key Driving Forces

Wastewater Generates:

- Hydrogen Sulfide (H2S)
  - Main Constituent
  - Rotten Egg Odor
  - Corrosive
- Other Compounds
  - Reduced Sulfur Compounds (RSC)
  - Reduced Nitrogen Compounds (RNC)

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Wet (Chemical) Scrubbers

Overview

- Traditional Technology with a Proven Track Record
- Adjusts to Variable Odor Loads
- Small Footprint
- Removes the Most Odorous Compounds
- High Odor Removal Efficiency

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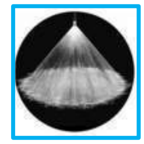
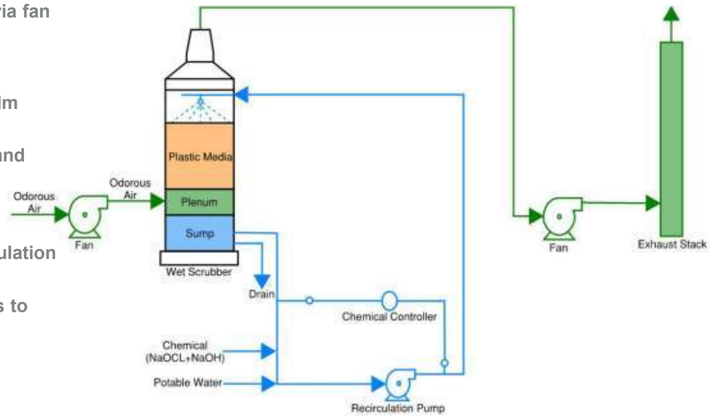
Wet (Chemical) Scrubbers - Process



Counter-Current Operation – Air Up & Liquid Down

- Air Operation
  1. Odorous air enters into a plenum inside the scrubber via fan
  2. Air is forced up into plastic packing
     - *Plastic packing has liquid film (high pH)*
  3. Odors from air are absorbed and oxidized into liquid film leaving clean air
  4. Clean air exits the top of scrubber and is expelled via and exhaust stack
- Water Operation
  1. Potable water and chemicals are pumped with a recirculation pump into the scrubber
  2. The water is sprayed over the plastic media via nozzles to form a liquid film
  3. Odors absorb into the liquid
  4. Liquid flows down into a sump and is oxidized and recirculated



Wet (Chemical) Scrubbers – Pros & Cons

Pros	Cons

• High Odor Removal Efficiency (99%)
• Low Capital Cost
• Small Footprint
	• High O&M Costs
	  • **Operator Intensive**
	    • *Maintain Chemical Balance within Scrubber*
	    • *Operate Chemical Feed System*
	  • **Maintenance Costs**
	    • *Routine Acid Washing to **Prevent Scaling***
	    • *Maintain Chemical Feed System (Significant Amount of Equipment)*

Biological Oxidation Systems Overview

Overview

- Two Types of Biological Oxidation Systems
  - ***Biofilters***
  - ***Biotowers***
- Uses microorganisms, not chemicals, to oxidize odorous compounds
  - **Requires:**
    - *Moisture*
    - *Nutrients*
    - *Substrate*
  - **Bacteria consumes odorous compounds (nutrients)**

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Biological Oxidation Systems – Biofilters and Biotowers

Biofilters

- Built-in-place concrete structure with media
  - **Organic Media (Typical)**
    - *Mulch or Bark (2-4 yr Media Life)*
    - *Largest Footprint*
    - *Usually Uncovered*
  - **Inorganic Media**
    - *Synthetic Media*
    - *Longer Lasting Media (10-yr Media Life)*
    - *Smaller Footprint (Compared to Organic)*
    - *Covered or Uncovered*
- Intermittent Irrigation

Biotowers

- Biotowers
  - **Bioscrubbers**
  - **Biological Trickling Filters (BTFs)**
- Cylindrical Vertical Towers (typ)
  - **Synthetic Media (10+-yr Media Life)**
  - **Smaller Footprint, Tall Vessels**
- Requires Additional Nutrients
  - **Nutrient Feed System**
- Requires More Water

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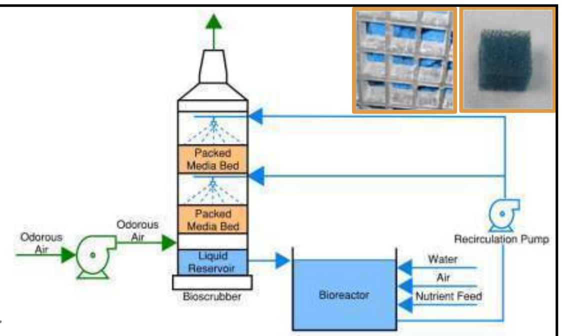
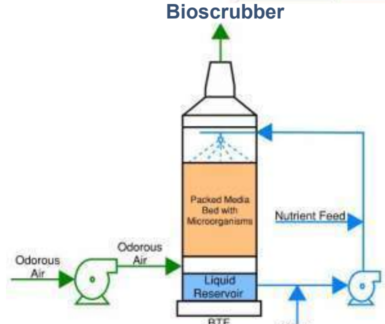
Biological Oxidation Systems - Process

Counter-Current Operation – Air Up & Liquid Down

- Air Operation
  1. Odorous air enters into the scrubber
  2. Air is forced up into plastic packing
     - *Bioscrubber – Packing has liquid film (low pH)*
     - *BTF – Packing has layer of microorganisms*
  3. Odors from air are absorbed or oxidized into liquid film leaving clean air
  4. Clean air exits the top of scrubber
- Water Operation
  1. The water is sprayed over the plastic media via nozzles
  2. Odors are removed from air
     - *Bioscrubber – Oxidized in bioreactor*
     - *BTF – Oxidized in media*
  3. Water is sent to the scrubber



Bioscrubber



Biological Trickling Filter

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Biological Oxidation Systems – Pros & Cons

Pros	Cons
• Sustainable • No Chemicals	• High Capital Costs
• Treats Variety of Compounds	• Large Footprint (Biofilters)
• Simple O&M Requirements	• Tall (Biotowers)
• Low O&M Costs	• Difficult to Meet Stringent Odor Control Requirements (Still Effective)
• Operational Costs are Constant as Loading Increases	• Need Continuous Odor Load (fluctuations ok, not on/off)
	• May Need Secondary System Depending on Odor Constituents

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Dry Media Adsorption Overview

Overview

- Dry media treatment
- Odors adsorb to media (carbon) surface
- Proven technology
- Not mechanically intensive

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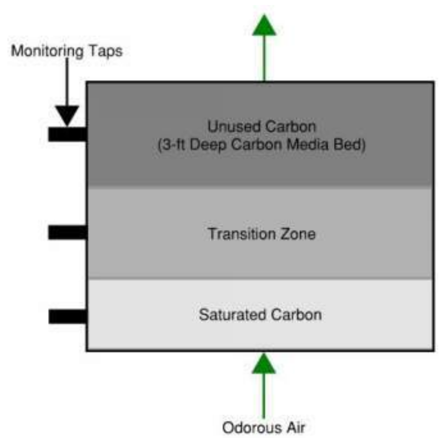
Dry Media Adsorption - Process

Carbon Adsorption

1. Odorous air is passed through packed bed of carbon
   - Typically, carbon beds form zones in which have different contaminant concentrations
2. Contaminants are adsorbed onto surface of carbon
   - Carbon is engineered with high ratio of surface area to volume
   - Carbon is consumed as contaminants are adsorbed
   - New carbon will be required once it is consumed

Types of Carbon

1. Catalytic Carbon
   - H2S Removal
2. Virgin Coconut Shell
   - Reduced Sulfur + H2S Removal
3. Impregnated Carbon
   - Caustic Impregnated – Fire Hazard
   - Potassium Permanganate Impregnated – Reduced Sulfur



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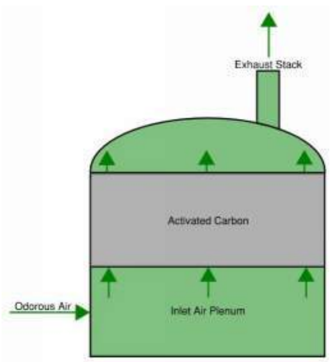
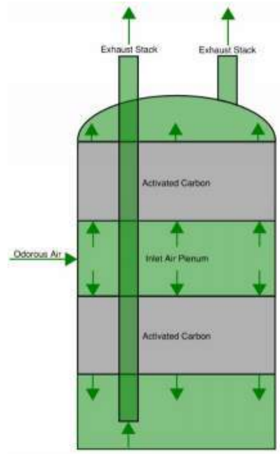
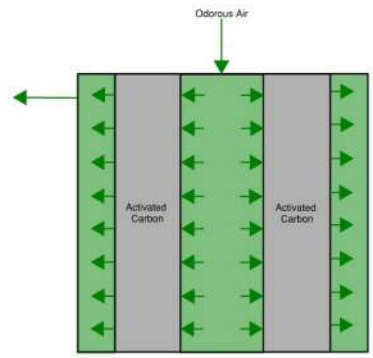
Dry Media Adsorption – Alternate Configurations

Single Deep Bed Unit	Dual Deep Bed Unit	Radial Flow Unit







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Dry Media Adsorption – Pros & Cons

Pros

- Low Maintenance
- Moderate Footprint
- Long Track Record
  - Effective H2S Removal
  - Reliable
- Dry System
- Simple Monitoring
- Minimal Mechanical Components

Cons

- Limited Capacity
- Media Needs to be Replaced Regularly
  - 2-5 Years Typically
- Must Monitor Bed Capacity (Taps)
- No Reserve Capacity

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Odor Control – Technology Comparison

Treatment Technology	Chemical Scrubbing	Biofilters	Biotowers	Dry Media Adsorption
Capital Cost	$$	$$$	$$$	$
O&M Cost	High – High Odor Medium – Low Odor	Low	Low	High – High Odor Low – Low Odor
H2S Removal	Great (99%+)	Great (99%+)	Great (99%+)	Great (99%+)
RSC Removal	Great (99%+)	Good (70-90%) Given Proper Design Criteria	~50%	Good (85-95%)
Intermittent Loading	Great	Ok	Poor	Great

A lifecycle cost analysis of the selected odor control technologies can be developed once the headworks equipment is finalized.

Hazen 105

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Next Steps

- City selection of screening technology
- Hazen to assist City in identifying local installation of selected screening technology and facility communication with utility staff
- Hazen will evaluate the selected make and model of equipment

Thank You!

Hazen

Hazen 106

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Appendix D: Preliminary Technical Specification List

SECTION 00 01 10

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

Section	Title
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 78 43	Spare Parts and Extra Material
01 79 00	Instruction of Owner's Personnel
01 88 16	Watertightness Testing of Concrete Structures

DIVISION 02 – EXISTING CONDITIONS

Section	Title
02 32 00	Subsurface Exploration
02 41 00	Site Demolition
02 42 00	Pavement Removal and Replacement

DIVISION 03 – CONCRETE

Section	Title
03 11 00	Concrete Formwork
03 15 00	Concrete Accessories
03 15 16	Joints in Concrete
03 21 00	Reinforcing Steel
03 30 00	Cast-in-Place Concrete
03 35 00	Concrete Finishes
03 39 00	Concrete Curing
03 40 00	Precast Concrete
03 48 00	Precast Concrete Specialties
03 60 00	Grout

DIVISION 04 – MASONRY

Section	Title
04 05 13	Mortar and Masonry Grout
04 05 23	Masonry Accessories
04 20 00	Unit Masonry

DIVISION 05 – METALS

Section	Title
05 05 13	Galvanizing
05 05 23	Metal Fastening
05 10 00	Metal Materials
05 14 00	Structural Aluminum
05 50 00	Metal Fabrications
05 51 00	Metal Stairs
05 51 33	Ladders
05 52 00	Guards and Railings
05 53 00	Gratings, Checkered Floor Plates, and Access Doors
05 55 00	Stair Treads and Nosings
05 56 00	Castings
05 59 00	Bearing Devices and Anchoring

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES (NOT USED)

Section	Title
06 51 00	Glass Fiber and Resin Fabrications

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Section	Title
07 26 16	Vapor Barrier
07 84 00	Firestopping
07 90 00	Joint Fillers, Sealants and Caulking

DIVISION 08 – OPENINGS

Section	Title
08 11 16	Aluminum Doors and Frames
08 33 23	Roll-up Doors
08 71 00	Finish Hardware
08 90 00	Louvers and Dampers

DIVISION 09 – FINISHES

Section	Title
09 90 00	Painting
09 96 59	Epoxy MIC Coating System

DIVISION 10 – SPECIALTIES

Section	Title
10 14 00	Identifying Devices

DIVISION 12 – FURNISHINGS (NOT USED)

DIVISION 13 – SPECIAL CONSTRUCTION

Section	Title
13 33 12	Aluminum Flat Covers

DIVISION 21 – FIRE SUPPRESSION (NOT USED)

DIVISION 22 – PLUMBING (NOT USED)

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) (NOT USED)

DIVISION 26 – ELECTRICAL

Section	Title
26 05 00	Basic Electrical Requirements
26 05 19	Low-Voltage Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33.13	Conduit for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 60	Low-Voltage Electric Motors

26 05 73	Power System Studies
26 09 16	Electric Controls and Relays
26 22 00	Low-Voltage Transformers
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 16.16	Enclosed Switches
26 36 23	Automatic Transfer Switches
26 41 00	Facility Lightning Protection
26 43 13	Surge Protective Devices
26 50 00	Lighting

DIVISION 27 – COMMUNICATIONS (NOT USED)

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY (NOT USED)

DIVISION 31 – EARTHWORK

Section	Title
31 05 19	Geotextiles
31 12 00	Site Preparation
31 23 13	Subgrade Preparation
31 23 16	Excavation
31 23 19	Dewatering
31 23 23	Fill and Backfill
31 23 24	Flowable Fill
31 23 33	Trenching and Backfilling
31 25 00	Erosion and Sedimentation Control

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section	Title
32 11 00	Surface Restoration
32 12 00	Asphalt Concrete Pavement

32 15 00	Limerock Base
32 16 00	Concrete Curb and Sidewalk
32 17 00	Pavement Markings
32 92 23	Sodding

DIVISION 33 – UTILITIES

Section	**Title**
33 01 30.11	Television Inspection
33 05 05.46	Lamp Testing
33 05 31.43	Corrugated Polypropylene Drainage Pipe
33 05 61	Utility Structures
33 71 19	Underground Electrical

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION (NOT USED)

DIVISION 40 – PROCESS INTERCONNECTIONS

Section	**Title**
40 05 00	Basic Mechanical Requirements
40 05 07	Pipe Supports
40 05 19	Ductile Iron Pipe
40 05 24.43	Steel Pipe for Miscellaneous Service
40 05 31	PVC/CPVC Pipe
40 05 36.13	FRP Ductwork for Odor Control Service
40 05 51	Valves, General
40 05 57	Valve Operators and Electric Valve Actuators
40 05 58	Gate Operators and Electric Gate Actuators
40 05 59	Stop Plates and Stop Logs
40 05 59.23	Fabricated Stainless-Steel Slide Gates
40 05 61	Gate Valves (Including Knife Gate Valves)
40 05 62	Plug Valves
40 05 63	Ball Valves

40 05 65.23	Check Valves
40 05 68.13	PVC and CPVC Valves
40 05 70	Miscellaneous Valves
40 05 81	Fire, Wall, and Yard Hydrants
40 05 97	Piping and Equipment Identification Systems
40 06 20	Process Pipe, Valve, and Gate Schedules
40 61 13	Process Control System General Provisions
40 61 15	Process Control System Submittals
40 61 21	Process Control System Testing
40 61 21.72	Field Testing
40 61 21.73	Final Acceptance Test
40 61 22	Tools, Supplies, and Spare Parts, General
40 61 23	Signal Coordination Requirements
40 61 24	Quality Assurance
40 61 26	Process Control System Training
40 61 91	Process Control System Instrument List
40 61 93	Process Control System Input/Output List
40 63 43	Programmable Logic Controllers
40 66 00	Network and Communication Equipment
40 67 00	Control System Equipment Panels and Racks
40 67 63	Uninterruptible Power Systems
40 68 00.13	Process Control Software (Modify)
40 70 00	Instrumentation for Process Systems
40 71 13.13	Inline Magnetic Flow Meters
40 71 79.16	Flow Switches (Thermal)
40 72 23	Radar Level Meters
40 72 76.26	Level Switches (Floats)
40 73 13	Pressure and Differential Pressure Gauges
40 73 20	Pressure Transmitters
40 78 56	Isolators, Intrinsically-Safe Barriers, and Surge Suppressors
40 79 00	Miscellaneous Instruments, Valves, and Fittings

DIVISION 41 – MATERIAL PROCESSING AND HANDLING EQUIPMENT (NOT USED)

DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT (NOT USED)

DIVISION 44 – POLLUTION AND WASTE CONTROL MANAGEMENT

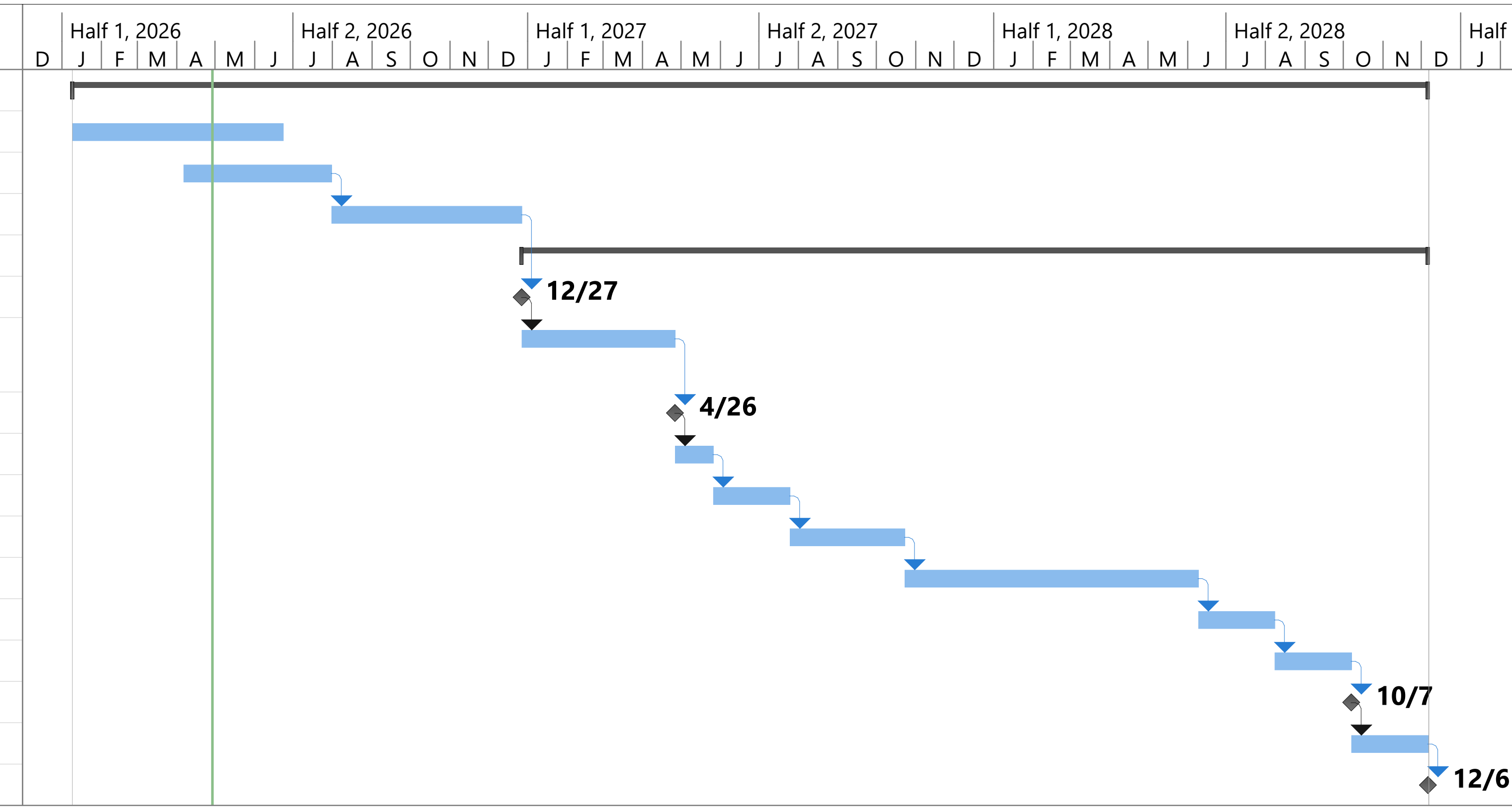
Section	Title
44 31 32	Biological Odor Control System

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

Section	Title
46 00 00	Equipment General Provisions
46 21 43	Centerflow Band Screens and Screenings Screw Washer/Compactors

Appendix E: Implementation Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Cooper City WWTP Headworks - Phase I**	**758 days**	**Fri 1/9/26**	**Wed 12/6/28**	
2		Design Phase	165 edays	Fri 1/9/26	Tue 6/23/26	
3		Permitting Phase	116 edays	Mon 4/6/26	Fri 7/31/26	
4		Bidding and Award	149 edays	Fri 7/31/26	Sun 12/27/26	3
5		**Construction Phase**	**507 days**	**Sun 12/27/26**	**Wed 12/6/28**	
6		Notice of Award	0 days	Sun 12/27/26	Sun 12/27/26	4
7		Procurement of Permits, Equipment and Materials	120 edays	Sun 12/27/26	Mon 4/26/27	6
8		Notice to Proceed	0 edays	Mon 4/26/27	Mon 4/26/27	7
9		Mobilization	30 edays	Mon 4/26/27	Wed 5/26/27	8
10		Site Work	60 edays	Wed 5/26/27	Sun 7/25/27	9
11		Yard Piping/Site Electric	90 edays	Sun 7/25/27	Sat 10/23/27	10
12		Headworks and Odor Control Facilities	230 edays	Sat 10/23/27	Fri 6/9/28	11
13		Startup and Testing	60 edays	Fri 6/9/28	Tue 8/8/28	12
14		Certificates and Permit Approvals	60 edays	Tue 8/8/28	Sat 10/7/28	13
15		Substantial Completion	0 edays	Sat 10/7/28	Sat 10/7/28	14
16		Punchlist	60 edays	Sat 10/7/28	Wed 12/6/28	15
17		Final Completion	0 days	Wed 12/6/28	Wed 12/6/28	16



Project: Cooper City WWTP Headworks - Phase I
Implementation Schedule
Date: Wed 4/29/26

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

Appendix D: Public Participation

Appendix E: SRF Required Forms

AUTHORIZED REPRESENTATIVE'S SITE CERTIFICATION

Project Number WW06251

Project Description The intent of this project is to construct a Headworks facility at the City of Cooper City Wastewater Treatment Plant (WWTP), located at 11791 SW 49th Street, Cooper City, FL 33330, in Broward County. The Headworks facility will include fine screening, provisions for a future stacked-tray grit removal system, and a dedicated odor control system. The Plant is owned and operated by the City.

I do hereby certify as to the following:

1. City of Cooper City has acquired all real property or real property rights that are or will be, required for the construction, operation and maintenance of the Project described above.

2. All real property and real property rights required for the entire Project were acquired in accordance with the State and local requirements.

Dated this 17th day of April , 20 26

Signed by:
Alex Rey
432944AE9915453...

Signature of Authorized Representative

Alex Rey
Name (print)

City Manager
Title

ASHLEY ACEVEDO
Notary Public - State of Florida
Commission # HH 700338
My Comm. Expires Jul 20, 2029
Bonded through National Notary Assn.

Ashley Acevedo
4/17/2026 X personally Known

August 26, 2004

STATE OF FLORIDA STATE REVOLVING FUND (SRF)
PROJECT SPONSOR'S CYBERSECURITY CERTIFICATION

Project Sponsor:	City of Cooper City
Project Name:	Cooper City Wastewater Treatment Plant New Headworks Facility
Project Number:	WW06251

On February 12, 2013, the Presidential Policy Directive/PPD-21 was introduced concerning Critical Infrastructure Security and Resilience. The Environmental Protection Agency (EPA) interpretation of PPD-21 is that when a Public Water System (PWS) or a Wastewater Treatment Works* (WTS), uses operational technology, such as an industrial control system (ICS), as part of the equipment or operation of any required component of a PWS or WTS, then an evaluation is needed for the adequacy of the cybersecurity of that operational technology.

An "industrial control system" is an information system used to control industrial processes such as manufacturing, product handling, production, and distribution. ICSs include supervisory control and data acquisition systems, used to control geographically dispersed assets, as well as distributed control systems and smaller control systems using programmable logic controllers to control localized processes.

I understand that all ICS or other operational technology as part of the equipment or operation involved with the above referenced project has been identified, evaluated, and no significant deficiencies for cybersecurity have been noted.

I understand that falsifying information on this certification may be grounds for termination of the SRF loan agreement.

Alex Rey City Manager

Typed Name and Title of the Sponsor's Authorized Representative

Signed by:
Alex Rey
432944AE9915453...

Signature of the Sponsor's Authorized Representative

May 29, 2026

Date

- defined by Section 212, Title VI of the Clean Water Act

STATE OF FLORIDA STATE REVOLVING FUND (SRF)
PROJECT SPONSOR'S USEFUL LIFE CERTIFICATION

Project Sponsor: City of Cooper City
Project Name: Cooper City Wastewater Treatment Plant New Headworks Facility
Project Number: WW06251

We certify that the useful life of the project equals or exceeds the amortization period of the assistance agreement. Note that the standard assistance agreement amortization period is 20 years for a construction loan but can be increased to 30 years if the project is to serve a small community qualifying as having a financial hardship.

Please enter the projected useful life of the proposed project along with the desired amortization period of the assistance agreement in the table below:

Useful Life of the Project: ~50+ years
Desired Duration of the Assistance Agreement: 20-year

We understand that falsifying information on this certification may be grounds for termination of the SRF loan agreement.

Project Authorized Representative

Print Name: Alex Rey

Signature: Signed by: Alex Rey 432944AE9915453...

Date: May 29, 2026

Professional Engineer

Print Name: Elizabeth Page, PE, ENV SP

Signature: Signed by: Elizabeth Page, PE, ENV SP F0B9A1FC5391494...

Date: May 29, 2026

STATE OF FLORIDA STATE REVOLVING FUND (SRF)
PROJECT SPONSOR'S FISCAL SUSTAINABILITY PLAN CERTIFICATION

Project Sponsor: City of Cooper City
Project Name: Cooper City Wastewater Treatment Plant New Headworks Facility
Project Number: WW06251

On June 10, 2014, the Water Resources Reform and Development Act of 2014 (WRRDA) was signed into law. Among its provisions are amendments to Titles I, II, V, and VI of the Federal Water Pollution Control Act (FWPCA). Section 603(d)(1)(E) of the FWPCA requires a loan recipient to certify regarding the development and implementation of a fiscal sustainability plan.

> *(E) for a treatment works proposed for repair, replacement, or expansion, and eligible for assistance under subsection (c)(1), the recipient of a loan shall –*
> *(i) develop and implement a fiscal sustainability plan that includes –*
> *(I) an inventory of critical assets that are a part of the treatment works;*
> *(II) an evaluation of the condition and performance of inventoried assets or asset groupings;*
> *(III) a certification that the recipient has evaluated and will be implementing water and energy conservation efforts as part of the plan; and*
> *(IV) a plan for maintaining, repairing, and, as necessary, replacing the treatment works and a plan for funding such activities; or*
> *(ii) certify that the recipient has developed and implemented a plan that meets the requirements under clause (i);*

I understand that a fiscal sustainability plan must be developed and implemented for the above referenced project, and certify that the developed plan meets the requirements set forth with Section 603(d)(1)(E) of the FWPCA.

I also certify that this fiscal sustainability plan will be implemented prior to the final loan disbursement.

I understand that falsifying information on this certification may be grounds for termination of the SRF loan agreement.

Alex Rey City Manager

Typed Name and Title of the Sponsor's Authorized Representative

Signed by:
Alex Rey
432944AE9915453...

Signature of the Sponsor's Authorized Representative

May 28, 2026

Date

STATE OF FLORIDA STATE REVOLVING FUND (SRF)
PROJECT SPONSOR'S COST AND EFFECTIVENESS CERTIFICATION
AND WATER/ENERGY CONSERVATION CERTIFICATION

Project Sponsor: City of Cooper City
Project Name: Cooper City Wastewater Treatment Plant New Headworks Facility
Project Number: WW06251

On June 10, 2014, the Water Resources Reform and Development Act of 2014 (WRRDA) was signed into law. Among its provisions are amendments to Titles I, II, V, and VI of the Federal Water Pollution Control Act (FWPCA). Sections 602(b)(13)(A) and (B) of the FWPCA requires that the loan recipient:

(A) has studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is sought under this title; and

(B) has selected, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation, and energy conservation, taking into account—
(i) the cost of constructing the project or activity;
(ii) the cost of operating and maintaining the project or activity over the life of the project or activity; and
(iii) the cost of replacing the project or activity;

We certify that the above referenced project meets the requirements set for in Sections 602(b)(13)(A) and (B) of the FWPCA. We also certify that the documentation justifying this certification will be made available upon request.

We understand that falsifying information on this certification may be grounds for termination of the SRF loan agreement.

Project Authorized Representative

Print Name: Alex Rey

Signature: Signed by: Alex Rey 432944AE9915453...

Date: May 28, 2026

Professional Engineer

Print Name: Elizabeth Page, PE, ENV SP

Signature: Signed by: Elizabeth Page, PE, ENV SP F0B9A1FC5391494...

Date: May 29, 2026

Appendix F: SSOs Reports

BROWARD COUNTY FLORIDA

Broward County Board of County Commissioners
Environmental Permitting Division (EPD)
One N. University Drive • Mailbox 201 • Plantation, Florida 33324-2020 • (954) 519-1483 • FAX (954) 519-1412

Email Written Notification
Wastewater Utility Spill/Abnormal Event Report

Notification to Broward County Resilient Environment Department (RED):
(954) 519-1499 or QAlert Date: 06 /13/2024 Time:8:15 AM ☒ PM ☐
FDEP Notified at (561) 681-6710: Yes ☒ No ☐ Date: 06/13/2024 Time:8:30 AM ☒ PM ☐
State Watch Office Notified * (800) 320-0519: Yes ☒ No ☐ Incident # 2024-4972

Date/Time utility aware of event:	06/13/2024	1:00	AM	☒	PM	☐
Estimated Date/Time event started:	06/13/2024	1230	AM	☒	PM	☐
Date/Time flow stopped:	06/13/2024	2:30	AM	☒	PM	☐

Utility Contact:	Ryan Webster	Title:	Chief Operator
Name of Utility:	Cooper City Utilities Department	Phone:	954-434-5519
Email Address:	rwebster@coopercity.gov	Cell:	954-675-8865

Event Location/Address: 11791 SW 49th Streeet City: Cooper City Lat/Long:

Description of Discharge/Abnormal Event (include cause and affected waterbody): Due to an abnormal rain event totaling 6.5 inches of rain, wastewater plant #2 backed up causing a splash over. This facility is self contained, and no bodies of water were impacted. Based on field observations, we approxiamte the amount to be 1,500 gallons.

☐ **Gravity** Sewer Main Size: _____ Material: _____; or ☐ **Manhole**; or ☐ Lateral ☐ Public or ☐ Private

☐ **Force Main** Pipe Size: _____ Material: _____ Age: _____; or ☐ **Valve** Type _____

☐ **Lift Station** Name/Designation: _____; ☐ Other: _____

Total Volume Discharged: 1,500 **Volume Recovered**: 1,500 **Raw or Treated Discharge**: Raw

Discharge to: GROUND ☒ GROUNDWATER ☐ SURFACE WATER ☐ STORM DRAIN ☐ PUBLIC ACCESS AREA ☐
Storm Drain Discharge To: Surface Water Outfall ☐ French Drain (infiltration system) ☐

Samples Taken: YES ☐ *NO* ☒ Initial Sample Date: / /
Second Sample Date: / /

Email Lab Test Results with a Location Map and Pictures (when necessary) to the email addresses below.

Sampling Required:
Marine Surface Waters East of US 1 (Test for *Enterococci*): Discharges ≥ 1000 Gallons.
Marine Surface Waters West of US 1 and East of I-95 (Test for *Enterococci*): Discharges ≥ 500 Gallons.
Marine Surface Waters West of I-95 (Test for *Enterococci*): Discharges ≥ 100 Gallons.
All Fresh Surface Waters Regardless of Locations (Test for *E. coli*): Discharges ≥ 100 Gallons.
Minimum samples for *E. coli*, and *Enterococci* should be taken at the point of discharge, 200-400 feet upstream and 200-400 feet downstream of discharge. Take samples at 24-hour intervals until the indicator bacteria count is below 410 MPN/100 ml for *E. coli*, and 130 MPN/100 ml for *Enterococci*.

Steps Taken to Contain and Correct: Coordination with the lift station spuervisor to alternante and limit the run time of larger lift stations.

Method of Cleanup and Cleanup Status: Spillage was remove using Vac trucks and disposed of in an on-site lift station where it was returned to the head of the plant. The affected areas were hosed and then disinfected using HTH.

Steps Taken to Prevent Recurrence: Currently have a contractor scheduled for grit removal or our surge tank which will increas the capacity of our holding tank.

Email form and documents to: Broward County Domestic Wastewater Program, WWCompliance@broward.org **and** Jonathan Odjo, Jonathan.Odjo@floridadep.gov along with the State's inbox SED.Wastewater@FloridaDEP.gov.
All spills 1000 gallons or more or abnormal events that endanger the public health and/or environment must be reported within twenty-four (24) hours of the event to the **State Watch Office by calling (800) 320-0519. Furthermore, the State Watch Office initial report must be emailed to Jonathan.Odjo@floridadep.gov or be provided verbally by calling (561) 681-6710 and providing the SWO incident ID#.*

Ryan Webster

From: no-reply@dep.state.fl.us
Sent: Friday, June 14, 2024 4:12 PM
To: alexis.glenn@floridadep.gov; Ryan Webster
Subject: Public Notice of Pollution – Updated Notice

FLORIDA DEPARTMENT OF
Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Shawn Hamilton
Secretary

Pollution Notice

Thank you for submitting a Public Notice of Pollution for a reportable Incident in compliance with Section 403.077, F.S.

Your DEP Incident ID is **24357**. Please use this ID during any future correspondence with the Department concerning this Incident.

To update the information you have entered please click the link the below:
Update My Notice

Type of Notice: Updated Report
Date of Notice: 06/14/2024

Incident Information
Name of Incident: Raw Sewage release
State Watch Office Case Number: 20244972
Start of Incident: 06/13/2024 08:20 AM
End of Incident: 06/13/2024 02:00 PM

Incident Description
Cooper City Utilities reports a release of 1500 gallons of raw sewage from the treatment plant due to an overflow from rain in Cooper City. No waterways were impacted and cleanup is ongoing.

Incident Location
Facility/Installation Name: Cooper City Utilities
Address Line 1:
Address Line 2:

Directions:
City:
State: FL
Zip Code:
Coordinates (in decimal degrees):
Lat: 26.120060849956165, Long: -80.16742385524314
Click to view Incident Location
Impacted Counties: Broward
Updated Impact:

Incident Reported By
Name: Alexis Glenn
Title: Environmental Specialist I
Phone: (561) 681-6762
Ext:
E-mail Address: alexis.glenn@floridadep.gov
Relationship: DEP

On-Site Contact
Name: Ryan Webster
Phone: (954) 434-5519
Ext:
E-mail Address: rwebster@coopercityfl.org

To view a list of all received Public Notices of Pollution or to modify your e-mail subscription settings, please click the link below:
Public Notice of Pollution

Florida Department of Environmental Protection

Customer Service Survey

Ryan Webster
Chief Operator
Cooper City Utilities
11791 SW 49th Street
Cooper City, FL 33330
Date June 13, 2024

Mr. Jonathan Odjo
Florida Department of Environmental Protection
Southeast District – West Palm Beach
3301 Gun Club Road, MSC 7210-1
West Palm Beach, FL 33406
Jonathan.Odjo@floridadep.gov
Phone: (561) 681-6710

RE: Be advised that on 06/13/24, at 12:30 AM, there was a discharge at 11791 SW 49th Street. Cooper City, FL 3330

Please be advised that on 06/13/2024 at 12:30 AM there was a sanitary sewer discharge at 11791 SW 49th St. Cooper City, FL 33330 which was stopped on 06/13/2024 @2:30 AM.

The discharge occurred due to an abnormal rain event

Approximately 1,500 gallons discharged to the ground and approximately 0 gallons discharged to water bodies or storm drains.
The discharge location *was not in an area with public access.*

The initial call was placed to the Broward County Resilient Environment Department Hotline on 06/13/2024 @ 8:20 AM and then to the Florida Department of Environmental Protection - West Palm Beach Office, and the State Watch Office.

The cause of the discharge was attributable to an abnormal rain event that produced 6.5" of rainfall causing a backup within our wastewater plant.

The discharge was *fully recovered* and disinfectant was utilized in the ground areas.
There was no discharge to any bodies of water. No samples were taken.

Our utility has contracted with an engineering firm to remove grit/sediment from our surge tank which in affect will increase our surge capacity. This work is scheduled to commence on June 18, 2024. A schedule of events leading towards improved operation, maintenance and future emergency response to this facility are as follows: Preceding grit removal from our surge tank, twice annually our surge tank will be lowered and evaluated and cleaned if necessary. This will assure the maximum amount of capacity to better handle larger than average rain events.

Sincerely,

Ryan Webster
Chief Plant Operator
Attachments: Pictures
CC: WWCompliance@broward.org, BC Environmental Permitting Division

Attachment B

BROWARD COUNTY FLORIDA
Broward County Board of County Commissioners
Environmental Engineering and Permitting Division
One N. University Drive • Mailbox 201 • Plantation, Florida 33324-2020 • (954) 519-1483 • FAX (954) 519-1412

Email Written Notification
Wastewater Utility Spill/Abnormal Event Report

Notification to Broward County Environmental Protection and Growth Management Department:
(954) 519-1499 or QAlert Date: 11 /17/2023 Time:1135 AM ☒ PM ☐
FDEP Notified at (561) 681-6659: Yes ☒ No ☐ Date: 11/17/2023 Time:1142 AM ☒ PM ☐
State Watch Office Notified * (800) 320-0519: Yes ☒ No ☐ Incident # 2023-9563

Date/Time utility aware of event:	11/17/2023	1000	AM	☒	PM	☐
Estimated Date/Time event started:	11/17/2023	930	AM	☒	PM	☐
Date/Time flow stopped:	11/17/2023	100	AM	☐	PM	☒

Utility Contact:	Ryan Webster	Title:	Chief Operator
Name of Utility:	Cooper City Utilities Dept	Phone:	954-434-5519
Email Address:	rwebster@coopercity.gov	Cell:	954-372-4289

Event Location/Address: 11791 SW 49 Street City: Cooper City Lat/Long:

Description of Discharge/Abnormal Event (include cause and affected waterbody): Influent lines to our Watewater plant surge tank were overwhelmed due to an abnormal rainfall event. This facility is self-contained, and no bodies of water were impacted. Based on field observations, we approximate it to be 1500 gallons.

☐ **Gravity** Sewer Main Size: _____ Material: _____; or ☐ **Manhole**; or ☐ Lateral ☐ Public or ☐ Private

☐ **Force Main** Pipe Size: _____ Material: _____ Age: _____; or ☐ **Valve** Type _____

☐ **Lift Station** Name/Designation: _____; ☐ Other: _____

Total Volume Discharged: 1500 gals **Volume Recovered**: 1325 gals **Raw or Treated Discharge**: Raw

Discharge to: GROUND ☒ GROUNDWATER ☐ SURFACE WATER ☐ STORM DRAIN ☐ PUBLIC ACCESS AREA ☐
Storm Drain Discharge To: Surface Water Outfall ☐ French Drain (infiltration system) ☐

Samples Taken: YES ☐ *NO* ☒ Initial Sample Date: / /
Second Sample Date: / /

Email Lab Test Results with a *Location Map* to the email addresses below.

Sampling Required:
Marine Surface Waters East of US 1 (Test for *Enterococci*): Discharges ≥ 1000 Gallons.
Marine Surface Waters West of US 1 and East of I-95 (Test for *Enterococci*): Discharges ≥ 500 Gallons.
Marine Surface Waters West of I-95 (Test for *Enterococci*): Discharges ≥ 100 Gallons.
All Fresh Surface Waters Regardless of Locations (Test for *E. coli*): Discharges ≥ 100 Gallons.
Minimum samples for *E. coli*, and *Enterococci* should be taken at the point of discharge, 200-400 feet upstream and 200-400 feet downstream of discharge. Take samples at 24-hour intervals until the indicator bacteria count is below 410 MPN/100 ml for *E. coli*, and 130 MPN/100 ml for *Enterococci*.

Steps Taken to Contain and Correct: Coordination with the Life Station Supervisor to limit run time and flows of various lift stations

Method of Cleanup and Cleanup Status: Spillage was removed using multiple VAC trucks and then sent to the head of the wastewater plant for treatment. The affected areas were hosed and disinfected using HTH.

Steps Taken to Prevent Recurrence: N/A

Email form and documents to: Broward County Domestic Wastewater Program, WWCompliance@broward.org **and** Zara Mansoor, Zara.Mansoor@FloridaDEP.gov along with the State's inbox SED.Wastewater@FloridaDEP.gov.
*All spills *1000 gallons* or more or *abnormal events that endanger the public health and/or environment* must be reported within twenty-four (24) hours of the event to the ***State Watch Office*** by calling (800) 320-0519.

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Environmental Engineering and Permitting Division
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