4. WASTEWATER SYSTEM

The City's wastewater system is comprised of collection, treatment, reuse, and effluent disposal systems.

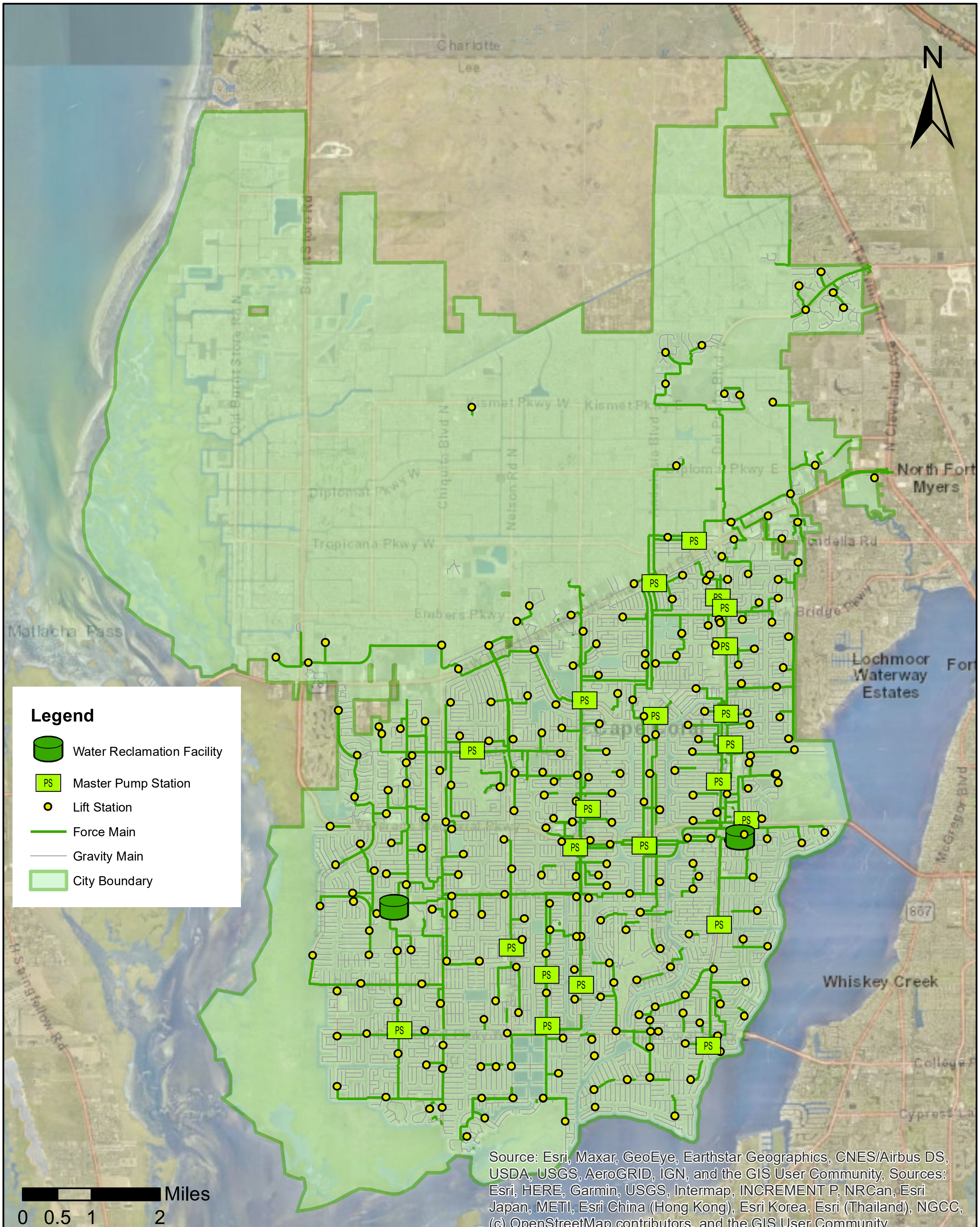
4.1 Existing System Description

The City's wastewater system is comprised of collection, treatment, reuse, and effluent disposal systems. The system includes two water reclamation facilities and an extensive wastewater collection and conveyance system with gravity sewers, pumping stations, and a manifolded force main network. **Figure 4-1** illustrates the City's wastewater system as of January 2020.

4.1.1 Water Reclamation Facilities

The City currently owns and operates two water reclamation facilities (WRF), the Everest WRF and the Southwest (SW) WRF. Each of the WRFs has tertiary treatment to produce effluent with disinfection that meets state standards for public access reuse water and land application.

The City's water reclamation facilities are permitted and regulated by the FDEP. **Table 4-1** summarizes the FDEP permits and permitted capacities for both treatment facilities. At the time of updating this draft master plan, a renewal permit for the Everest WRF was issued by FDEP (noted in **Table 4-1**). The WRFs are required to meet Class 1 Reliability in accordance with the FDEP Regulations. Currently, both water reclamation facilities are being operated according to industry standards and are compliant with regulations.



User: kmansilla Source: City of Cape Coral Date: Oct 2021	Cape Coral FLORIDA	**City of Cape Coral** **2020 Existing Wastewater System**	AECOM	**Figure 4-1**

Table 4-1: Water Reclamation Facilities FDEP Permit Summary

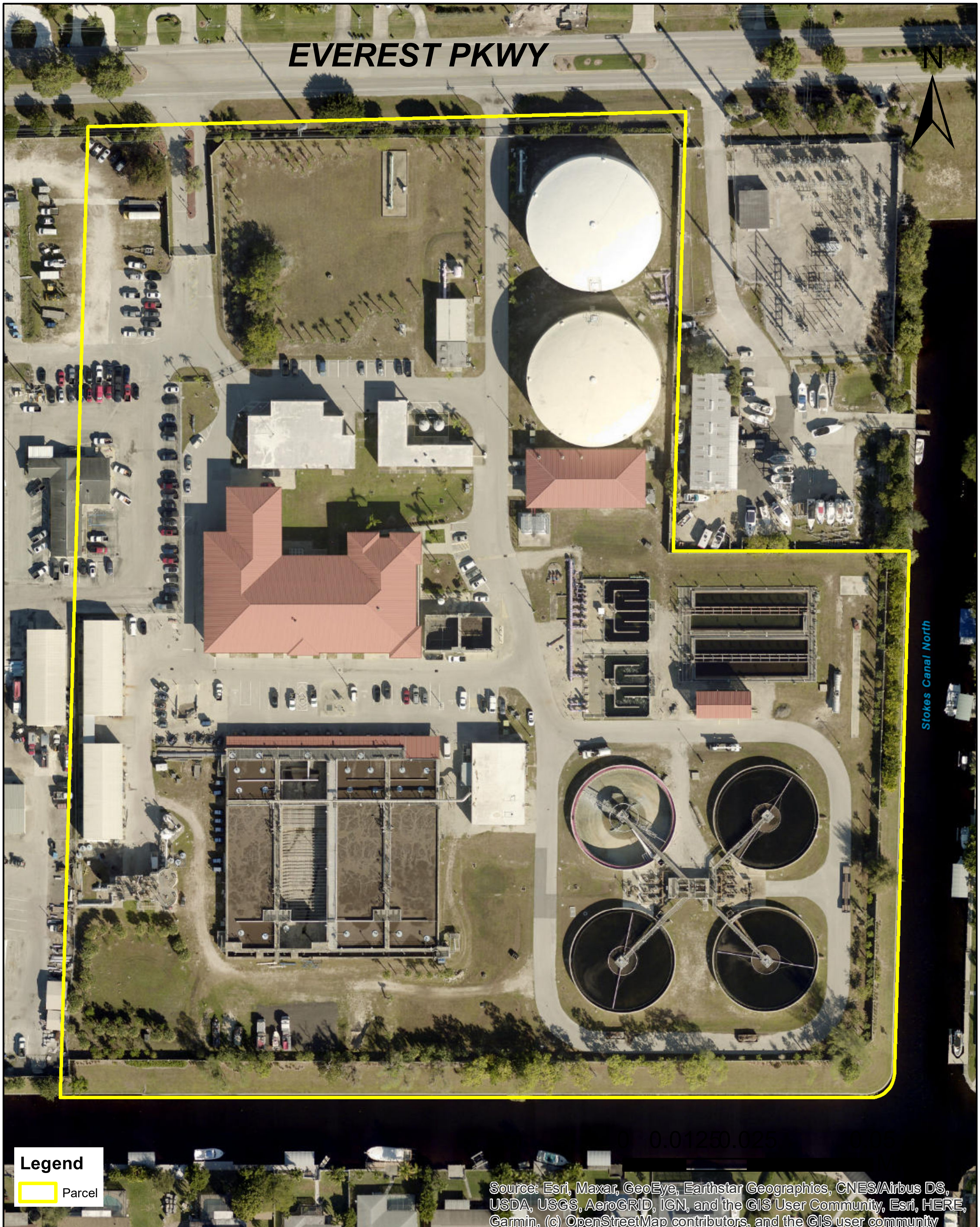
Facility	ID#	Capacity (MGD)	Basis	FDEP Permit#	Expiration Date
Everest WRF	FL0030007	13.4	AADF	FL0030007-024-DW1P	11/29/2027*
Southwest WRF	FLA455458	15.0	AADF	FLA455458-009-DW1P	10/24/2026

* At the time of updating this draft report, the new permit FL0030007-024-DW1P was issued. The permit will be effective from November 30, 2022 till November 29, 2027.

4.1.1.1 Everest WRF

The Everest WRF was constructed as a 2.3 MGD treatment plant in 1975. After several expansions, the facility was upgraded to the current capacity of 13.4 million gallon per day (MGD) annual average daily flow (AADF) and based on site limitations is at full buildout capacity. It currently operates under FDEP permit number FL0030007 and is located at 1800 Everest parkway, Cape Coral, FL 33904. A site plan of the Everest WRF is shown in **Figure 4-2**.

The facility consists of three treatment processes: preliminary treatment, secondary treatment, and tertiary treatment as shown in the process flow diagram **Figure 4-3**. After the treatment is complete, the effluent flow is transferred to reuse storage tanks or the deep injection well.



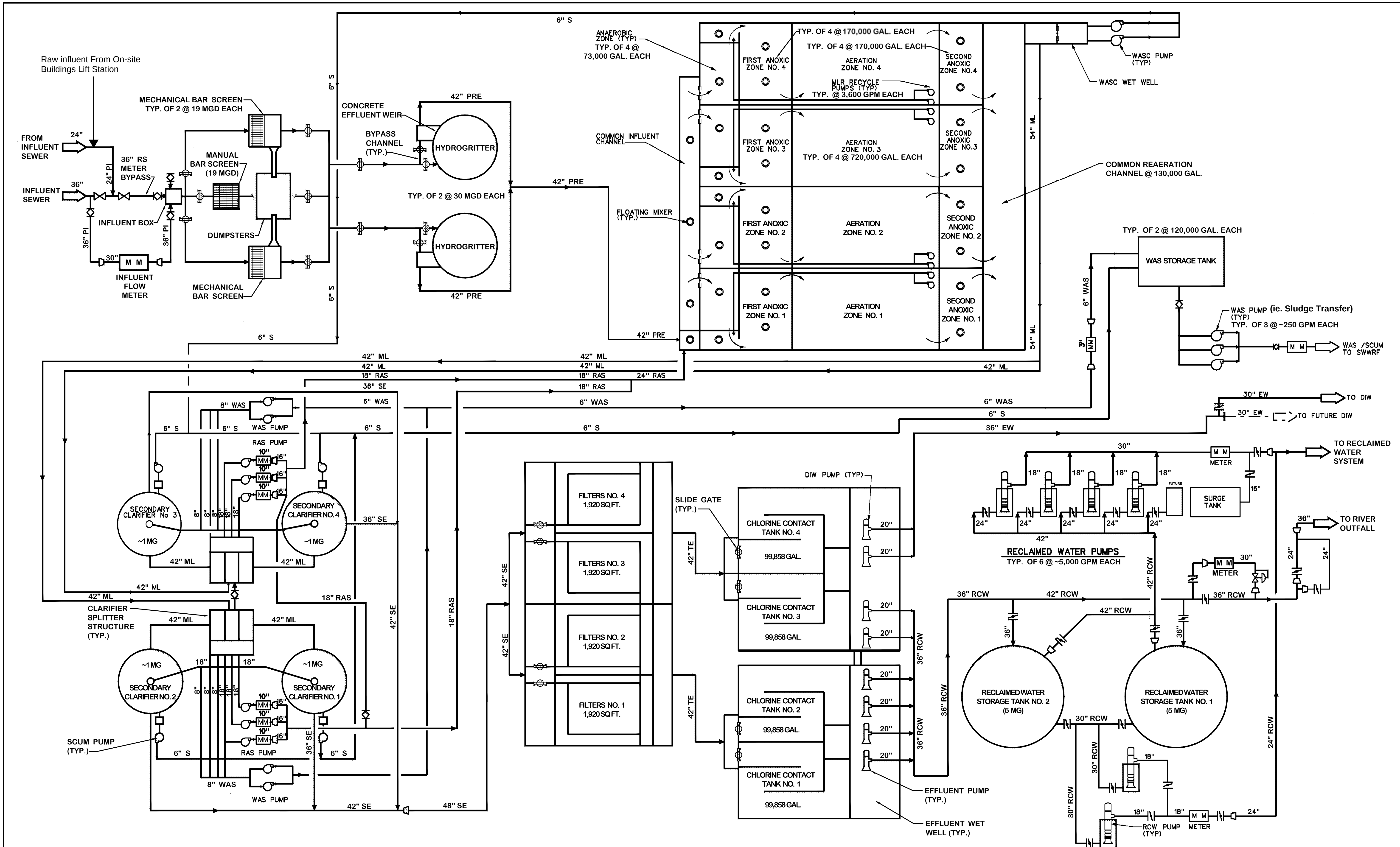
User: mhonigfort
Source: City of Cape Coral
Date: November 2022

Cape Coral FLORIDA

City of Cape Coral
Comprehensive Utilities Master Plan
Everest WRF Site Plan

AECOM

Figure 4-2



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DEPARTMENT OF PUBLIC WORKS
P.O. BOX 150027
Cape Coral, Florida 33915-0027

Figure 4-3: Everest WRF Process Flow Diagram

Everest Parkway Water Reclamation Facility
Permit Renewal 2022

Preliminary treatment consists of mechanical equipment that removes grit and debris from the influent water before entering the biological treatment process. The influent water is screened by two mechanical bar screens, a third manual bar screen acts as a back-up. After screening, two vortex-type units and two cyclone/classifier units are used to remove grit from the screened water. After the screening and grit removal process is complete, the water is gravity fed into the biological treatment process.

The secondary treatment process is comprised of a five-stage Bardenpho nitrification-denitrification biological treatment process. The influent water is passed through four biological treatment tanks that provide an anaerobic zone, an anoxic zone, and lastly an aerobic zone. The different biological zones promote the efficient removal of nutrients and the degradation of organic waste. A percentage of the treated water or mixed liquor from the biological process is recycled from the aerobic to the anoxic zone using high volume pumps. This ensures that the level of nutrient and organics removal is maintained at a sufficient level.

The effluent water from secondary treatment flows by gravity into four secondary clarifiers for settling. After settling of the solids is complete, the solids are recirculated through the biological treatment tanks with a portion pumped to waste holding tanks and eventually pumped by a force main to the Southwest WRF for processing and disposal. The clarified water is fed through traveling bridge filters and treated in a chlorine contact chamber (tertiary treatment) to provide high level disinfection using sodium hypochlorite.

Transfer pumps are used to pump the reclaimed water into two 5.0 MG holding tanks. From the holding tank, the reclaimed water is then distributed into the irrigation network. If the reclaimed water does not meet irrigation quality standards, the reject water is injected into a deep well. Surface water discharge is available in case of excess effluent in accordance with the current FDEP permit. While the City has retained its backup surface water discharge for the Everest WRF in the new permit, it has not been utilized as a disposal method since 2008 which is favorable for the City with the recent adoption of Senate Bill 64 . Everest WRF is not equipped to process the bio-solids produced at this facility and must pump waste sludge via force main to the Southwest WRF for treatment.

The Everest WRF receives utility power from LCEC. There are four separate LCEC 24.9 kV primary service lines that feed the plant facilities and five stand-by generators. Each service and generator are individually capable of handling their respective connected MCC loads. LCEC Line Nos. 1 and 2 are connected to the Existing Main Switchgear and are backed up with two (2) 1,250 kW diesel generators. LCEC Line Nos. 3 and 4 are connected to Main Switchgear 1A (MSWGR-1A) and Main Switchgear 1B (MSWGR-1B) and are backed up with three (3) additional 2,000 kW diesel generators which are connected to a separate electrical feed. The WRF meets FDEP and EPA requirements for auxiliary power.

Operating Permit

The FDEP issued a permit renewal (Permit # FL0030007-024-DW1P) to the City of Cape Coral on September 23, 2022, for operation of the Everest WRF during the time of updating this draft master plan. The new permit and will be effective on November 30, 2022 and the monitoring requirements stipulated in the new permit will be effective on January 1, 2023. The permit defines the requirements for effluent discharge, residuals disposal and ground water monitoring. The Everest WRF has consistently met the effluent requirements of the permit. The effluent limits for surface water discharge, underground injection, and reuse and land application are provided in **Table 4-2**, **Table 4-3**, and **Table 4-4** respectively.

Table 4-2 identifies effluent criteria when discharging to Surface Water. A plan allowing surface water discharge as a backup disposal alternative has been submitted by the City and approved by FDEP.

Table 4-2: Everest WRF Effluent Permit Limits for Surface Water Discharge

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements*	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Flow	MGD	Max Max	15.1 12.35	Monthly Average Annual Average	Continuous	Recording Flow Meter with Totalizer
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 25.0 40.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC
BOD, Carbonaceous 5 day, 20C	lb/day	Max Max	2061.1 2924.0	Annual Average Monthly Average	5 Days/Week	Calculated
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
Solids, Total Suspended	lb/day	Max Max	2061.1 3779.8	Annual Average Monthly Average	5 Days/Week	Calculated
Coliform, Fecal	#/100 mL	Max Max Max	200 200 800	Monthly Geometric Mean Annual Average Single Sample	5 Days/Week	Grab
Enterococci	#/100 mL	Max	35	Monthly Geometric Mean	5/Month	Grab
pH	s.u.	Min Max	6.5 8.5	Single Sample Single Sample	Continuous	Meter

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements*	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	Continuous	Meter
Chlorine, Total Residual (For Dechlorination)	mg/L	Max	0.01	Single Sample	Daily, 24 hours	Grab
Nitrogen, Total	mg/L	Max Max Max	3.0 3.6 6.0	Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
Nitrogen, Total	lb/day	Max Max	308.5 377.2	Annual Average Monthly Average	5 Days/Week	Calculated
Phosphorus, Total (as P)	mg/L	Max Max Max	0.5 0.6 1.0	Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
Phosphorus, Total (as P)	lb/day	Max Max	51.4 62.9	Annual Average Monthly Average	5 Days/Week	Calculated
Oxygen, Dissolved Percent Saturation	Percent samples in compliance	Min	90	Monthly Total	Daily; 24 hours	Meter
Oxygen, Dissolved Percent Saturation	Number of exceedances	Max Max	1 1	Quarterly Total Annual Total	Daily; 24 hours	Meter
Acute Whole Effluent Toxicity, 96 Hour LC50 (Ceriodaphnia dubia)	Percent	Min	100	Single Sample	Quarterly	4 grabs/24 hr period
Acute Whole Effluent Toxicity, 96 Hour LC50 (Cyprinella leedsi)	Percent	Min	100	Single Sample	Quarterly	4 grabs/24 hr period
Chlorodibromomethane	µg/L	Max Max	34 Report	Annual Average Monthly Average	Semi-Annually; twice per year	Grab
Dichlorobromomethane	µg/L	Max Max	22 Report	Annual Average Single Sample	Semi-Annually; twice per year	Grab

Source: Everest Permit # FL0030007-024-DW1P Effective as of November 30, 2022.
** Monitoring requirements effective on January 1, 2023.*

Table 4-3: Everest WRF Effluent Permit Limits for Underground Injection

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Flow	MGD	Max Max	3.35 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter

Source: Everest Permit # FL0030007-024-DW1P Effective as of November 30, 2022.
** Monitoring requirements effective on January 1, 2023.*

Table 4-4: Everest WRF Effluent Permit Limits for Reuse and Land Application

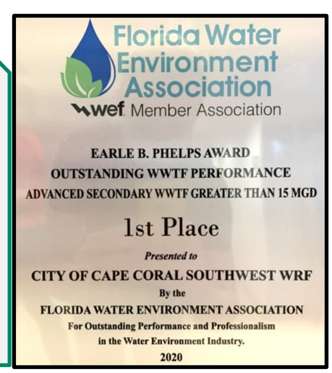
Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Flow	MGD	Max Max	Report Report	Annual Average Monthly Average	Continuous	Calculated
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter
Coliform, Fecal	#/100 mL	Max	25	Single Sample	Daily; 24 hours	Grab
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	Daily; 24 hours	Calculated
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter
Giardia	cysts/100L	Max	Report	Single Sample	Biennially; every 2 years	Grab
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	Biennially; every 2 years	Grab
Sodium, Total Recoverable	mg/L	Max	Report	Single Sample	Monthly	Grab
Solids, Total Dissolved (TDS)	mg/L	Max	Report	Single Sample	Monthly	Grab
Chloride (as Cl)	mg/L	Max	Report	Single Sample	Monthly	Grab
Nitrogen, Nitrate, Total (as N)	mg/L	Max	12.0	Single Sample	Monthly	Grab

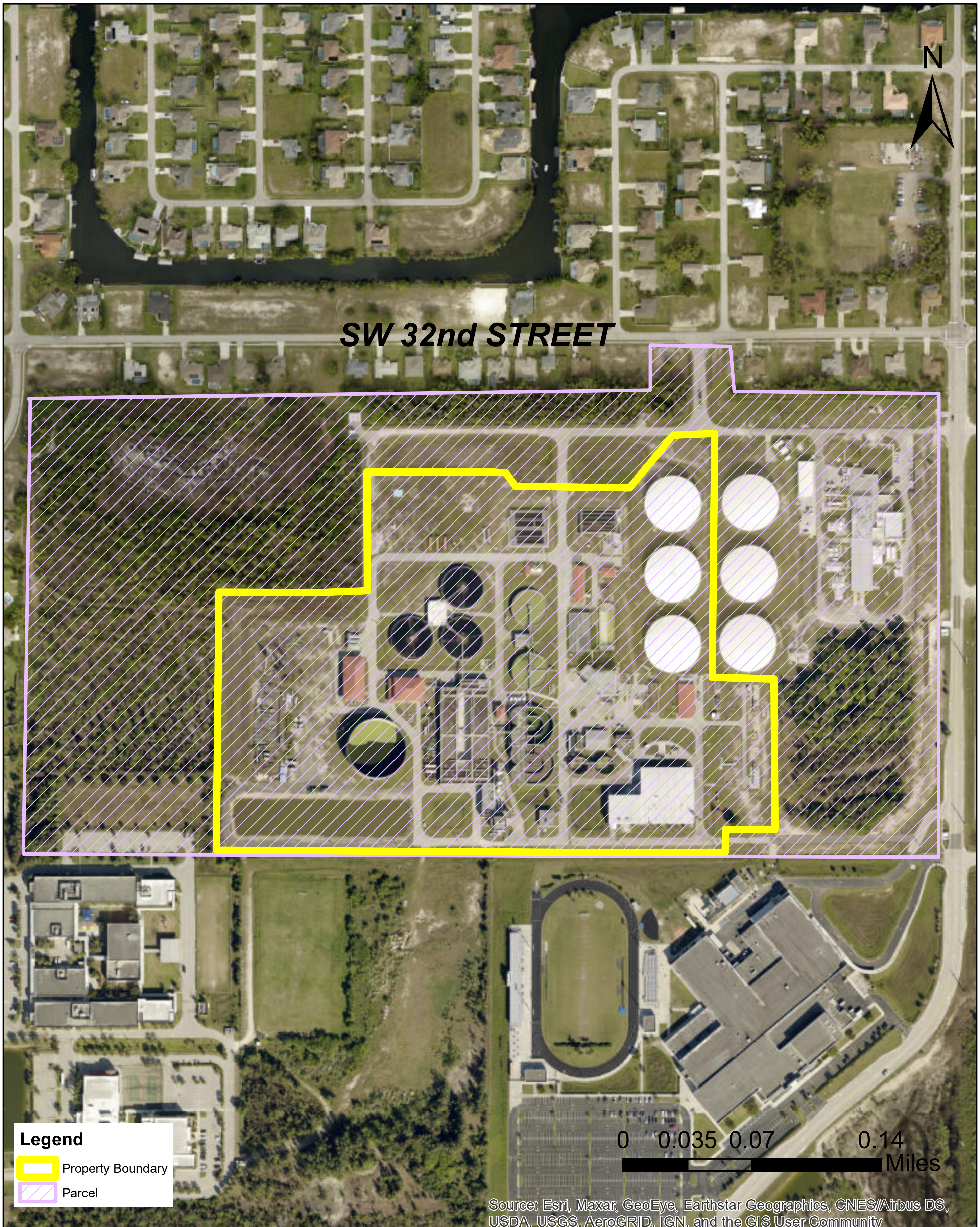
Source: Everest Permit # FL0030007-024-DW1P Effective as of November 30, 2022.
** Monitoring requirements effective on January 1, 2023.*

4.1.1.2 Southwest WRF

The Southwest WRF began operation with a permitted capacity of 6.6 MGD in 1994. In 2010 the facility was expanded to the current permitted capacity of 15.0 million gallon per day (MGD) annual average daily flow (AADF). During the expansion in 2010, significant modifications were made in a manner that allows for the plant to be expanded to a 20.0 MGD facility in the future. It currently operates under FDEP permit number FLA455458 and is located at 2104 SW 32nd Street, Cape Coral, FL 33914. The facility has a 15.0 million gallon per day (MGD) annual average daily flow (AADF) capacity. A site plan of the Southwest WRF is shown below in **Figure 4-4**.

The Southwest WRF won the Florida Water Environment Association (FWEA) Earle B. Phelps Award for outstanding wastewater treatment facility performance in the Advanced Secondary WWTF Greater than 15 MGD category in 2020.





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User: zhayek
Source: City of Cape Coral
Date: July 2021

City of Cape Coral
Comprehensive Utilities Master Plan
Southwest WRF Site Plan

AECOM

Figure 4-4

The Southwest WRF consists of three major treatment processes: preliminary treatment, secondary, and tertiary as depicted in the process flow diagram in **Figure 4-5**. The preliminary treatment process consists of mechanical equipment that is designed to remove grit and debris from the influent water before entering the biological treatment process. The influent water is screened by two mechanical step bar screens and a third manual bar screen which acts as a back-up. After screening, four vortex-type units and two cyclone/classifier units are used to remove grit from the water. After the screening and grit removal process is complete, the water is gravity fed into the biological treatment process.

The secondary treatment process is comprised of a three-stage nitrification-denitrification biological treatment process. The influent water is passed through different biological processes of the treatment train that include an anaerobic zone, an anoxic zone, and lastly an aerobic zone. The different biological zones promote the efficient removal of nutrients and the degradation of organic waste. A percentage of the biologically treated wastewater or mixed liquor is recycled internally to maintain the health and functionality of the nutrient and organic removal process. The effluent water from secondary treatment flows by gravity into five secondary clarifiers for settling. After settling of the solids is complete, the solids are pumped from the bottom of the clarifier to waste holding tanks or recirculated to the biological treatment process.

Tertiary treatment is the final stage in the process and improves the quality of water after biological treatment. The clarified water is fed through up-flow sand filters or traveling bridge sand filters and treated in a chlorine contact chamber to provide high level disinfection using sodium hypochlorite. Transfer pumps are used to pump the reclaimed water into holding tanks. From the holding tanks the reclaimed water is then distributed into the irrigation system. If the reclaimed water does not meet irrigation quality standards, the reject water is stored in reject water tanks.

The biosolids dewatering and treatment facility located at the Southwest WRF processes the waste sludge from both WRFs. Waste sludge from the Everest WRF is pumped via force main to a gravity collection system which is then pumped to the Southwest WRF headworks. This results in mixing of waste sludge with raw wastewater prior to entering the Southwest WRF. At the Southwest WRF, the solids wasted from the biological process are dewatered using centrifuges. The dewatered solids are converted into compost, used for fuel at the Waste-to-Energy Plant or transferred to the Lee County Solid Waste Landfill. A project has been designed is to allow waste sludge from Everest WRF to pump directly to the biosolids treatment system rather than impact the Southwest WRF influent loading. Connections have already been established at the Southwest WRF, but the installation of the necessary pipes between the two facilities has been pushed out with an estimated project completion date by the end of 2023.

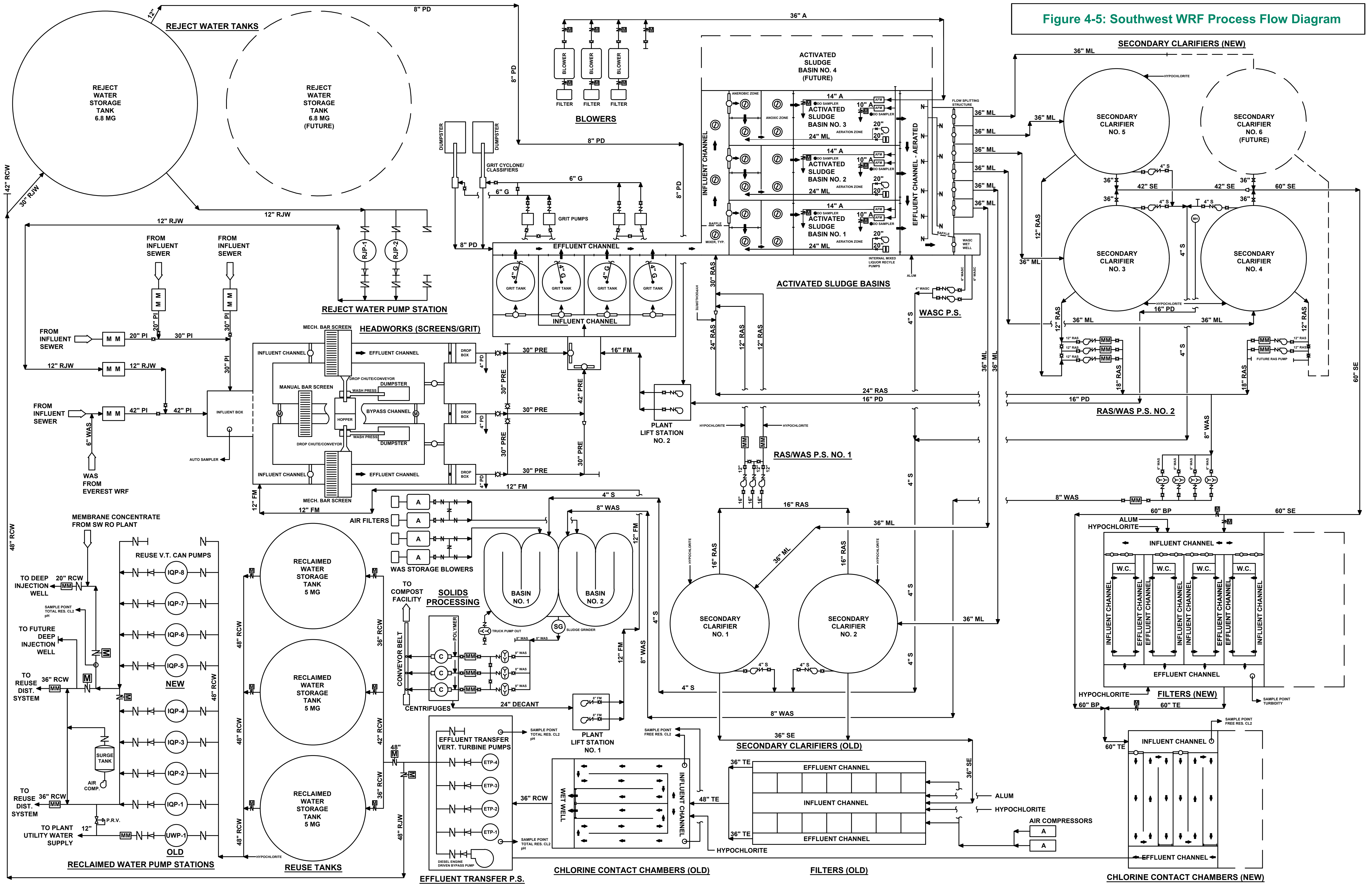


Figure 4-5: Southwest WRF Process Flow Diagram

The Southwest WRF receives utility power from LCEC. The plant has four separate 24.9 kV primary service lines that feed the plant facilities. There are three 1,500 KW generators which can provide power for 100% of the load at the reuse/biosolids operation. There are also three 2,250 KW generators that can provide power for 100% of the load for the remaining process equipment at the WRF. The WRF meets FDEP and EPA requirements for auxiliary power.

Operating Permit

The FDEP issued a permit (Permit # FLA455458) to the City of Cape Coral on May 21, 2021, with an effective date of October 25, 2021 for operation of the Southwest WRF. The permit defines the requirements for effluent discharge, residuals disposal and ground water monitoring.

Note that this facility discharges reclaimed water in the Caloosahatchee Basin Management Plan (BMAP) area. The BMAP requires domestic wastewater treatment facilities to meet new nutrient limits in the groundwater. The Southwest WRF discharges to a reuse system regulated under the Everest wastewater permit, FL0030007. The compliance limits in the newly issued Everest WRF permit (issued at the time of updating this draft report) remain unchanged from the previous permit.

The Southwest WRF has consistently met the effluent requirements of the permit. The effluent limits for underground injection, and reuse and land application are provided below in **Table 4-5** and **Table 4-6**, respectively.

Table 4-5: Southwest WRF Permit Effluent Limits for Underground Injection

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Flow (to IW-1)	MGD	Max	9.703	Daily Maximum	Continuous	Recording Flow Meter with Totalizer
Flow (to IW-2)	MGD	Max	10.15	Daily Maximum	Continuous	Recording Flow Meter with Totalizer
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter

Source: Southwest Permit # FLA455458

Table 4-6: Southwest WRF Permit Effluent Limits for Reuse and Land Application

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements	
			Limit	Statistical Basis	Frequency of Analysis	Sample Type
Flow	MGD	Max Max	Report Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab
Coliform, Fecal	#/100 mL	Max	25	Single Sample	Daily; 24 hours	Grab
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	Daily; 24 hours	Calculated
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter
Giardia	cysts/100L	Max	Report	Single Sample	Bi-Annually; every 2 years	Grab
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	Bi-Annually; every 2 years	Grab

Source: Southwest Permit # FLA455458

4.1.2 Wastewater Collection and Conveyance System

The City owns and operates the wastewater collection and conveyance system located within the service area boundaries. The system consists of gravity sewers, pumping stations and a manifolded force main network. Refer to **Figure 4-1** for the City's existing wastewater system as of January 2020. The following sections provide a general description of the City's wastewater collection system. It should be noted that the inventory provided in the subsections below reflect the City's wastewater infrastructure inventory through July 2022, which was provided by the City at the time of updating this master plan.

4.1.2.1 Gravity Sewer System

The gravity collection system for the City consists of approximately 820 miles of pipeline, ranging from 4 inches to 36 inches in diameter. Most of the gravity mains are polyvinyl chloride (PVC) pipe; however, approximately 164 miles of vitrified clay sewers still exist, which were constructed as part of the original City infrastructure. Inflow (stormwater that enters the collection system from roof leaders and through manhole covers) and infiltration (extraneous groundwater that enters the collection system through leaking joints, cracks and breaks) into the gravity sewer system is more prevalent in the older sections of the City, where clay piping exists. The gravity sewers in the UEP service areas are being constructed with PVC pipe. The gravity collection system also includes 13,142 manholes, of which 301 are master manholes and 464 are private manholes.

4.1.2.2 Wastewater Pump Stations,

The City owns and operates 281 duplex submersible wastewater pumping stations, 24 Master Pump Stations (MPS), 2 plant site stations. The City's collection system also receives flows from 41 privately owned pump stations (businesses, schools, fire station, etc.) located throughout the service area. These pump stations adhere to the City standards and have no adverse impact on the City's collection system.

4.1.2.3 Force main Network

The City's force main network conveys wastewater, under pressure, from the wastewater pump stations to the City's WRFs. The City's force main network is comprised of 203 miles of pipeline, ranging from 2 inches to 42 inches in diameter, 597 plug valves, and 122 gate valves. The majority of the force mains are PVC pipe, but there are also pipes made of high-density polyethylene (HDPE) and ductile iron. Additionally, there is a total of 6 miles of private force mains ranging from 2 inches to 18 inches in diameter.

4.2 Wastewater Regulatory Compliance

Wastewater treatment, biosolids, and effluent disposal requirements are set federally by the United States Environmental Protection Agency (EPA) and are enforced on a state level by the Florida Department of Environmental Protection (FDEP). FDEP is responsible for permitting and compliance of domestic wastewater treatment facilities (DWWTFs). Current regulations on the state and federal level mandate that the guidelines enforce the regulation of discharges into surface water bodies under the Clean Water Act to protect and conserve water resources while meeting public health needs for effective wastewater treatment.

In 2020, the Florida legislature passed the Clean Waters Act, Senate Bill 712. The Florida Department of Environmental Protection (FDEP) has introduced rulemaking in response to this legislation with the assistance of the Florida Water Environment Association (FWEA) Utility Council and Florida Rural Water Association. This response includes amendments to Chapter 62 of the Florida Administrative Code (FAC). In addition, Senate Bill 64 (SB 64) was approved by the Governor of Florida in June of 2021. The bill focuses on eliminating effluent, reclaimed water, and reuse water discharges to surface waters by domestic wastewater utilities and regulates authorized discharges that are beneficially used. Beneficial use or regulated authorized discharges include discharges associated with indirect potable reuse projects.

The Water Quality Improvements section of this legislation requires FDEP to set rules to limit, reduce or eliminate leaks, seepages, or inputs into wastewater collections systems, increases penalties regarding sanitary sewer overflows (SSOs), and requires studies related to SSOs, leaks, and infiltration. The FDEP is also required by this legislation to initiate rule amendments based on the Potable Reuse Commission's 2020 potable reuse implementation report; adopt specific recommendations from the Blue-Green Algae Task Force; and implement rules for biosolids management. The Clean Waters Act requires FDEP to update language and regulatory programs specific to domestic wastewater management and Collection Systems and Transmission Facilities.

Key updates to Chapter 62-600, FAC Domestic Wastewater Facilities are summarized in **Table 4-7**. Current and proposed regulations are detailed in **Appendix B.** The adoption of these new FAC updates has little impact on the City since (a) the WRFs meet Class I reliability requirements, (b) the City has Emergency Response plans, (c) the City has an on-going maintenance and repair program to identify and address wastewater infrastructure needs, and (d) the City does not discharge plant effluent to a surface water given the operation of an extensive reclaimed water system and available injection wells, which ensures compliance with SB 64 requirements. It should be noted that while the City has not discharged effluent to a surface water body in 14 years, it has maintained an approved river discharge as an alternative disposal site.

Table 4-7: Key Updates to Chapter 62-600, FAC Domestic Wastewater Facilities

FAC Chapter	Description of Update
62-600.400: Design Requirements	Unless otherwise stated, new or modified wastewater treatment and biosolids treatment, handling, and dewatering facilities shall provide Class III reliability as described in paragraph 62-600.300(2)(1), FAC. The minimum Class III requirement shall only apply to the new or modified portions of the facilities.
62-600.410: Operation and Maintenance Requirements	(7) Permittees of domestic wastewater treatment facilities with a permitted flow of 100,000 gallons per day (gpd) or greater shall develop a written emergency preparedness/response plan by no later than (one year after the effective date of the rule) and shall update and implement the plan as necessary thereafter.
62-600.520: Discharge to Surface Waters – (Coastal and Open Ocean)	(6) The discharge of domestic wastewater through ocean outfalls is prohibited after December 31, 2025, except as a backup discharge that is part of a functioning reuse system or other wastewater management system authorized by the department. A backup discharge may occur only during periods of reduced demand for reclaimed water in the reuse system, such as periods of wet weather, or as a result of peak flows from other wastewater management systems and must comply with the advanced wastewater treatment requirements of paragraph 403.086(9)(b).
62-600.710: Collection Systems – Facilities	The facility permittee for a wastewater treatment facility shall develop a pipe assessment, repair, and replacement action plan, referred to hereafter in this section as the “collection system action plan” or “plan,” with at least a 5-year planning horizon for all collection/transmission systems under the utility’s control to mitigate sanitary sewer overflows and underground pipe leaks to the extent technically and economically feasible.

4.3 Wastewater Historical and Projected Flows

4.3.1 Historical Wastewater Flows

The City is served by the Everest WRF and the Southwest WRF. Daily flows into both WRFs were provided by the City for the years of 2010-2019. Using a period of 10 years helps to identify wastewater flow trends that will form the basis for estimating future flows for planning purposes. A summary of the historical wastewater flows for the system is presented in **Table 4-8** and illustrated in **Figure 4-6** and **Figure 4-7.** The table presents the historical wastewater flows in terms of the following:

- Annual Average Daily Flows (AADF) are the average flows received over a one-year period
- Maximum Month Daily Flows (MMADF) are the highest of monthly average flows over a one-year period
- Maximum Three-Day Flows (M3DF) are the maximum flows received over three consecutive days over a one-year period
- Maximum Daily Flows (MDF) are the maximum flows received in a single day over a one-year period

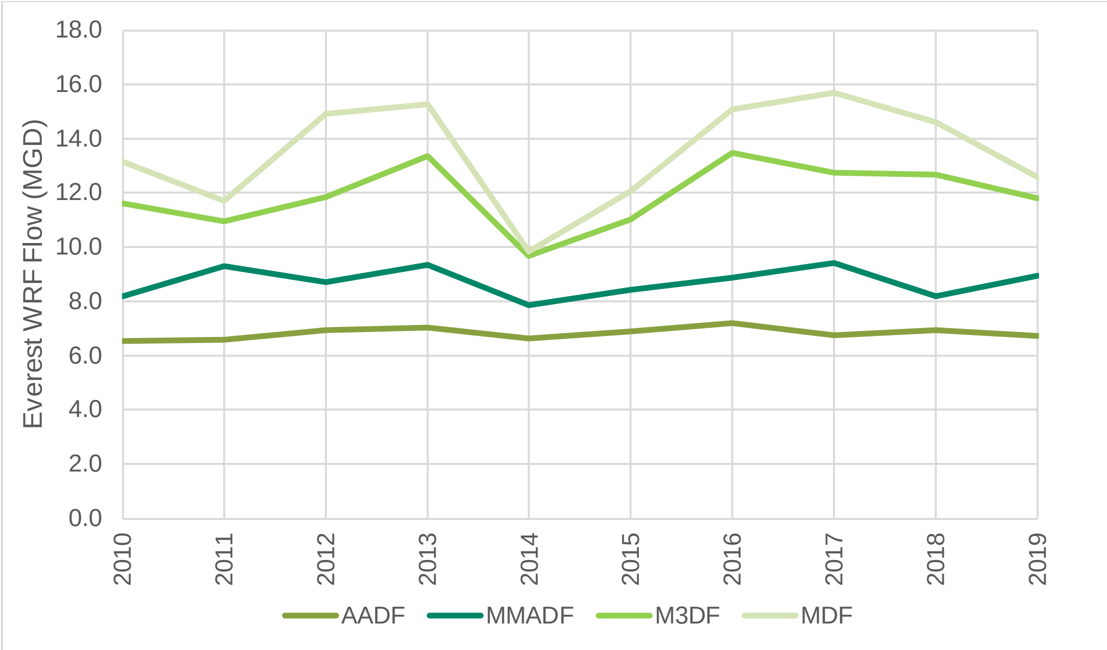
The historical analysis of these flows provides an understanding of the variation of wastewater due to daily patterns, patterns caused by the influx of tourists and seasonal residents, and wet/dry weather. In addition, the results of this historical analysis are used to develop wastewater flow projections.

Table 4-8: Historical Wastewater Flows

Fiscal Year	Wastewater Flows at Everest WRF (MGD)				Wastewater Flows at SW WRF (MGD)				Total Wastewater Flows (MGD)			
	Annual Average Daily Flow (AADF)	Maximum Month Average Daily Flow (MMADF)	Maximum 3-Day Consecutive Daily Flow (M3DF)	Maximum Daily Flow (MDF)	Annual Average Daily Flow (AADF)	Maximum Month Average Daily Flow (MMADF)	Maximum 3-Day Consecutive Daily Flow (M3DF)	Maximum Daily Flow (MDF)	Annual Average Daily Flow (AADF)	Maximum Month Average Daily Flow (MMADF)	Maximum 3-Day Consecutive Daily Flow (M3DF)	Maximum Daily Flow (MDF)
2010	6.55	8.18	11.60	13.13	6.28	8.18	11.60	13.13	12.82	16.35	23.19	26.26
2011	6.58	9.29	10.94	11.70	5.76	6.04	6.79	7.11	12.33	15.33	17.73	18.81
2012	6.94	8.71	11.84	14.90	6.33	7.13	9.08	13.48	13.26	15.84	20.93	28.38
2013	7.03	9.33	13.35	15.26	5.78	6.80	8.51	9.67	12.80	16.07	21.68	24.93
2014	6.64	7.87	9.68	9.84	5.70	6.29	7.16	7.46	12.34	14.15	16.84	17.30
2015	6.88	8.41	11.01	12.06	5.92	6.78	8.40	12.30	12.81	15.20	19.29	24.36
2016	7.20	8.86	13.49	15.07	6.55	7.38	9.87	10.74	13.76	16.24	23.37	25.81
2017	6.75	9.43	12.73	15.70	6.58	6.92	8.61	12.57	13.21	16.14	20.31	28.27
2018	6.93	8.20	12.66	14.61	6.57	7.04	8.61	9.60	13.50	14.97	20.85	24.21
2019	6.72	8.93	11.80	12.58	6.93	8.14	8.82	9.27	13.65	17.07	20.56	21.85
10-year Average	6.82	8.72	11.91	13.49	6.24	7.07	8.75	10.53	13.05	15.74	20.48	24.02

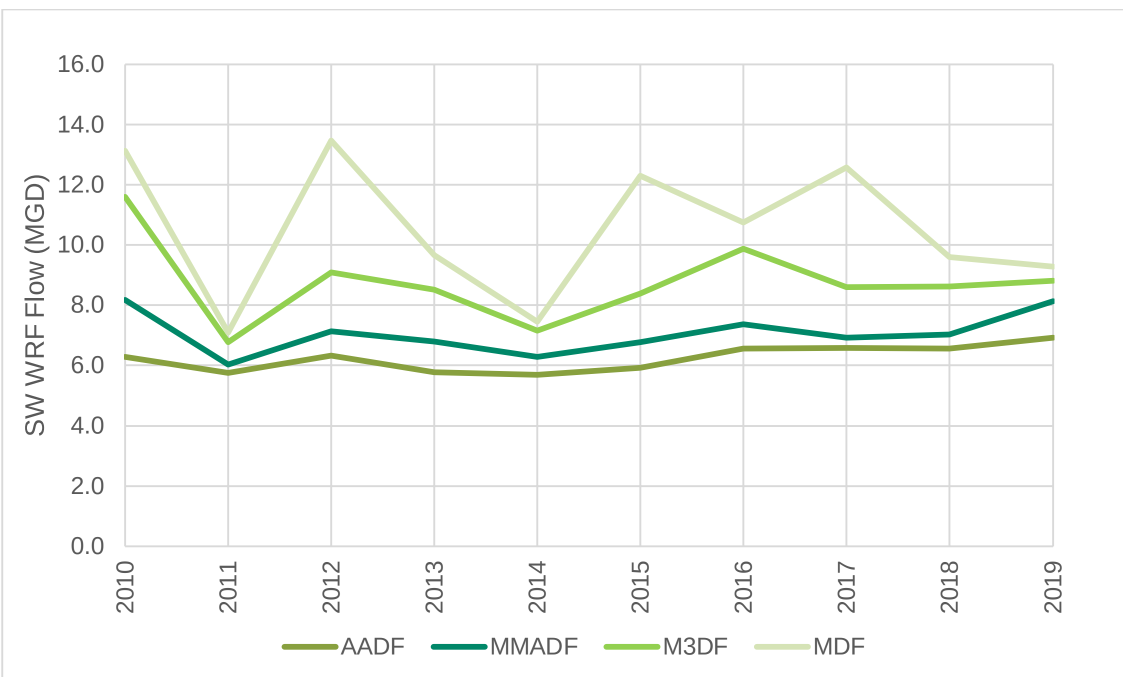
Historical flow data provided by City of Cape Coral

Figure 4-6: Historical Wastewater Flows Everest WRF



Over the past 10 years the annual average daily wastewater flows have been consistent as a result of the limited variation in the number of wastewater customers, with an average AADF at Everest WRF of 6.82 MGD and 6.24 MGD at the SW WRF. These flows are expected to increase with addition of customers in the existing and future service areas. The MMADF, M3DF, and MDF which represent higher flow conditions typically vary more as shown in **Figures 4-6** and **4-7.**

Figure 4-7: Historical Wastewater Flows SW WRF



4.3.2 Wastewater Flow Per Capita

To establish per capita wastewater flows, the Annual Average Daily flow (AADF) for each year is divided by the population served that year. **Table 4-9** presents this data and calculation on a system wide basis.

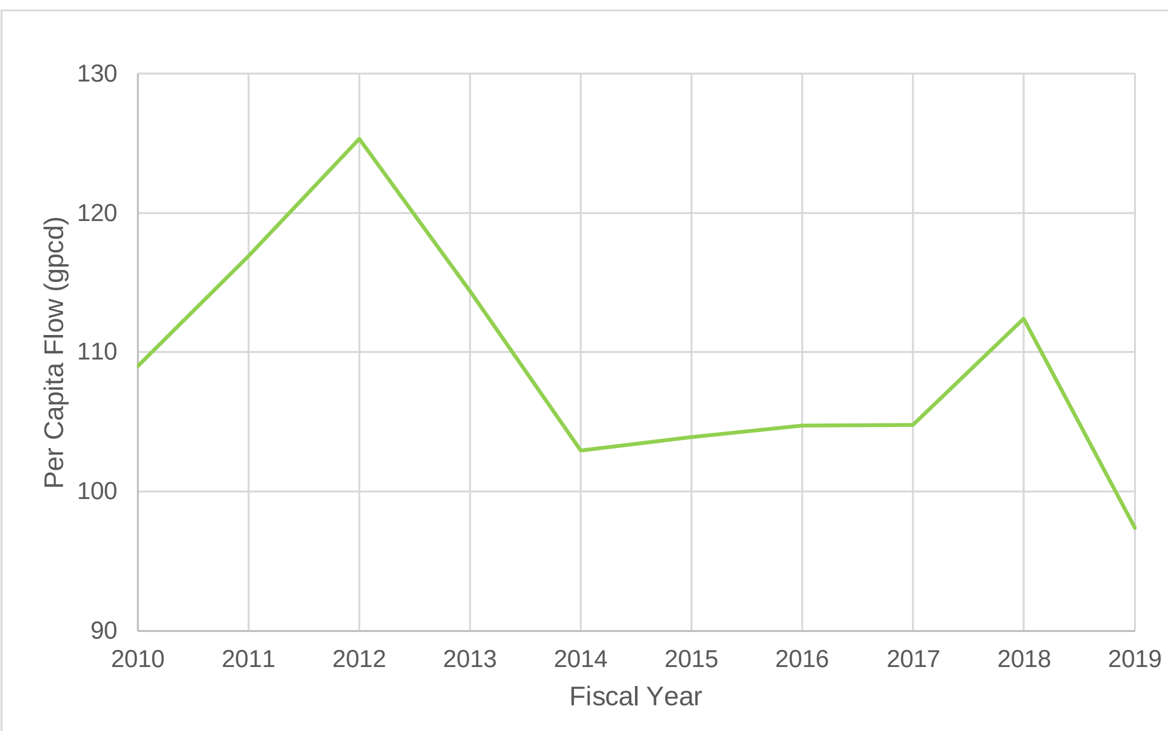
Table 4-9: Historical Per Capita Wastewater Flow

Fiscal Year	Permanent Population	Annual Average Daily Flows (AADF)	
		System Flows (MGD)	Per Capita Flows (gpcd)
2010	117,626	12.82	109
2011	105,483	12.33	117
2012	105,852	13.26	125
2013	111,913	12.80	114
2014	119,909	12.34	103
2015	123,279	12.81	104
2016	131,369	13.76	105
2017	126,036	13.21	105
2018	120,113	13.50	112
2019	140,102	13.65	97
Average	120,168	13.05	109

Historical population based on account data provided by City Utilities.

Wastewater per capita flow rates have varied over the 10-year period. Per capita flows ranged from 97 to 125 gallons per capita per day (gpcd) over the 10-year period, averaging 109 gpcd as shown in **Table 4-9** and **Figure 4-8**.

Figure 4-8: Historical per Capita Wastewater Flows



As part of the wastewater hydraulic modeling effort, AECOM evaluated the wet-weather and dry weather flow events for 2019 and developed per capita demands for each condition. The wet weather per capita demand was calculated as 143 gpcd and the dry weather per capita demand as 77 gpcd (about the same as the 2019 per capita potable water consumption). The difference between per capita flows for each event indicates the contribution of Inflow and Infiltration (I&I), which typically varies based upon sewer materials and age. Given the variation in dry and wet weather per capita flow rates, this master planning effort uses two different per capita flow rates to project future wastewater flows. The existing service areas with older infrastructure that are more prone to I&I are assigned a per capita flow of 110 gpcd (based upon the 10-year historical average) and newly constructed areas are assigned 91.2 gpcd (200 gpd per ERU) as per the City design procedures manual which is more representative of a "tight" system.

4.3.3 Peaking Factors

An essential element of analysis involves determining the projected maximum and peak flows to identify reliable capacity requirements. The total reliable treatment capacity of the water reclamation facilities must be able to treat the projected maximum and peak flows.

The MDF peaking factor (PF) is obtained by dividing the MDF by the AADF for the respective year. The 10-year historical MDF and PFs are summarized in **Table 4-10** for the Everest WRF and in **Table 4-11** for the SW WRF.

Table 4-10: Everest WRF Historical Maximum Day Flow

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum Daily Flow (MGD)	Maximum Daily Flow Peaking Factor
2010	6.55	13.13	2.01
2011	6.58	11.70	1.78
2012	6.94	14.90	2.15
2013	7.03	15.26	2.17
2014	6.64	9.84	1.48
2015	6.88	12.06	1.75
2016	7.20	15.07	2.09
2017	6.75	15.70	2.33
2018	6.93	14.61	2.11
2019	6.72	12.58	1.87
10-year Average	**6.82**	**13.49**	**1.97**

For the Everest WRF, the MDF PF ranged from 1.48 in 2014 to 2.33 in 2017, with an average of 1.97 during the 10-year period. For wastewater flow projections, the highest MDF PF of **2.33** for the Everest WRF is used.

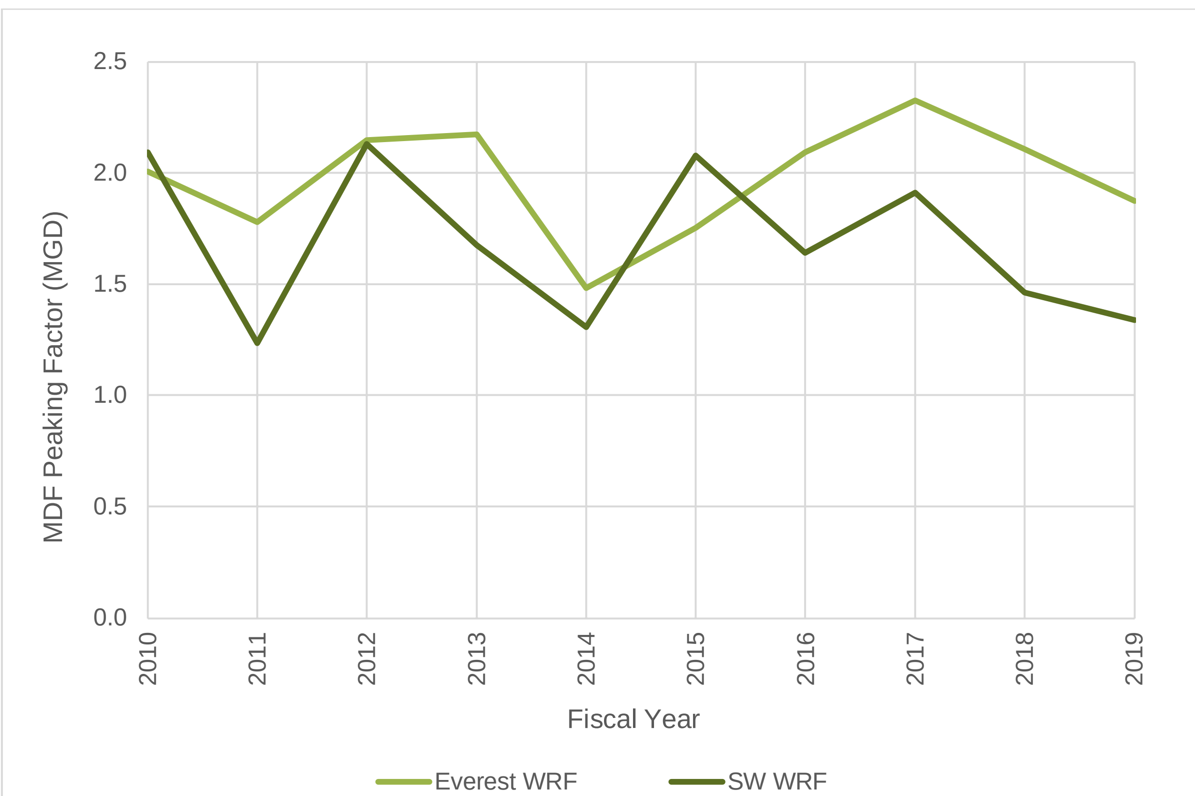
Table 4-11: SW WRF Historical Maximum Day Flow

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum Daily Flow (MGD)	Maximum Daily Flow Peaking Factor
2010	6.28	13.13	2.09
2011	5.76	7.11	1.24
2012	6.33	13.48	2.13
2013	5.78	9.67	1.67
2014	5.70	7.46	1.31
2015	5.92	12.30	2.08
2016	6.55	10.74	1.64
2017	6.58	12.57	1.91
2018	6.57	9.60	1.46
2019	6.93	9.27	1.34
10-year Average	**6.24**	**10.53**	**1.69**

For the SW WRF, the MDF PF ranged from 1.24 in 2011 to 2.13 in 2012, with an average of 1.69 during the 10-year period. For wastewater flow projections, the highest MDF PF of **2.13** for this WRF is used.

Figure 4-9 shows a graphical representation of the historical MDF PFs for these facilities for the years 2010-2019.

Figure 4-9: Historical MDF PF Per Facility



The M3DF PF is obtained by dividing the M3DF by the AADF for the respective year. The 10-year historical M3DF and PFs are summarized in **Table 4-12** for the Everest WRF and in **Table 4-13** for the SW WRF.

Table 4-12: Everest WRF Historical Maximum Consecutive 3-Day Flow

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum 3-Day Consecutive Daily Flow (MGD)	M3DF Peaking Factor
2010	6.55	11.60	1.77
2011	6.58	10.94	1.66
2012	6.94	11.84	1.71
2013	7.03	13.35	1.90
2014	6.64	9.68	1.46
2015	6.88	11.01	1.60
2016	7.20	13.49	1.87
2017	6.75	12.73	1.89
2018	6.93	12.66	1.83
2019	6.72	11.80	1.76
10-year Average	**6.82**	**11.91**	**1.74**

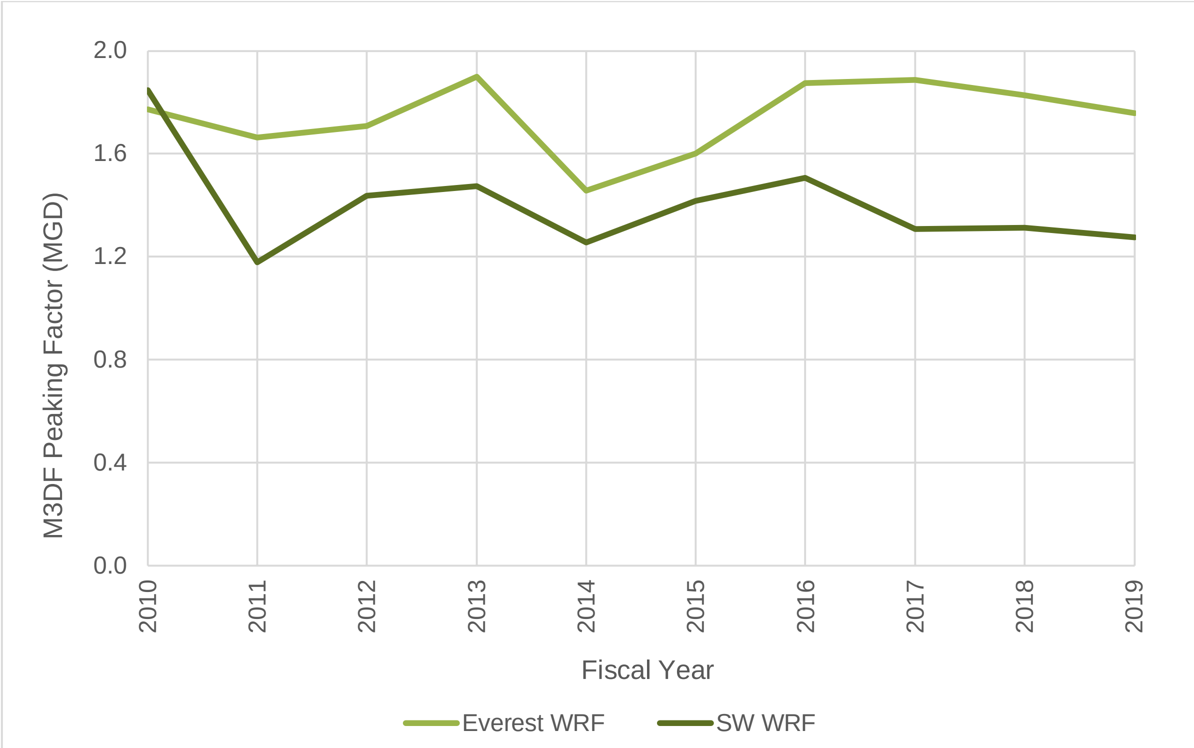
For the Everest WRF, the M3DF PF ranged from 1.46 in 2014 to 1.90 in 2013, with an average of 1.74 during the 10-year period. For wastewater flow projections, the highest M3DF PF of **1.90** for the Everest WRF is used.

Table 4-13: SW WRF Historical Maximum Consecutive 3-Day Flow

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum 3-Day Consecutive Daily Flow (MGD)	M3DF Peaking Factor
2010	6.28	11.60	1.85
2011	5.76	6.79	1.18
2012	6.33	9.08	1.44
2013	5.78	8.51	1.47
2014	5.70	7.16	1.26
2015	5.92	8.40	1.42
2016	6.55	9.87	1.51
2017	6.58	8.61	1.31
2018	6.57	8.61	1.31
2019	6.93	8.82	1.27
10-year Average	**6.24**	**8.75**	**1.40**

For the SW WRF, the M3DF PF ranged from 1.18 in 2011 to 1.85 in 2010, with an average of 1.40 during the 10-year period. For wastewater flow projections, the highest M3DF PF of **1.85** for this WRF is used. **Figure 4-10** shows a graphical representation of the historical M3DF PFs for these facilities for the years 2010-2019.

Figure 4-10: Historical M3DF PF Per Facility



To project MMDF, a PF is developed by dividing the MMDF by the AADF. Historical MMDF values for the Everest WRF are summarized in **Table 4-14**, and values for the SW WRF are in **Table 4-15**.

Table 4-14: Everest WRF Maximum Month Daily Flow and Peaking Factor

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum Month Daily Flow (MGD)	MMDF Peaking Factor
2010	6.55	8.18	1.25
2011	6.58	9.29	1.41
2012	6.94	8.71	1.26
2013	7.03	9.33	1.33
2014	6.64	7.87	1.18
2015	6.88	8.41	1.22
2016	7.20	8.86	1.23
2017	6.75	9.43	1.40
2018	6.93	8.20	1.18
2019	6.72	8.93	1.33
10-year Average	6.82	8.72	1.28

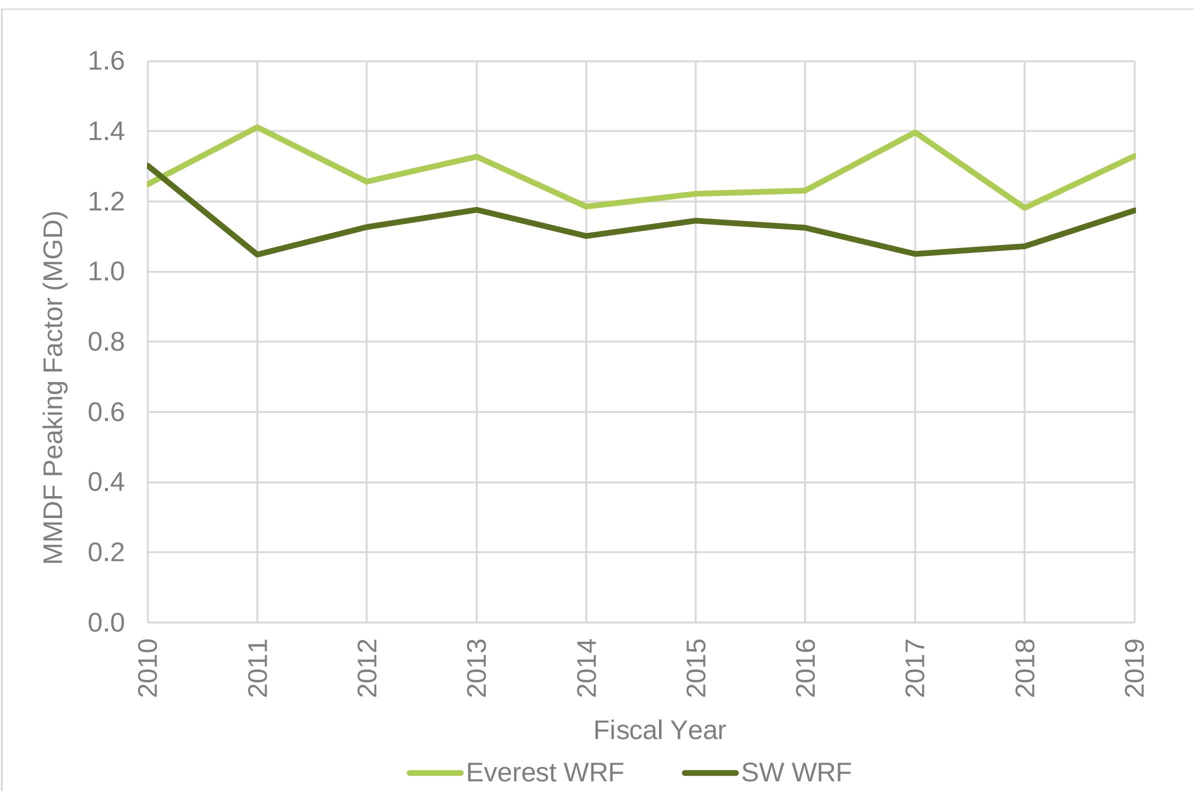
The MMDF PF for the Everest WRF ranged from 1.25 in 2010 to 1.41 in 2011 and 1.33 in 2019, with an average of 1.28 during the 10-year period. For wastewater flow projections, the highest MMDF PF of **1.41** for the Everest WRF is used.

Table 4-15: SW WRF Maximum Month Daily Flow and Peaking Factor

Fiscal Year	Annual Average Daily Flow (MGD)	Maximum of 12 Monthly Averages of Daily Flow (MGD)	MMDF Peaking Factor
2010	6.28	8.18	1.30
2011	5.76	6.04	1.05
2012	6.33	7.13	1.13
2013	5.78	6.80	1.18
2014	5.70	6.29	1.10
2015	5.92	6.78	1.14
2016	6.55	7.38	1.13
2017	6.58	6.92	1.05
2018	6.57	7.04	1.07
2019	6.93	8.14	1.17
10-year Average	**6.24**	**7.07**	**1.13**

MMDF PF ranged from 1.05 to 1.30 for the SW WRF, averaging 1.13 over the 10-year period of 2010-2019. The highest PF of **1.30** is used for planning purposes. **Figure 4-11** shows a graphical representation of the historical MMDF PFs for these facilities for the years 2010-2019. As shown in the figures and tables above the peaks at the Everest WRF are higher which is most likely due to the age of its collection system.

Figure 4-11: Historical MMDF PF Per Facility



4.4 Level of Service Standards/Performance Criteria

A baseline assessment of the City's LOS Standards/Performance Criteria to be utilized when evaluating the wastewater system's infrastructure needs was completed and the results are summarized below.

The City has adopted wastewater service LOS Standards for per capita flow and design criteria for peaking factors. This information is documented in City of Cape Coral Design Procedure Manual and the infrastructure element of the Cape Coral Comprehensive Plan. **Table 4-16** shows that the per capita flow recommended by the City Design Procedures Manual is 200 gpd per ERU. This equates to 91.2 gpd per capita based on City demographics provided by Metro Forecasting Models (2.55 persons per residence, 14% vacancy rate).

Table 4-16: Water Reclamation Recommended Design Per Capita Flows

Source	Flow	
	Per Capita	***Per ERU***
City's Design Procedures Manual	91.2 gallons per day (SF)	200 gallons per lot 170 gpd per duplex unit (340 total) 150 gpd per multi-family unit (1800 total) Commercial: Reference Chapter 64 E-6, Table 1 of the Florida Administrative Code
Cape Coral Comprehensive Plan	91.2 gallons per day	200 gallons per day

The City Design Procedures Manual and Comprehensive Plan recommends a per capita flow of 91.2 gpcd for use in design which is less than the 109 gpcd averaged over the past 10 years based upon ten years of historical analysis. After discussion with City staff, it was agreed that a lower per capita flow be used for projecting flows within service areas with new infrastructure and that a higher per capita flow based on historical data be used for existing service area flow projections where infrastructure is older, and inflow and infiltration is more of an issue. Therefore, 91.2 gpcd is used for new service area flow projections and 110 gpcd is used for existing service area flow projections. These two per capita flow rates are used in demand projections for both the hydraulic modeling and gap analyses.

After completing a historical analysis of wastewater flows and peaking factors and completing a review of various reference documents/engineering reports, a list of LOS Standards/ Performance & Design Criteria for wastewater service was accepted by the City for use in this master plan as summarized in **Table 4-17.**

The most significant additions/changes to the performance criteria include:

- Using 110 gpcd for per capita flow rate for existing service areas and 91.2 gpcd for future service areas.

- Evaluating planning level Deep Injection Well Capacity needs based upon Average Annual Daily Flow conditions.

Table 4-17: Recommended Wastewater Level of Service Standards/Performance Criteria

Service Value	Performance Criteria Statement	2020 LOS/Performance Criteria	Unit of Measure	Driver	Reference Material
Capacity & Access	Annual average day per capita flow for new service areas	LOS 91.2	gpcd	Design	Cape Coral Design Procedures Manual
Capacity & Access	Annual average day per capita flow for existing service areas	110	gpcd	Design	FAC 62-604.300(g), Historical Data Analysis
Capacity & Access	Annual Average Daily Flow process design basis	AADF	MGD	Design	FDEP Permit # FLA455458 and FL0030007
Quality & Reliability	Conveyance system minimum scour velocity	2	fps	Design	Cape Coral Design Procedures Manual
Quality & Reliability	Conveyance system maximum scour velocity	7	fps	Design	Cape Coral Design Procedures Manual
Environment & Sustainability	Effluent quality to comply with FDEP permit requirements	Treatment plant effluent complies with the plant permit requirements	-	Regulatory	FDEP Permit # FLA455458 and FL0030007
Quality & Reliability	Unit operations in the main wastewater treatment system shall be designed such that, with the largest flow capacity unit out of service, the hydraulic capacity of the remaining units shall be sufficient to handle peak wastewater flow (Class I Reliability)	-	MGD	Reliability	EPA-430-99-74-001 Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability Sec 212: Component Backup Req & FAC 62.600-540 (2)
Quality & Reliability	Reliable capacity for deep injection well for effluent disposal	AADF	MGD	Reliability	Recommended criterion when DIW is a secondary disposal method

The criteria outlined above are used to determine levels of capacity for wastewater facilities, collection and conveyance to mitigate concerns regarding potential service interruption and as a basis to measure the overall performance of the wastewater system.

4.5 Wastewater System Future Needs

The wastewater system customer base is expanding with the gradual addition of UEP areas. In order to identify system improvements required to continue providing services that satisfy established LOS/performance criteria adopted by the City the wastewater treatment, and collection and conveyance systems are evaluated using flow projections for the planning horizons of 2025, 2030, 2040, and buildout.

Hydraulic modeling of the wastewater primary force main network was completed simultaneously with treatment plant gap analyses to determine the needed wastewater infrastructure improvements which consisted primarily of new gravity collection systems to serve UEP project areas, modifications to the Southwest and Everest WRF service areas and treatment capacity upgrades, a new North WRF and new Master Pump Stations and force mains to convey wastewater flow to treatment facilities.

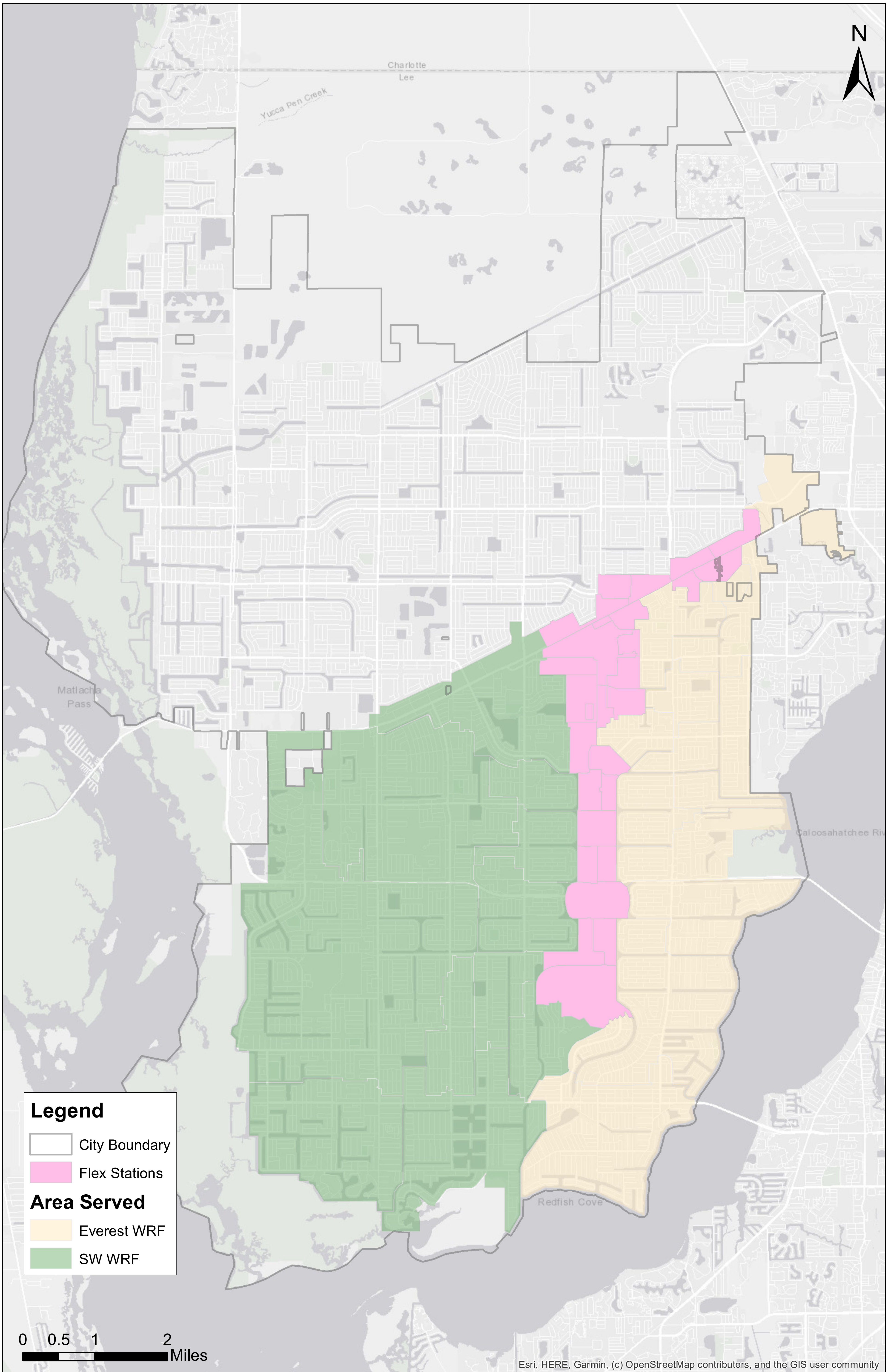
4.5.1 Wastewater Flow Projections

Flow projections are carried out on a per-WRF basis to ensure each plant maintains capacity to serve its corresponding service area which will vary. A portion of the City's pump stations have the flexibility to convey flow to either the SW or Everest WRFs by opening and closing valves resulting in a change to each WRF service area. These pump stations are referred to by the City and herein as "Flex Stations". Therefore, in order to evaluate flow projections, the Flex Station discharge locations are also identified.

In addition, the services areas for the SW and Everest WRF change as wastewater service expands and a new WRF is constructed. The results of hydraulic modeling determined that although the Everest and Southwest WRFs have a combined treatment capacity of 28.4 MGD, in order to serve the northern most UEP areas a new North WRF is required to keep force main pressures below 75 to 80 psi during peak hour flow conditions. When the new North WRF is operational, a portion of wastewater flows which were previously conveyed to Everest and the Southwest WRF will then flow to the new North WRF. **Figure 4-12** identifies the existing service areas, as of January 2020, for Everest and the Southwest WRF, and Flex Stations. **Figure 4- 13** identifies which UEP areas will be conveying wastewater flow to each WRF and the anticipated timing. **Figure 4-14** identifies the wastewater service areas for each WRF at buildout.

Flow projections are calculated based upon AADFs to facilitate treatment plant gap analyses and hydraulic modeling of the force main network where diurnal patterns for wet and dry weather flow conditions are applied to future projected AADFs. In order to gain an understanding of higher flow and biological loading conditions peaking factors are used to estimate MMADFs, MDFs, and M3DFs.

AADF projections are prepared for each wastewater service area using the projected served population based upon the UEP schedule (discussed in Chapter 2 of this report) along with per capita wastewater flow rates. A per capita rate of 110 gpcd is used for the area South of Pine Island Road that has older infrastructure and 91.2 gpcd is used for future service areas north of Pine Island Road that will have new infrastructure. Flow projections for MMADF, M3DF, and MDF are calculated by multiplying the AADF for each service area by the respective PFs.



User: zhayek
Source: City of Cape Coral
Date: November 2022

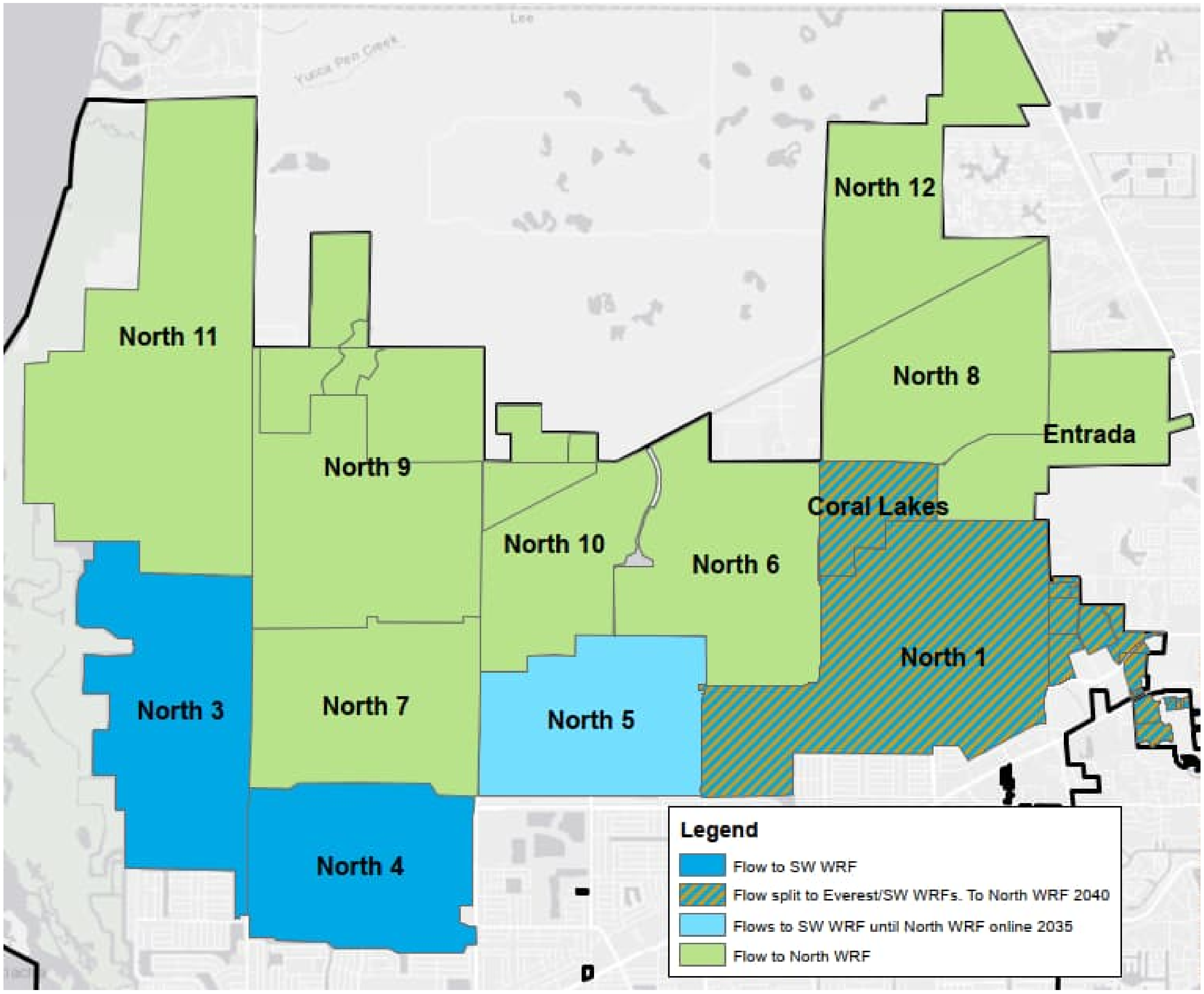
Cape Coral FLORIDA

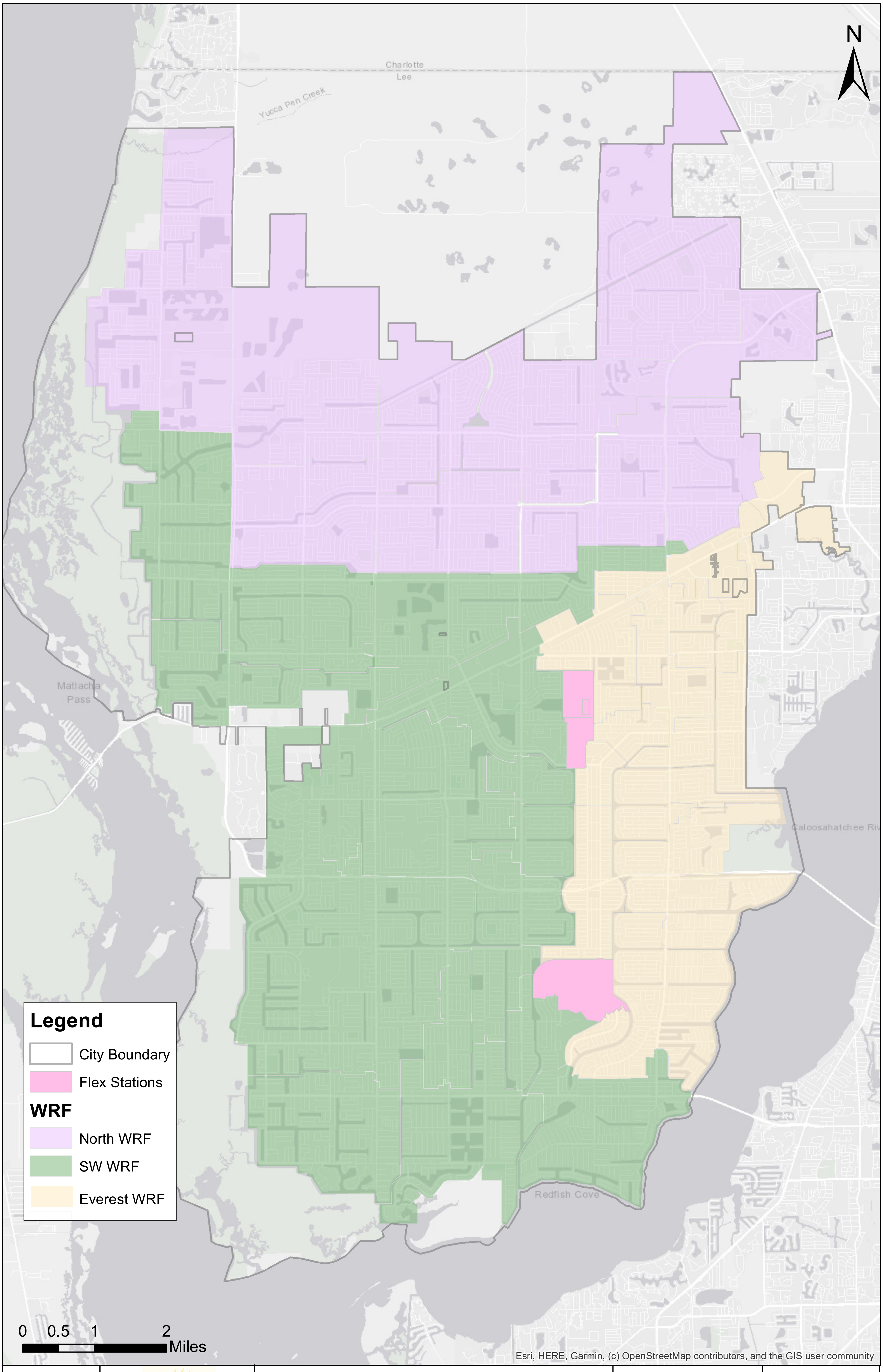
City of Cape Coral
2020 Existing Wastewater System Basins

AECOM

Figure 4-12

Figure 4-13: Distribution of UEP Wastewater Flows by WRF





User: zhayek
Source: City of Cape Coral
Date: November 2022

City of Cape Coral
Areas Served by WRF at Buildout

Figure 4-14

Tables 4-18 through **4-21** show the flow projections for the wastewater service areas for the planning horizon of 2020 through 2080 and for buildout. These projections take into account the UEP schedule and changes in the WRF service areas.

Gray shaded areas show where flow projections provided exceeds the 20-year planning horizon (FY 2020 through FY 2040). This is meant to indicate that projections after this point are more uncertain and should be revisited for future planning.

Table 4-18: Everest WRF Wastewater Flow Projections (MGD)

Fiscal Year	AADF	MMADF	M3DF	MDF
2020	5.55	7.82	10.54	12.93
2025*	7.33	10.33	13.93	17.08
2030	8.02	11.31	15.25	18.70
2035**	8.72	12.30	16.57	20.32
2040	7.36	10.38	13.99	17.15
2045	7.36	10.38	13.99	17.15
2050	7.36	10.38	13.99	17.15
2055	7.36	10.38	13.99	17.15
2060	7.36	10.38	13.99	17.15
2065	7.36	10.38	13.99	17.15
2070	7.36	10.38	13.99	17.15
2075	7.36	10.38	13.99	17.15
2080	7.36	10.38	13.99	17.15
BUILDOUT	**7.36**	**10.38**	**13.99**	**17.15**

* Flows from MPS 100 service area diverted from the Everest WRF to the Southwest WRF in 2025.
** Reduced flows to Everest WRF after 2035 as North 1 flows are redirected to the North WRF.

As shown in **Table 4-18**, the Everest WRF AADF is expected to increase from 5.55 MGD in FY 2020 to 7.36 MGD in FY 2040 or an increase of 32.6%. The flow remains at 7.36 MGD due to the 2% infill rate that was applied and increased the population to reach buildout in FY 2040. The flow projections presented in this table reflect the North 1 flow splitting between the Everest and SW WRFs prior to the North WRF coming online in 2035. The decrease in flows from 8.72 MGD in 2035 to 7.36 MGD in 2040 is due to the diversion of all North 1 flows to the new North WRF which comes online in 2035.

Table 4-19: SW WRF Wastewater Flow Projections (MGD)

Fiscal Year	AADF	MMADF	M3DF	MDF
2020	9.44	12.27	17.46	20.11
2025*	13.67	17.77	25.29	29.12
2030	16.29	21.18	30.14	34.70
2035**	17.51	22.77	32.40	37.30
2040	17.24	22.41	31.89	36.71
2045	17.38	22.60	32.16	37.03
2050	17.51	22.77	32.40	37.30
2055	17.62	22.90	32.59	37.52
2060	17.70	23.01	32.75	37.70
2065	17.76	23.09	32.86	37.83
2070	17.81	23.15	32.95	37.93
2075	17.85	23.20	33.02	38.02
2080	17.88	23.24	33.08	38.08
BUILDOUT	**18.01**	**23.41**	**33.32**	**38.36**

* Flows from MPS 100 service area diverted from the Everest WRF to the Southwest WRF in 2025.
** Reduced flows to SW WRF after 2035 as North 1 flows are redirected to the North WRF.

As shown in **Table 4-19**, the SW WRF AADF is expected to increase from 9.44 MGD in FY 2020 to 17.24 MGD in FY 2040 or an increase of 82.6%. This flow is projected to increase to 18.01 MGD at buildout or an increase of 90.8% from FY 2020 which should be viewed with caution due to uncertainty after the 20-year planning period. The flow projections presented in this table reflect the North 1 flow splitting between the Everest and SW WRFs prior to the North WRF coming online in 2035. In addition, the projected flows for 2025 include the redirected flows from the MPS 100 service area. The decrease in flows from 2035 to 2040 is due to the diversion of all North 1 flows to the new North WRF which comes online in 2035.

Separate wastewater flow projections were evaluated for the Flex Station sewer shed areas since these pump stations can convey flow to either the SW or Everest WRFs and the discharge location will vary over time. As shown by **Table 4-20**, the flex station AADF is expected to decrease from 2.09 MGD in FY 2020 to 0.61 MGD in FY 2040 and at buildout. The projected flow for the flex stations decrease since some pump stations overtime will be operated to only convey flow to either the Everest or SW WRFs. The flow remains at 0.61 MGD due to the 2% infill rate that was applied and increased the population to reach buildout in FY 2040.

Table 4-20: Flex Station Wastewater Flow Projections (MGD)

Fiscal Year	AADF	MMADF	M3DF	MDF
2020	2.09	2.95	3.97	4.87
2025	0.56	0.79	1.07	1.31
2030	0.61	0.86	1.15	1.42
2035	0.66	0.93	1.25	1.53
2040	0.61	0.86	1.16	1.43
2045	0.61	0.86	1.16	1.43
2050	0.61	0.86	1.16	1.43
2055	0.61	0.86	1.16	1.43
2060	0.61	0.86	1.16	1.43
2065	0.61	0.86	1.16	1.43
2070	0.61	0.86	1.16	1.43
2075	0.61	0.86	1.16	1.43
2080	0.61	0.86	1.16	1.43
BUILDOUT	**0.61**	**0.86**	**1.16**	**1.43**

The results of hydraulic modeling have determined the need for a new North WRF to service the northern UEP areas. The analysis of the additional wastewater flows associated with these northern UEP areas has indicated that when the North 6 UEP area is provided wastewater services in the (Year 2035) a new WRF should be constructed and operational. With the new WRF online, the sewer shed boundaries for Everest and Southwest will be modified over time as shown in **Figures 4-12** and **4-14**. **Table 4-21** summarizes the flow projections for the new North WRF over the planning horizon as the northern UEP areas North 6 to North 12 are provided wastewater service.

Table 4-21: North WRF Wastewater Flow Projections (MGD)

Fiscal Year	AADF	MMDF	M3DF	MDF
2020	-	-	-	-
2025	-	-	-	-
2030	-	-	-	-
2035	2.19	2.85	4.06	4.68
2040	5.79	7.53	10.72	12.34
2045	7.39	9.61	13.68	15.75
2050	8.16	10.61	15.09	17.38
2055	8.67	11.27	16.04	18.46
2060	9.05	11.76	16.74	19.27
2065	9.35	12.16	17.31	19.92
2070	9.61	12.50	17.79	20.48
2075	9.83	12.78	18.19	20.95
2080	10.02	13.03	18.54	21.35
BUILDOUT	11.15	14.50	20.64	23.76

As shown by **Table 4-21**, the North WRF AADF is expected to start at 2.19 MGD in FY 2035 when the plant is brought online. This flow is projected to increase to 5.79 MGD in FY 2040 as a result of additional UEP areas coming online and being conveyed to this facility. The AADF is projected to increase to 11.15 MGD at buildout or an increase of 509% from FY 2035 which should be viewed with caution due to uncertainty after the 20-year planning period.

4.5.2 WRF Treatment Capacity Gap Analysis

A WRF capacity gap analysis identifies the differential between the City's existing wastewater treatment plant capacity and the projected wastewater flows. The reliable wastewater treatment plant capacity is defined by the FDEP Operation Permit, as the total permitted treatment capacity. The estimated reliable capacity of the Everest WRF is 13.4 MGD, and the estimated reliable capacity of the SW WRF is 15.0 MGD. The WRF's permitted operational capacity and the projected annual average daily flow (AADF) are used to develop the wastewater treatment gap analysis. A WRF treatment gap analysis is completed for the existing Everest and SW WRFs and a new North WRF to ensure that sufficient treatment capacity is available with the expansion of wastewater services.

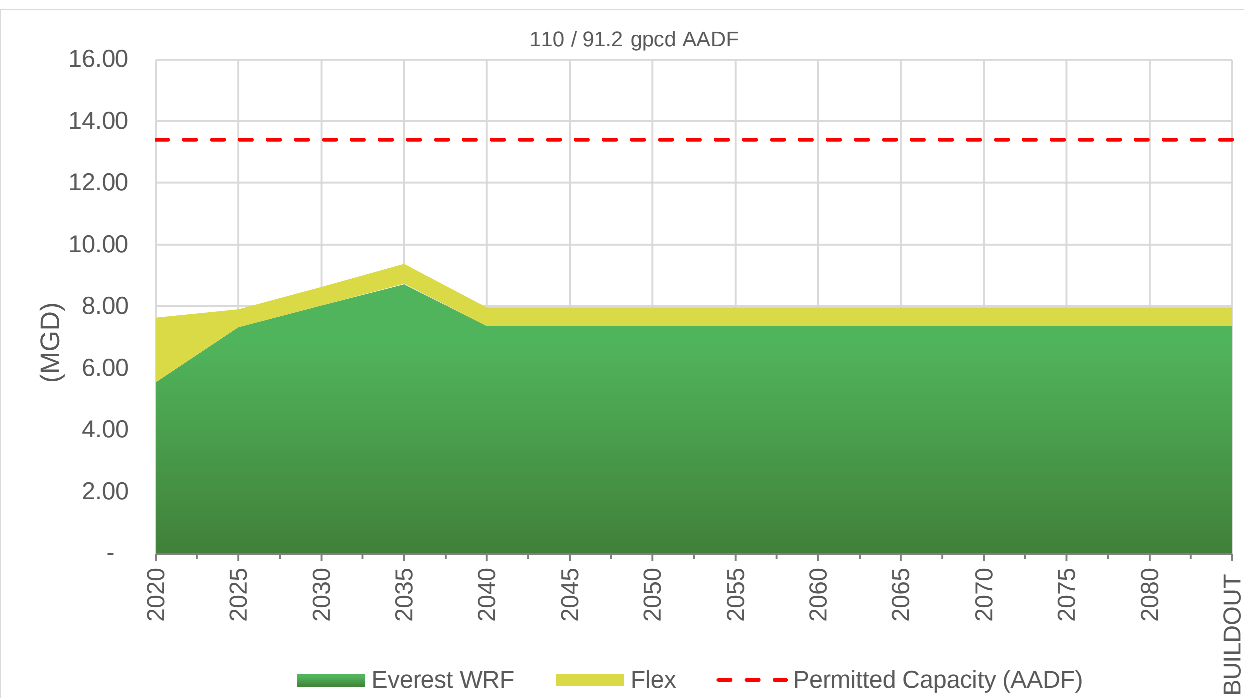
4.5.2.1 Everest WRF Gap Analysis

The area served by the Everest WRF encompasses the east of the wastewater service area and will vary when the discharge locations for the Flex Stations are changed, when the North 1 UEP is provided service, and when the new North WRF is constructed as shown previously in **Figures 4-12** through **4-14**. For this gap analysis it is assumed all the Flex Station flows are conveyed to the Everest WRF to represent the highest influent flow condition. Flow projections verses permitted capacity and the treatment gap (either excess capacity or the capacity deficit) for the Everest WRF are shown in **Table 4-22** and **Figure 4-15**.

Table 4-22: Everest WRF Gap Analysis (MGD)

Fiscal Year	AADF	AADF + Flex	Permitted Capacity (AADF)	Gap
2020	5.55	7.64	13.40	5.76
2025	7.33	7.89	13.40	5.51
2030	8.02	8.63	13.40	4.77
2035	8.72	9.38	13.40	4.02
2040	7.36	7.97	13.40	5.43
2045	7.36	7.97	13.40	5.43
2050	7.36	7.97	13.40	5.43
2055	7.36	7.97	13.40	5.43
2060	7.36	7.97	13.40	5.43
2065	7.36	7.97	13.40	5.43
2070	7.36	7.97	13.40	5.43
2075	7.36	7.97	13.40	5.43
2080	7.36	7.97	13.40	5.43
BUILDOUT	**7.36**	**7.97**	**13.40**	**5.43**

Figure 4-15: Everest WRF Gap Analysis



The Everest WRF existing capacity is sufficient to provide wastewater treatment to its service area through buildout.

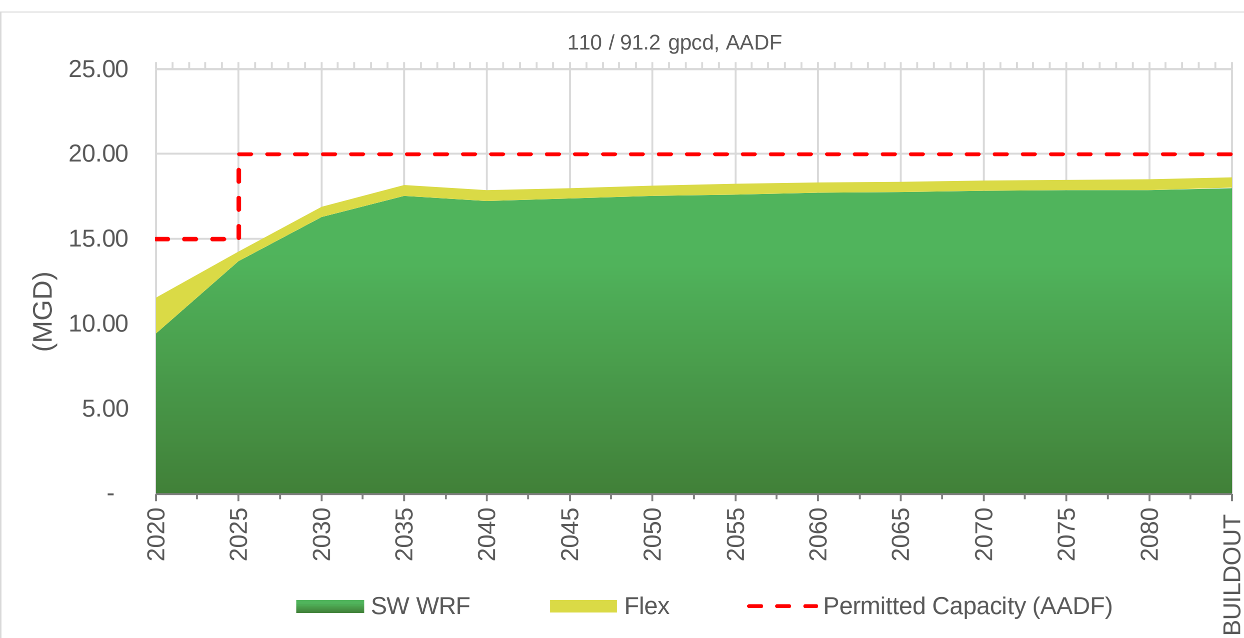
4.5.2.2 Southwest WRF Gap Analysis

The area served by the SW WRF is comprised of MPS basins located to the west of the service area as shown previously in **Figures 4 -12** through **4-14.** The area served will be increased by the construction of MPS 100, which will divert the basin's flows from the Everest WRF to the SW WRF, and the addition of the North 1 (a portion of the flow until the North WRF comes online in 2035), North 3, and North 4 UEPs. For this gap analysis it is assumed all the Flex Station flows are conveyed to the Southwest WRF to represent the highest influent flow condition. Flow projections vs permitted capacity and the treatment gap (either excess capacity or the capacity deficit) for the SW WRF are shown in **Table 4-23** and **Figure 4-16**.

Table 4-23: Southwest WRF Gap Analysis (MGD)

Fiscal Year	AADF	AADF + Flex	Permitted Capacity (AADF)	Gap
2020	9.44	11.53	15.00	3.47
2025	13.67	14.23	20.00	5.77
2030	16.29	16.90	20.00	3.10
2035	17.51	18.17	20.00	1.83
2040	17.24	17.85	20.00	2.15
2045	17.38	18.00	20.00	2.00
2050	17.51	18.12	20.00	1.88
2055	17.62	18.23	20.00	1.77
2060	17.70	18.31	20.00	1.69
2065	17.76	18.37	20.00	1.63
2070	17.81	18.42	20.00	1.58
2075	17.85	18.46	20.00	1.54
2080	17.88	18.49	20.00	1.51
BUILDOUT	18.01	18.62	20.00	1.38

Figure 4-16: SW WRF Gap Analysis



The existing SW WRF has sufficient capacity to provide service through 2025, a 5 MGD treatment capacity expansion is planned and expected to be online by 2025. The 20 MGD capacity is sufficient to serve the WRF's service area through buildout.

4.5.2.3 North WRF Treatment Capacity Analysis

The North WRF is projected to serve areas in the north of the City's service area, UEPs North 1 and North 5 through North 12 will be a part of the new North WRF service area.

Originally, the proposed initial capacity of the North WRF was 4 MGD in 2035 to be expanded to 8 MGD in 2040. However, the gap analysis indicated that an intermediate expansion to 6 MGD would be needed in 2037. Design and construction of plant expansions require a few years at minimum, thus an expansion after two years of the plant coming online is typically not recommended. The gap analysis based on this treatment capacity expansion timing is shown in **Table 4-24** in the "Alternative A" column and in **Figure 4-17**.

Flow projections verses proposed permitted capacity and the treatment gap (either excess capacity or the capacity deficit) for the "Alternative B" North WRF treatment capacity expansion timing is shown in **Table 4-24** and **Figure 4-18.**

Table 4-24: North WRF Treatment Capacity Analysis (MGD)

Fiscal Year	AADF	Alternative B		Alternative A	
		Permitted Capacity	Gap	Permitted Capacity	Gap
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	-	-	-	-	-
2035	2.19	6.00	3.81	4.00	1.81
2036	2.91	6.00	3.09	4.00	1.09
2037	3.63	6.00	2.37	6.00	2.37
2038	4.35	6.00	1.65	6.00	1.65
2039	5.07	6.00	0.93	6.00	0.93
2040	5.79	8.00	2.21	8.00	2.21
2045	7.39	8.00	0.61	8.00	0.61
2050	8.16	12.00	3.84	12.00	3.84
2055	8.67	12.00	3.33	12.00	3.33
2060	9.05	12.00	2.95	12.00	2.95
2065	9.35	12.00	2.65	12.00	2.65
2070	9.61	12.00	2.39	12.00	2.39
2075	9.83	12.00	2.17	12.00	2.17
2080	10.02	12.00	1.98	12.00	1.98
BUILDOUT	11.15	**12.00**	0.85	**12.00**	0.85

Figure 4-17: North WRF Treatment Capacity Analysis (Alternative A Capacities)

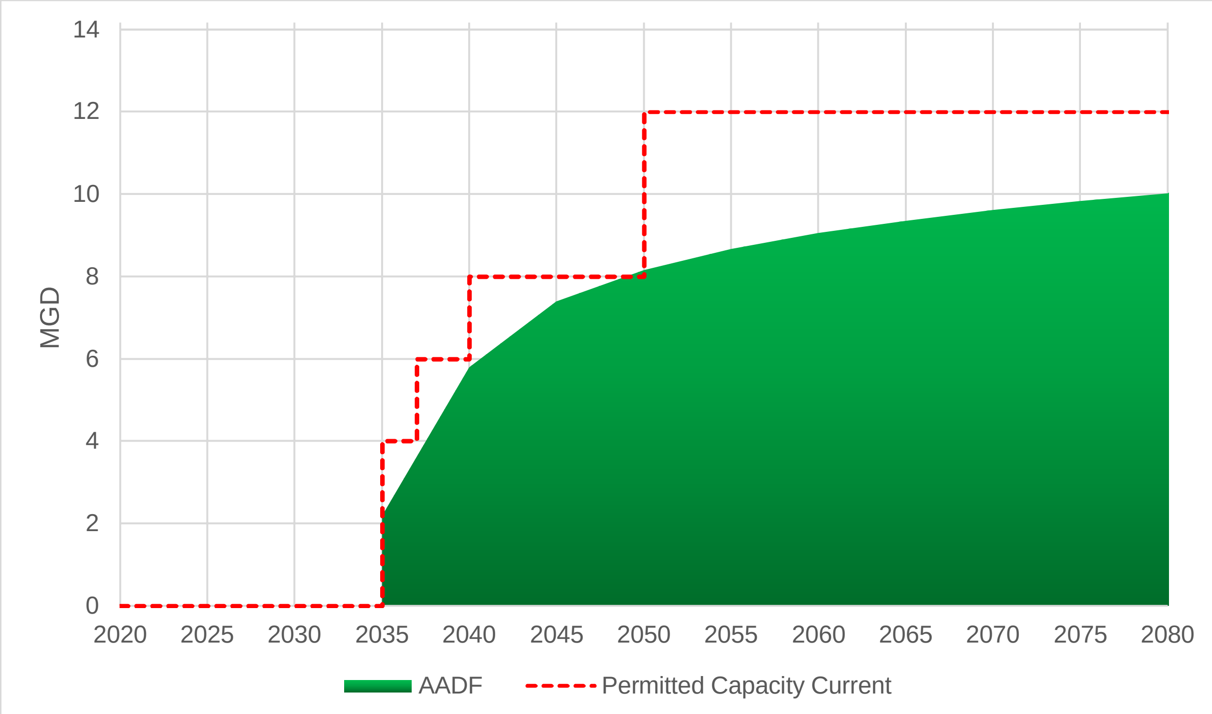
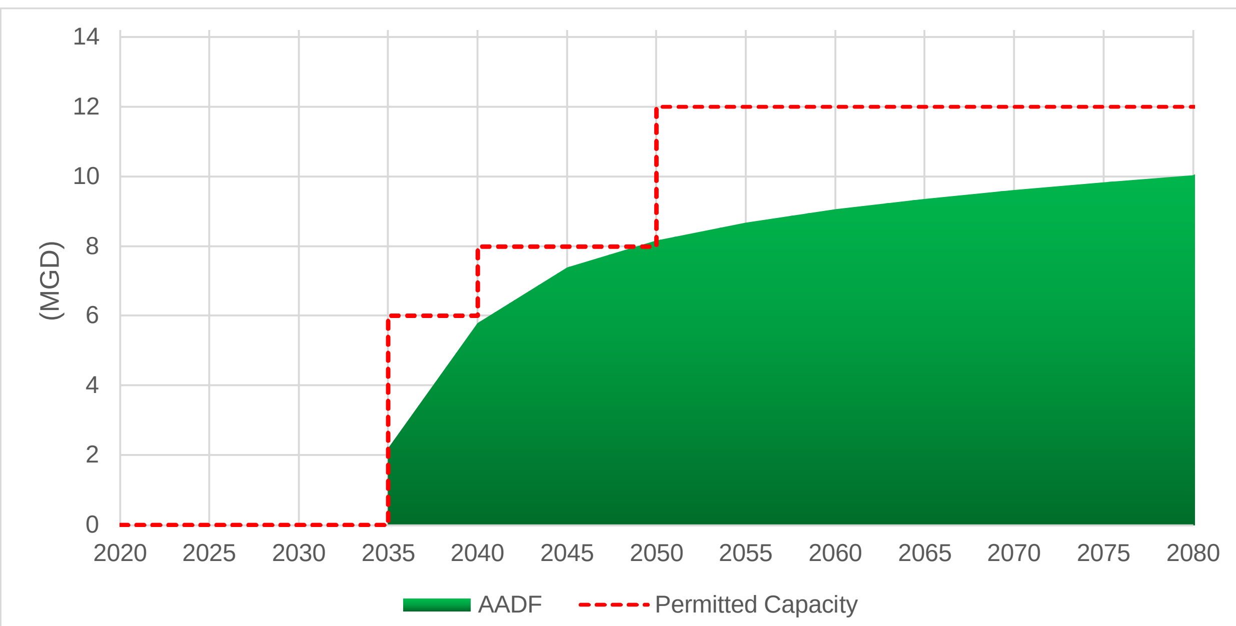


Figure 4-18: North WRF Treatment Capacity Analysis (Alternative B Capacities)



Based on the discussion above, a second alternative was evaluated where the initial capacity for the North WRF is 6 MGD as shown in Alternative B in **Figure 4-18**. By 2040, a 2 MGD plant expansion (total 8 MGD capacity) should be online, which would accommodate flows up through Year 2050. At that point, an expansion of an additional 4 MGD (total treatment capacity 12 MGD) in 2050 would ensure sufficient treatment capacity through buildout.

For this master planning effort, it is assumed in 2035 the new North WRF capacity will be 4 MGD, as noted in Alternative A. However, it is recommended that the City re-evaluate this when initiating the preliminary design.

4.5.3 Deep Injection Well Capacity

4.5.3.1 Everest WRF

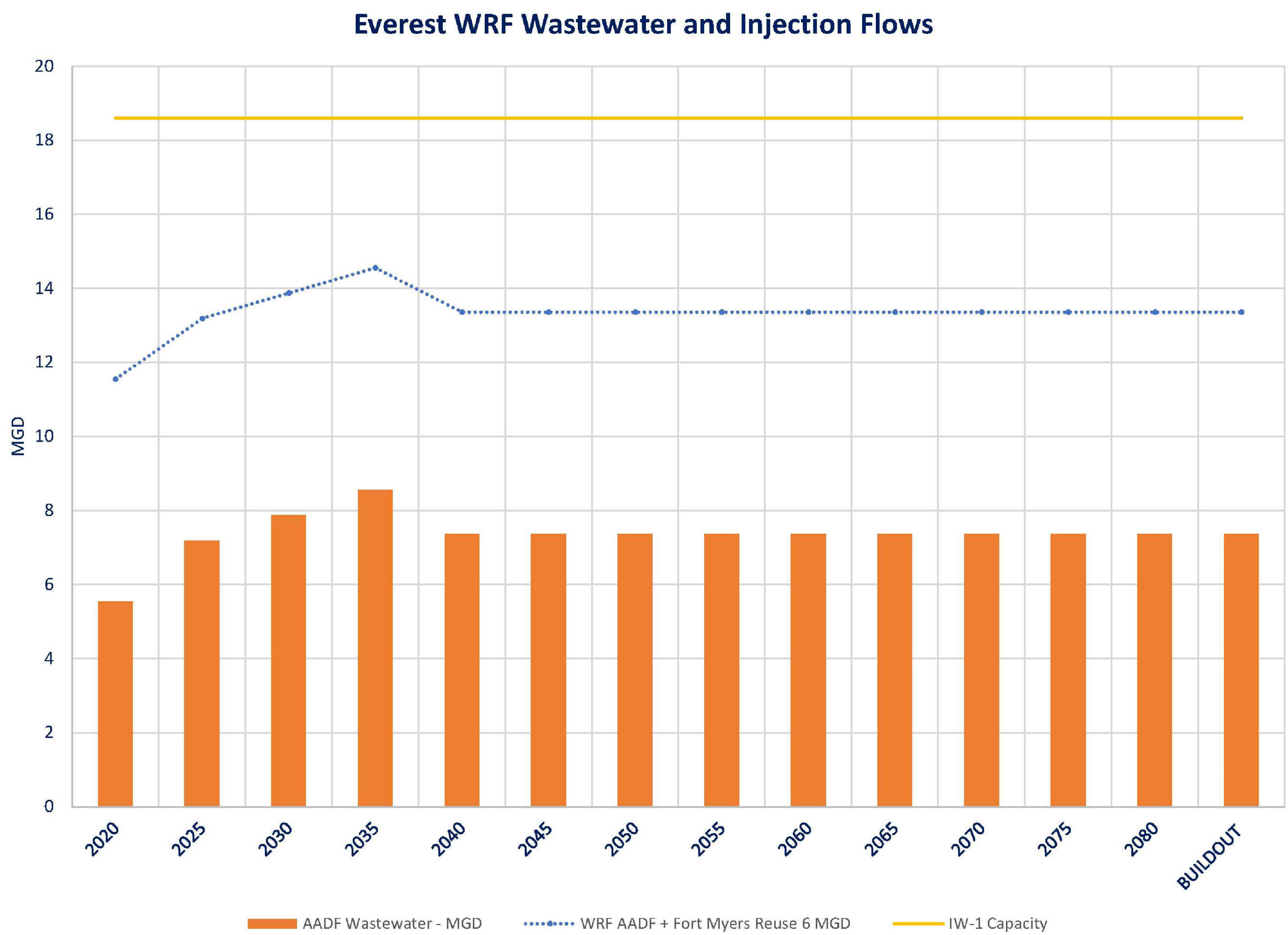
The injection well system at the Everest facility is used to dispose excess treated wastewater effluent. Primary disposal is provided through the City's irrigation reuse program. The injection well system at the Everest WRF consists of one Class 1 injection well (IW-1) and one dual-zone monitor well (DZMW-1). The well has a permitted maximum injection rate of 18.6 MGD. Long-term projections suggest that at buildout the AADF at the WRF will be 7.36 MGD, excluding any flex flows. The currently permitted injection capacity of the well is considered adequate to handle the backup disposal needs of the Everest WRF as shown in **Figure 4-19**.

4.5.3.2 Southwest WRF

The injection well system at the Southwest RO WTP is used for disposal of both RO concentrate and treated municipal effluent from the SW WRF facility. As noted previously in the Potable Water section of this report, there are 2 deep injection wells and a dual zone monitor well (DZMW) and a total injection capacity of 20 MGD is provided. At buildout, the anticipated total injectate flow for the expanded Southwest WRF and Southwest WTP is approximately 24 MGD (refer to Figure 3-20), which is slightly higher than the current injection capacity of 20 MGD at the facility. However, because the City is able to use all of its wastewater effluent daily for irrigation, use of the injection well system for backup wastewater effluent disposal is extremely rare. Construction of an additional injection well to cover this small projected deficit that would essentially never be realized is not recommended as there are other means to manage the available effluent.

4.5.3.3 Proposed North WRF

The existing injection well with a permitted capacity of 7.4 MGD at the North RO WTP can also be utilized for the proposed North WRF. At buildout, the maximum anticipated total injectate flow from both the North RO WTP and the North WRF which comes online in 2035, is 17.1 MGD, indicating that the facility will require approximately 10 MGD of additional injection capacity. A second injection well and associated DZMW is already planned for and is anticipated to be operational by 2027. The additional DZMW will be required since this second injection well is proposed to be constructed off the site of the North RO WTP/WRF. A separate injection well site is proposed due to the less than typical amount of confinement strata encountered during construction of IW-2 at the North RO WTP. Additional details regarding this injection well system are noted in the Potable Water System section of this report.



Water Science Associates	PROJECT NAME: CAPE CORAL MASTER PLAN	COA30437	NOT TO SCALE
	PROJECT NUMBER: 6220-02	NOVEMBER 2022	

Figure 4-19: Wastewater Flows and Existing Injection Well Capacity at the Everest WRF.

4.5.4 Collection and Conveyance System

Hydraulic modeling analyses of the collection and conveyance system was completed using the City's calibrated sewer hydraulic model to evaluate the existing collection system and identify hydraulic restrictions and future improvements needed throughout the system.

4.5.4.1 Collection and Conveyance System Analysis Under 5-Year UEP Implementation Schedule

North 1 Population and Flow Analysis

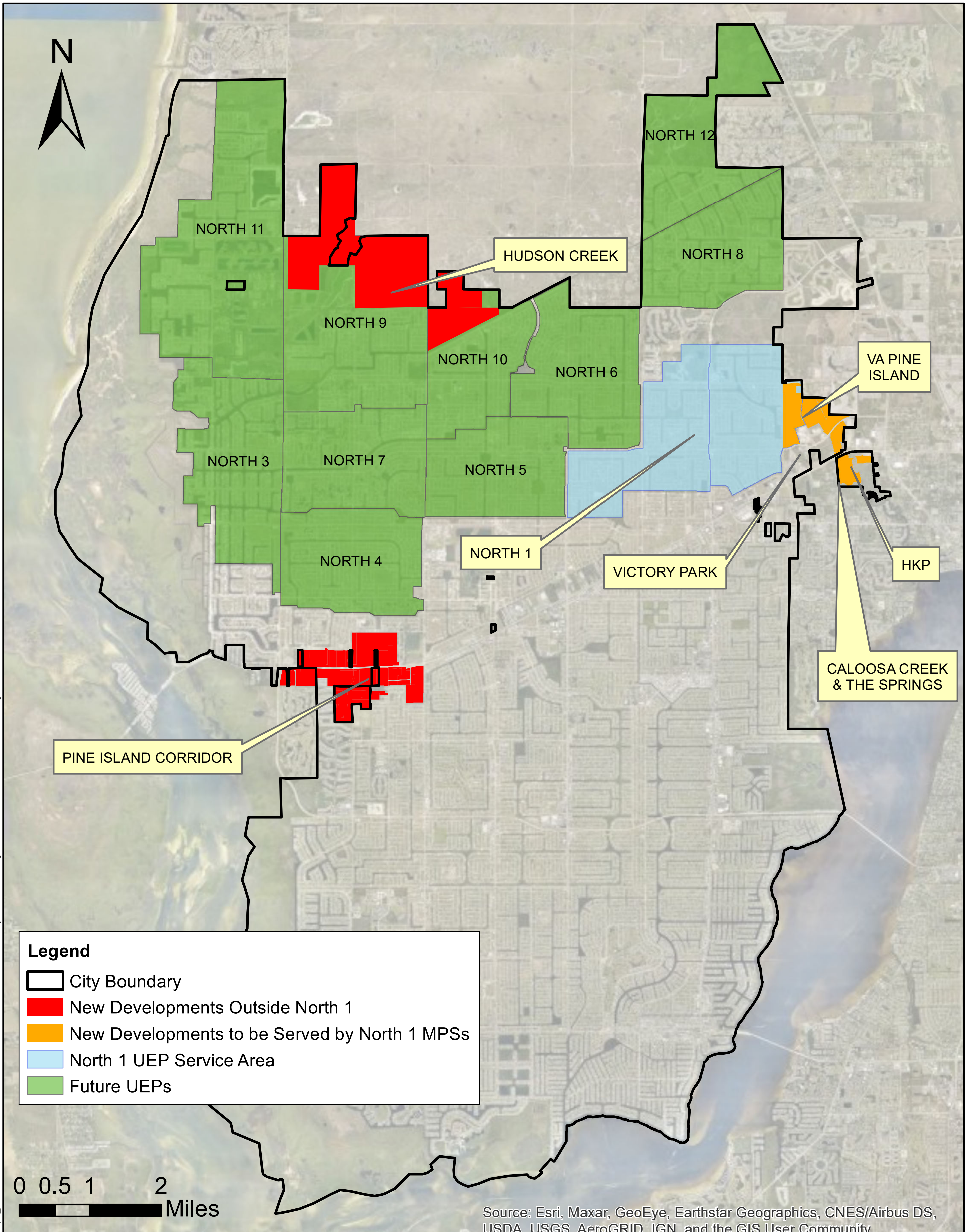
The City intends to extend service to the North 1 UEP area and its vicinity in the immediate future. Hydraulic modeling was completed as part of this plan to establish how this area will be integrated with the City's existing wastewater collection and conveyance system.

The North 1 hydraulic modeling efforts evaluate needed upgrades to the City's wastewater conveyance system to serve the North 1 UEP area over the 20-year planning horizon and buildout. The location and projected required capacity for proposed master pumping station facilities as well as the location and sizes of the proposed wastewater force mains for the North 1 UEP area are recommended based upon the model results.

In addition to flows from the delineated North 1 area, wastewater flows from the following developments adjacent to North 1 are planned to be conveyed to the North 1 UEP Master Pump Stations (MPS) as well. The additional developments listed below are shown in **Figure 4-20**.

- Victory Park
- VA Pine Island
- The Springs
- HKP
- Caloosa Creek
- Currently served area to the north and east of North 1 UEP

Permanent population estimates and projections are summarized in **Table 4-25** and wastewater flow projections are identified in **Tables 4-26** and **4-27**.



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User: kkaragoz
Source: City of Cape Coral
Date: May 2021

City of Cape Coral
Additional Developments Considered in the North 1 Analysis

FIGURE 4-20

Table 4-25: North 1 UEP Service Area Population Estimates

Fiscal Year	Population[1]	Population from Additional Developments[2]	Total
2020	7,605	6,600	14,205
2025	9,031	6,600	15,631
2030	10,497	6,600	17,097
2040	13,293	6,600	19,893
Buildout	19,830	6,600	26,430

1. *Source: Metro Forecasting Models*
2. *Source: City of Cape Coral*

Table 4-26: Additional Flow to North 1 UEP

Development	AADF (gpd)	AADF (gpm)
Victory Park	302,000	210
VA Pine Island*	236,000	164
The Springs	58,900	41
Caloosa Creek	32,500	23
HKP	45,000	31
Existing PS to the north and east of North 1**	738,000	513

** Flows for VA Pine Island were not provided therefore they are based on flow per acre for "The Springs" multiplied by a factor of 0.5. Source: City of Cape Coral.*
***This area was considered in the initial North 1 hydraulic modeling analysis to be included as a part of North 1 , however later it was removed.*

Table 4-27: North 1 Area Estimated Flows

Fiscal Year	Population	Estimated Flows* (AADF, gpm)	Estimated Flows* (PHF, fpm)
2020	7,605	995	2,984
2025**	9,031	1,554	4,151
2030	10,497	1,646	4,410
2040	13,293	1,824	4,904
Buildout	19,830	2,238	5,594

** AADF and PHF starting 2020 include additional flows from developments listed in Table 4-26 except for the existing PS to the north and east of North 1. Flows from the existing PS to the north and east of North 1 are accounted for in 2025.*
All developments assumed to be online at the same time as North 1 UEP.
***Flows are applicable for North 1 analysis under the accelerated timeline where it comes online in 2024.*

In addition to the proposed developments to be included in the North 1 area, there are two additional developments outside of the North 1 area that are in the permitting phase and will need to be accounted for in the analysis. These developments are also shown in **Figure 4-20**. Flows for these developments were provided by the City and are listed in **Table 4-28.**

Table 4-28: Flow from Developments Outside the North 1 UEP Area

Development	AADF (gpd)
Pine Island Corridor	574,000
Hudson Creek	627,000

Hydraulic modeling analysis was performed for the flows estimated for North 1 UEP and development areas to determine the impacts on the existing system. Simulations were performed for four planning horizons (2025, 2030, 2040, and Buildout) under PHF conditions.

Future UEP areas were added gradually based on constructability, proximity to existing and proposed facilities, and time they're expected to be online. **Table 4-29** below shows the flow projections performed for future UEP areas for AADF and PHF conditions. Simulation results show that both conveyance and treatment systems require expansions with the inclusion of UEPs.

Table 4-29: Buildout Population and Flows of Future UEP Areas

UEP Area	Population at Buildout	Estimated Flows (AADF, gpm)	Estimated Flows (PHF, gpm)
North 3	12,297	779	1,947
North 4	10,807	684	2,053
North 5	10,240	649	1,946
North 6	14,623	926	2,315
North 7	9,382	594	1,783
North 8	10,712	678	2,035
North 9[1]	17,682	1,120	2,800
North 10[1]	6,294	399	1,196
North 11	14,738	933	2,334
North 12	5,876	372	1,116

[1] North 9 and 10 populations include a total of 6,900 which correspond to proposed flows for Hudson Creek.

Description and Conclusions for North 1 Hydraulic Modeling Analysis Routing Under 5-Year UEP Implementation Schedule

Initial hydraulic modeling analyses for North 1 evaluated conditions when utility services were extended to one UEP area every five years (referred herein as the 5 Year UEP Implementation Schedule). Three alternatives were evaluated to determine the best available route to convey flows from the North 1 UEP area and additional developments to the City's existing WRFs. The alternatives were developed using existing infrastructure and minimizing the need for improvements outside of the project area while avoiding adverse impacts to the existing system. Simulations were performed for AADF and PHF conditions for the following planning horizons for 2025, 2030, 2040 and buildout. The general conclusions from this initial North 1 analysis identified that two MPSs are required to convey North 1 flows to the Everest and SW WRFs. New infrastructure outside of the North 1 service area includes a 30-in force main along Veterans Pkwy, which is critical to maintain acceptable pressure conditions, and a new North WRF to accommodate wastewater flows from the northern most UEP areas and in order to keep system pressures below 75 to 80 psi during peak hour flow conditions. The initial alternative routing options evaluated to convey flows from North 1 to the existing WRFs were revised as master planning efforts continued. The details and results of this initial North 1 modeling analysis are. provided in **Appendix C** for reference and an updated North 1 modeling analysis is provided later herein.

Future Collection/Conveyance System Analysis

The calibrated hydraulic model was used to estimate further impacts of growth within the existing service area as well as the addition of the UEP service areas on the collection systems. These simulations were completed based on the 5-year per UEP implementation schedule. The system was evaluated for the following scenarios:

- 2020 (Existing Conditions Scenario)
- 2025 (Short Term Scenario)
- 2030 (Mid-Term Scenario)
- 2040 (Long Term Scenario
- Buildout conditions

The hydraulic modeling analysis was performed using extended period simulations for the following conditions:

- Dry Weather Flow Conditions
- Average Daily Flow Conditions
- Wet Weather Flow Conditions

The hydraulic model was run for the indicated scenarios and the identified conditions and was analyzed for the following criteria:

- **Force mains:** The maximum velocity in the existing and proposed force mains is desired to be above 2 feet per second (fps) but below 8 fps as per the City's performance criteria.
- **Pump Station Wetwell:** The existing pump station wetwells may not flood but operate within the pump ON and OFF levels.
- **Existing Pump Stations:** The existing pump stations should have enough capacity and operate within the pump curve.
- **New Pump Station:** The new pump stations were analyzed to determine the pump station total dynamic head (THD) requirement.

The hydraulic analyses identified the system deficiencies for each planning scenario and proposed infrastructure upgrades to meet the City's performance criteria. It should be noted that the proposed infrastructure upgrades were sized to meet the buildout wet weather flows in the system. Also, the timing for infrastructure updates was based on the City's UEP schedule and the related population/flow projections. The timing proposed for the recommended infrastructure improvements can differ based on the City's changes to the UEP schedule and feasibility and constructability of the project.

Hydraulic Modeling Results and Findings

Hydraulic modeling analyses for different planning horizons and flow conditions were performed and the results and findings from the analyses are summarized below by planning scenario.

2025 Scenario

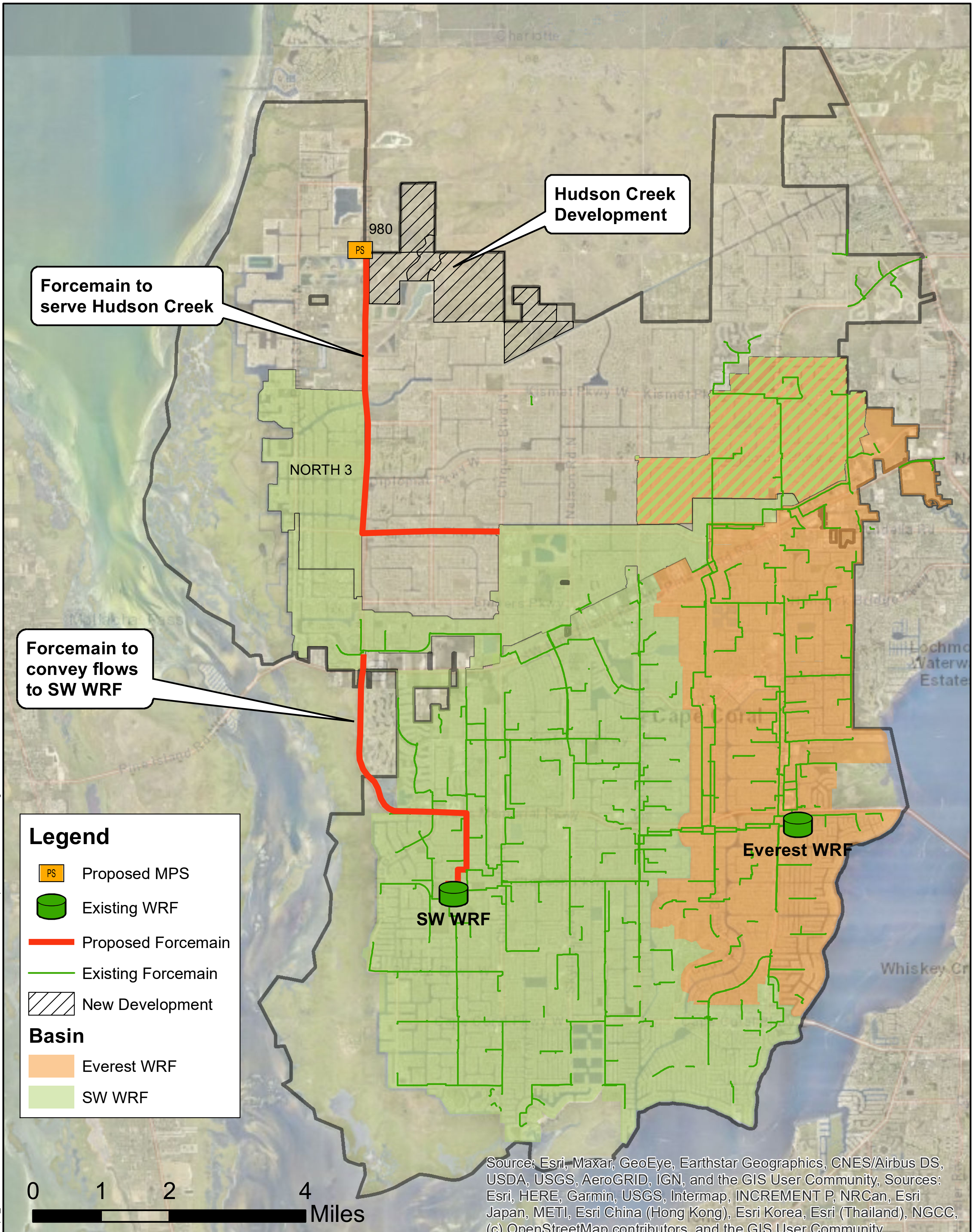
Analyses for the 2025 planning horizon were performed to evaluate the wastewater collection and conveyance system with the addition of wastewater service connections in the North 1 UEP and North 3 UEP and multiple planned unit developments. The City's service area for the 2025 scenario of the hydraulic modeling analysis included:

- Existing service area
- Hudson Creek
- Pine Island Corridor
- North 1 UEP, North 2 UEP, North 3 UEP (assuming North 1 and North 3 are online at the same time)

The hydraulic model was simulated for Dry Weather, Average Day, and Wet Weather flow conditions. **Figure 4-21** shows the service areas that were modeled in the 2025 scenario.

The hydraulic modeling analysis for the 2025 scenario indicated that the following upgrades are required to accommodate 2025 flows:

- North 1 and North 3 collection and conveyance mains, as well as two MPS per UEP.
- New transmission mains along Burnt Store Rd and Tropicana Parkway (33,500 LF) and Master Pump Station to be installed to serve Hudson Creek
- New 30-inch force main (22,000 LF) along Veterans Pkwy to be constructed to convey flows from the north of the service area to the SW WRF.
- Upgrade MPS 409 with higher head pumps.



User: kkaragoz Source: City of Cape Coral Date: May 2020	Cape Coral FLORIDA	**CITY OF CAPE CORAL PUBLIC UTILITIES MASTER PLAN 2025 Hydraulic Modeling Analysis**	AECOM	**FIGURE 4-21**

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2030 Scenario

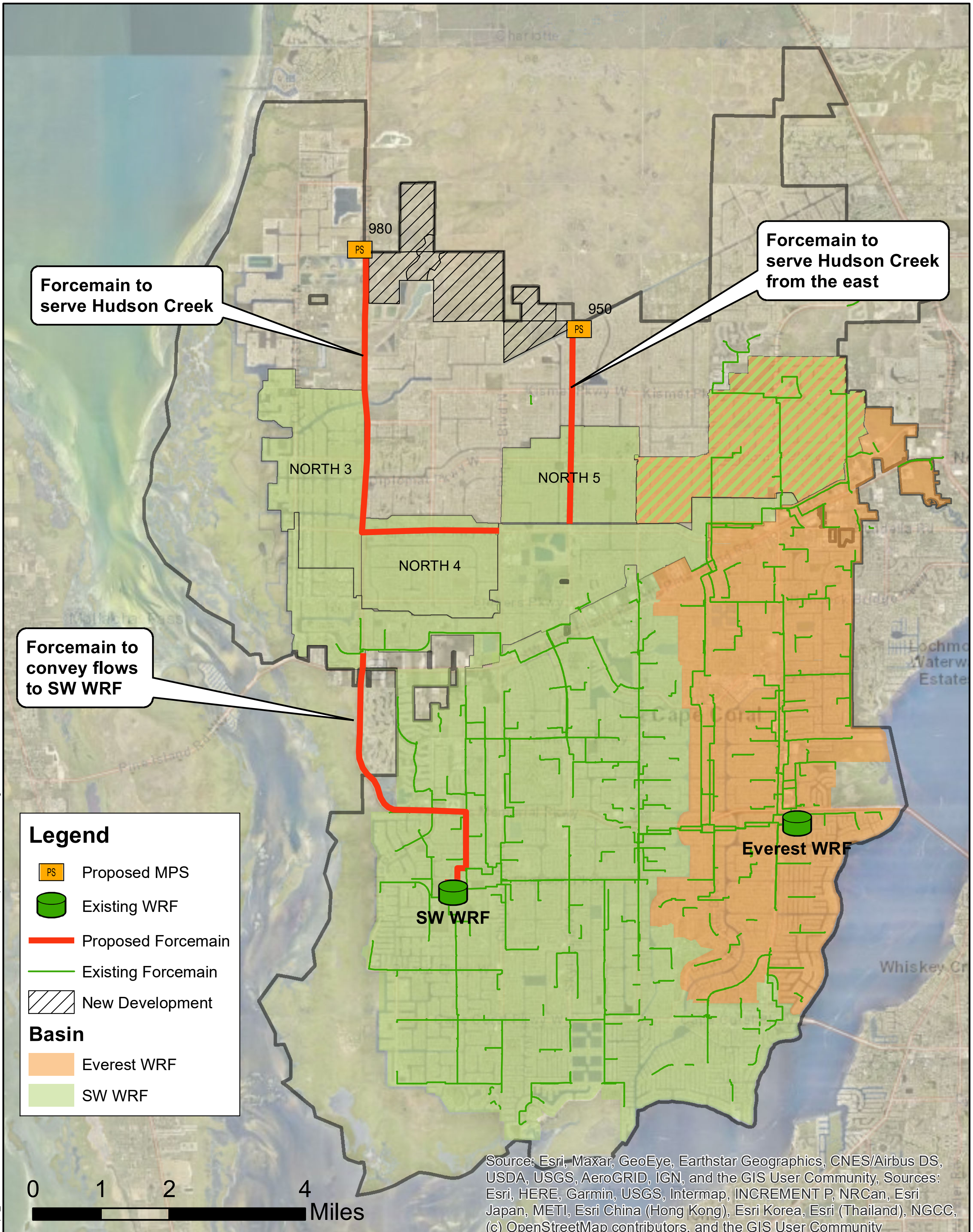
The City's service area for the 2030 scenario of the hydraulic modeling analysis included:

- Existing service area
- Hudson Creek (served from the East)
- North 4 UEP, North 5 UEP

The hydraulic model was simulated for Dry Weather, Average Day, and Wet Weather flow conditions. **Figure 4-22** shows the service areas that were modeled in the 2030 scenario.

The hydraulic modeling analysis for the 2030 scenario indicated that the following upgrades are required to accommodate 2030 flows:

- North 4 and North 5 collection and conveyance mains, as well as two MPS per UEP.
- New transmission main along Nelson Rd (15,800 LF) and Master Pump Station to be installed to serve Hudson Creek. The 20-inch portion of the transmission main can potentially be downsized to a 16-inch following a hydraulic evaluation to ensure pressures are maintained within acceptable levels.
- Upgrade MPS 405 with higher head pumps.



User: kkaragoz
Source: City of Cape Coral
Date: May 2020

Cape Coral FLORIDA

CITY OF CAPE CORAL
PUBLIC UTILITIES MASTER PLAN
2030 Hydraulic Modeling Analysis

AECOM

FIGURE 4-22

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2040 Scenario

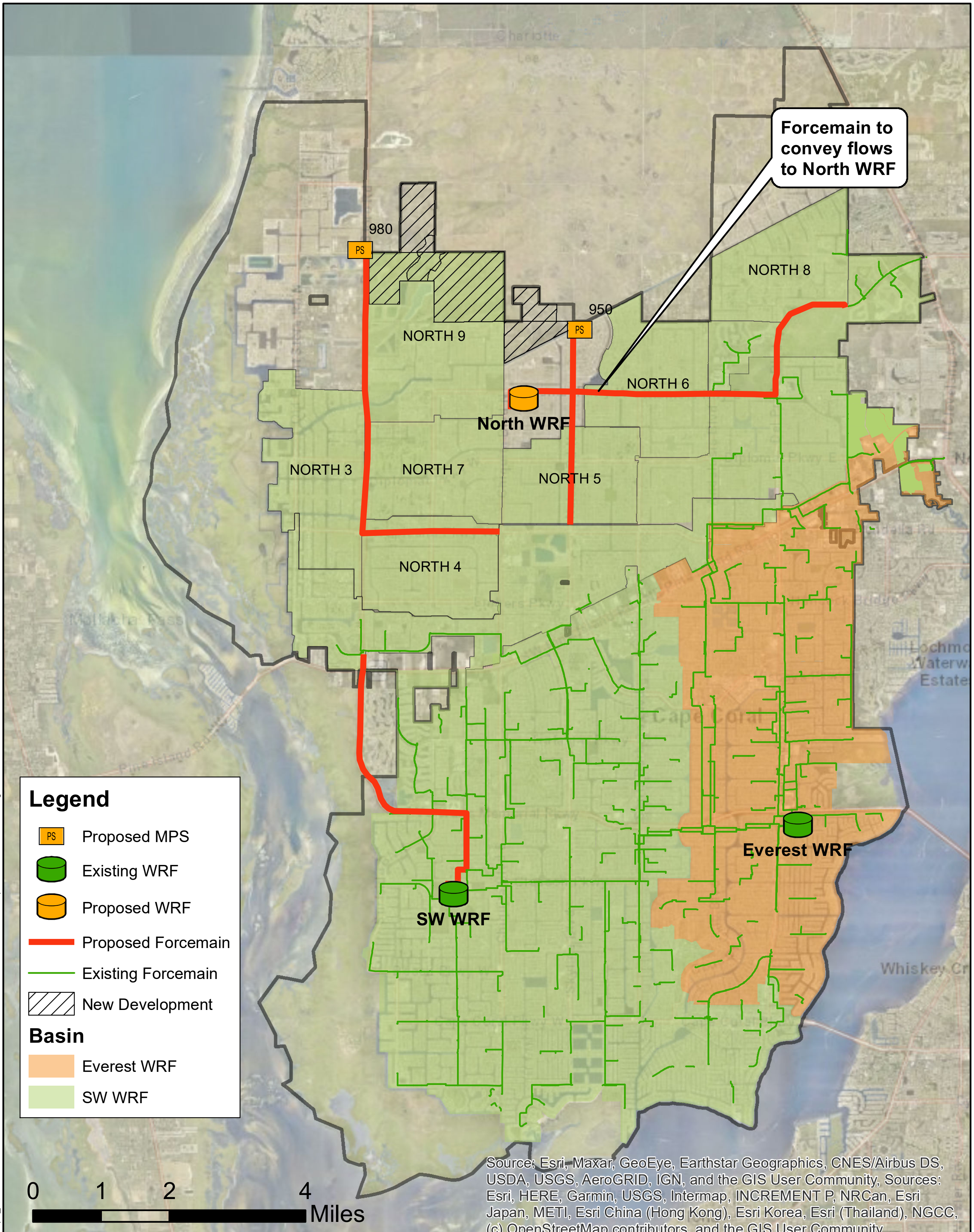
The City's service area for the 2040 scenario of the hydraulic modeling analysis included:

- Existing service area
- North 6 and 7 UEPs online in 2035
- Entrada (transmission and collection mains purchase in 2035)
- North 8 UEP, North 9 UEP
- Based on the gap analysis, the new North WRF facility was recommended to be online by 2035.

The hydraulic model was simulated for Dry Weather, Average Day, and Wet Weather flow conditions. **Figure 4-23** shows the service areas that were modeled in the 2040 scenario.

The hydraulic modeling analysis for the 2040 scenario indicated that the following upgrades are required to accommodate 2040 flows:

- North 6, North 7, North 8, and North 9 collection and conveyance mains and MPSs.
- New transmission main along Del Prado Blvd. (4,600 LF of 12" and 3,500 LF of 20") and Master Pump Station to be installed to serve Entrada
- New 36-inch force main (2,200 LF) and 42-in force main (500 LF) along Kismet Pkwy to be constructed to convey flows to the North WRF.
- Upgrade MPS 419, MPS 505, and MPS 539 with higher head pumps.



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User: kkaragoz
Source: City of Cape Coral
Date: May 2020

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PUBLIC UTILITIES MASTER PLAN
2040 Hydraulic Modeling Analysis

FIGURE 4-23

Buildout Scenario

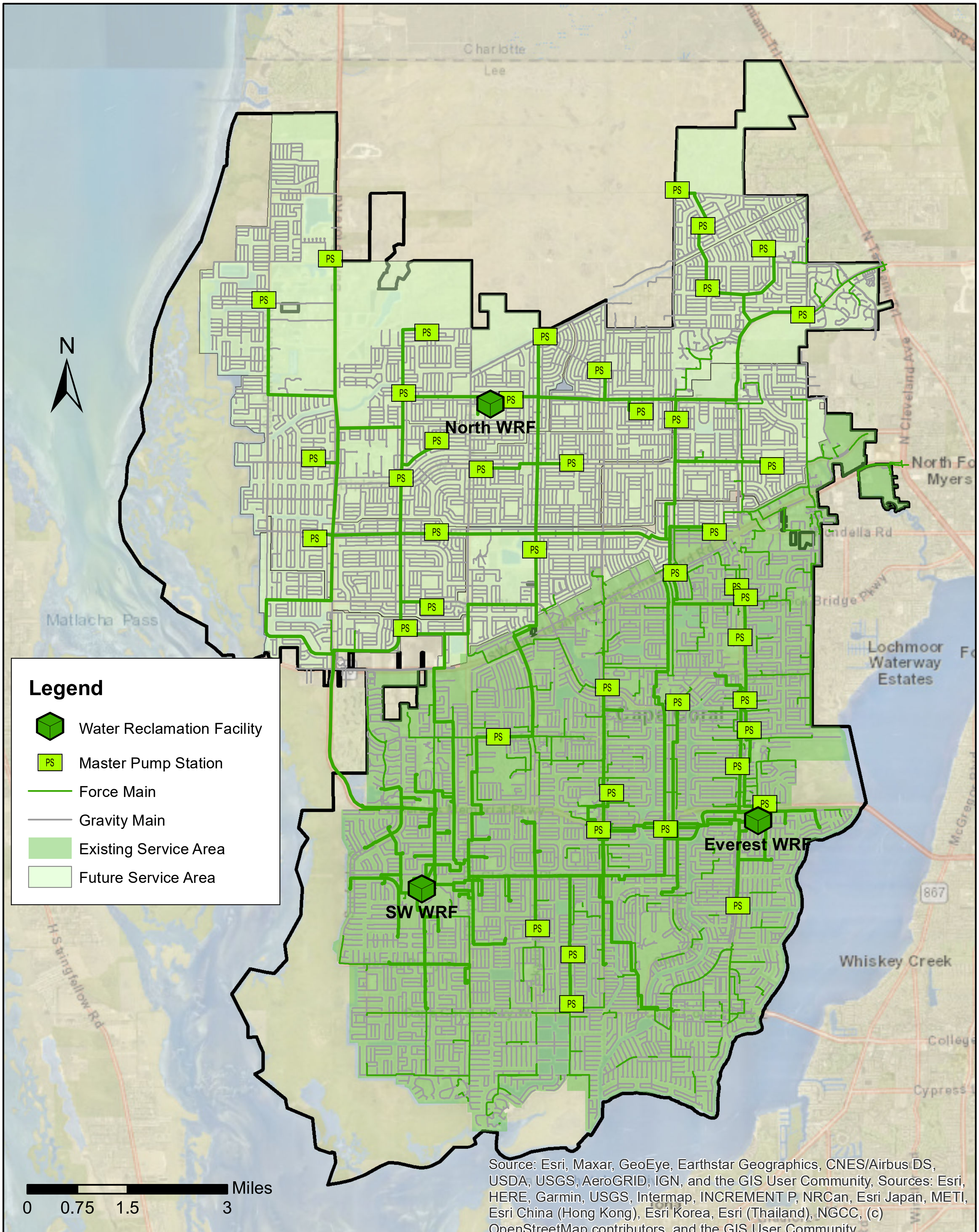
The City's service area for the Buildout scenario of the hydraulic modeling analysis included:

- Existing service area
- North 10 UEP, North 11 UEP, North 12 UEP

The hydraulic model was simulated for Dry Weather, Average Day, and Wet Weather flow conditions. **Figure 4-24** shows the service areas that were modeled in the Buildout scenario.

The hydraulic modeling analysis for the Buildout scenario indicated that the following upgrades are required to accommodate Buildout flows:

- North 10, North 11, and North 12 collection and conveyance mains and MPSs.
- Upgrade MPS 215, MPS 334, and MPS 371 with higher head pumps



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Date: June 2021

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Buildout Hydraulic Modeling Analysis

AECOM

Figure 4-24

4.5.4.2 Collection and Conveyance System Analysis Under an Accelerated UEP Implementation Schedule

After the initial North 1 modeling analysis was completed, the City decided to implement an accelerated UEP schedule. The accelerated UEP schedule considers North 1 coming online in 2024, North 3 in 2025, and two UEP areas coming online every 5 years thereafter. The additional analyses completed for this schedule include the impacts to proposed North 1 infrastructure if the North WRF and Veterans Parkway force main are delayed. The conclusions and recommendations for accelerated schedule analysis are discussed in this section.

Additional Modeling Scenarios

For this analysis under the accelerated UEP schedule, the additional modeling scenarios assume that the proposed Veterans Parkway force main is constructed in 2025 and wastewater flows south to both the Everest and Southwest WRFs. The results of this analysis are presented in **Table 4-30**.

The results in **Table 4-30** show that the new North WRF can be delayed to 2038 when UEP areas North 1, 3,4, 5, and 7 can come online and pump south to both existing WRFs. North 5 and 7 can be conveyed south only if the flex stations pump to the Everest WRF. North 6 must be delayed until a new North WRF is constructed. The new North WRF allows flow from North 1 to be conveyed northerly instead of southerly where there are constraints in the existing force main system at the Pine Island crossing and south of Pine Island Road.

Table 4-30: Results for Additional Scenarios

Scenario		Flows from MPS 720 (gpm)	Pressure (psi)	Flows from MPS 725 (gpm)	Pressure (psi)	Areas Served by existing WRF	Areas served by North WRF
1	2025	1,602 (PHF)	58	2,549 (PHF)	62	• Existing service area • North 1 (Flows to both WRF), North 2, North 3 • All developments E Pine Island • Pine Island Corridor • Hudson Creek Phase I (50%)	-
2		534 (ADF)	51	1,020 (ADF)	56		
3	2038 - North 1 routed south[1]	2,071 (PHF)	71	2,833 (PHF)	74	• Existing service area • North 1, North 2, North 3, North 4, North 5 • All developments E Pine Island • Pine Island Corridor • Hudson Creek	-
4	2038 - North 1 routed south[1]	2,071 (PHF)	72	2,833 (PHF)	75	• Existing service area • North 1, North 2, North 3, North 4, North 5, North 7 • All developments E Pine Island • Pine Island Corridor • Hudson Creek	-
5	2038 - North 1 to North WRF	2,071 (PHF)	22	2,833 (PHF)	39	• Existing service area • North 2, North 3, North 4 • Pine Island Corridor • Hudson Creek west	• North 1, North 5, North 6, North 7 • All developments E Pine Island • Hudson Creek east
6	Buildout - North 1 to North WRF	2,301 (PHF)	26	3,293 (PHF)	40	• Existing service area • Pine Island Corridor • North 2, North 3, North 4	• North 1, North 5, North 6, North 7, North 8, North 9, North 10, North 11, North 12 • Hudson Creek

1. New North WRF anticipated to be online during the period 2034-2038 based on gap analysis. Analysis considers the impact of delaying construction of the North WRF till 2038. 2040 population/flows used to represent worst-case scenario.
2. North 5 and 7 can be conveyed south only if all "flex" pump stations are conveyed to Everest WRF. North 6 is delayed as it triggers North WRF.

Alternative Routing for North 1

Another evaluation was carried out for North 1 to reflect the impact of North 1 coming online in 2024 prior to North 3 coming online. This evaluation included several routing alternatives, Alternatives 1-3 as shown in **Figures 4-25** through **4-27**, to convey North 1 flows without the proposed FM on Veterans Parkway and without overwhelming one treatment facility over the other. This analysis also determines whether the pumps selected for the North 1 MPS can handle the flows independent of the Veterans Parkway FM and North WRF coming online.

The pressure results shown below are for the pipelines downstream of the North 1 MPS. The pipe downstream of MPS 720 also carries flows from Coral Lakes, whereas the pipe downstream of MPS 725 only carries the flows from that MPS.

Alternative 1

In this alternative, shown in **Figure 4-25**, flows are conveyed south from North 1 to the Everest WRF. This alternative was selected for this evaluation as it represents a worst-case scenario of sending all North 1 flows to the Everest WRF without any split flows which would reduce pressures. When all North 1 flows are routed to Everest WRF, the overall average wastewater flows to the Everest and Southwest WRFs are 5.3 MGD and 7.1 MGD, respectively.

Table 4-31 summarizes the pressure results in the pipelines directly downstream of the North 1 MPSs, 720 and 725.

Table 4-31: Results for Alternative 1

MPS	Average Flow (gpm)	Average Pressure (psi)
720 (N1C)	444	35.1
725 (N1E)	650	36.0

Alternative 2

In this alternative, shown in **Figure 4-26**, flows are conveyed south from North 1 to the Southwest WRF. This alternative was selected for this evaluation as it represents a worst-case scenario of sending all North 1 flows to the SW WRF without any split flows which would reduce pressures. When all North 1 flows are routed to Southwest WRF, the overall average wastewater flows to the Everest and Southwest WRFs are 4.4 MGD and 8.0 MGD, respectively.

Table 4-32 summarizes the pressure results in the pipelines directly downstream of the North 1 MPS, 720 and 725.

Table 4-32: Results for Alternative 2

MPS	Average Flow (gpm)	Average Pressure (psi)
720 (N1C)	444	36.1
725 (N1E)	650	32.5

Alternative 3

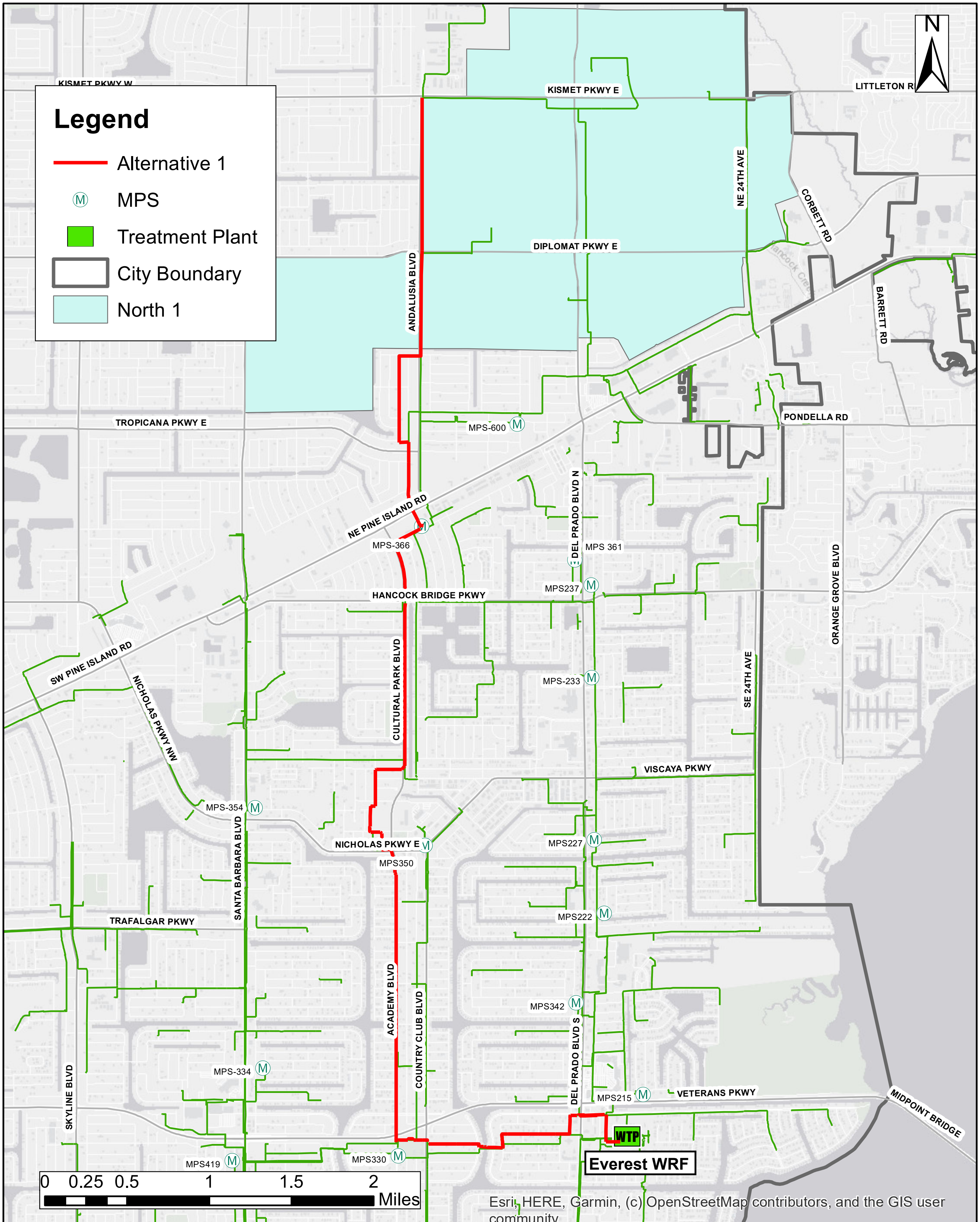
In this alternative, shown in **Figure 4-27**, flows from North 1 are split and conveyed and to both the Southwest WRF and Everest WRF; a combined alternative comprising of routes 1 and 2. When all North 1 flows are routed to Southwest WRF, the overall average wastewater flows to the Everest and Southwest WRFs are 4.8 MGD and 7.7 MGD, respectively. It should be noted that the flow split for North 1 is not fixed throughout the entire extended period simulation. North 1 flows are most evenly split for approximately the first 6 hours of the simulation as seen in **Figure 4-28**.

Table 4-33 summarizes the pressure results in the pipelines directly downstream of the North 1 MPS, 720 and 725.

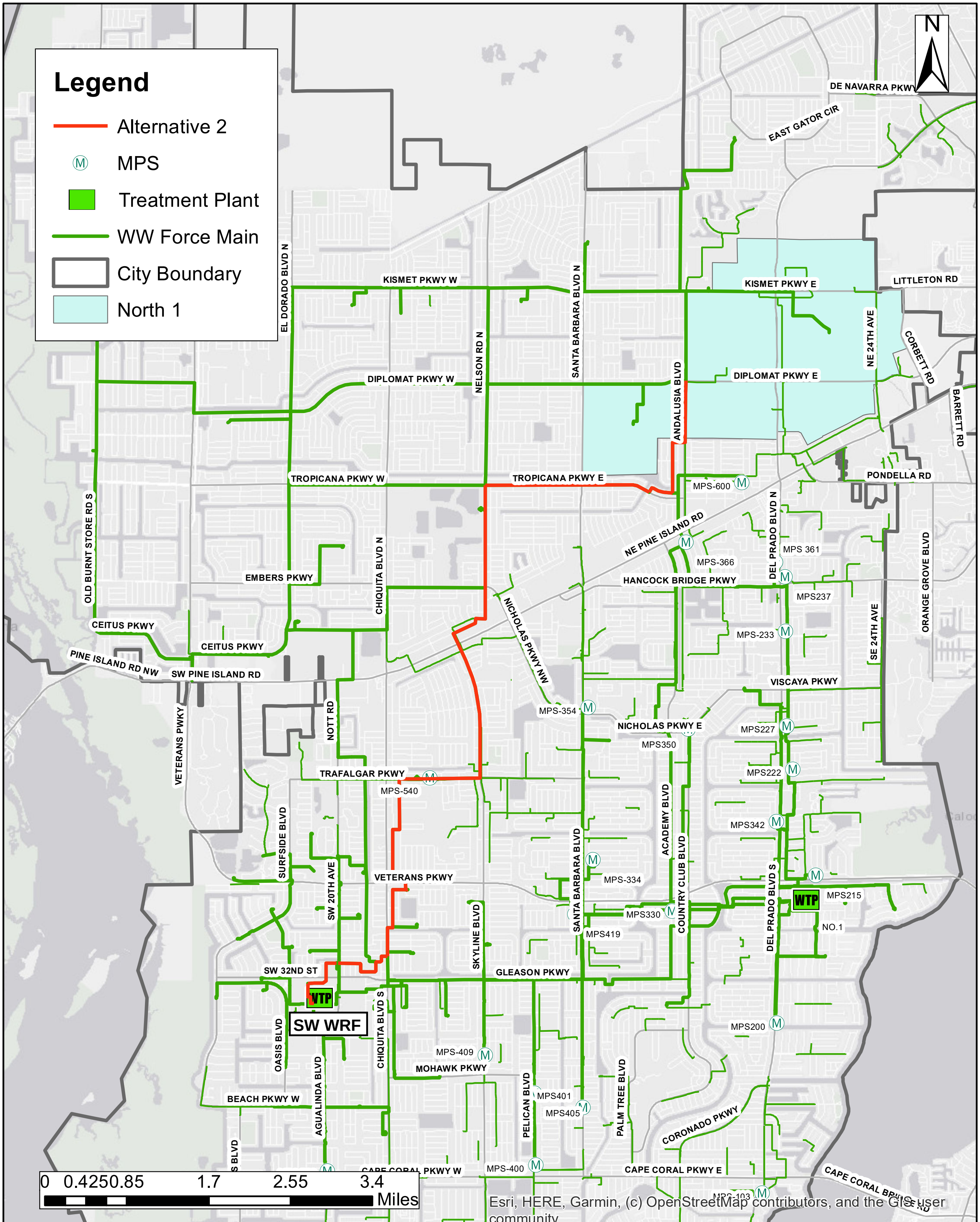
Table 4-33: Results for Alternative 3

MPS	Average Flow (gpm)	Average Pressure (psi)
720 (N1C)	444	21.1
725 (N1E)	650	22.1

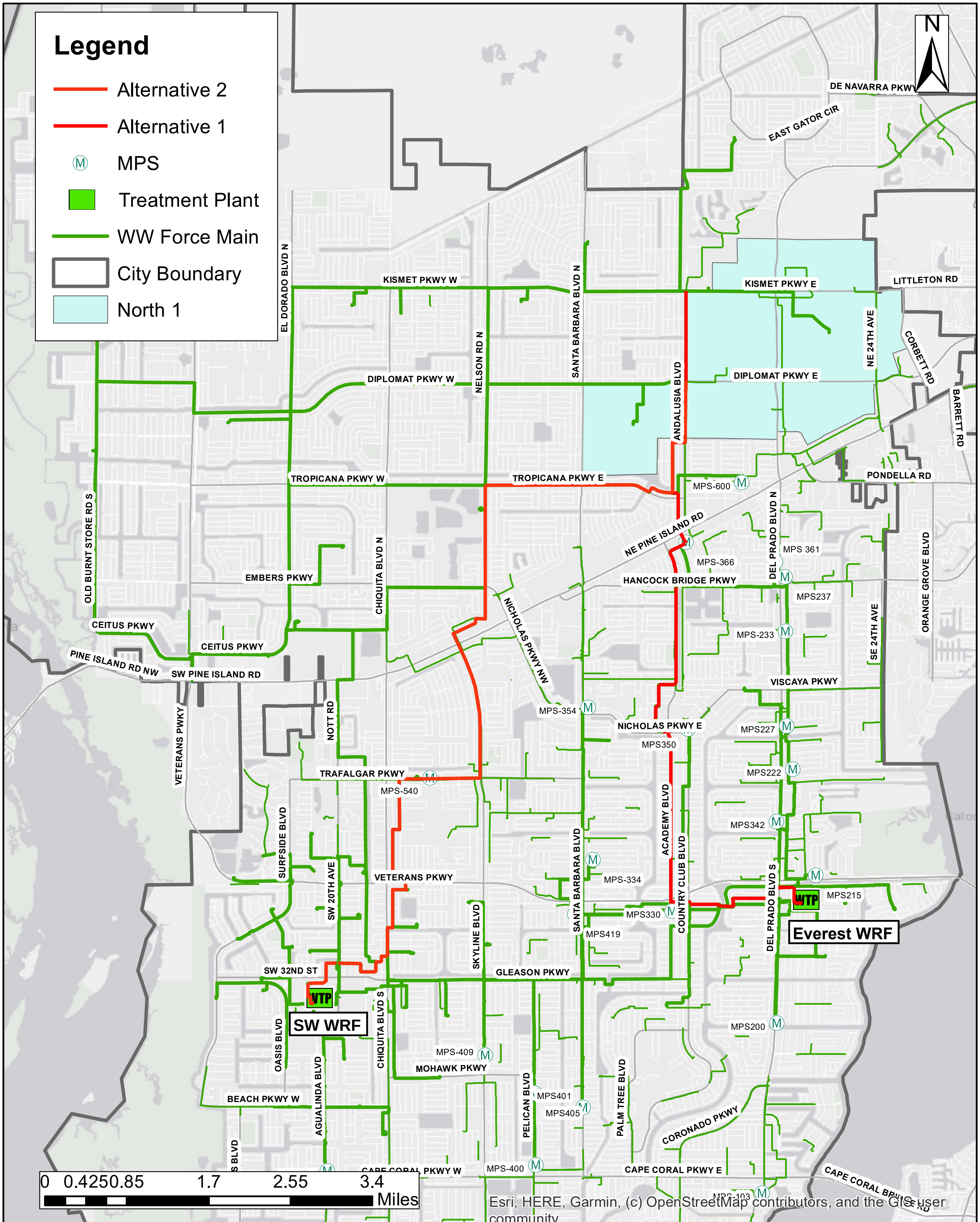
As previously mentioned, splitting flows is recommended to reduce pressures, which is evident in the results presented in **Table 4-33** for Alternative 3.



Date Created: August 2022	Cape Coral FLORIDA	City of Cape Coral Routing Alternative 1 for North 1	Figure 4-25



Date Created: August 2022	Cape Coral FLORIDA	**City of Cape Coral Routing Alternative 2 for North 1**	**Figure 4-26**

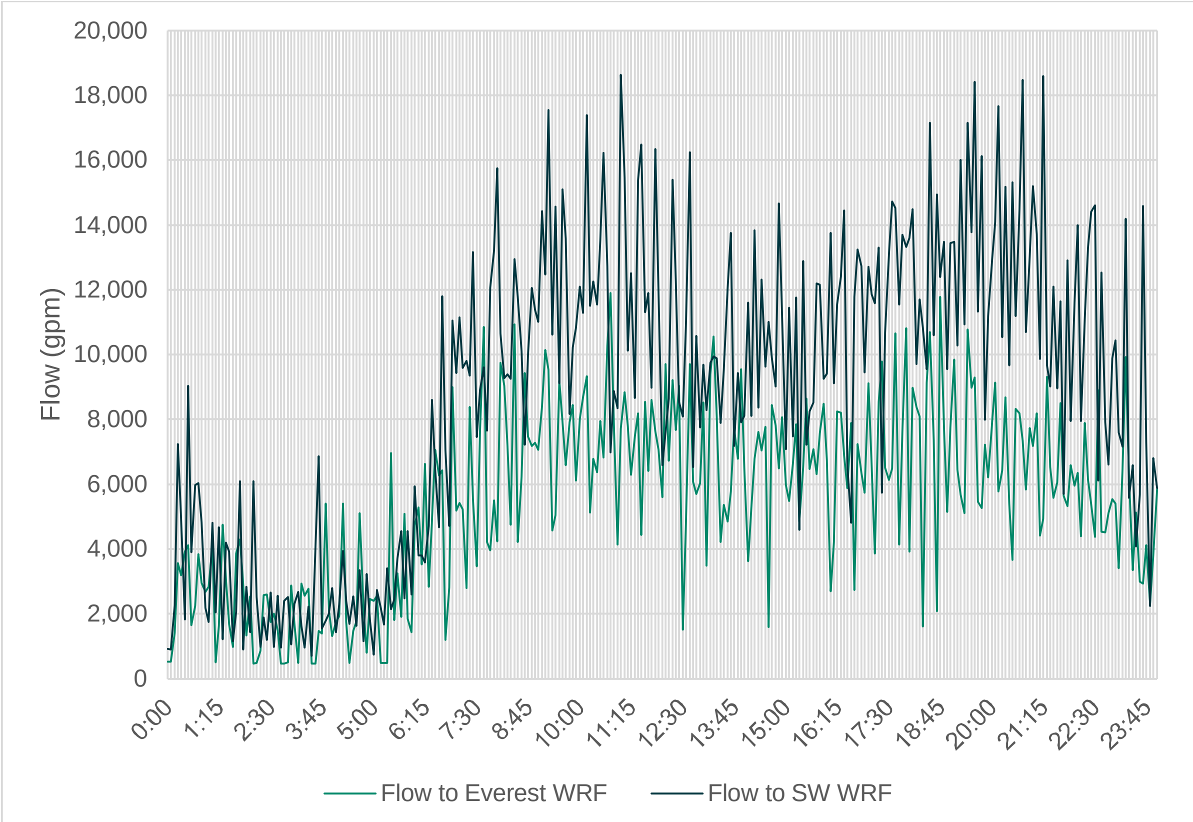


Date Created: August 2022

City of Cape Coral
Routing Alternative 3
for North 1

Figure 4-27

Figure 4-28: North 1 Split Flows Results from Extended Period Simulation



Conclusions and Recommendations for the Accelerated UEP Schedule Analysis

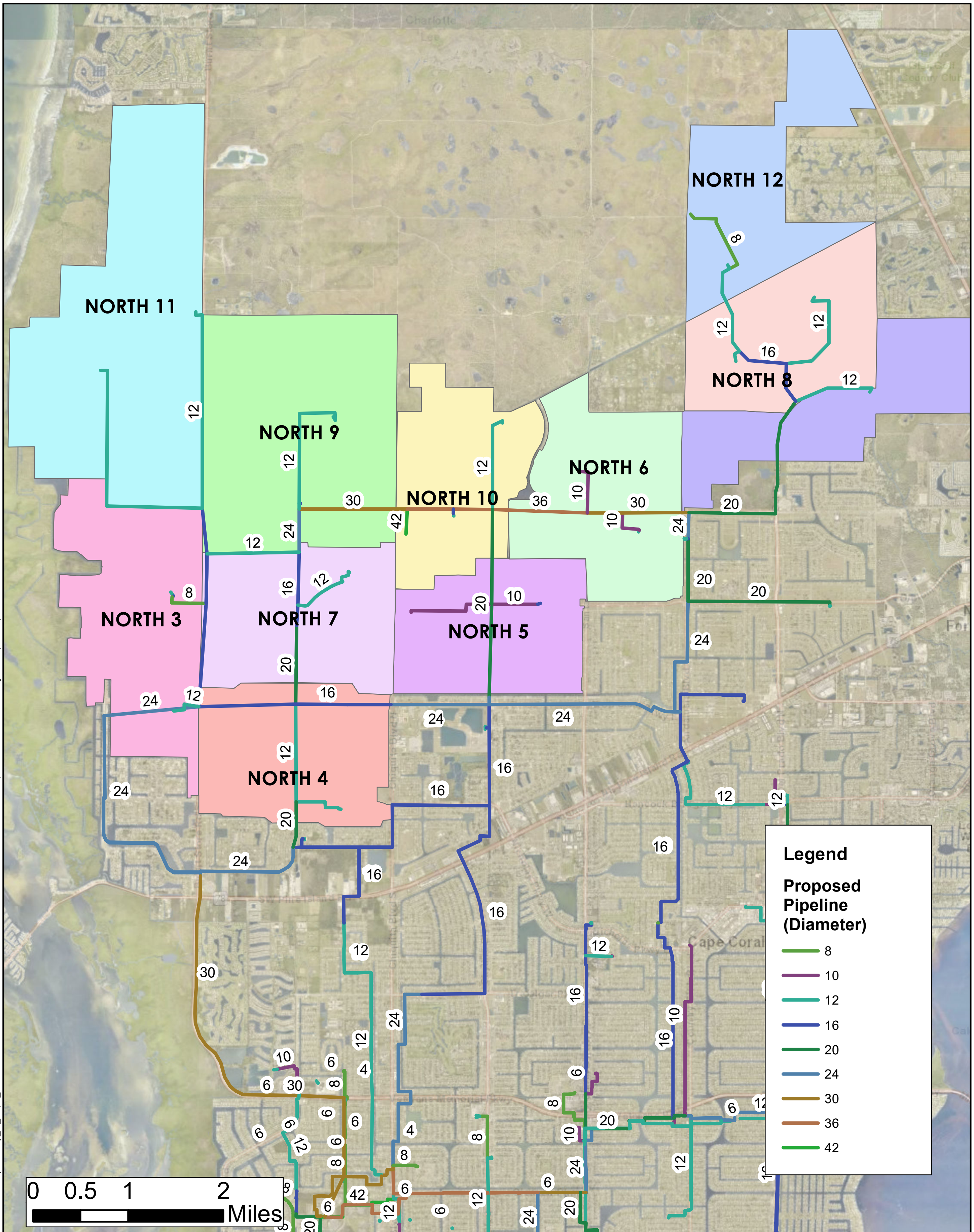
Based upon the hydraulic modeling results with an accelerated UEP schedule where North 1 is online in 2024 and North 3 is online in 2025, the Veterans Parkway FM can be delayed so it is constructed just prior to North 3 coming online. The new North WRF is recommended to be constructed by 2035 with the accelerated UEP schedule, however, it could be delayed to 2038 as long as North 6 is not online and the flex stations pump flow to Everest.

While the UEPs come online at different times, the collection and conveyance mains needed for each UEP were sized based on interim/buildout conditions and the ability to convey flows to the existing treatment plants until the new North WRF is online. Therefore, the lengths and diameters of the collection and conveyance main improvements for the UEPs are summarized in **Table 4-34**. These collection and conveyance mains, shown in **Figure 4-29**, are the improvements included in the growth-related cost summary in Chapter 7.

Table 4-34: Summary of Recommended UEP Wastewater Improvements

UEP	Diameter (inch)	Length (LF)	Year Online
North 1 Collection and Conveyance Mains	8”	398,890	2024
	10”	24,300	
	20”	11,600	
	24”	3,200	
North 3 Collection and Conveyance Mains	8”	243,257	2025
	12”	1,735	
	24”	5,290	
North 4 Collection and Conveyance Mains	8”	238,511	2030
	12”	8,289	
	20”	2,386	
North 5 Collection and Conveyance Mains	8”	240,698	
	10”	7,474	
North 6 Collection and Conveyance Mains	8”	289,605	2035
	10”	4,572	
	30”	5,633	
	36”	4,367	
North 7 Collection and Conveyance Mains	8”	210,395	
	12”	8,913	
	16”	4,044	
	20”	3,199	
North 8 Collection and Conveyance Mains	8”	243,472	2040
	12”	13,847	
	16”	5,112	
North 9 Collection and Conveyance Mains	8”	197,954	
	12”	7,631	
	24”	2,408	
	30”	5,996	
North 10 Collection and Conveyance Mains	8”	151,600	Buildout
	36”	5,626	
	48”	1,396	
North 11 Collection and Conveyance Mains	8”	260,703	
	12”	14,000	
North 12 Collection and Conveyance Mains	8”	77,463	
	8” (FM)	4,900	
	12”	2,100	

Note: 8-inch pipes are gravity pipes unless stated otherwise.



User: zhayek
Source: City of Cape Coral
Date: August 2022

CITY OF CAPE CORAL
Summary of UEP Wastewater Linear Improvements

Figure 4-29

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