FINAL

LEE COUNTY UTILITIES
WASTEWATER MASTER PLAN

Master Plan Report

B&V PROJECT NO. 199611
B&V FILE NO. 40.0500

PREPARED FOR

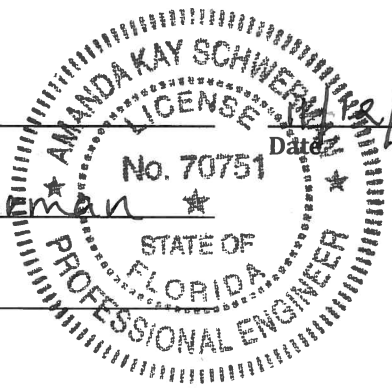
Lee County
Southwest Florida

Lee County Utilities

12 NOVEMBER 2019

BLACK & VEATCH

Professional Engineer:



Signature — Date: 12/12/19

Amanda Schweerman

Printed Name

70751

License No.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

List of Abbreviations

3MADF	Three Month Average Daily Flow
AADF	Annual Average Daily Flow
AWRF	Advanced Water Reclamation Facility
AWS	Alternative Water Supply
BSF	Base Sanitary Flow
BEBR	Bureau of Economic and Business Research
CAS	Cast Iron
CFM	City of Fort Myers
CIP	Capital Improvement Plan
CWSRF	Clean Water State Revolving Funds
DWL	Dry Weather Loadings
DI	Ductile Iron
FDEP	Florida Department of Environmental Protection
FMB	Fort Myers Beach
fps	Feet per second
gpcd	Gallons per Capita per Day
GIS	Geographic Information System
GWI	Groundwater Infiltration
gpd	Gallons per Day
gpm	Gallons per Minute
HOA	Home Owner's Association
I&I	Inflow and Infiltration
kgal	Thousand Gallons
LCU	Lee County Utilities
MMDF	Maximum Monthly Daily Flow
MNF	Minimum Nighttime Flow
MG	Million Gallons
MGD	Million Gallons per Day
MPO	Metropolitan Planning Organization
NOAA	National Oceanic and Atmospheric Administration
NCDC	National Climatic Data Center
mi	Mile
PE	Poly Ethelene
PF	Peaking Factor
PHF	Peak Hour Flow
PVC	Poly Vinyl Chloride
RDII	Rainfall Dependent Inflow and Infiltration
ROW	Right of Way
R&R	Repair & Rehabilitation
SCADA	Supervisory Controls and Data Acquisition
SDCs	System Development Charges
SFWMD	South Florida Water Management District
TAZ	Traffic Analysis Zone
TWC	Total Water Consumption
WIFIA	Water Infrastructure Finance and Innovation Act
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

1.0 Introduction

Lee County Utilities (LCU) is located in Southwest Florida. LCU owns and operates a large and complex wastewater collection, conveyance, and treatment system, which includes six distinct regional water reclamation facilities and covers a service area of approximately 180 square miles. The six plants are composed of five regional water reclamation facilities (WRF) and one advanced water reclamation facility (AWRF). In addition to the six LCU owned WRFs, LCU has an agreement in place to utilize half of the permitted capacity of the City of Fort Myers' (CFM) two wastewater treatment plants, CFM South and CFM Central. The Highpoint WRF was not included in this master plan due to its small size. The wastewater collection and conveyance system is comprised of laterals, gravity sewers, manholes, pump stations, and force mains that convey wastewater from the point of origin to the wastewater treatment facilities.

1.1 PURPOSE

LCU selected Black & Veatch Corporation to provide professional services to support the development of an updated Wastewater Master Plan, which focuses on the wastewater collection system and utilizing calibrated force main hydraulic models provided by LCU. The overall goals of LCU for the Wastewater Master Plan Update are to identify capital improvement projects to address future growth and expansion of the collection system and to investigate options to optimize the operations of the collection systems. This report summarizes the population and flow analysis, model development, capacity analysis and resulting capital improvement plan.

2.0 Existing System Summary

2.1 COLLECTION SYSTEM SERVICE AREAS

Each of the seven facilities, at which flow from the Lee County Utilities (LCU) collection system is treated, has a service area from where flows are collected. In the LCU system each of the facilities operate independently with minimal ability to transfer flow between service areas. **Table 2-1** summarizes the LCU service areas with the permitted capacity of the corresponding facility. The current LCU service area is shown on **Figure 2-2**.

Table 2-1 LCU Collection System Service Areas

SERVICE AREA	TREATMENT FACILITY	PERMITTED CAPACITY
Fiesta Village Service Area	Fiesta Village AWRF	5.0
Fort Myers Beach Service Area	Fort Myers Beach WRF	6.0
City of Fort Myers Central Service Area	City of Fort Myers Central WWTP	5.5 (LCU)[1]
City of Fort Myers South Service Area	City of Fort Myers South WWTP	6.0 (LCU)[1]
Gateway Service Area	Gateway WRF	3.0/6.0/9.0[2]
Pine Island Service Area	Pine Island WRF	0.338
Three Oaks Service Area	Three Oaks WRF	6.0/8.0[2]

1. LCU has an agreement to utilize half of the permitted capacity for the two City of Fort Myers Facilities
2. Gateway and Three Oaks have pre-planned expansions available (Current capacity/expansion/expansion)

2.2 WASTEWATER PUMPING STATIONS

Wastewater flow collected by the systems' gravity mains flow into collection points which typically consist of a wet well and pumps used for pressurizing wastewater flows. These collection points are called lift stations and pump stations. **Table 2-2** summarizes the number of pump and lift stations for each of the LCU service areas.

Table 2-2 Pump/Lift Stations per LCU Service Area

SERVICE AREA	NUMBER OF STATIONS
Fiesta Village Service Area	194
Fort Myers Beach Service Area	210
City of Fort Myers Central Service Area	133
City of Fort Myers South Service Area	201
Gateway Service Area	33
Pine Island Service Area	40
Three Oaks Service Area	282

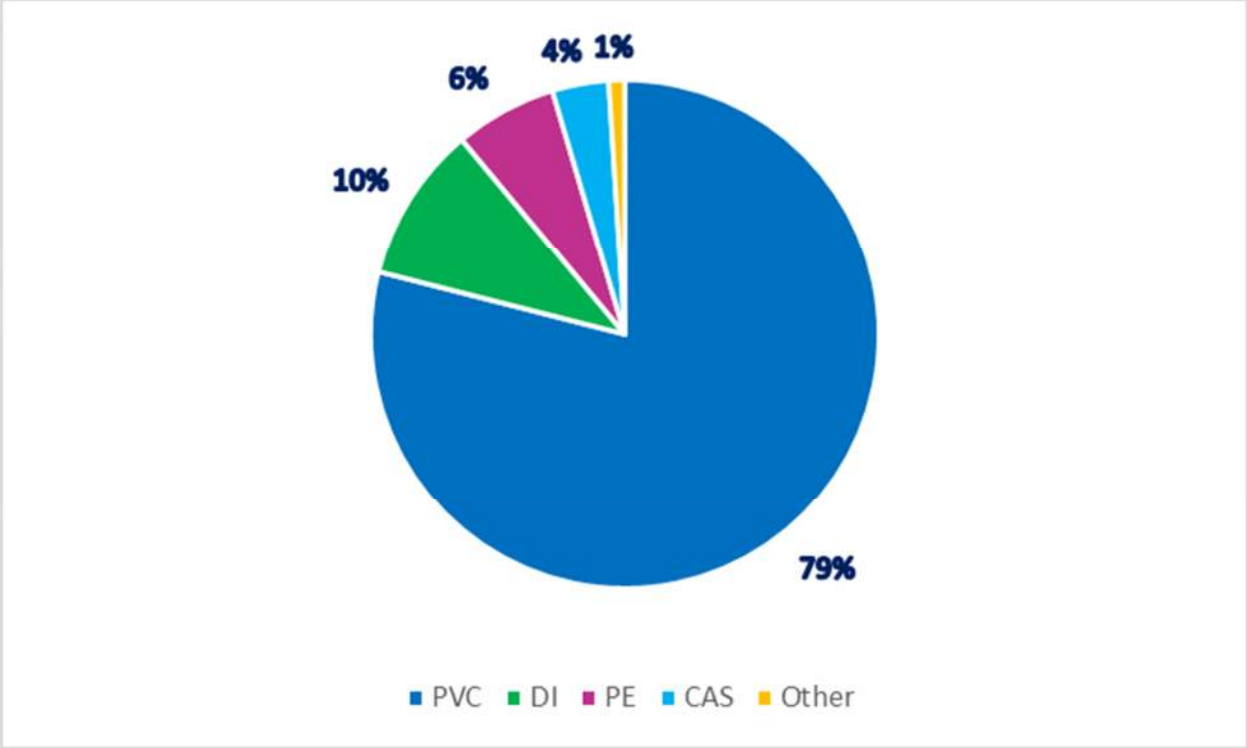
2.3 WASTEWATER FORCE MAINS

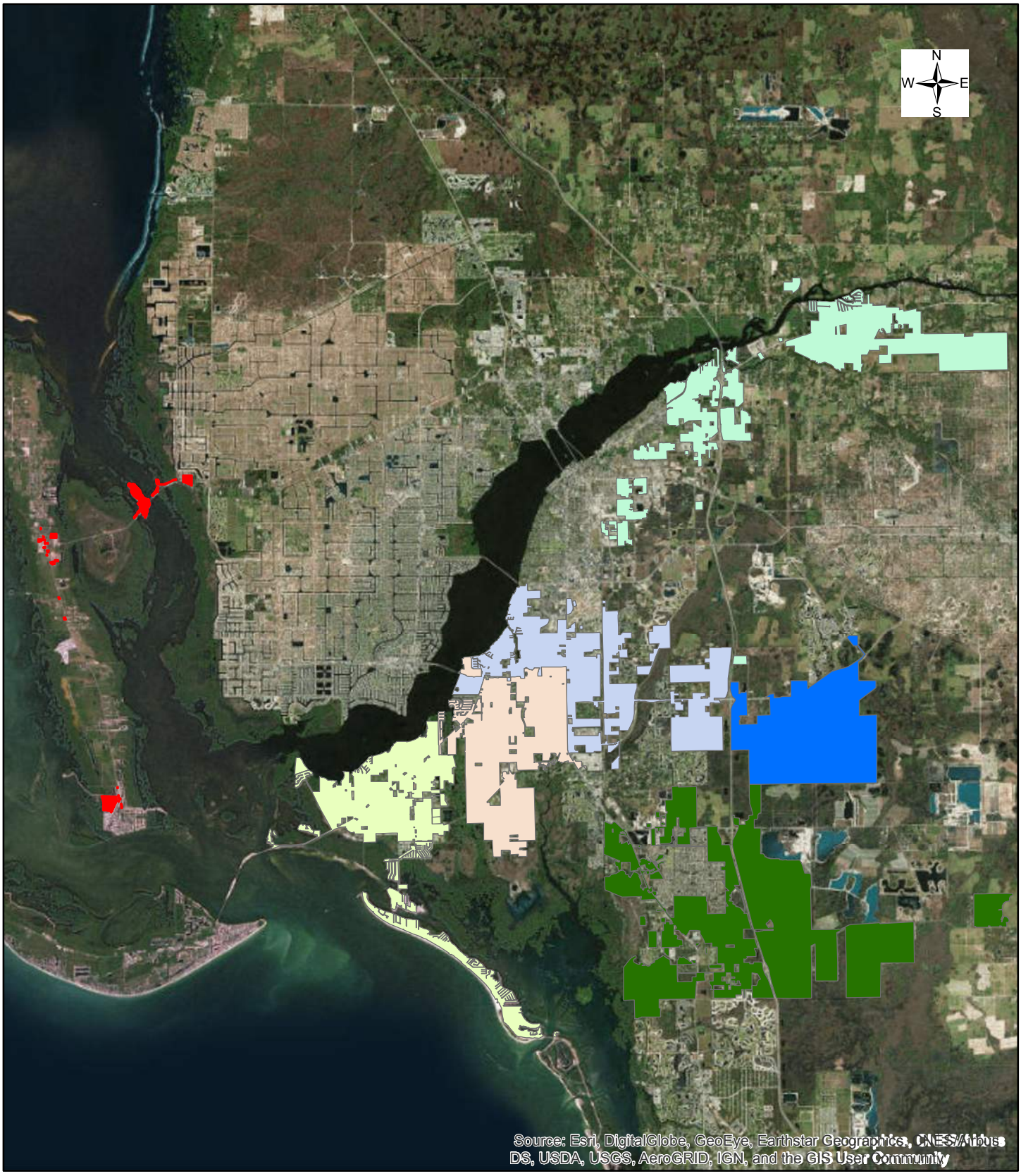
Wastewater flow is transmitted between stations and ultimately to each facility through the use of pressurized force mains. These force mains are typically made of polyvinyl chloride (PVC), poly Ethelene (PE), ductile iron (DI), or cast iron (CAS) and come in a wide variety of diameters. **Table 2-3** summarizes the length of force main for each LCU service area. **Figure 2-1** illustrates the distribution of force mains by material.

Table 2-3 Length of Force Main per Service Area

SERVICE AREA	LENGTH OF FORCE MAINS (FT)
Fiesta Village Service Area	265,830
Fort Myers Beach Service Area	336,411
City of Fort Myers Central Service Area	273,695
City of Fort Myers South Service Area	309,880
Gateway Service Area	85,709
Pine Island Service Area	91,078
Three Oaks Service Area	559,499

Figure 2-1 Force Main Distribution by Material





Lee County Southwest Florida

BLACK & VEATCH

- Fiesta Village
- Ft. Myers Beach
- Gateway
- Pine Island
- Three Oaks
- Ft. Myers Central (LCU Area)
- Ft. Myers South (LCU Area)

0 10,000 20,000
Feet

1:250,000

LEE COUNTY

Wastewater Master Plan

FIGURE 2-2

CURRENT SERVICE AREA

3.0 Population and Flow Projections

It is common practice to use historic population, historic flow trends and population projections to predict future collection flows. The current flow was used as a base scenario and the future flows were projected based on developed population predictions. The following sections document the analysis of Lee County Utilities' (LCU) historic and projected population and flow. Additional detail on population and flow projections is provided in **Appendix A – Population and Flow Projections Technical Memorandum**.

3.1 HISTORIC WASTEWATER FLOWS

3.1.1 Totalized Per Capita Flows

Totalized per capita flows are calculated by dividing the average influent flow by the total population within the collection system service area in this was they include all types of flows entering the system. The per capita flows are then used in conjunction with the population projections to forecast future flows. The annual average daily flow (AADF), three month average daily flow (3MADF), and maximum month daily flow (MMDF) per capita flows were calculated by dividing historical facility flows by the corresponding service area populations; the results are summarized in **Table 3-1**. During the analysis, if it was determined that the service area's MMDF occurred during the winter months (November – April), the functional population was used in the calculation to account for seasonal population fluctuations, while the permanent population was used all other times. The totalized per capita flow estimations include all flows entering the treatment facilities including base sanitary flows (BSF), groundwater infiltration (GWI) and rain derived inflow and infiltration (RDII). Though similar to GWI, RDII only accounts for additional infiltration caused by rain events.

3.1.2 Peaking Factors

The 8-year and 5-year average peaking factors for each service area were developed from the influent flow data, as shown in **Table 3-2**. These peaking factors will be used to assess future flows.

3.1.3 Dry Weather Flow Analysis

Unlike the totalized per capita flows referenced above, dry weather flows are only comprised of BSF and GWI and does not include RDII. The facility influent flow data for two selected dry weather periods were analyzed to determine the dry weather loadings (DWL) for each service area. DWL is further analyzed by evaluating the influent diurnal pattern for each service area. GWI is determined by identifying the minimum nighttime flow (MNF) and is a constant flow due to infiltration through defects in the gravity mains caused by the high groundwater tables in Florida. GWI is commonly represented by gpd/in-mile of gravity main in order to help normalize the amount of GWI flow moving through pipes accounting for various lengths and diameters. The difference between the DWL and GWI is the BSF which represents the potable flow returned to the collection system after being used and is a nonconstant flow with a diurnal pattern. With the additional breakdown of DWL a BSF per capita demand is calculated. **Table 3-3** shows the calculated GWI, BSF, BSF per capita flows and GWI gpd/in-mile for each service area.

Table 3-1 Totalized Per Capita Flow

SERVICE AREA	WASTEWATER INFLUENT FLOW (GPCD)	8-YEAR AVERAGE	5-YEAR AVERAGE
Fiesta Village Service Area	Average Annual Daily Flow (AADF)	125.94	126.81
	Three Month Average Daily Flow (3MADF)	135.60	132.47
	Max Month Daily Flow (MMDF)	140.90	137.90
Fort Myers Beach Service Area	Average Annual Daily Flow (AADF)	146.20	149.76
	Three Month Average Daily Flow (3MADF)	148.07	152.26
	Max Month Daily Flow (MMDF)	155.52	160.08
City of Fort Myers Central Service Area (LCU Flow)[1.]	Average Annual Daily Flow (AADF)	103.92	104.93
	Three Month Average Daily Flow (3MADF)	112.54	113.05
	Max Month Daily Flow (MMDF)	115.67	115.90
City of Fort Myers South Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	126.95	126.95
	Three Month Average Daily Flow (3MADF)	142.77	142.77
	Max Month Daily Flow (MMDF)	149.84	149.84
Gateway Service Area	Average Annual Daily Flow (AADF)	128.64	136.37
	Three Month Average Daily Flow (3MADF)	133.26	139.25
	Max Month Daily Flow (MMDF)	142.80	153.13
Pine Island Service Area	Average Annual Daily Flow (AADF)	153.26	156.14
	Three Month Average Daily Flow (3MADF)	153.74	160.30
	Max Month Daily Flow (MMDF)	160.73	168.09
Three Oaks Service Area	Average Annual Daily Flow (AADF)	122.77	119.46
	Three Month Average Daily Flow (3MADF)	124.85	122.20
	Max Month Daily Flow (MMDF)	128.59	126.11

1. Per capita flow for the City of fort Myers Central Plant were assumed to be equal to the per capita flows for the total LCU system.

Table 3-2 Peaking Factor

SERVICE AREA	PEAKING FACTOR	8-YEAR AVERAGE	5-YEAR AVERAGE
Fiesta Village Service Area	3MADF/ AADF	1.12	1.11
	MMDF / AADF	1.16	1.15
	PHF / AADF	1.26	1.25
Fort Myers Beach Service Area	3MADF/ AADF	1.19	1.20
	MMDF / AADF	1.25	1.26
	PHF / AADF	1.36	1.36
City of Fort Myers Central Service Area (LCU Flow)	3MADF/ AADF	1.38	1.38
	MMDF / AADF	1.44	1.44
	PHF / AADF	1.58	1.58
City of Fort Myers South Service Area (LCU Flow)	3MADF/ AADF	1.12	1.12
	MMDF / AADF	1.18	1.18
	PHF / AADF	1.27	1.27
Gateway Service Area	3MADF/ AADF	1.11	1.11
	MMDF / AADF	1.18	1.20
	PHF / AADF	1.34	1.36
Pine Island Service Area	3MADF/ AADF	1.18	1.21
	MMDF / AADF	1.24	1.27
	PHF / AADF	1.73	1.78
Three Oaks Service Area	3MADF/ AADF	1.10	1.09
	MMDF / AADF	1.14	1.13
	PHF / AADF	1.23	1.22

Table 3-3 GWI & BSF per Service Area for March 2017

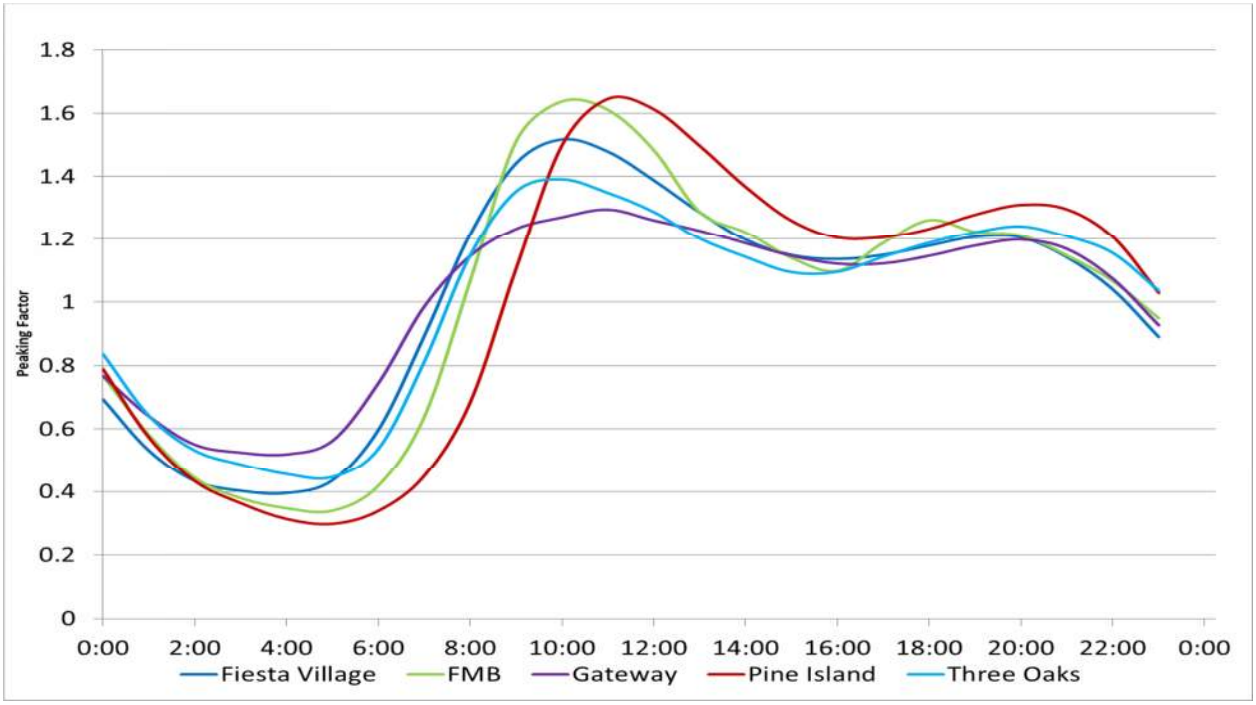
FACILTY	AVERAGE FLOW	BSF	GWI	GWI/ AVE. FLOW	BSF PER CAPITA	GWI PER IN-MILE
Units	(MGD)	(MGD)	(MGD)	(%)	(gpcd)	(gpd/in-mile)
Three Oaks	3.20	2.28	0.92	29%	74.5	0.098
Gateway	1.26	0.66	0.60	48%	59.1	1.216
Pine Island[3.]	0.10	0.07	0.02	24%	99.7	0.052
Fort Myers Beach	3.73	2.48	1.25	33%	90.5	0.170
Fiesta Village	3.16	1.97	1.20	38%	66.6	0.186
LS 4480[4.]	2.63	1.05	1.58	60%	49.4	0.244

1. Calculations were based on the hourly flow data provided for March 2017.
2. The GWI was based on the average GWI/(in-mile) for the gravity mains within each service area.
3. The Return Ratio for Pine Island was assumed to be 80% due to the quality of data available. A minimum night time flow calculation was used to determine the BSF.
4. LS 4480 flow data was used to estimate the flow to the City of Fort Myers Central plant. The calculated BSF and GWI will also be applied to the City of Fort Myers South plant. October 2018 flows were used due to data availability.

3.1.3.1 Diurnal Patterns

The BSF diurnal patterns (GWI was subtracted) were calculated using the hourly flow data from the Supervisory Controls and Data Acquisition (SCADA) system provided for March 2017 and January 2018. The average flow for each time step was divided by the overall average flow to calculate the peaking factor for each time step, thus normalizing to the average BSF during that period. The diurnal patterns for all treatment facilities are shown in **Figure 3-1**.

Figure 3-1 Diurnal Patterns for All Treatment Facilities



3.1.4 Wet Weather Flow Analysis

3.1.4.1 Rainfall Analysis

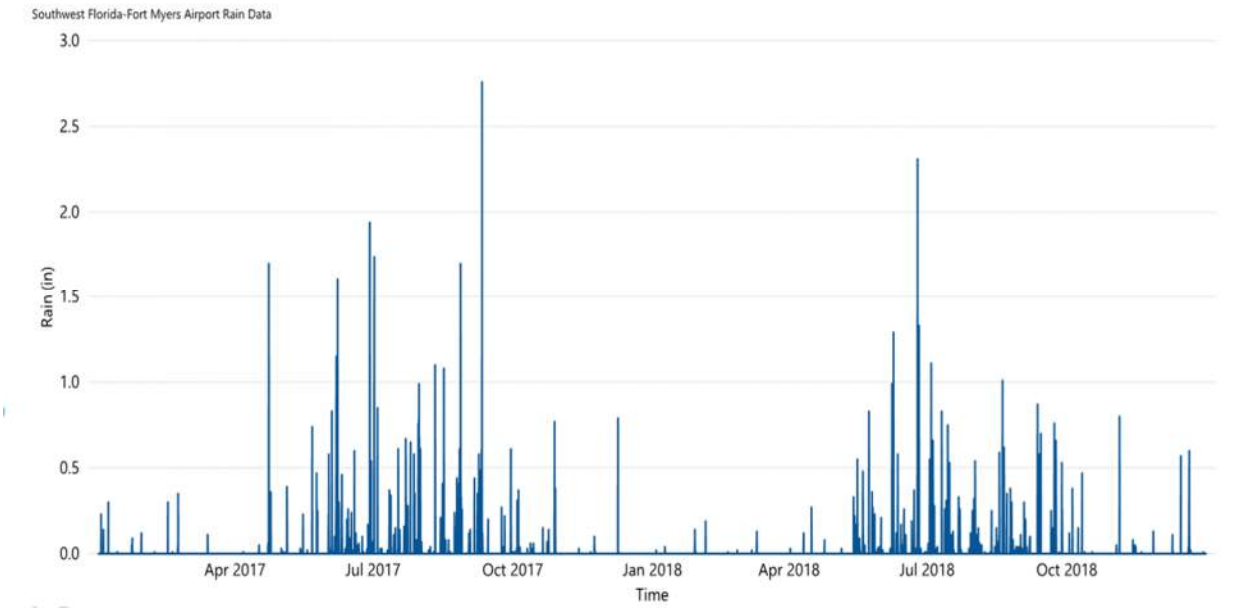
To further refine and understand the impact of growth and influence of inflow and infiltration (I&I), the influent flows of the treatment facilities were further investigated during dry and wet weather. As such, data from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) was analyzed for the rain gauge located at the Southwest Florida-Fort Myers Airport. The historic records showed typical Florida weather patterns from January 2017 through December 2018, as shown in **Figure 3-2.** The dry season for Lee County occurs between November and April, and the wet season occurs between May and October. Historical periods representative of dry and wet weather conditions were identified and selected for further flow analysis.

Dry Weather Periods: There was little to no rainfall during both March 2017 and January 2018. Therefore, these time periods were selected as the dry weather analysis timeframe.

Wet Weather Periods: Three historic significant storm events were identified to assess the wet weather impacts on LCU's collections system: June 5-8, 2017; August 27-28, 2017 and June 23-26, 2018.

The criteria used to select the wet weather periods include: 1) high volume and 2) length of continuous rainfall. It should be noted that rainfall that occurred within twelve hours was classified as the same event. This caused some back-to-back storm events to be grouped together as a larger event.

Figure 3-2 Rain Data 2017-2018 at Southwest Florida-Fort Myers Airport



3.1.4.2 Wet Weather Impacts

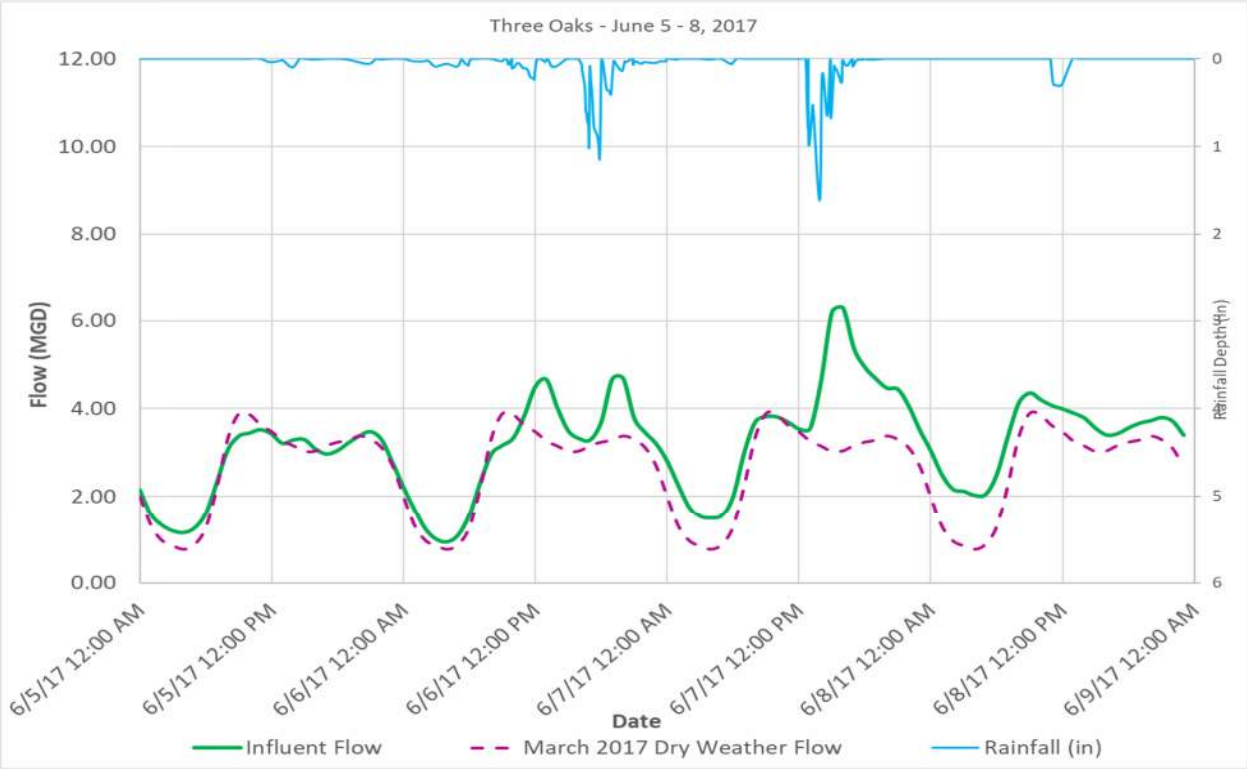
Increased flows observed in the sewer system during periods of rainfall are caused by RDII, which occurs when unintended groundwater or storm water enters the collection system. Inflow is the direct connection of storm water to the sewer collection system through sources such as manholes, cleanout lids, roof downspouts, and catch basins; whereas infiltration is characterized by defective pipes and manholes allowing groundwater to infiltrate into the collection system.

In a sanitary system, the RDII is driven by a myriad of factors including:

- Age and condition of the system
- Construction practices at the time of installation
- Prevalence of direct (illicit) stormwater connections to the sanitary system
- Maintenance of the system
- Antecedent moisture conditions (the saturation of the ground around the sewers)
- Groundwater elevation

The impacts of wet weather storm events can be viewed when comparing the normal flow patterns during dry weather with the flow patterns during a storm event. Wet Weather and rainfall events are shown to have an impact on the influent flows to each of the treatment facilities, however, several of the collection system peak flows are experienced during the dry season when LCU's seasonal residents and visitors arrive, and the functional population is highest. This was considered when the peaking factors were selected during the system analysis phase of the Master Plan. **Figure 3-3** illustrates the impacts of a wet weather event at Three Oaks WRF.

Figure 3-3 Wet Weather Impact at Three Oaks WRF 6/5/17-6/8/17



Prior to the rain event depicted by the blue line at the top of the graph, the influent flow (green line) closely matches the average dry weather flow (magenta line). Influent peaks are observed after the rain events as well as a higher influent flow continuing after the events had concluded. This show that the Three Oaks WRF is suffering from I&I caused flow increases. I&I typically increases over time due to aging infrastructure and should be monitored to prevent unnecessary capital expenses implemented to control larger flows. More detailed wet weather analyses were conducted on each of the service areas and are located in **Appendix A – Population and Flow Projection Technical Memorandum**.

3.2 SERVICE AREA POPULATION PROJECTIONS

The future LCU population projections were gathered from the Bureau of Economic and Business Research (BEBR) medium population projection and 2040 Traffic Area Zone (TAZ) data. The spatial allocation of population for LCU provided by the TAZ data was analyzed in conjunction with the LCU's future service areas using ESRI's ArcGIS. The LCU future service areas anticipate both expansion and "fill-in" or increased density within the existing service areas, from new development, the transfer of Home Owner's Association (HOA) wastewater treatment systems, and on-site septic replacement.

By performing a spatial analysis similar to what was used to determine historic population, the 2040 TAZ shapefile data was used to determine the projected population per service area within LCU. As with the population estimates, the BEBR population projection for LCU was used at the controlling population and the 2040 TAZ projections were globally adjusted to match the BEBR total population. A linear interpolation was then used between the 2040 and 2016 population

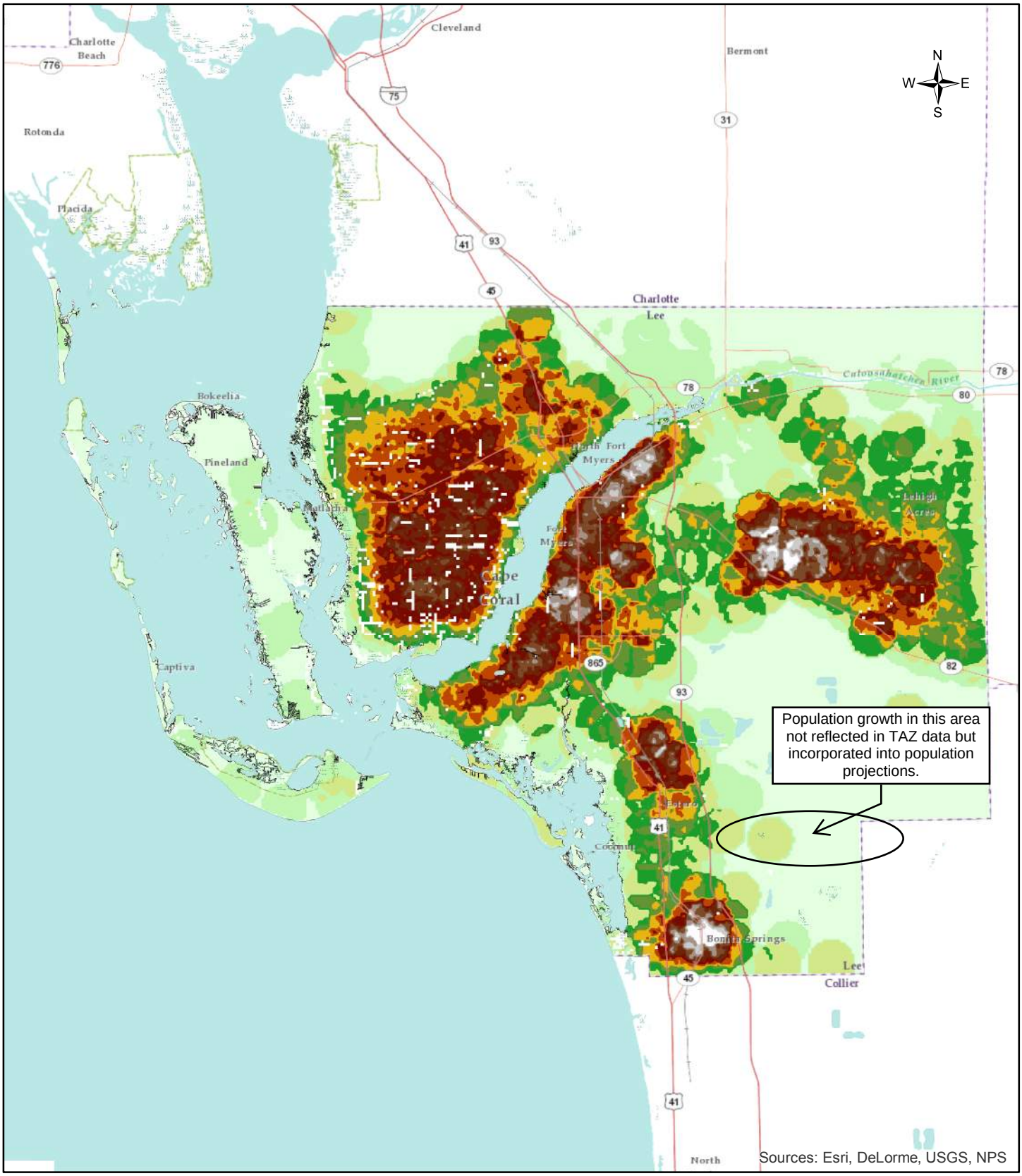
distribution to estimate the population per service area for the planning years between 2016 and 2040 as shown in **Table 3-4**. These assumptions and the final population totals were provided to the Lee County Planning Department and have been approved by the Department.

The Future LCU Service areas and distributed total population projections are shown in **Figure 3-4**. **Figure 3-5** illustrates the population growth between 2016 and 2040.

Table 3-4 Future Population Projections

SERVICE AREA	YEAR					
	Population	2020	2025	2030	2035	2040
Lee County Population	BEBR Population	749,600	826,900	891,200	951,500	1,007,100
Fiesta Village Service Area	BEBR Population[1]	27,310	30,149	32,988	35,827	38,665
	Seasonal Population	4,916	5,427	5,938	6,449	6,960
	Functional Population	32,226	35,576	38,926	42,275	45,625
Fort Myers Beach Service Area	BEBR Population[1]	25,422	28,159	30,895	33,632	36,369
	Seasonal Population	4,576	5,069	5,561	6,054	6,546
	Functional Population	29,998	33,227	36,457	39,686	42,916
Fort Myers Central Service Area (LCU Flow)	BEBR Population[1]	20,570	24,648	28,726	32,804	36,882
	Seasonal Population	3,703	4,437	5,171	5,905	6,639
	Functional Population	24,272	29,084	33,897	38,709	43,521
Fort Myers South Service Area (LCU Flow)	BEBR Population[1]	33,965	40,604	47,243	53,882	60,521
	Seasonal Population	6,114	7,309	8,504	9,699	10,894
	Functional Population	40,078	47,912	55,746	63,580	71,414
Gateway Service Area	BEBR Population[1]	9,957	10,636	11,315	11,994	12,673
	Seasonal Population	1,792	1,914	2,037	2,159	2,281
	Functional Population	11,749	12,551	13,352	14,153	14,954
Pine Island Service Area	BEBR Population[1]	2,236	4,041	5,846	7,650	9,455
	Seasonal Population	403	727	1,052	1,377	1,702
	Functional Population	2,639	4,768	6,898	9,027	11,157
Three Oaks Service Area	Lee County Utilities[2]	31,332	41,427	51,522	61,617	74,424
	Seasonal Population	5,640	7,457	9,274	11,091	13,396
	Functional Population	36,972	48,884	60,796	72,708	87,820
Total LCU Service Areas	**Permanent**	**150,792**	**179,663**	**208,535**	**237,406**	**268,989**
	Seasonal	**27,142**	**32,339**	**37,536**	**42,733**	**48,418**
	Functional	**177,934**	**212,003**	**246,071**	**280,139**	**317,408**

1.BEBR Estimates were distributed proportionally to LCU service areas based on Census and TAZ spatial distributions
2. Lee County Indicated that their population estimate for Three Oak 2040 would be used in leu of BEBER Data



Lee County Southwest Florida

BLACK & VEATCH

0 - 150	1,500 - 1,950	3,300 - 3,750
150 - 600	1,950 - 2,400	3,750 - 4,200
600 - 1,050	2,400 - 2,850	4,200 - 4,650
1,050 - 1,500	2,850 - 3,300	4,650 - 5,100
		5,100 - 7,500

0 16,000 32,000
Feet

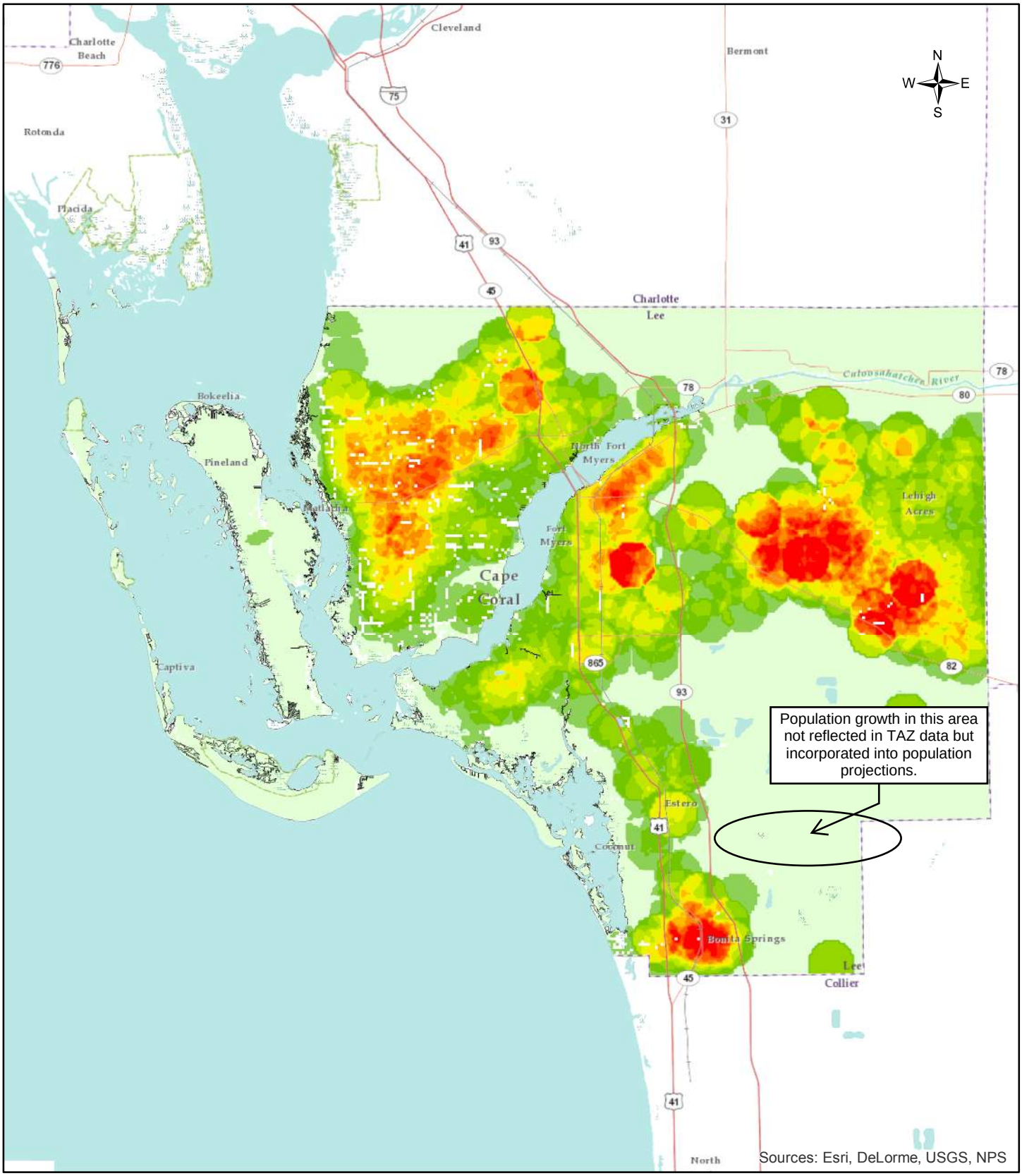
1:400,000

LEE COUNTY

Wastewater Master Plan

FIGURE 3-4

TAZ POPULATION DISTRIBUTION 2040



Lee County Southwest Florida

BLACK & VEATCH

LEE COUNTY

Wastewater Master Plan

FIGURE 3-5

POPULATION GROWITH 2016-2040

3.3 PROJECTED SYSTEM FLOWS

The totalized per capita flows summarized in **Table 3-1** were used to determine the future AADF, 3MADF, and MMDF when multiplied with the projected populations. The PHF was determined using the 10 States Standards method. **Table 3-5** summarizes the flow projections through the year 2040 for the overall LCU Service Area.

Table 3-5 Future System Flows

SERVICE AREA	WASTEWATER INFLUENT FLOW (MGD)	YEAR					
		gpcd[3]	2020	2025	2030	2035	2040
Fiesta Village Service Area[1]	Average Annual Daily Flow (AADF)	125.94	3.44	3.80	4.15	4.51	4.87
	Three Month Average Daily Flow (3MADF)	135.60	3.70	4.09	4.47	4.86	5.24
	Max Month Daily Flow (MMDF)	140.90	3.85	4.25	4.65	5.05	5.45
	Peak Hour Flow (PHF)[2]	----	4.17	4.58	5.00	5.42	5.83
Fort Myers Beach Service Area	Average Annual Daily Flow (AADF)	146.20	3.72	4.12	4.52	4.92	5.32
	Three Month Average Daily Flow (3MADF)	148.07	3.76	4.17	4.57	4.98	5.39
	Max Month Daily Flow (MMDF)	155.52	4.67	5.17	5.67	6.17	6.67
	Peak Hour Flow (PHF)[2]	----	5.07	5.59	6.11	6.63	7.15
Fort Myers Central Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	103.92	2.14	2.56	2.99	3.41	3.83
	Three Month Average Daily Flow (3MADF)	112.54	2.31	2.77	3.23	3.69	4.15
	Max Month Daily Flow (MMDF)	115.67	2.81	3.36	3.92	4.48	5.03
	Peak Hour Flow (PHF) [2]		3.08	3.65	4.24	4.82	5.39
Fort Myers South Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	126.95	4.31	5.15	6.00	6.84	7.68
	Three Month Average Daily Flow (3MADF)	142.77	4.85	5.80	6.75	7.69	8.64
	Max Month Daily Flow (MMDF)	149.84	6.01	7.18	8.35	9.53	10.70
	Peak Hour Flow (PHF) [2]	----	6.46	7.67	8.88	10.10	11.30
Gateway Service Area	Average Annual Daily Flow (AADF)	128.64	1.28	1.37	1.46	1.54	1.63
	Three Month Average Daily Flow (3MADF)	133.26	1.33	1.42	1.51	1.60	1.69
	Max Month Daily Flow (MMDF)	142.80	1.68	1.79	1.91	2.02	2.14
	Peak Hour Flow (PHF) [2]	----	1.91	2.02	2.15	2.27	2.40
Pine Island Service Area	Average Annual Daily Flow (AADF)	153.26	0.34	0.62	0.90	1.17	1.45
	Three Month Average Daily Flow (3MADF)	153.74	0.34	0.62	0.90	1.18	1.45
	Max Month Daily Flow (MMDF)	160.73	0.42	0.77	1.11	1.45	1.79
	Peak Hour Flow (PHF) [2]	----	0.53	0.93	1.30	1.67	2.04
Three Oaks Service Area	Average Annual Daily Flow (AADF)	122.77	3.85	5.09	6.33	7.56	9.14
	Three Month Average Daily Flow (3MADF)	124.85	3.91	5.17	6.43	7.69	9.29
	Max Month Daily Flow (MMDF)	128.59	4.03	5.33	6.63	7.92	9.57
	Peak Hour Flow (PHF) [2]	----	4.34	5.69	7.03	8.36	10.05

1. Permanent population used to calculate MMDF and PHF
2. Peak Hour Flow (PHF) was calculated using the 10-state standard: PHF = Qavg(18+sqrt(Population))/(4+sqrt(Population))
3. Per Capita flows are based on the average from all historic system flows found in Table 3-1

4.0 Capacity Analysis

Black & Veatch worked with Lee County Utilities (LCU) to establish the desired system performance criteria, which were used as the basis for determining if improvements are needed to meet the projected increases in system demands over the planning horizon. The criteria are based on various wastewater system design guidelines and consider references such as existing and proposed regulations (e.g. Florida Department of Environmental Projection (FDEP) regulations). **Table 4-1** summarizes the performance criteria on which the system was evaluated.

Table 4-1 Performance Criteria

CRITERIA	MAXIMUM	MINIMUM
Pipeline Criteria		
Velocity	7 fps	2 fps
Pressure	150 psi	10 psi
Pump Criteria		
Starts per Hour	6 Starts/hr.	2 Starts/hr.
Lag Pump Run Time	0 min	NA
Wet Well and Surcharging Criteria		
Wet Well Level	5 ft Freeboard	NA
Gravity System	Allows Surcharging	NA

1. Surcharging of the gravity system is considered a surcharged influent pipe on the wetwell invert with the lowest elevation.

"Status Quo" system improvements were identified to meet the performance criteria discussed above. These improvements include upsizing force mains and pump stations that are under capacity but are not necessarily fully optimized. Then alternative improvement scenarios were developed for consideration to optimize the solution and provide the most cost-effective solution. The three alternative scenarios included: parallel piping routes, master pump station utilization, and flow shedding.

4.1 STATUS QUO IMPROVEMENT

Status quo improvements are standard upsizing improvements to provide increased capacity to handle the future flows projected to be seen in a collection system. Status quo improvements have been determined based on projected future flows for each LCU service area. These improvements include upsizing of existing force mains and increasing pumping capacity at existing pump stations. When possible, one of the pump models already in use in the LCU system was selected for the pump upgrades. Selecting pump models already in use will allow LCU to reuse parts and limit the need for additional inventory in LCU's warehouse. It must be noted that pump station upgrades were based on the duplex pump stations modeled in the provided LCU models. Due to all pump stations being modeled as duplex stations, further investigation into existing pump configurations and sizing should be employed prior to project execution.

4.2 PARALLEL PIPING

The use of parallel piping can help increase capacity without the need for replacing a force main as well as providing redundancy and resilience. LCU staff provided insight into the operational and maintenance challenges with parallel force mains. The main concern with this alternative improvement scenario was the proximity of the parallel force mains to each other causing difficulties with maintenance. It was agreed that should any areas require further investigation for the use of parallel force mains, a separate right of way (ROW) would be used to avoid placing the force mains too close to each other.

After investigation into locations to install parallel pipelines and discussion with LCU staff at the Alternatives Analysis Workshop, it was determined that there was one area in which parallel force mains would be considered for further analysis. In 2040 the acquisition of the Eagle Ridge WWTP was assumed, requiring major force main upgrades along Daniel's Parkway and Metro Parkway. This alternative scenario would be largely dependent on the acquisition of the Eagle Ridge WWTP as well as the possible flow shedding from the City of Fort Myers (CFM) South Wastewater Treatment Plan (WWTP) to the Gateway Water Reclamation Facility (WRF). As the acquisition of the Eagle Ridge WWTP approaches, Black & Veatch recommends a more detailed study into the use of parallel force mains to transport the additional flow. This study should address the use of parallel piping to avoid installing oversized pipes that may not have proper scour velocity and have sludge build up during periods of low flow.

4.3 MASTER PUMP STATIONS

The intended use of master pump stations is to create lower head conditions for upstream pump stations, thus avoiding upgrades to those pump stations and allowing for overall fewer upgrades. Two locations were identified for possible master pump stations, 1.) Fort Myers Beach WRF service area – near the corner of McGregor Blvd. and Pine Ridge Rd.; 2.) City of Fort Myers South WWTP service area – near the corner of Metro Pkwy. and Crystal Dr. The addition of the first master pump station in the Fort Myers Beach service area will also allow for the rehabilitation of PS 2256 which is nearing the end of its useful life. Both of these master pump stations are planned in the long term CIP, however, there is an opportunity to complete the upgrade PS 2256 due to condition with the creation of Master Pump Station 1 described below. **Table 4-2** summarizes the flow and head conditions in the location of each proposed master pump station as well as the improvements they would help to avoid.

Table 4-2 Proposed Master Pump Stations

PROJECT ID	FLOW (GPM)	HEAD (FT)	PROJECTS AVOIDED
Master Pump Station 1	1,564	55	FMB-Pump-2
			FMB-Pump-3
			FMB-Pump-4
			FMB-Pump-6
			FMB-Pump-7
			FMB-Pump-24
Master Pump Station 2	6,272	59	FMSGW-Pump-9
			FMSGW-Pump-10
			FMSGW-Pump-11
			FMSGW-Pump-12
			FMSGW-Pump-19
			FMSGW-Pump-20
			FMSGW-Pump-23
			FMSGW-Pump-24
			FMSGW-Pump-25

4.4 FLOW SHEDDING

Two flow shedding options were analyzed as part of this alternative analysis. The projected baseline flow scenario was the 2040 Maximum Month Daily Flow (MMDF) including the conversion of all septic areas and acquisition of private utilities located within the future LCU service area. It is not likely that all the acquisitions will occur at the same time within the planning horizon, and more detailed analyses should be performed in anticipation of these acquisitions.

Two options were analyzed for the use of flow shedding. Option A diverts flow from the City of Fort Myers (CFM) WRFs with the intention of removing all flow from the two CFM plants allowing the City to utilize the full capacity and potentially avoid needing to construct the East WRF, which is currently in the City's CIP. Option B maximizes the use of LCU's portion of the current CFM plant capacities and sends excess flows to Three Oaks WRF and Southeast WRF. **Table 4-3** summarizes the results of the flow shedding analysis. Flow shedding options A and B are as described below and illustrated in **Figure 4-1**.

Option A:

- Flows from LS4481 diverted from the Fort Myers Central WWTP to the Gateway WRF via a new pipeline running south along I-75
- Flows from the Fort Myers South WWTP diverted to the Gateway WRF via a connecting pipeline run under I-75
- Flows, east of I-75, in the Three Oaks WRF service area sent to the new Southeast WRF

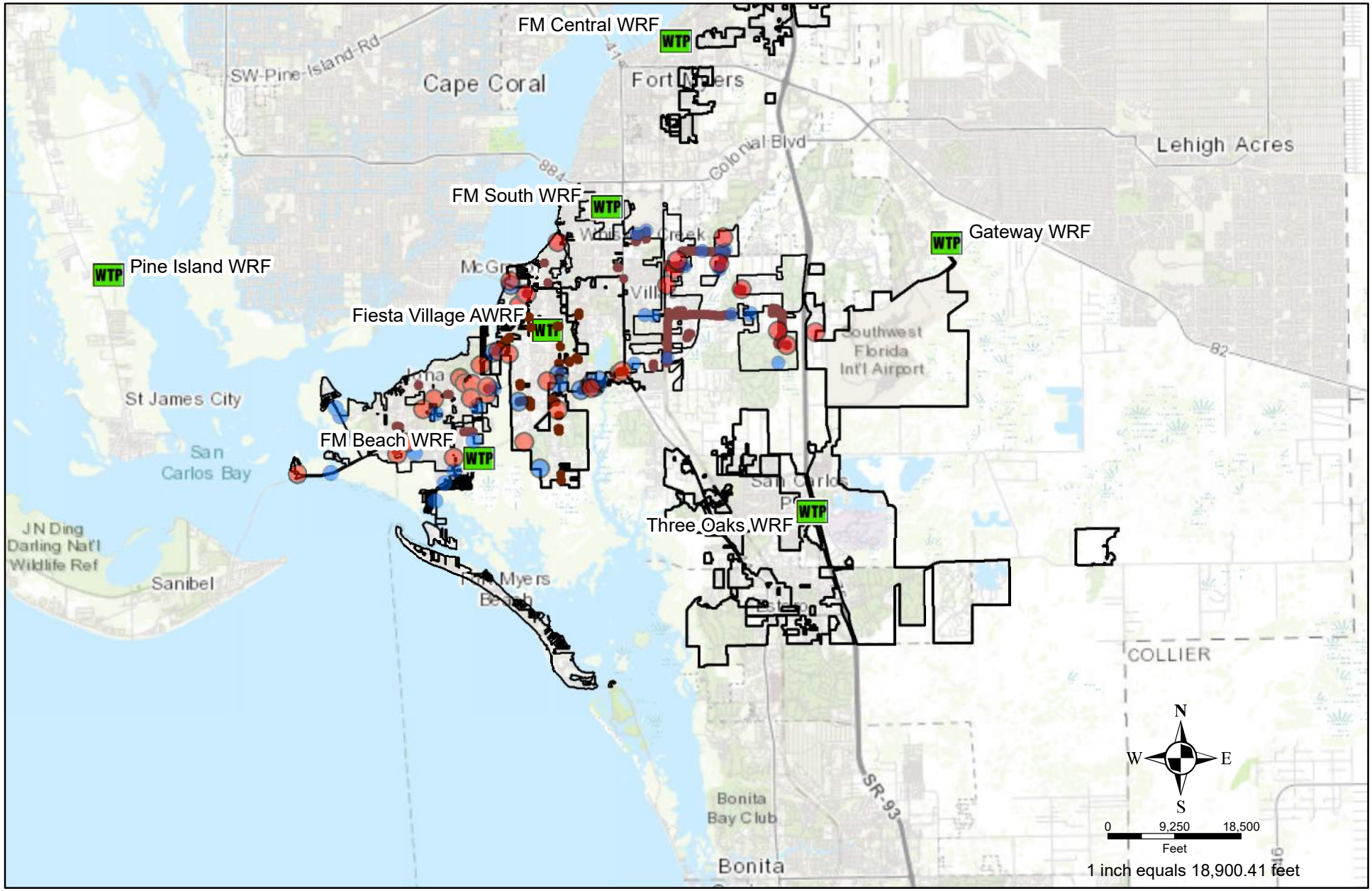
- Full Plant Expansion at Gateway, Three Oaks, and Southeast
- Eliminates all flows to both City of Fort Myers Plants

Option B:

- Partial flows from LS4481 diverted from the Fort Myers Central WWTP to the Gateway WRF via a new pipeline running south along I-75, while continuing to use the full capacity of CFM Central
- Partial flows from the Fort Myers South WWTP diverted to the Gateway WRF via a connecting pipeline run under I-75, while continuing to use the full capacity of CFM South
- Flows, east of I-75, in the Three Oaks WRF service area sent to the new Southeast WRF
- Full Plant Expansion at Gateway, Three Oaks, and Southeast

Table 4-3 Flow Shedding Analysis Results

PLANT	PERMITTED CAPACITY (MGD)	2040 MMDF (MGD)	OPTION A		OPTION B	
			Flow (MGD)	Remaining Capacity (MGD)	Flow (MGD)	Remaining Capacity (MGD)
Fiesta Village	5.0	5.45	5.45	-0.5	5.45	-0.5
Fort Myers Beach	6.0	6.67	6.67	-0.7	6.67	-0.7
City of Fort Myers Central	5.5 (LCU)	5.03	0	-	5.03	0.5 (10% remaining)
City of Fort Myers South	6.0 (LCU)	10.7	0	-	6.00	0.0
Gateway	3.0/6.0/9.0	2.14	17.87	-8.9	6.84	2.2 (24% remaining)
Pine Island	0.5	1.79	1.79	-1.3	1.79	-1.3
Three Oaks	6.0/8.0	11.29	6.45	1.6 (20% remaining)	6.45	1.6 (20% remaining)
Southeast Plant	2.0/6.0	NA	4.84	1.2 (20% remaining)	4.84	1.2 (20% remaining)



Lee County Southwest Florida

BLACK & VEATCH

Legend

- Pump Improvement
- New Pump Station
- Pipe Improvement

LEE COUNTY

Wastewater Master Plan

FIGURE 4-1

Lee County Force Main System Flow Shedding Scenarios

5.0 Recommended Improvements

5.1 2040 SYSTEM ANALYSIS

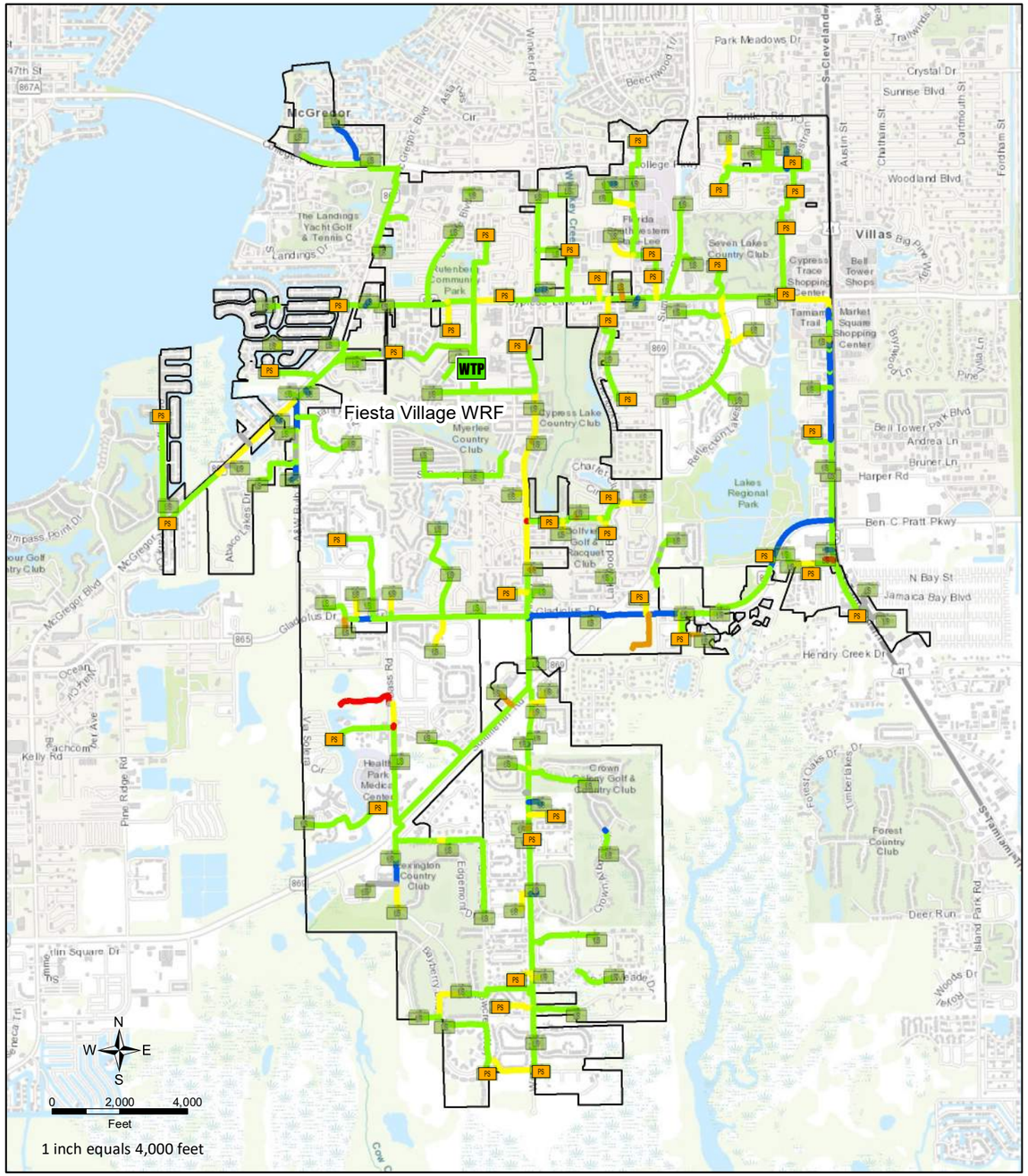
The initial evaluation for each service area included 2040 maximum month daily flows (MMDF) flows with no improvements (the existing system). The 2040 system improvements were developed using the data gathered in these initial model runs for each service area. The development of all improvements was based on meeting the performance criteria summarized in **Table 4-1**, which includes criteria for pump run times, pipe velocities, wet well overflows, etc. **Figure 5-1** through **Figure 5-5** compare the existing system performance results with no improvements to the system results with the recommended improvements for each service area. It should be noted that some of the velocities in the existing system figures which are below the performance criteria of 2.0 feet per second (fps) for minimum velocity due to several pumps unable to pump against increased system pressures, also known as dead heading.

5.2 IMPROVEMENT PHASING

The assessment of the collection system revealed that the system will require a few improvements to meet the projected growth over the 20-year planning horizon. MMDF projections, presented in **Section 3.3** were developed for 5-year increments based on Bureau of Economic and Business Research (BEBR) population growth rates and were used as model inputs to develop the improvement phasing. MMDF Flows for each planning year were input into each model, each system was analyzed for existing conditions and then 2040 improvements were inserted until the system met all performance criteria. This process was completed for each planning year, thus assigning anticipated phasing years. A specific trigger was also identified for each project. It is recommended that Lee County Utilities (LCU) monitor those triggers yearly to be able to adapt to change conditions and adjust the actual implementation dates accordingly.

5.3 RECOMMENDED IMPROVEMENTS

Fifty-nine pump station improvements, approximately ten miles of force main improvements and two potential master pump stations were identified amongst all of the service areas. **Figure 5-6** through **Figure 5-10** illustrate the improvements recommended for each service area. **Appendix B – Wastewater Integration and Optimization TM** includes a tabular list of all projects by service year.



Lee County Southwest Florida

BLACK & VEATCH

PS Surcharged Wet Well
LS Existing Pumps

Max. Velocity

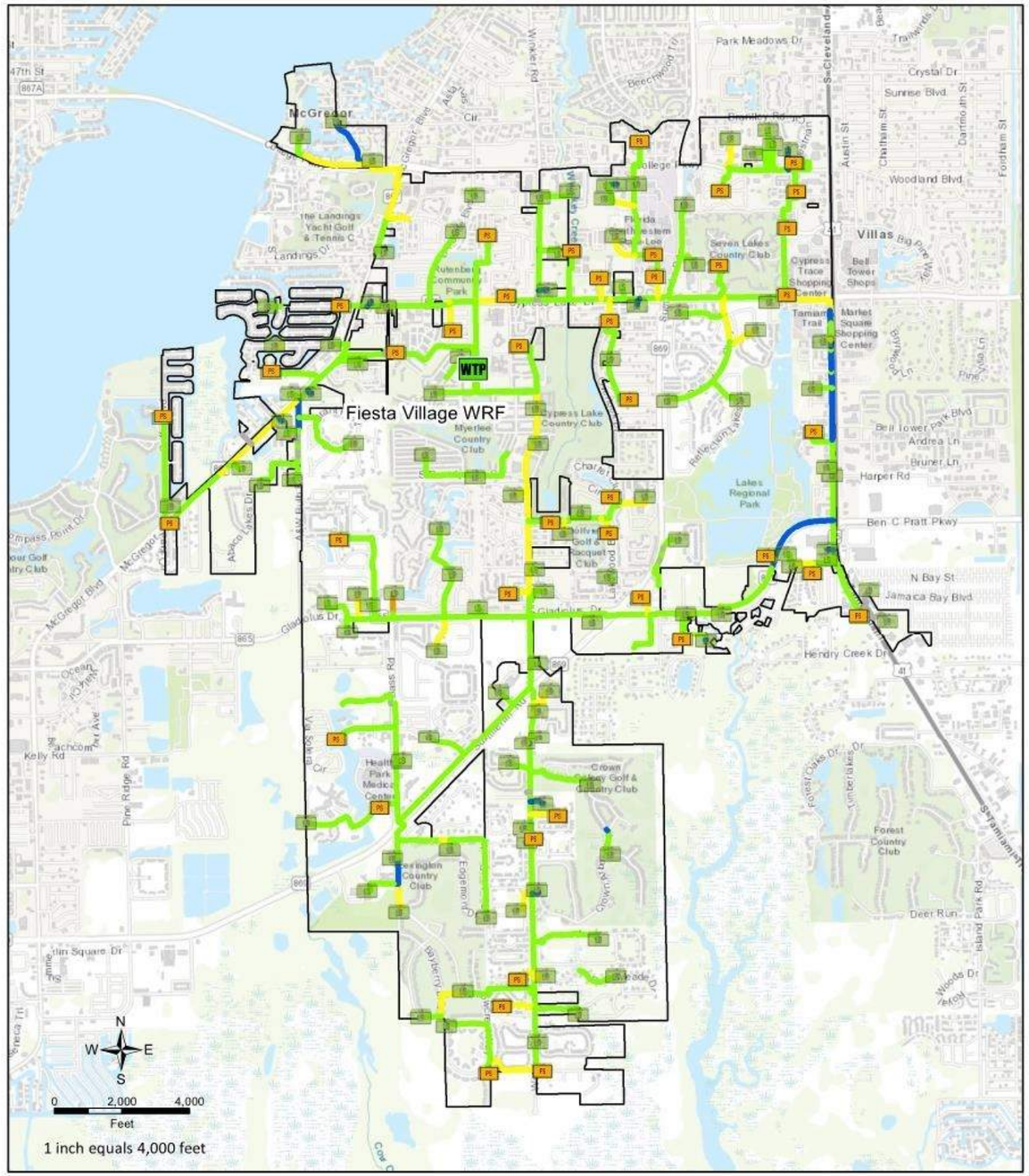
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-1

Fiesta Village
2040 Existing System
Maximum Velocity



Lee County Southwest Florida

BLACK & VEATCH

PS Surcharged Wet Well
LS Existing Pumps

Maximum Velocity

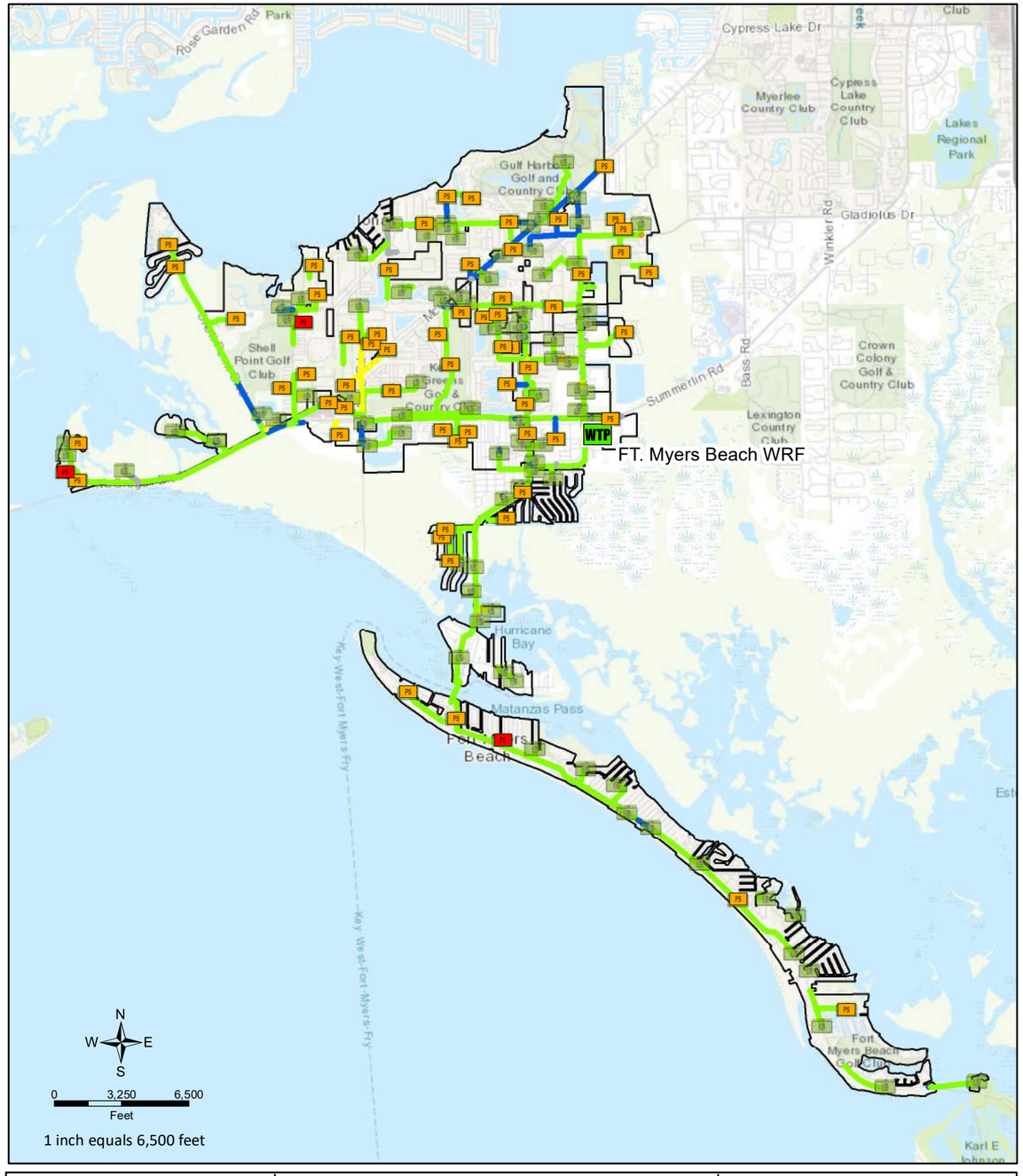
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-1

Fiesta Village
2040 Status Quo
Maximum Velocity



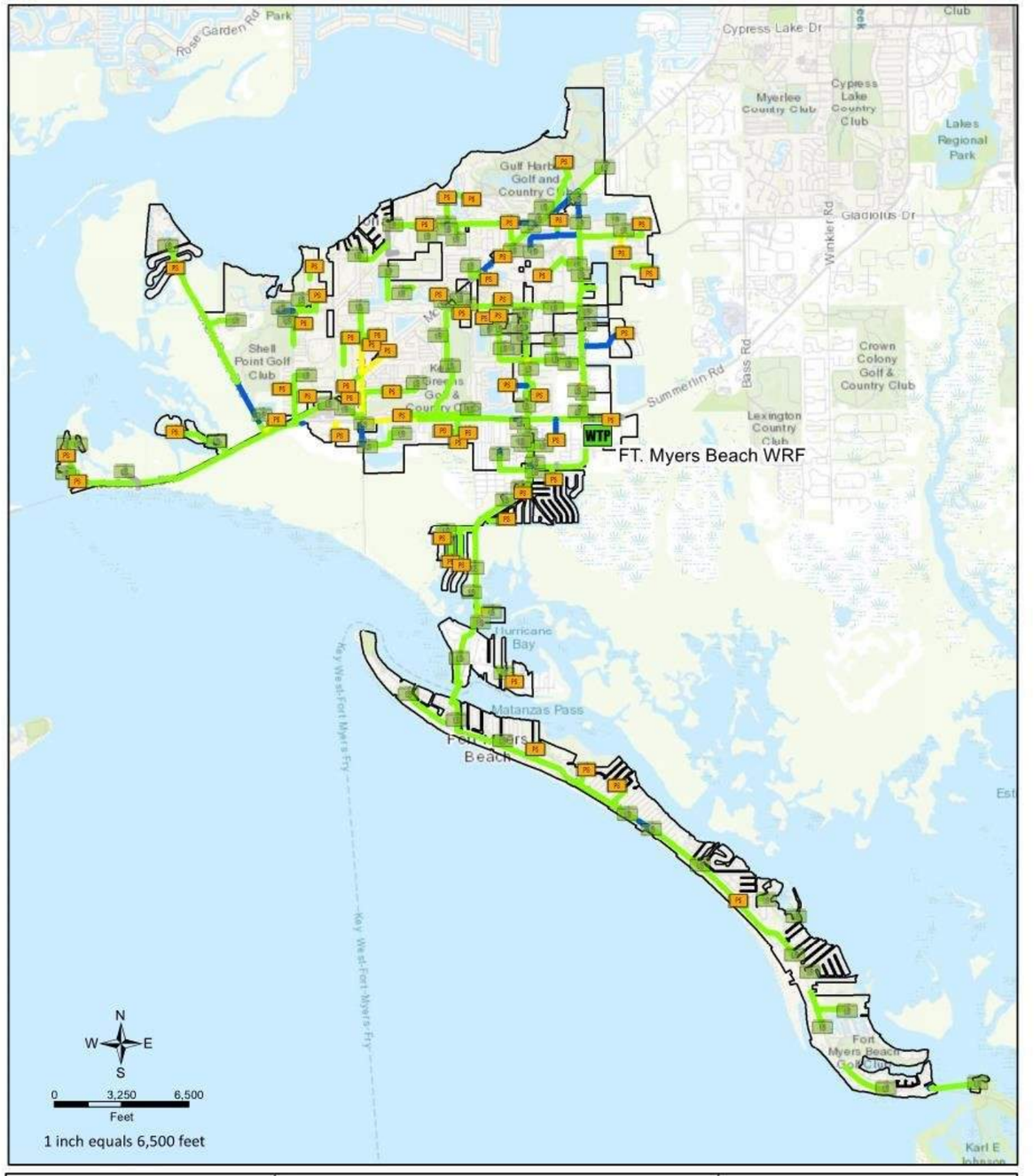
PS Surcharged Wet Well **Max. Velocity**
PS Max Level Wet Well
LS Exisiting Pumps

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

Lee County Southwest Florida

BLACK & VEATCH

LEE COUNTY
Wastewater Master Plan
FIGURE 5-2
Ft. Myers Beach
2040 Existing System
Maximum Velocity



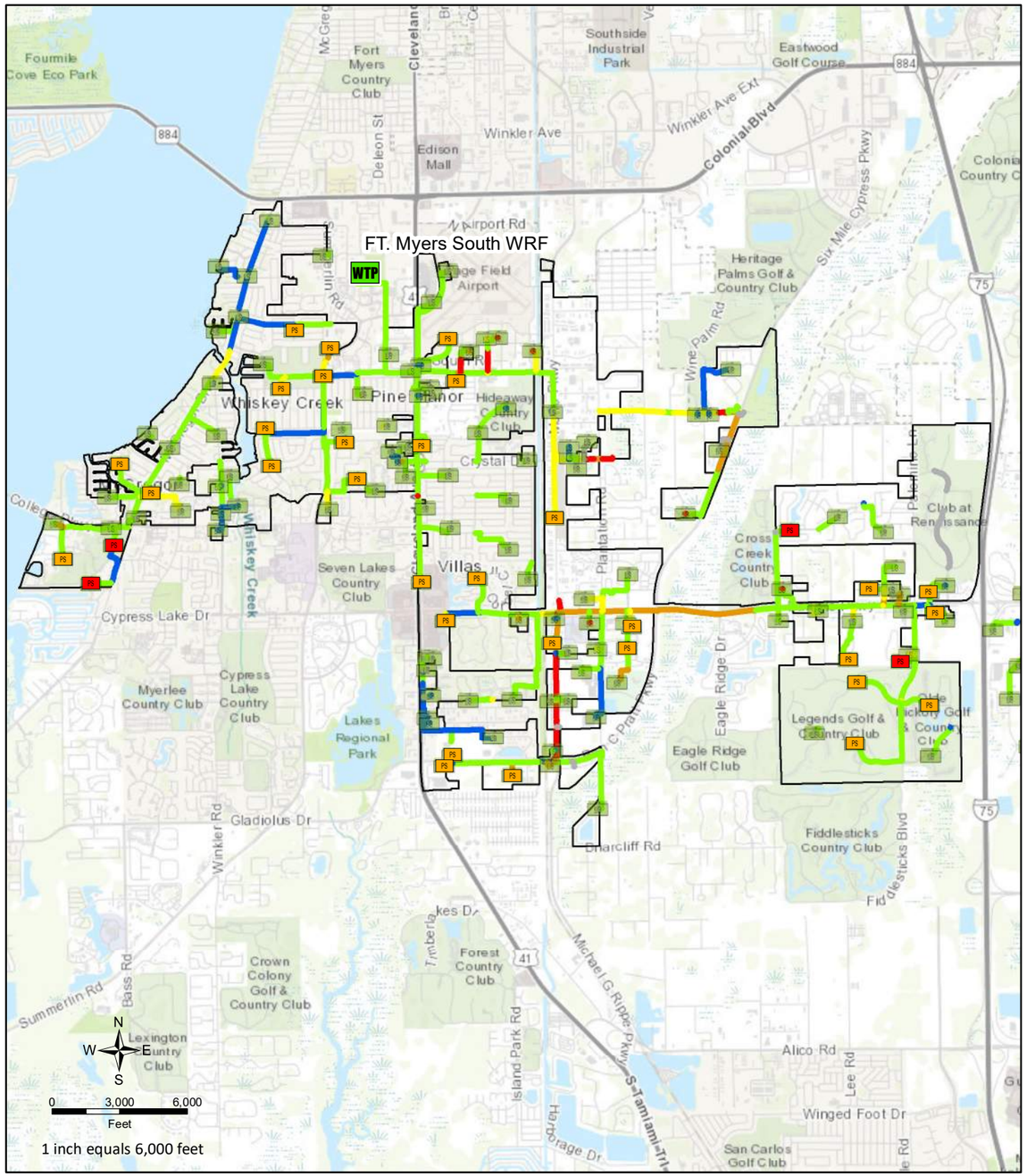
PS Surcharged Wet Well **Maximum Velocity**
LS Exisiting Pumps

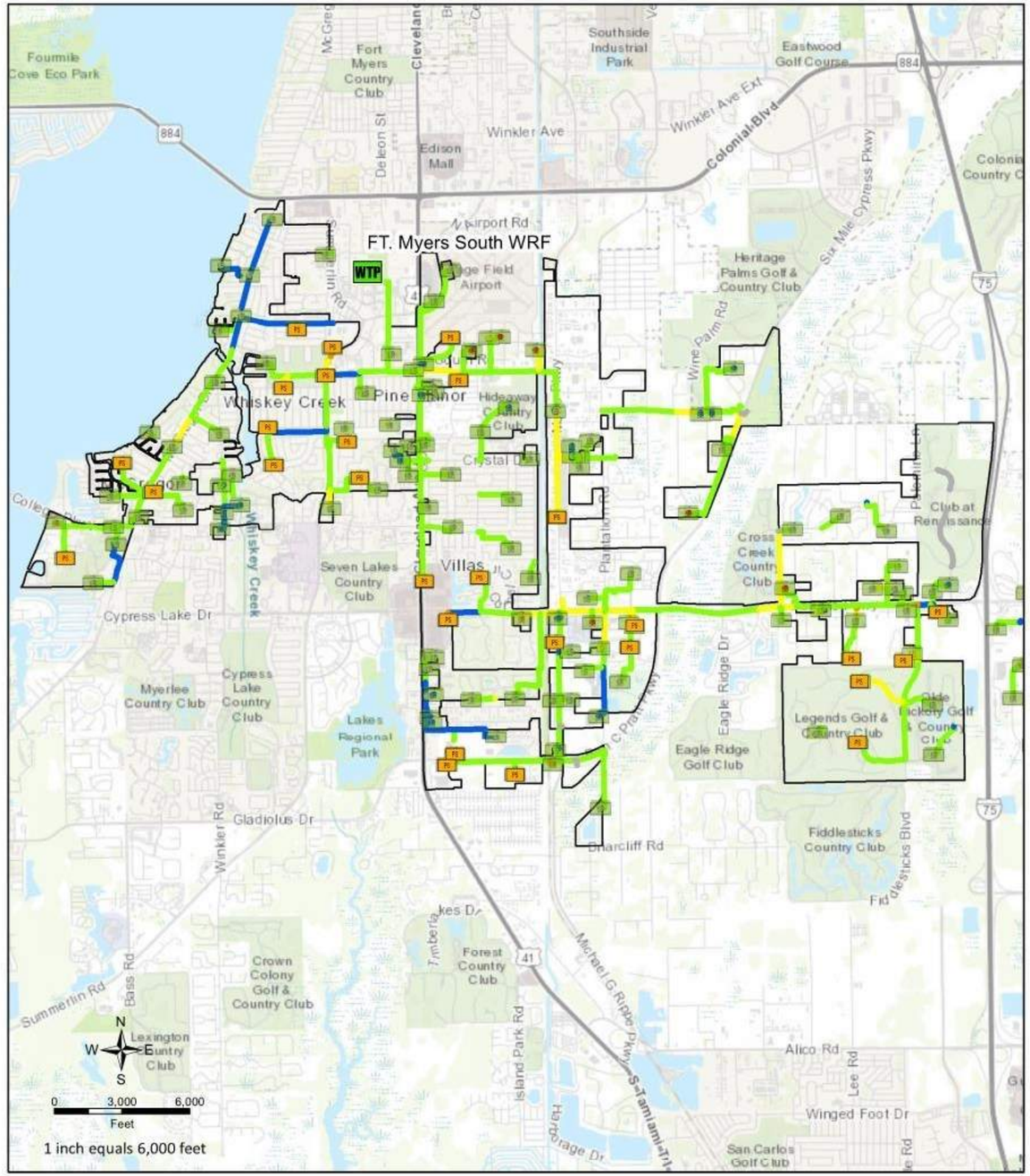
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

Lee County Southwest Florida

BLACK & VEATCH

LEE COUNTY
Wastewater Master Plan
FIGURE 5-2
Ft. Myers Beach
2040 Status Quo
Maximum Velocity





Lee County Southwest Florida

BLACK & VEATCH

Surcharged

- Max Level Wet Well
- Surcharged Wet Well
- Existing Pumps

Max. Velocity

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-3

Ft. Myers South 2040 Existing System Improvements

Lee County Southwest Florida

BLACK & VEATCH

- Surcharged Wet Well
- Existing Pumps

Maximum Velocity

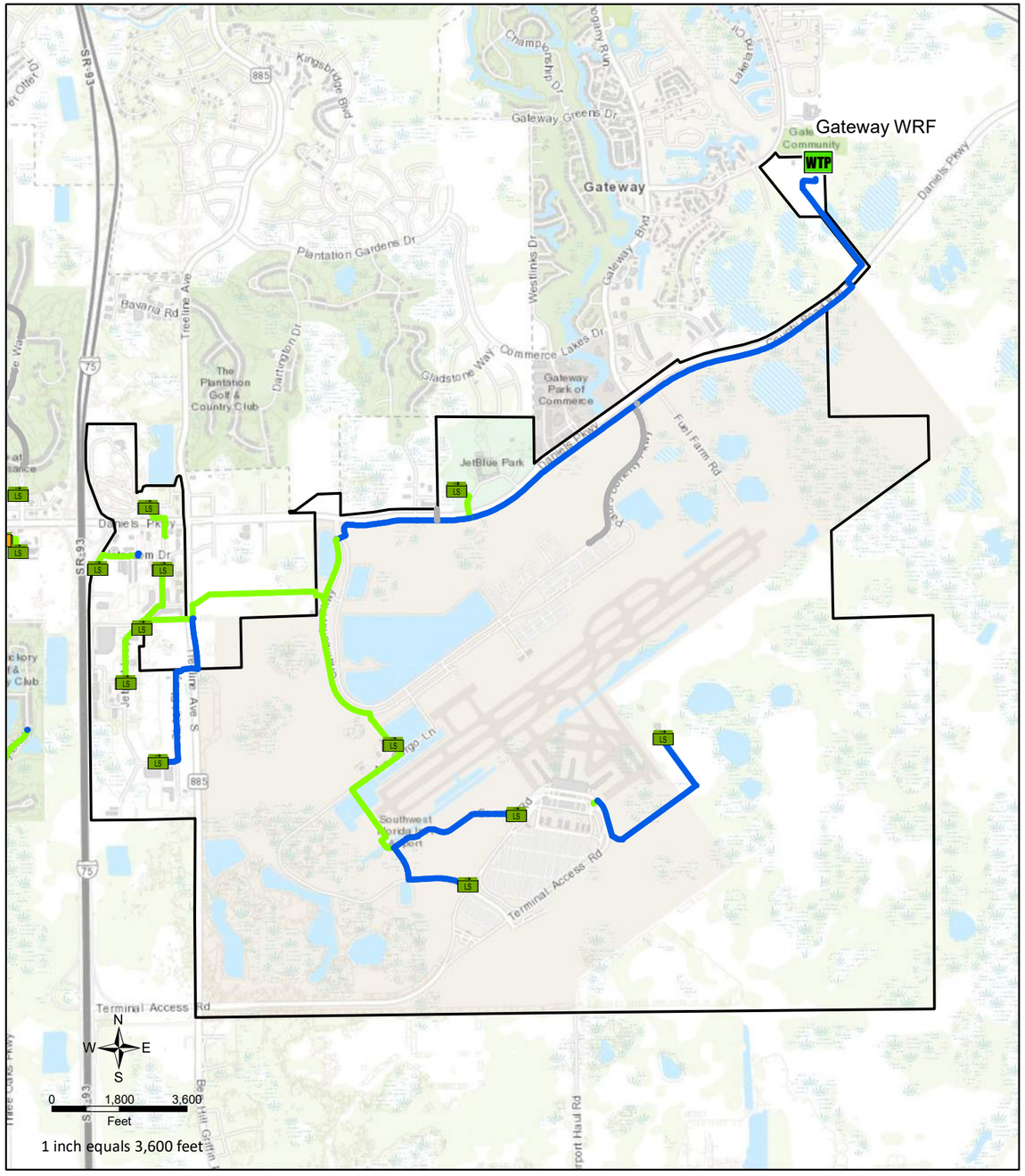
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-3

Ft. Myers South 2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Surcharged

- Max Level Wet Well
- Surcharged Wet Well
- Existing Pumps

Max. Velocity

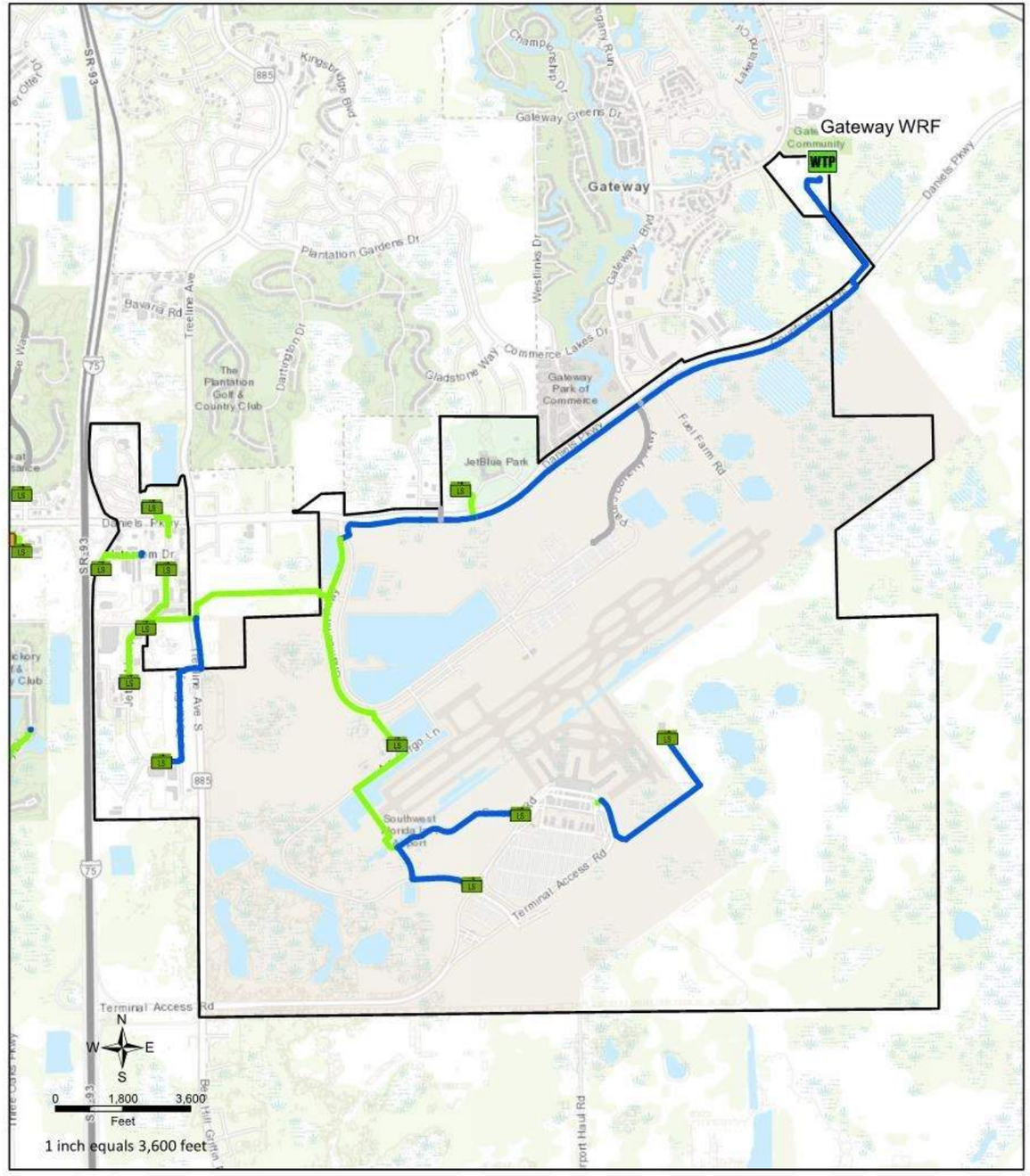
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-4

Gateway
2040 Existing System
Maximum Velocity



Lee County Southwest Florida

BLACK & VEATCH

- Surcharged Wet Well
- Existing Pumps

Maximum Velocity

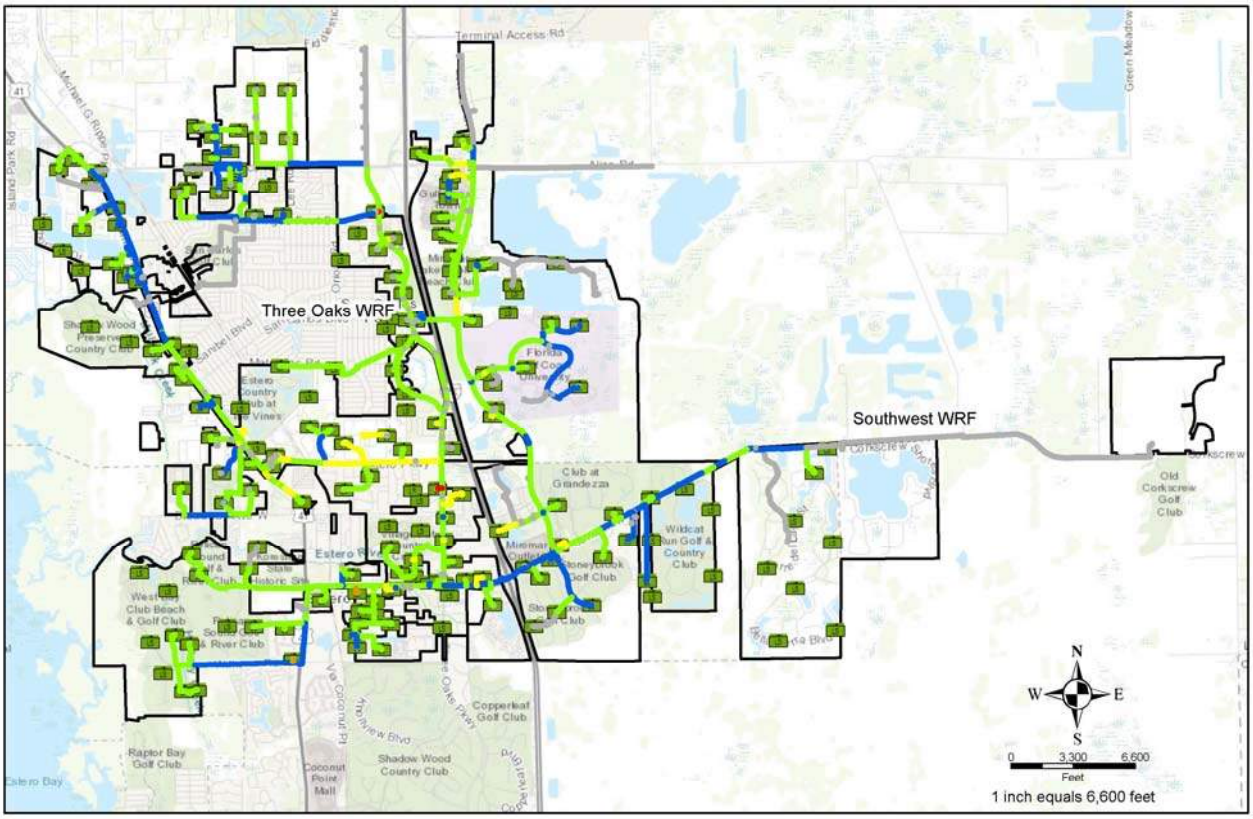
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-4

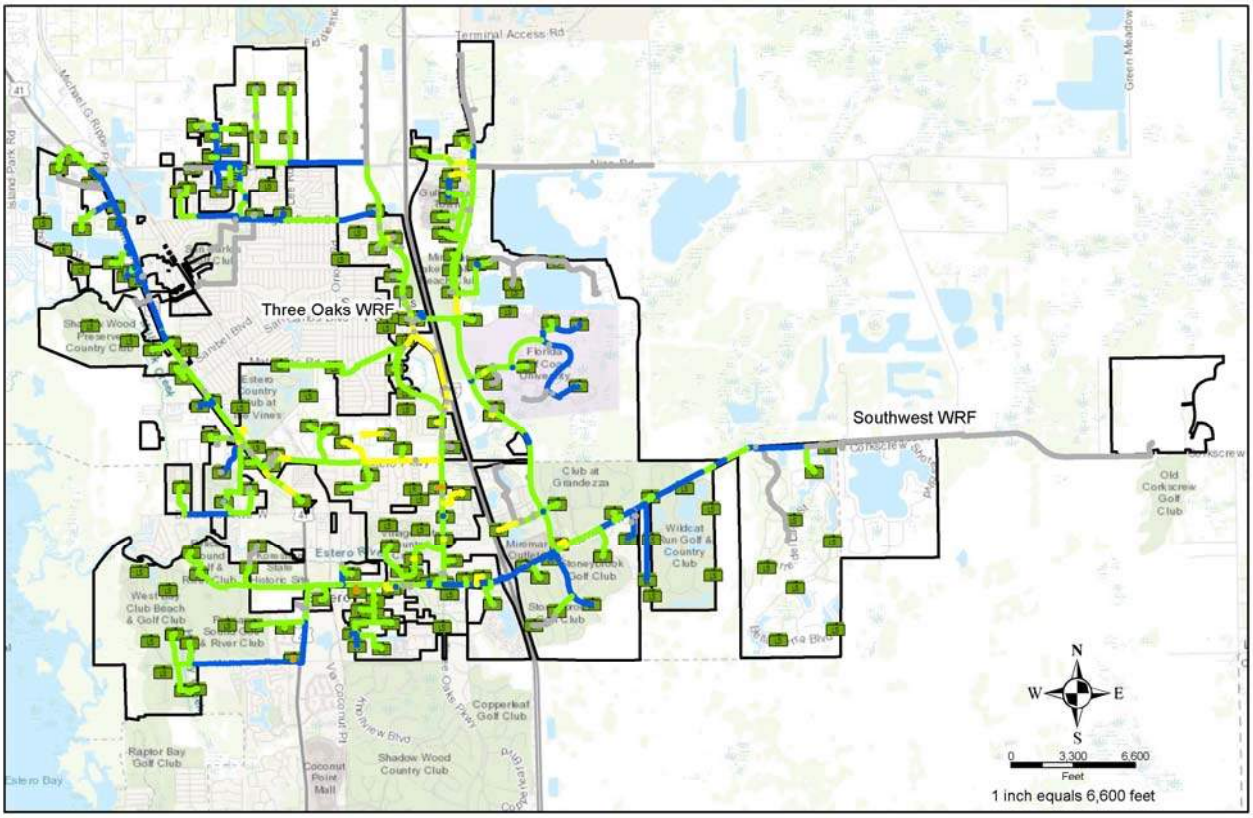
Gateway
2040 Status Quo
Maximum Velocity



Lee County Southwest Florida
BLACK & VEATCH

Max. Velocity
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps
- Existing Pumps

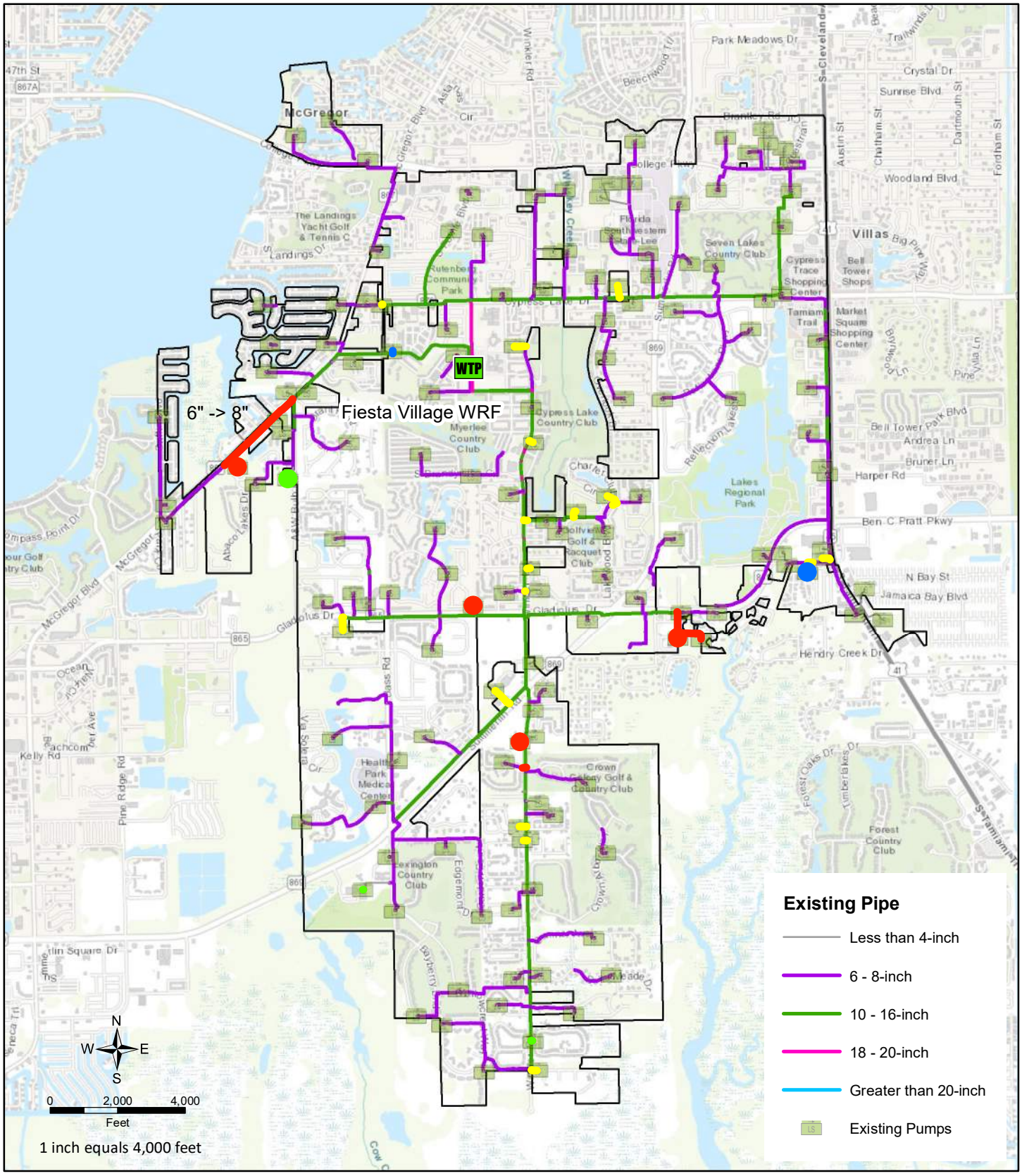
LEE COUNTY
Wastewater Master Plan
FIGURE 5-5a
Three Oaks
2040 Existing System Maximum Velocities



Lee County Southwest Florida
BLACK & VEATCH

Max. Velocity
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps
- Existing Pumps

LEE COUNTY
Wastewater Master Plan
FIGURE 5-5b
Three Oaks
2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2025
- 2030
- 2040

Pipe Upgrades

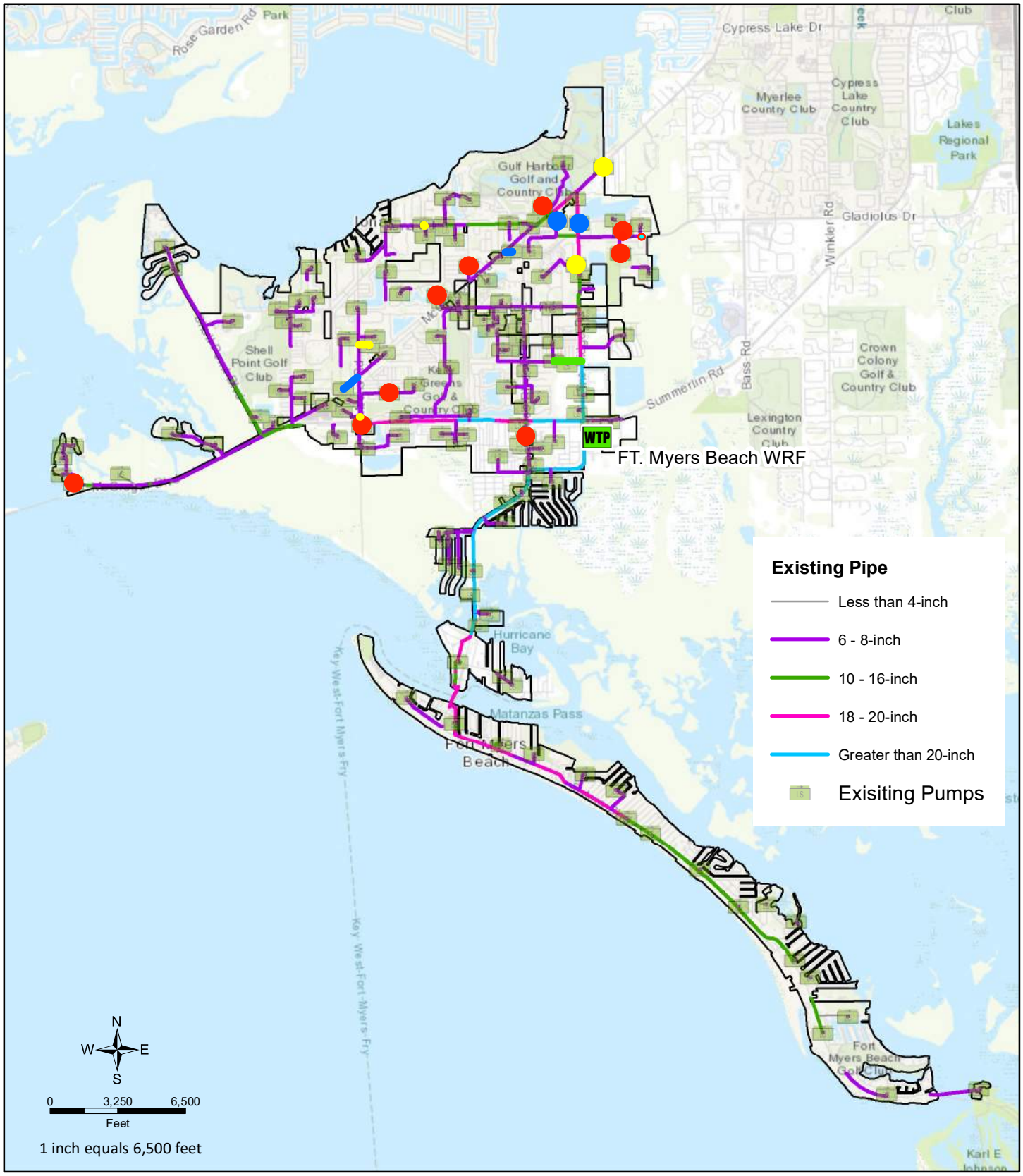
- 2020
- 2025
- 2030
- 2040

LEE COUNTY

Wastewater Master Plan

FIGURE 5-6

Fiesta Village
2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

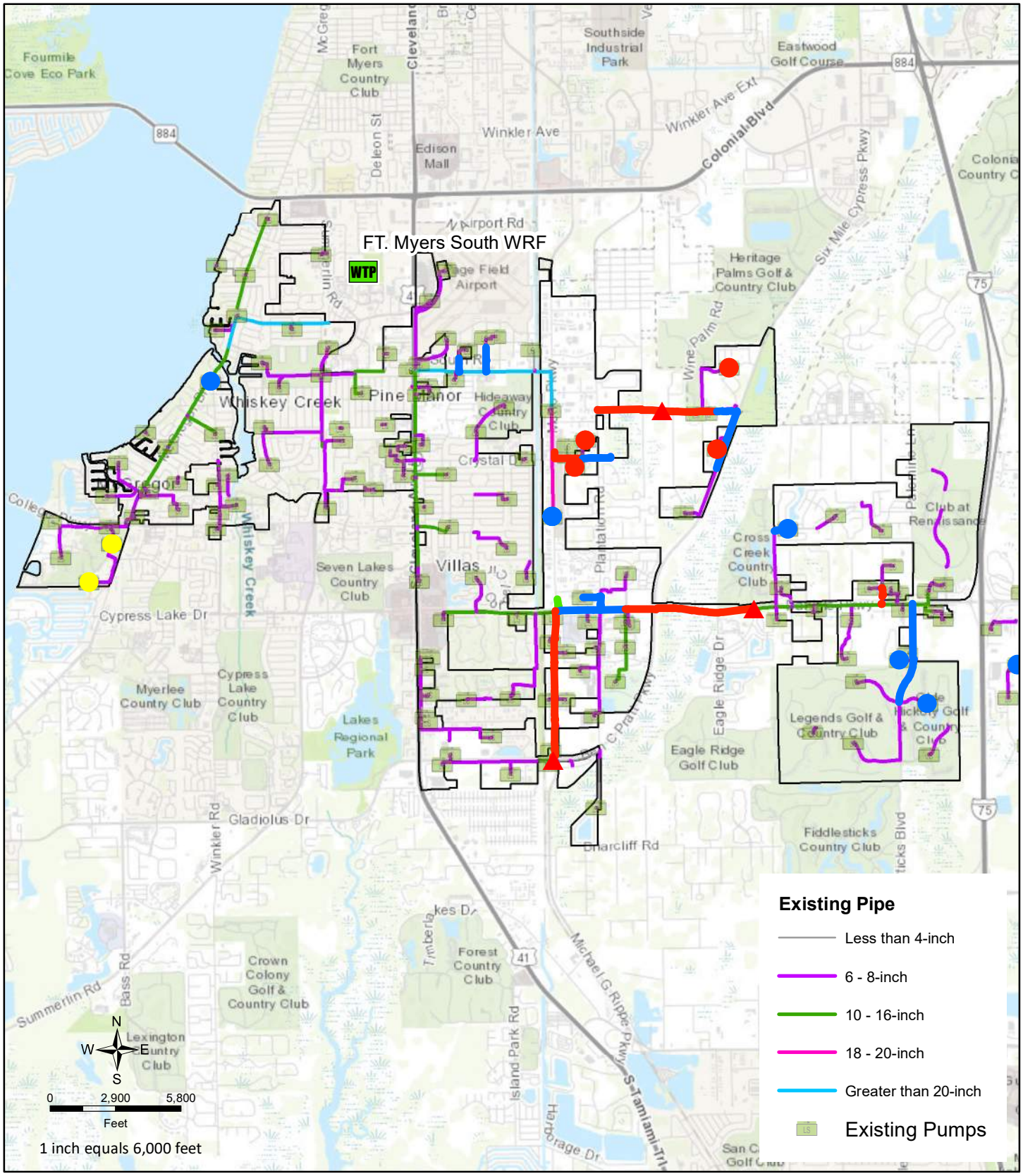
Pump Upgrades	Pipe Upgrades
2020	2020
2030	2025
2040	2030
	2040

LEE COUNTY

Wastewater Master Plan

FIGURE 5-7

Ft. Myers Beach 2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

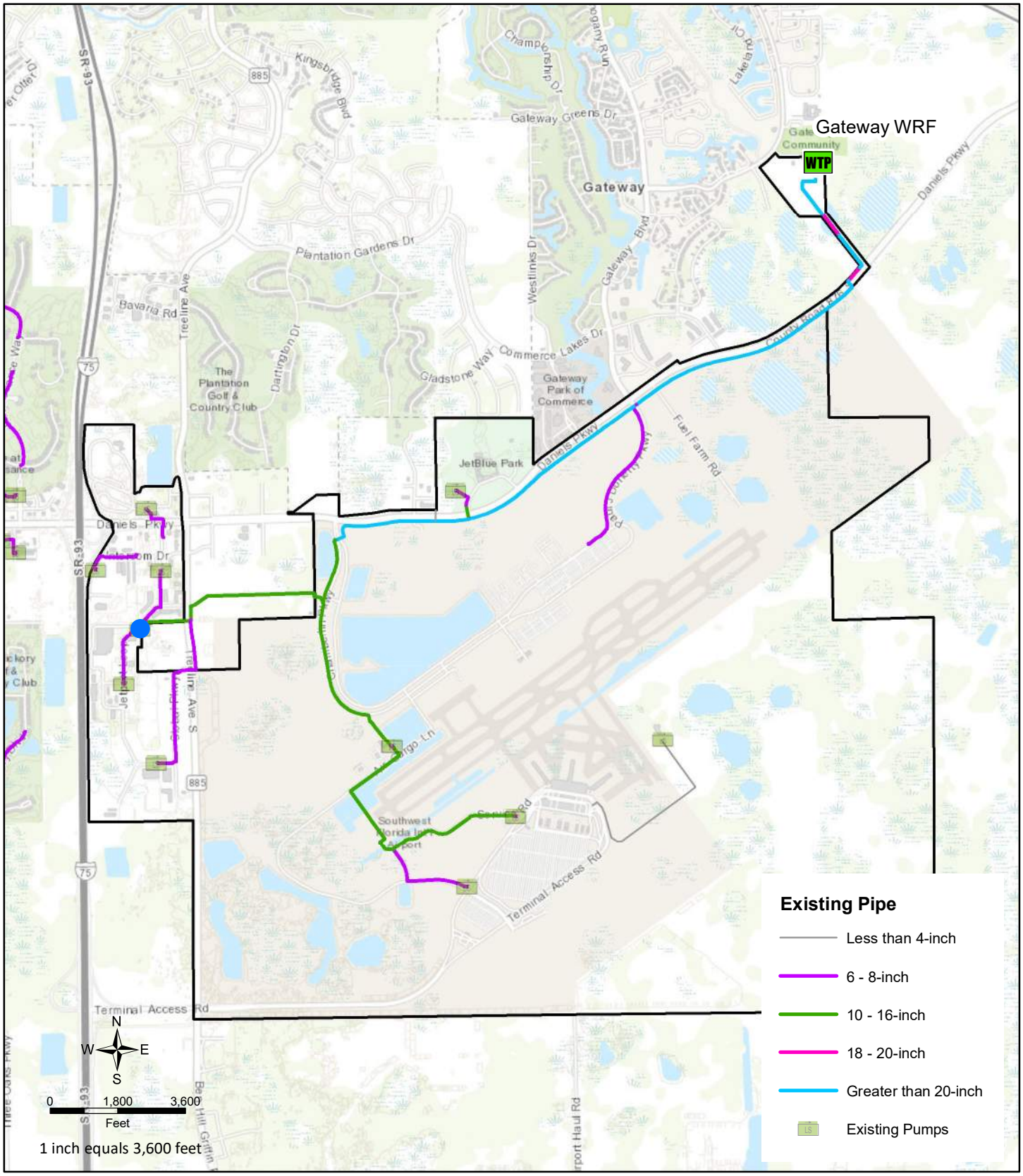
Pump Upgrades	New Pump	Pipe Upgrades
2020	2025	2025
2030	2030	2030
2040	2040	2040

LEE COUNTY

Wastewater Master Plan

FIGURE 5-8

Ft. Myers South 2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades **Pipe Upgrades**

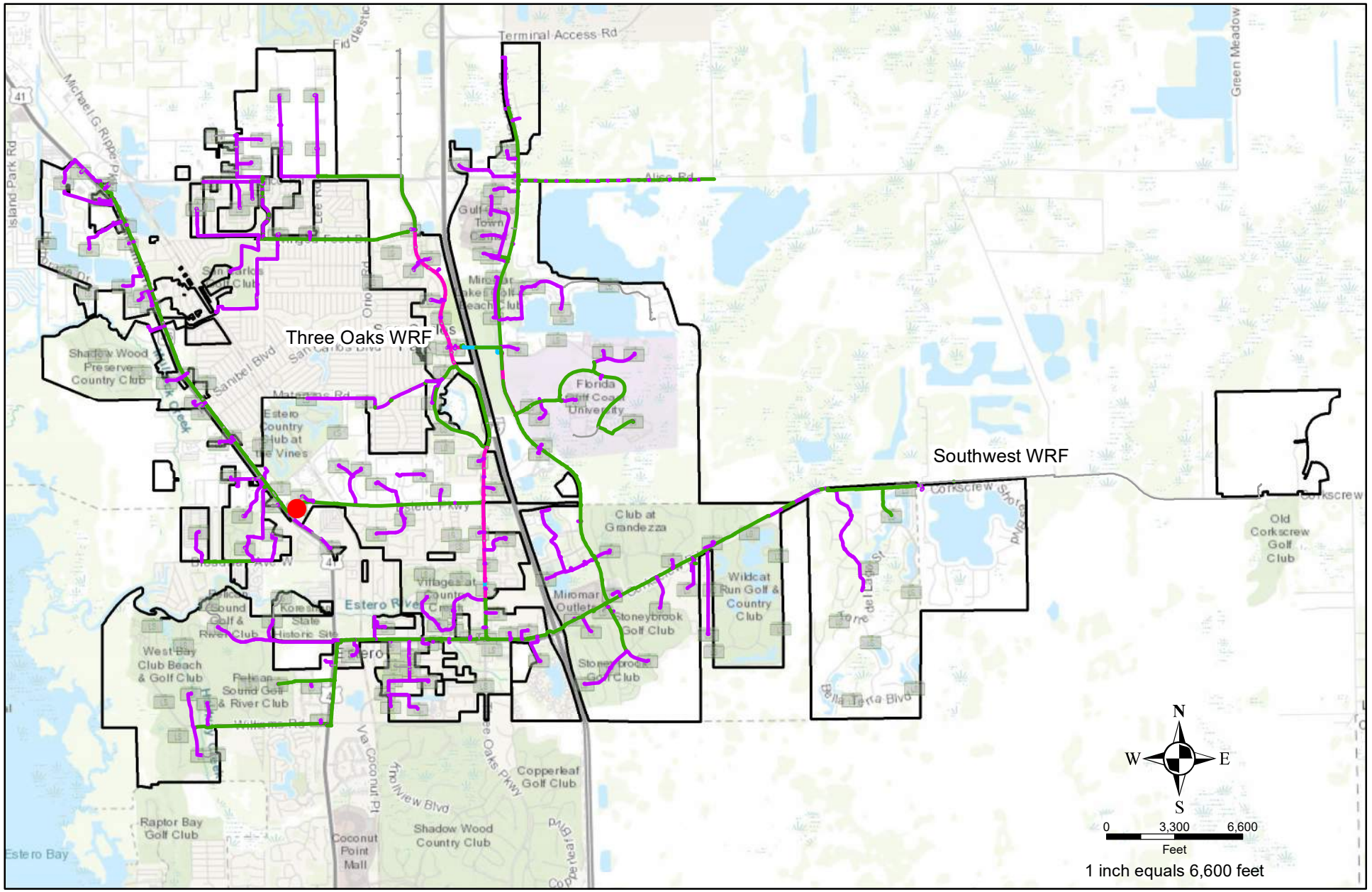
Pump Upgrades	Pipe Upgrades
2020	2025
2030	2030
2040	2040

LEE COUNTY

Wastewater Master Plan

FIGURE 5-9

Gateway
2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2040

Existing Pipe

- Less than 4-inch
- 6 - 8-inch
- 10 - 16-inch
- 18 - 20-inch
- Greater than 20-inch
- Existing Pumps

LEE COUNTY

Wastewater Master Plan

FIGURE 5-10

Three Oaks

2020-2040 Status Quo Improvements

6.0 Capital Improvement Plan

Once the recommended improvement projects were identified and preliminary implementation planning years established, the cost for each improvement project was estimated. The following section describes the unit costs established, the proposed capital improvement plan and the cash flow required to implement the improvements.

6.1 FORCE MAIN UNIT COSTS

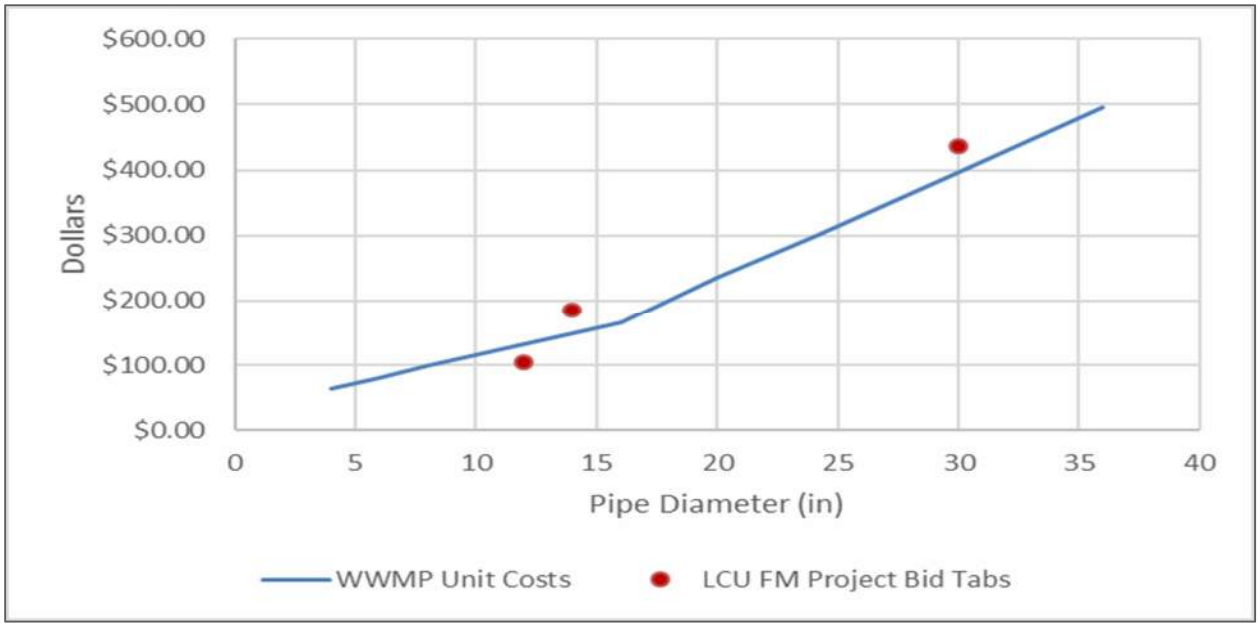
Table 6-1 summarizes the recommended unit costs for force main replacement diameters, 4-inch through 36-inch, per linear foot. **Figure 6-1** illustrates the recommended unit costs compared to the unit costs from three recent bid tabulations provided by Lee County Utilities (LCU). The comparison shows that the recommended unit costs are reasonable compared to recent construction bids. The recommended unit costs include:

- PVC pipe including fittings, valves, excavation and fill, and labor
- Markups: 30% Contingency, 10% Engineering Fee, and 10% Construction Engineering Inspection

Table 6-1 Wastewater Force Main Unit Costs

DIAMETER (IN)	UNIT COST ($/LF)
4	$63.10
6	$80.35
8	$98.56
12	$132.11
16	$166.62
20	$235.44
24	$298.54
30	$397.00
36	$495.46

Figure 6-1 Wastewater Force Main Unit Costs

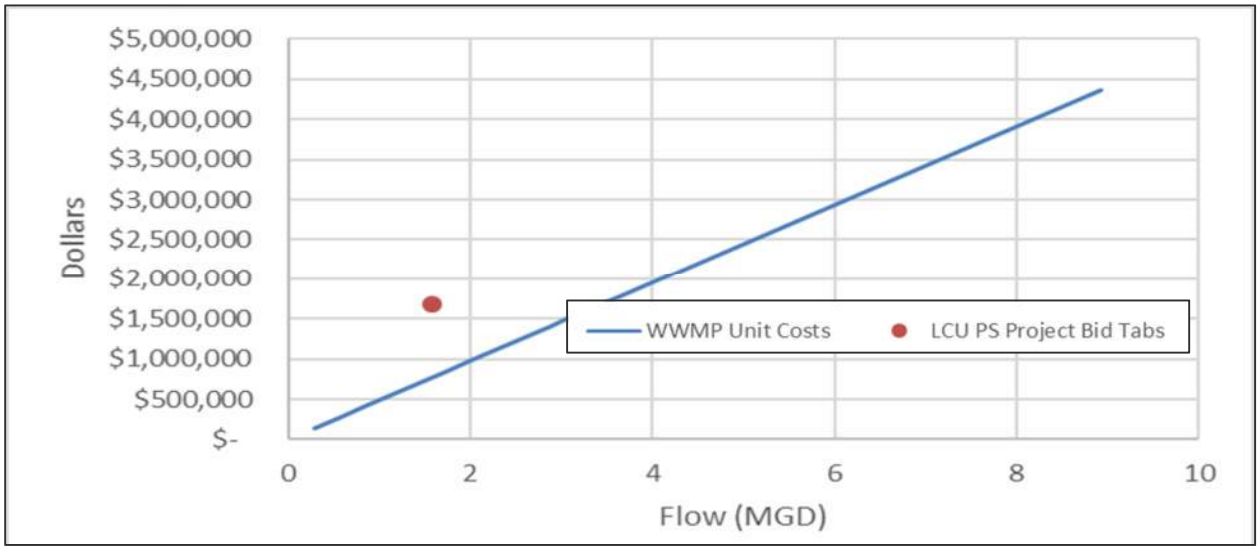


6.2 NEW PUMP STATIONS OR PUMP STATION REPLACEMENT

Figure 6-2 illustrated the recommended unit costs for pump stations per gallon per minute (gpm) flow. Items included in the unit cost are:

- Pumps, pipes, valves, and other appurtenances
- Structure/Excavation
- Electrical, instrumentation and controls, Generators
- Markups: 30% Contingency, 10% Engineering Fee, and 10% Construction Engineering Inspection

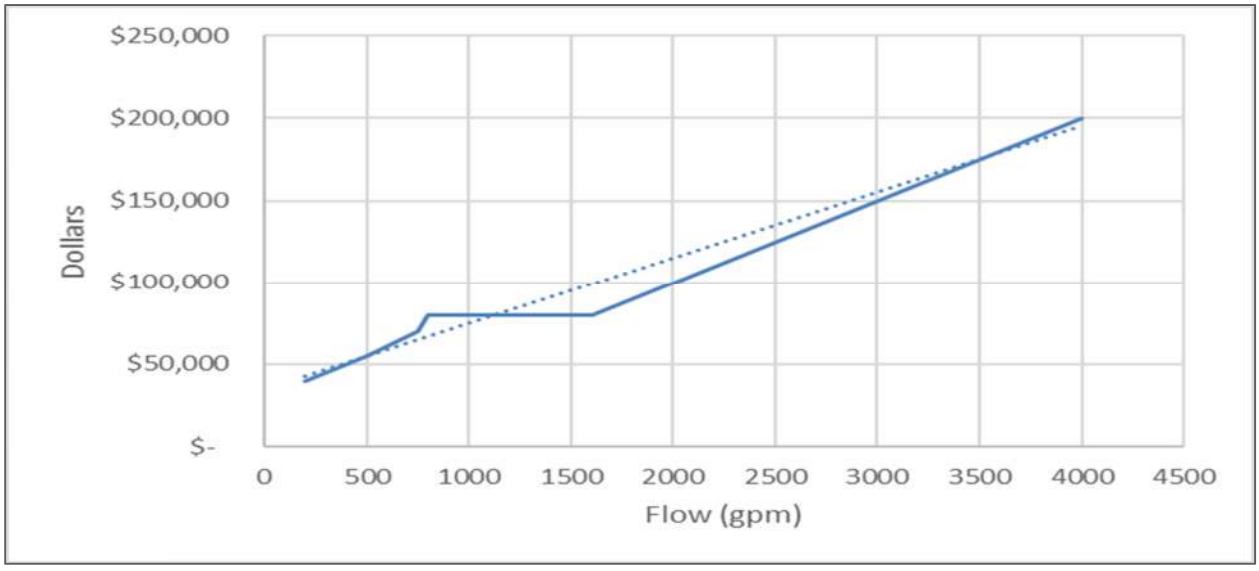
Figure 6-2 New Pump Station Unit Costs



6.3 PUMP REPLACEMENT UNIT COSTS

Figure 6-3 illustrates the recommended unit costs for pump replacement under multiple pump flow conditions. Pump replacement costs only include the capital cost of the pumps and do not include any markups.

Figure 6-3 Pump Replacement Unit Costs



6.4 CAPITAL IMPROVEMENT PLAN

The collection system capital improvement plan (CIP) includes 73 separate improvement projects through planning year 2040. The short term CIP projects have been grouped into annual system improvement projects in order to assist in the execution of the smaller projects recommended. The CIP has a total project cost of $21.4M, which includes a 2.5% inflation rate beginning in 2025. In addition to LCU projects, approximately $37.7M is expected to be required for system additions and improvements due to new developments in the LCU service areas. These are typically incurred by individual developers and thus are not included in the LCU CIP.

As part of the **Wastewater Optimization Technical Memorandum (Located in Appendix B)**, the construction of two master pump stations were recommended as an alternative to several pump station projects. The two master pump station projects are expected to cost $9.3M and would replace $12.9M in other project costs. It must be noted that the master pump station projects would be replacing a large portion of developer driven projects so the majority of the $12.9M would likely not be the responsibility of LCU.

In addition to the force main replacements, several treatment plant expansions are required within the 20-year planning horizon. Based on LCU estimates, the treatment plant project costs total $319.7M. **Figure 6-4** illustrates the timeline and trigger points for the expansion of the Three Oaks WRF and Southeast WRF due to flows in the southeastern portion of Lee County. **Figure 6-5** through **Figure 6-10** illustrate the capacity analysis for all other facilities.

LCU uses a capacity threshold of 80% of the treatment capacity as a trigger for plant expansion. However, Chapter 62-600.405 of the Florida Administrative Code requires "planning and preliminary design" to be initiated within 5-years of the projected flows exceeding the plant capacity. It is recommended that Lee County perform a capacity analysis report when the influent flows exceed 80% of the plant capacity, however, planning and design should only commence 5-years before the capacity is projected to be exceeded. For example, the capacity analysis of Fiesta Village and Fort Myers Beach WRFs show the facility capacities as reaching 80% of the permitted capacity in 2022 and 2021 respectively. However, planning and preliminary design should start at 2027 and 2028 based the projected date of exceeding the permitted capacity.

Detailed cost estimate assumptions are provided for each project in the CIP spreadsheet file provided to LCU. **Table 6-2** summarizes the CIP cash flow needs per year through 2024 and in 5-year increments afterwards.

Table 6-2 Capital Improvement Plan Cash Flow Summary

CASH FLOW	2020	2021	2022	2023	2024	2025-2029	2030-2039	2040-FUTURE
Force Main	$0	$0	$0	$0	$0	$171,179	$2,591,818	$5,943,709
Pump Replacement	$0	$0	$0	$0	$0	$0	$0	$0
New Pump Station	$0	$0	$0	$0	$0	$0	$634,056	$7,642,079
Master Pump Station	$0	$0	$0	$138,000	$0	$2,196,399	$6,930,581	$0
System Improvements	$0	$254,000	$254,000	$254,000	$230,000	$304,237	$1,260,255	$1,963,595
Plant Project	$8,490,000	$28,705,000	$55,865,000	$0	$2,400,000	$27,457,063	$80,890,416	$85,197,105
Total	$6,346,000	$28,902,000	$28,913,000	$357,000	$2,573,000	$30,128,877	$92,307,126	$100,459,070

Figure 6-4 Three Oaks WRF and Southeast WRF Expansions Based on Projected Flows

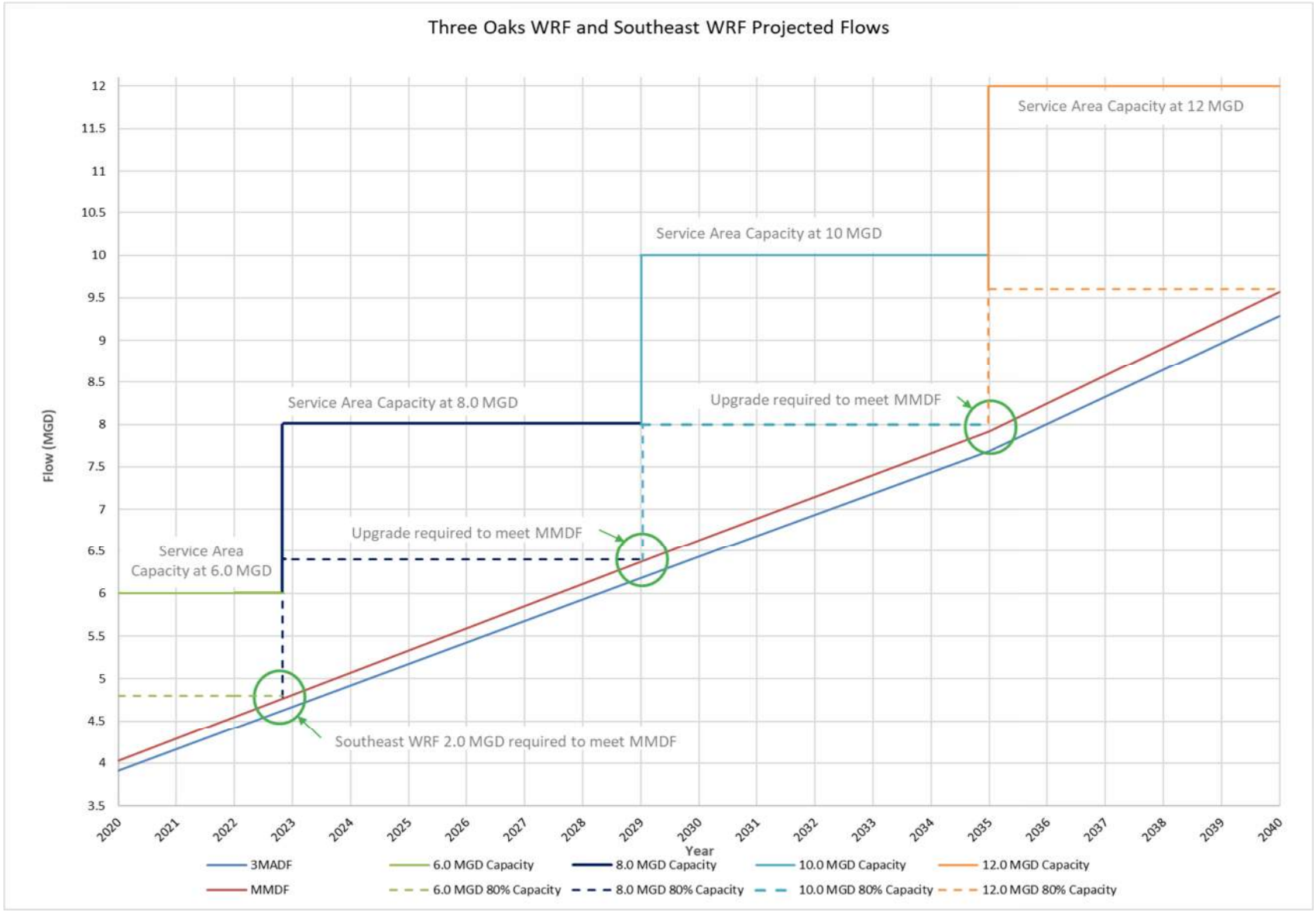


Figure 6-5 Fiesta Village AWRF Capacity Assessment

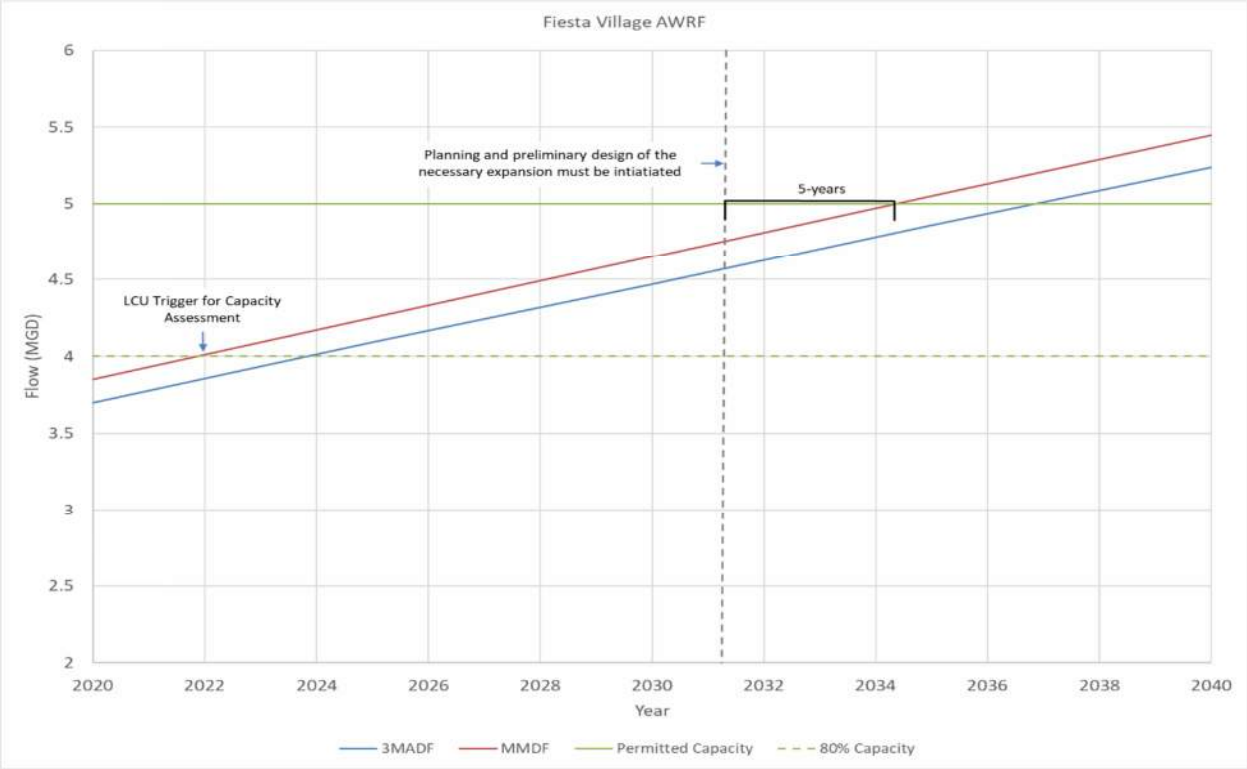


Figure 6-6 Fort Myers Beach AWRF Capacity Assessment

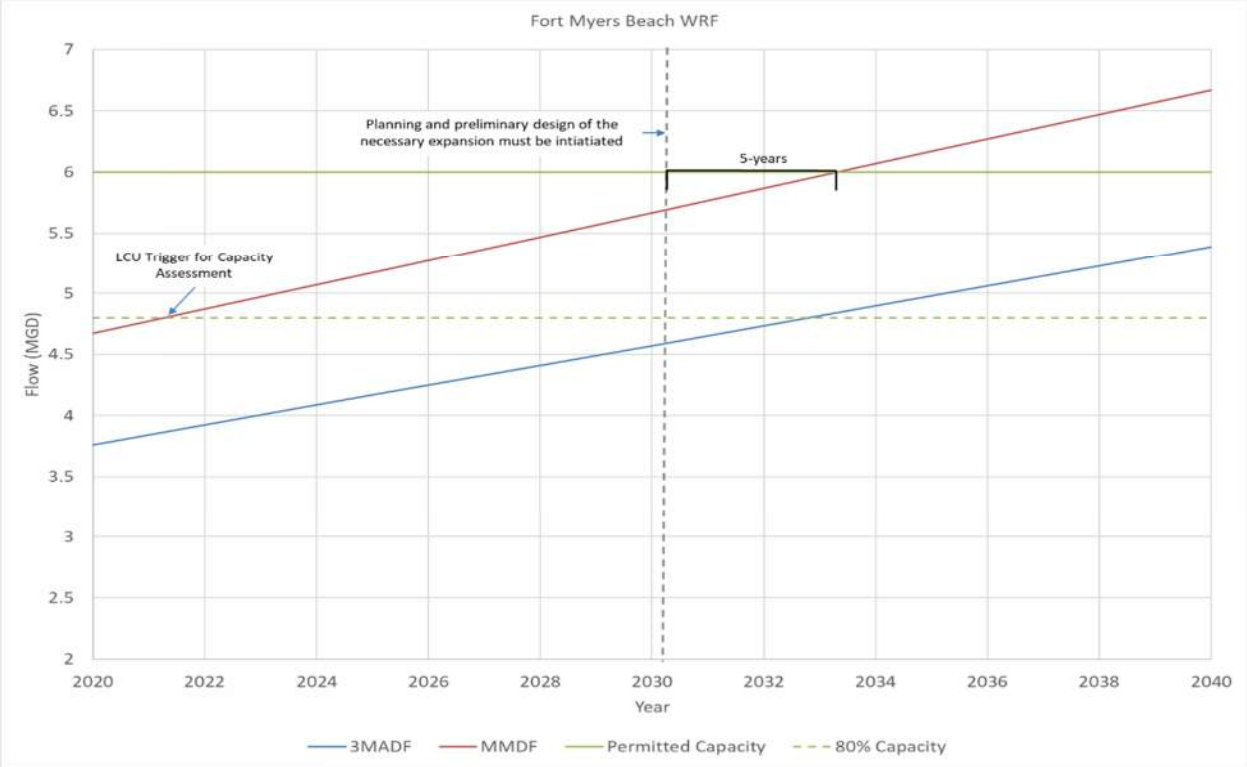


Figure 6-7 City of Fort Myers Central WWTP Capacity Analysis

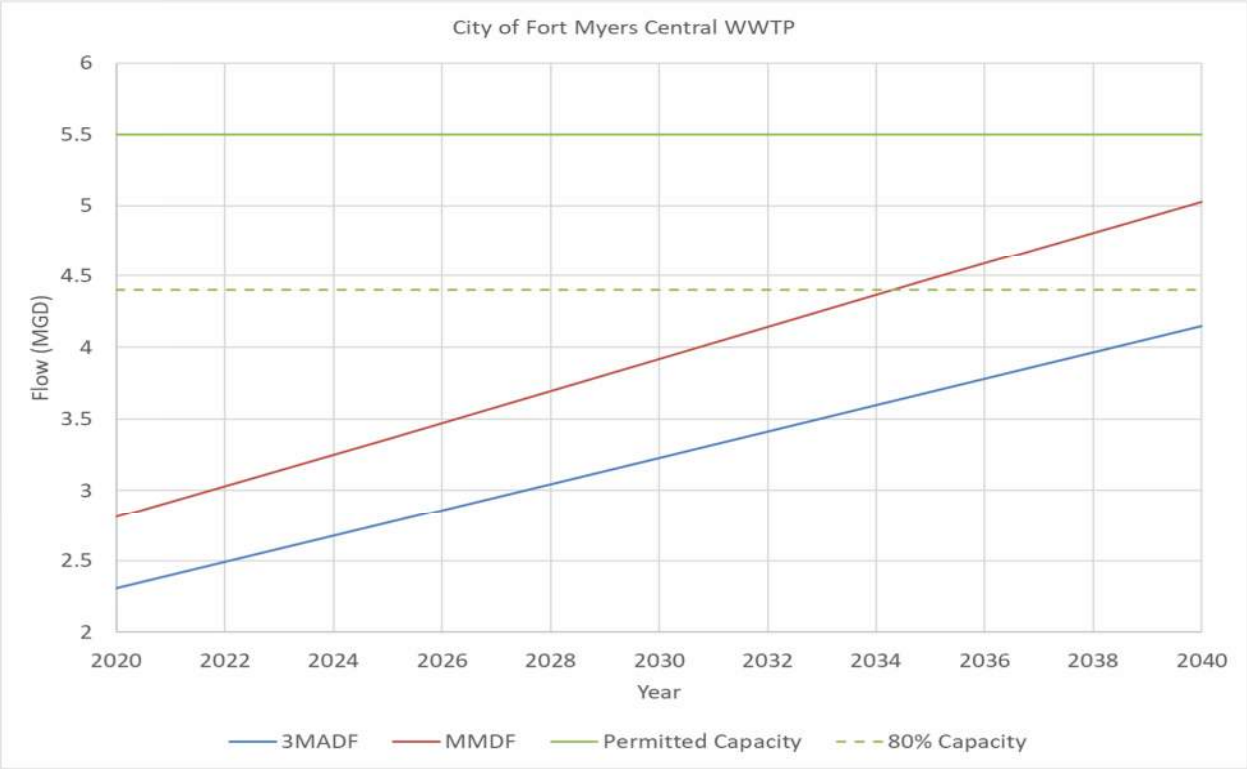


Figure 6-8 City of Fort Myers South WWTP Capacity Analysis

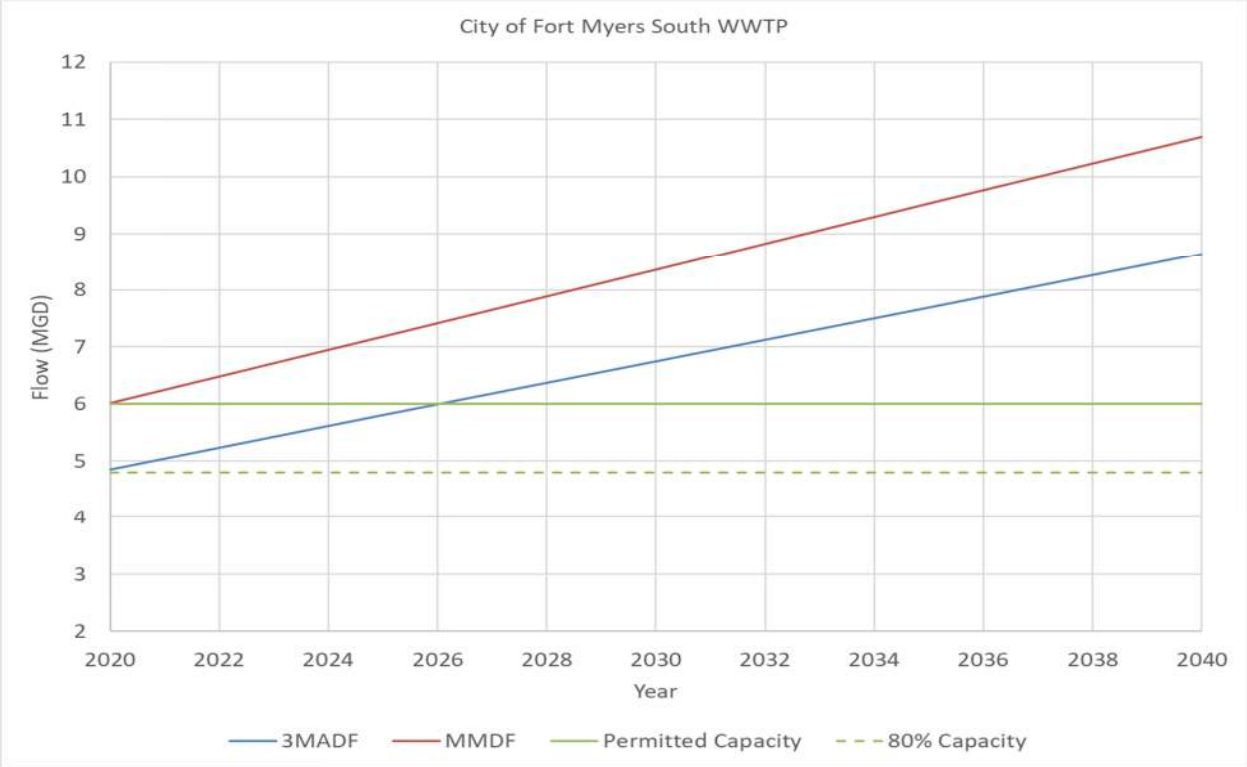


Figure 6-9 Gateway WRF Capacity Analysis

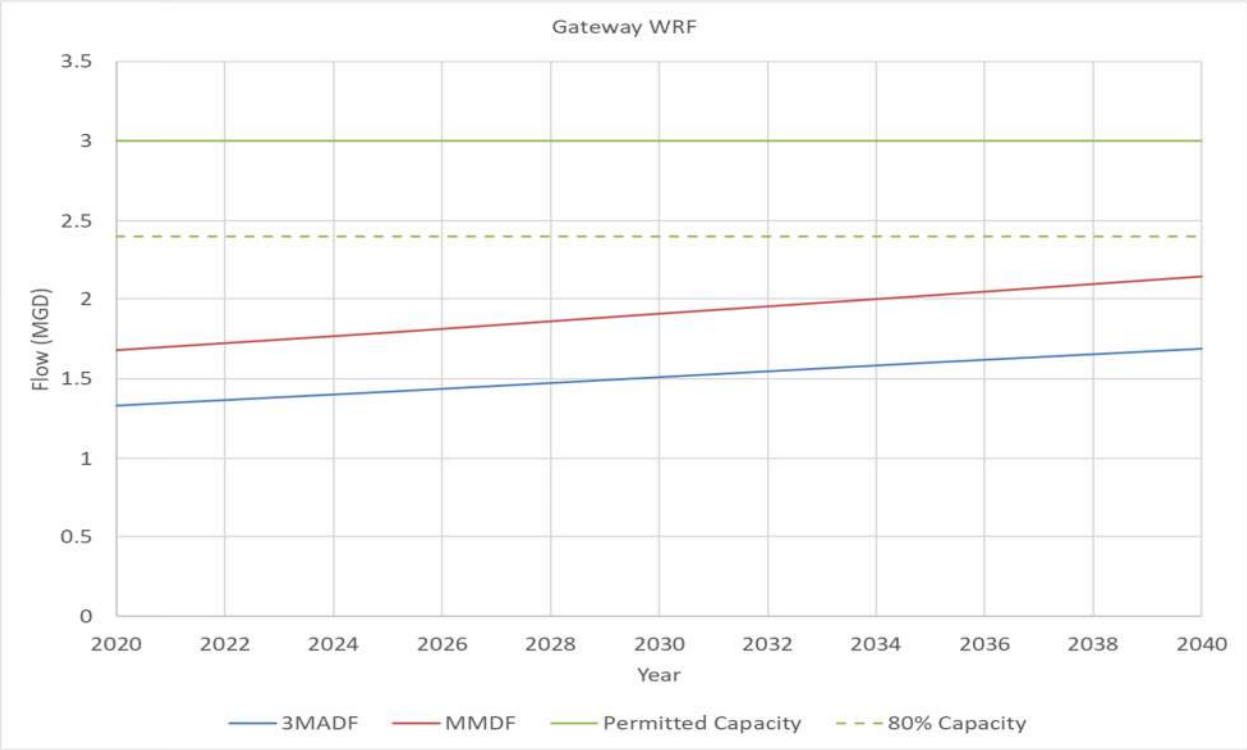


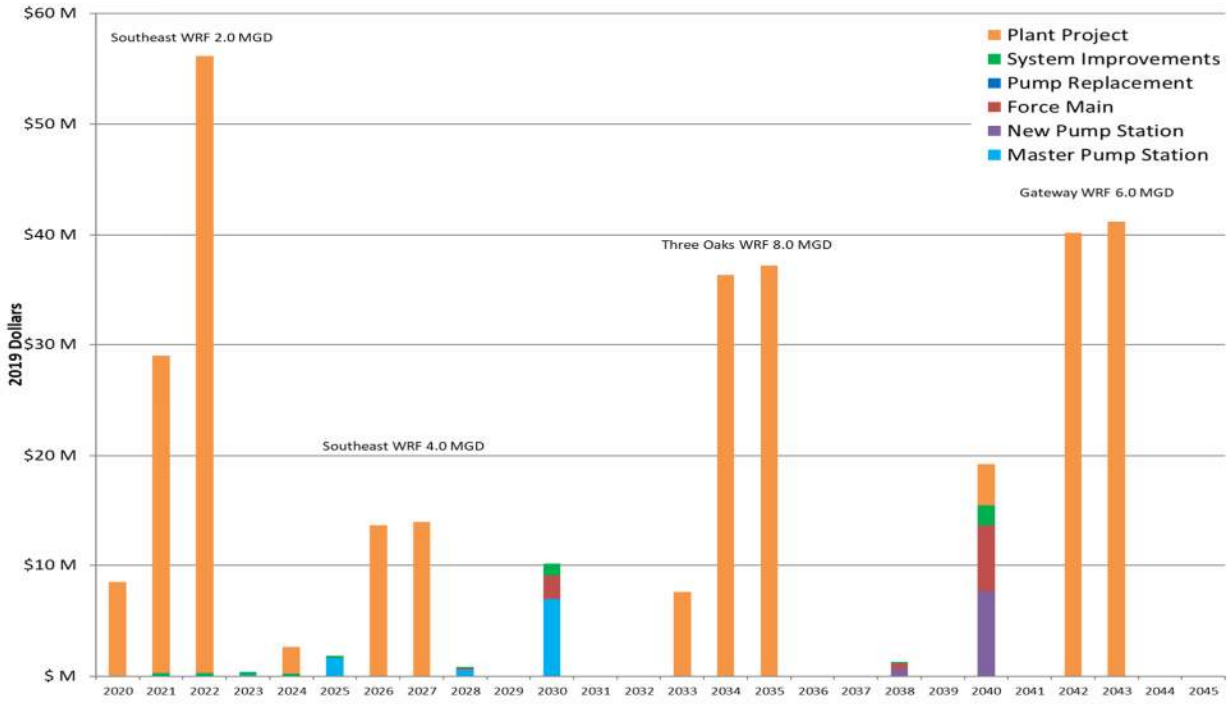
Figure 6-10 Pine Island WRF Capacity Analysis

The projected flows for Pine Island account for flows from the entirety of Pine Island and should be monitored accordingly.

6.5 CASH FLOW

The recommended CIP involves a number of significant capital cost projects through the 2040 planning horizon. **Figure 6-11** illustrates the required capital expenditure needs, including inflation, over the planning horizon assuming all design costs are encumbered at the beginning of the design period and all pump station and pipeline construction costs are encumbered at the beginning of the construction period. An inflation rate of 2.5% was applied to all project costs outside of the short-term CIP (5 years). However, due to the large cost of the treatment plant construction and expansion projects, those costs are encumbered for an approximate two-year construction period. Additionally, in accordance with LCU procurement practices, a one-year lag between design and construction was incorporated.

Figure 6-11 Capital Expenditure Needs Cash Flow Graph with Inflation



7.0 Capital Improvement Plan Funding Evaluation

7.1 CAPITAL PROGRAM FUNDING OVERVIEW

This section provides a high-level assessment of the potential funding options for the suite of capital improvement plan (CIP) projects included in **Table 6-2**. Key factors considered in performing a funding assessment for the list of projects include the following:

1. **Project Feature**: The nature and purpose of the CIP project and the multi-benefit objectives that the project fulfills;
2. **Current Funding Approach**: The capital financing approach that Lee County Utilities (LCU) currently uses and has historically used to support capital projects;
3. **Potential Capital Project Funding Sources**: A high level overview of a few financing mechanisms including grants that LCU may be able to leverage; and
4. **Project Funding Matrix**: Summary evaluation of one or more funding sources for a project or aggregate of projects.

7.1.1 Master Plan CIP Project Feature Overview

As indicated in **Table 6-2**, the suite of CIP projects relates to both system improvements on existing wastewater infrastructure such as collection system and force mains and the development of new infrastructure such as new pump stations and new wastewater treatment plan facility. The key purpose of the system improvements vs new facilities are as follows:

- **Existing Force Main System Improvements**: The existing system improvements, to be performed in a phased approach between 2020 and 2038. These improvements consist of several projects geared towards upgrading/replacing the existing force mains.
- **Master Pump Station**: This CIP entails installing a larger master pump station facility rather than a completing the rehabilitation of several existing smaller pump stations, whose pumping capacity will be exceeded within the planning horizon.
- **New Pump Stations Development**: This CIP entails the development of new pump station facilities to pump the additional flows, expected from the annexation of service area, to the WRFs.
- **Transmission (Force Main) Capacity Expansion**: This CIP entails expansion of transmission capacity to accommodate growth in wastewater flows.
- **Expansion of WRF and New WRF**: The construction and expansion of a new Southeast WRF, including offsite infrastructure of associated force mains and pumping infrastructure, and the expansion of the existing Three Oaks and Gateway WRFs during the 20-year planning horizon. The construction of a new WRF is necessary to accommodate growth in wastewater flows, and the expansions to the two existing WRFs are also expected to accommodate growth in reclaimed water demand beyond 2040.

The distinction, between repair & rehabilitation (R&R) type improvements on existing infrastructure and system expansion type projects, is important as the type and purpose of capital

improvement have an influence on the applicability of funding sources. Similarly, with respect to funding the utility capital program, it is important to recognize the distinction between the two key terms of "revenue" and "financing":

- **Revenue**: Revenue refers to either a recurring or one-time generation of money, which could then be used for funding capital program either in the form of "cash financing" of CIP or for paying debt service associated with capital program financing, subject to potential statutory requirements on the use of the revenues.
    - In the context of wastewater revenues, recurring operating revenues typically include wastewater user fees and charges that generate a fairly predictable stream of dedicated revenues, other miscellaneous sewer charges for services such as late fees, and any special surcharges such as septage hauler fees. Recurring capital revenues typically include system development charges (SDCs) or impact fees, or other types of special assessment charges that may have a sunset provision.
    - One-time revenues usually include grants or developer contribution received for specific capital projects or operating initiatives, or any other type of one time infusion of money such as a litigation settlement.
- **Financing**: Financing refers to funding generated primarily through long-term borrowing from the financial markets including municipal revenue bonds or general obligation bonds, or federal and state low interest loans. While these sources of funding providing timely and adequate funding for small and large CIP, a utility needs to have the financial capability in the form of adequate revenues to repay the principal and interest associated with these long-term debt financing mechanisms.

Hence, a holistic assessment of funding feasibility for any planned existing and future CIP must include an evaluation of both the "revenue" sources and "financing" mechanisms so that a reliable capital funding proforma cash flow analysis could be developed.

7.1.2 Current Capital Projects Funding Approach

The LCU has a dedicated Sewer Enterprise Fund, for which the primary source of revenues is the LCU's sewer user charges and fees. Historically, LCU has funded capital projects primarily through a combination of funding sources which include the following:

- Clean Water State Revolving Funds (CWSRF);
- Utility revenue bonds;
- Sewer connection fees; and
- Sewer user fee revenues

7.1.3 Potential Capital Projects Funding Sources

From a capital program funding best practice perspective, capital projects that result in assets that have a useful life of greater than 10 years and are capital intensive are ideally suited to a combination of "financing mix" including cash financing from user fee revenues and grants, and long-term debt financing with the repayment of debt through recurring operating and capital revenues.

A brief discussion, of potential capital funding sources that could be leveraged for the 20-year CIP, is presented in **Table 7-1**. The programs detailed in **Table 7-1** include a combination of low interest loans and grants that typically provide funding for pre-construction, construction, and maintenance activities related to wastewater capital projects. Each program is based on specific goals and objectives, supports specific operating and funding characteristics, requires the completion of a dedicated application process, and awards funds on a competitive basis to projects that best exemplify the goals and objectives of the program.

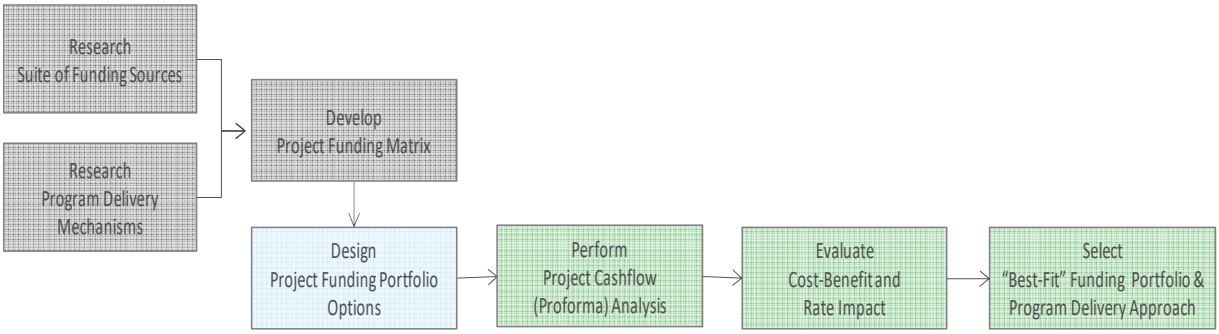
7.2 WASTEWATER MASTER PLAN CIP FUNDING EVALUATION

As indicated above, the suite of wastewater master plan projects planned for the 2020 through 2040 horizon are geared to providing multiple community benefits, including enhancing existing system integrity through force main replacements and pump station replacement along with new WRF and expansions to accommodate customer growth and reclaimed water demand. When evaluating funding, it would be prudent to leverage the multi-benefit outcomes of the projects, so as to achieve a lowest cost funding mix.

7.2.1 CIP Funding Evaluation Process

Developing a CIP funding portfolio requires research, developing partnerships, defining alternative portfolios, evaluating cost/benefits, and selecting a "best-fit" funding portfolio that optimizes the costs and benefits. **Figure 7-1** illustrates the potential steps involved in the Program Portfolio Funding evaluation process.

Figure 7-1 Wastewater Master Plan CIP Portfolio Evaluation Process



- Researching various funding sources, as discussed in **Table 7-1**, is essential to identify one or more funding sources that maybe applicable to a specific multi-year program such as the force main system rehabilitation or a single large project such as the southeast WRF.
- Based on the findings of funding sources, a viable funding matrix can then be developed.
- The project planning and execution timing can be modified as maybe necessary taking in to consideration not only the growth and rehabilitation needs but also the availability and timing of funding sources.
- An overall capital cash flow proforma analysis integrating the funding portfolio options defined for the masterplan CIP and LCU's existing CIP will help provide a holistic assessment of the overall financial impact on future annual debt service projections and user rate impact.

Table 7-1 Potential Funding Sources for the 2020 – 2045 Wastewater CIP

Line	Program	Description	Type of Funding	Eligibility	Other
1	**Florida Clean Water State Revolving Fund Loan (CWSRF)**	This is administered by the Florida Department of Environmental Protection (FDEP) with joint funding from the U.S. Environmental Protection Agency (EPA) and the State of Florida. Awarded over $1.1 billion during the last 5 years for a variety of wastewater and stormwater projects.	Source: STATE 1. Low Interest Loans 2. Maximum amortization period is 20 years Note: - The CWSRF financing rate is determined using the Bond Buyer 20-Bond GO Index average market rate that exists during the fiscal quarter preceding the application time frame; - In addition, financing rates are determined considering the median household income, the poverty index, and the unemployment index, but average less than 50 percent of the market rate. - Interest rates could be lower than 2%	1. Municipalities, utilities, and small communities are all eligible to seek funding. 2. Smaller communities may even be eligible for some grants. 3. This program provides low-interest loans, on a competitive basis, for planning, designing and constructing water pollution control facilities.	1. Significant funding in the State for rehabilitation of wastewater infrastructure and the protection of water quality. 2. Repayment of equal principal and interest can be structured to begin on completion of construction.
2	**Water Infrastructure Finance and Innovation Act (WIFIA) Program**	WIFIA program is designed to accelerate investment in water, sewer, and stormwater infrastructure by providing long-term, low cost, supplemental credit assistance under customized terms to creditworthy projects of national and regional significance.	Source: FEDERAL 1. Low Interest Loans 2. WIFIA will fund 49% of the total Project cost. 3. Maximum amortization period could be up to 35 years. 4. Interest rate set equal to or greater than the Treasury rate as of the date of closing;	1. Local, state, tribe, and federal government entities. 2. Corporations and trusts 3. Partnerships and joint ventures (P3s). 4. Clean Water and Drinking Water SRF Programs. 5. $5.0 million is the minimum project size	Type of Projects & Activities to be funded: 1. Development-phase activities; 2. Construction, reconstruction, rehabilitation, and replacement activities; 3. Acquisition or interest in real property; and

Line	Program	Description	Type of Funding	Eligibility	Other
			interest rate could be 3% or higher. 5. Repayment can be deferred during construction and up to five years after project completion. 6. Could provide flexible financial terms without risk of higher interest rate.	for small communities (population < 25,000). 6. $20.0 million is the minimum project size for large communities. 7. Projects serving the same purpose may be bundled to qualify	4. Capitalized interest, capital issuance expense, carrying cost during construction.
3	**Cooperative Funding Program (South Florida Water Management District - SFWMD)**	SFWMD is a regional governmental agency that manages the water resources in the southern half of the state. The District provides funding for Alternative Water Supply, Stormwater, and Water Conservation projects. Reclaimed water plants and transmission expansions qualify for Alternative Water Supply grants.	1. Grant Funding. 2. Grant funding applications accepted annually, and the application receipts are closed by August of each year.	Source: REGIONAL WMD 1. Local governments; special districts; utilities; homeowners associations; and other public and private organizations 2. Alternative Water Supply projects must be construction ready projects.	1. The District has provided approximately $215.0 Million in budgeted grants for Alternative Water Supply projects during 1997 through 2018. 2. Project matching requirements may apply.
4	**Community Development Block Grant (CDBG)**	CDBG funds are used for long term community needs involving housing, economic development, infrastructure development, and the prevention of damage due to natural disasters and other situations. Additionally, funds administered through this program cannot be duplicated with FEMA, the Small Business Administration, and the United States Army Corp. of Engineers.	1. Grant Funding	Source: FEDERAL 1. Metropolitan Cities with a population of at least 50,000. 2. Urban Counties with a population of at least 200,000 (excluding the population of entitled cities).	1. To qualify, applicant must submit a Consolidated Plan. 2. HUD notifies the eligible jurisdictions and these jurisdictions must submit an Action Plan that outlines the needs, strategies, and project uses of the funds. 3. Not less than 70% of funds must be for

Line	Program	Description	Type of Funding	Eligibility	Other
		Funds administered through this program can be used to match FEMA grants.			activities that benefit low and moderate income persons.
5	**Municipal General Obligation (GO) Bonds**	A long-term borrowing mechanism, where the bond is backed by the credit and taxing power of the jurisdiction that issues such bonds. These bonds are typically issued by public entities to finance any type off public capital programs and/or projects.	1. Long-term bond usually with a 20 to 30 year amortization period 2. Revenues including tax revenues could be used to repay the debt	1. Jurisdiction can issue this type of GO Bond as and when required subject to local jurisdictional requirements and market conditions	1. No assets are pledged as collateral
6	**Municipal Utility Revenue Bonds**	A long-term borrowing mechanism, where the bond is backed by "project revenues" rather than the jurisdiction's tax revenues.	1. Long-term bond usually with a 20 to 30 year amortization period 2. Typically, the utility's user fee service revenues provide the cash flow to repay the debt obligations 3. These bonds generally are issued at the market rate and the rates could be higher than the low interest CWSRF loans.	1. Jurisdiction can issue this type of Utility Revenue Bond as and when required subject to utility charter and bond covenants. 2. Must demonstrate a utility revenue program that is viable to meet the debt payment, debt service coverage and debt service reserve requirements.	

7.2.2 Master Plan CIP Funding Matrix

Based on a high level evaluation of potential sources of funding available at the Federal, State, and Regional levels, a CIP Funding Matrix was developed to provide insights in to the applicability of various sources of revenues and financing mechanisms, for funding one or more projects in the wastewater master plan CIP.

Examining a portfolio of funding is essential for the following reasons:

- The Project involves significant capital investment and will exert pressure on the LCU's existing funding capacity and rate payer affordability. Hence, it is necessary to examine multiple sources of funding that maximize benefits while minimizing costs;
- Multiple sources of funding may be available for individual projects. Integrating multiple funding sources could enhance the ability to meet fund matching requirements that certain funding mechanisms require. For instance, grants can be leveraged to meet fund matching requirements of a CWSRF, and CWSRF loan amount in turn can be used to meet the fund matching requirements of Water Infrastructure Finance and Innovation Act (WIFIA). The cumulative benefit of such leveraging would be a reduction in the overall amount of borrowing and/or ability to pace both the levels of annual repayment and the timing of those repayments so as to ultimately mitigate the pressure on stormwater user rates and charges;
- Develop the flexibility to aggregate multiple projects that serve a specific purpose, in to a single larger package, which may enhance the competitiveness when seeking federal or state funding. In addition, such aggregation could help leverage a funding source such as WIFIA that maybe available in the immediate term but may not exist at a future time, and
- The Alternative Water Supply (AWS) aspects of the WRF projects can be leveraged to garner competitive grant funding, as AWS is a key issue in Florida.

Table 7-2 illustrates our team's evaluation of the potential sources of funding for the wastewater master plan CIP projects. It is important to note that in **Table 7-2**, we have aggregated Force Main system improvement projects in to two time periods – through 2024, and those between 2025 through 2040. The matrix provides a quick snap shot of what types of funding sources may be applicable to the projects.

7.2.3 Example of Funding Portfolio for the Southeast WRF Construction

An illustration of the funding portfolio concept is presented in **Table 7-3**, where a combination of funding sources are leveraged to minimize borrowing cost while enhancing the competitiveness of the Project. The hypothetical example illustrates creating a funding portfolio that includes a mix of CWSRF Loan; WIFIA Loan; and assumes potential grants from the Cooperative Funding Program Grant (SFWMD); SDC revenues; and sewer user rates and charges.

Table 7-2 Example of Program Portfolio Funding

Line	Project / Program	Total Cost		Potential Funding Sources				
			Budget Year	CWSRF	WIFIA[1]	Bond Finance	Sewer Connection Fees	Grants[2]
1	Transmission (Force Main) Capacity Expansion	$8,706,706	2028	x		x	x	
2	New Pump Station Development	$8,276,135	2038	x		x	x	
3	Master Pump Station	$9,264,980	2023[3]	x		x		
4	Existing Force Main System Improvements (through 2024)	$1,205,416	2021	x		x		
5	Existing Force Main System Improvements (2025-2040)	$3,028,252	2025	x		x		
6	WRF Gateway (expansion)	$85,197,105	2040	x	x	x	x	x
7	WRF Three Oaks (expansion)	$80,890,416	2033	x	x	x	x	x
8	WRF Southeast (new)	$63,560,000	2021	x	x	x	x	x
9	WRF Southeast (new offsite infrastructure)	$29,537,999	2020	x	x	x	x	x
10	WRF Southeast (expansion)	$29,857,063	2024	x	x	x	x	x
	Total	$319,524,072						

[1] Availability of WIFIA funding for long term projects is uncertain; project minimum is typically $20.0 Million

[2] See lines 3 and 4 in Table 7-1 for potential grant opportunities

[3] The 2023 budget year only applies to the Master Pump Station projects if the rehabilitation of PS 2256 is planned. Master pump stations will be part of the long term CIP otherwise.

Table 7-3 Hypothetical Example of Project Portfolio Funding

Line	Description	Example Funding Options	Hypothetical Funding Amounts
1	Technical Planning & Design Costs ($15,013,444)	- WIFIA Loan (49% Planning & Design Costs and 35 Year Loan Term) - Utility Revenue Bonds (residual amount)	- $7,356,588 - $7,656,856
2	Construction Costs ($78,084,555)	- CWSRF Loan (41% Construction Costs and 20 Year Loan Term) - WIFIA Loan (49% Construction Cost and 35 Year Loan Term) - Potential Grants (a) - Utility Revenue Bonds (residual amount)	- $32,014,668 - $38,261,432 - $500,000 - $7,308,456
3	Annual Loan Debt Repayment	- Sewer User Fee Revenues - Connection Fee Revenues	

(a) Likely maximum based on 2013-2018 SFWMD grant funding records

Appendix A – Population and Flow Projections TM

FINAL

LEE COUNTY UTILITIES WASTEWATER MASTER PLAN

Population and Flow Projections Technical Memorandum

B&V PROJECT NO. 199611

PREPARED FOR

Lee County Utilities

26 AUGUST 2019

Lee County Southwest Florida

BLACK & VEATCH

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

3MADF	Three Month Average Daily Flow
AADF	Annual Average Daily Flow
AWRF	Advanced Water Reclamation Facility
BSF	Base Sanitary Flow
BEBR	Bureau of Economic and Business Research
CFM	City of Fort Myers
DWL	Dry Weather Loadings
FDEP	Florida Department of Environmental Protection
GIS	Geographic Information System
GWI	Groundwater Infiltration
gpm	Gallons per Minute
HOA	Home Owner's Association
I&I	Inflow and Infiltration
kgal	Thousand Gallons
LCU	Lee County Utilities
MMDF	Maximum Monthly Daily Flow
MG	Million Gallons
MGD	Million Gallons per Day
MPO	Metropolitan Planning Organization
NOAA	National Oceanic and Atmospheric Administration
NCDC	National Climatic Data Center
mi	Mile
PF	Peaking Factor
PHF	Peak Hour Flow
RDII	Rainfall Dependent Inflow and Infiltration
SCADA	Supervisory Controls and Data Acquisition
SFWMD	South Florida Water Management District
TAZ	Traffic Analysis Zone
TWC	Total Water Consumption
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

1.0 Introduction

Lee County Utilities (LCU) is located in Southwest Florida. LCU's wastewater collection, conveyance, and treatment system covers a service area of approximately 180 square miles and is composed of four regional water reclamation facilities (WRF) and one advance water reclamation facility (AWRF) . In addition to the five LCU owned WRFs, LCU owns half of the permitted capacity of the City of Fort Myer's (CFM) two wastewater treatment plants, CFM South and CFM Central. LCU currently serves a permanent residential population of approximately 144,000 people with an additional 25,920 seasonal residents. Population is a key component of estimating dry weather collection flows. The following sections document how the total system flows were calculated for the base and future planning years (2016, 2020, 2025, 2030, 2035 and 2040.), and how those flows are spatially allocated throughout the collection system.

The following is a list of the data sources used for the population and demand analysis:

- Lee County Planning Department staff,
- University of Florida Bureau of Economic and Business Research (BEBR),
- US Census,
- Lee County Metropolitan Planning Organization (MPO) Traffic Analysis Zone data (TAZ),
- South Florida Water Management District (SFWMD),
- The County's Public Supply Annual Reports,
- The County's supervisory control and data acquisition (SCADA) controls and monitoring data.

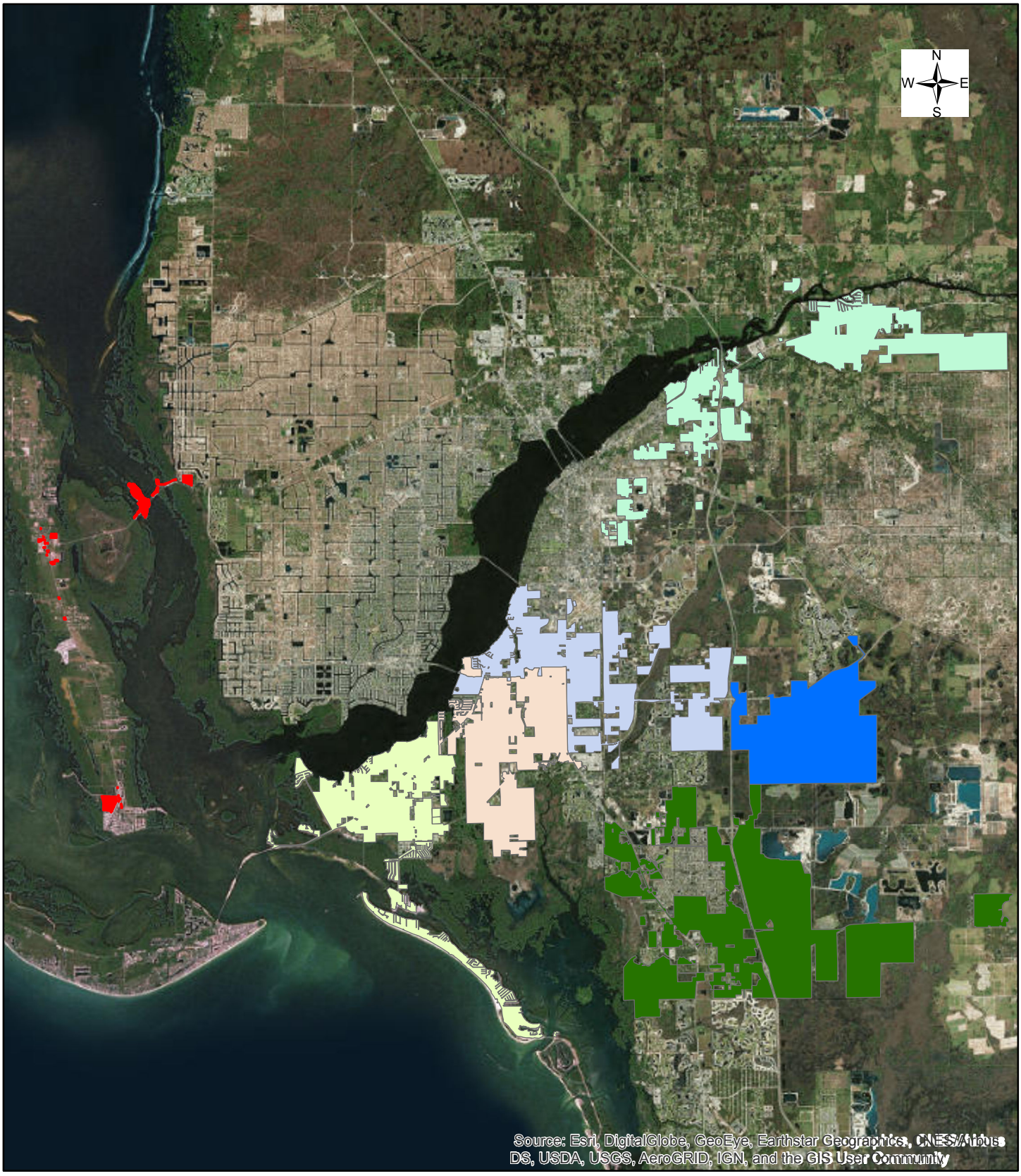
This data was used to develop the future collection system flows, diurnal pattern, peaking factors and the inflow and infiltration (I&I) contribution.

2.0 Historic Population and Existing System Flows

It is common practice to use historic population, historic flow trends and population projections to predict future collection flows. The current flow was used as a base scenario and the future flows were projected based on developed population predictions. The following section documents the analysis of LCU's historic population and demands.

2.1 HISTORIC POPULATION ESTIMATES

The spatial distribution of the historic population for all of Lee County was provided via the 2010 US Census and 2010 TAZ shapefile data. However, the BEBR population data was assumed to be the controlling total population, as referenced in the Florida Administrative Code. Since the BEBR data has no spatial distribution, the 2010 US Census and 2016 TAZ population totals were adjusted to match the BEBR population totals and their spatial distribution was used. The data was then analyzed in comparison to the LCU's facility service area boundaries using ESRI's ArcGIS to determine the historic population per service area. For the years between 2010 and 2016, where the spatial distribution of population was not provided, a linear interpolation between 2010 and 2016 was assumed using the BEBR population data as the controlling total population. The current LCU service areas are shown in **Figure 1** and the historic populations for Lee County and each service area are summarized in **Table 1**.



Lee County Southwest Florida

BLACK & VEATCH

- Fiesta Village
- Ft. Myers Beach
- Gateway
- Pine Island
- Three Oaks
- Ft. Myers Central (LCU Area)
- Ft. Myers South (LCU Area)

0 10,000 20,000
Feet

1:250,000

LEE COUNTY

Wastewater Master Plan

FIGURE 1

CURRENT SERVICE AREA

In order to accurately predict peak month flows during winter months; the seasonal population must be added to the residential population to produce what is called the functional population. LCU has indicated that their seasonal population is an additional 18%.

Table 1: Historic Population Estimates

SERVICE AREA	YEAR							
	Population	2010	2011	2012	2013	2014	2015	2016
Lee County Population	Permanent (BEBR)	618,754	625,310	638,029	643,367	653,485	665,845	680,539
1. Fiesta Village Service Area	Permanent	24,649	24,714	24,779	24,844	24,909	24,974	25,039
	Seasonal	4,437	4,449	4,460	4,472	4,484	4,495	4,507
	Functional	29,086	29,162	29,239	29,316	29,393	29,469	29,546
2. Fort Myers Beach Service Area	Permanent	23,239	23,238	23,237	23,236	23,234	23,233	23,232
	Seasonal	4,183	4,183	4,183	4,182	4,182	4,182	4,182
	Functional	27,422	27,421	27,419	27,418	27,417	27,415	27,414
3. Fort Myers Central Service Area (LCU Flow)	Permanent	17,203	17,221	17,238	17,255	17,273	17,290	17,307
	Seasonal	3,097	3,100	3,103	3,106	3,109	3,112	3,115
	Functional	20,300	20,320	20,341	20,361	20,382	20,402	20,422
4. Fort Myers South Service Area (LCU Flow)	Permanent	29,223	29,128	29,033	28,938	28,843	28,748	28,653
	Seasonal	5,260	5,243	5,226	5,209	5,192	5,175	5,158
	Functional	34,483	34,371	34,259	34,147	34,035	33,923	33,811
5. Gateway Service Area	Permanent	8,884	8,973	9,061	9,149	9,237	9,326	9,414
	Seasonal	1,599	1,615	1,631	1,647	1,663	1,679	1,695
	Functional	10,483	10,588	10,692	10,796	10,900	11,004	11,108
6. Pine Island Service Area	Permanent	878	864	850	835	821	807	793
	Seasonal	158	156	153	150	148	145	143
	Functional	1,036	1,019	1,003	986	969	952	935
7. Three Oaks Service Area	Permanent	20,363	21,297	22,231	23,165	24,099	25,034	25,968
	Seasonal	3,665	3,833	4,002	4,170	4,338	4,506	4,674
	Functional	24,028	25,130	26,233	27,335	28,437	29,540	30,642
Total LCU Service Areas	Permanent	124,439	125,434	126,428	127,423	128,417	129,411	130,406
	Seasonal	22,399	22,578	22,757	22,936	23,115	23,294	23,473
	Functional	146,839	148,012	149,185	150,359	151,532	152,706	153,879

2.2 HISTORIC WASTEWATER INFLUENT FLOWS

2.2.1 Existing System Flows

The historic facility flows for the seven services areas included in this Master Plan were analyzed for the past 8 years to calculate the average annual daily flow (AADF), three-month average daily flow (3MADF), max month daily flow (MMDF), and peak hour flow (PHF). These peaking factors will be used when analyzing the future system capacity. An 8-year and 5-year average is summarized for all the service areas in **Table 2.** The Three Oaks historical flows are also graphically shown in **Figure 2**, while the other service area figures are provided in **Appendix A**.

Table 2: Historic Flow Estimates

SERVICE AREA	WASTEWATER INFLUENT FLOW (MGD)	8-YEAR AVERAGE[2]	5-YEAR AVERAGE[2]
Fiesta Village Service Area	Average Annual Daily Flow (AADF)	3.14	3.17
	Three Month Average Daily Flow (3MADF)	3.51	3.52
	Max Month Daily Flow (MMDF)	3.64	3.66
	Peak Hour Flow (PHF)[1]	3.95	3.97
Fort Myers Beach Service Area	Average Annual Daily Flow (AADF)	3.40	3.48
	Three Month Average Daily Flow (3MADF)	4.06	4.17
	Max Month Daily Flow (MMDF)	4.26	4.39
	Peak Hour Flow (PHF)[1]	4.62	4.75
Fort Myers Central Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	0.73	0.73
	Three Month Average Daily Flow (3MADF)	0.88	0.88
	Max Month Daily Flow (MMDF)	0.93	0.93
	Peak Hour Flow (PHF)[1]	1.02	1.02
Fort Myers South Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	4.30	4.30
	Three Month Average Daily Flow (3MADF)	4.83	4.83
	Max Month Daily Flow (MMDF)	5.07	5.07
	Peak Hour Flow (PHF)[1]	5.45	5.45
Gateway Service Area	Average Annual Daily Flow (AADF)	1.19	1.28
	Three Month Average Daily Flow (3MADF)	1.33	1.42
	Max Month Daily Flow (MMDF)	1.42	1.55
	Peak Hour Flow (PHF)[1]	1.61	1.76
Pine Island Service Area	Average Annual Daily Flow (AADF)	0.13	0.13
	Three Month Average Daily Flow (3MADF)	0.15	0.15
	Max Month Daily Flow (MMDF)	0.16	0.16
	Peak Hour Flow (PHF)[1]	0.22	0.22
Three Oaks Service Area	Average Annual Daily Flow (AADF)	2.97	3.04
	Three Month Average Daily Flow (3MADF)	3.27	3.31
	Max Month Daily Flow (MMDF)	3.37	3.42
	Peak Hour Flow (PHF)[1]	3.65	3.70

1. Peak Hour Flow (PHF) was calculated using the 10-State Standard: PHF = Qavg(18+sqrt(Population))/4+sqrt(Population)
2. 2016 Population estimates were used for 2017 and 2018

NOTE: The peak hour flows (PHF) in **Table 2** were calculated from 10 States Standards using the following formula: PHF = Q_{avg} (18+sqrt(Population))/4+sqrt(Population).

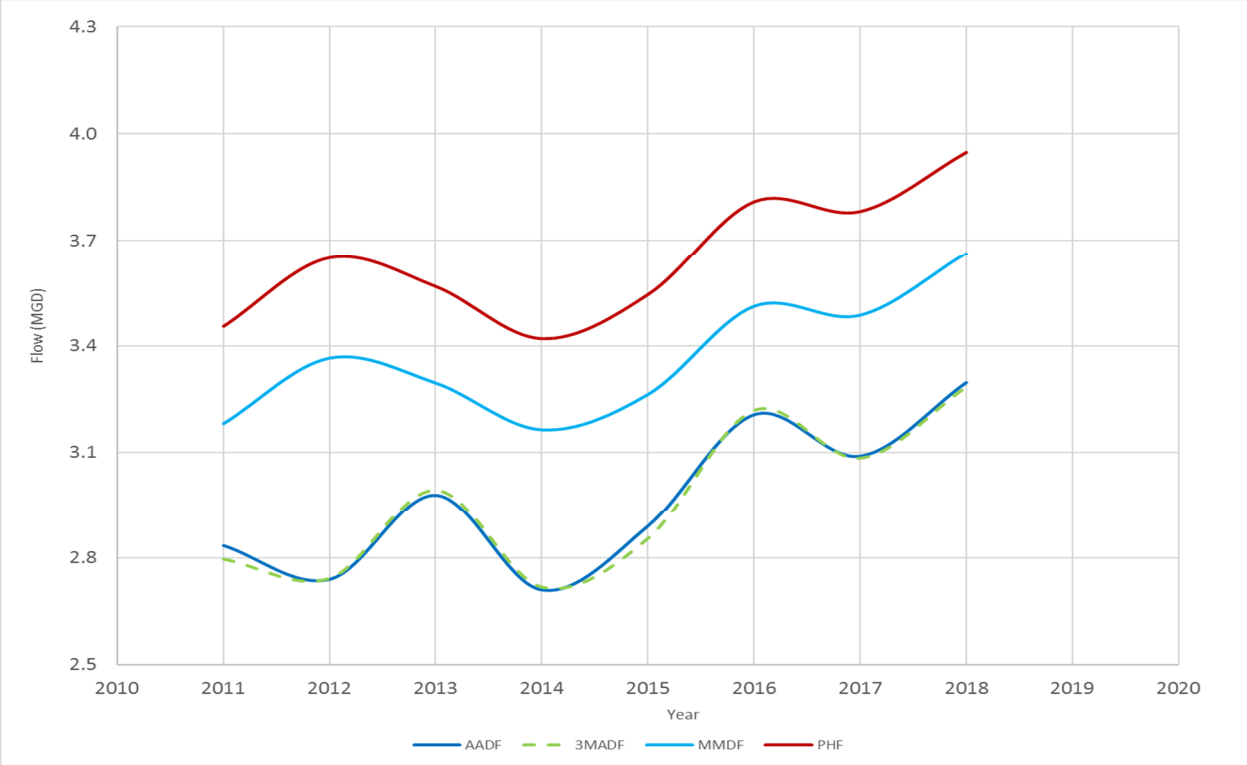


Figure 2: Three Oaks WRF Historic System Influent Flows

2.2.2 Totalized Per Capita Flows

Per Capita flows are the flow contribution per person and can be calculated by dividing the average influent flow by the total population within the collection system service area. The per capita flows are then used in conjunction with the population projections to forecast future flows. The AADF, 3MADF, and MMDF per capita demands were calculated by dividing flows in **Table 2** by the populations summarized in **Table 1**; the results are summarized in **Table 3**. During the analysis, if it was determined that the service area's maximum month flows (MMDF) occurred during the winter months (November – April), the functional population was used in the calculation to account for seasonal population fluctuations, the permanent population was used all other times.

NOTE: The totalized per capita flow estimations includes all flows entering the treatment facilities including base sanitary flows (BSF), groundwater infiltration (GWI) and rain derived inflow and infiltration (RDII). These will be further defined and detailed in this technical memorandum, and the BSF per capita demands will be normalized.

Table 3: Totalized Per Capita Flow

SERVICE AREA	WASTEWATER INFLUENT FLOW (GPCD)	8-YEAR AVERAGE	5-YEAR AVERAGE
Fiesta Village Service Area	Average Annual Daily Flow (AADF)	125.94	126.81
	Three Month Average Daily Flow (3MADF)	135.60	132.47
	Max Month Daily Flow (MMDF)	140.90	137.90
Fort Myers Beach Service Area	Average Annual Daily Flow (AADF)	146.20	149.76
	Three Month Average Daily Flow (3MADF)	148.07	152.26
	Max Month Daily Flow (MMDF)	155.52	160.08
Fort Myers Central Service Area (LCU Flow)[1.]	Average Annual Daily Flow (AADF)	103.92	104.93
	Three Month Average Daily Flow (3MADF)	112.54	113.05
	Max Month Daily Flow (MMDF)	115.67	115.90
Fort Myers South Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	126.95	126.95
	Three Month Average Daily Flow (3MADF)	142.77	142.77
	Max Month Daily Flow (MMDF)	149.84	149.84
Gateway Service Area	Average Annual Daily Flow (AADF)	128.64	136.37
	Three Month Average Daily Flow (3MADF)	133.26	139.25
	Max Month Daily Flow (MMDF)	142.80	153.13
Pine Island Service Area	Average Annual Daily Flow (AADF)	153.26	156.14
	Three Month Average Daily Flow (3MADF)	153.74	160.30
	Max Month Daily Flow (MMDF)	160.73	168.09
Three Oaks Service Area	Average Annual Daily Flow (AADF)	122.77	119.46
	Three Month Average Daily Flow (3MADF)	124.85	122.20
	Max Month Daily Flow (MMDF)	128.59	126.11

1. Per capita flow for the City of fort Myers Central Plant were assumed to be equal to the per capita flows for the total LCU system.

2.2.3 Peaking Factors

The 8-year and 5-year average peaking factors for each service area were developed from the influent flows data as shown below in **Table 4**. These peaking factors will be used to assess future flows.

Table 4: Peaking Factor

SERVICE AREA	PEAKING FACTOR	8-YEAR AVERAGE	5-YEAR AVERAGE
Fiesta Village Service Area	3MADF/ AADF	1.12	1.11
	MMDF / AADF	1.16	1.15
	PHF / AADF	1.26	1.25
Fort Myers Beach Service Area	3MADF/ AADF	1.19	1.20
	MMDF / AADF	1.25	1.26
	PHF / AADF	1.36	1.36
Fort Myers Central Service Area (LCU Flow)	3MADF/ AADF	1.38	1.38
	MMDF / AADF	1.44	1.44
	PHF / AADF	1.58	1.58
Fort Myers South Service Area (LCU Flow)	3MADF/ AADF	1.12	1.12
	MMDF / AADF	1.18	1.18
	PHF / AADF	1.27	1.27
Gateway Service Area	3MADF/ AADF	1.11	1.11
	MMDF / AADF	1.18	1.20
	PHF / AADF	1.34	1.36
Pine Island Service Area	3MADF/ AADF	1.18	1.21
	MMDF / AADF	1.24	1.27
	PHF / AADF	1.73	1.78
Three Oaks Service Area	3MADF/ AADF	1.10	1.09
	MMDF / AADF	1.14	1.13
	PHF / AADF	1.23	1.22

2.3 RAINFALL ANALYSIS

To further refine and understand the impacts of growth and influence of inflow and infiltration (I&I), the influent flows of the treatment facilities were investigated further during dry and wet weather. As such, data from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) was analyzed for the rain gauge located at the SWFL-FM Airport. The historic records showed typical Florida weather patterns from January 2017 through December 2018 (**Figure 3**); the dry season for Lee County is between November and April and the wet season is between May and October. Both dry and wet weather periods were identified for analysis based on the rainfall data.

Dry Weather Periods: There was little to no rainfall during both March 2017 and January 2018. Therefore, these time periods were selected as the dry weather calibration timeframe.

Wet Weather Periods: Three historic significant storm events were identified to assess the wet weather impacts on the County's collections system: June 5-8, 2017; August 27-28, 2017 and June 23-26, 2018.

The criteria used to select the wet weather periods include: 1) high volume and 2) length of continuous rainfall. It should be noted that rainfall that occurred within twelve hours was classified as the same event. This caused some back-to-back storm events to be grouped together as a larger event.

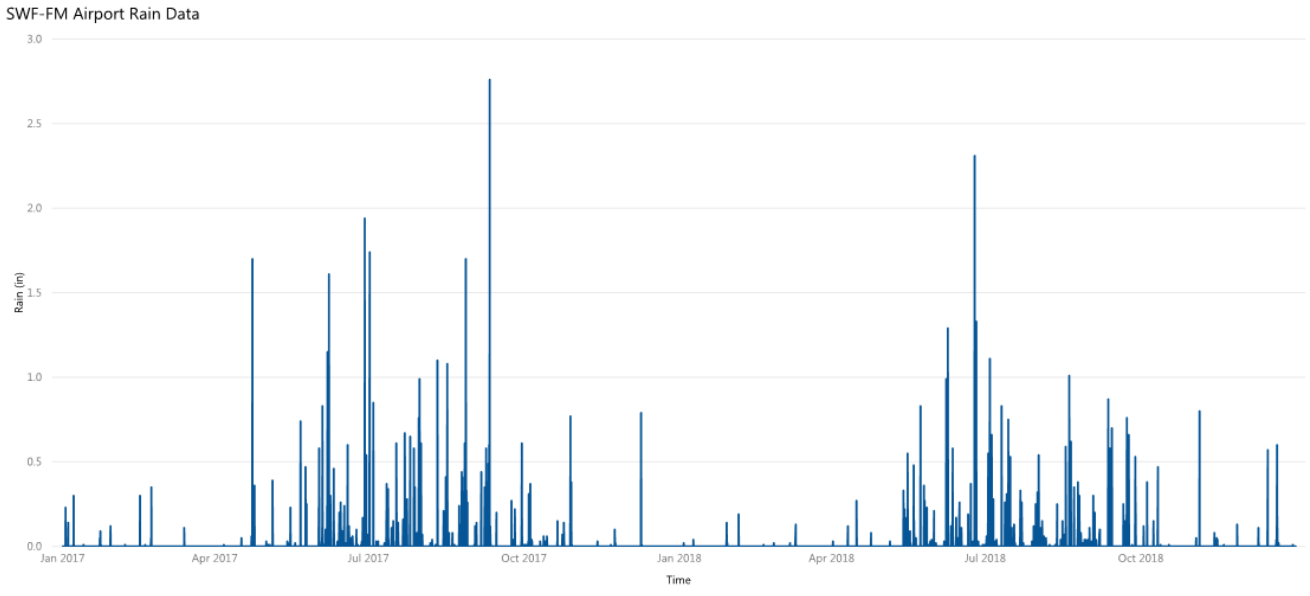


Figure 3: Rain Data 2017-2018 - SWF FM Airport

2.4 DRY WEATHER FLOW ANALYSIS

The facility influent flow data for both selected dry weather periods were analyzed to determine the dry weather loadings (DWL) for each service area. DWL is comprised of both groundwater infiltration (GWI) and base sanitary flows (BSF) and is applied to the system with a diurnal flow pattern for each service area. **Figure 4** below provides a graphical explanation of flows during dry weather. This breakdown enables a better understanding of the flows generated from normal infiltration due to high groundwater tables in Florida and the potable flow returned to the collection system after being used; base sanitary flow. During dry weather, these are typically the only two sources of flow into the collection system.

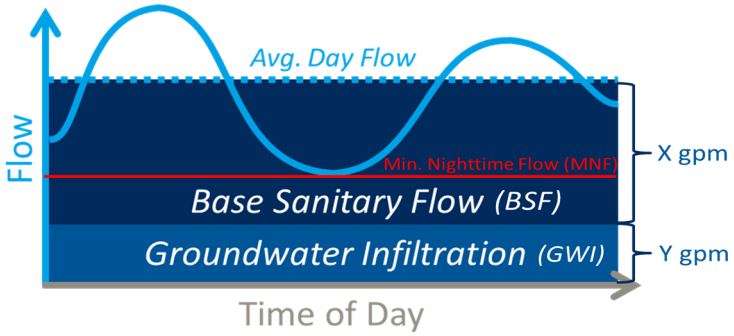


Figure 4: Dry Weather Loading Breakdown

Base Sanitary Flow: A typical collection system has a total water consumption (TWC) to sanitary flow return ration (RR) between 50% and 80%, which accounts for most indoor uses such as toilets, clothes washers, dishwasher, showers, faucets, etc. The balance of the water consumption is typically used for outdoor purposes such as lawn irrigation, car washes, etc. or is lost via leaks in the service lateral. This flow follows a diurnal pattern throughout the day similar to the pattern of water consumption.

Total Metered Flow = Base Sanitary Flow + Groundwater Infiltration

Base Sanitary Flow = Return Ratio x Total Water Consumption

A BSF per capita flow was calculated based on the total BSF and the total population served per service and will be used to determine the impacts of population growth on the future BSF flows.

Groundwater Infiltration: GWI is a fixed flow rate into the collection system based on groundwater levels. It can fluctuate seasonally in Florida depending on the groundwater levels between the dry and wet seasons. GWI cannot be larger than the minimum nighttime flows and is determined by analyzing the influent flow data over multiple days.

Total GWI flows per service area are broken down into infiltration flow per gravity main size and length, which is then used to spatially allocate the GWI based on the extents of the collection system.

As an example, the average influent flow data for the Three Oaks WRF service area is illustrated in **Figure 5**. During the dry weather calibration period, on average, the Three Oaks WRF influent flow meter recorded 3.20 million gallons per day (MGD) in March 2017 and 3.14 MGD in January 2018.

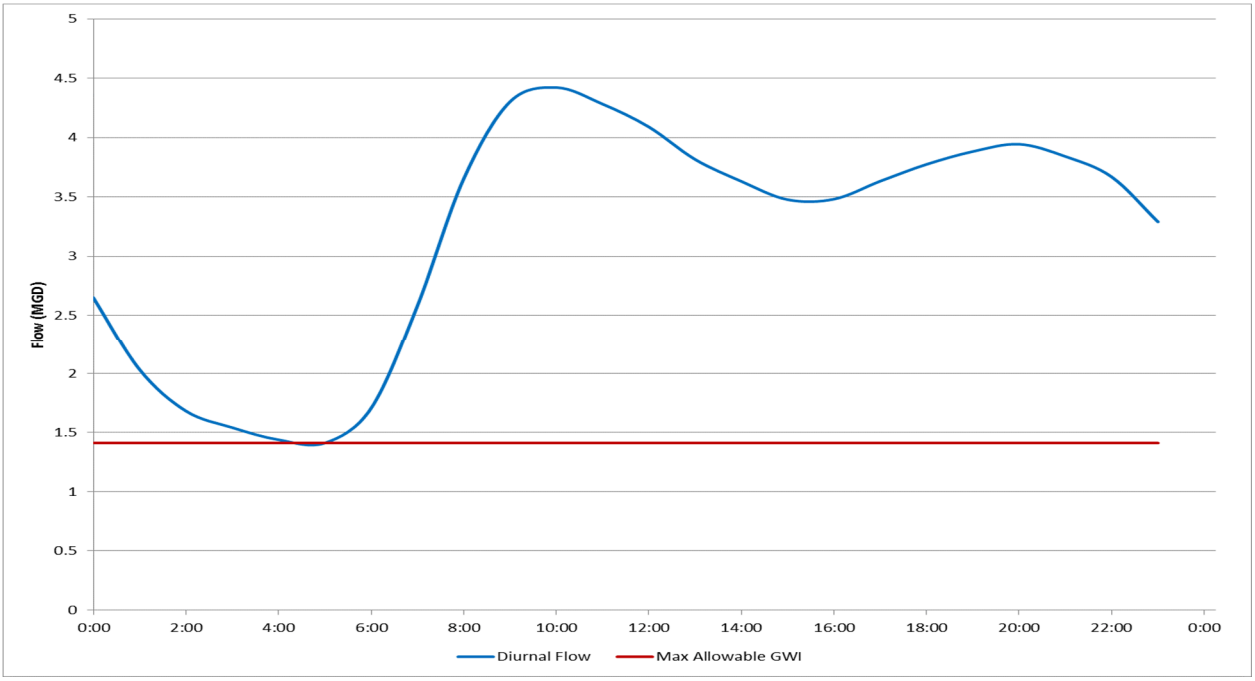


Figure 5: Average Influent Flows to Three Oaks WRF for Dry Weather

For the Three Oaks service area,

- TWC = 136,094 thousand gallons (kgal) per month, or 4.39 MGD, for March 2017.
- If the return ratio (RR) = 52%, then
- GWI = 0.922 MGD; otherwise, the GWI would be greater than the minimum recorded nighttime flows.
- BSF Per Capita = 74.5
- GWI (gpd)/in-mile = 0.098

GIS tools including aerial images and meter location records were reviewed to identify potential water customers which may not discharge to the collection system, such as water customers on septic tank systems. The water consumption for those accounts were removed from the TWC values. **Table 5** shows the calculated GWI, BSF, BSF per capita flows and GWI gpd/in-mile for each service area.

NOTE: There was limited flow data available for the collection systems discharging into the City of Fort Myers (CFM) Central plant and CFM South plant. However, there is an influent flow meter at Lift station 4480 which is one of the main collection points for the CFM Central plant. Due to lack of available data for the two CFM plants (South and Central), and since they should have similar age and condition characteristics, flow data collected from lift station 4480 was used to calculate a typical BSF and GWI loadings to be used across the CFM Central and South collection systems.

Table 5: GWI & BSF per Service Area for March 2017

FACILTY	AVERAGE FLOW	TWC	RETURN RATIO	BSF	GWI	GWI/ AVE. FLOW	BSF PER CAPITA	GWI PER IN-MILE
Units	(MGD)	(kgal/month)		(MGD)	(MGD)	(%)	(gpcd)	(gpd/in-mile)
Three Oaks	3.20	136,094	52%	2.28	0.922	29%	74.5	0.098
Gateway	1.26	50,872	40%	0.66	0.604	48%	59.1	1.216
Pine Island[3.]	0.10	N/A	80%	0.07	0.024	24%	99.7	0.052
Fort Myers Beach	3.73	130,342	59%	2.48	1.248	33%	90.5	0.170
Fiesta Village	3.16	127,050	48%	1.97	1.195	38%	66.6	0.186
LS 4480[4.]	2.63	47,267	69%	1.05	1.58	60%	49.4	0.244

1. Calculations were based on the hourly flow data provided for March 2017.
2. The GWI was based on the average GWI/(in-mile) for the gravity mains within each service area.
3. The Return Ratio for Pine Island was assumed to be 80% due to the quality of data available. A minimum night time flow calculation was used to determine the BSF.
4. LS 4480 flow data was used to estimate the flow to the City of Fort Myers Central plant. The calculated BSF and GWI will also be applied to the City of Fort Myers South plant. October 2018 flows were used due to data availability.

2.3.2 Diurnal Patterns

The BSF diurnal patterns (GWI was subtracted) were calculated using the hourly flow data from the Supervisory Controls and Data Acquisition (SCADA) system provided for March 2017 and January 2018. The average flow for each time step was divide by the over average flow calculate the peaking factor for each time step thus normalizing to the average BSF during that period. **Figure 6** illustrates the weekday and weekend diurnal patterns for Three Oaks WRF. The remaining diurnal patterns are included in **Appendix B**.

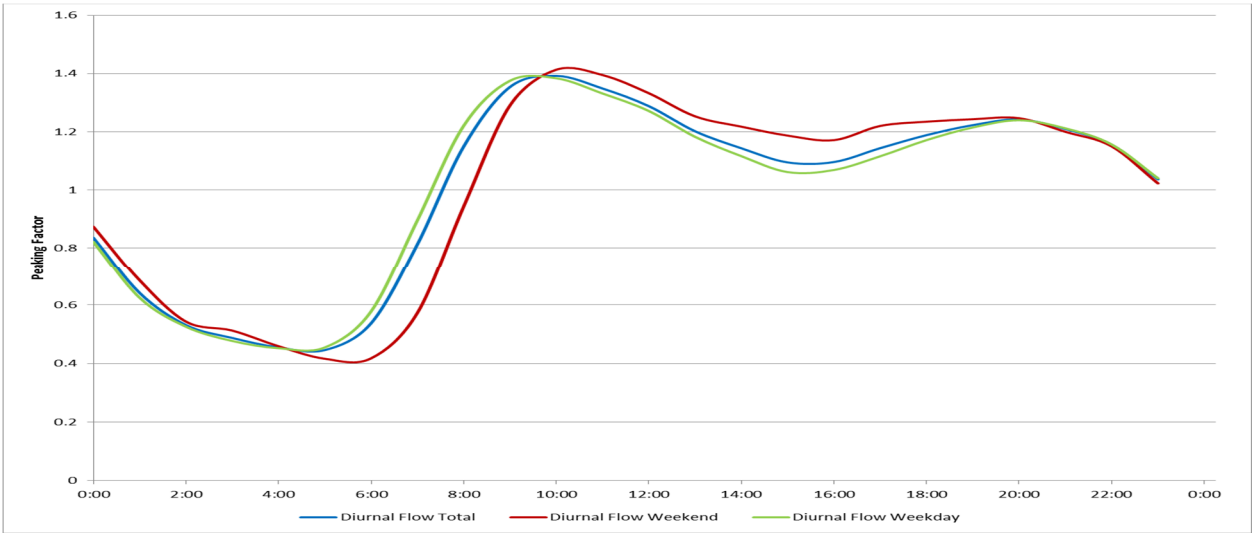


Figure 6: Diurnal Pattern - Three Oaks WRF

2.5 WET WEATHER IMPACTS

Increased flows observed in the sewer system during periods of rainfall are caused by rainfall derived inflow and infiltration (RDII), which is when unintended groundwater or storm water enters the collection system. Inflow is the direct connection of storm water to the sewer collection system through sources such as manholes, cleanout lids, roof downspouts, and catch basins; whereas infiltration is characterized by leaky pipes and manholes allowing groundwater to infiltrate the collection system.

In a sanitary system, the RDII is driven by a myriad of factors including:

- Age and condition of the system
- Construction practices at the time of installation
- Prevalence of direct (illicit) stormwater connections to the sanitary system
- Maintenance of the system
- Antecedent moisture conditions (the saturation of the ground around the sewers)
- Groundwater elevation

The impacts of wet weather storm events can be viewed when comparing the normal flow patterns during dry weather with the flow patterns during a storm event. **Figure 7** - **Figure 9** illustrate the dry weather and wet weather flows for the Three Oaks WRF for each identified storm event. The June 5 – 7, 2017 storm event has classic rainfall responses:

- Before the storm occurs, the influent flow matches the March 2017 dry weather flows well.
- One the rainfall begins around June 6th at noon and again at about 6pm, an increased inflow is observed. This shows the immediate impacts of the inflow portion of RDII.
- Increase flows continue until about June 7th at 9AM even after the rainfall stops, which shows the prolonged impact of the infiltration portion of RDII.
- This is repeated with the second part of the rainstorm starting at about 1pm on June 7th with flows peaking to 6.3 MGD which is 1.6 times the normal daily peak flow.

Wet Weather and rainfall events are shown to have an impact on the influent flows to each of the treatment facilities, however, several of the collection system peak flows are experienced during the dry season when the County's seasonal residents and visitors arrive, and the functional population is highest. This will be considered when the peaking factors are selected during the system analysis phase of the Master Plan.

Table 6: Maximum Month Daily Flows Occurrence

SERVICE AREA	SPRING PEAK FLOW	SUMMER PEAK FLOW
Fiesta Village Service Area	2	6
Fort Myers Beach Service Area	8	0
Fort Myers Central Service Area (LCU Flow)	3	1
Fort Myers South Service Area (LCU Flow)	4	0
Gateway Service Area	4	4
Pine Island Service Area	8	0
Three Oaks Service Area	4	4

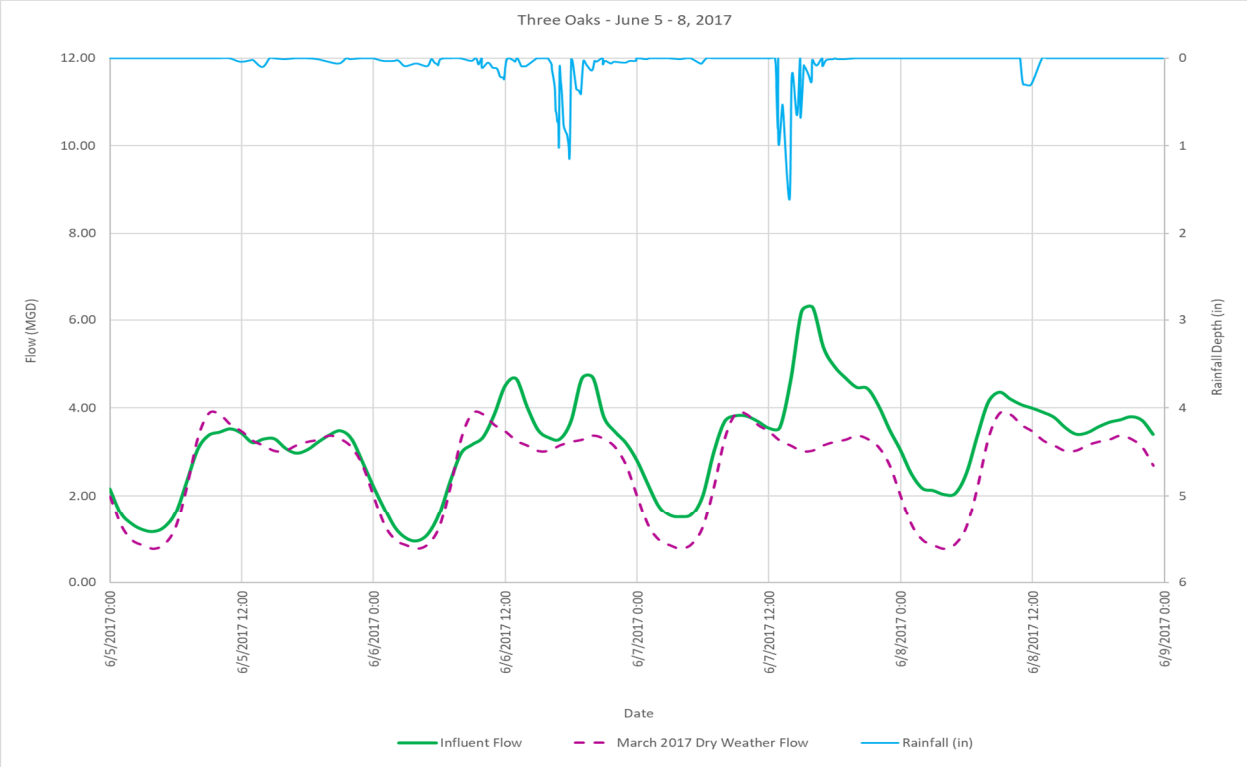


Figure 7: Three Oaks WRF June 5 – 7, 2017 Flows

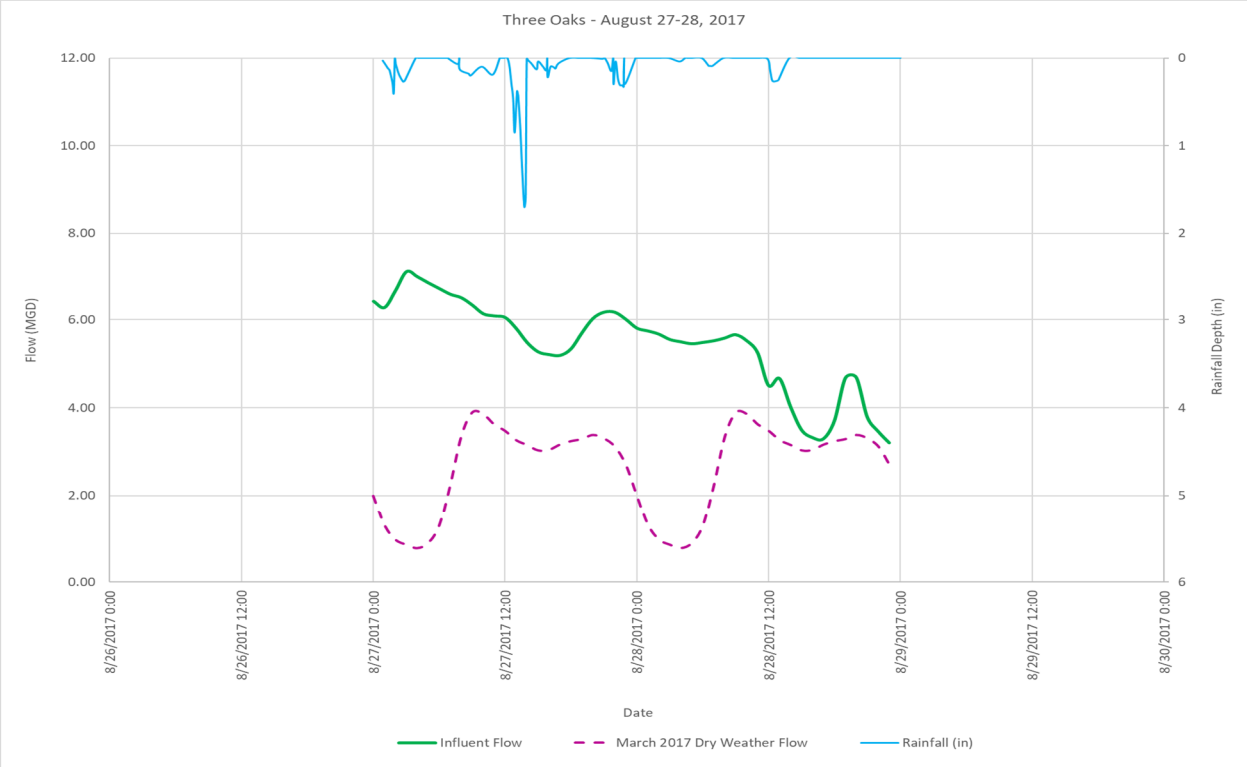


Figure 8: Three Oaks WRF August 27 - 28, 2017 Flows

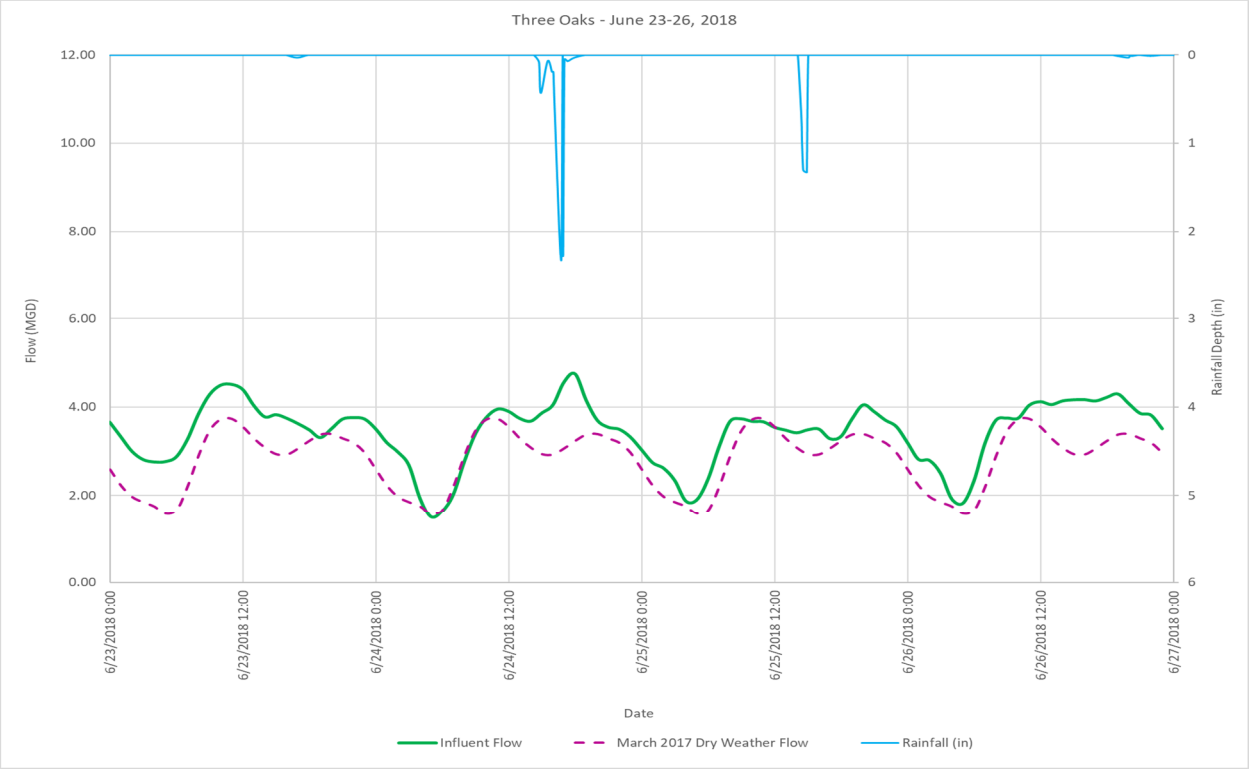


Figure 9: Three Oaks WRF June 23 – 26, 2018 Flows

Similar graphs for the remaining treatment facilities are located in **Appendix C**.

3.0 Population and Flow Projections

The historic demand use trends provide a roadmap to project the future demands by means of multiplying the future population projections with the per capita flows and the applicable peaking factor. The following section documents the results of the flow projections.

3.1 SERVICE AREA POPULATION PROJECTIONS

The Future Lee County population projections were gathered from the BEBR medium population projection and 2040 TAZ data. The spatial allocation of population for Lee County provided by the TAZ data was analyzed in conjunction with the LCU's water reclamation facilities future service areas using ESRI's ArcGIS. The Lee County future service areas anticipate both expansion and "fill-in" or increased density within the existing service areas, from new development, the transfer of Home Owner's Association (HOA) wastewater treatment systems, and on-site septic replacement.

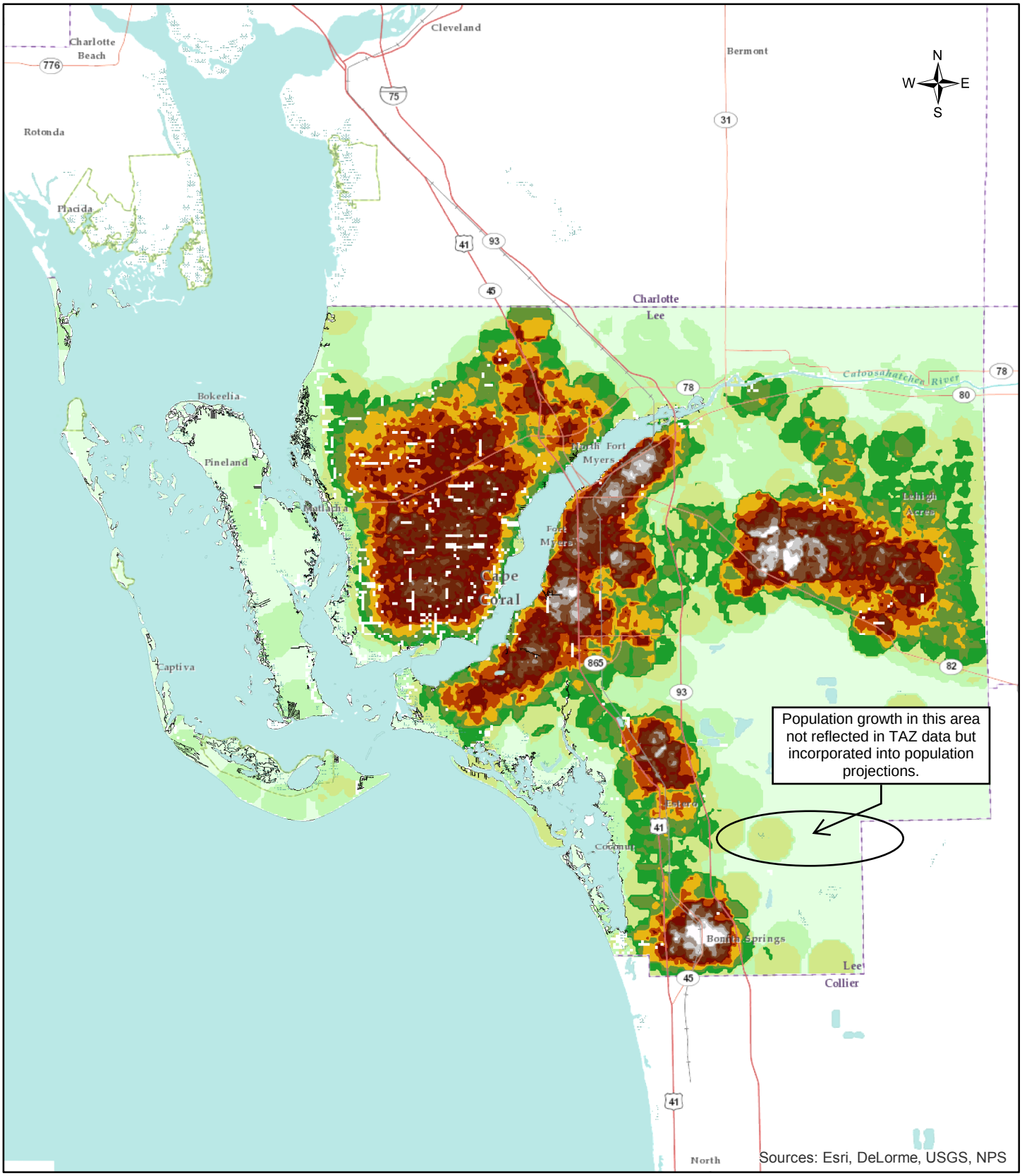
By performing a spatial analysis similar to what was used to determine historic population, the 2040 TAZ shapefile data was used to determine the projected population per service area within Lee County Utilities. As with the population estimates, the BEBR population projection for Lee County was used at the controlling population and the 2040 TAZ projections were globally adjusted to match the BEBR total population. A linear interpolation was then used between the 2040 and 2016 population distribution to estimate the population per service area for the planning years between 2016 and 2040 as shown in **Table 7**. These assumptions and the final population totals were provided to the Lee County Planning Department and have been approved by the Department.

The Future Lee County Service areas and distributed total population projections are shown in **Figure 10. Figure 11** illustrates the population growth between 2016 and 2040.

Table 7: Future Population Projections

SERVICE AREA	YEAR					
	Population	2020	2025	2030	2035	2040
Lee County Population	BEBR Population	749,600	826,900	891,200	951,500	1,007,100
Fiesta Village Service Area	BEBR Population[1]	27,310	30,149	32,988	35,827	38,665
	Seasonal Population	4,916	5,427	5,938	6,449	6,960
	Functional Population	32,226	35,576	38,926	42,275	45,625
Fort Myers Beach Service Area	BEBR Population[1]	25,422	28,159	30,895	33,632	36,369
	Seasonal Population	4,576	5,069	5,561	6,054	6,546
	Functional Population	29,998	33,227	36,457	39,686	42,916
Fort Myers Central Service Area (LCU Flow)	BEBR Population[1]	20,570	24,648	28,726	32,804	36,882
	Seasonal Population	3,703	4,437	5,171	5,905	6,639
	Functional Population	24,272	29,084	33,897	38,709	43,521
Fort Myers South Service Area (LCU Flow)	BEBR Population[1]	33,965	40,604	47,243	53,882	60,521
	Seasonal Population	6,114	7,309	8,504	9,699	10,894
	Functional Population	40,078	47,912	55,746	63,580	71,414
Gateway Service Area	BEBR Population[1]	9,957	10,636	11,315	11,994	12,673
	Seasonal Population	1,792	1,914	2,037	2,159	2,281
	Functional Population	11,749	12,551	13,352	14,153	14,954
Pine Island Service Area	BEBR Population[1]	2,236	4,041	5,846	7,650	9,455
	Seasonal Population	403	727	1,052	1,377	1,702
	Functional Population	2,639	4,768	6,898	9,027	11,157
Three Oaks Service Area	Lee County Utilities[2]	31,332	41,427	51,522	61,617	74,424
	Seasonal Population	5,640	7,457	9,274	11,091	13,396
	Functional Population	36,972	48,884	60,796	72,708	87,820
Total LCU Service Areas	**Permanent**	**150,792**	**179,663**	**208,535**	**237,406**	**268,989**
	Seasonal	**27,142**	**32,339**	**37,536**	**42,733**	**48,418**
	Functional	**177,934**	**212,003**	**246,071**	**280,139**	**317,408**

1.BEBR Estimates were distributed proportionally to LCU service areas based on Census and TAZ spatial distributions
2. Lee County Indicated that their population estimate for Three Oak 2040 would be used in leu of BEBER Data



Lee County Southwest Florida

BLACK & VEATCH

0 - 150	1,500 - 1,950	3,300 - 3,750
150 - 600	1,950 - 2,400	3,750 - 4,200
600 - 1,050	2,400 - 2,850	4,200 - 4,650
1,050 - 1,500	2,850 - 3,300	4,650 - 5,100
		5,100 - 7,500

0 16,000 32,000
Feet

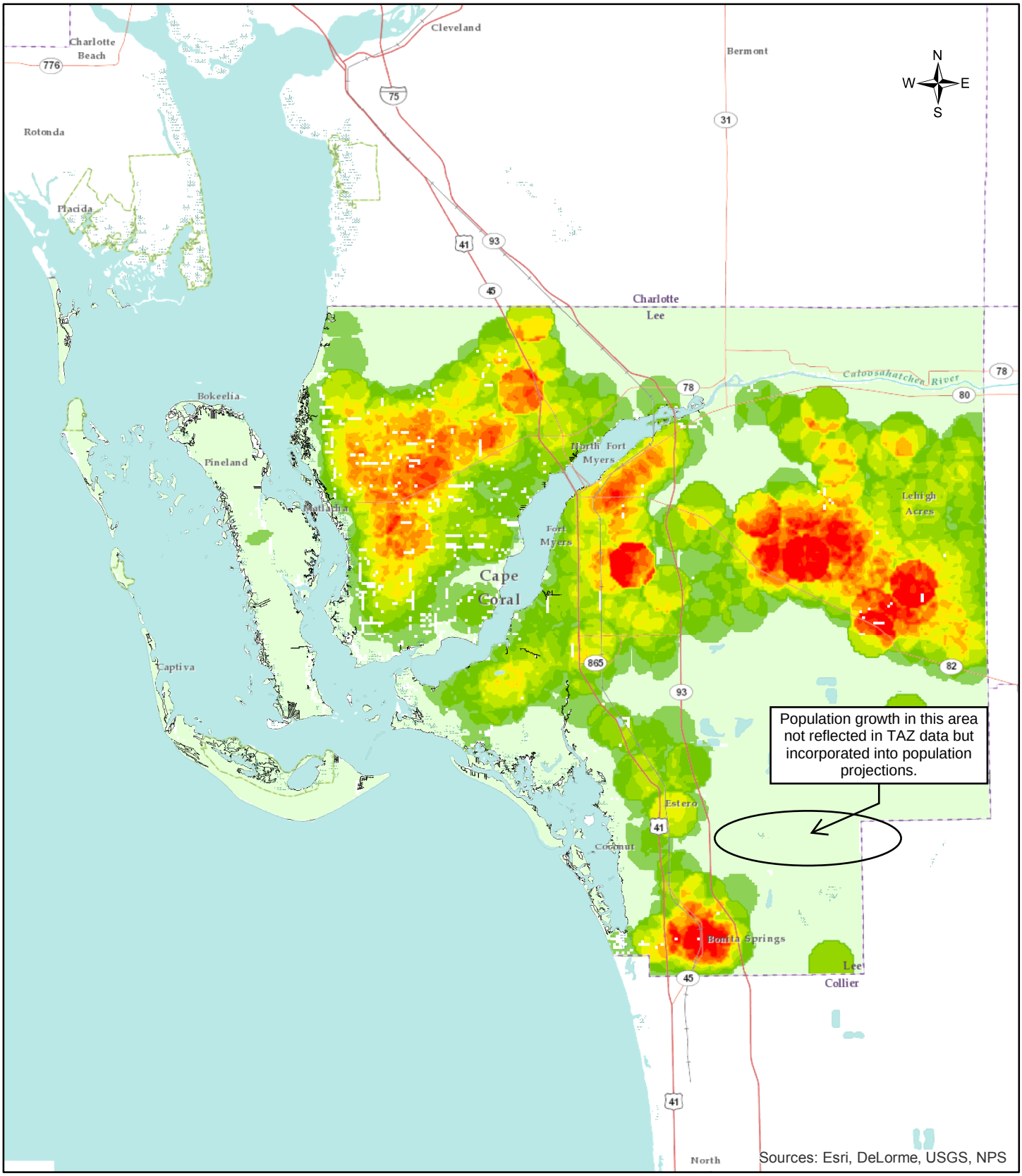
1:400,000

LEE COUNTY

Wastewater Master Plan

FIGURE 10

TAZ POPULATION DISTRIBUTION 2040



Lee County Southwest Florida

BLACK & VEATCH

0 - 200	800 - 1,000	1,600 - 1,800
200 - 400	1,000 - 1,200	1,800 - 2,000
400 - 600	1,200 - 1,400	2,000 - 2,200
600 - 800	1,400 - 1,600	2,200 - 4,000

0 16,000 32,000
Feet

1:400,000

LEE COUNTY

Wastewater Master Plan

FIGURE 11

POPULATION GROWITH 2016-2040

3.2 FUTURE SYSTEM FLOWS

The totalized per capita flows summarized in **Table 3** were used to determine the future AADF, 3MADF, and MMDF when multiplied with the projected populations. The PHF was determined using the 10 States Standards method. **Table 8** summarizes the flow projections through the year 2040 for the overall Lee County Service Area. This information is also illustrated in **Figure 12** for Three Oaks WRF.

Table 8: Future System Flows

SERVICE AREA	WASTEWATER INFLUENT FLOW (MGD)	YEAR					
		gpcd[3]	2020	2025	2030	2035	2040
Fiesta Village Service Area[1]	Average Annual Daily Flow (AADF)	125.94	3.44	3.80	4.15	4.51	4.87
	Three Month Average Daily Flow (3MADF)	135.60	3.70	4.09	4.47	4.86	5.24
	Max Month Daily Flow (MMDF)	140.90	3.85	4.25	4.65	5.05	5.45
	Peak Hour Flow (PHF)[2]	----	4.17	4.58	5.00	5.42	5.83
Fort Myers Beach Service Area	Average Annual Daily Flow (AADF)	146.20	3.72	4.12	4.52	4.92	5.32
	Three Month Average Daily Flow (3MADF)	148.07	3.76	4.17	4.57	4.98	5.39
	Max Month Daily Flow (MMDF)	155.52	4.67	5.17	5.67	6.17	6.67
	Peak Hour Flow (PHF)[2]	----	5.07	5.59	6.11	6.63	7.15
Fort Myers Central Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	103.92	2.14	2.56	2.99	3.41	3.83
	Three Month Average Daily Flow (3MADF)	112.54	2.31	2.77	3.23	3.69	4.15
	Max Month Daily Flow (MMDF)	115.67	2.81	3.36	3.92	4.48	5.03
	Peak Hour Flow (PHF) [2]		3.08	3.65	4.24	4.82	5.39
Fort Myers South Service Area (LCU Flow)	Average Annual Daily Flow (AADF)	126.95	4.31	5.15	6.00	6.84	7.68
	Three Month Average Daily Flow (3MADF)	142.77	4.85	5.80	6.75	7.69	8.64
	Max Month Daily Flow (MMDF)	149.84	6.01	7.18	8.35	9.53	10.70
	Peak Hour Flow (PHF) [2]	----	6.46	7.67	8.88	10.10	11.30
Gateway Service Area	Average Annual Daily Flow (AADF)	128.64	1.28	1.37	1.46	1.54	1.63
	Three Month Average Daily Flow (3MADF)	133.26	1.33	1.42	1.51	1.60	1.69
	Max Month Daily Flow (MMDF)	142.80	1.68	1.79	1.91	2.02	2.14
	Peak Hour Flow (PHF) [2]	----	1.91	2.02	2.15	2.27	2.40
Pine Island Service Area	Average Annual Daily Flow (AADF)	153.26	0.34	0.62	0.90	1.17	1.45
	Three Month Average Daily Flow (3MADF)	153.74	0.34	0.62	0.90	1.18	1.45
	Max Month Daily Flow (MMDF)	160.73	0.42	0.77	1.11	1.45	1.79
	Peak Hour Flow (PHF) [2]	----	0.53	0.93	1.30	1.67	2.04
Three Oaks Service Area	Average Annual Daily Flow (AADF)	122.77	3.85	5.09	6.33	7.56	9.14
	Three Month Average Daily Flow (3MADF)	124.85	3.91	5.17	6.43	7.69	9.29
	Max Month Daily Flow (MMDF)	128.59	4.03	5.33	6.63	7.92	9.57
	Peak Hour Flow (PHF) [2]	----	4.34	5.69	7.03	8.36	10.05

1. Permanent population used to calculate MMDF and PHF
2. Peak Hour Flow (PHF) was calculated using the 10-state standard: PHF = Qavg(18+sqrt(Population))/4+sqrt(Population)
3. Per Capita flows are based on the average from all historic system flows found in Table 3

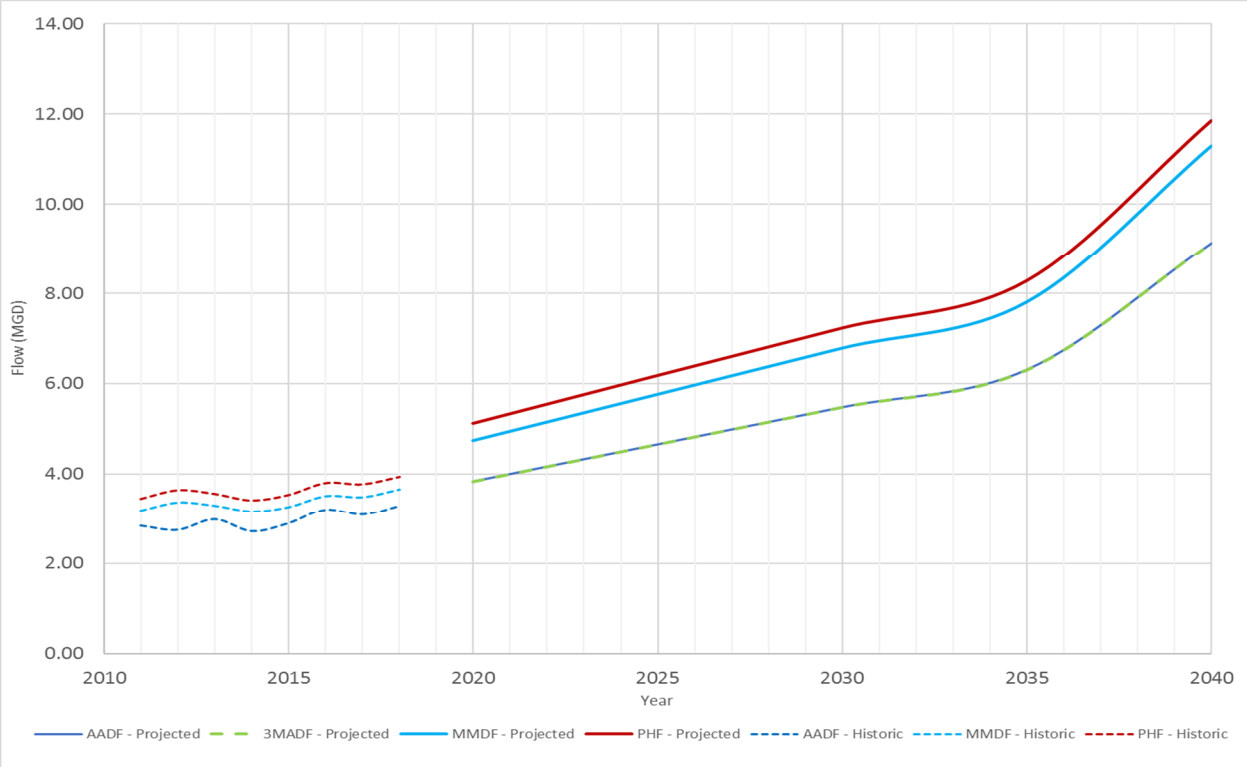
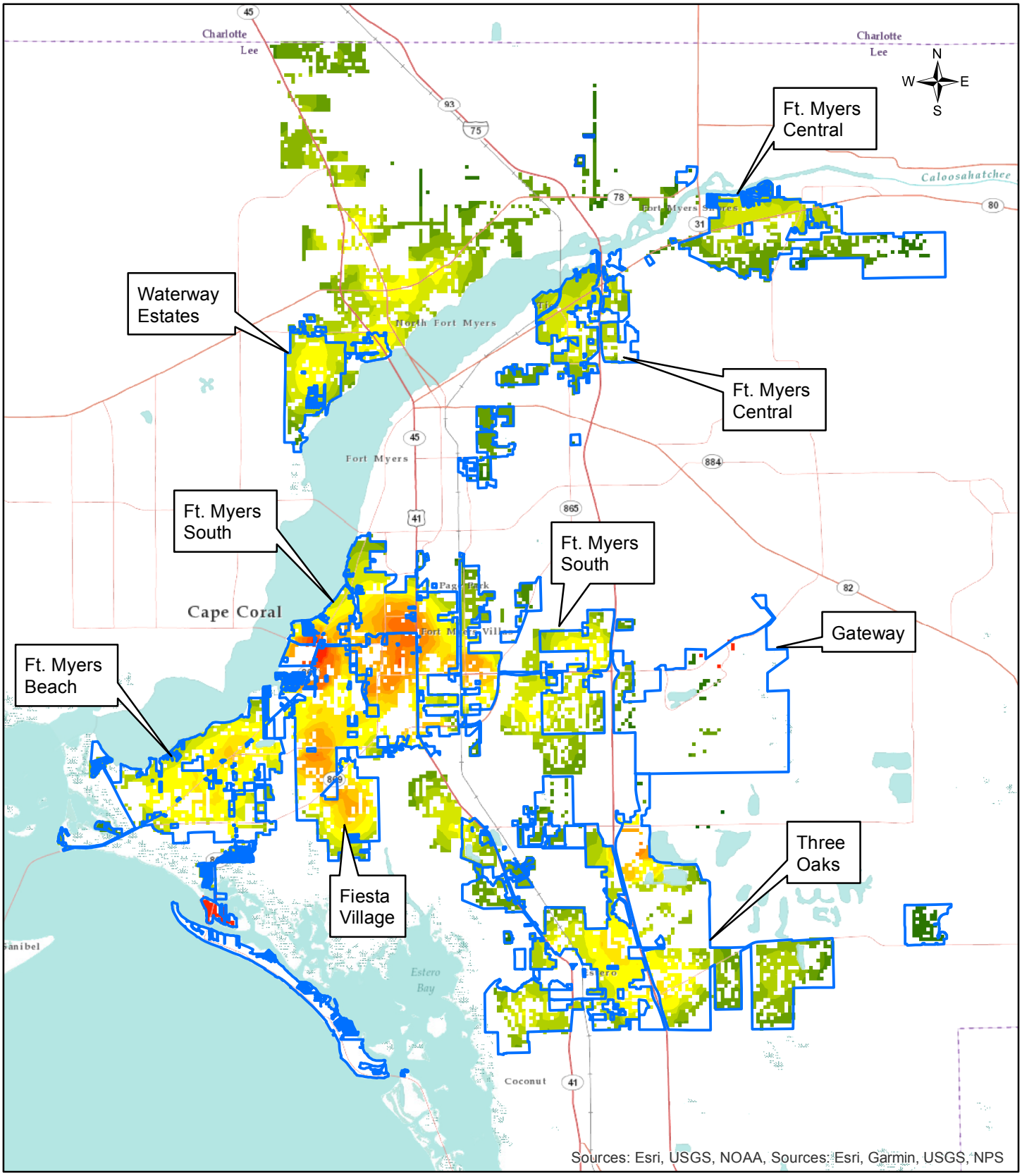


Figure 12: Three Oaks WRF Flow Projection

3.3 SPATIAL DISTRIBUTION OF SYSTEMS FLOWS

To accurately model the existing and future flows and their impacts on the collection system, it is important to know where those flows are located. To accomplish this for the BSF, the 2018 customer billing data was geo-located and analyzed across the system. **Figure 13** and **Figure 14** shows the historic water consumption as a heat density map to illustrate the distribution of flow across the system. GWI will be distributed across the collection system based on the length and diameter of the gravity sewer mains.



Lee County Southwest Florida

BLACK & VEATCH

Flow in kgal

0 - 2	3,300- 4,500	10,600- 11,900
2 - 500	4,500 - 5,800	11,900- 13,100
500- 900	5,800- 8,300	13,100 - 14,300
900 - 2,100	8,300 - 9,500	14,300 - 15,600
2,100- 3,300	9,500 - 10,600	15,600- 35,000

LCU Service Areas

0 9,200 18,400
Feet

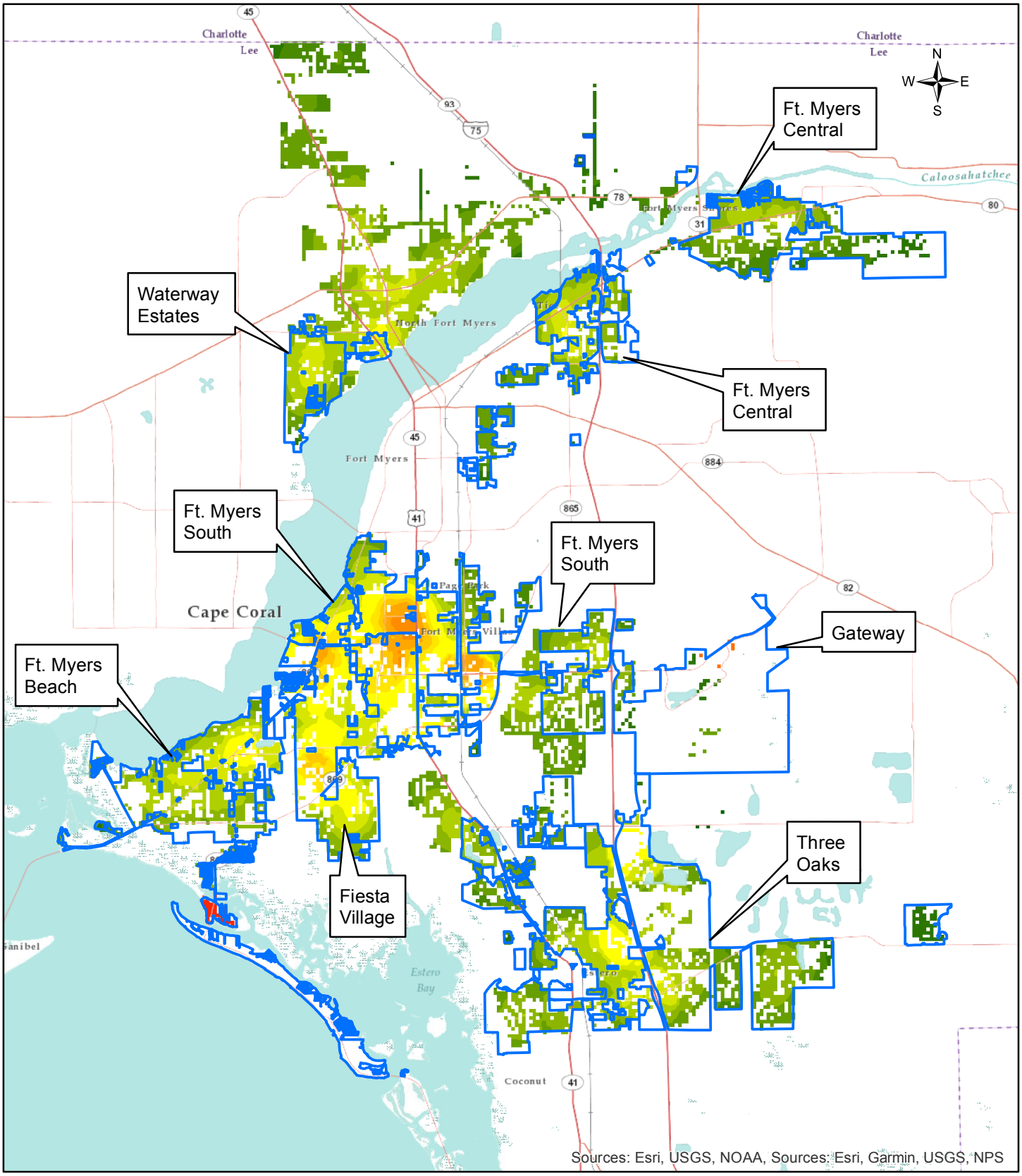
1:208,558

LEE COUNTY

Wastewater Master Plan

FIGURE 13

Maximum Consumptive Data



Lee County Southwest Florida

BLACK & VEATCH

Flow in kgal

0 - 2	3,300 - 4,500	10,600 - 11,900
2 - 500	4,500 - 5,800	11,900 - 13,100
500 - 900	5,800 - 8,300	13,100 - 14,300
900- 2,100	8,300 - 9,500	15,600 - 35,000
2,100 - 3,300	9,500- 10,600	LCU Service Areas

0 9,200 18,400
Feet

1:208,558

LEE COUNTY

Wastewater Master Plan

FIGURE 14

Minimum Consumptive Data

Appendix A - Existing and Future System Flow Graphs

EXISTING SYSTEM FLOWS

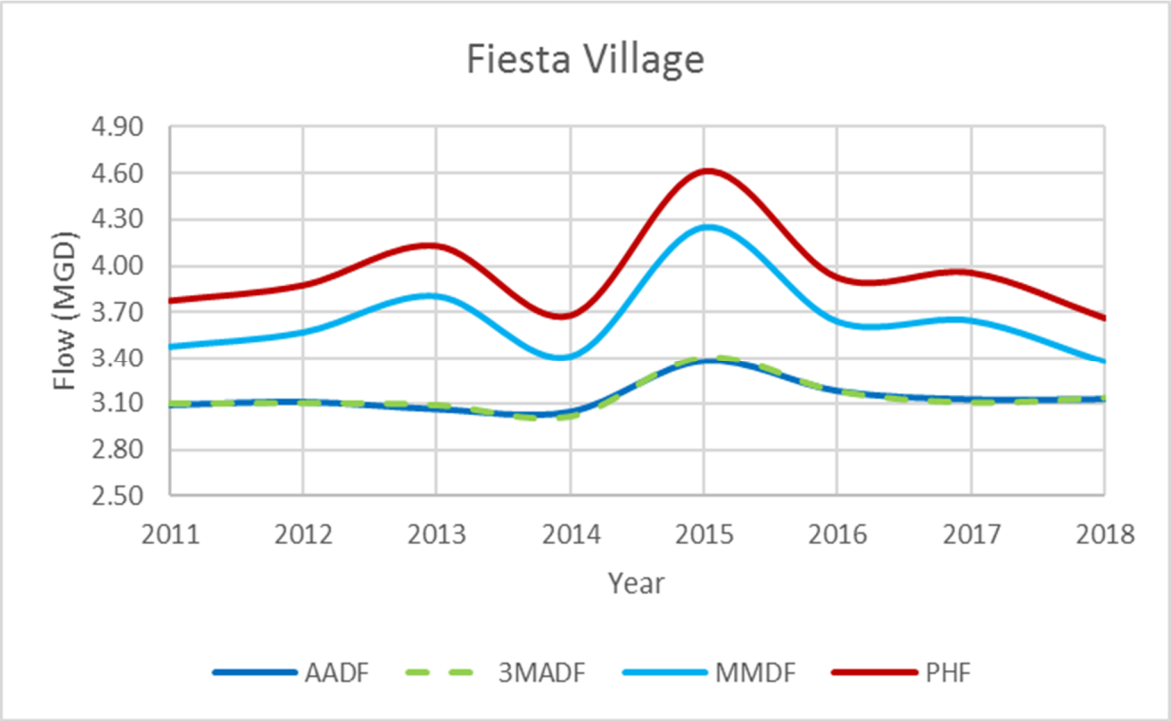


Figure A - 1 Existing System Flow - Fiesta Village

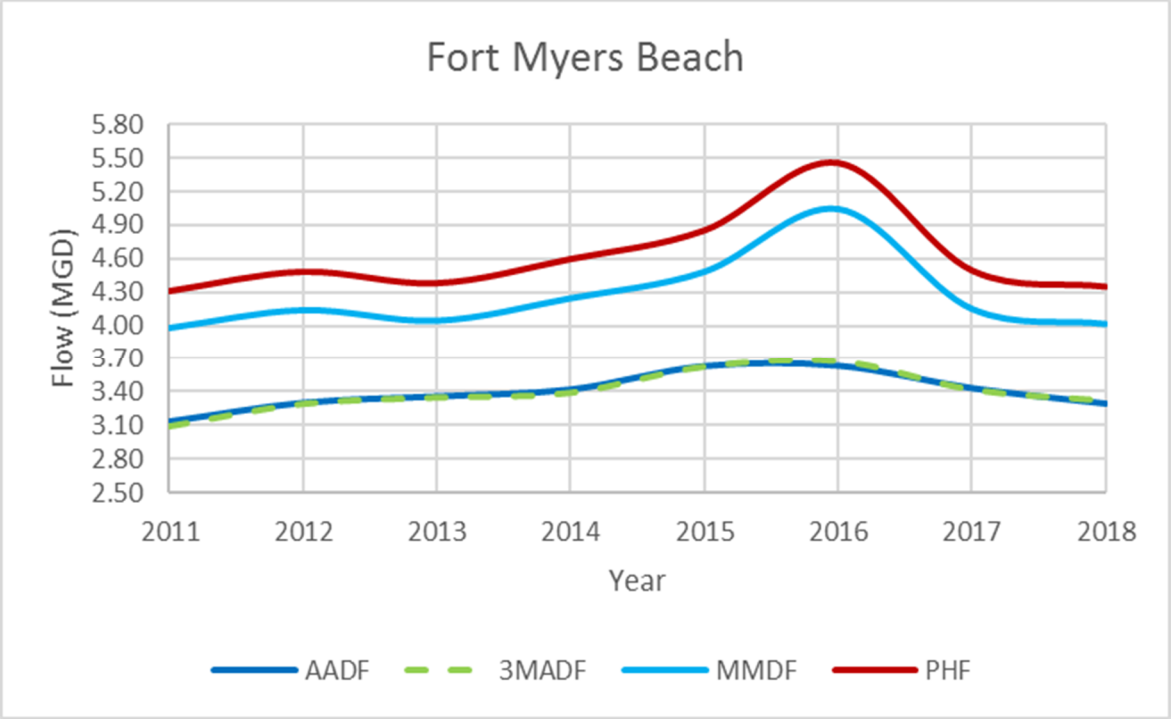


Figure A - 2 Existing System Flow - Fort Myers Beach

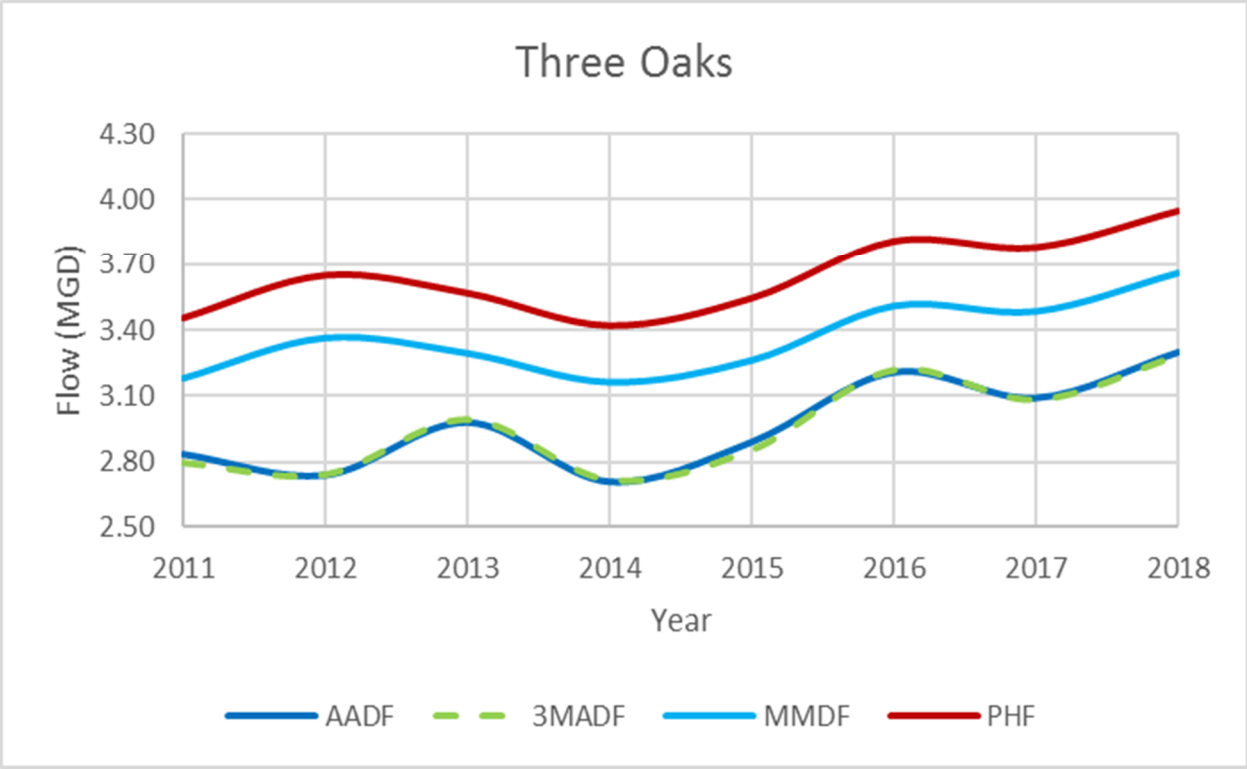


Figure A - 3 Existing System Flow - Three Oaks

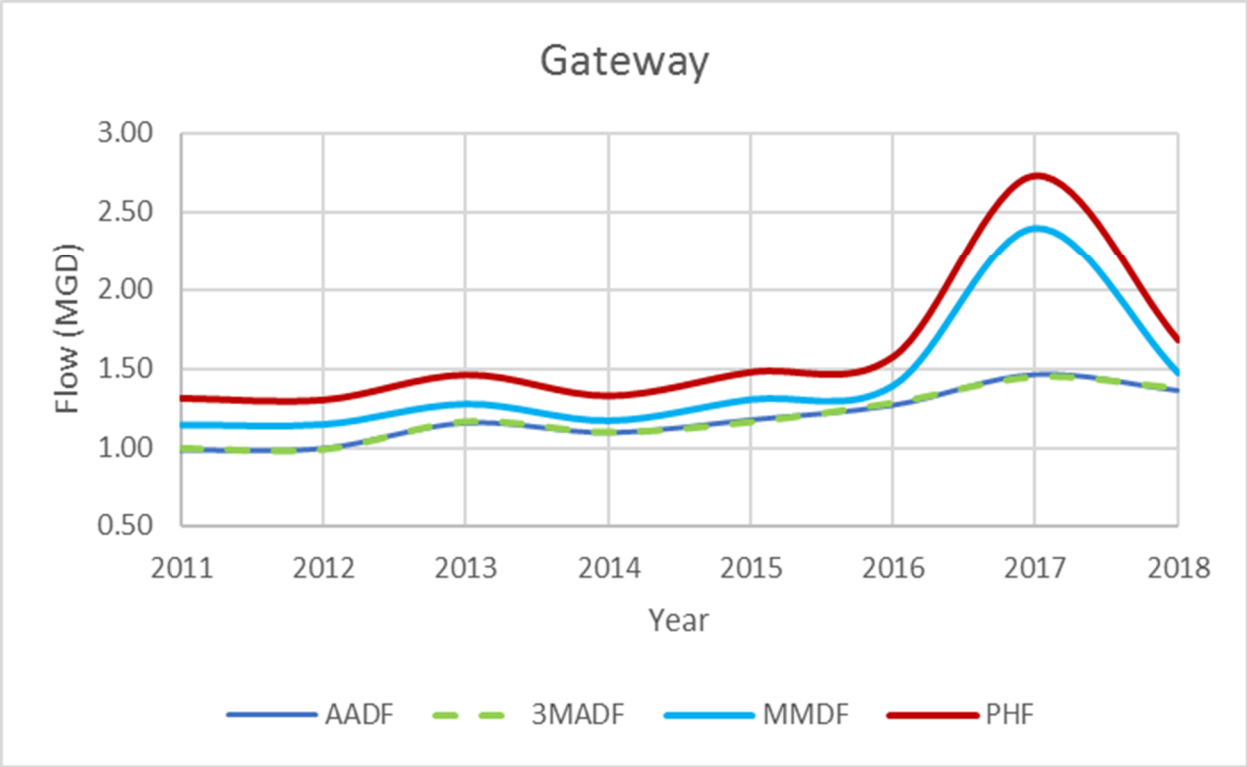


Figure A - 4 Existing System Flow – Gateway

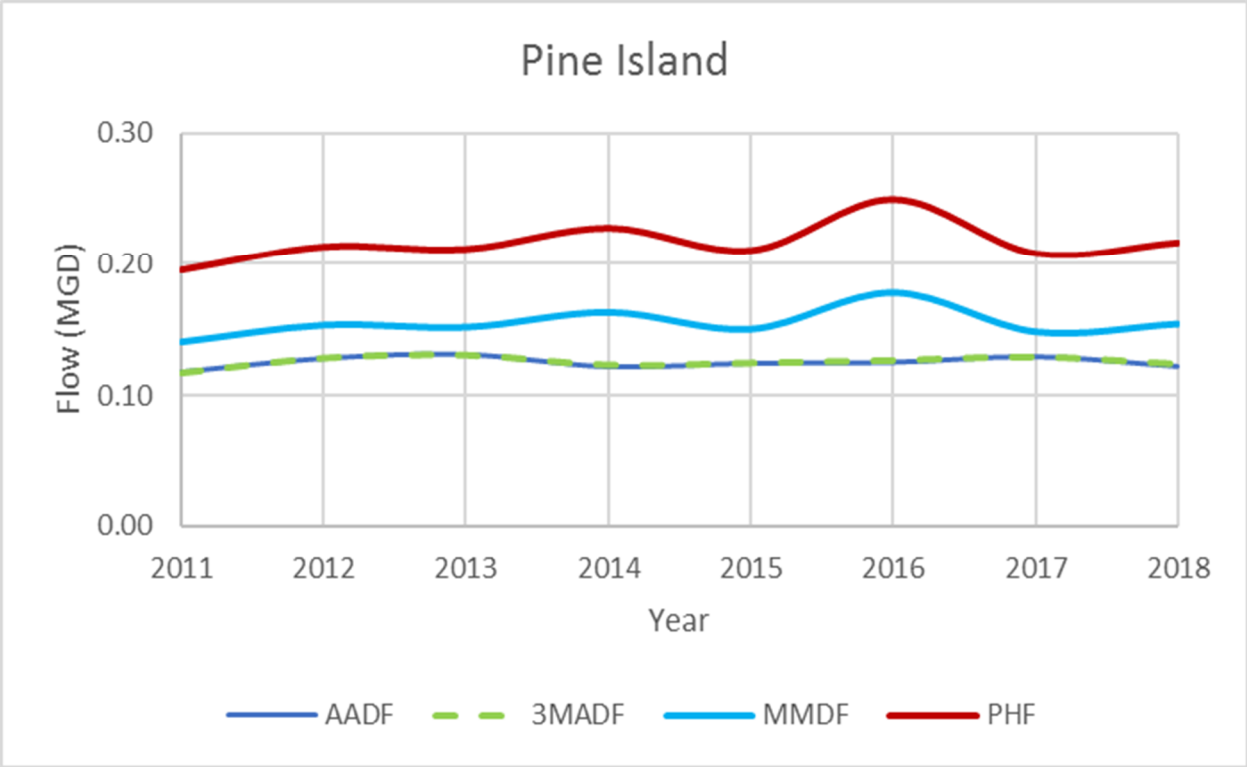


Figure A - 5 Existing System Flow – Pine Island

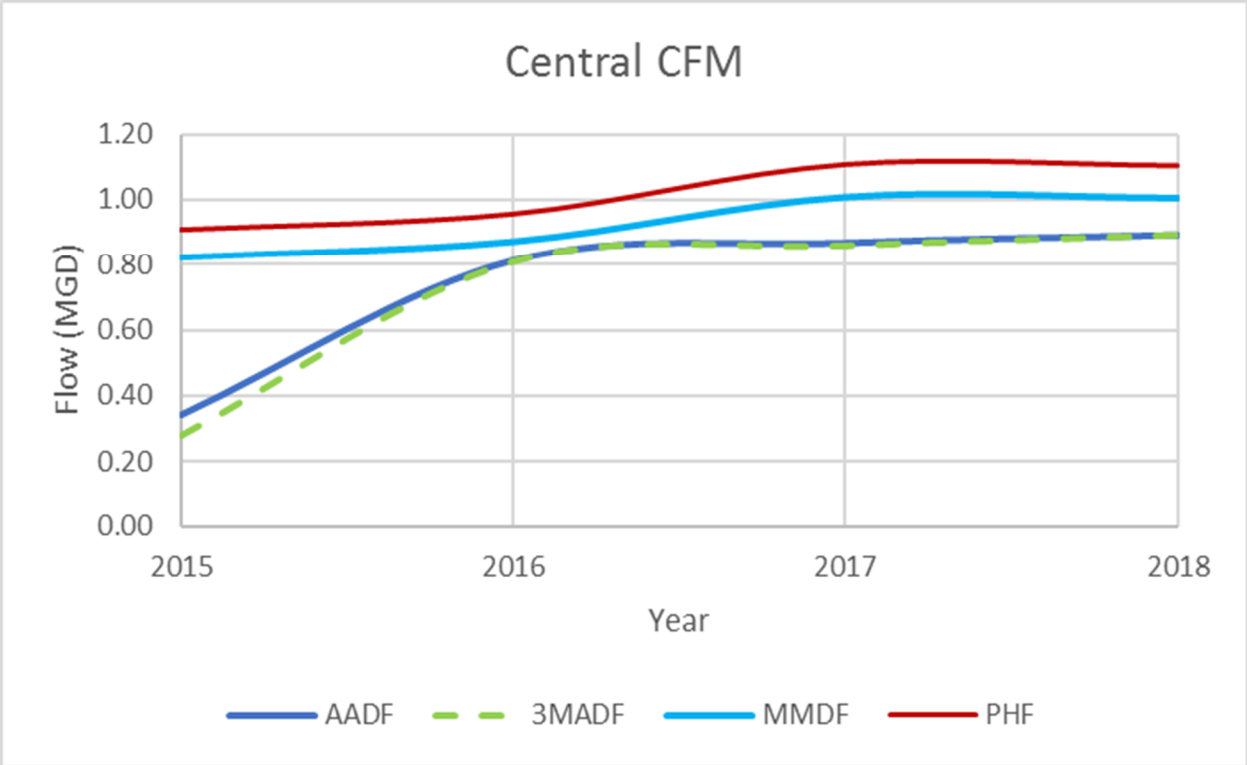


Figure A - 6 Existing System Flow - City of Fort Myers Central

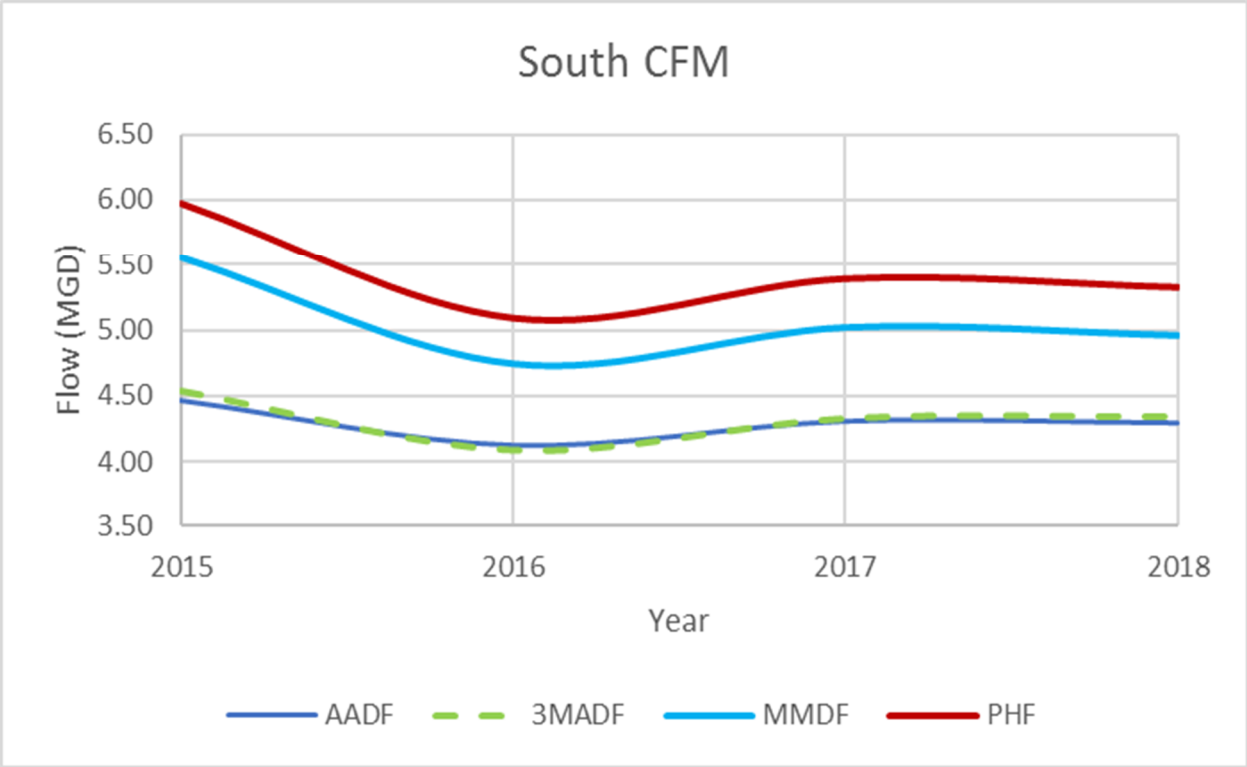


Figure A - 7 Existing System Flow - City of Fort Myers South

FUTURE SYSTEM FLOWS

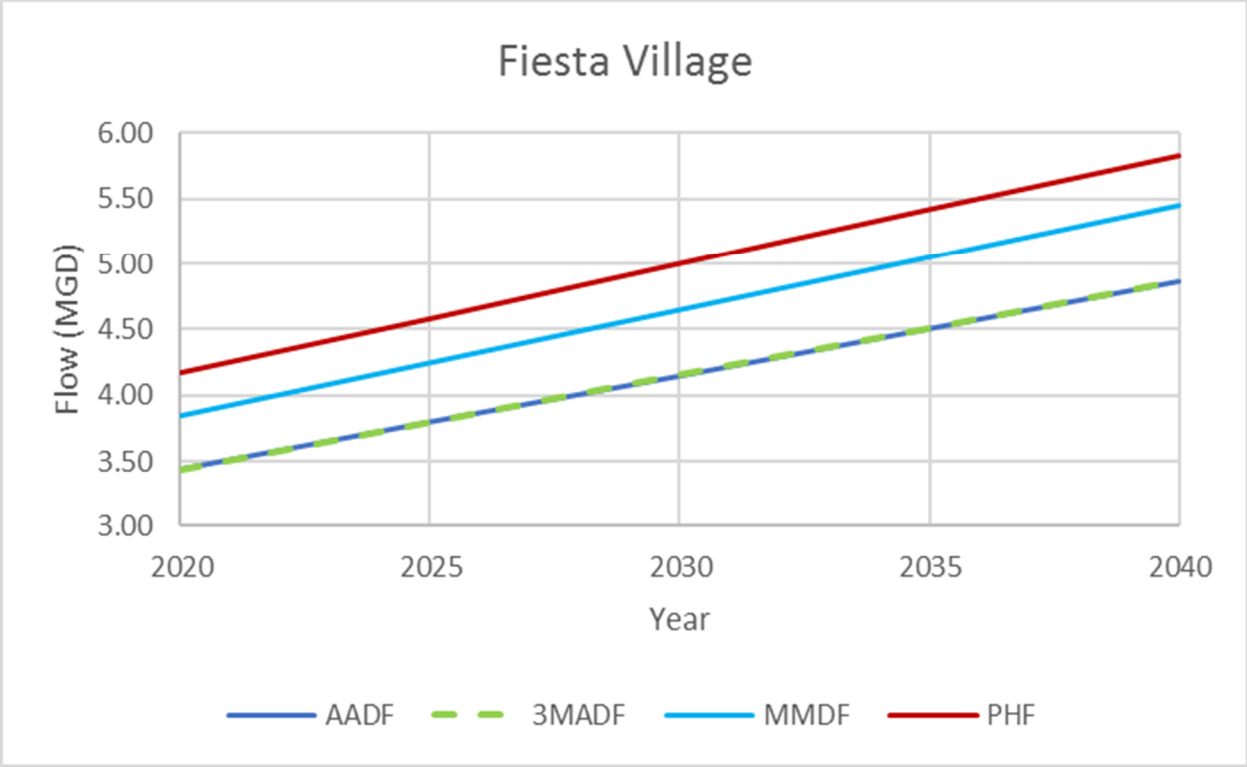


Figure A - 8 Future System Flows - Fiesta Village

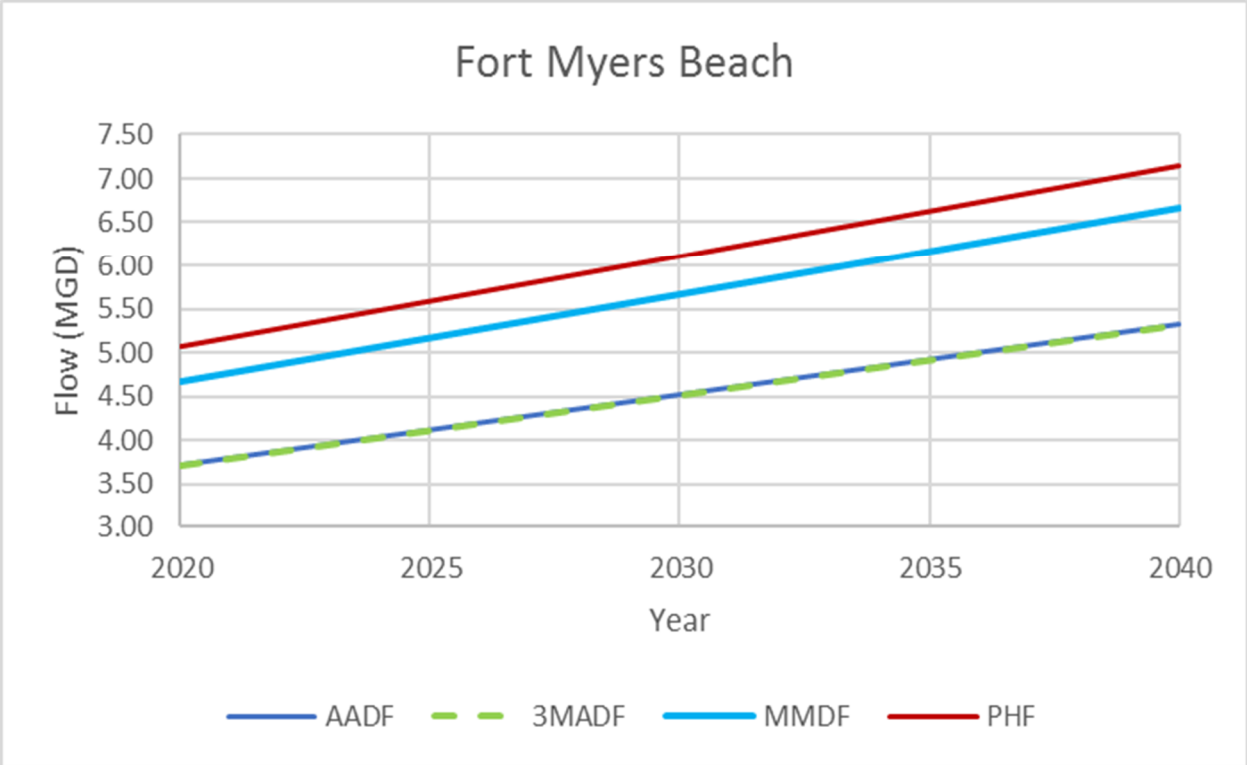


Figure A - 9 Future System Flows - Fort Myers Beach

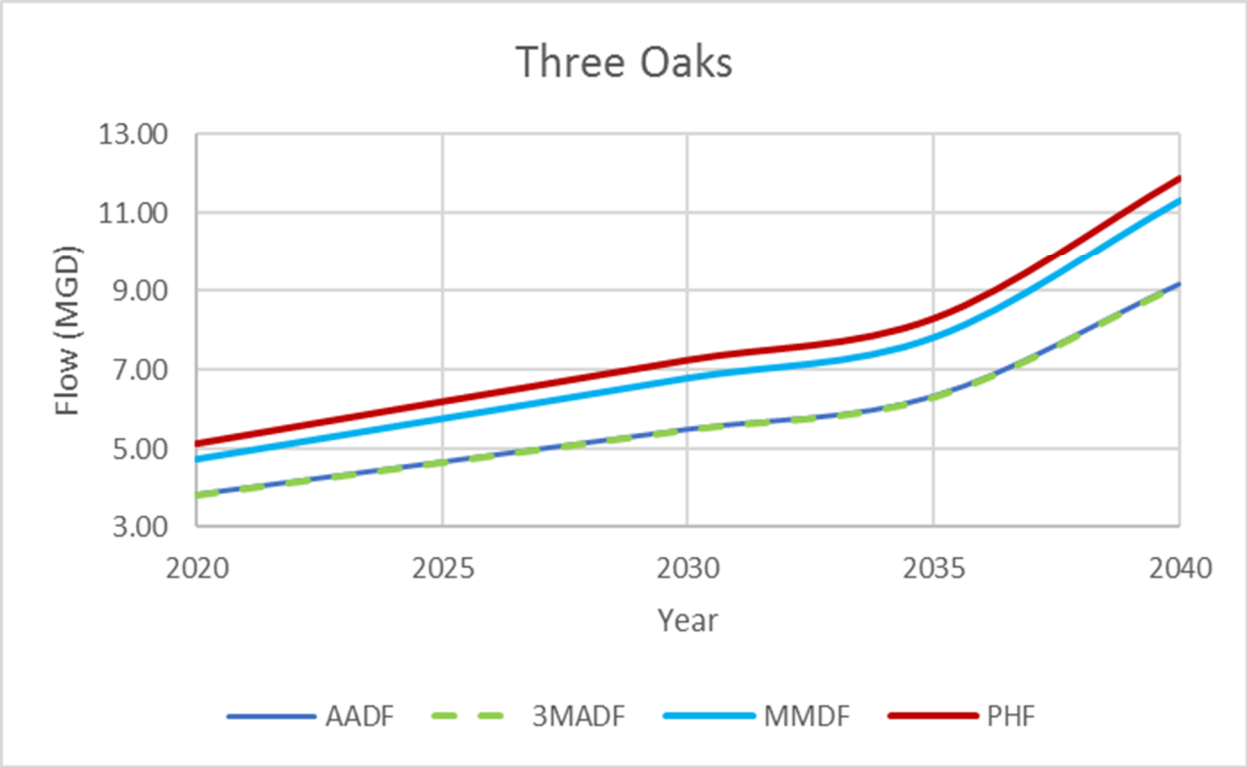


Figure A - 10 Future System Flows - Three Oaks

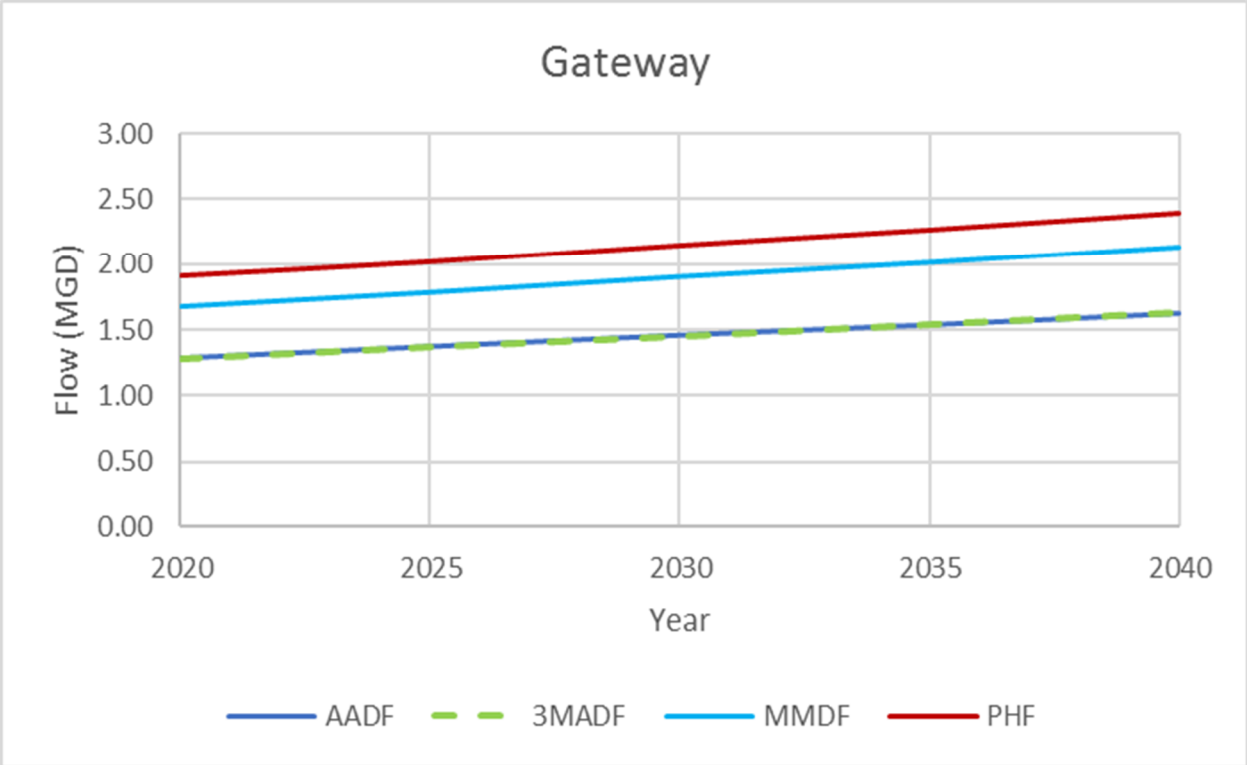


Figure A - 11 Future System Flows – Gateway

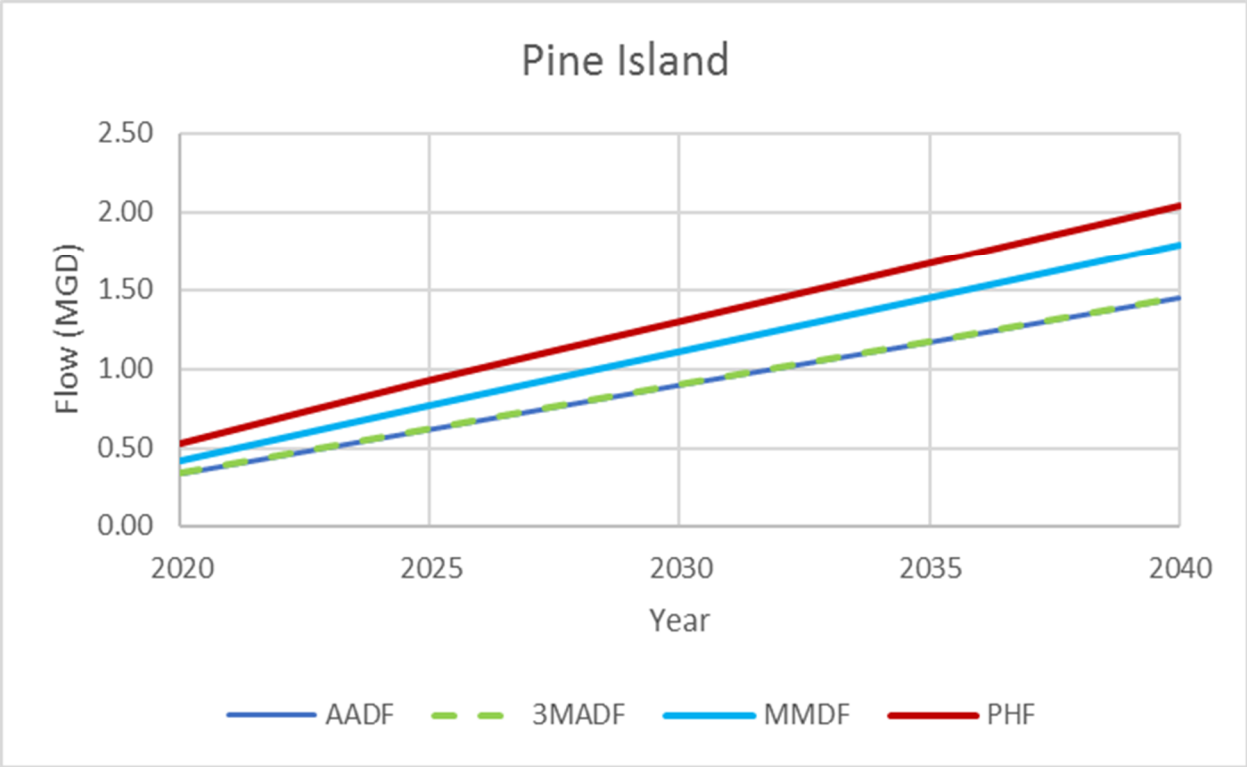


Figure A - 12 Future System Flows - Pine Island

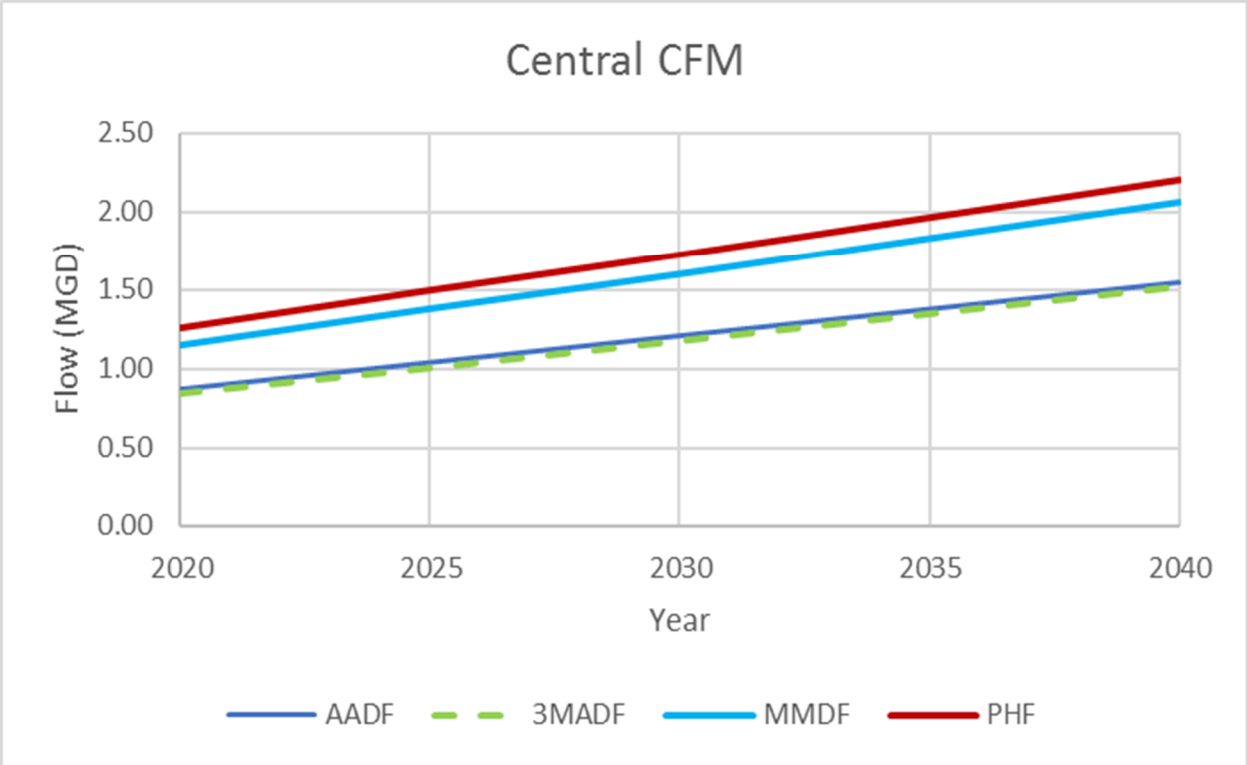


Figure A - 13 Future System Flows - City of Fort Myers Central

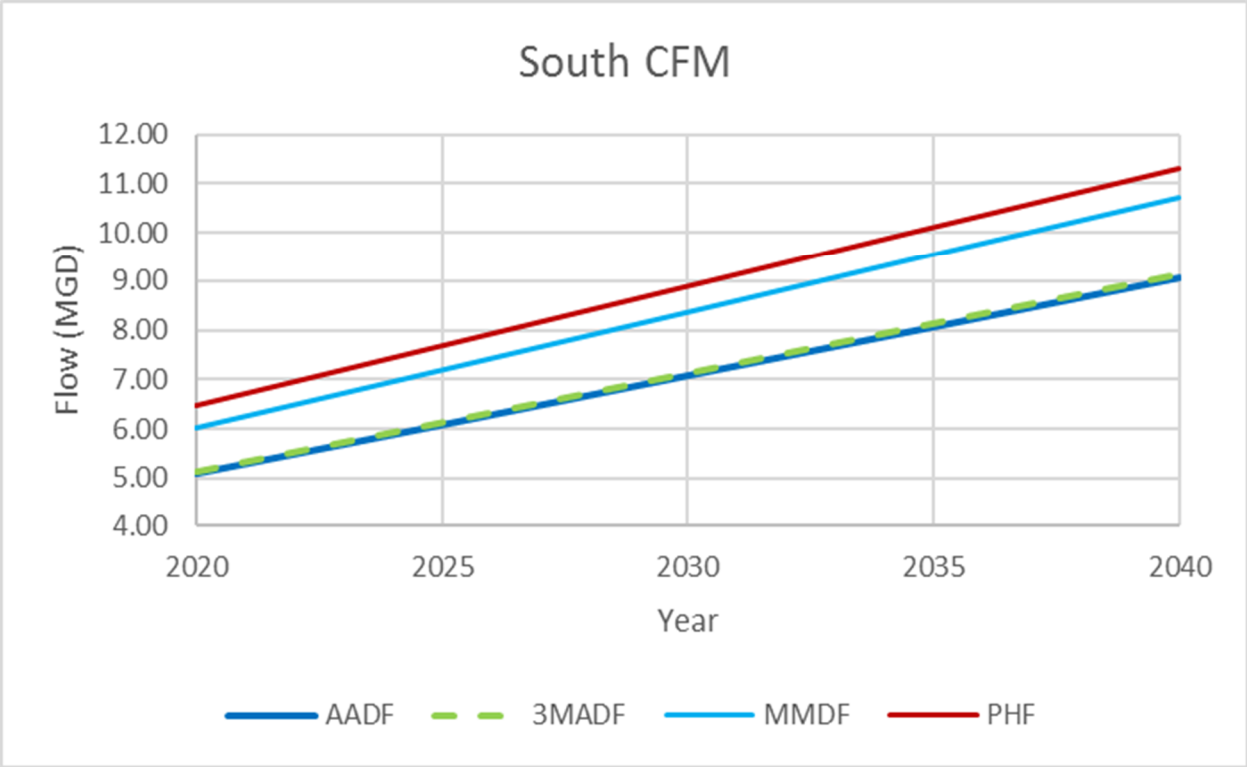


Figure A - 14 Future System Flows - City of Fort Myers South

Appendix B - Dry Weather Diurnal Flow Patterns

DIURNAL FLOW PATTERNS

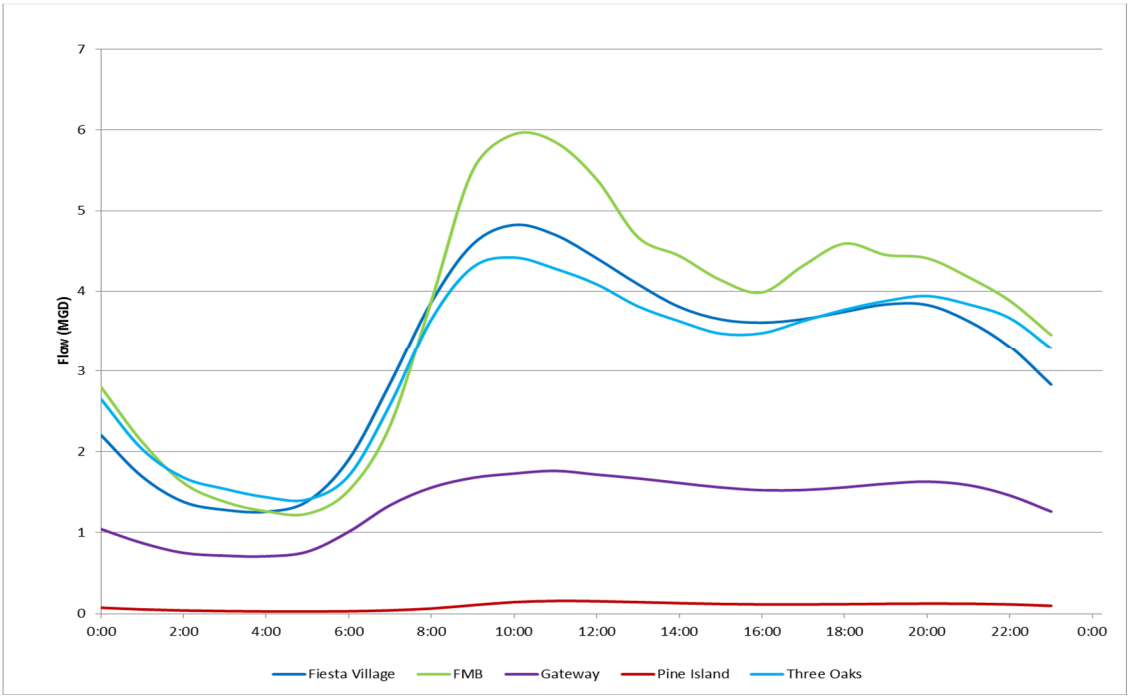


Figure B - 1 Diurnal Flow All Plants - Dry Weather

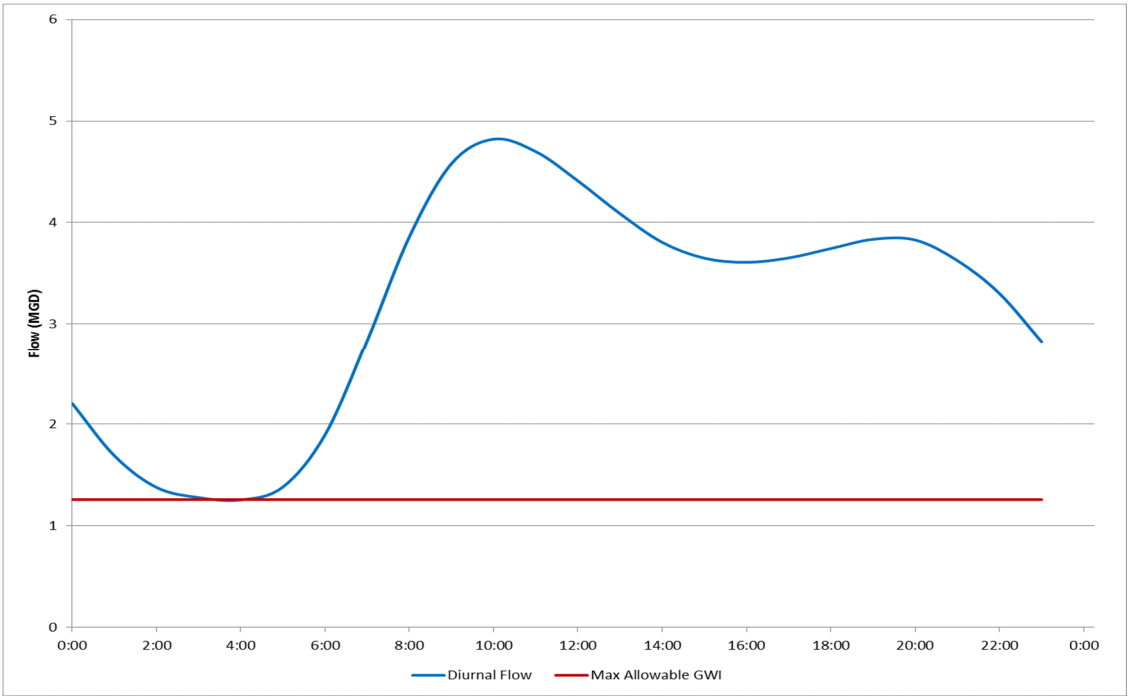


Figure B - 2 Diurnal Flow Fiesta Village – Dry Weather

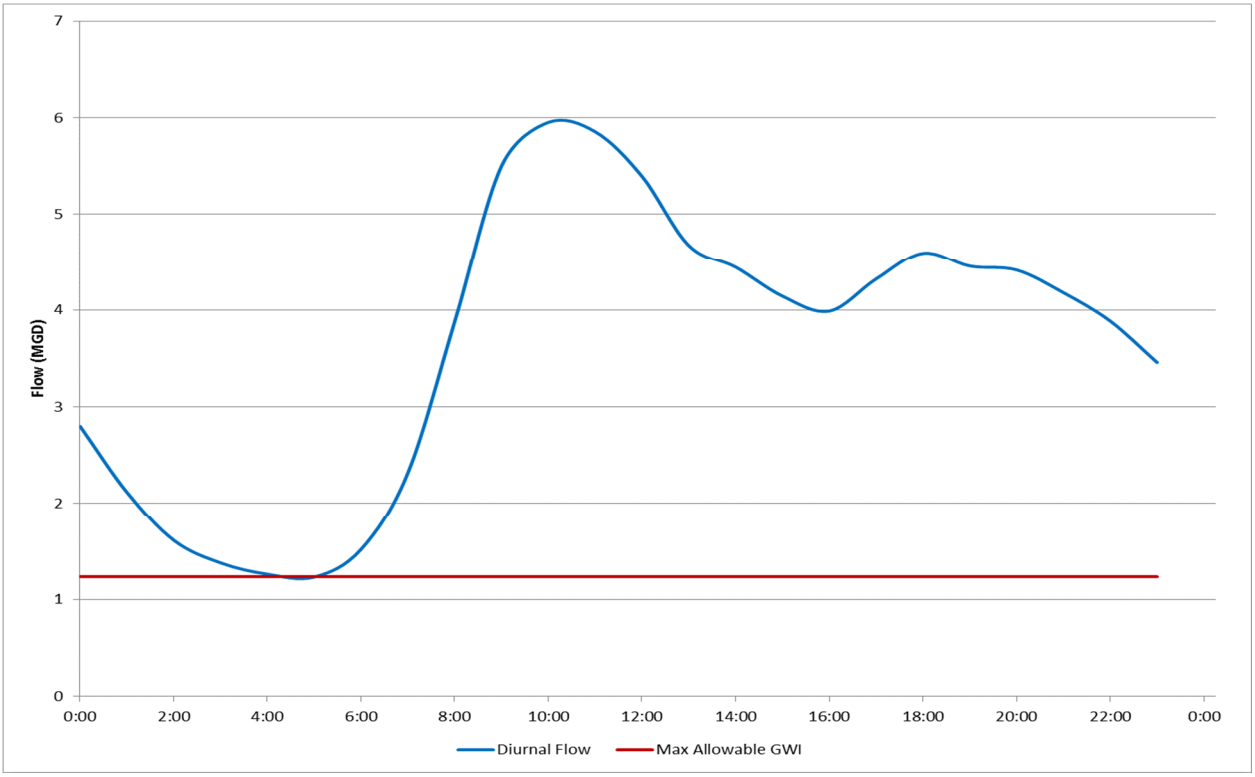


Figure B - 3 Diurnal Flow Fort Myers Beach - Dry Weather

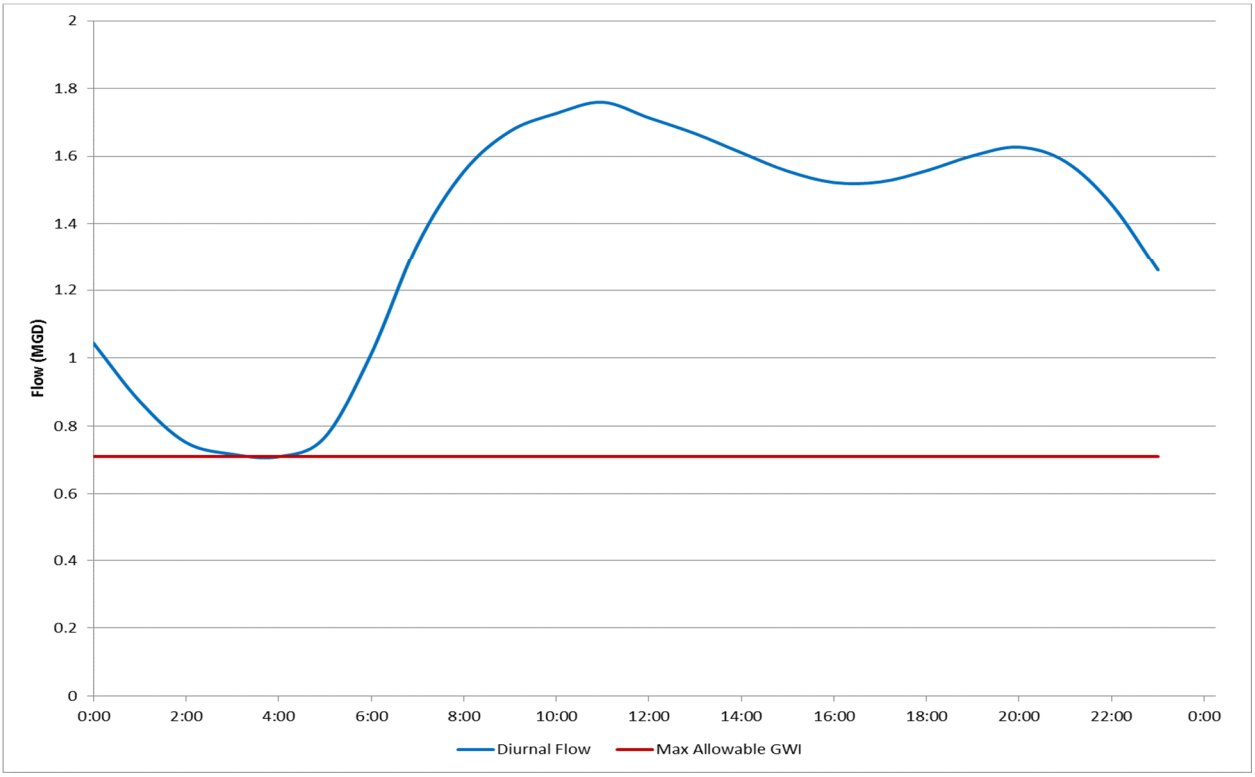


Figure B - 4 Diurnal Flow Gateway - Dry Weather

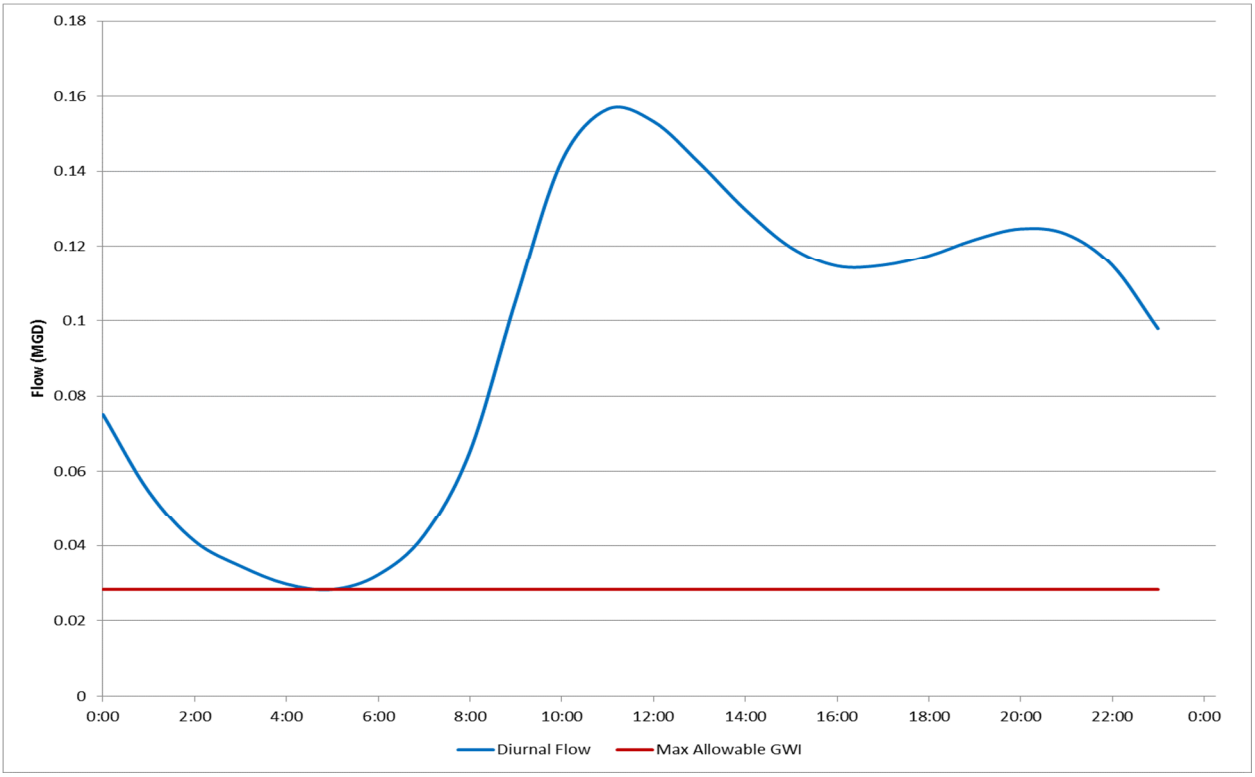


Figure B - 5 Diurnal Flow Pine Island - Dry Weather

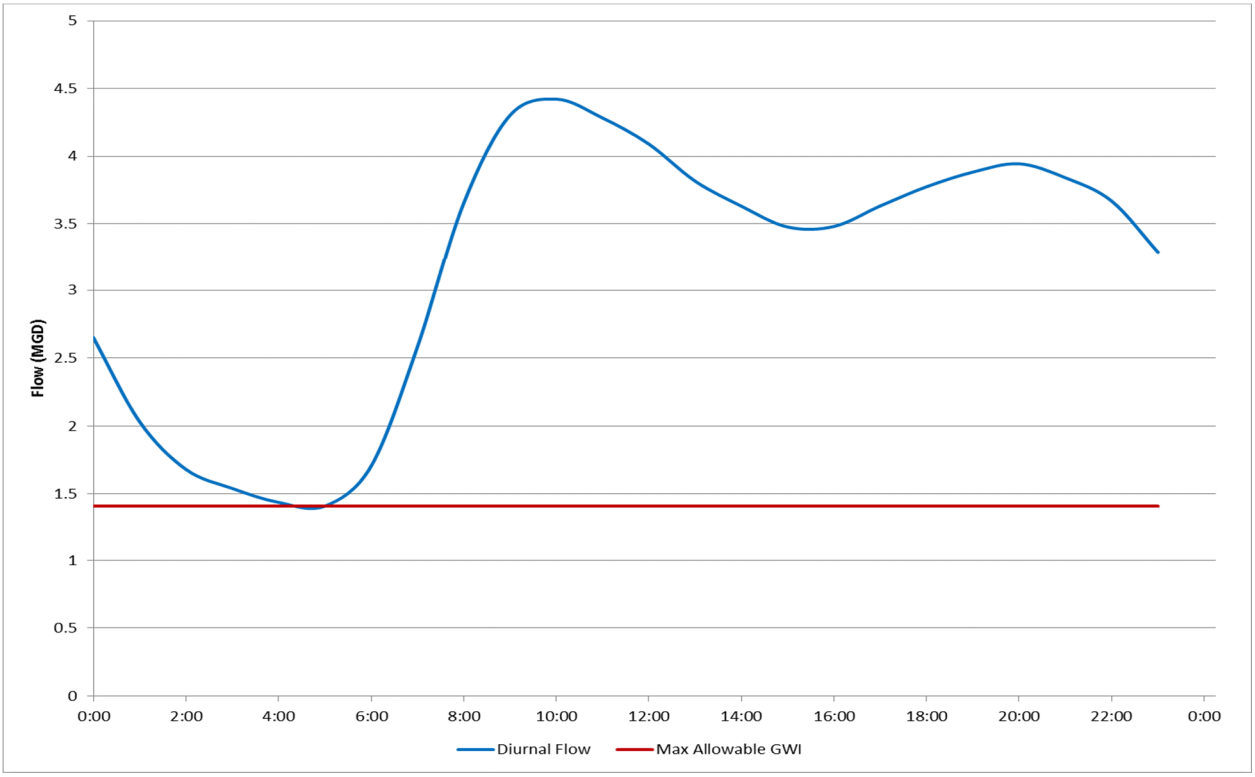


Figure B - 6 Diurnal Flow Three Oaks - Dry Weather

DIURNAL PEAKING FACTORS

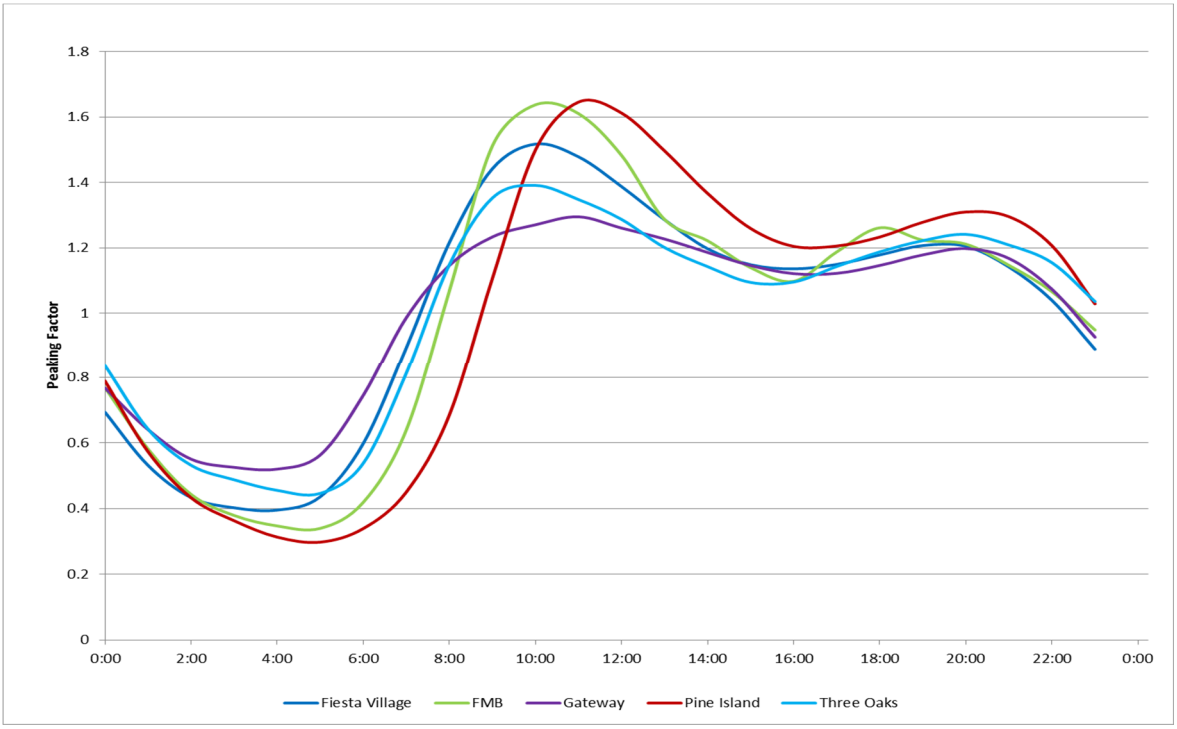


Figure B - 7 Diurnal Peaking Factors All Plants - Dry Weather

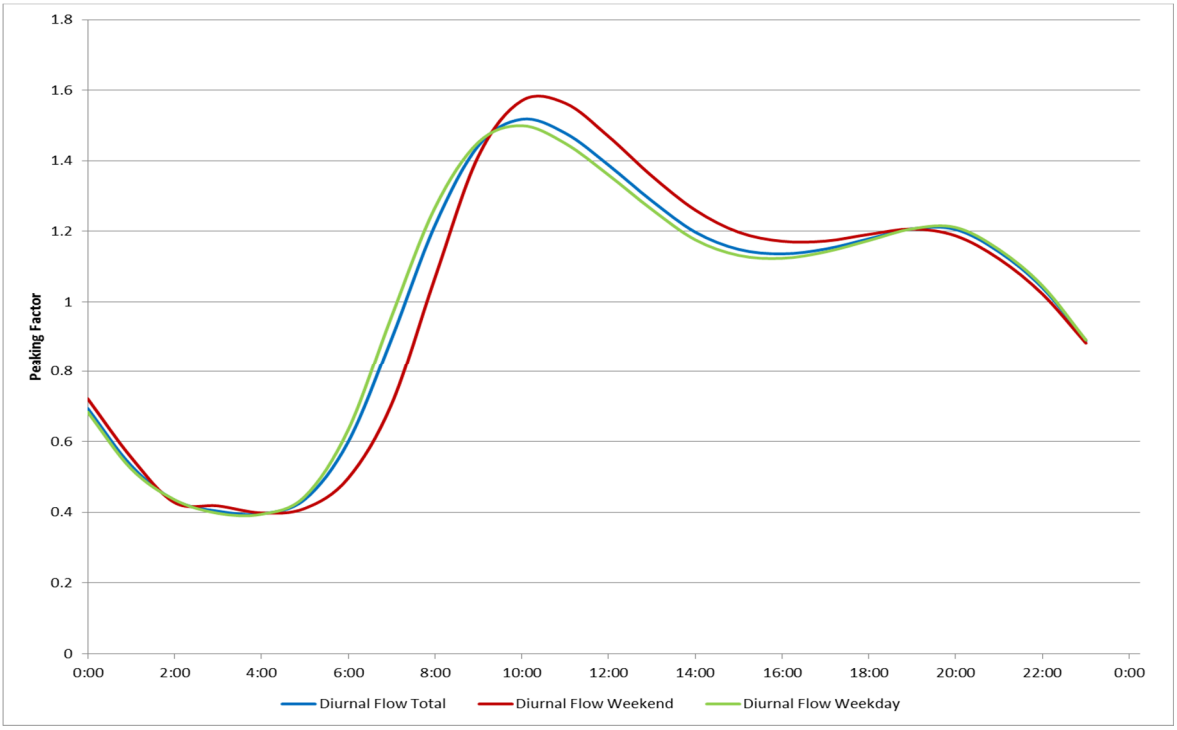


Figure B - 8 Diurnal Peaking Factors Fiesta Village - Dry Weather

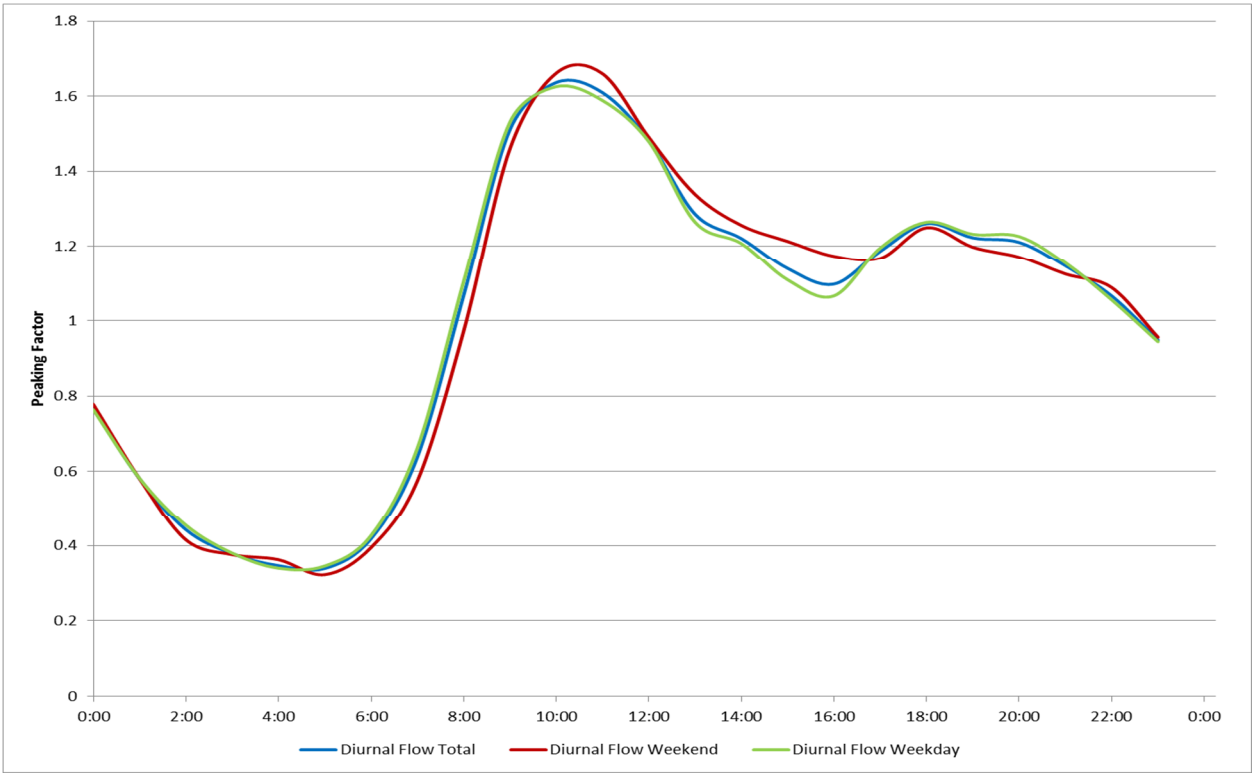


Figure B - 9 Diurnal Peaking Factors Fort Myers Beach - Dry Weather

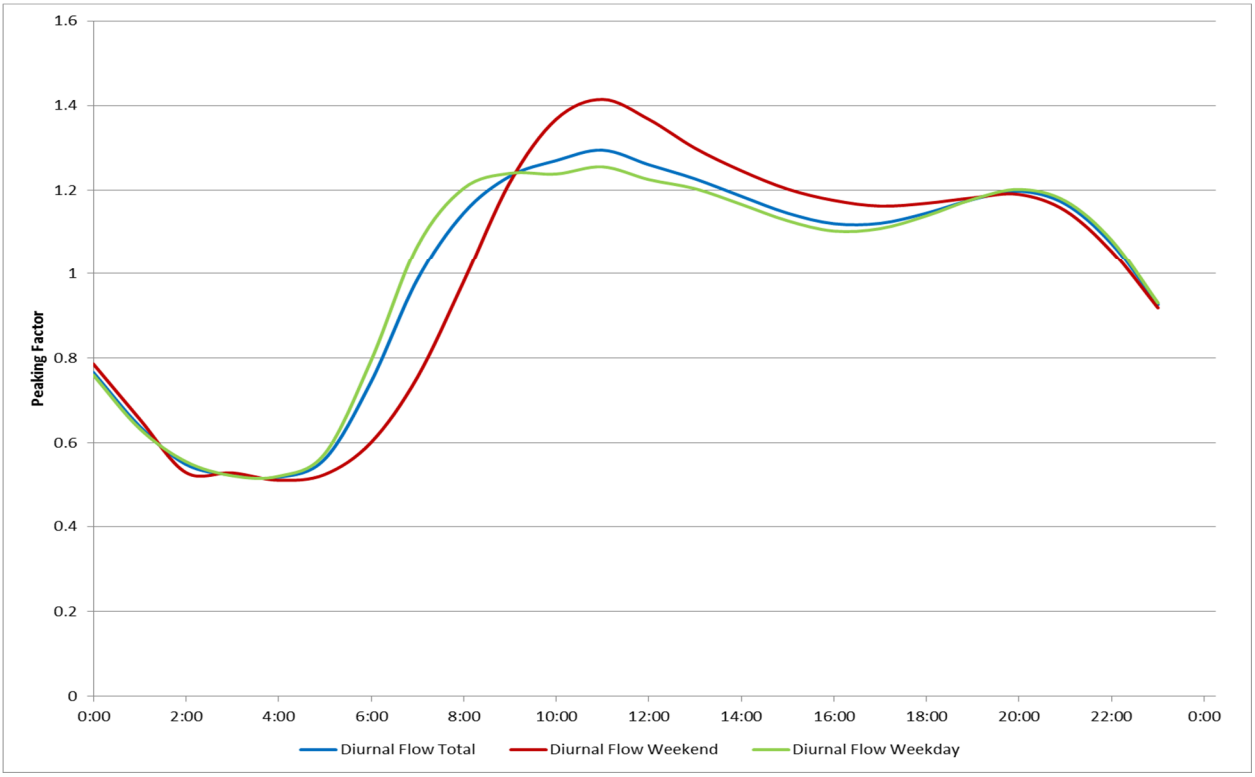


Figure B - 10 Diurnal Peaking Factors Gateway - Dry Weather

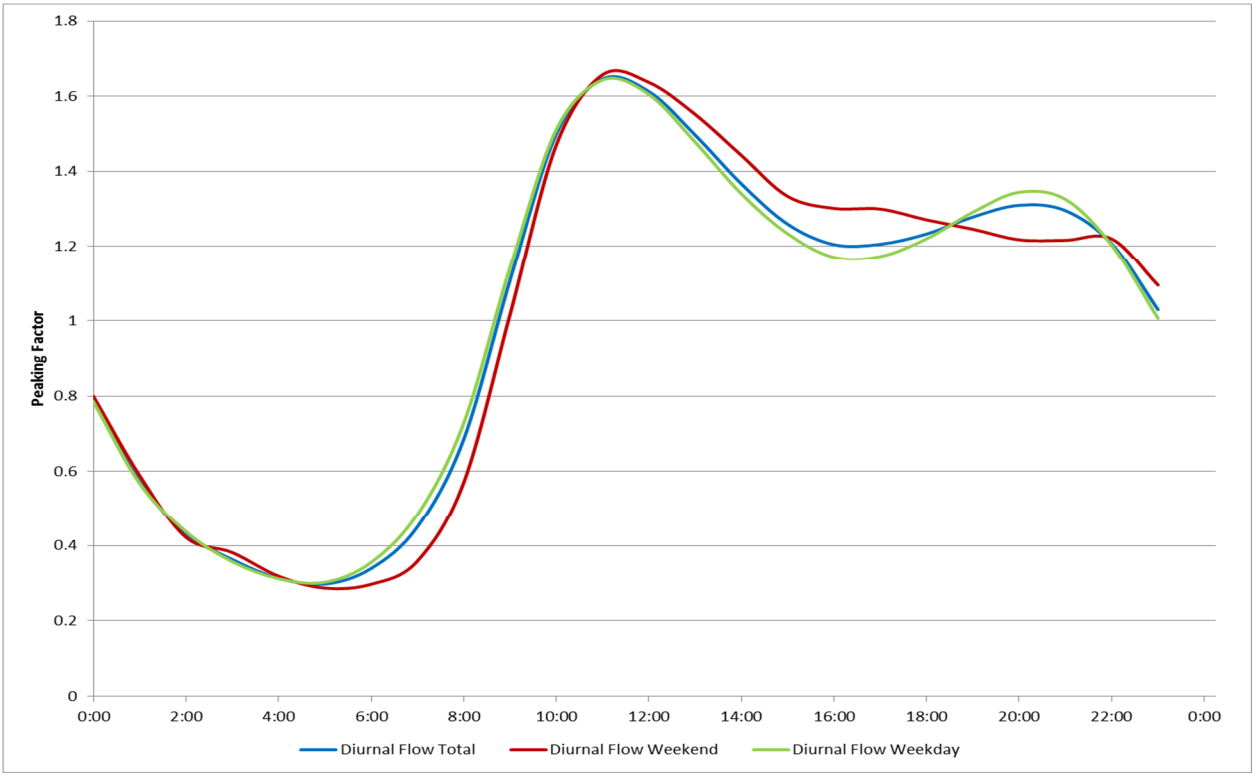


Figure B - 11 Diurnal Peaking Factors Pine Island - Dry Weather

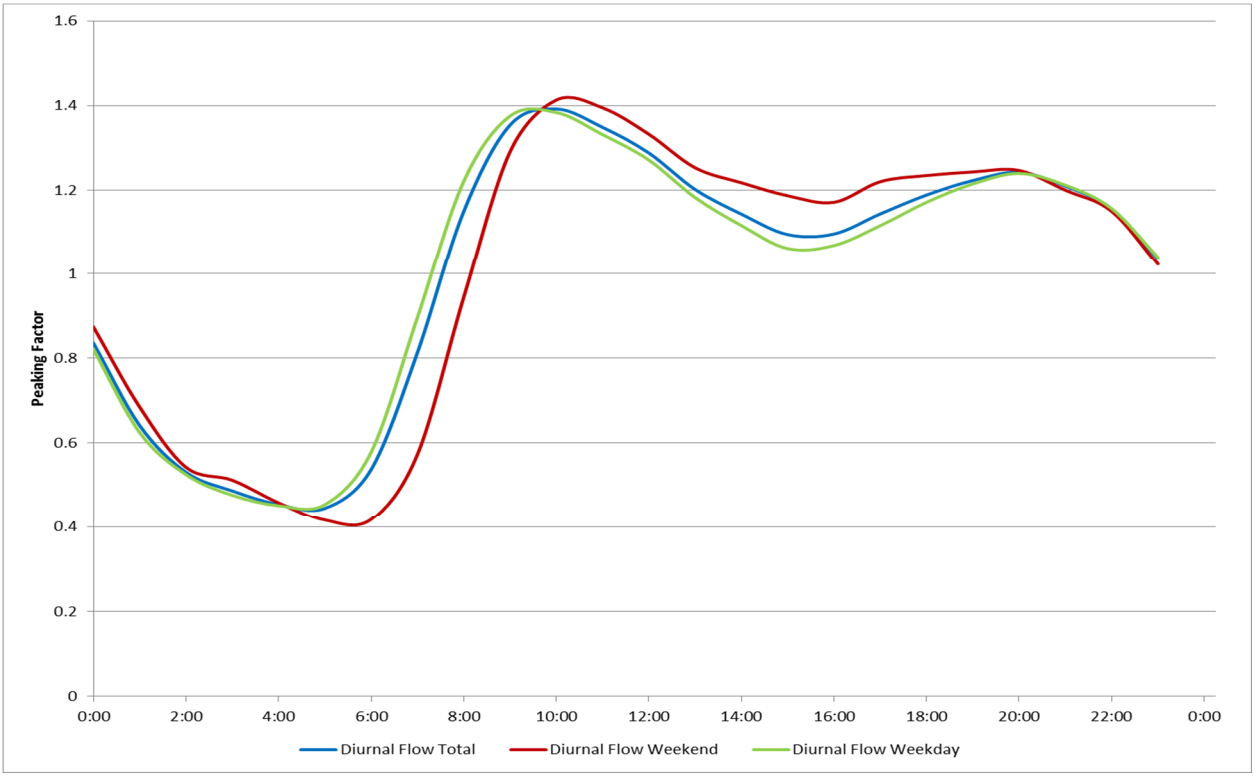


Figure B - 12 Diurnal Peaking Factors Three Oaks - Dry Weather

Appendix C – Wet Weather Impact Graphs

JUNE 2017 RAIN EVENT

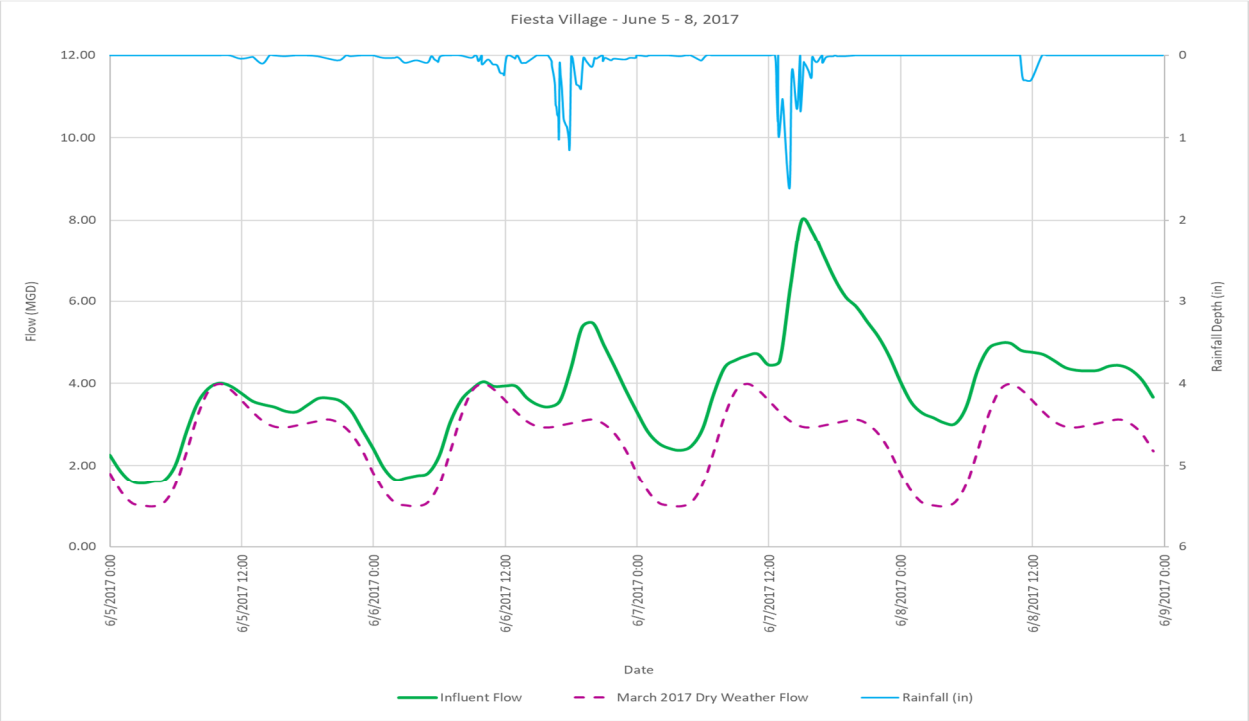


Figure C - 1 Wet Weather Flows June 5-8, 2017 - Fiesta Village

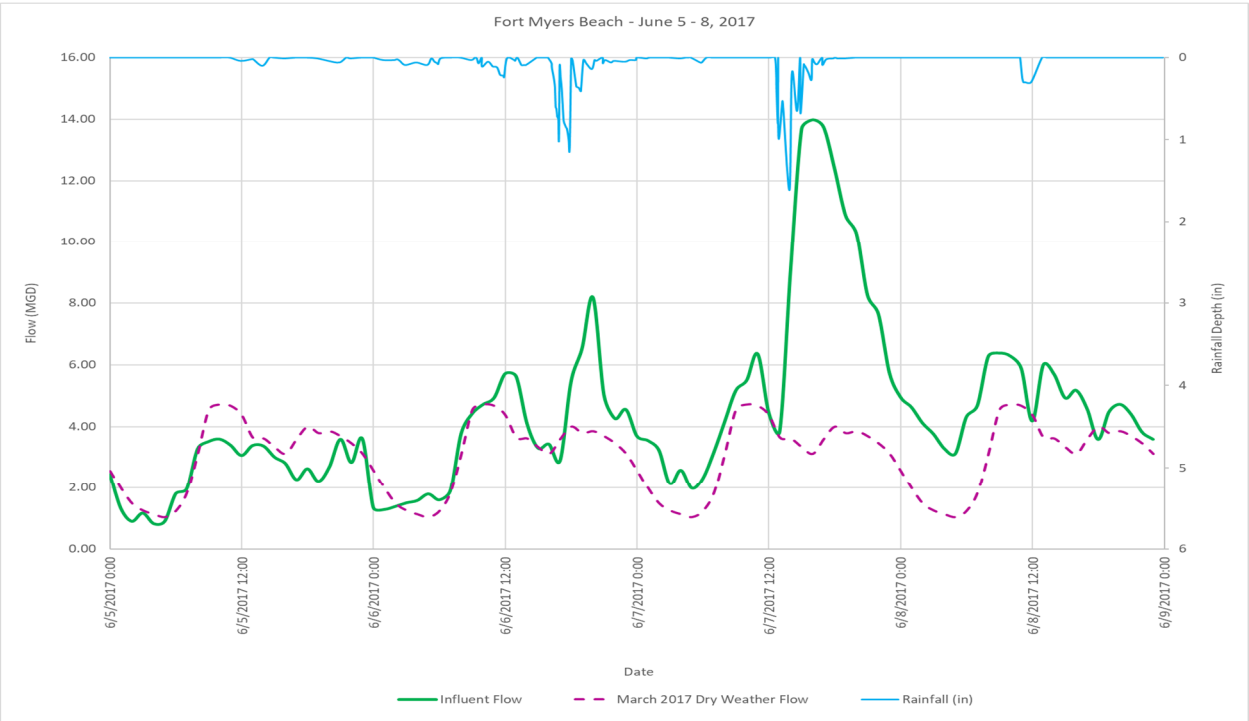


Figure C - 2 Wet Weather Flows June 5-8, 2017 - Fort Myers Beach

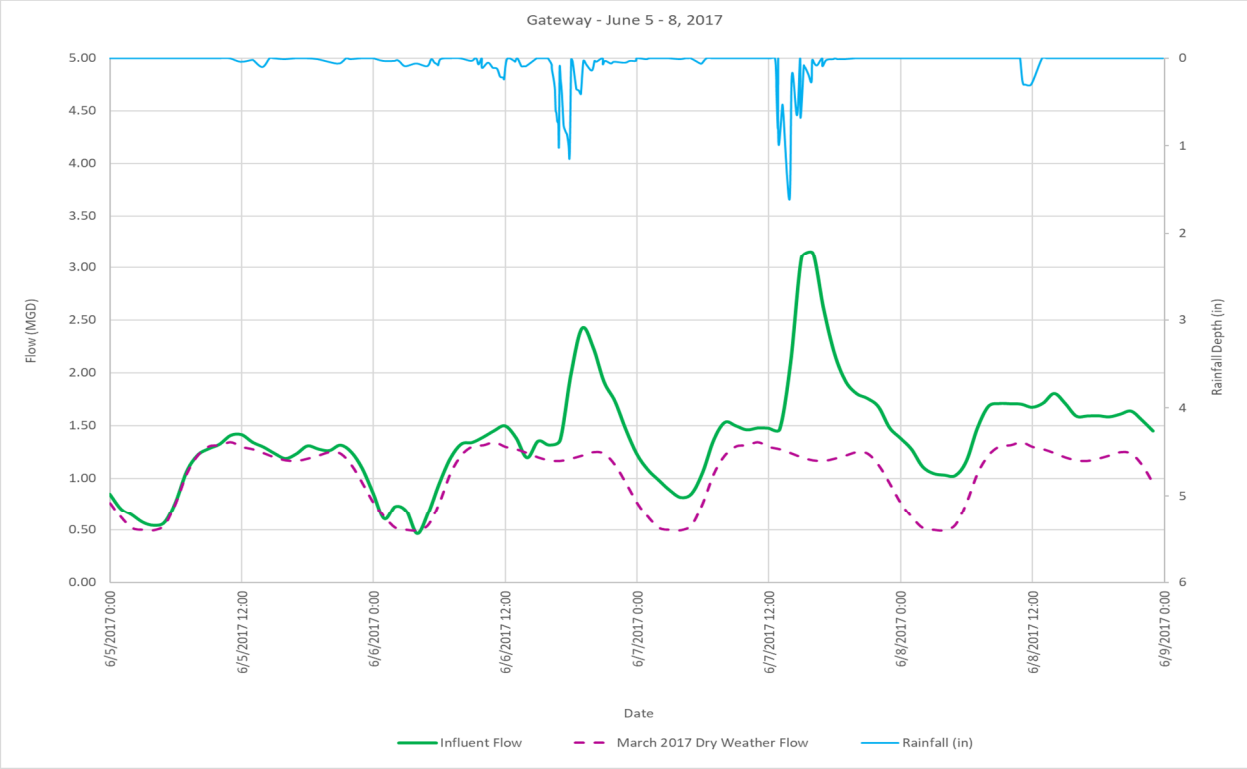


Figure C - 3 Wet Weather Flows June 5-8, 2017 - Gateway

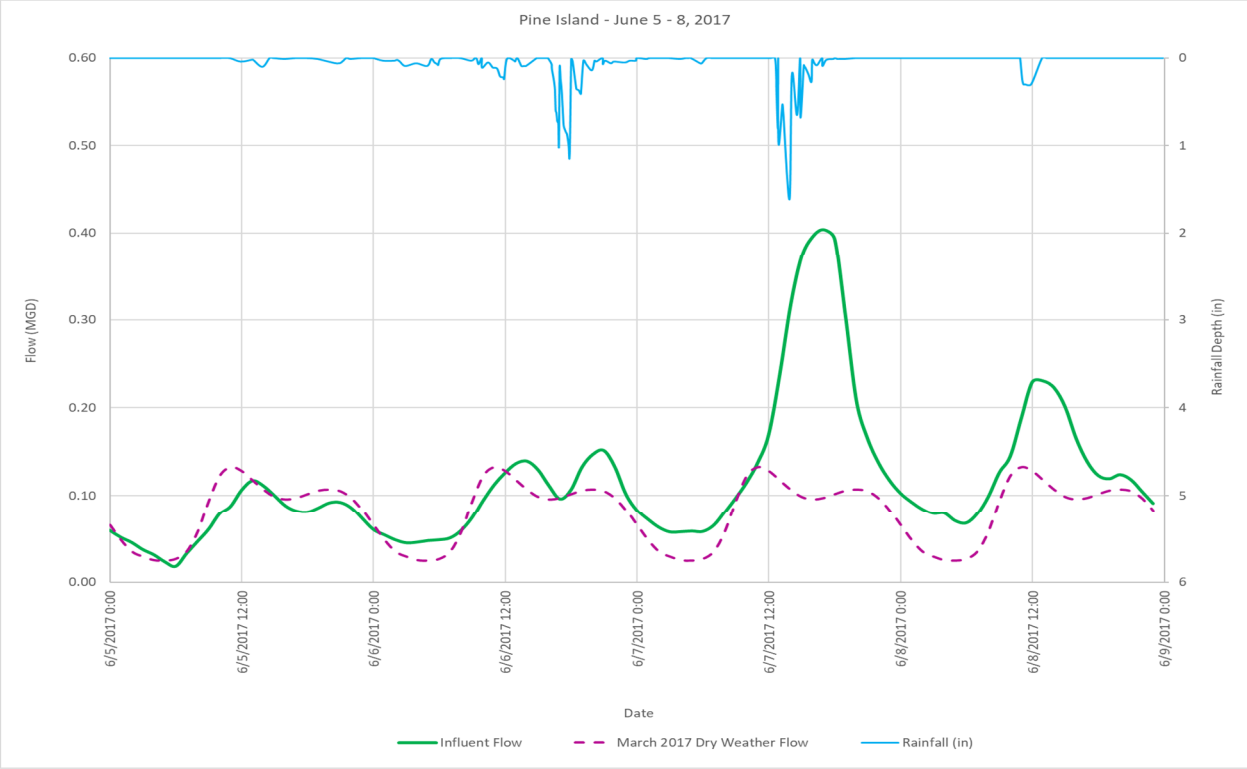


Figure C - 4 Wet Weather Flows June 5-8, 2017 - Pine Island

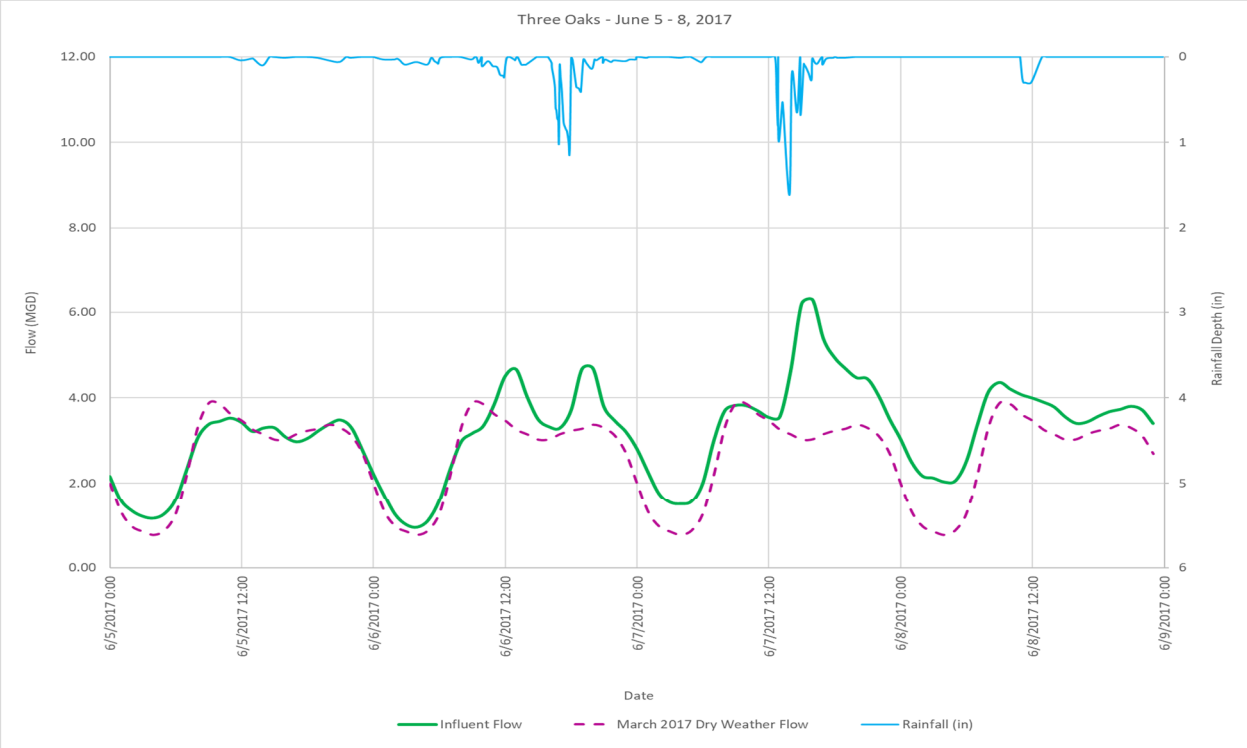


Figure C - 5 Wet Weather Flows June 5-8, 2017 - Three Oaks

AUGUST 2017 RAIN EVENT

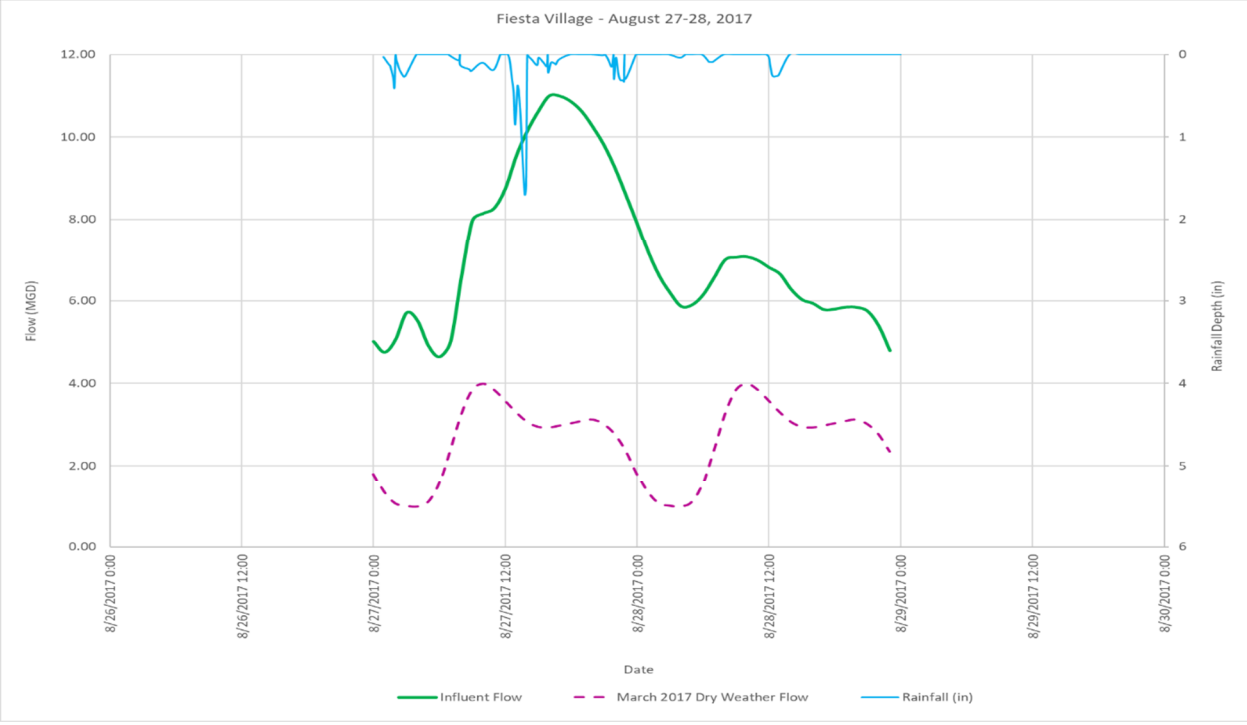


Figure C - 6 Wet Weather Flows August 27-28, 2017 - Fiesta Village

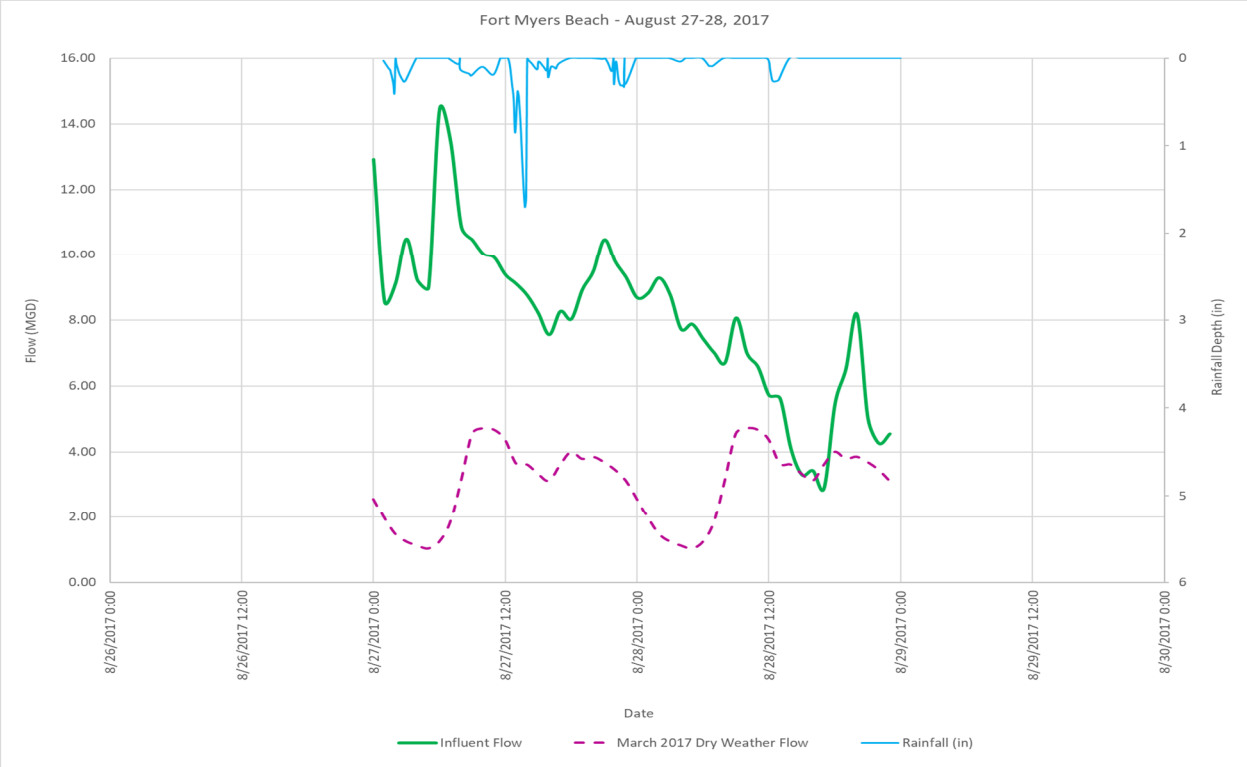


Figure C - 7 Wet Weather Flows August 27-28, 2017 - Fort Myers Beach

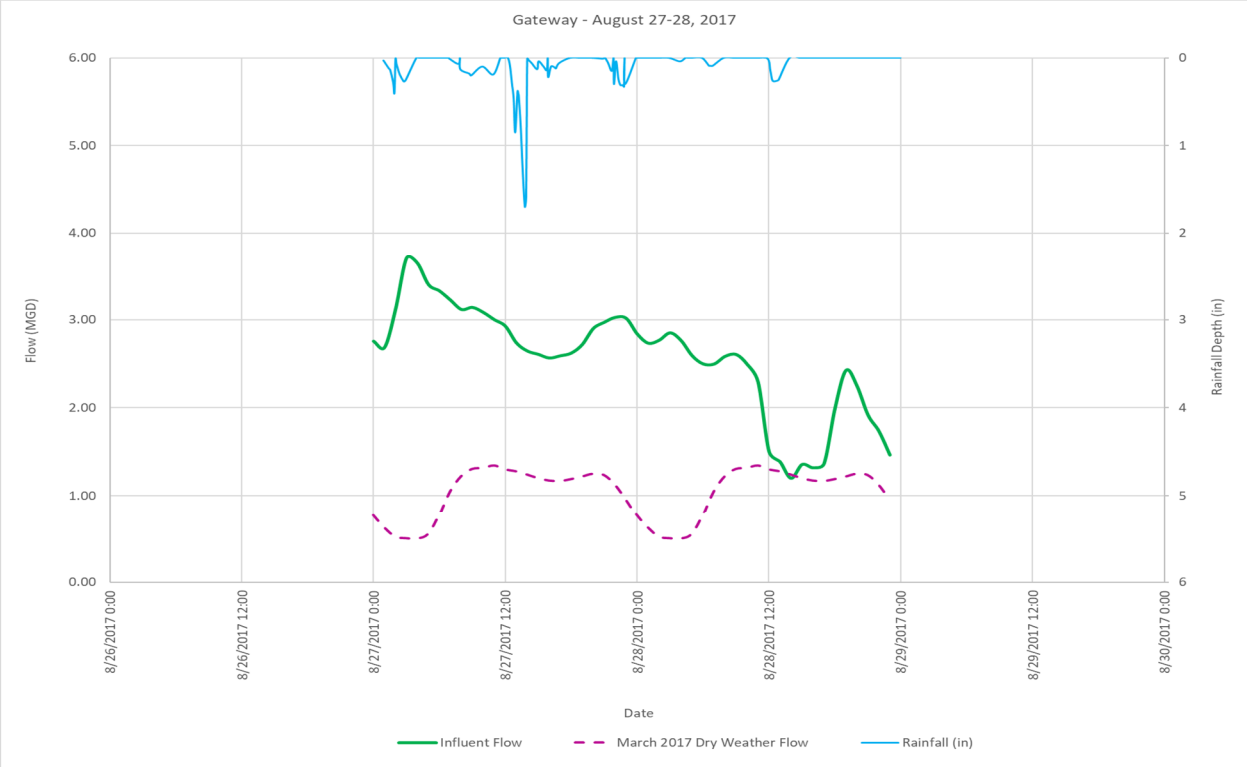


Figure C - 8 Wet Weather Flows August 27-28, 2017 - Gateway

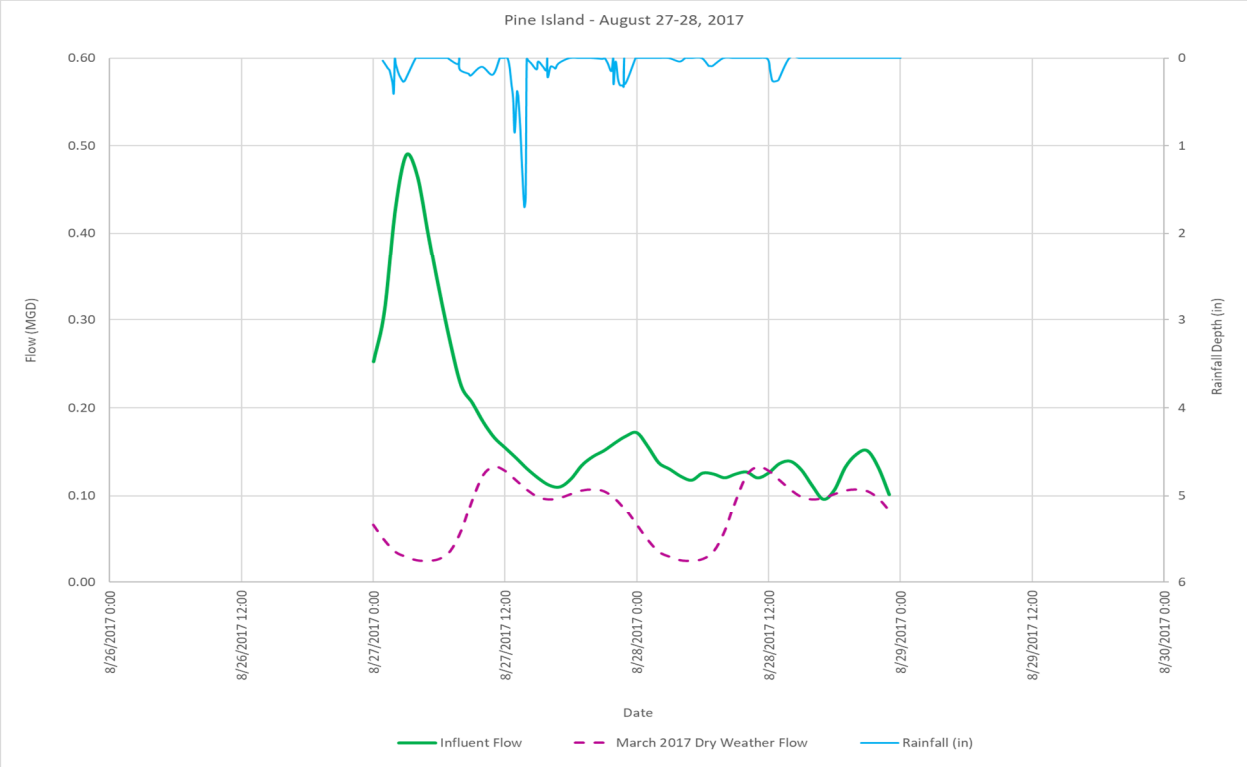


Figure C - 9 Wet Weather Flows August 27-28, 2017 - Pine Island

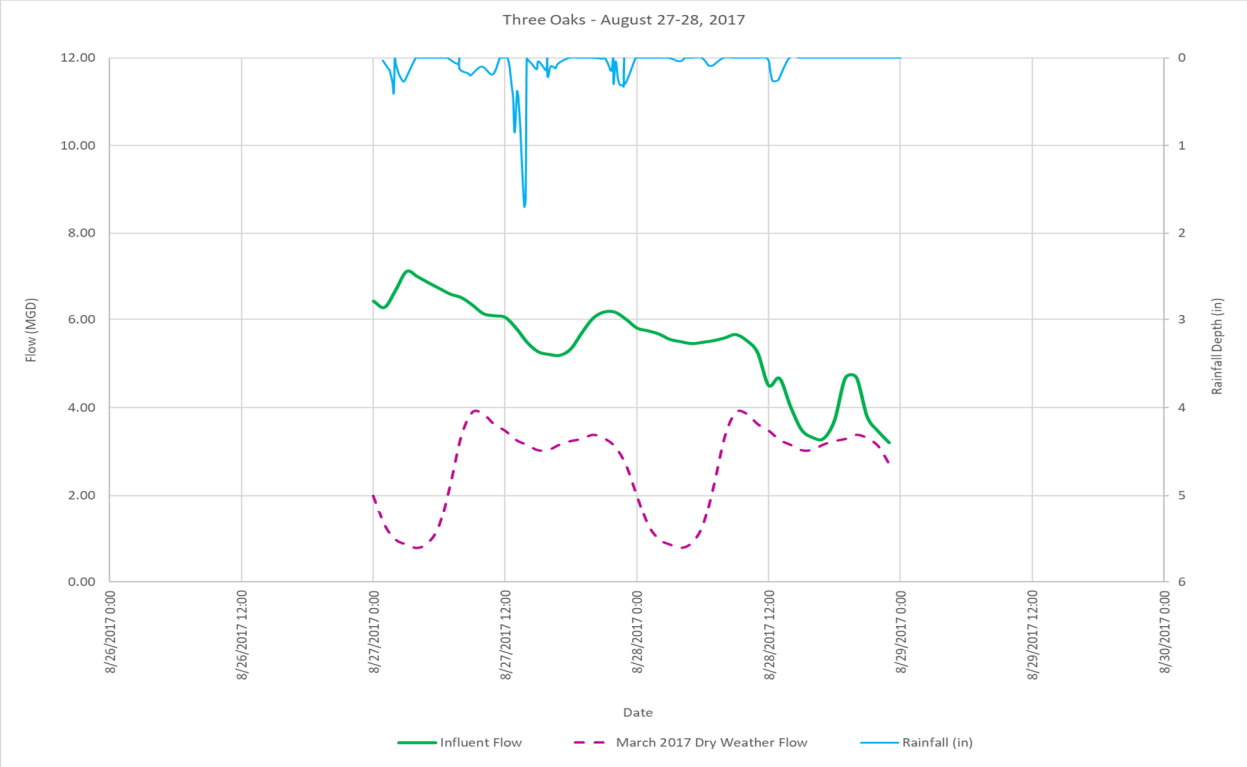


Figure C - 10 Wet Weather Flows August 27-28, 2017 - Three Oaks

JUNE 2018 RAIN EVENT

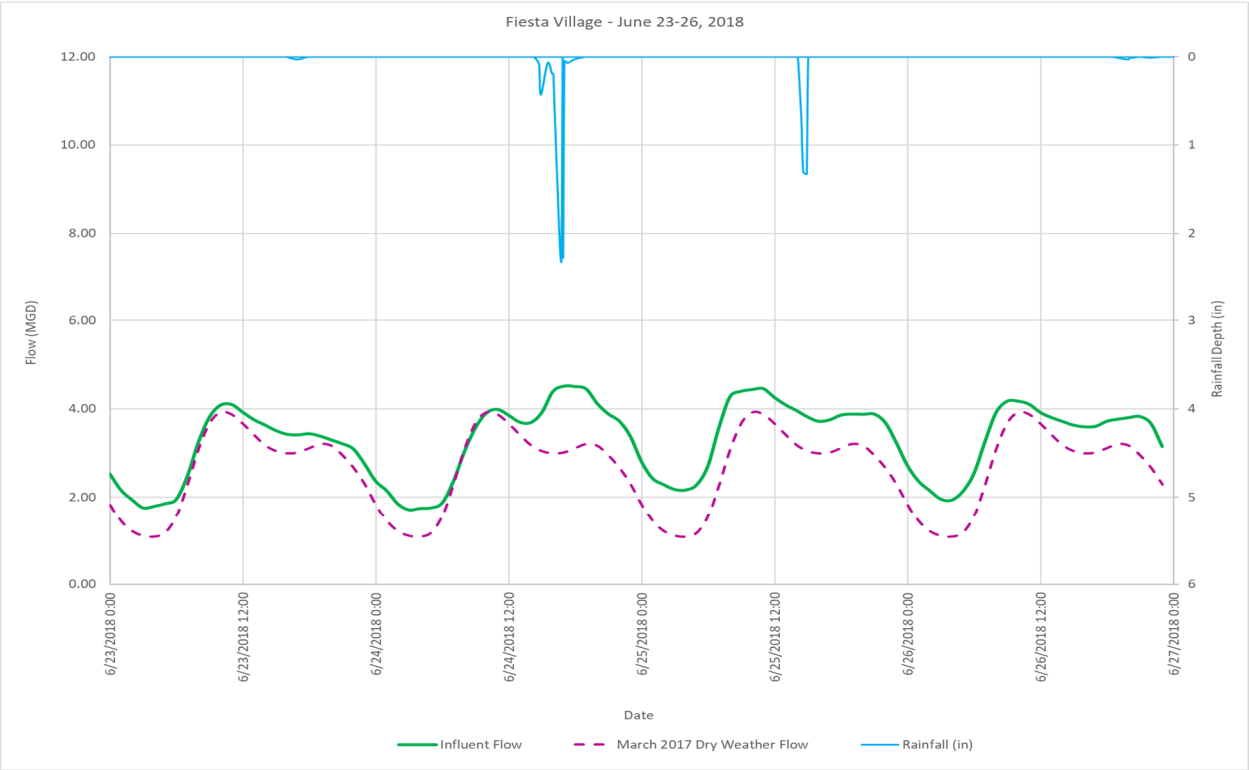


Figure C - 11 Wet Weather Flows June 23-26, 2018 - Fiesta Village

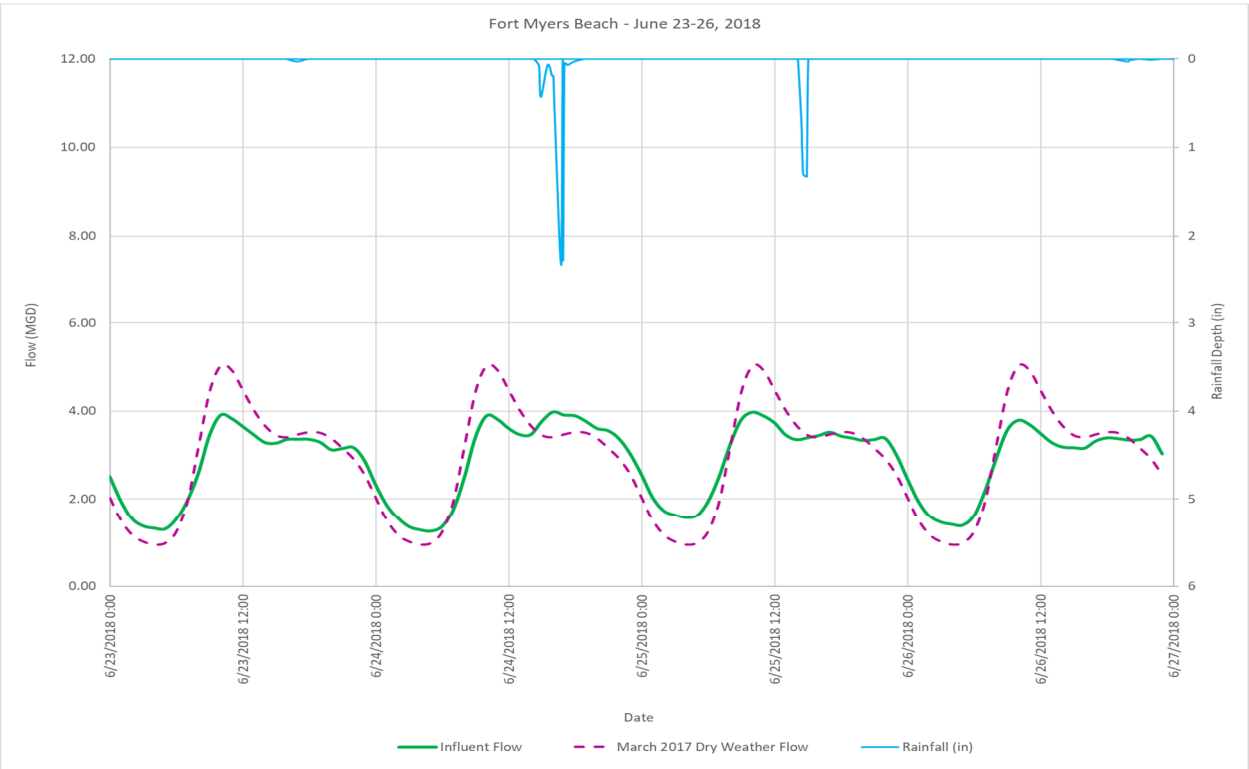


Figure C - 12 Wet Weather Flows June 23-26, 2018 - Fort Myers Beach

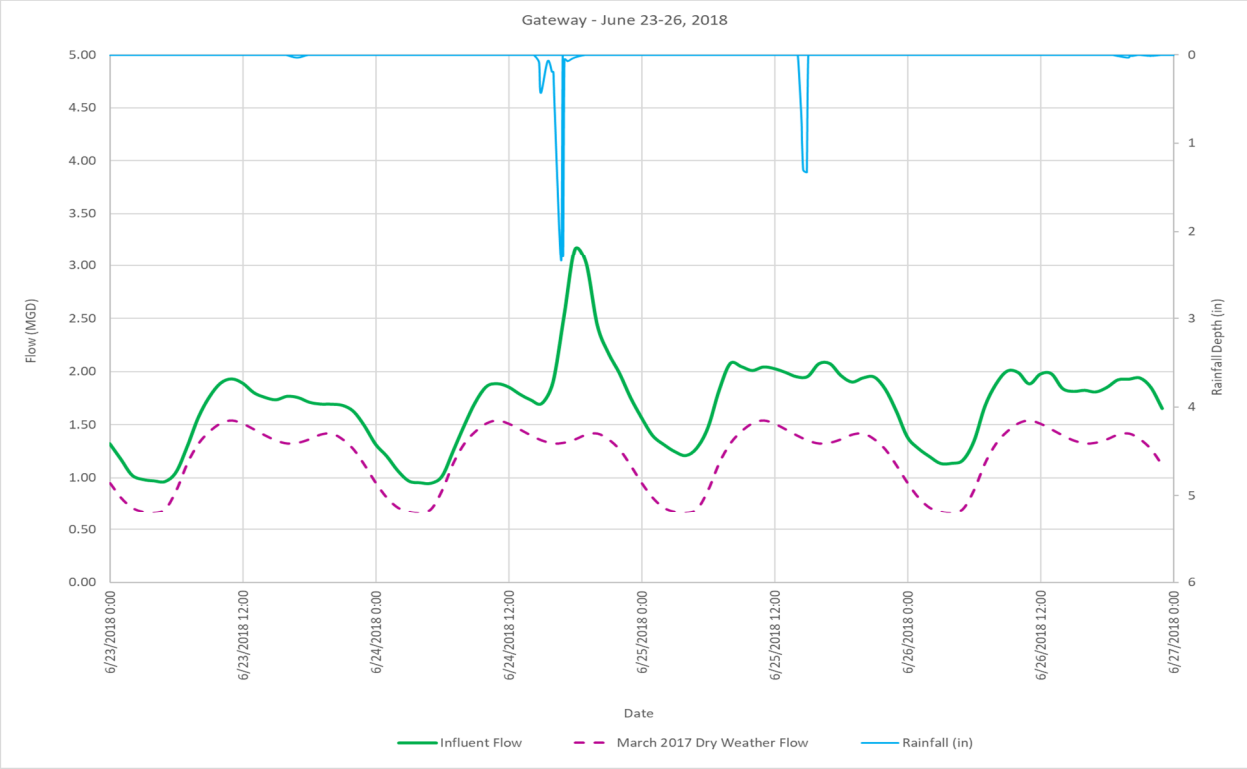


Figure C - 13 Wet Weather Flows June 23-26, 2018 - Gateway

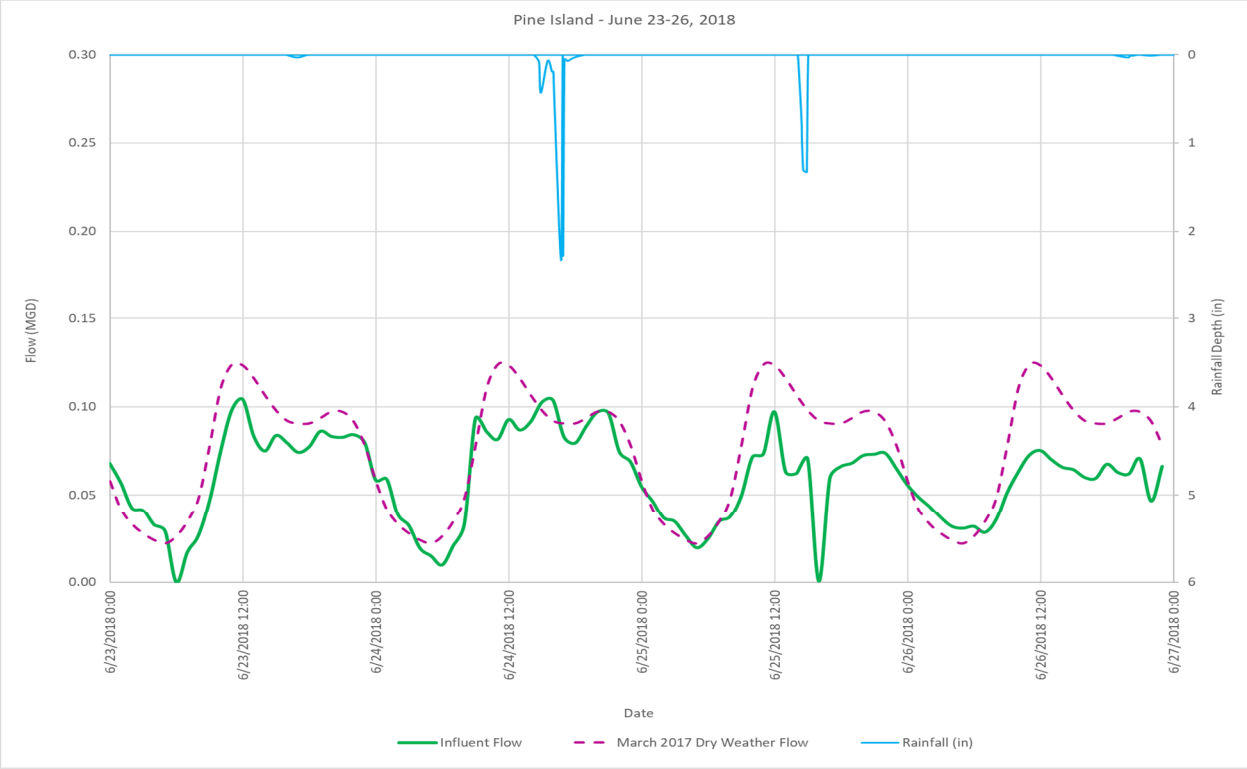


Figure C - 14 Wet Weather Flows June 23-26, 2018 - Pine Island

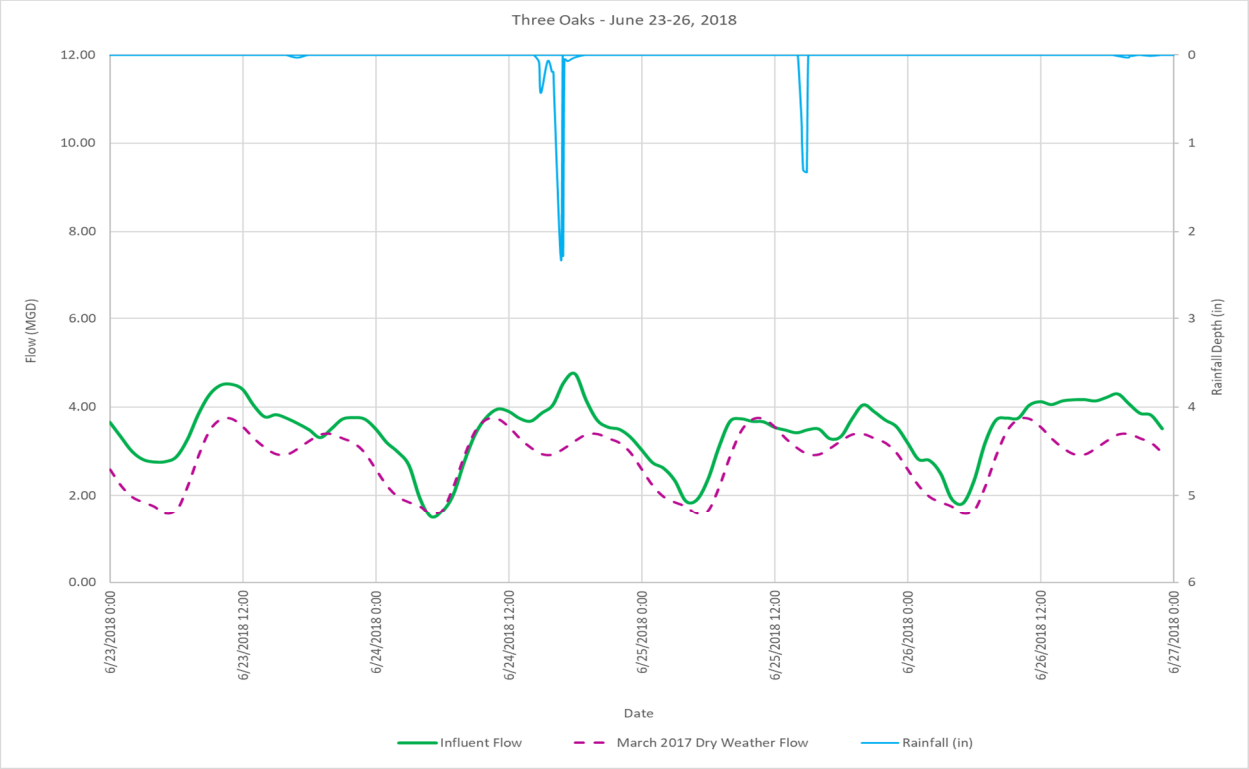


Figure C - 15 Wet Weather Flows June 23-26, 2018 - Three Oaks

Appendix B – Wastewater Integration and Optimization TM

FINAL

WASTEWATER INTEGRATION AND OPTIMIZATION

Technical Memorandum

B&V PROJECT NO. 199611

PREPARED FOR

Lee County Utilities

30 OCTOBER 2019

Lee County Southwest Florida

BLACK & VEATCH

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AWRF	Advanced water reclamation facility
BEBR	Bureau of Economic and Business Research
BSF	Base sanitary flow
CFM	City of Fort Myers
CIP	Capital Improvement Plan
EPS	Extended Period Simulations
FDEP	Florida Department of Environmental Protection
fps	Feet per second
GIS	Geographic Information System
GWI	Groundwater infiltration
gpm	Gallons per Minute
HSPS	High Service Pump Station
LCU	Lee County Utilities
MGD	Million Gallons per Day
MMDF	Maximum Month Daily Flow
MPO	Metropolitan Planning Organization
ROW	Right of Way
TAZ	Traffic Area Zone
TM	Technical Memorandum
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

1.0 Introduction

Lee County Utilities (LCU) owns and operates four regional water reclamation facilities (WRF) and one advance water reclamation facility (AWRF). In addition to the five LCU owned WRFs, LCU owns half of the permitted capacity of the City of Fort Myer's (CFM) two wastewater treatment plants, CFM South and CFM Central. The following technical memorandum details the efforts completed in the collection system capacity assessment as part of the LCU Wastewater Master Plan Update. Items covered include performance criteria, baseline model development, baseline capacity assessment, alternatives development and analysis, recommended collection system improvements, and improvement phasing. As part of the process two workshops were conducted to capture consensus from the team.

1. Alternatives Development Workshop to present the existing system performance criteria and select the alternative improvement options for analysis.

2. Alternatives Analysis Workshop to present the improvement options and select the improvement set for inclusion in the Capital Improvement Plan (CIP)

2.0 Performance Criteria

Black & Veatch worked with LCU to establish the desired system performance criteria, which were used as the basis for determining if improvements are needed to meet the projected increases in system demands over the planning horizon. The criteria are based on various wastewater system design guidelines and consider references such as existing and proposed regulations (e.g. FDEP regulations). **Table 1** summarizes the performance criteria on which the system was evaluated.

Table 1 Performance Criteria

CRITERIA	MAXIMUM	MINIMUM
Pipeline Criteria		
Velocity	7 fps	2 fps
Pressure	150 psi	10 psi
Pump Criteria		
Starts per Hour	6 Starts/hr.	2 Starts/hr.
Lag Pump Run Time	0 min	NA
Wet Well and Surcharging Criteria		
Wet Well Level	5 ft Freeboard	NA
Gravity System	Allows Surcharging	NA

1. Surcharging of the gravity system is considered a surcharged influent pipe on the wetwell invert with the lowest elevation.

3.0 Baseline Model Development

3.1 CALIBRATED MODEL

LCU provided Black & Veatch calibrated hydraulic models of the pressurized infrastructure existing within its wastewater collection system to conduct various analyses on the capabilities and capacities of the system. The models included the portion of pump stations manifolded together and discharging at the WRFs, as well as a select number of lift stations discharging to gravity (represented as a reservoir in the model). **Table 2** compares the number of stations in the LCU GIS to the number of stations included in the models for each service area. The difference in the number of stations is attributed to stations that discharge to gravity or were not at construction completion during the data collection period. The calibrated models provided were set up to undergo a steady state analysis with one flow scenario and all pumps on.

Table 2 Comparison of LCU GIS Station to Modeled Stations

PLANT	NUMBER OF STATIONS IN GIS	NUMBER OF STATIONS IN MODEL
Fiesta Village AWRF	194	154
Fort Myers Beach WRF	210	177
Fort Myers South WWTP	221	139
Gateway WRF	36	11
Three Oaks WRF	283	184

Though steady state scenarios are an acceptable method for calibration, they do not adequately represent the true flow patterns of highly manifolded systems such as the Lee County service areas. Analyzing the system using a steady state scenario with all pumps on has a risk of over sizing future improvements, not identifying force mains with low velocities and potential sedimentation and might cause the County to spend capital in unnecessary locations and at unneeded times.

Industry best practices recommend a 24-hour extended period simulations (EPS) analysis and provides a more accurate representation of the system's true operating conditions under a variety of conditions. As such, Black & Veatch updated the County's hydraulic model with updated wastewater flow information and prepared the model for EPS.

Additionally, with the exception of PS 3345 in the Fort Myers South WWTP service area, all other stations are modeled as duplex stations. As future modeling efforts progress, pump stations in the models can be adjusted, by number of pumps and detailed controls, to more closely fit the real-world infrastructure.

3.2 BASELINE MODEL FLOW

As part of the Population and Flow Projection Technical Memorandum (Flow Projection TM), Black & Veatch developed base sanitary flows (BSF), groundwater infiltration (GWI), and diurnal flow patterns for each service area. The BSF and GWI for each gravity main were attributed to gravity mains and then pump stations within the model based on geospatial water meter data provided by

LCU records. Specifically, the maximum month water consumption for each customer water meter was assigned to the nearest gravity main using a spatial join function and traced back to the gravity main's terminal lift or pump station. [*The terminal pump station is the manifolded pump station in the model.*] Using the ratio of water consumption to BSF, the water consumption was adjusted to represent the BSF. The GWI per in-mile factor (calculated as part of the Flow Projection TM) was applied to each gravity main by the length and diameter of the gravity mains and was similarly traced back to the gravity main's terminal lift or pump station. Similarly, a terminal pump station was identified for each upstream lift station such that the flow was accounted for in the manifolded force man system.

To simulate real-world flow allocations, the BSF was assigned a diurnal pattern for each service area and the GWI was assigned a constant or fixed flow pattern. The diurnal patterns used for each service area are in the Flow Projection TM.

3.3 CONTROLS

Wetwell and pump controls were added to the model to replicate the actual operation of the collection system. Total wetwell depths and wetwell invert elevations were already included in the calibrated models. The lowest invert of the influent pipe(s) for each wetwell was determined using LCU GIS data. Pump controls were generally determined using industry standards for station design based on the wet well invert and influent pipe invert. The calculated controls were assigned using the following methodology:

- All Pumps Off = ±2 ft above Wetwell Invert Elevation
- Lead Pump On = Min of 3 ft above All Pumps Off; OR Lag Pump On – 0.5 ft if the Influent Pipe was greater than 5.5ft above the Wetwell Invert Elevation;
- Lag Pump On = Influent Pipe Invert Elevation – 0.5 ft OR 0.5 ft above the Lead Pump On

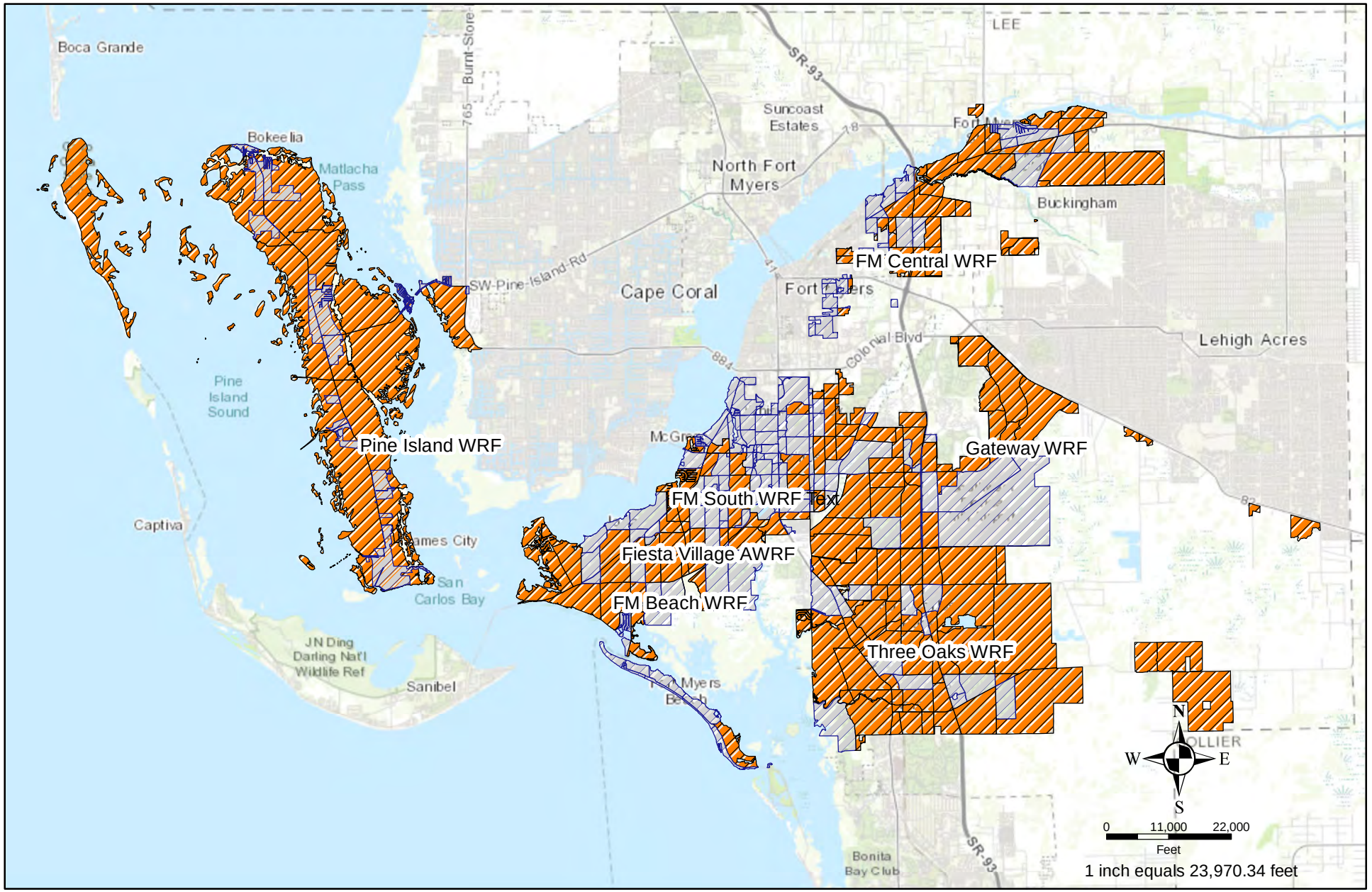
Black & Veatch recommends updating the pump controls in the model to match the actual pump controls as part of the next model update.

3.4 FUTURE FLOWS

Future flows were added into each model based on the population growth identified in the traffic analysis zones (TAZ) prepared by the Lee County Metropolitan Planning Organization (MPO). Population growth from 2020 to 2040 in each service area was categorized as: 1) Increased Density or 2) System Expansion. Increased density flows were assigned to existing infrastructure whereas system expansion flows were assigned to new pump stations. **Figure 1** illustrates TAZ organized into the increased density and system expansion categories. TAZ containing the need for both increased density and system expansion were classified as system expansion in **Figure 1** and divided into more detailed areas during the modeling process. New collection system infrastructure was not modeled within the expansion areas due to the unknown nature of future development. Pumped flows were instead applied to the modeled force mains which would most likely receive the new flows. **Table 3** summarizes the projected flows for each service area through the planning horizon.

Table 3 2020 – 2040 Flow Projections

WATER RECLAMATION FACILITY	MMDF (MGD)				
	2020	2025	2030	2035	2040
Fiesta Village Service Area	3.85	4.25	4.65	5.05	5.45
FM Beach Service Area	4.67	5.17	5.67	6.17	6.67
CFM Central Service Area (LCU Flow)	2.81	3.36	3.92	4.48	5.03
CFM South Service Area (LCU Flow)	6.01	7.18	8.35	9.53	10.7
Gateway Service Area	1.68	1.79	1.91	2.02	2.14
Pine Island Service Area	0.42	0.77	1.11	1.45	1.79
Three Oaks Service Area	4.03	5.33	6.63	7.92	9.57



Lee County Southwest Florida

BLACK & VEATCH

Increased Density

System Expansion

LEE COUNTY

Wastewater Master Plan

Figure 1

Increased Density vs System Expansion

4.0 Capacity Analysis

Black & Veatch identified "Status Quo" system improvements to meet the performance criteria discussed above. These improvements include upsizing force mains and pump stations that are under capacity but are not necessarily fully optimized. Black & Veatch met with LCU to develop alternative improvement scenarios for consideration to optimize the solution and provide the most cost-effective solution. The three alternative scenarios included: parallel piping routes, master pump station utilization and flow shedding.

4.1 STATUS QUO IMPROVEMENTS

Status quo improvements are standard improvements to provide increased capacity to handle the future flows projected to be seen in a collection system. Status quo improvements have been determined based on projected future flows for each LCU service area. These improvements include upsizing of existing force mains and increasing pumping capacity at existing pump stations. When possible, one of the pump models already in use in the LCU system was selected for the pump upgrades. Selecting pump models already in use will allow the County to reuse parts and limit the need for additional inventory in the County's warehouse. It must be noted that pump station upgrades were based on the duplex pump stations modeled in the provided LCU models. Due to all pump stations being modeled as duplex stations, further investigation into existing pump configurations and sizing should be employed prior to project execution.

4.2 PARALLEL PIPING

The use of parallel piping can help increase capacity without the need for replacing a force main as well as providing redundancy and resilience. Based on experience, LCU staff provided insight into the operational and maintenance challenges with parallel force mains. The main concern with this alternative improvement scenario was the proximity of the parallel force mains to each other causing difficulties with maintenance. It was agreed that should any areas require further investigation for the use of parallel force mains, a separate right of way (ROW) would be used to avoid placing the force mains too close to each other.

After investigation into locations to install parallel pipelines and discussion with LCU staff at the Alternatives Analysis Workshop, it was determined that there was one area in which parallel force mains would be considered for further analysis. In 2040 the acquisition of the Eagle Ridge WWTP was assumed, requiring major force main upgrades along Daniel's Parkway and Metro Parkway. This alternative scenario would be largely dependent on the acquisition of the Eagle Ridge WWTP as well as the possible flow shedding from the CFM South WWTP to the Gateway WRF. As the acquisition of the Eagle Ridge WWTP approaches, Black & Veatch recommends a more detailed study into the use of parallel force mains to transport the additional flow.

4.3 MASTER PUMP STATIONS

The intended use of master pump stations is to create lower head conditions for upstream pump stations, thus avoiding upgrades to those pump stations and allowing for overall fewer upgrades. Two locations were identified for possible master pump stations, 1.) Fort Myers Beach WRF service area – near the corner of McGregor Blvd. and Pine Ridge Rd.; 2.) City of Fort Myers South WWTP service area – near the corner of Metro Pkwy. and Crystal Dr. The addition of the first master pump

station in the Fort Myers Beach service area will also allow for the rehabilitation of PS 2256 which is nearing the end of its useful life. **Table 4** summarizes the flow and head conditions in the location of each proposed master pump station as well as the improvements they would help to avoid.

Table 4 Proposed Master Pump Stations

PROJECT ID	FLOW (GPM)	HEAD (FT)	PROJECTS AVOIDED
Master Pump Station 1	1,564	55	FMB-Pump-2
			FMB-Pump-3
			FMB-Pump-4
			FMB-Pump-6
			FMB-Pump-7
			FMB-Pump-24
Master Pump Station 2	6,272	59	FMSGW-Pump-9
			FMSGW-Pump-10
			FMSGW-Pump-11
			FMSGW-Pump-12
			FMSGW-Pump-19
			FMSGW-Pump-20
			FMSGW-Pump-23
			FMSGW-Pump-24
			FMSGW-Pump-25

4.4 FLOW SHEDDING

Two flow shedding options were analyzed as part of this alternative analysis. The projected flow scenario was the 2040 MMDF flows including the conversion of all septic areas and acquisition of private utilities located within the future LCU service area. It is not likely that all the acquisitions will occur at the same time within the planning horizon and more detailed analyses should be performed in anticipation of these acquisitions. In order to provide a more detailed understanding of flow shedding options, Black & Veatch will develop an interactive wastewater flow forecast tool as part of the capital improvement phase of the Wastewater Master Plan Update. Flow shedding options A and B are as described below and illustrated in **Figure 2**.

Option A:

- Flows from LS4481 diverted from the Fort Myers Central WWTP to the Gateway WRF via a new pipeline running south along I-75
- Flows from the Fort Myers South WWTP diverted to the Gateway WRF via a connecting pipeline run under I-75

- Flows, east of I-75, in the Three Oaks WRF service area sent to the new Southeast WRF
- Full Plant Expansion at Gateway, Three Oaks, and Southeast
- Eliminates all flows to both City of Fort Myers Plants

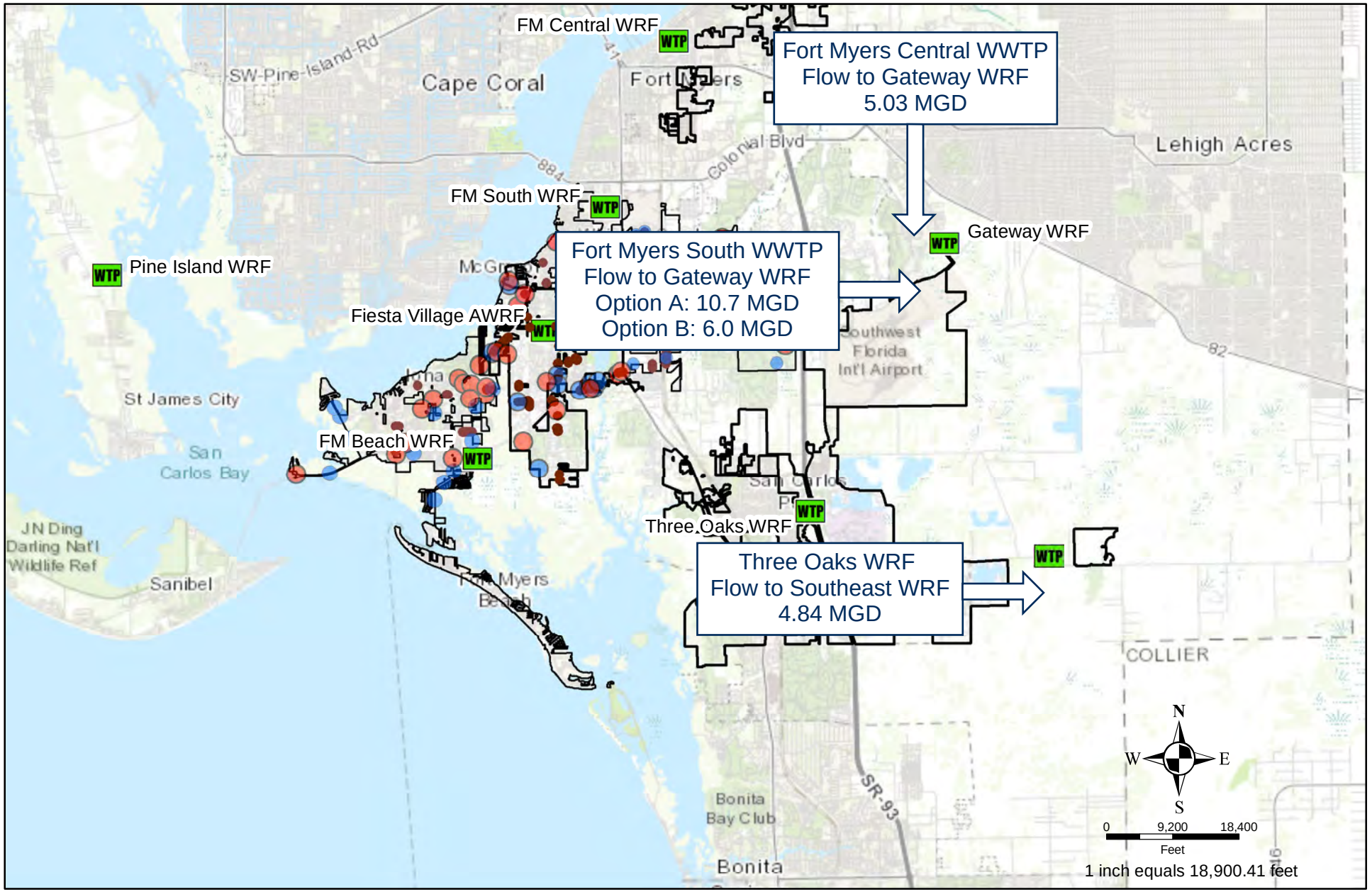
Option B:

- Partial flows from LS4481 diverted from the Fort Myers Central WWTP to the Gateway WRF via a new pipeline running south along I-75, while continuing to use the full capacity of CFM Central
- Partial flows from the Fort Myers South WWTP diverted to the Gateway WRF via a connecting pipeline run under I-75, while continuing to use the full capacity of CFM South
- Flows, east of I-75, in the Three Oaks WRF service area sent to the new Southeast WRF
- Full Plant Expansion at Gateway, Three Oaks, and Southeast

Table 5 summarizes the results of the flow shedding analysis.

Table 5 Flow Shedding Analysis Results

PLANT	PERMITTED CAPACITY (MGD)	2040 MMDF (MGD)	OPTION A		OPTION B	
			Flow (MGD)	Remaining Capacity (MGD)	Flow (MGD)	Remaining Capacity (MGD)
Fiesta Village	5.0	5.45	5.45	-0.5	5.45	-0.5
Fort Myers Beach	6.0	6.67	6.67	-0.7	6.67	-0.7
Fort Myers Central	5.5 (LCU)	5.03	0	0.5 (10% remaining)	5.03	0.5 (10% remaining)
Fort Myers South	6.0 (LCU)	10.7	0	-	6.00	0.0
Gateway	3.0/6.0/9.0	2.14	17.87	-8.9	6.84	2.2 (24% remaining)
Pine Island	0.5	1.79	1.79	-1.3	1.79	-1.3
Three Oaks	6.0/8.0	11.29	6.45	1.6 (20% remaining)	6.45	1.6 (20% remaining)
Southeast Plant	2.0/6.0	NA	4.84	1.2 (20% remaining)	4.84	1.2 (20% remaining)



Lee County Southwest Florida

BLACK & VEATCH

Legend

- Pump Improvement
- New Pump Station
- Pipe Improvement

LEE COUNTY

Wastewater Master Plan

FIGURE 2

Lee County Force Main System Flow Shedding Improvements

5.0 Recommended Improvements

5.1 2040 SYSTEM ANALYSIS

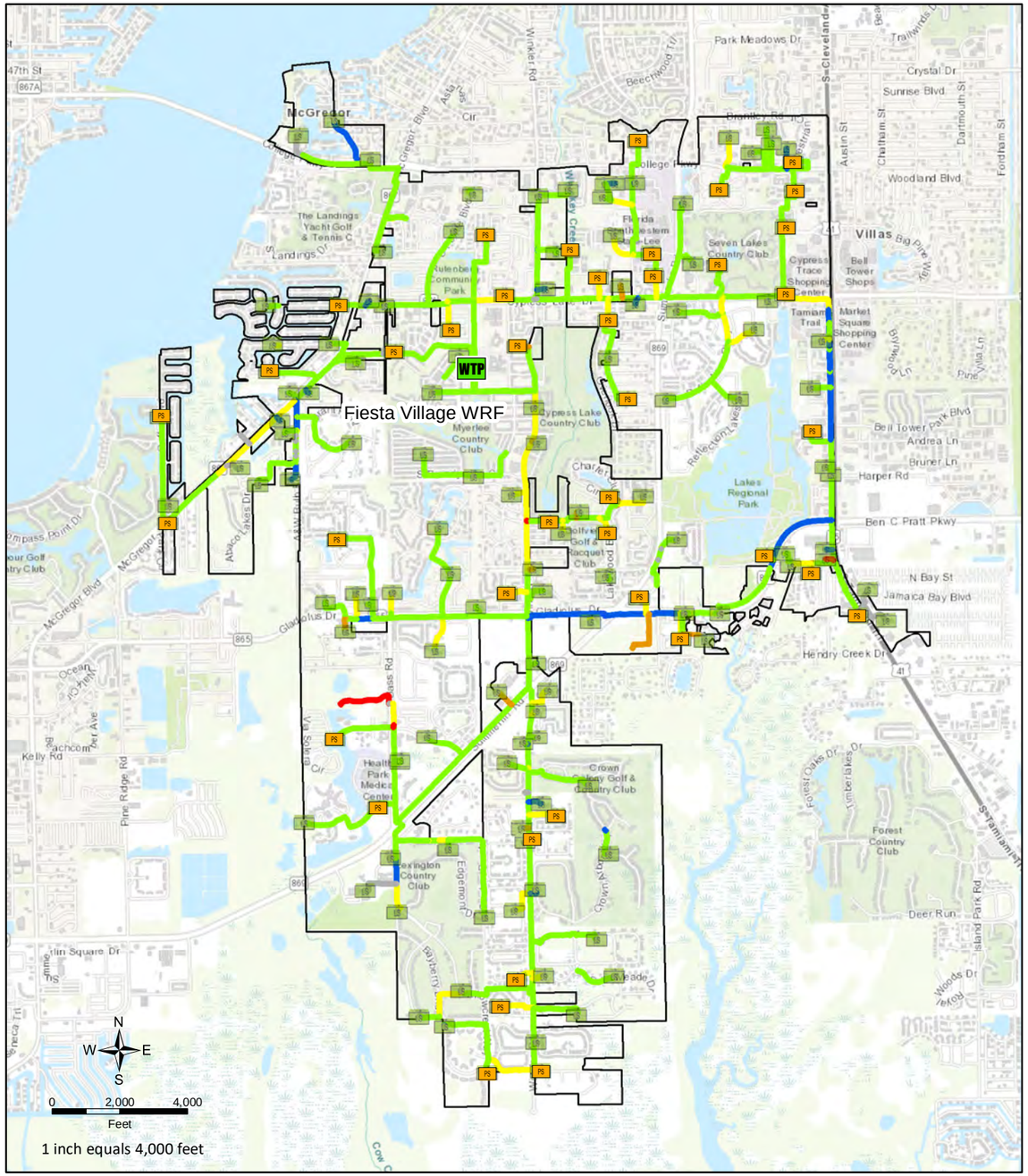
The initial evaluation for each service area included 2040 maximum month daily flows (MMDF) flows with no improvements (the existing system). The 2040 system improvements were developed using the data gathered in these initial model runs for each service area. The development of all improvements was based on meeting the performance criteria summarized in **Table 1** which includes criteria for pump run times, pipe velocities, wet well overflows, etc. **Figure 3** through **Figure 6** compare the existing system results with no improvements to the system results with the recommended improvements for each service area. It should be noted that some of the velocities in the existing system figures which are below the performance criteria of 2.0 fps for minimum velocity due to several pumps unable to pump against increased system pressures, also known as dead heading.

5.2 IMPROVEMENT PHASING

The assessment of the collection system revealed that the system will require a few improvements to meet the projected growth over the 20-year planning horizon. MMDF projections were developed for 5-year increments in the Flow Projection TM (**Table 3**) based on BEBR population growth rates were used as model inputs to develop the improvement phasing. MMDF Flows for each planning year were input into each model, each system was analyzed for existing conditions and then 2040 improvements were inserted until the system met all performance criteria. This process was completed for each planning year, thus assigning anticipated phasing years. A specific trigger was also identified for each project. It is recommended that the County monitor those triggers yearly to be able to adapt to change conditions and adjust the actual implementation dates accordingly.

5.3 RECOMMENDED IMPROVEMENTS

Fifty-nine pump station improvements, approximately 10 miles of force main improvements and one potential master pump station were identified amongst all of the service areas. **Figure 8** through **Figure 12** illustrate the improvements recommended for each service area. **Attachment 1** includes a tabular list of all of the projects by service year. The table provides a project ID, summaries, the project description including length, diameter or flow/head conditions, identifies the anticipated implementation year and summarizes the specific trigger(s) for each project. Capital costs will be determined in Task 400 for each project.



Lee County Southwest Florida

BLACK & VEATCH

PS Surcharged Wet Well
LS Existing Pumps

Max. Velocity

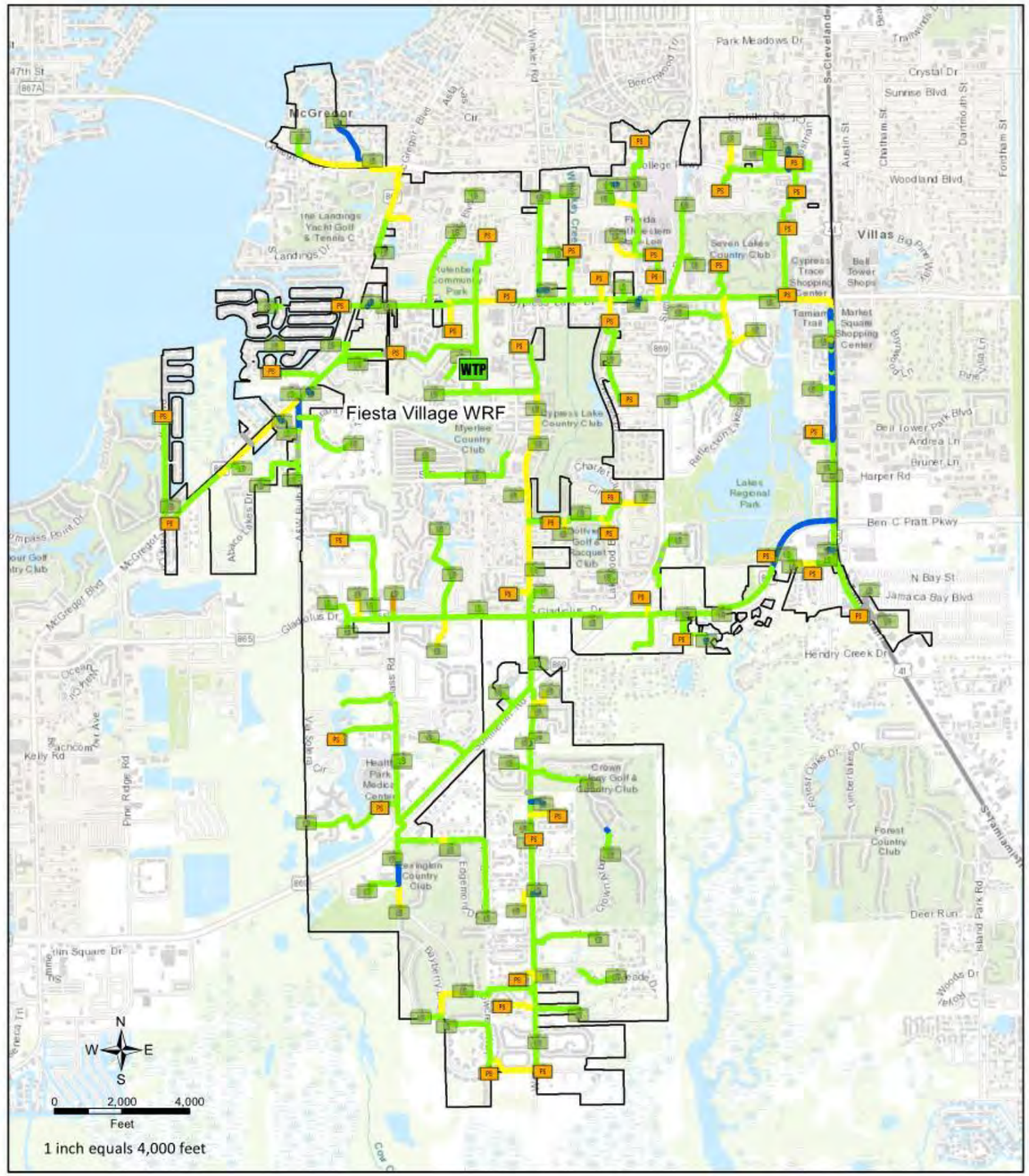
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 3

Fiesta Village
2040 Existing System
Maximum Velocity



Lee County Southwest Florida

BLACK & VEATCH

PS Surcharged Wet Well
LS Existing Pumps

Maximum Velocity

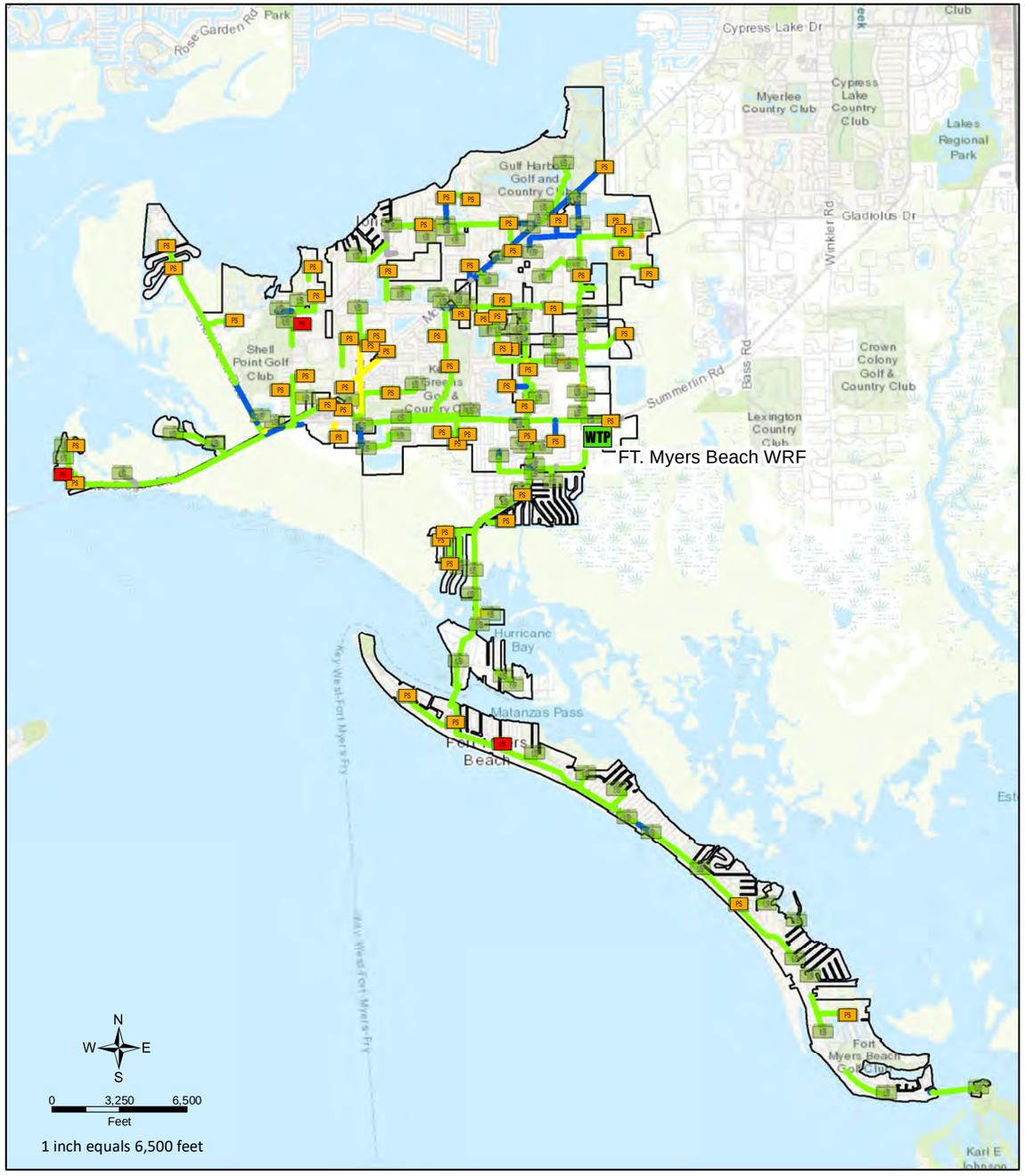
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 3

Fiesta Village
2040 Status Quo
Maximum Velocity

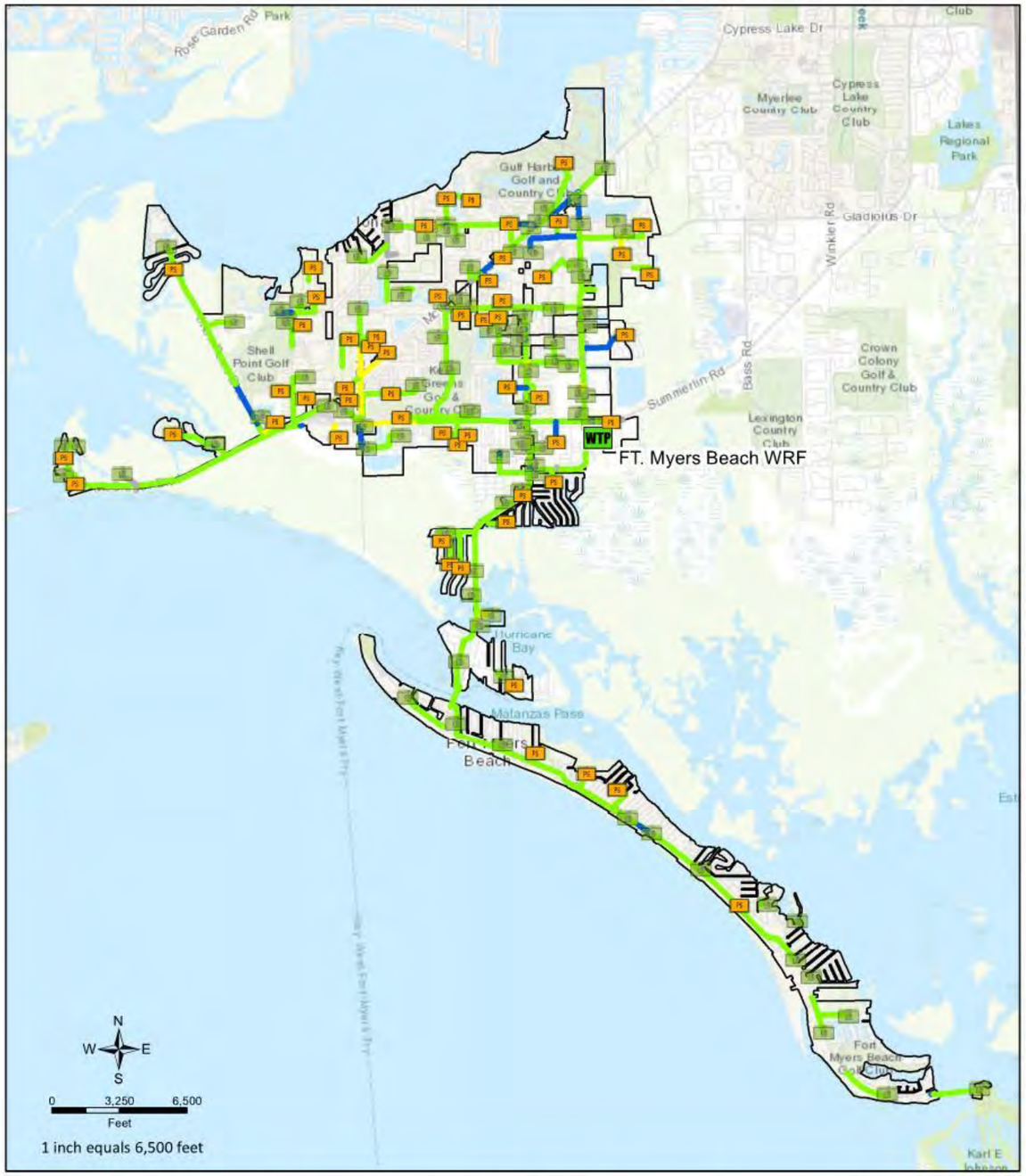


Surcharged Wet Well **Max. Velocity**
Max Level Wet Well
Exisiting Pumps

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

BLACK & VEATCH

LEE COUNTY
Wastewater Master Plan
FIGURE 4
Ft. Myers Beach
2040 Existing System
Maximum Velocity

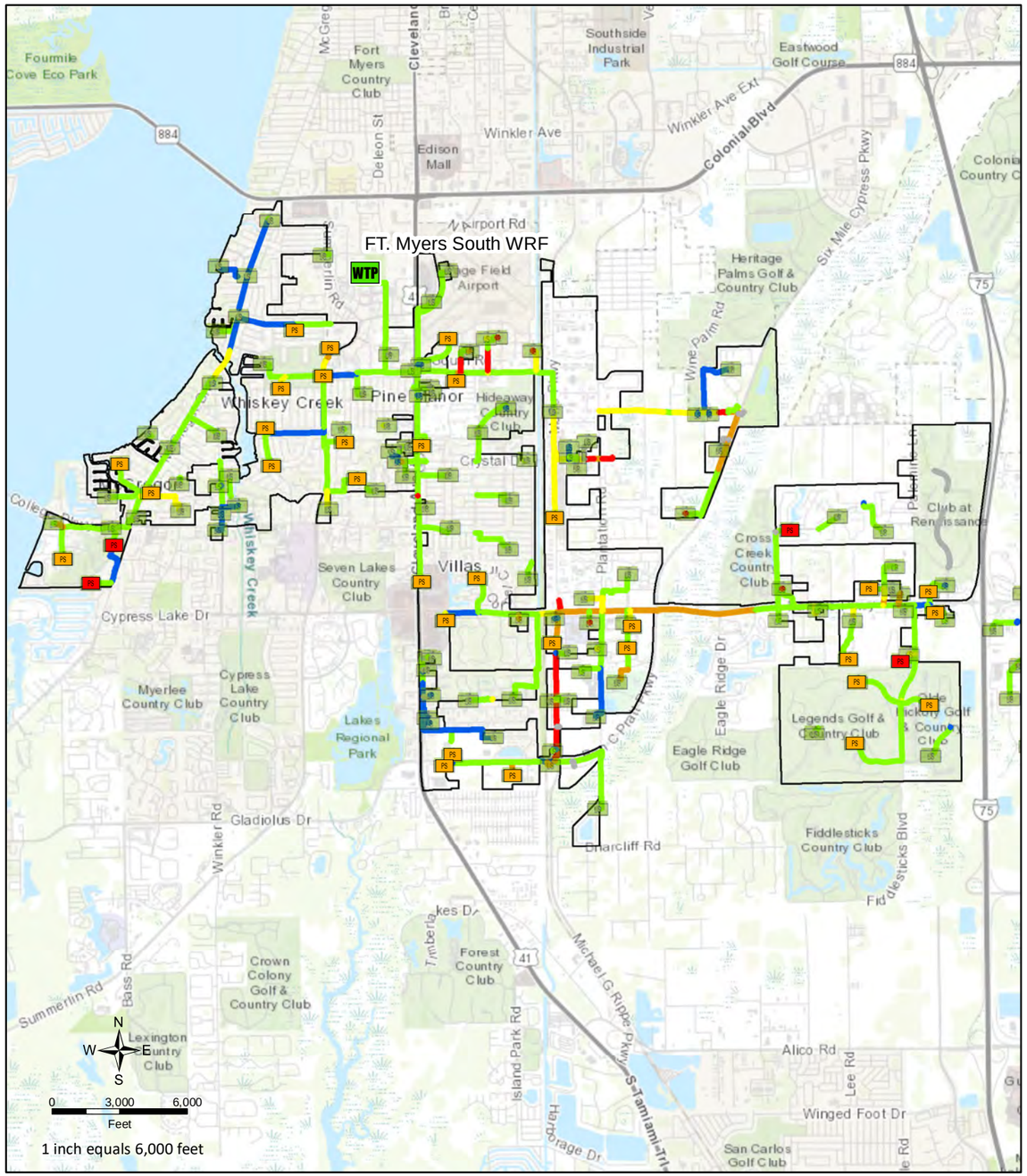


Surcharged Wet Well **Maximum Velocity**
Exisiting Pumps

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

BLACK & VEATCH

LEE COUNTY
Wastewater Master Plan
FIGURE 4
Ft. Myers Beach
2040 Status Quo
Maximum Velocity



Surcharged	Max. Velocity
Max Level Wet Well	Less than 0.01 fps
Surcharged Wet Well	0.01 - 2 fps
Existing Pumps	2 - 5 fps
	5 - 7 fps
	7 - 10 fps
	Greater than 10 fps

Lee County Southwest Florida

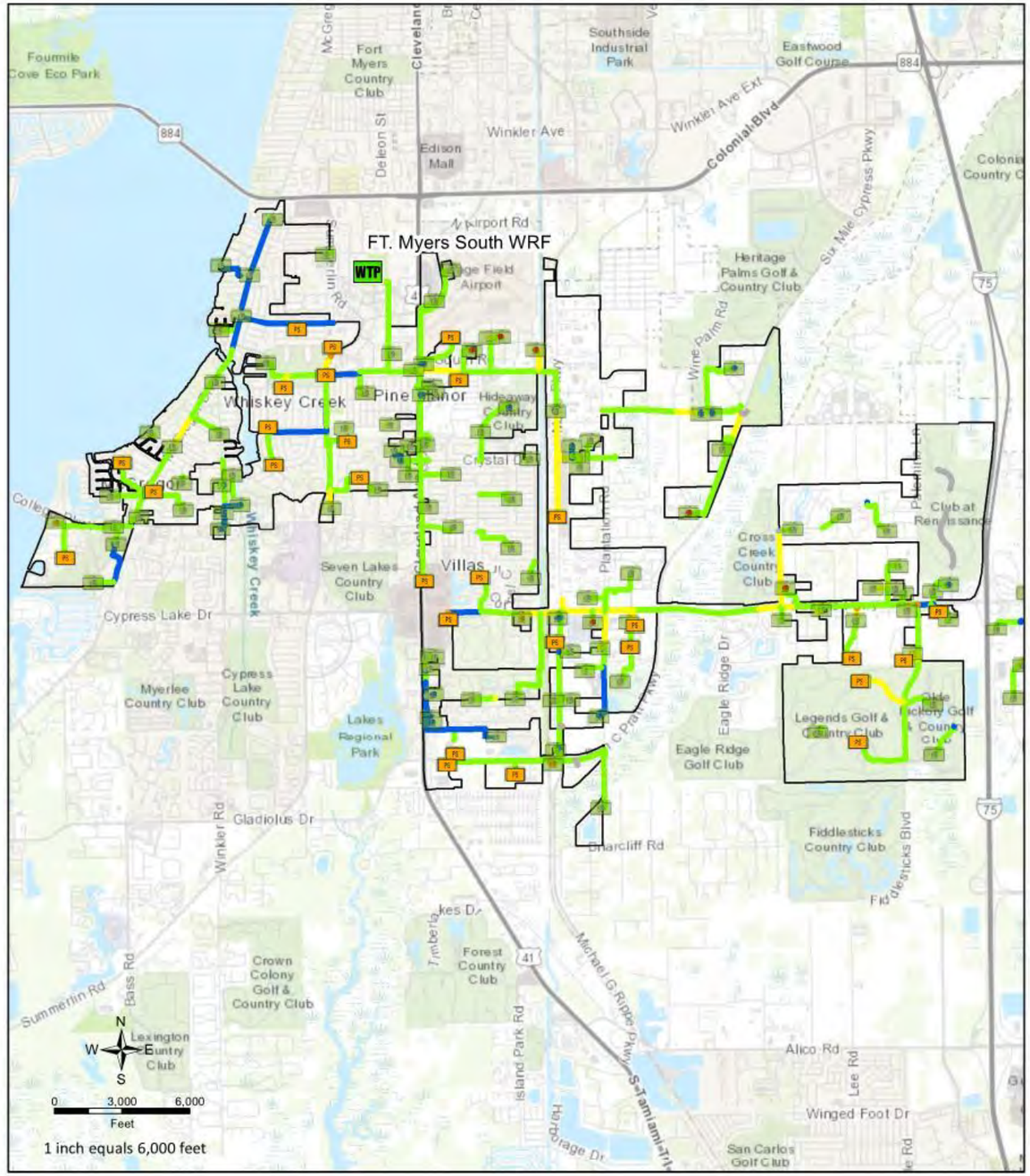
BLACK & VEATCH

LEE COUNTY

Wastewater Master Plan

FIGURE 5

Ft. Myers South
2040 Existing System
Improvements



	Maximum Velocity
Surcharged Wet Well	Less than 0.01 fps
Existing Pumps	0.01 - 2 fps
	2 - 5 fps
	5 - 7 fps
	7 - 10 fps
	Greater than 10 fps

Lee County Southwest Florida

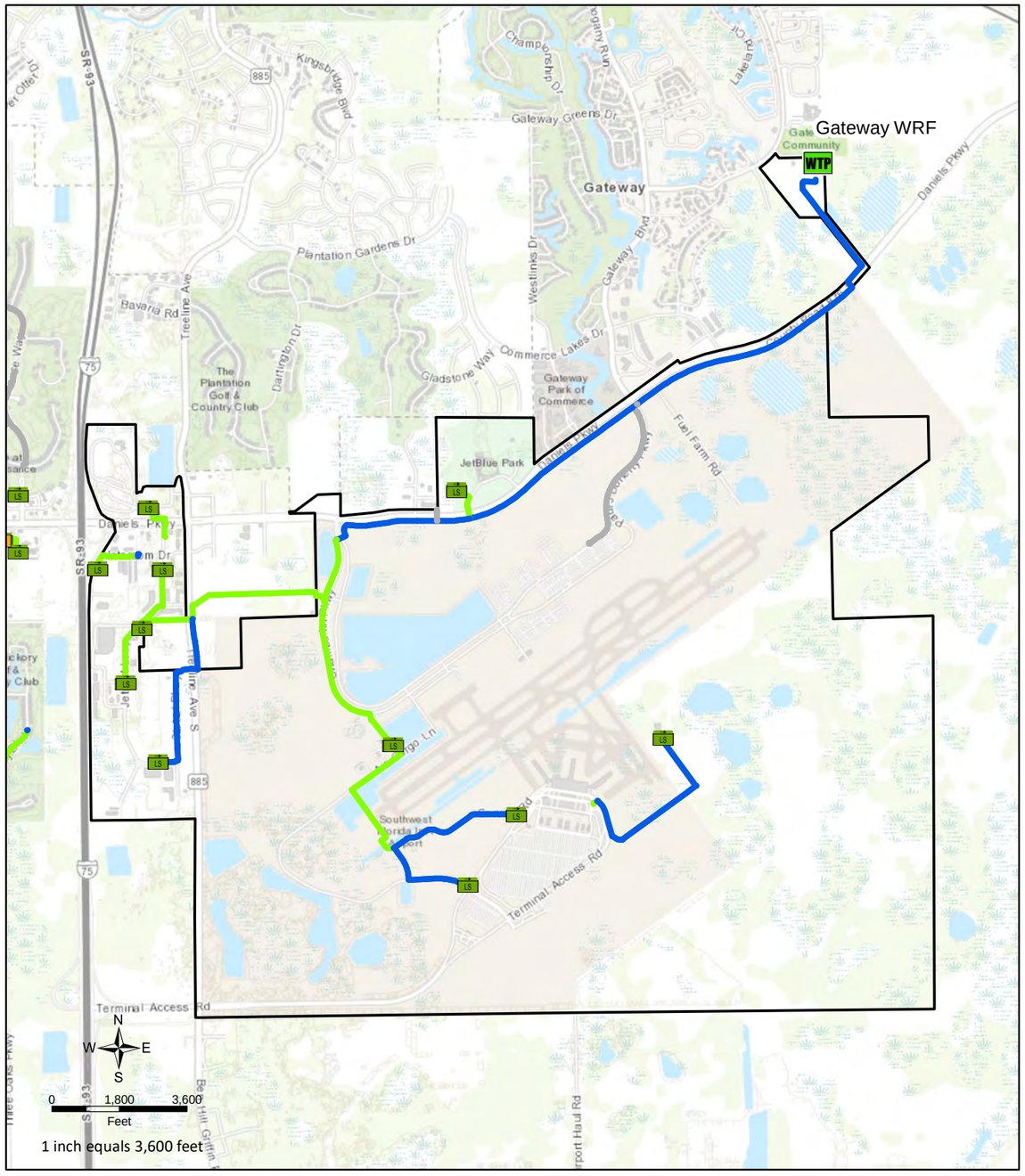
BLACK & VEATCH

LEE COUNTY

Wastewater Master Plan

FIGURE 5

Ft. Myers South
2040 Status Quo
Improvements



Lee County Southwest Florida

BLACK & VEATCH

Surcharged

- Max Level Wet Well
- Surcharged Wet Well
- Existing Pumps

Max. Velocity

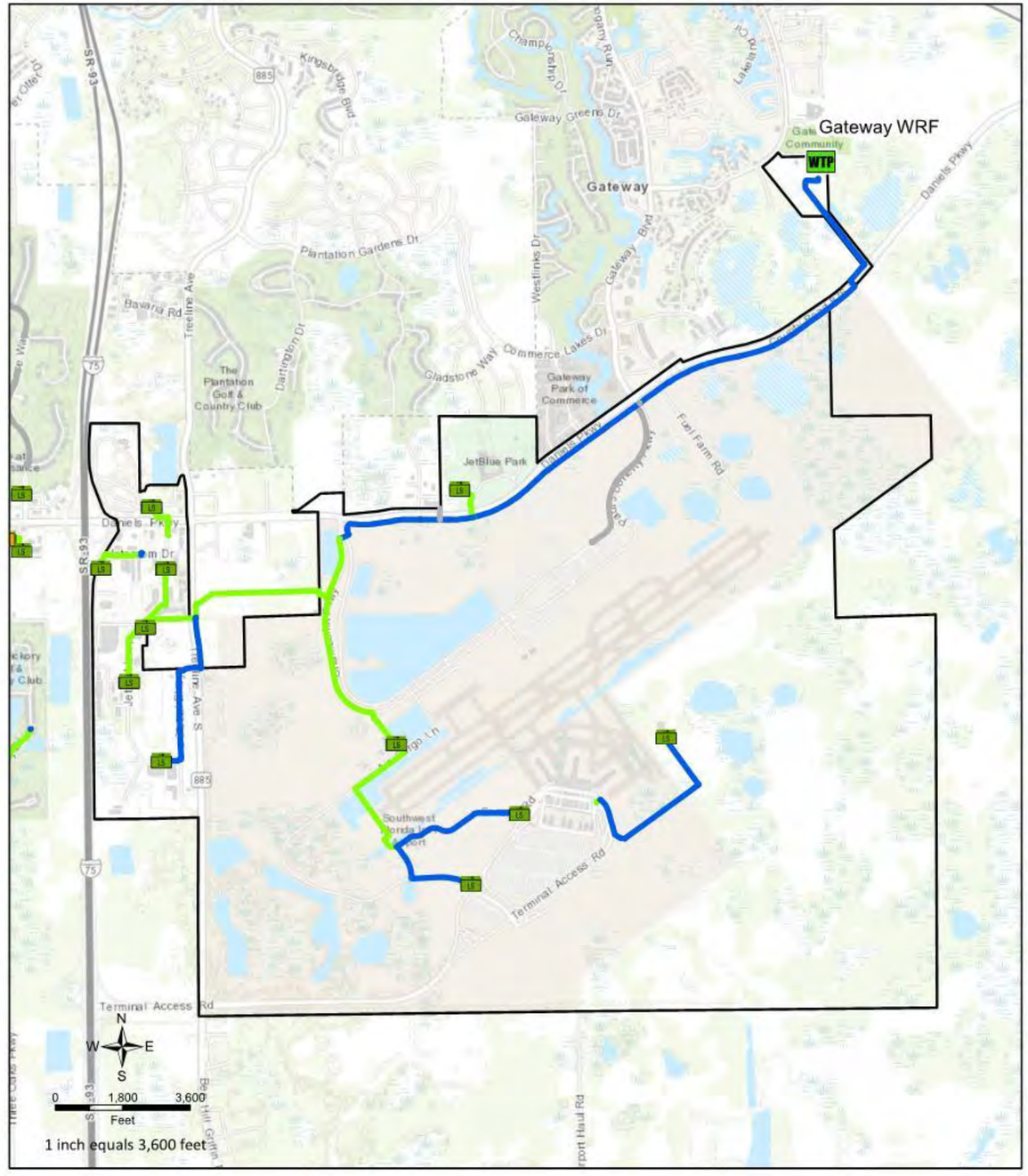
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 6

Gateway
2040 Existing System
Maximum Velocity



Lee County Southwest Florida

BLACK & VEATCH

- Surcharged Wet Well
- Existing Pumps

Maximum Velocity

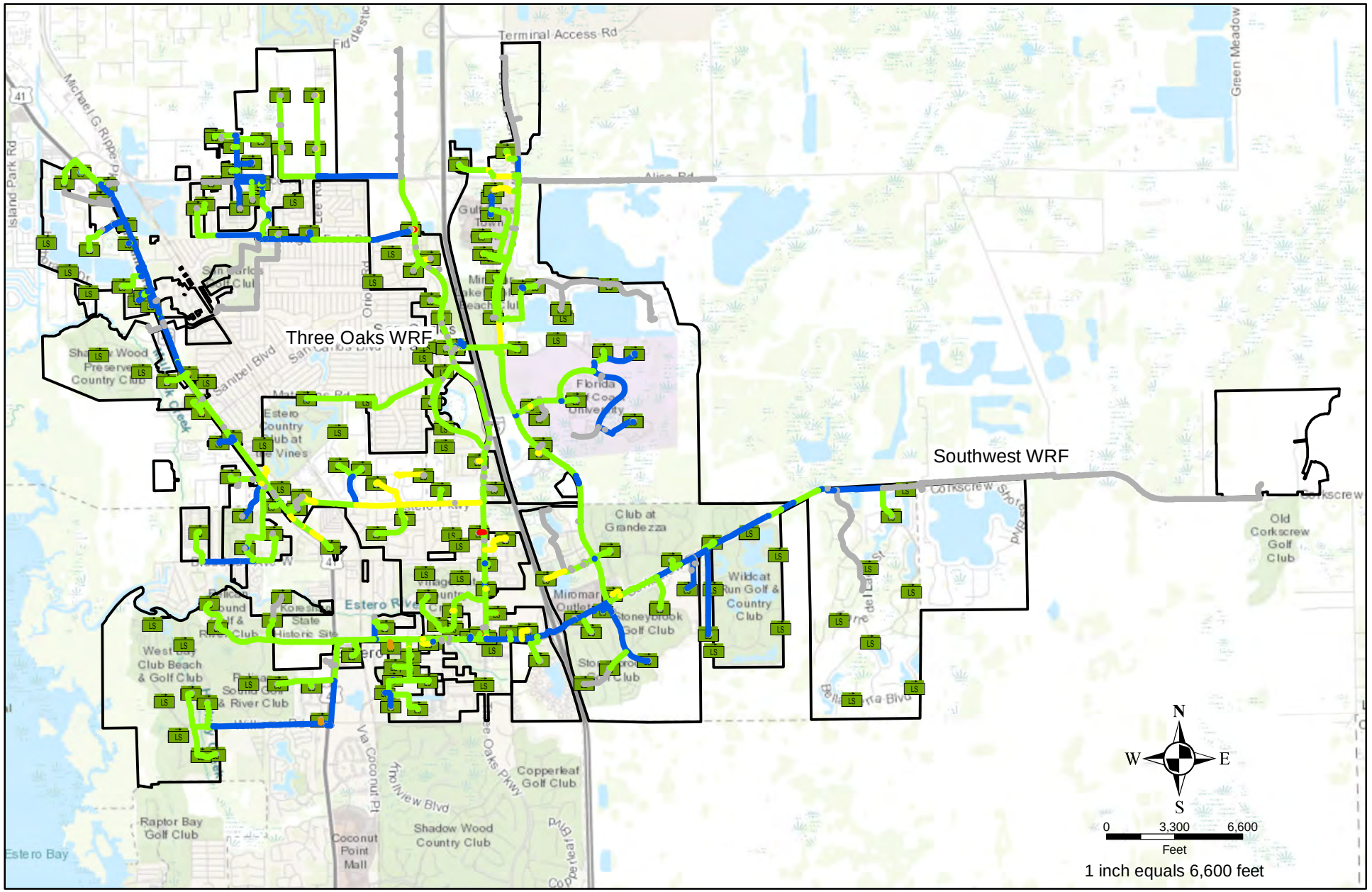
- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps

LEE COUNTY

Wastewater Master Plan

FIGURE 6

Gateway
2040 Status Quo
Maximum Velocity



Lee County Southwest Florida

BLACK & VEATCH

Max. Velocity

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps
- Existing Pumps

LEE COUNTY

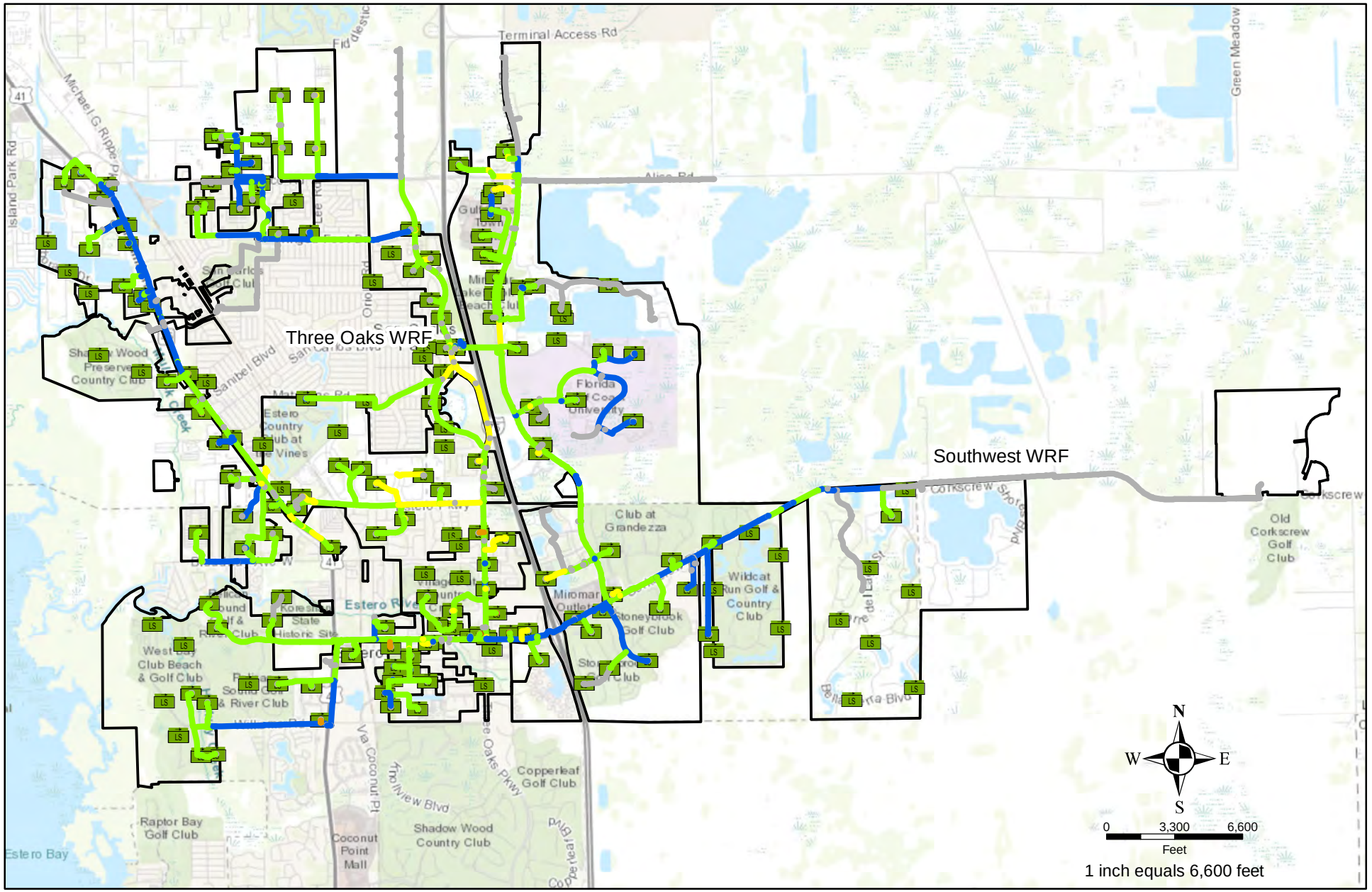
Wastewater Master Plan

FIGURE 7-1

Three Oaks

2040 Existing System

Maximum Velocities



Lee County Southwest Florida

BLACK & VEATCH

Max. Velocity

- Less than 0.01 fps
- 0.01 - 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- Greater than 10 fps
- Existing Pumps

LEE COUNTY

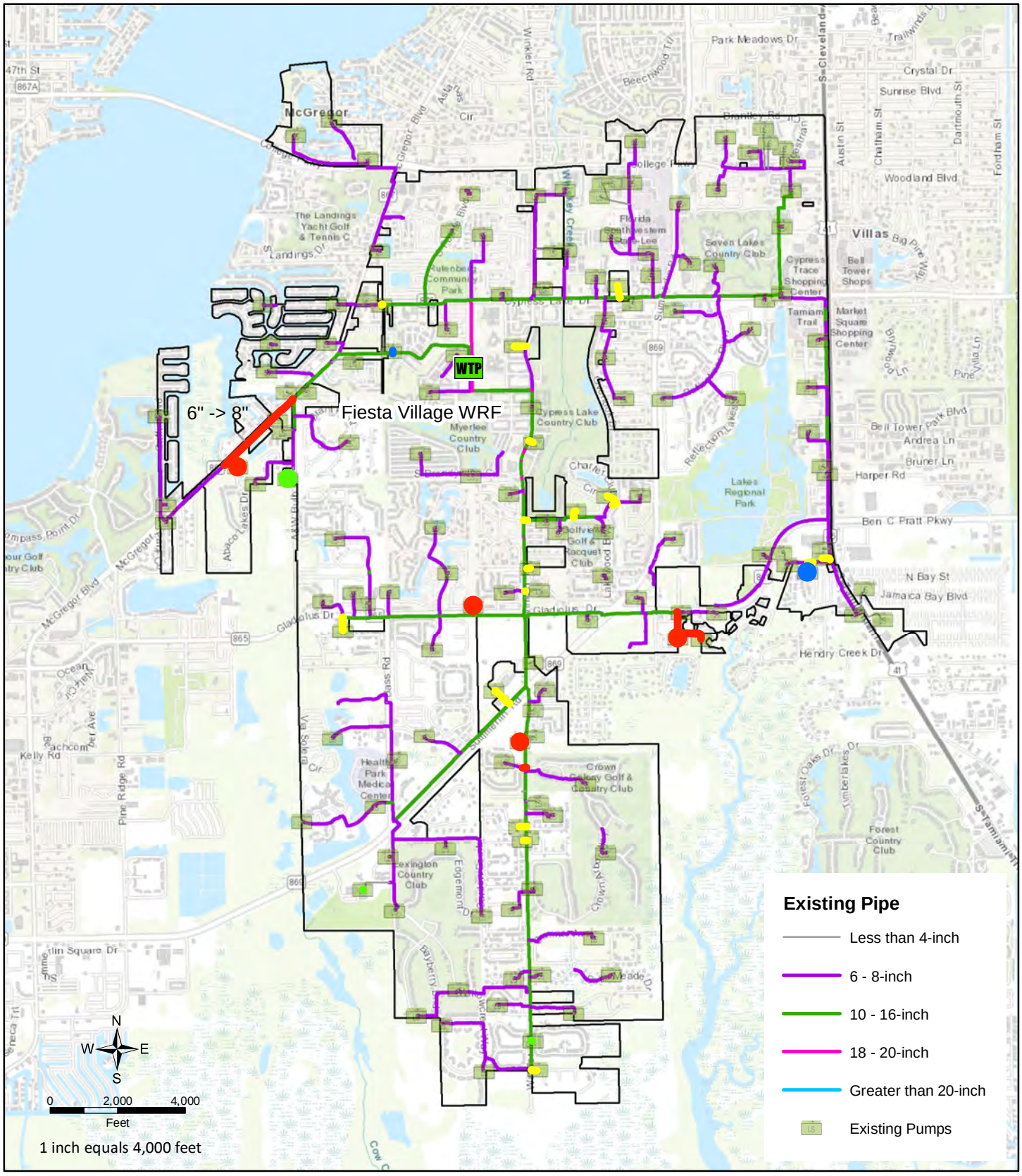
Wastewater Master Plan

FIGURE 7-2

Three Oaks

2040 Status Quo

Maximum Velocities



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2025
- 2030
- 2040

Pipe Upgrades

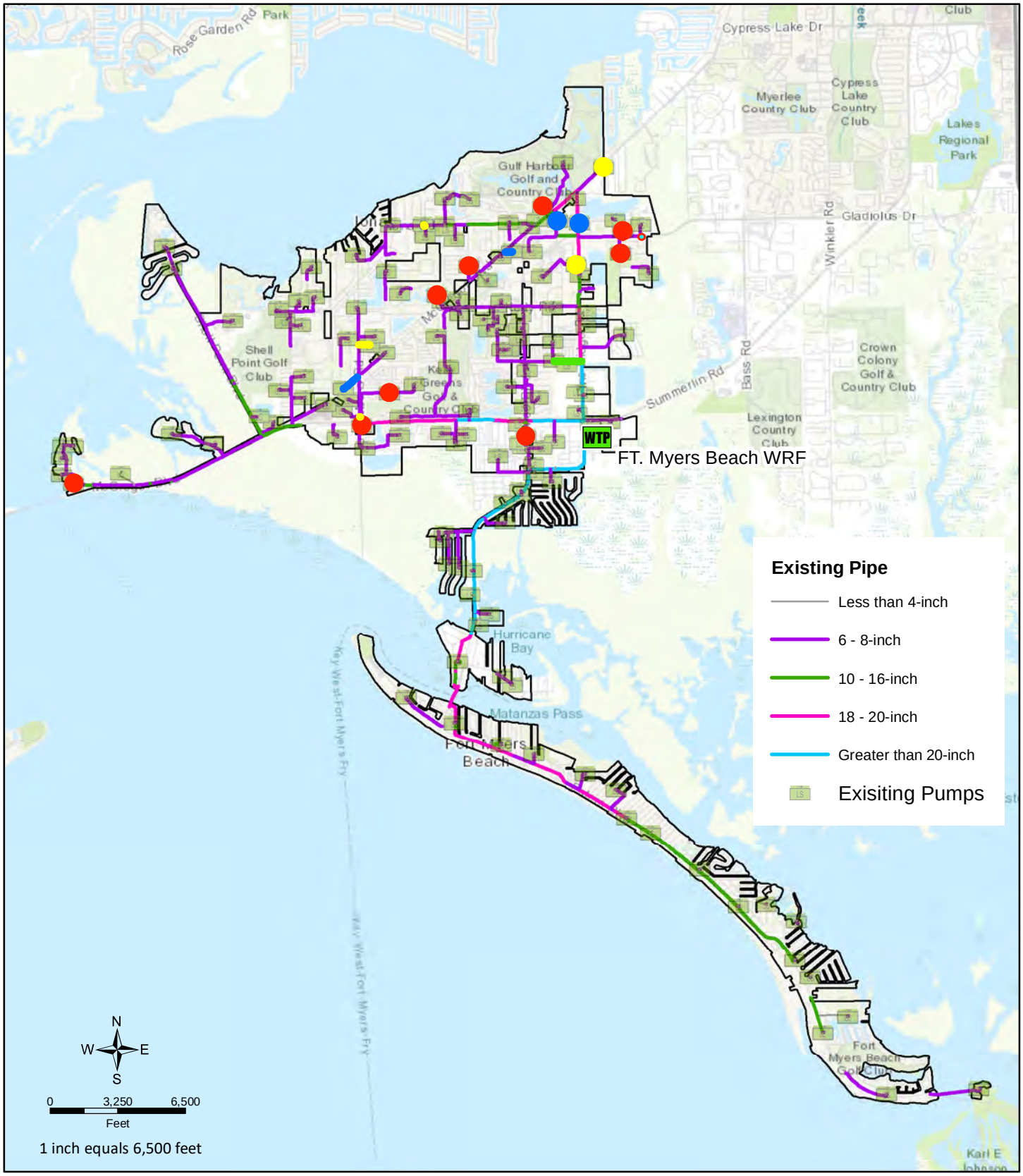
- 2020
- 2025
- 2030
- 2040

LEE COUNTY

Wastewater Master Plan

FIGURE 8

Fiesta Village
2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2020
- 2030
- 2040

Pipe Upgrades

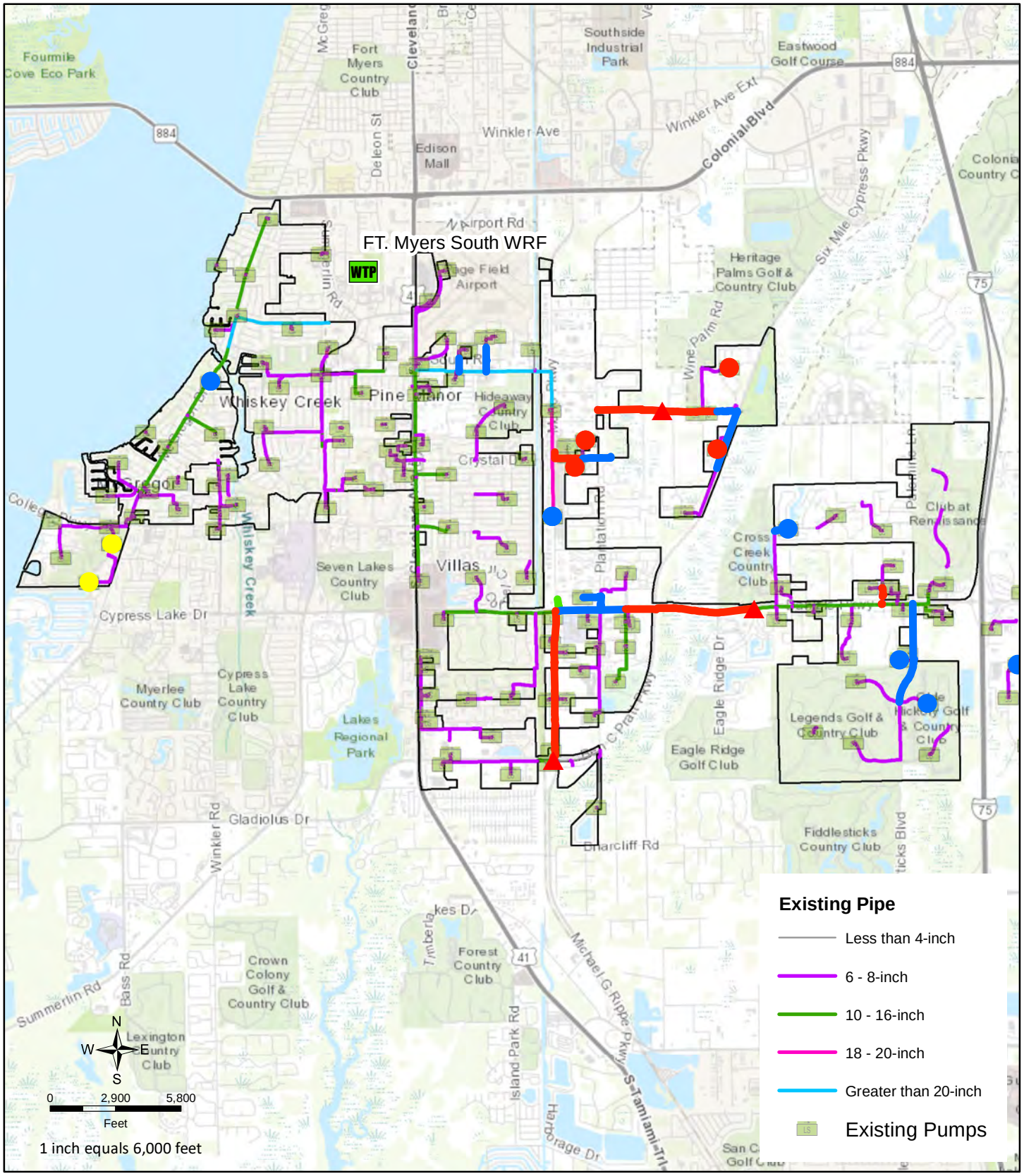
- 2020
- 2025
- 2030
- 2040

LEE COUNTY

Wastewater Master Plan

FIGURE 9

Ft. Myers Beach 2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

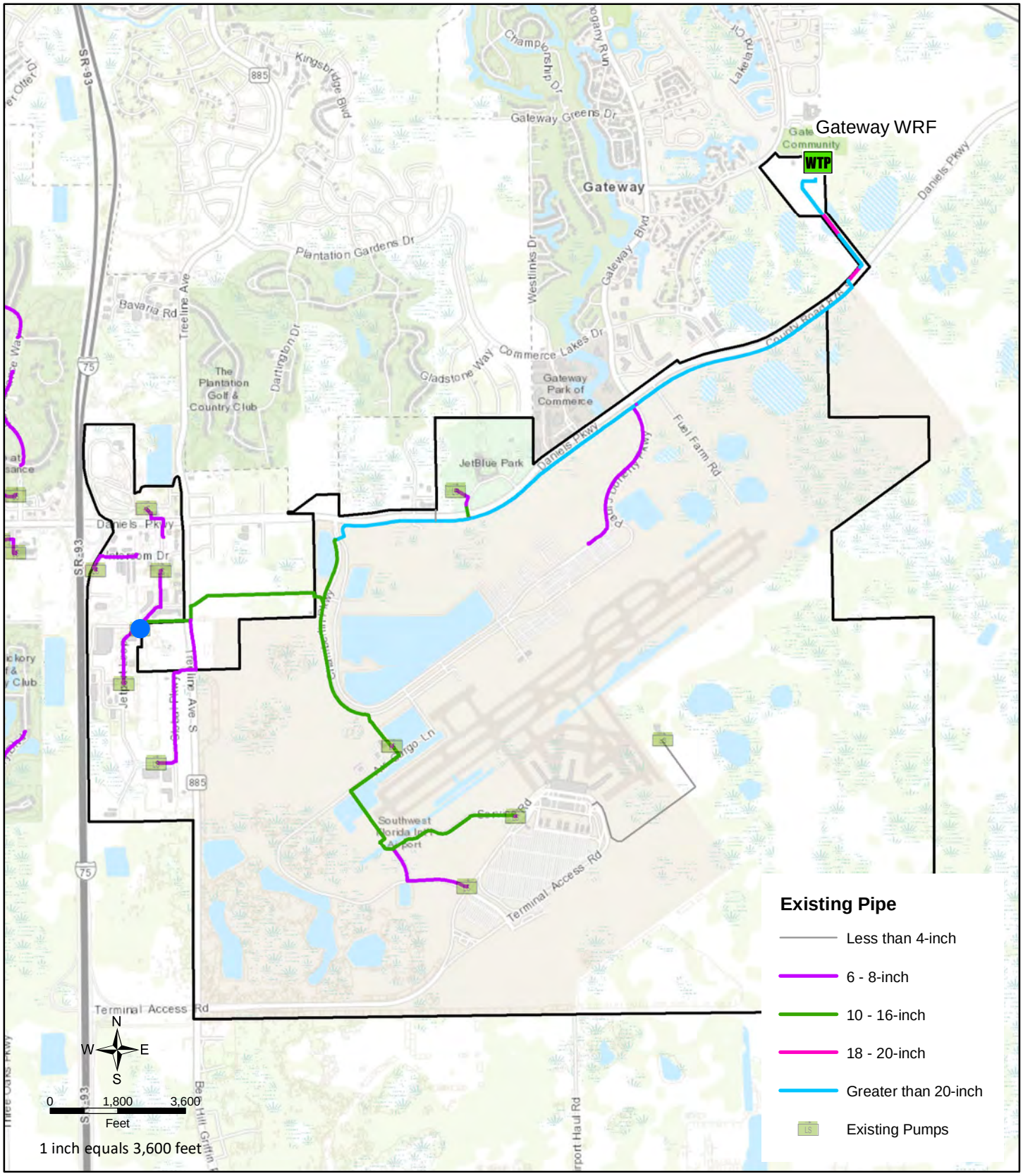
Pump Upgrades	New Pump	Pipe Upgrades
2020	2025	2025
2030	2030	2030
2040	2040	2040

LEE COUNTY

Wastewater Master Plan

FIGURE 10

Ft. Myers South 2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2020
- 2030
- 2040

Pipe Upgrades

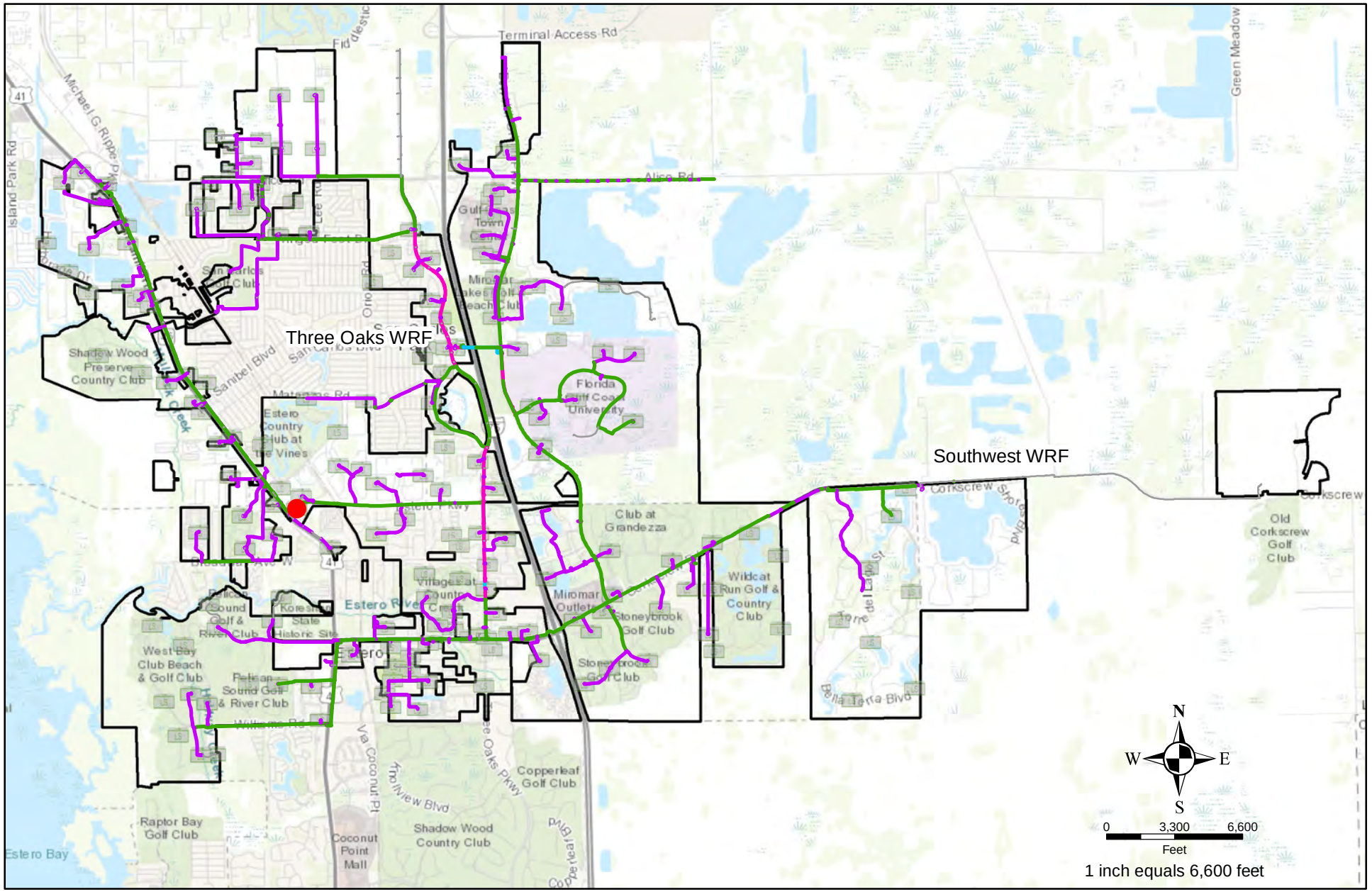
- 2025
- 2030
- 2040

LEE COUNTY

Wastewater Master Plan

FIGURE11

Gateway
2020-2040 Status Quo Improvements



Lee County Southwest Florida

BLACK & VEATCH

Pump Upgrades

- 2040

Existing Pipe

- Less than 4-inch
- 6 - 8-inch
- 10 - 16-inch
- 18 - 20-inch
- Greater than 20-inch
- Existing Pumps

LEE COUNTY

Wastewater Master Plan

FIGURE 12

Three Oaks

2020-2040 Status Quo Improvements

Attachment 1 – Improvement Phasing Tables

Project ID	Project Number	Length	Diameter	Planning Year	Trigger
Fiesta Village		(Ft)	(in)		
Summerlin Crossing (Discharge from PS 1104)	FV-Pipe-1	579	8"	2020	Already triggered, velocity performance criteria exceeded.
Lakewood Blvd. and Charter Club Blvd.	FV-Pipe-2	487	8"	2020	Already triggered, velocity performance criteria exceeded.
Preserve Blvd. from PS 1110 to Gladiolus Dr.	FV-Pipe-3	402	8"	2020	Already triggered, velocity performance criteria exceeded.
Memoli Ln (Discharge from PS 0055)	FV-Pipe-5	353	8"	2020	Already triggered, velocity performance criteria exceeded.
Village Edge Cir (Discharge from PS 1115)	FV-Pipe-6	215	8"	2020	Already triggered, velocity performance criteria exceeded.
Winkler Rd @ Bracken Way (Discharge from PS 0080)	FV-Pipe-7	203	8"	2020	Already triggered, velocity performance criteria exceeded.
Big Mangrove Dr (Discharge from PS 1117)	FV-Pipe-8	170	8"	2020	Already triggered, velocity performance criteria exceeded.
Old Gladiolus Dr	FV-Pipe-9	165	8"	2020	Pump Project: FV-Pump-1
Winkler Rd @ Popham Dr	FV-Pipe-10	120	12"	2020	Already triggered, velocity criteria exceeded. GIS has 6" force main downstream of a 12" force main. Confirm size and replace if necessary.
Winkler Rd (Discharge from PS 0079)	FV-Pipe-11	119	8"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2020 - 4"	FV-Pipe-12	99	4"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2020 - 8"	FV-Pipe-13	119	8"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2025 - 4"	FV-Pipe-14	20	4"	2025	
Miscellaneous 2025 - 6"	FV-Pipe-15	42	6"	2025	
Miscellaneous 2030	FV-Pipe-16	91	6"	2030	
McGregor Blvd from Crescent Dr. to A&W Bulb Rd.	FV-Pipe-17	2816	8"	2040	New development in TAZ polygon 2973, 2957, 2941. North and South of McGregor Blvd. between Willems Dr. and Crescent Dr., West of A&W Bulb Rd. between La Linda Way and Forrest River Ln.
Maida Ln. South of Gladiolus Dr.	FV-Pipe-18	1760	8"	2040	New development to West of Coral Waters Apartments. Project may be avoided/optimized with the distribution of flow to LS 0053 or PS 0065
Fort Myers Beach					
Plantation Estates (Discharge from PS 2255)	FMB-Pipe-1	529	8"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2020	FMB-Pipe-2	70	4"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2040	FMB-Pipe-3	89	6"	2040	
Miscellaneous 2040	FMB-Pipe-4	5	8"	2040	
Pine Ridge Rd @ Tricia Ln	**Monitor Only**	1355	16"	2025	Pipe is at the maximum velocity criteria, however due to useful life remaining an improvement is not recommended. Velocities should be monitored.
City of Fort Myers South/Gateway					
Lee County Sports Complex (Discharge from PS 3339)	FMSGW-Pipe-1	1024	12"	2020	Already triggered, velocity performance criteria exceeded.
Wiersma Ln. crossing Daniels Pkwy	FMSGW-Pipe-2	598	8"	2020	Already triggered, velocity performance criteria exceeded.
Technology Ct. (Discharge from PS 3302)	FMSGW-Pipe-3	549	8"	2020	Already triggered, velocity performance criteria exceeded.
Trailwinds (Discharge from PS 3378)	FMSGW-Pipe-4	367	8"	2020	Already triggered, velocity performance criteria exceeded.
Crossing Daniels Pkwy @ Appaloosa Ln.	FMSGW-Pipe-5	367	6"	2020	Already triggered, velocity performance criteria exceeded.
Crystal Dr. @ Penner Ln. (Discharge from PS 3349)	FMSGW-Pipe-6	218	8"	2020	Already triggered, velocity performance criteria exceeded.
Whale Harbor Ln. (Discharge from PS 3341)	FMSGW-Pipe-7	94	8"	2020	Pump Project: FMSGW-Pump-1
Miscellaneous 2020 - 6"	FMSGW-Pipe-8	40	6"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2020 - 8"	FMSGW-Pipe-9	78	8"	2020	Already triggered, velocity performance criteria exceeded.
Miscellaneous 2020 - 12"	FMSGW-Pipe-10	6	12"	2020	Already triggered, velocity performance criteria exceeded.
Metro Pkwy @ Daniels Pkwy	FMSGW-Pipe-11	538	30"	2025	Flows in pipe trigger upgrade, 11,000 gpm Trigger in 30" pipe
Penzance Blvd. from Six Mile Cypress Pkwy. to Cypress Walk Dr.	FMSGW-Pipe-12	422	12"	2030	New development between Plantation Rd. and Ben C Pratt Pkwy.
		235	8"	2030	

Project ID	Project Number	Length	Diameter	Planning Year	Trigger
Daniels Pkwy from International Dr. to Metro Pkwy.	FMSGW-Pipe-13	2941	24"	2030	Flows in pipe trigger upgrade, 7050 gpm Trigger in 24" pipe
		623	12"		
		816	8"		
Six Mile Cypress Pkwy. from Crystal Dr. to Penzance Blvd.	FMSGW-Pipe-14	2693	8"	2030	New development between Plantation Rd. and Ben C Pratt Pkwy.
Page Park 1st St. and 3rd St.	FMSGW-Pipe-15	1690	8"	2030	Pump Projects: FMSGW-Pump-17 and FMSGW-Pump-19
PS 3409 to Crystal Dr. crossing Plantation Rd.	FMSGW-Pipe-16	1280	8"	2030	New development between Plantation Rd. and Ben C Pratt Pkwy.
Cross Creek Blvd.	FMSGW-Pipe-17	629	12"	2030	Pump Project: FMSGW-Pump-6
Fiddlesticks Blvd. from White Hickory Ln. to Daniels Pkwy.	FMSGW-Pipe-18	4503	12"	2030	Pump Projects: FMSGW-Pump-5 and FMSGW-Pump-16
Metro Pkwy from Six Mile Cypress Pkwy. to Daniels Pkwy.	FMSGW-Pipe-19	6694	16"	2040	Annexation of Briarcliff.
		7	12"		
Daniels Pkwy American Colony Blvd. to International Dr.	FMSGW-Pipe-20	5931	24"	2040	Annexation of Eagle Ridge WWTP.
Penzance Blvd from Cypress Walk Dr. to Plantation Rd.	FMSGW-Pipe-21	3354	16"	2040	New development between Plantation Rd. and Ben C Pratt Pkwy.
		4006	12"		
Crystal Dr from Plantation Rd. to Metro Pkwy.	FMSGW-Pipe-22	1534	8"	2040	New development between Plantation Rd. and Ben C Pratt Pkwy.
Appaloosa Ln. @ Jobe Rd.	FMSGW-Pipe-23	407	6"	2040	New development between Shire Ln. and Pinto Ln. North of Daniels Pkwy.

Project Name	Project ID	Replacement Pump/Design	Planning Year	Pump Condition	Trigger
Fiesta Village					
PS 0056 Duplex Model	FV-Pump-1	PUMP-FLYGT-CP3140-481-15HP	2030	Both pumps in station running concurrently.	Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 0065 Duplex Model	FV-Pump-2	Design Point Head: 100ft Flow: 500gpm	2040	Will need to upgrade pump station due to additional flows assumed from Pump Project: FV-Pump-12. Pump station will also need to be upgraded should if receive flows assumed to be sent to FV-New-Pump-6.	New development to West of Coral Waters Apartments. Flows are assumed to be conveyed by Pump Project: FV-Pump-12 however can be diverted solely to PS 0065 or to LS 0053. Pipe Project FV-Pipe-18 can be avoided with diversion of flows to LS 0053 or PS 0065, however pipes and stations will be ~60 years old at planning year. Further investigation recommended.
Fort Myers Beach					
PS 1180 Duplex Model	FMB-Pump-1	PUMP-FLYGT-CP3127-462-7.5HP	2020	Both pumps in station running concurrently.	Already triggered. Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 1197 Duplex Model	FMB-Pump-2	PUMP-FLYGT-MP3102-263-6HP	2020	At MMDF, pumps deadhead, pumps running concurrently, and wet well overflows	Already triggered due to multiple criteria
PS 1155 Duplex Model	FMB-Pump-3	PUMP-FLYGT-CP3127-462-7.5HP	2030	Both pumps in station running concurrently.	Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 2269 Duplex Model	FMB-Pump-4	PUMP-FLYGT-CP3127-461-10HP	2030	Need larger pumps to break head under MMDF conditions	Monitor Pressures in force main behind Publix on Gladiolus Dr. and McGregor Blvd. - 25 psi Trigger
PS 1173 Duplex Model	FMB-Pump-5	PUMP-FLYGT-CP3127-461-10HP	2040	Need larger pumps to break head under MMDF conditions	Monitor Pressures in force main on Thornton Rd. and McGregor Blvd. - 25 psi Trigger
PS 1176 Duplex Model	FMB-Pump-6	PUMP-FLYGT-CP3127-481-10HP	2040	Both pumps in station running concurrently.	Completion of LS 1127
PS 1178 Duplex Model	FMB-Pump-7	PUMP-FLYGT-CP3126-461-9.4HP	2040	Both pumps in station running concurrently.	New development North of Gladiolus Dr from Pine Ridge Rd. to Wall Dr.
PS 2207 Duplex Model	FMB-Pump-8	PUMP-FLYGT-CP3102-432-4HP	2040	Both pumps in station running concurrently.	Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 2229 Duplex Model	FMB-Pump-9	PUMP-FLYGT-CP3126-461-9.4HP	2040	Both pumps in station running concurrently.	New development around the Sanibel Harbour Marriott.
PS 2237 Duplex Model	FMB-Pump-10	Design Point Head: 100ft Flow: 4000gpm	2040	Wet well overflows due to high flows.	Station is modeled as a duplex and likely has more pumps given it's flow. Total station pumping conditions should be compared to model inputs prior to project initiation.
PS 2264 Duplex Model	FMB-Pump-11	PUMP-FLYGT-CP3127-461-10HP	2040	Both pumps in station running concurrently.	Monitor influent flow at pump station. - 250 gpm Trigger
PS 2266 Duplex Model	FMB-Pump-12	PUMP-FLYGT-CP3152-454-20HP	2040	Both pumps in station running concurrently.	Monitor influent flow at pump station. - 45 gpm Trigger
City of Fort Myers South/Gateway					
PS 3341 Duplex Model	FMSGW-Pump-1	PUMP-FLYGT-CP3102-254-6HP	2020	At MMDF, pumps running concurrently and wet well overflows.	Already triggered due to multiple criteria. Pipe Project: FMSGW-Pipe-7 should be completed with this project.
PS 3373 Duplex Model	FMSGW-Pump-2	PUMP-FLYGT-CP3102-254-6HP	2020	Both pumps in station running concurrently.	Already triggered. Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 3315 Duplex Model	FMSGW-Pump-3	Design Point Head: 110 ft Flow: 750 gpm	2030	Both pumps in station running concurrently.	New development between I-75 and Treeline Ave. North of Daniels Pkwy.
PS 3316 Duplex Model	FMSGW-Pump-4	PUMP-FLYGT-CP3126-432-11HP	2030	At MMDF, pumps running concurrently and wet well overflows.	New development in TAZ polygon 3000 West of Cypress Preserve Pl.
PS 3334 Duplex Model	FMSGW-Pump-5	Design Point Head: 145 ft Flow: 200 gpm	2030	Both pumps in station running concurrently.	New development between I-75 and Fiddlesticks Blvd. South of Old Hickory Golf & Country Club. Pipe Project: FMSGW-Pipe-18 should be completed with this project.
PS 3340 Duplex Model	FMSGW-Pump-6	PUMP-ABS-AFP1000-270MM-33.5HP	2030	Both pumps in station running concurrently.	New development between I-75 and Six Mile Cypress Pkwy. North of Daniels Pkwy. Pipe Project: FMSGW-Pipe-17 should be completed with this project.
PS 3345 Six Pump Model	FMSGW-Pump-7	Design Point Head: 110 ft Flow: 1800 gpm	2030	All pumps in station running concurrently.	Many stations upstream of PS 3345, Monitor SCADA run times for pumps for instances of pumps running concurrently.
PS 3393 Duplex Model	FMSGW-Pump-8	Design Point Head: 100 ft Flow: 1600gpm	2030	Both pumps in station running concurrently.	Monitor influent flow at pump station. - 550 gpm Trigger
PS 3303 Duplex Model	FMSGW-Pump-9	PUMP-FLYGT-CP3102-254-6HP	2040	Pump in station are deadheading	New development between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-16 should be completed with this project.
PS 3351 Duplex Model	FMSGW-Pump-10	PUMP-FLYGT-CP3101-434-5HP	2040	Pump in station are deadheading	New development between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-16 should be completed with this project.

Project Name	Project ID	Replacement Pump/Design	Planning Year	Pump Condition	Trigger
PS 3322 Duplex Model	FMSGW-Pump-11	PUMP-FLYGT-CP3152-454-20HP	2040	Pump in station are deadheading	New development between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-21 should be completed with this project.
PS 3400 Duplex Model	FMSGW-Pump-12	PUMP-FLYGT-CP3127-483-10HP	2040	Pump in station are deadheading	New development between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-14 should be completed with this project.
Proposed PS 3419	FMSGW-Pump-13		2040	New infrastructure pump station	New development between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-21 should be completed with this project.
Proposed PS 3415	FMSGW-Pump-14		2040	New infrastructure pump station	New development on Metro Pkwy. and Six Mile Cypress Pkwy.
Eagle Ridge Pump Station	FMSGW-Pump-22	Connects to force main on Daniels Pkwy. and American Colony Blvd.	2040	New infrastructure pump station	Annexation of Eagle Ridge WWTP. Pipe Project: FMSGW-Pipe-20 should be completed with this project.

Appendix C – Capital Improvement Plan TM

FINAL

CAPITAL IMPROVEMENT PLAN

Technical Memorandum

B&V PROJECT NO. 199611

PREPARED FOR

Lee County Utilities

30 OCTOBER 2019

Lee County Southwest Florida

BLACK & VEATCH

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AWRF	Advanced water reclamation facility
CFM	City of Fort Myers
CIP	Capital Improvement Plan
gpm	Gallons per Minute
LCU	Lee County Utilities
MGD	Million Gallons per Day
MMDF	Maximum Month Daily Flow
WRF	Water Reclamation Facility

1.0 Introduction

Lee County Utilities (LCU) owns and operates four regional water reclamation facilities (WRF) and one advanced water reclamation facility (AWRF). In addition to the five LCU owned WRFs, LCU owns half of the permitted capacity of the City of Fort Myer's (CFM) two wastewater treatment plants, CFM South and CFM Central. The following technical memorandum details the efforts completed in the development of the capital improvement plan (CIP) as part of the LCU Wastewater Master Plan Update. Items covered include the unit costs established, the proposed capital improvement plan and the cash flow required to implement the improvements.

2.0 Project Unit Costs

Black & Veatch prepared unit cost information and assumptions for the three types of improvement projects identified during the system analysis portion of the Master Plan:

- Force Main Replacement
- New Pump Stations or Pump Station Replacement
- Pump Replacement Only

The unit costs were developed to allow an estimate of the design and construction costs for each project and to enable LCU to easily update planning-level opinions of probable costs in the future. The unit costs are based on Black & Veatch cost estimating research as well as recent bid tabulations provided by LCU.

2.1 FORCE MAINS

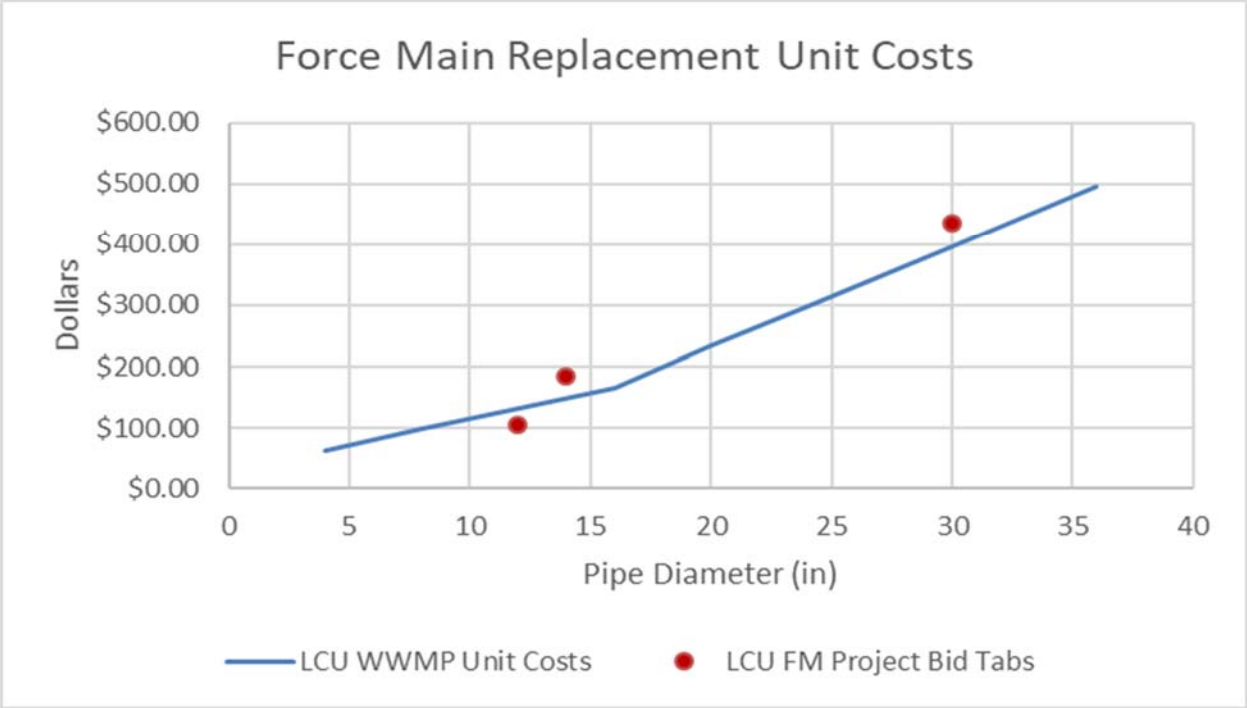
Table 1 summarizes the recommended unit costs for force main replacement diameters, 4-inch through 36-inch, per linear foot and illustrates the recommended unit costs compared to the unit costs from three recent bid tabulations within Lee County (Palm Beach BLVD force main replacement, U.S. 41 Transmission Mains - Phase 1B, and Ben Hill Griffin - Alico force main phase 2). The comparison shows that the recommended unit costs are reasonable compared to recent construction bids. The recommended unit costs include:

- PVC pipe including fittings, valves, excavation and fill, and labor
- Markups: 30% Contingency, 10% Engineering Fee, and 10% Construction Engineering Inspection

Table 1: Wastewater Force Main Unit Costs

DIAMETER (IN)	UNIT COST ($/LF)
4	$63.10
6	$80.35
8	$98.56
12	$132.11
16	$166.62
20	$235.44
24	$298.54
30	$397.00
36	$495.46

Figure 1: Wastewater Force Main Unit Costs



2.2 NEW PUMP STATIONS OR PUMP STATION REPLACEMENT

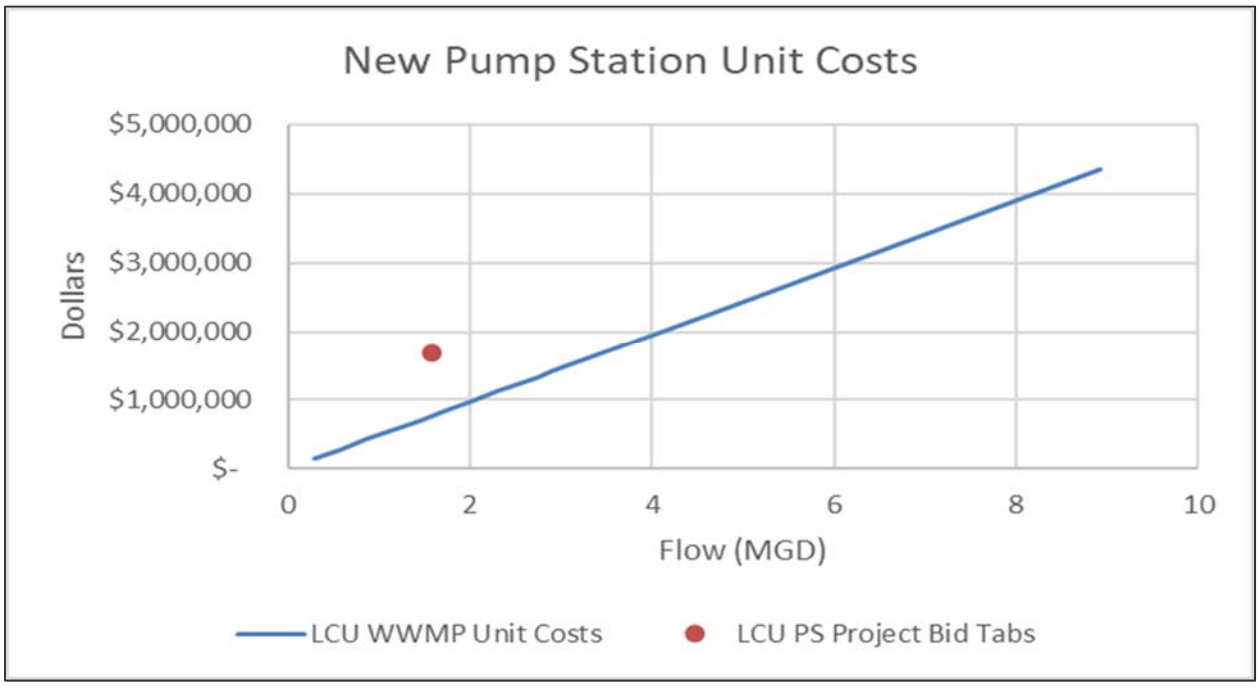
Table 2 summarizes the recommended unit costs for pump stations per gallon per minute (gpm) flow and illustrates the linear relationship for the recommended unit costs compared to pump station flow. Items included in the unit cost are:

- Pumps, pipes, valves, and other appurtenances
- Structure/Excavation
- Electrical, instrumentation and controls
- Generators
- Markups: 30% Contingency, 10% Engineering Fee, and 10% Construction Engineering Inspection

Table 2: New Pump Station Unit Costs

FLOW (MGD)	FLOW (GPM)	UNIT COST
0.288	200	$140,648
0.432	300	$210,972
0.576	400	$281,296
0.864	600	$421,944
1.008	700	$492,268
1.152	800	$562,592
1.44	1,000	$703,240
1.728	1,200	$843,888
2.016	1,400	$984,537
2.304	1,600	$1,125,185
2.736	1,900	$1,336,157
2.88	2,000	$1,406,481
3.024	2,100	$1,476,805
3.744	2,600	$1,828,425
4.608	3,200	$2,250,369
8.928	6,200	$4,360,090

Figure 2: New Pump Station Unit Costs



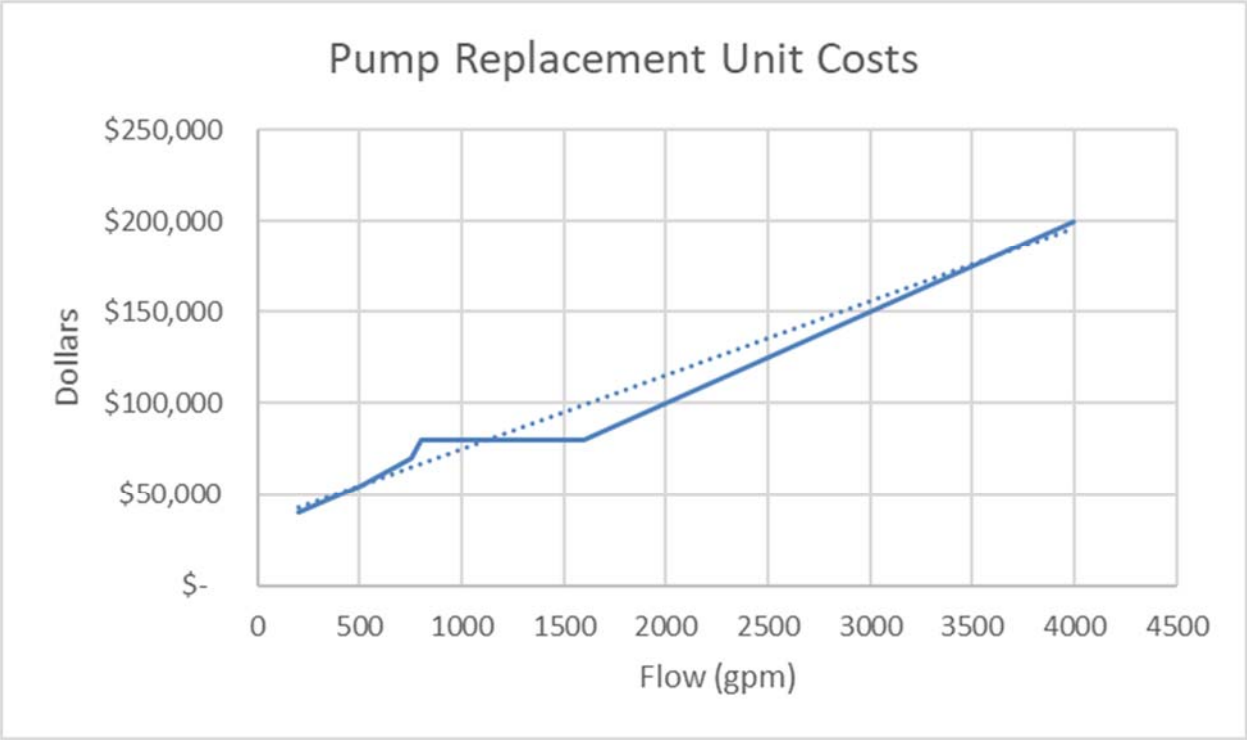
2.3 PUMP REPLACEMENT

Table 3 summarizes the recommended unit costs for pump replacement under multiple pump flow conditions and illustrates the linear trend for the recommended unit costs compared to pump size. Pump replacement costs only include the capital cost of the pumps and do not include any markups.

Table 3: Pump Replacement Unit Costs

PUMP NAME	UNIT COST
Design Point Head = 100 ft, Flow = 1,600 gpm	$80,000
Design Point Head= 100 ft, Flow= 4,000 gpm	$200,000
Design Point Head= 100 ft, Flow= 500 gpm	$55,000
Design Point Head= 110 ft, Flow= 1,800 gpm	$80,000
Design Point Head= 110 ft, Flow= 750 gpm	$70,000
Design Point Head= 145 ft, Flow= 200 gpm	$40,000

Figure 3: Pump Replacement Unit Costs



3.0 Capital Improvement Plan

The collection system capital improvement plan (CIP) includes 73 separate improvement projects through planning year 2040. The short term CIP projects have been grouped into annual system

improvement projects in order to assist in the execution of the smaller projects recommended. The CIP has a total project cost of $21.2M, which includes a 2.5% inflation rate beginning in 2025. In addition to LCU projects, approximately $37.7M is expected to be required for system additions and improvements due to new developments in the LCU service areas. These are typically incurred by individual developers and thus are not included in the LCU CIP.

As part of the Wastewater Optimization Technical Memorandum, Black & Veatch recommended the construction of two master pump stations as an alternative to several pump station projects. The two master pump station projects are expected to cost $9.3M and would replace $12.9M in other project costs. It must be noted that the master pump station projects would be replacing a large portion of developer driven projects so the majority of the $12.9M would likely not be the responsibility of LCU.

In addition to the force main replacements, several treatment plant expansions are required within the planning horizon. Based on LCU estimates, the treatment plant project costs total $290M. illustrates the timeline and trigger points for the expansion of the Three Oaks WRF and Southeast WRF due to flows in the southeastern portion of Lee County.

Black & Veatch has provided detailed cost estimate assumptions for each project in a CIP spreadsheet file. **Table 4** summarizes the CIP cash flow needs per year and Error! Reference source not found. at the end of the document summarizes the CIP per planning year.

Table 4: Capital Improvement Plan Cash Flow Summary

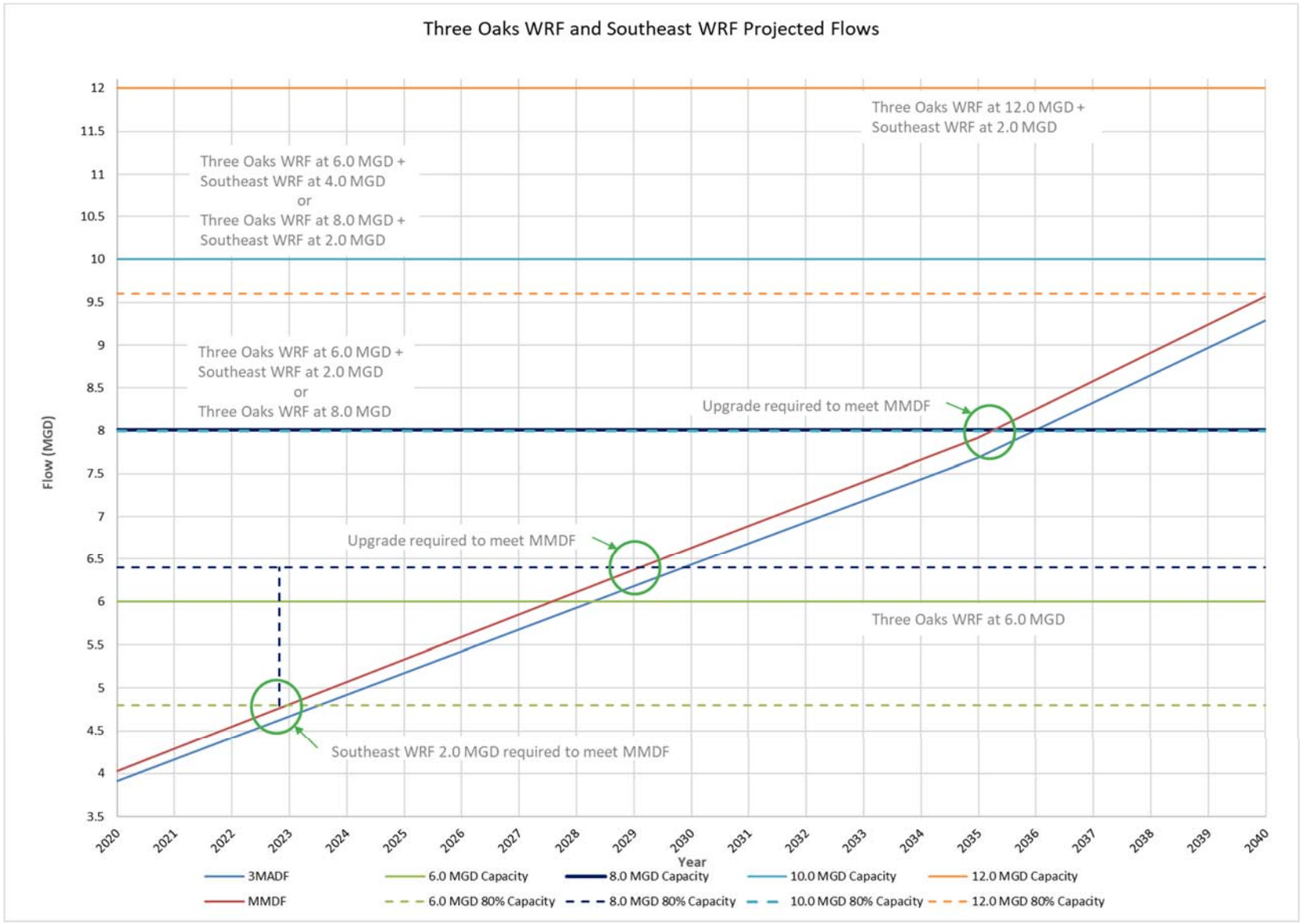
CASH FLOW	2020	2021	2022	2023	2024	2025-2029	2030-2039	2040-FUTURE
Force Main	$0	$0	$0	$0	$0	$171,179	$2,591,818	$5,943,709
Pump Replacement	$0	$0	$0	$0	$0	$0	$0	$0
New Pump Station	$0	$0	$0	$0	$0	$0	$634,056	$7,642,079
Master Pump Station	$0	$0	$0	$138,000	$0	$2,196,399	$6,930,581	$0
System Improvements	$0	$254,000	$254,000	$254,000	$230,000	$304,237	$1,260,255	$1,676,176
Plant Project	$6,150,000	$28,705,000	$28,705,000	$0	$2,400,000	$27,457,063	$80,890,416	$85,197,105
Total	$6,346,000	$28,902,000	$28,913,000	$357,000	$2,573,000	$30,128,877	$92,307,126	$100,459,070

Table 4 (cont.): Capital Improvement Plan Cash Flow Summary

20 YEAR CIP SUMMARY – W/INFLATION	TOTAL

Force Main	$8,706,706
Pump Replacement	$0
New Pump Station	$8,276,135
Master Pump Station	$9,264,980
System Improvements	$4,233,668
Plant Project	$259,504,584
Total	$289,986,073

Figure 4: Three Oaks WRF and Southeast WRF Expansions Based on Projected Flows



4.0 Cash Flow

The recommended CIP involves a number of significant capital cost projects through the 2040 planning horizon. and illustrate the required cash flow needs, with inflation and without, over the planning horizon assuming all design costs are encumbered at the beginning of the design period and all construction costs are encumbered at the beginning of the construction period. Due to the large cost of the treatment plant construction and expansion projects, the costs are encumbered for an approximate two-year construction period. In accordance with LCU procurement practices, a one-year lag between design and construction was incorporated.

Figure 5: Cash Flow Graph without Inflation

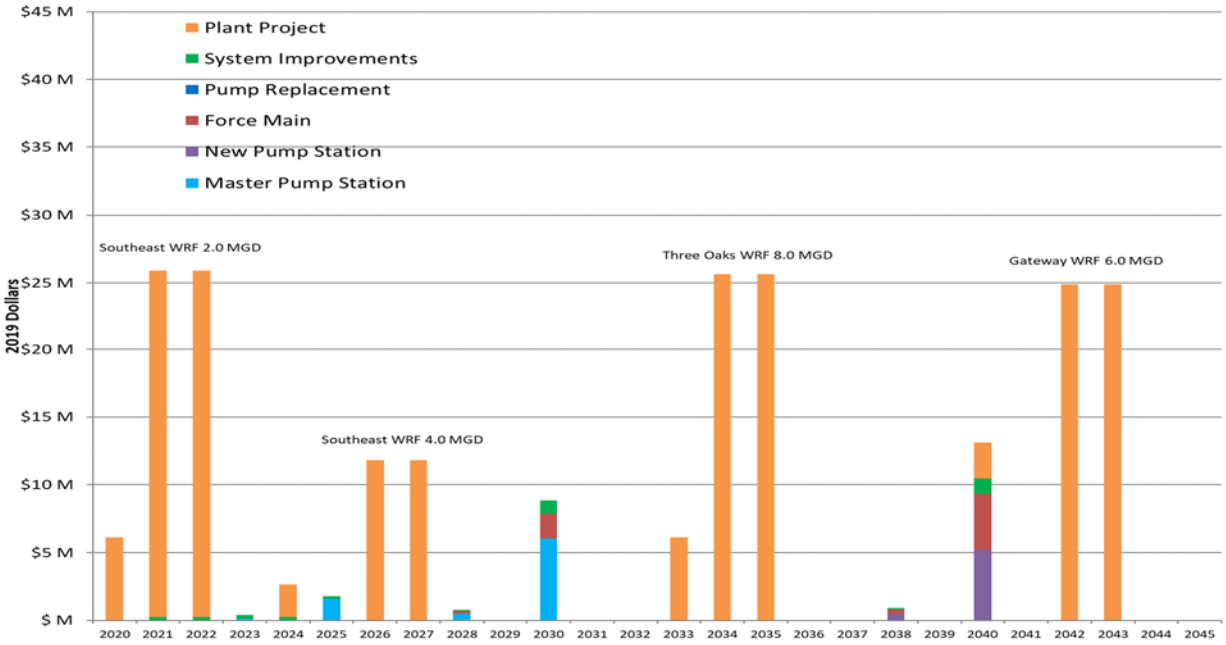


Figure 6: Cash Flow Graph with Inflation

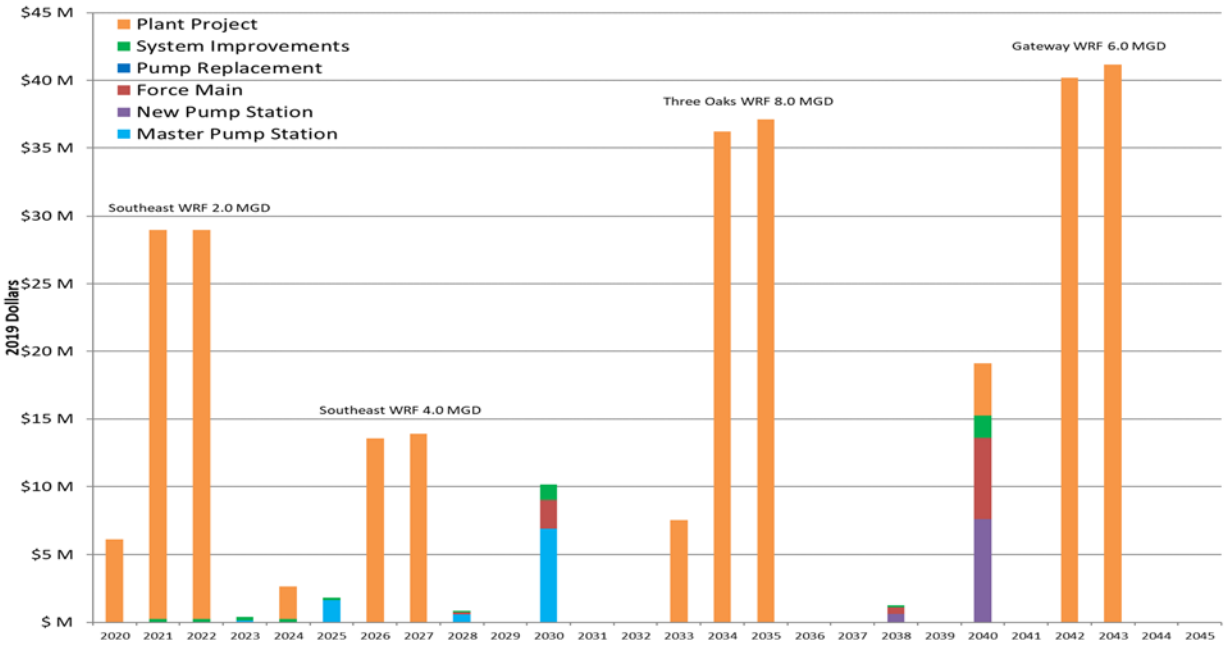


Table 5: Capital Improvement Plan Summary

PROJECT NAME	DESCRIPTION	TOTAL COST INCLUDING INFLATION	BUDGET YEAR (FY)
System Improvements 2021	The System Improvements 2021 consists of eleven force main improvements in the Fiesta Village, Fort Myers Beach, Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. - Summerlin Crossing (Discharge from PS 1104); 8-inch 580 ft - Winkler Rd @ Bracken Way (Discharge from PS 0080); 8-inch 200 ft - Big Mangrove Dr (Discharge from PS 1117); 8-inch 170 ft - Old Gladiolus Dr; 8-inch 170 ft - Winkler Rd @ Popham Dr; 12-inch 120 ft - Winkler Rd (Discharge from PS 0079); 8-inch 120 ft - Plantation Estates (Discharge from PS 2255); 8-inch 530 ft - FMB Force Main; 4-inch 70 ft - Technology Ct. (Discharge from PS 3302); 8-inch 550 ft - Whale Harbor Ln. (Discharge from PS 3341); 8-inch 90 ft - FMSGW Miscellaneous - 8"; 8-inch 80 ft	$ 254,000	2021
Southeast WRF (2.0 MGD)	Construction of Southeast WRF	$ 63,560,000	2020
System Improvements 2022	The System Improvements 2022 consists of two force main improvement and two pump station improvements in the Fort Myers Beach and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. - Lakewood Blvd. and Charter Club Blvd.; 8-inch 490 ft - Wiersma Ln. crossing Daniels Pkwy; 8-inch 600 ft - PS 1197 Duplex Model; 85 gpm at 70 ft - PS 3341 Duplex Model; 200 gpm at 65 ft	$ 254,000	2022
System Improvements 2023	The System Improvements 2023 consists of four force main improvement and two pump station improvements in the Fort Myers Beach and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. - Preserve Blvd. from PS 1110 to Gladiolus Dr.; 8-inch 400 ft - Trailwinds (Discharge from PS 3378); 8-inch 370 ft - Crossing Daniels Pkwy @ Appaloosa Ln.; 6-inch 370 ft - FMSGW Miscellaneous - 12"; 12-inch 10 ft - PS 1180 Duplex Model; 240 gpm at 60 ft - PS 3373 Duplex Model; 200 gpm at 65 ft	$ 254,000	2023
System Improvements 2024	The System Improvements 2024 consists of eight force main improvements in the Fiesta Village Services area and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. - Memoli Ln (Discharge from PS 0055); 8-inch 350 ft - Village Edge Cir (Discharge from PS 1115); 8-inch 220 ft - FV Miscellaneous - 4"; 4-inch 100 ft - FV Miscellaneous - 8"; 8-inch 120 ft - FV Miscellaneous - 6"; 6-inch 40 ft - Lee County Sports Complex (Discharge from PS 3339); 12-inch 1,020 ft - Crystal Dr. @ Penner Ln. (Discharge from PS 3349); 8-inch 220 ft - FMSGW Miscellaneous - 6"; 6-inch 40 ft	$ 230,000	2024
Master Pump Station 1 (2.25 MGD)	Master pump station in the Fort Myers Beach WRF service area – near the corner of McGregor Blvd. and Pine Ridge Rd. Project would replace FMB-Pump-2, FMB-Pump-3, FMB-Pump-4, FMB-Pump-6, FMB-Pump-7, and FMB-Pump-23. Project will also allow for the rehabilitation of PS 2256 which is nearing the end of its useful life.	$ 1,763,801	2023

PROJECT NAME	DESCRIPTION	TOTAL COST INCLUDING INFLATION	BUDGET YEAR (FY)
System Improvements 2025	The System Improvements 2025 consists of two force main improvements in the Fiesta Village Services area and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. - FV Miscellaneous - 4"; 4-inch 20 ft - Metro Pkwy @ Daniels Pkwy; 30-inch 540 ft	$ 212,416	2025
Southeast WRF Expansion to 4.0 MGD	Expansion of Southeast WRF to 4.0 MGD	$ 29,857,063	2024
System Improvements 2030	The System Improvements 2030 consists of four force main improvements and nine pump replacements in the Fiesta Village Services area and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. Projects include: - Miscellaneous - 6"; 6-inch; 90 ft - Penzance Blvd. from Six Mile Cypress Pkwy. to Cypress Walk Dr.; 12-inch; 420 ft, 8-inch; 240 ft - PS 3409 to Crystal Dr. crossing Plantation Rd.; 8-inch; 1280 ft - Cross Creek Blvd.; 12-inch; 630 ft - PS 0056 Duplex Model; 250gpm at 85 ft - PS 1155 Duplex Model; 200gpm at 65 ft - PS 2269 Duplex Model; 250gpm at 65 ft - PS 3315 Duplex Model; 750gpm at 110 ft - PS 3316 Duplex Model; 300gpm at 85 ft - PS 3334 Duplex Model; 200gpm at 145 ft - PS 3340 Duplex Model; 700gpm at 75 ft - PS 3345 Six Pump Model; 1800gpm at 110 ft - PS 3393 Duplex Model; 1600gpm at 100 ft	$ 1,210,247	2028 (Design) 2030 (construction)
Daniels Pkwy from International Dr. to Metro Pkwy.	24-inch; 2940 ft 12-inch; 620 ft 8-inch; 820 ft This project increases the wastewater transmission capacity for the force main along Daniels Pkwy from International Dr. to Metro Pkwy. This project will be required to account for increased flows due to population growth.	$ 1,141,809	2028
Six Mile Cypress Pkwy. from Crystal Dr. to Penzance Blvd.	8-inch; 2690 ft This project increases the wastewater transmission capacity for the force main along Six Mile Cypress Pkwy. from Crystal Dr. to Penzance Blvd. This project will be required to account for increased flows due to population growth.	$ 289,988	2028
Page Park 1st St. and 3rd St.	8-inch; 1690 ft This project increases the wastewater transmission capacity for the force main along 1st and 3rd St. in Page Park. This project will need to be completed in conjunction with the Pump Replacement projects "FMSGW-Pump-17" and "FMSGW-Pump-19".	$ 183,829	2028
Fiddlesticks Blvd. from White Hickory Ln. to Daniels Pkwy.	12-inch; 4500 ft This project increases the wastewater transmission capacity for the force main along Fiddlesticks Blvd. from White Hickory Ln. to Daniels Pkwy. This project will need to be completed in conjunction with the Pump Replacement projects "FMSGW-Pump-5" and "FMSGW-Pump-16".	$ 657,646	2028
Master Pump Station 2 (9.0 MGD)	Master pump station in the City of Fort Myers South WWTP service area – near the corner of Metro Pkwy. and Crystal Dr. Project would replace FMSGW-Pump-9, FMSGW-Pump-10, FMSGW-Pump-11, FMSGW-Pump-12, FMSGW-Pump-19, FMSGW-Pump-20, FMSGW-Pump-22, FMSGW-Pump-23, and FMSGW-Pump-24	$ 7,501,179	2028
Three Oaks WRF Expansion to 8.0 MGD	Expansion of Three Oaks WRF to 8.0 MGD	$ 80,890,416	2033
System Improvements 2040	The System Improvements 2040 consists of two force main improvements and fourteen pump replacements in the Fiesta Village Services area and Fort Myers South and Gateway services areas. System improvements including force main upgrades and pump replacement. Full pump station rehabilitation may be done in lieu of pump replacement depending on condition. Projects include:	$ 1,963,595	2038 (Design) 2040 (construction)

PROJECT NAME	DESCRIPTION	TOTAL COST INCLUDING INFLATION	BUDGET YEAR (FY)
	- Miscellaneous 2040; 6-inch; 90 ft - Miscellaneous 2040; 8-inch; 5 ft - Appaloosa Ln. @ Jobe Rd.; 6-inch; 410 ft - PS 0065 Duplex Model; 500gpm at 100 ft - PS 1173 Duplex Model; 200gpm at 70 ft - PS 1176 Duplex Model; 240gpm at 80 ft - PS 1178 Duplex Model; 160gpm at 75 ft - PS 2207 Duplex Model; 60gpm at 25 ft - PS 2229 Duplex Model; 280gpm at 65 ft - PS 2237 Duplex Model; 4000gpm at 100 ft - PS 2264 Duplex Model; 550gpm at 40 ft - PS 2266 Duplex Model; 400gpm at 85 ft - PS 3303 Duplex Model; 260gpm at 45 ft - PS 3351 Duplex Model; 200gpm at 30 ft - PS 3322 Duplex Model; 360gpm at 75 ft - PS 3400 Duplex Model; 105gpm at 85 ft - PS 7726 Duplex Model; 600gpm at 120 ft		
McGregor Blvd from Crescent Dr. to A&W Bulb Rd.	8-inch; 2820 ft This project increases the wastewater transmission capacity for the force main along McGregor Blvd from Crescent Dr. to A&W Bulb Rd. This project will be required to account for increased flows due to population growth.	$ 386,879	2038
Maida Ln. South of Gladiolus Dr.	8-inch; 1760 ft This project increases the wastewater transmission capacity for the force main along Maida Ln. South of Gladiolus Dr. This project will be required to account for increased flows due to population growth.	$ 235,615	2038
Metro Pkwy from Six Mile Cypress Pkwy. to Daniels Pkwy.	16-inch; 6690 ft 12-inch; 10 ft This project increases the wastewater transmission capacity for the force main along Metro Pkwy from Six Mile Cypress Pkwy. to Daniels Pkwy. This project will need to be completed in conjunction with the Pump Replacement project "FMSGW-Pump-23"	$ 1,556,442	2038
Daniels Pkwy American Colony Blvd. to International Dr.	24-inch; 5930 ft This project increases the wastewater transmission capacity for the force main along Daniels Pkwy American Colony Blvd. to International Dr. This project will need to be completed in conjunction with the Annexation of Eagle Ridge WWTP.	$ 2,516,339	2038
Penzance Blvd from Cypress Walk Dr. to Plantation Rd.	16-inch; 3350 ft 12-inch; 4010 ft This project increases the wastewater transmission capacity for the force main along Penzance Blvd from Cypress Walk Dr. to Plantation Rd. This project will be required to account for increased flows due to population growth.	$ 1,527,241	2038
Crystal Dr from Plantation Rd. to Metro Pkwy.	8-inch; 1530 ft This project increases the wastewater transmission capacity for the force main along Crystal Dr from Plantation Rd. to Metro Pkwy. This project will be required to account for increased flows due to population growth.	$ 210,919	2038
Proposed PS 3419	Construct a new pump station to accommodate flows from growth between Plantation Rd. and Ben C Pratt Pkwy. Pipe Project: FMSGW-Pipe-21 should be completed with this project.; Head: 20ft Flow: 2000gpm	$ 3,025,280	2038
Proposed PS 3415	Construct a new pump station to accommodate flows from growth on Metro Pkwy. and Six Mile Cypress Pkwy.; Head: 50ft Flow: 800gpm	$ 1,221,876	2038
Eagle Ridge Pump Station	Construct a new pump station to accommodate flows from the annexation of Eagle Ridge WWTP. Pipe Project: FMSGW-Pipe-20 should be completed with this project.; Head: 45ft Flow: 2600gpm	$ 4,028,979	2038
Gateway WRF Expansion to 6.0 MGD	Expansion of Gateway WRF to 6.0 MGD	$ 85,197,105	2040