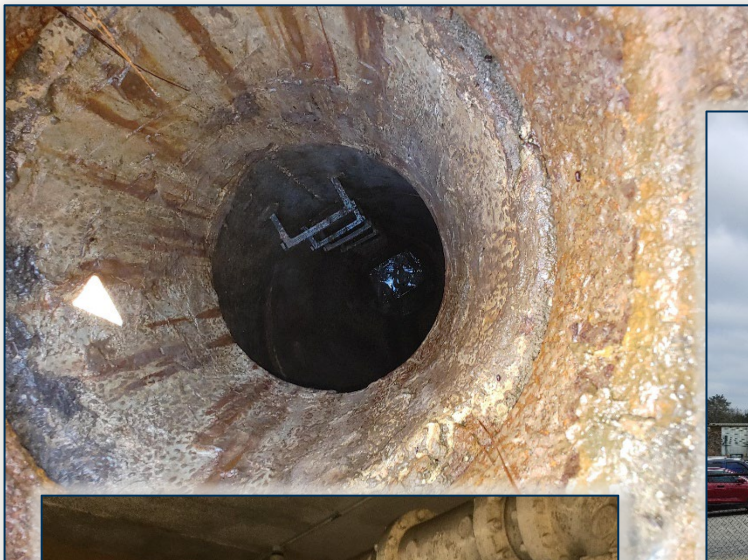
SANITARY SEWER COLLECTION SYSTEM MASTER PLAN

FINAL REPORT

BOARD OF WATER AND SEWER COMMISSIONERS OF THE CITY OF SARALAND

PROJECT NO. 1074304

JUNE 2022



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ACKNOWLEDGEMENTS

We sincerely appreciate all of the leadership and hard work from each and every individual listed below that assisted in the successful completion of this project.

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Mr. Ron Mitchell – Chairman
Mr. James Davis – Vice-Chairman
Mr. Dewey "Scooter" Thronson – Secretary/Treasurer
Mr. Jackie Haines – Board Member
Mr. O'Neil Robinson – Board Member

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SECTION 1 - INTRODUCTION

1.1. INTRODUCTION
The Board of Water and Sewer Commissioners of the City of Saraland (Board), doing business as Saraland Water and Sewer Service (SWSS), owns, operates, and maintains the sanitary sewer collection system as well as the Saraland Wastewater Treatment Plant (WWTP). All of the wastewater infrastructure was transferred to SWSS in 2017 by the City of Saraland.

The collection system conveys raw wastewater for over 4800 residential, commercial, and industrial customers through approximately 81 miles of gravity sewer, 1600 manholes, 37 lift stations, and 17 miles of pressure force main. The wastewater collected is conveyed to the Saraland WWTP, which is currently permitted through the Alabama Department of Environmental Management (ADEM) for a design flow of 2.6 million gallons per day (MGD) under National Pollutant Discharge Elimination System (NPDES) Permit No. AL0055786.

1.2. AUTHORIZATION
The Board approved *Task Agreement No. 4 – Sanitary Sewer Collection System Master Plan* on December 4, 2020 authorizing Volkert, Inc. to execute the work presented herein as it relates to the collection system infrastructure only. No assessments nor evaluations were completed for current or future needs of the Saraland WWTP.

1.3. PURPOSE
The purpose of the Sanitary Sewer Collection System Master Plan is to provide improvement recommendations for the sanitary sewer collection system infrastructure to meet current and future needs.

1.4. PREVIOUS STUDIES
Table 1.1 shows previous studies that were authorized and completed. The studies listed in the table below are included in Appendices A and B, respectively.

Table 1.1.: Previous Studies Performed in Sanitary Sewer Collection System

Title of Study	Date of Completion	Owner	Engineer	Project No.
Saraland Wastewater Collection System Capacity Analysis	Jan. 2005	City of Saraland	Volkert & Associates	111905
Saraland Sewer System 10-Year Plan	Oct. 2008	City of Saraland	Volkert & Associates	660107

1.5. LIMITATIONS OF STUDY
The data presented within this report were gathered, analyzed, and evaluated throughout the Study Period beginning December 2020 and ending January 2022. The findings and recommendations contained within this report are effective as of the Study Period dates using the assumptions and other information referenced herein. Additionally, the recommended projects and cost estimates

are presented at a conceptual level with a magnitude of cost and will assist SWSS with the development of annual capital improvements plan, maintenance plan, and fiscal year budgeting. Project verification and final engineering design will still be required prior to construction of any recommended projects.

Future changes to city zoning requirements, growth rate, growth patterns, and other factors may affect the prioritization and recommendations presented in this report. Therefore, it is recommended this Master Plan be reviewed at least annually beginning in the year 2023 through the year 2027 and revised as necessary. After which, the frequency of reviews and revisions can be reassessed.

SECTION 2 – EXISTING SANITARY SEWER COLLECTION SYSTEM

2.1. SERVICE AREA

SWSS owns, operates, and maintains the sanitary sewer collection system infrastructure primarily located within the City of Saraland's municipal boundaries. Currently, the total area within Saraland's city limits is approximately 20,750 acres. According to the United States Census Bureau (as of April 1, 2020) the City of Saraland has a total population of 16,171. SWSS has approximately 4880 residential, commercial, and industrial sewer customers at the time of this writing.

2.2. EXISTING COLLECTION SYSTEM

The existing collection system consists of six separate sewer basins which are generally defined by existing topographical features and include both gravity and pressure force main infrastructure. Table 2.1. below provides details of each sewer basin and Figure 2.1. on Page 2-2 depicts these basins graphically. The aerial map shown in Figure 2.2a. on Page 2-3 and the elevation map shown in Figure 2.2b. on Page 2-4 illustrate the current Saraland city limits and SWSS service area as well as the existing sanitary sewer collection system infrastructure owned, operated, and maintained by SWSS, excluding manholes and sanitary sewer service laterals. The manholes and service laterals are not shown for clarity.

Table 2.1.: Existing Sanitary Sewer Basin Details

Sewer Basin	Approx. Area (AC)	Gravity Sewer (LF)	Manholes	Pressure Force Mains (LF)	Lift Stations
West Celeste	2,057	129,790	519	50,285	15
East Celeste	625	53,396	192	2,437	4
Bayou Sara	566	47,188	192	9,440	6
Norton Creek	902	91,673	326	1,367	2
Highway 43	670	56,838	183	13,889	4
Industrial Parkway	984	47,733	202	10,729	6
TOTAL	**5,804**	**426,618**	**1,614**	**88,147**	**37**

*AC = acres, LF = linear feet

The following subsections provide further details of the existing gravity sewer collection system, lift station and pressure force main systems, as well as the results of the Infiltration and Inflow (I/I) Study and Analysis that was performed by CSL Services, Inc. between March 18, 2021 and August 18, 2021.

2.2.1. Gravity Sewer Collection System

The existing gravity sewer collection system is comprised of approximately 426,618 linear feet (LF) of gravity sewer mains and 1,614 manholes. The sewer mains come in a variety of sizes ranging from 6" – 30" and are composed of various materials, including vitrified clay pipe (VCP), ductile iron (DI), polyvinyl chloride (PVC), high-density polyethylene (HDPE), and spirolite, which is a polyethylene plastic pipe that is rarely used in wastewater applications. Unknown pipe sizes and materials make up less than 0.5% and approximately 23% of the gravity sewer system, respectively.

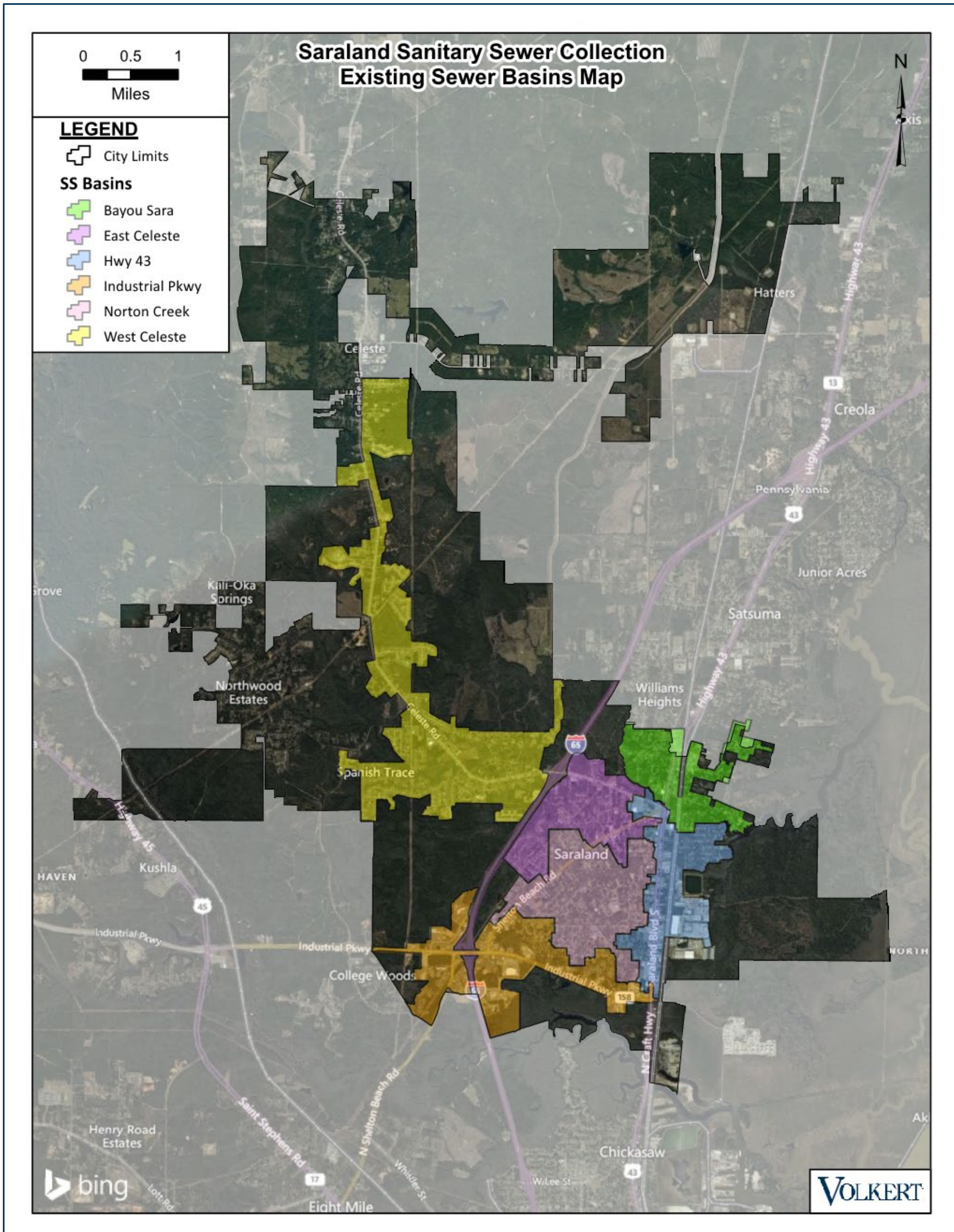


Figure 2.1.: Existing Sewer Basin Map

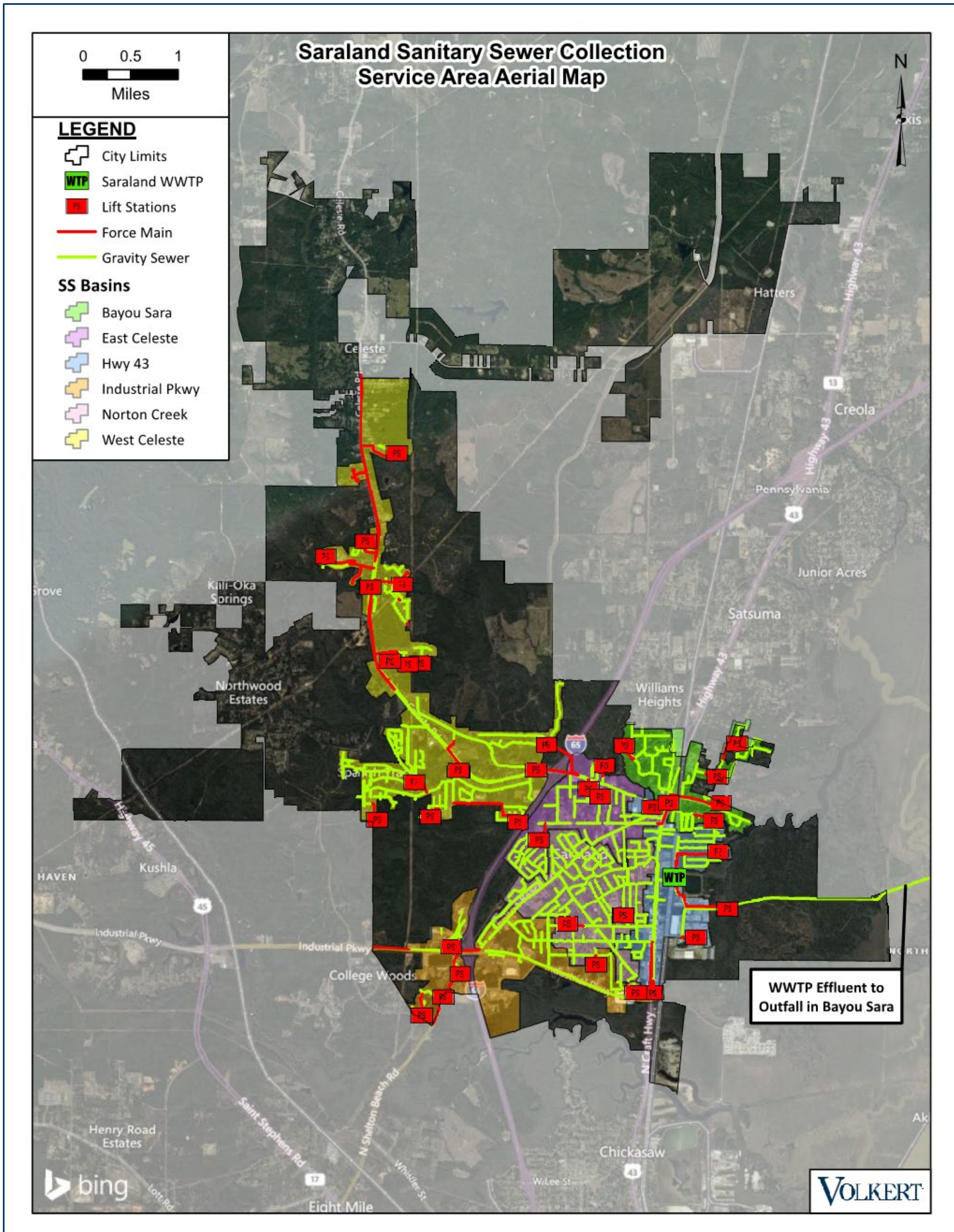


Figure 2.2a.: Service Area Aerial Map

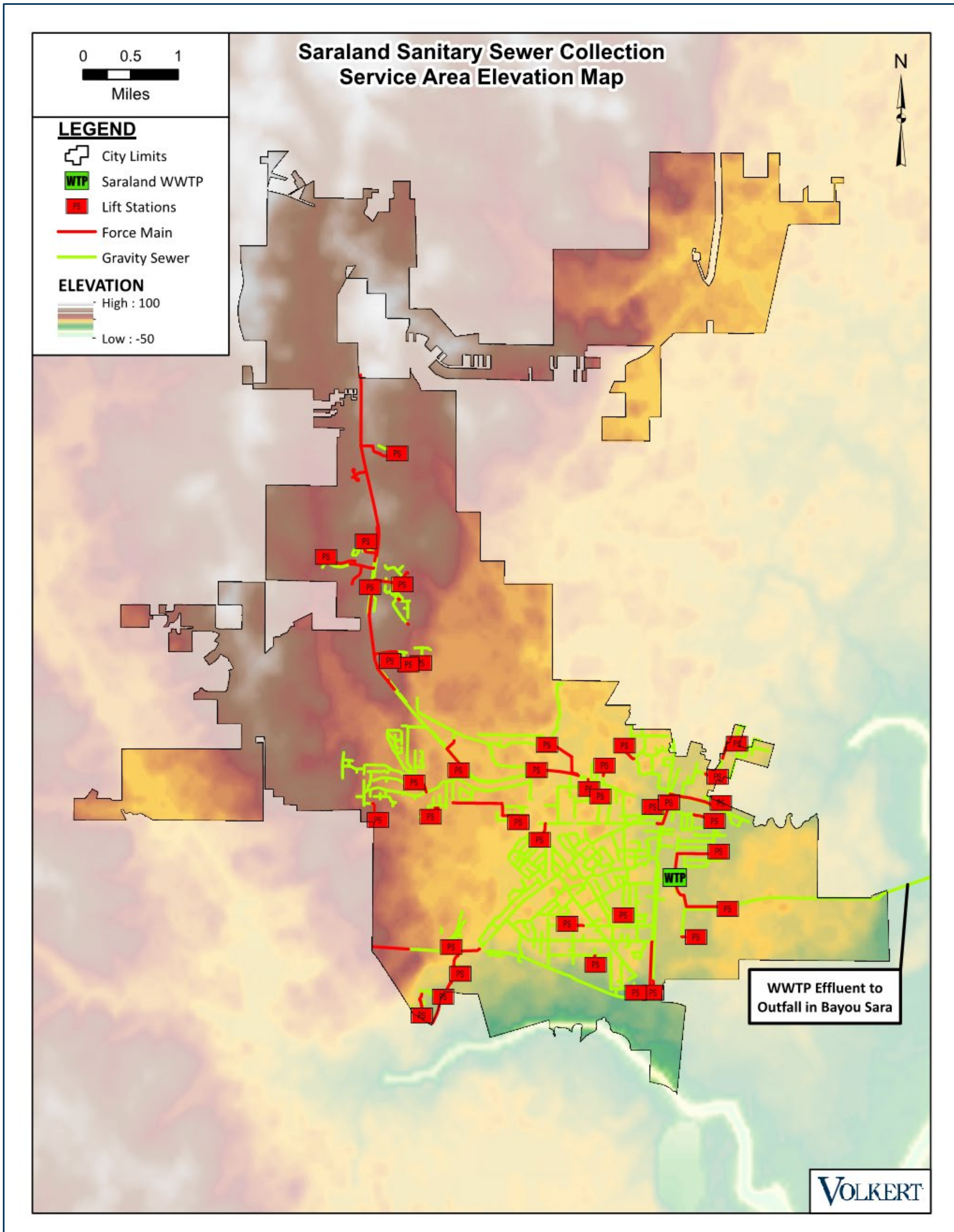


Figure 2.2b.: Service Area Elevation Map

Tables 2.2. and 2.3. below provide a breakdown of gravity sewer by pipe length, size, and material by each sewer basin. As can be seen, the sewer basin containing the largest quantity of gravity sewer pipe is the West Celeste Sewer Basin. Approximately 30% of the total gravity sewer pipe is located within this basin. 8" PVC is the most commonly used pipe size and material at 82% and 70%, respectively, for the entire collection system.

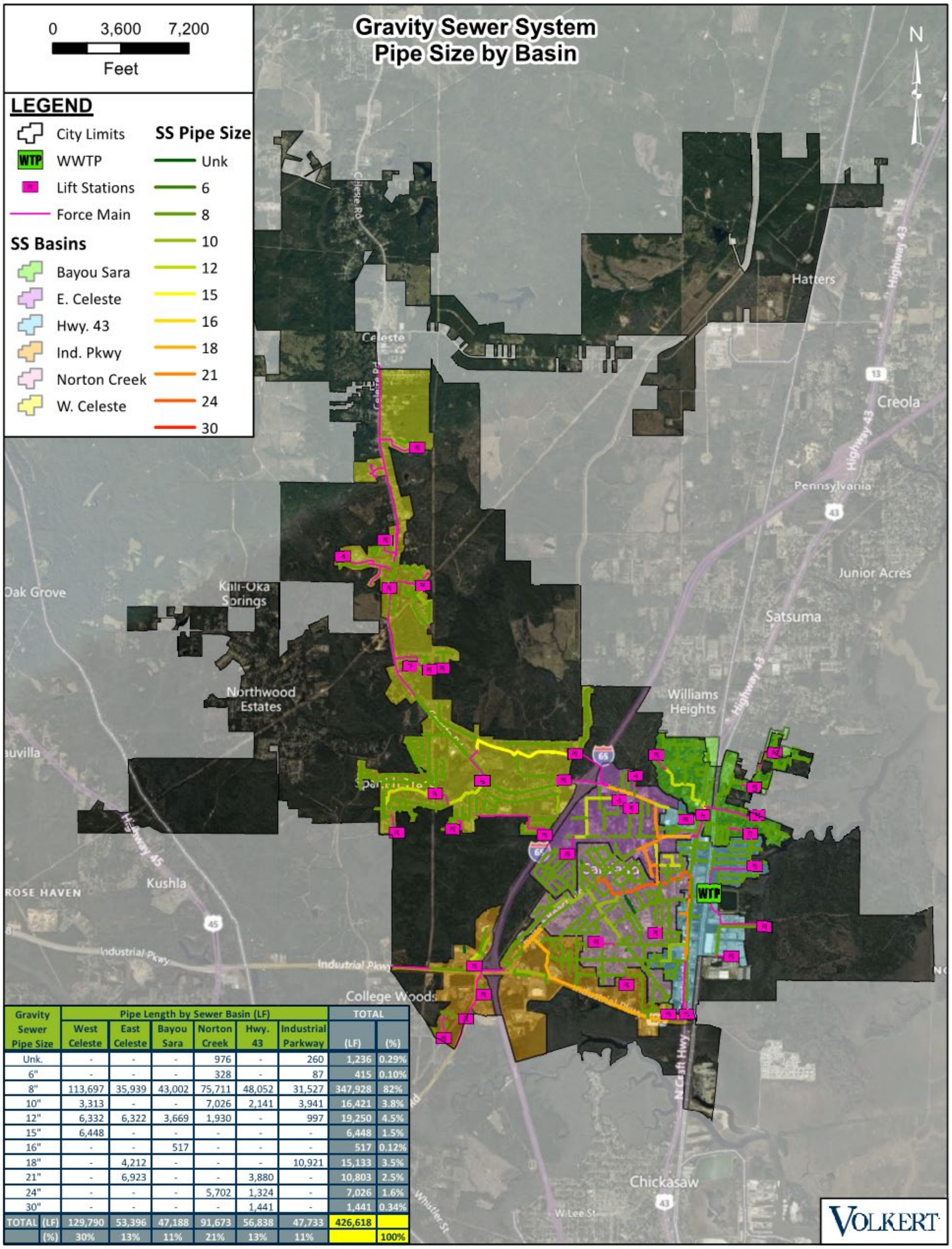
Table 2.2.: Gravity Sewer Pipe Size by Basin

Gravity Sewer Pipe Size		Pipe Length by Sewer Basin (LF)						TOTAL	
		West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.		-	-	-	976	-	260	1,236	0.29%
6"		-	-	-	328	-	87	415	0.10%
8"		113,697	35,939	43,002	75,711	48,052	31,527	347,928	82%
10"		3,313	-	-	7,026	2,141	3,941	16,421	3.8%
12"		6,332	6,322	3,669	1,930	-	997	19,250	4.5%
15"		6,448	-	-	-	-	-	6,448	1.5%
16"		-	-	517	-	-	-	517	0.12%
18"		-	4,212	-	-	-	10,921	15,133	3.5%
21"		-	6,923	-	-	3,880	-	10,803	2.5%
24"		-	-	-	5,702	1,324	-	7,026	1.6%
30"		-	-	-	-	1,441	-	1,441	0.34%
TOTAL	(LF)	129,790	53,396	47,188	91,673	56,838	47,733	426,618	
	(%)	30%	13%	11%	21%	13%	11%		100%

Table 2.3.: Gravity Sewer Pipe Material by Basin

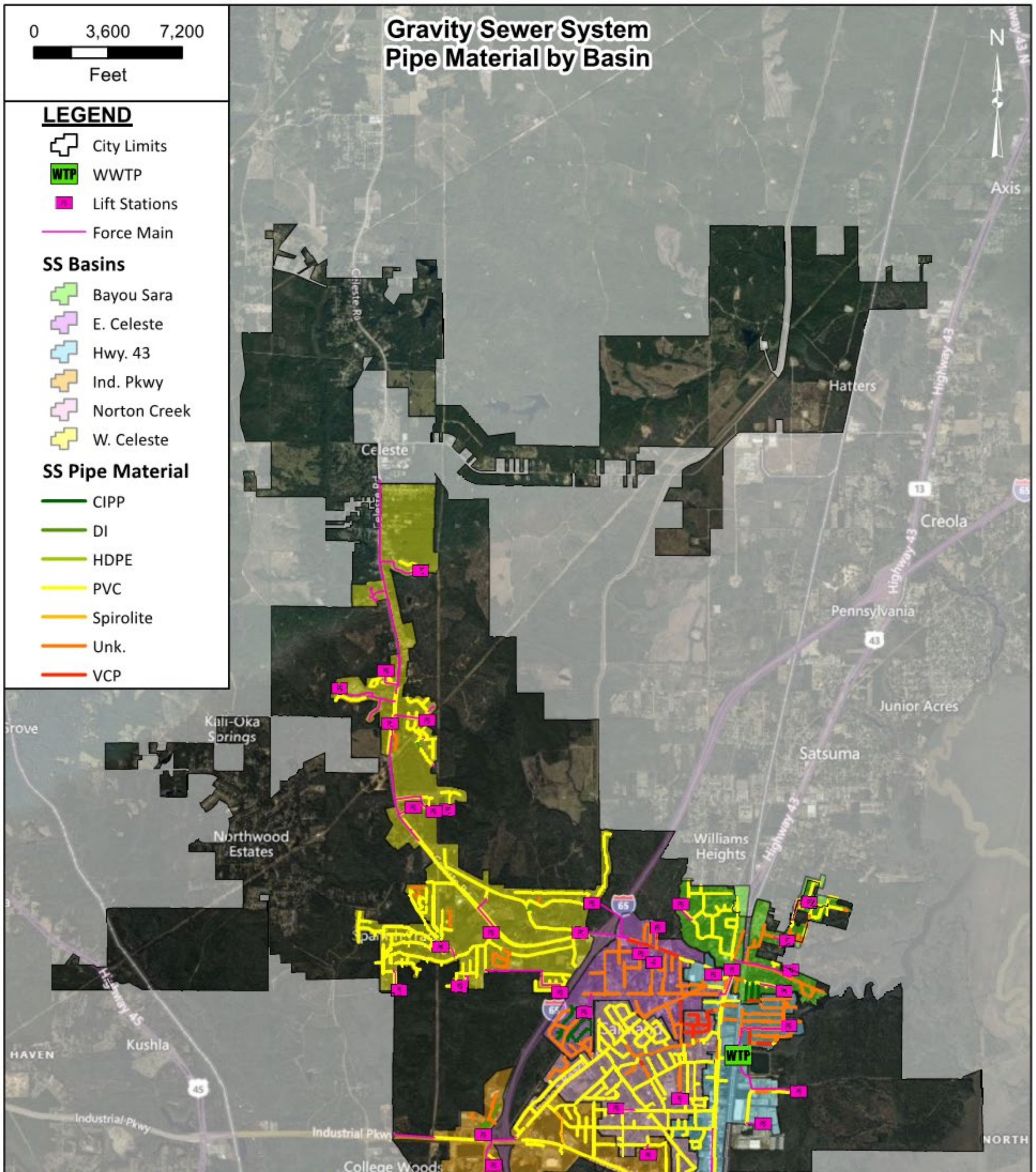
Gravity Sewer Pipe Material		Pipe Length by Sewer Basin (LF)						TOTAL	
		West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.		6,556	42,027	15,509	9,286	23,567	1,894	98,839	23%
VCP		-	3,844	580	4,961	1,805	-	11,190	2.6%
Spirolite		-	-	-	-	-	1,933	1,933	0.45%
HDPE		-	-	-	-	50	-	50	0.012%
PVC		121,446	814	28,233	77,308	31,328	40,933	300,062	70%
DI		1,788	-	517	118	88	2,973	5,484	1.3%
CIPP		-	6,711	2,349	-	-	-	9,060	2.1%
TOTAL	(LF)	129,790	53,396	47,188	91,673	56,838	47,733	426,618	
	(%)	30%	13%	11%	21%	13%	11%		100%

Figures 2.3. and 2.4. on the following pages illustrates the information provided in Tables 2.2. and 2.3. for the entire system. Figures 2.5. – 2.16. illustrate the same information but for each individual basin. The unknown pipe size and material is due to the lack of available record drawings and GIS data for these particular pipe segments.



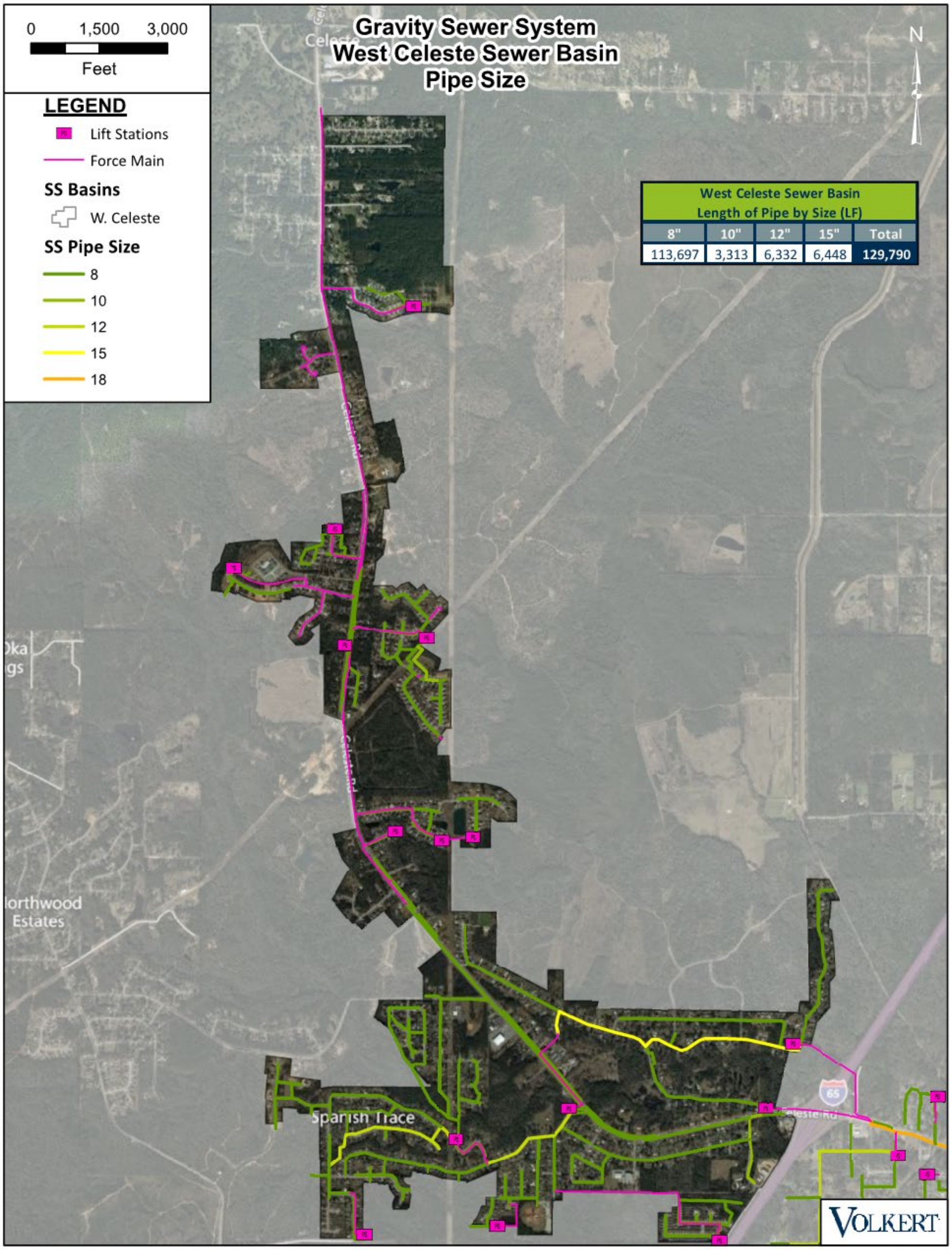
Gravity Sewer Pipe Size	Pipe Length by Sewer Basin (LF)						TOTAL	
	West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.	-	-	-	976	-	260	1,236	0.29%
6"	-	-	-	328	-	87	415	0.10%
8"	113,697	35,939	43,002	75,711	48,052	31,527	347,928	82%
10"	3,313	-	-	7,026	2,141	3,941	16,421	3.8%
12"	6,332	6,322	3,669	1,930	-	997	19,250	4.5%
15"	6,448	-	-	-	-	-	6,448	1.5%
16"	-	-	517	-	-	-	517	0.12%
18"	-	4,212	-	-	-	10,921	15,133	3.5%
21"	-	6,923	-	-	3,880	-	10,803	2.5%
24"	-	-	-	5,702	1,324	-	7,026	1.6%
30"	-	-	-	-	1,441	-	1,441	0.34%
TOTAL (LF)	129,790	53,396	47,188	91,673	56,838	47,733	426,618	
(%)	30%	13%	11%	21%	13%	11%		100%

Figure 2.3.: Gravity Sewer Pipe Size by Basin



Gravity Sewer Pipe Material	Pipe Length by Sewer Basin (LF)						TOTAL	
	West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.	6,556	42,027	15,509	9,286	23,567	1,894	98,839	23%
VCP	-	3,844	580	4,961	1,805	-	11,190	2.6%
Spirolite	-	-	-	-	-	1,933	1,933	0.45%
HDPE	-	-	-	-	50	-	50	0.012%
PVC	121,446	814	28,233	77,308	31,328	40,933	300,062	70%
DI	1,788	-	517	118	88	2,973	5,484	1.3%
CIPP	-	6,711	2,349	-	-	-	9,060	2.1%
TOTAL (LF)	129,790	53,396	47,188	91,673	56,838	47,733	426,618	
(%)	30%	13%	11%	21%	13%	11%		100%

Figure 2.4. Gravity Sewer Pipe Material by Basin



West Celeste Sewer Basin Length of Pipe by Size (LF)				
8"	10"	12"	15"	Total
113,697	3,313	6,332	6,448	129,790

Figure 2.5.: Gravity Sewer Pipe Size – West Celeste Sewer Basin

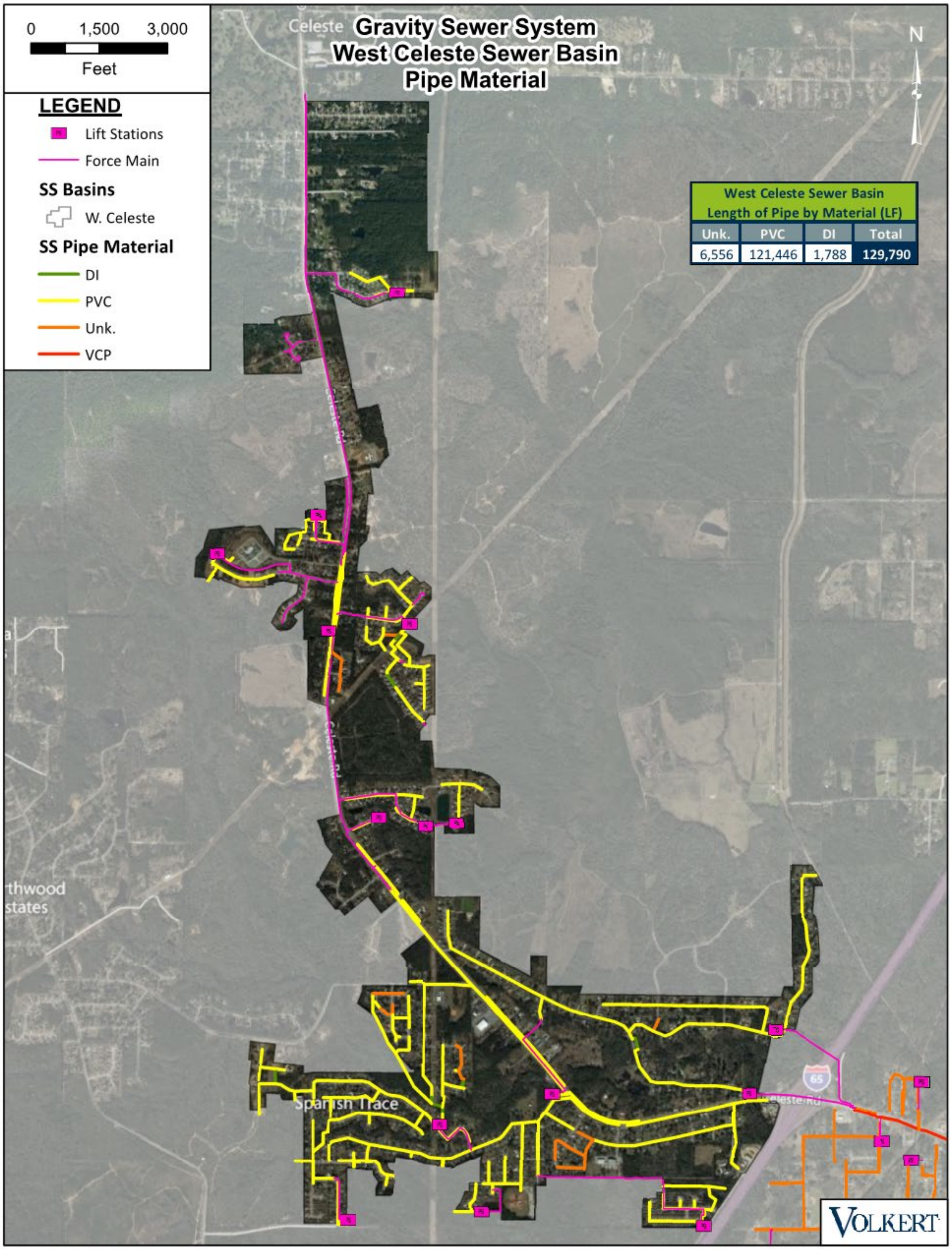


Figure 2.6.: Gravity Sewer Pipe Material – West Celeste Sewer Basin

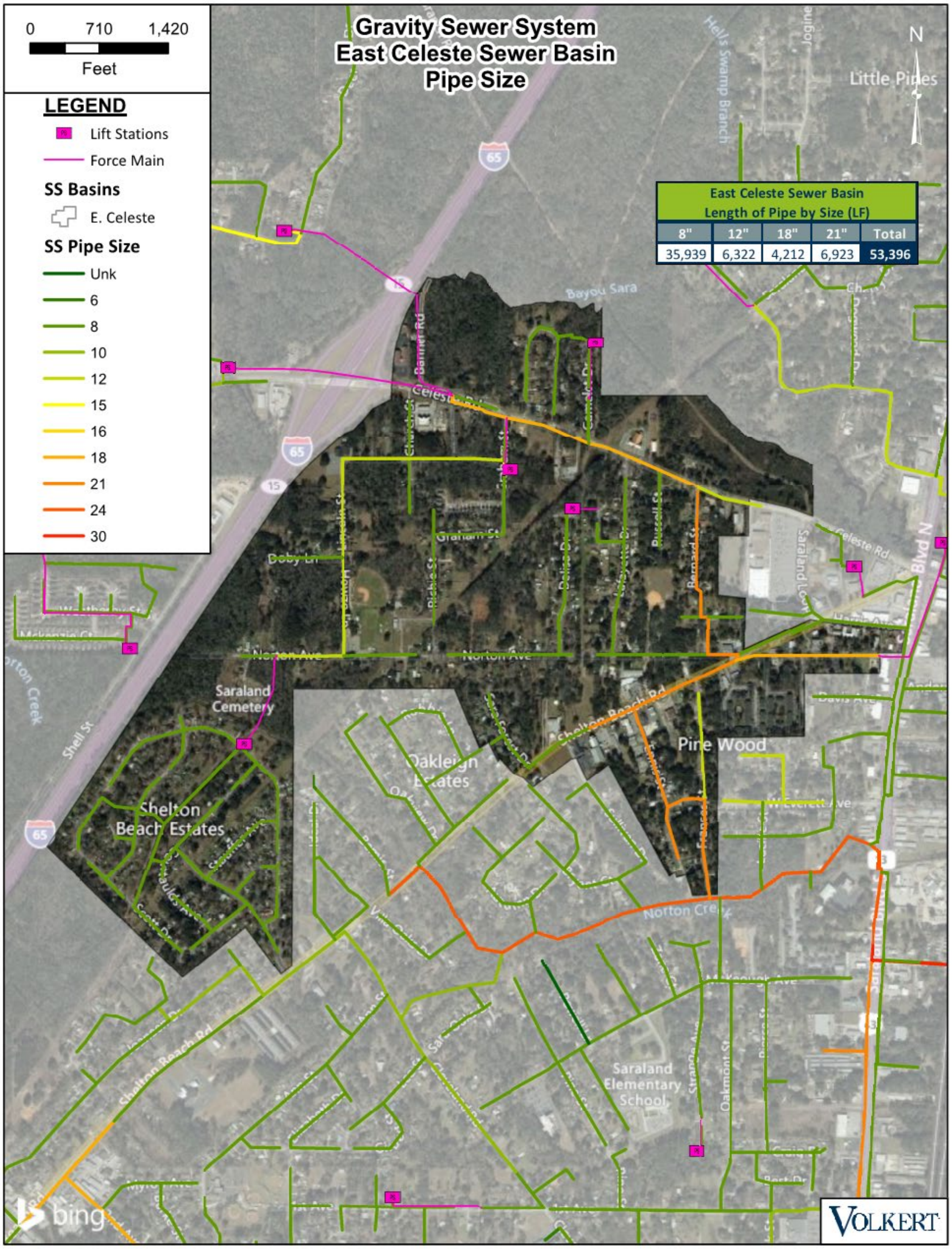


Figure 2.7.: Gravity Sewer Pipe Size – East Celeste Sewer Basin

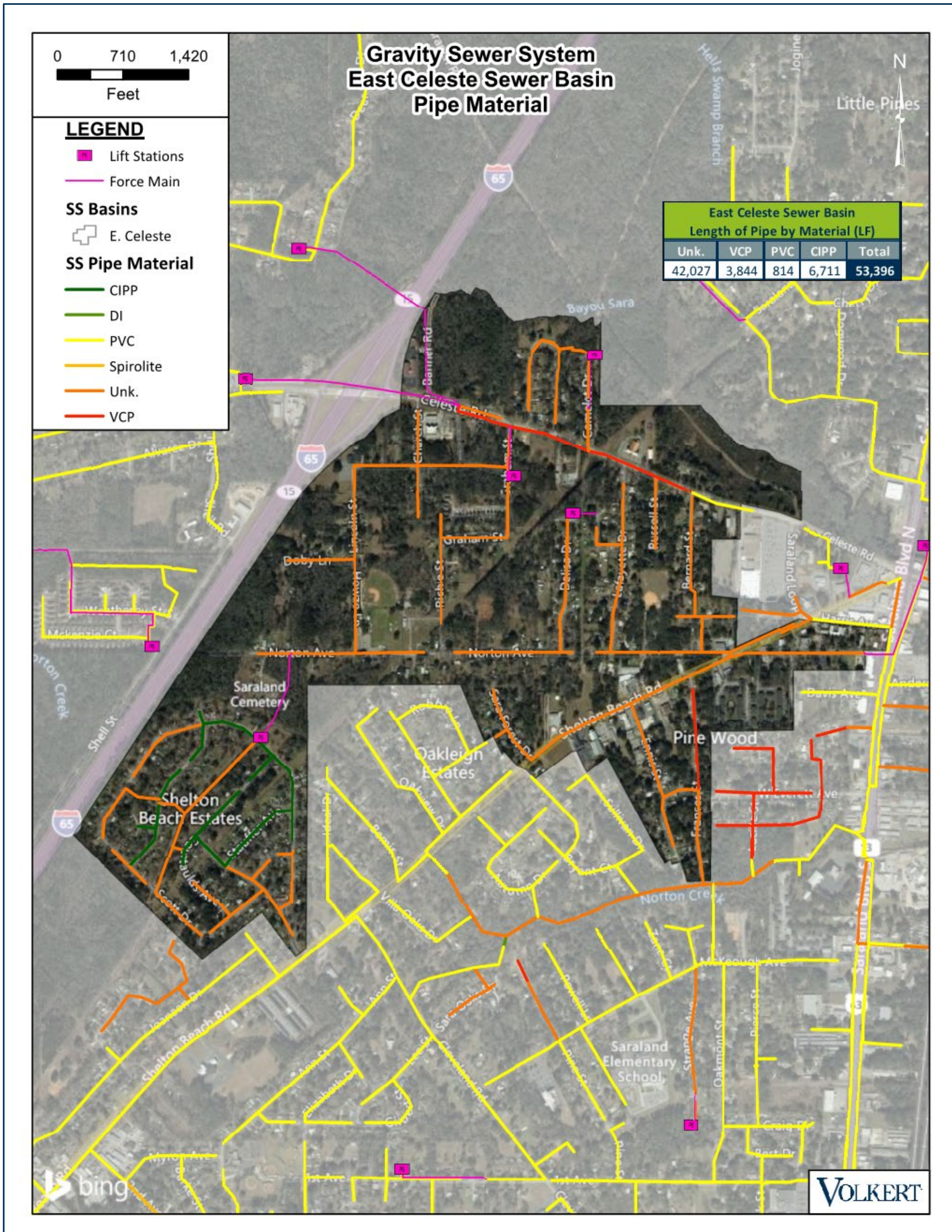


Figure 2.8.: Gravity Sewer Pipe Material – East Celeste Sewer Basin

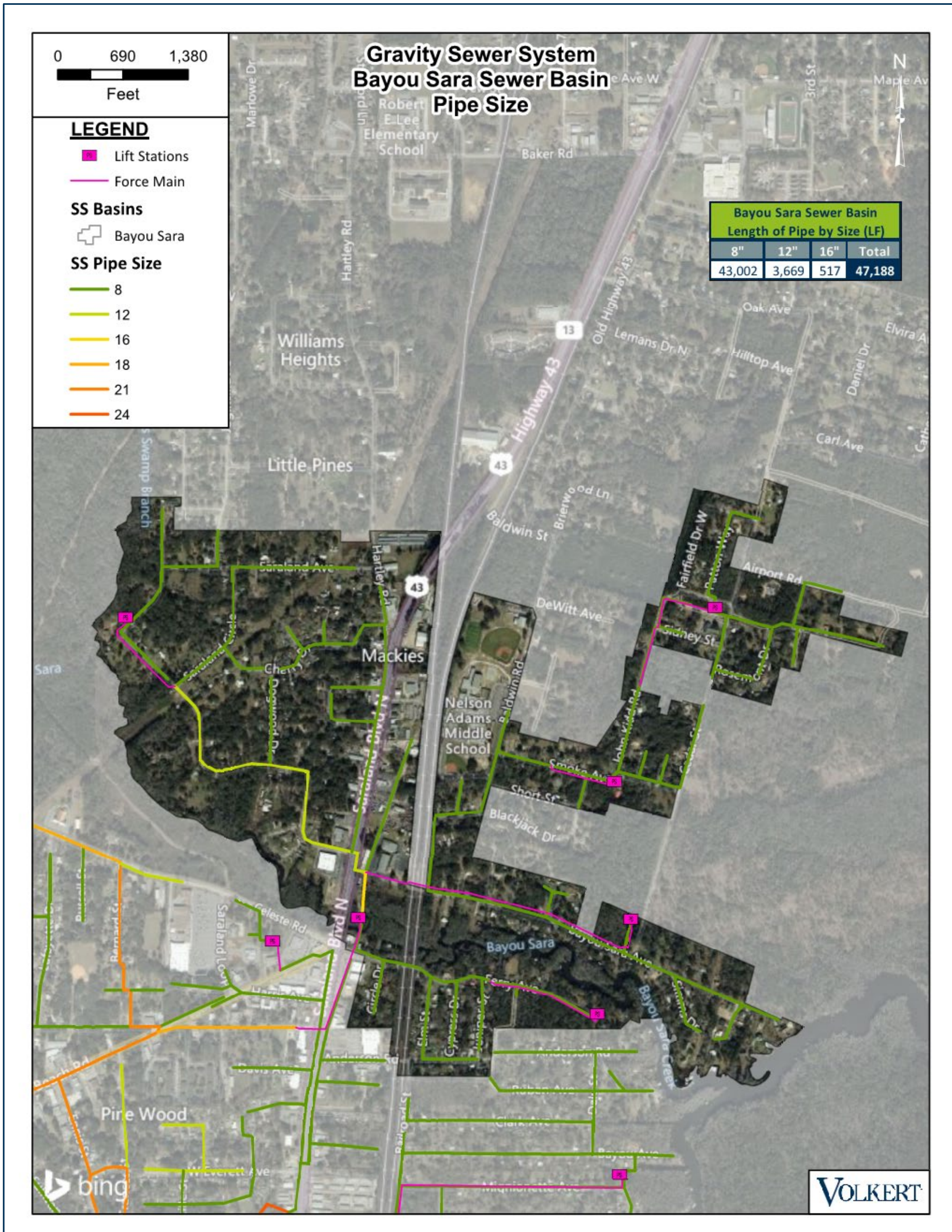


Figure 2.9.: Gravity Sewer Pipe Size – Bayou Sara Sewer Basin

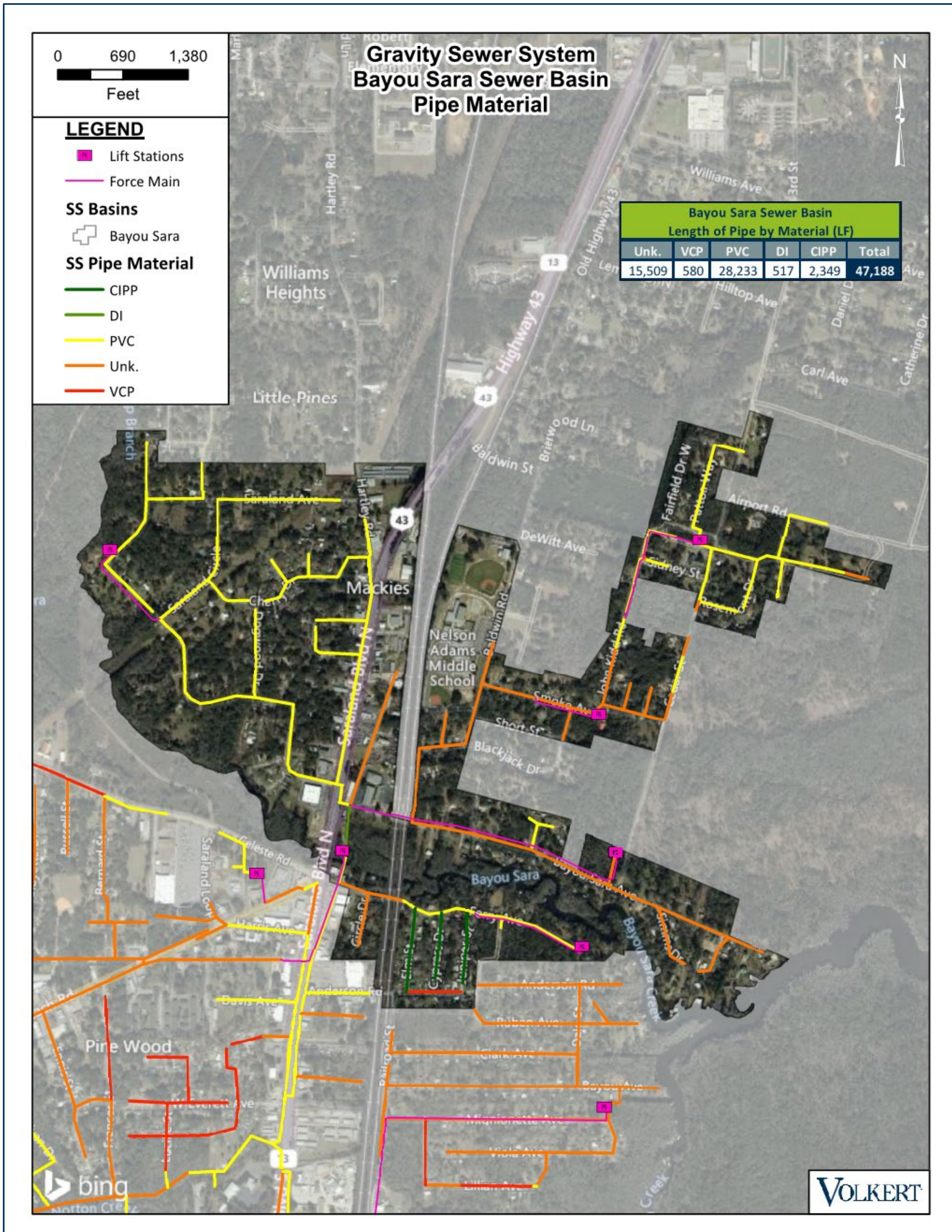
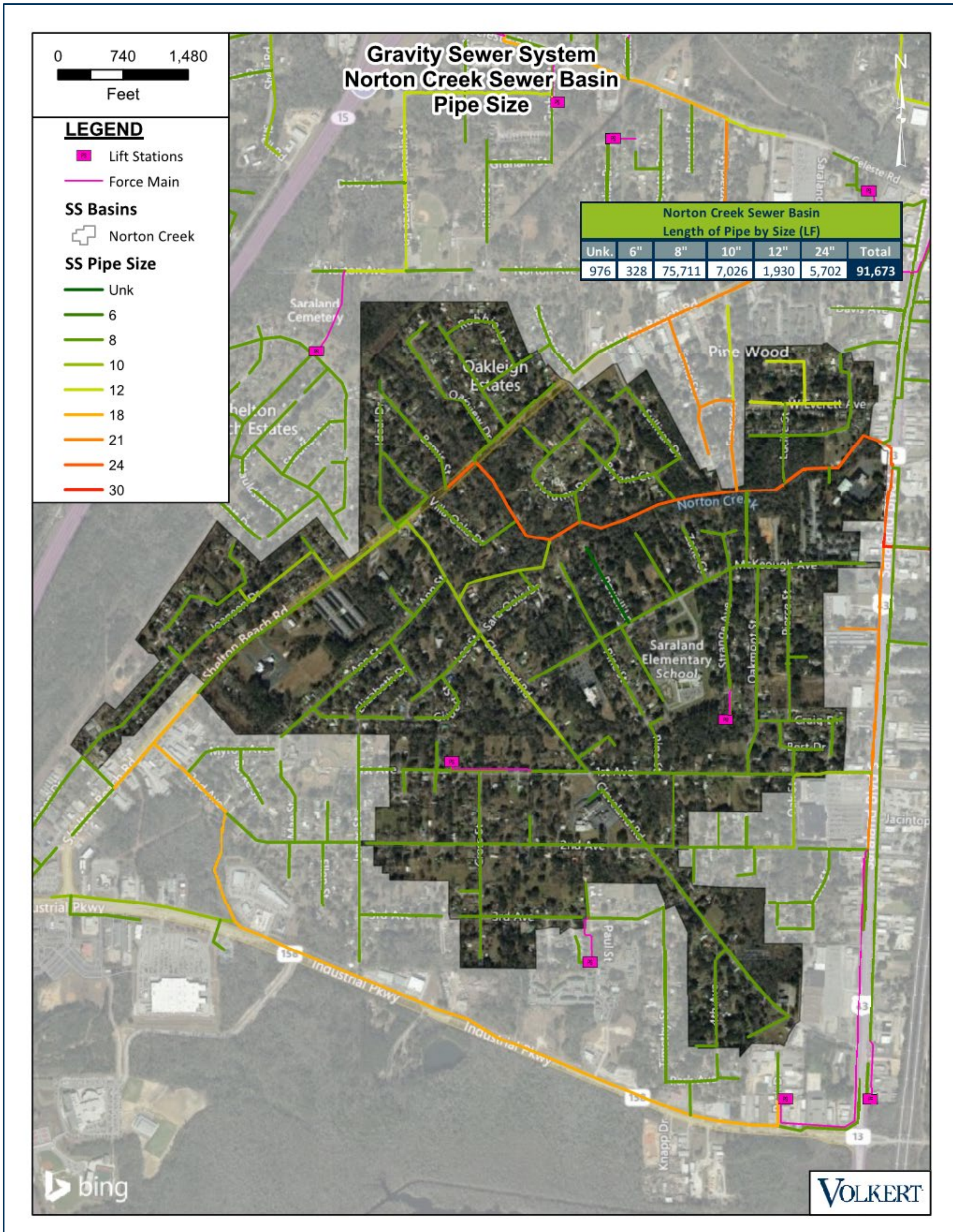


Figure 2.10.: Gravity Sewer Pipe Material – Bayou Sara Sewer Basin



Norton Creek Sewer Basin Length of Pipe by Size (LF)						
Unk.	6"	8"	10"	12"	24"	Total
976	328	75,711	7,026	1,930	5,702	91,673

Figure 2.11.: Gravity Sewer Pipe Size – Norton Creek Sewer Basin

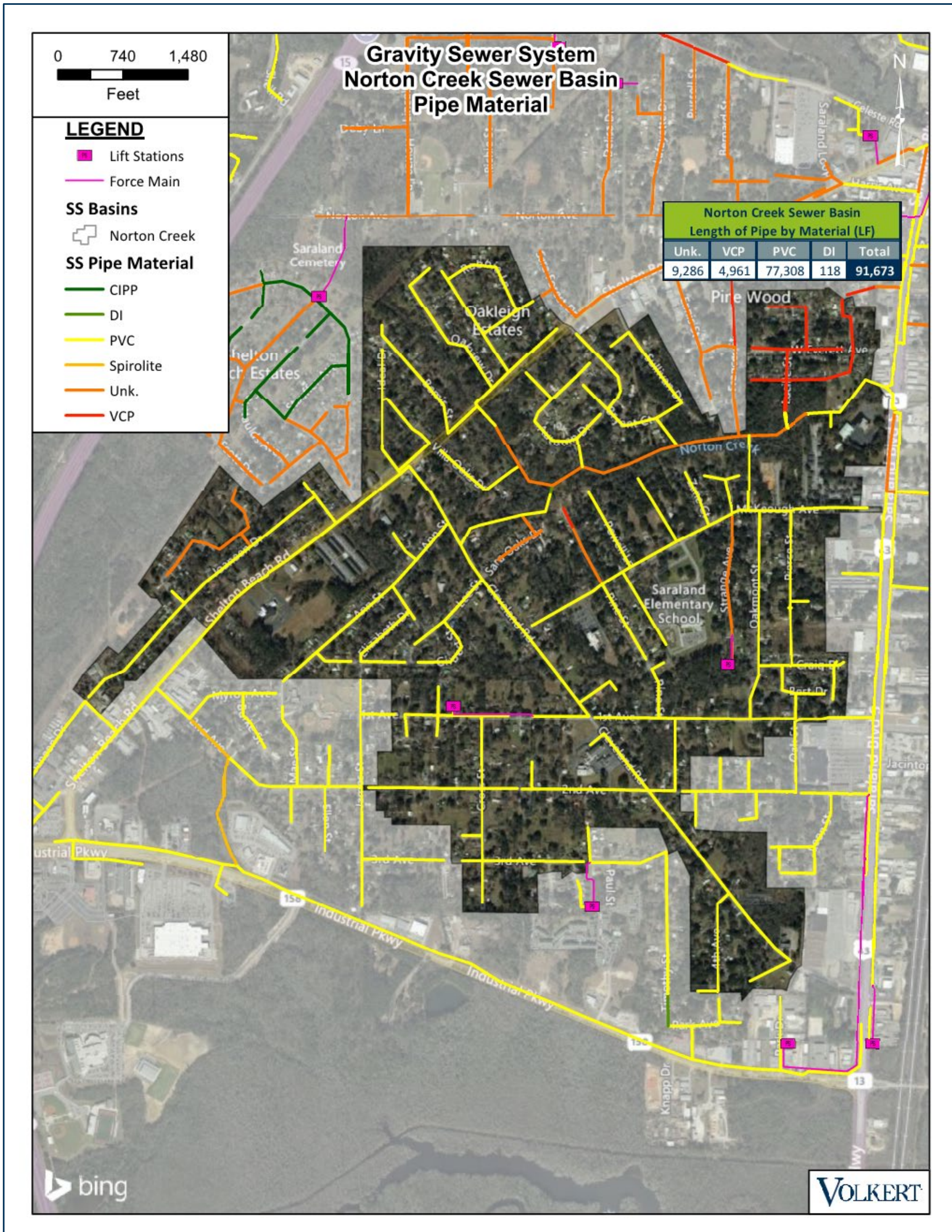


Figure 2.12.: Gravity Sewer Pipe Material – Norton Creek Sewer Basin

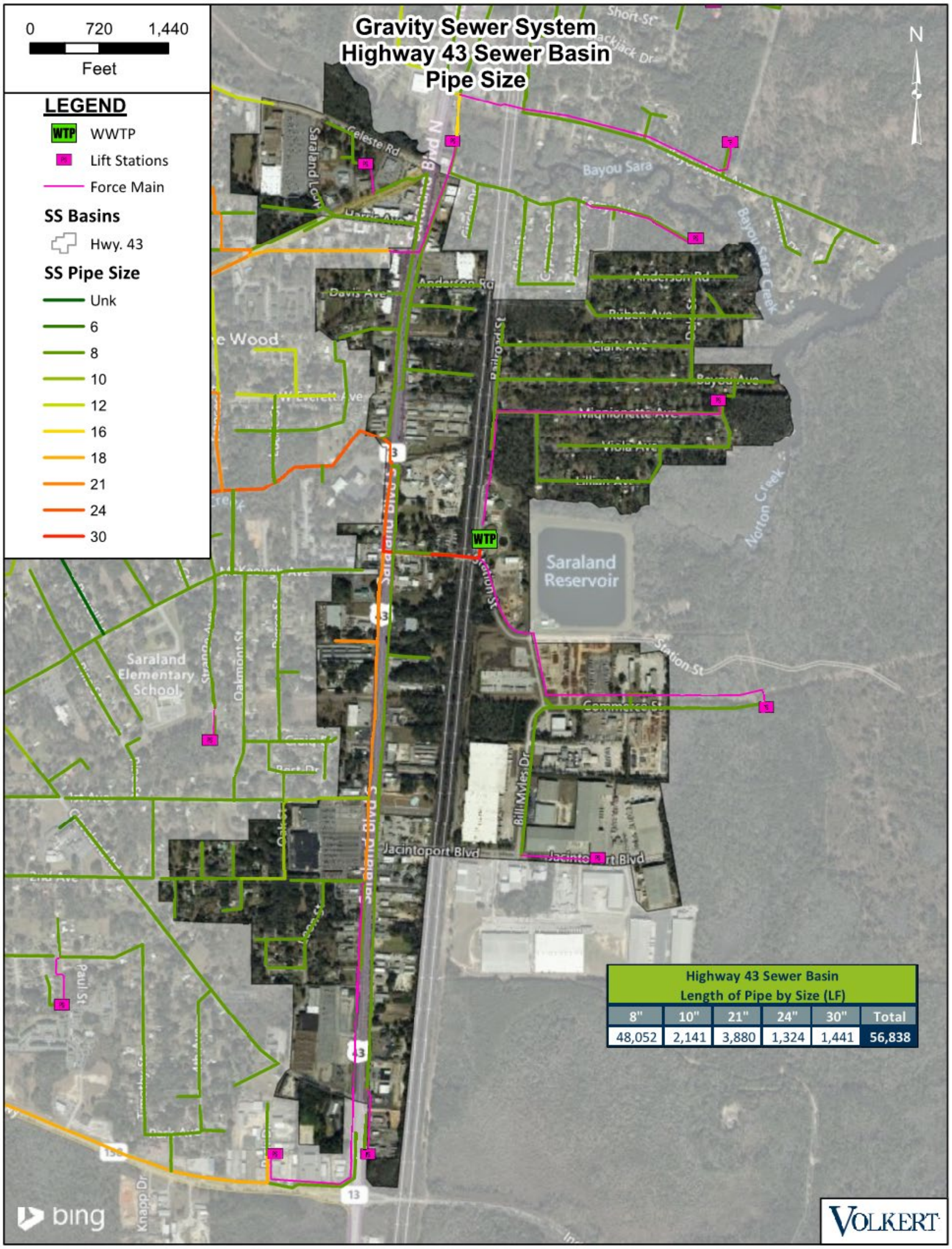
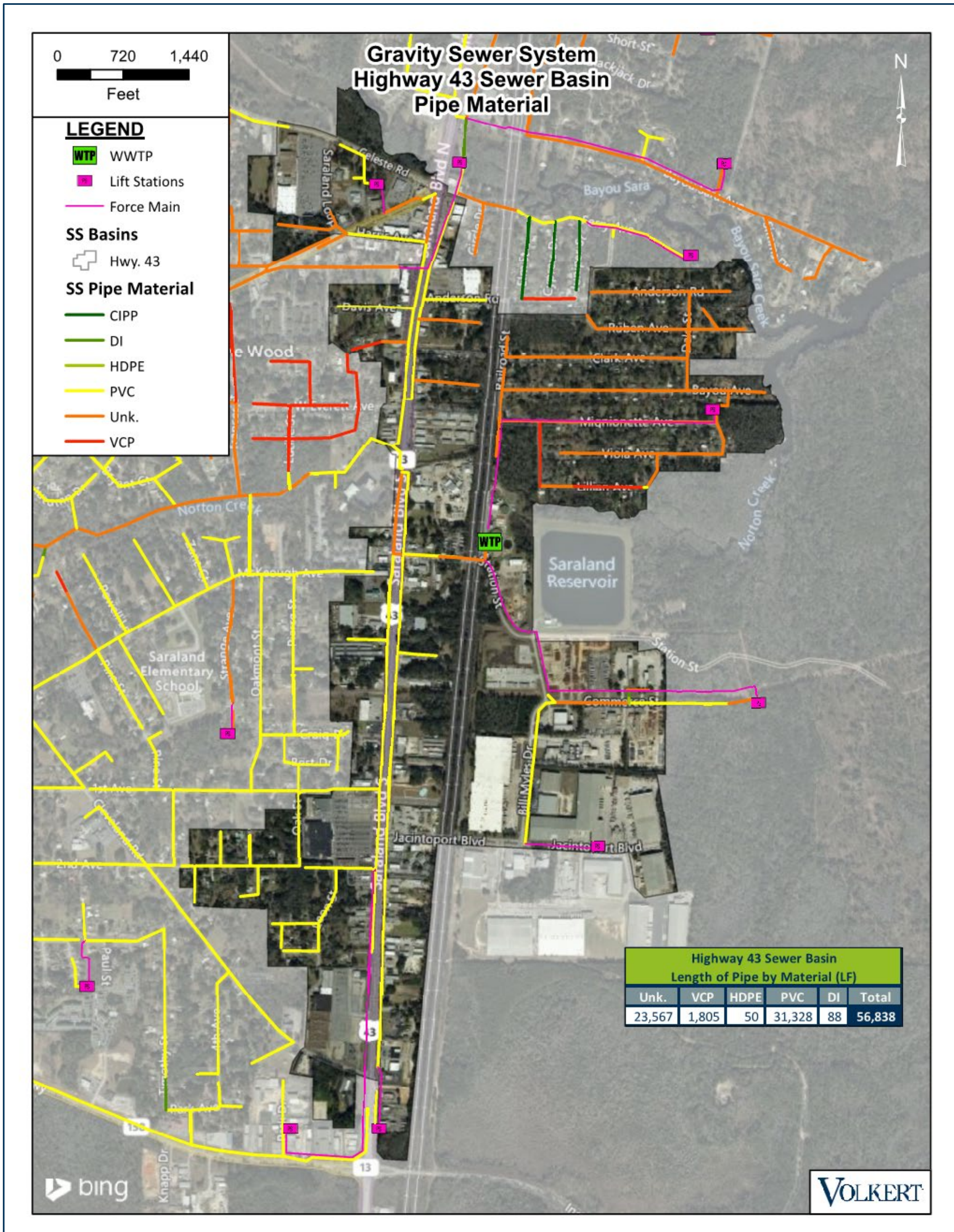
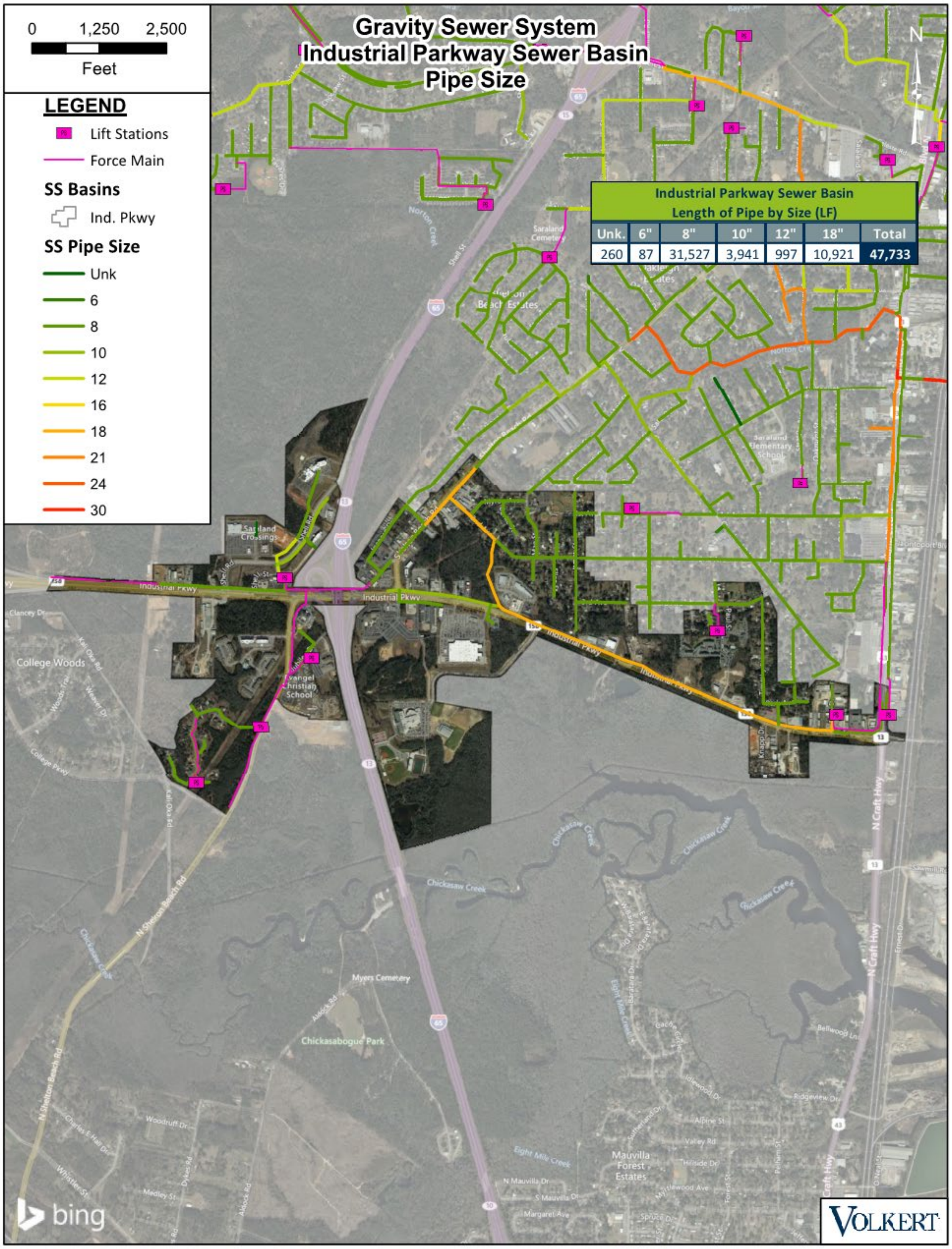


Figure 2.13.: Gravity Sewer Pipe Size – Highway 43 Sewer Basin



Highway 43 Sewer Basin Length of Pipe by Material (LF)					
Unk.	VCP	HDPE	PVC	DI	Total
23,567	1,805	50	31,328	88	56,838

Figure 2.14.: Gravity Sewer Pipe Material – Highway 43 Sewer Basin



Industrial Parkway Sewer Basin Length of Pipe by Size (LF)						
Unk.	6"	8"	10"	12"	18"	Total
260	87	31,527	3,941	997	10,921	47,733

Figure 2.15.: Gravity Sewer Pipe Size – Industrial Parkway Sewer Basin

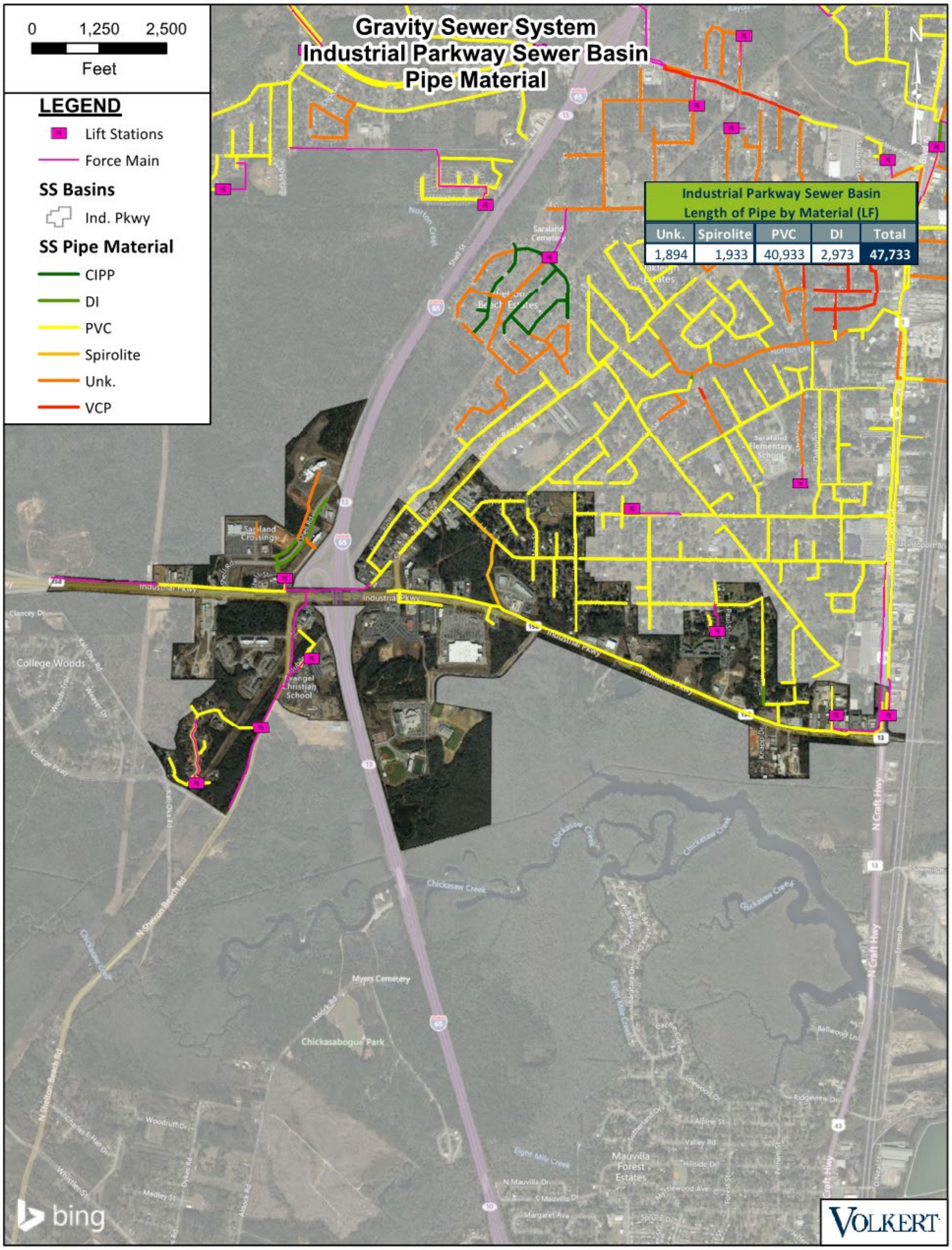


Figure 2.16.: Gravity Sewer Pipe Material – Industrial Parkway Sewer Basin

2.2.2. Lift Station and Pressure Force Main Systems

The existing lift station and force main systems are comprised of approximately 88,147 LF of pressure force mains and 37 lift stations. The force mains come in a variety of sizes ranging from 1.25" – 10" and are composed of various materials. Additionally, there is approximately 6% of pipe of unknown size and material that exists within the pressure force main system.

SWSS has a total of 37 lift stations in their collection system. Table 2.4. provides the number of lift stations by basin. The West Celeste Sewer Basin contains the largest number of lift stations with 15. This makes up approximately 39% of all lift stations within the system.

Table 2.4.: Lift Stations by Basin

No.	Lift Stations by Basin					
	West Celeste	**East Celeste**	**Bayou Sara**	**Norton Creek**	**Hwy. 43**	**Industrial Parkway**
1	Charleston Ridge LS	Camelot LS	Cedar St. LS	First Ave. LS	Celeste Rd. LS	Edgefield LS
2	Chase Dr. LS	DeLisa Dr. LS	Fairfield LS	Strange St. LS	Mignionette LS	Exxon LS
3	Deer Run LS	Graham St. LS	Ferry Ave. LS		Police Club LS	Jubilee Dr. LS
4	Forest Ave. LS	Scott Dr. LS	Saraland Ave. LS		Popeye's LS	Kalifield LS
5	Landfill LS		Smoke Ave. LS			Park St. LS
6	Laredo Dr. LS		Telegraph LS			Shelton Beach LS
7	Oakridge LS					
8	Saraland Learning Center LS					
9	Selena LS					
10	Spanish Trace LS					
11	Twin Lakes LS					
12	Twin Lakes #2 LS					
13	Weatherby LS					
14	Willow Walk LS					
15	Woodlands LS					
Total No. of Lift Stations: 37						

Table 2.5. presents summary data for each lift station, including in which sewer basin each lift station is located, wet well area, force main size, number of pumps, pump horsepower, pump capacity, and total dynamic head. Some lift stations do not have information available at this time and is marked in the table with a dash (-).

Table 2.5.: Lift Station Summary Table

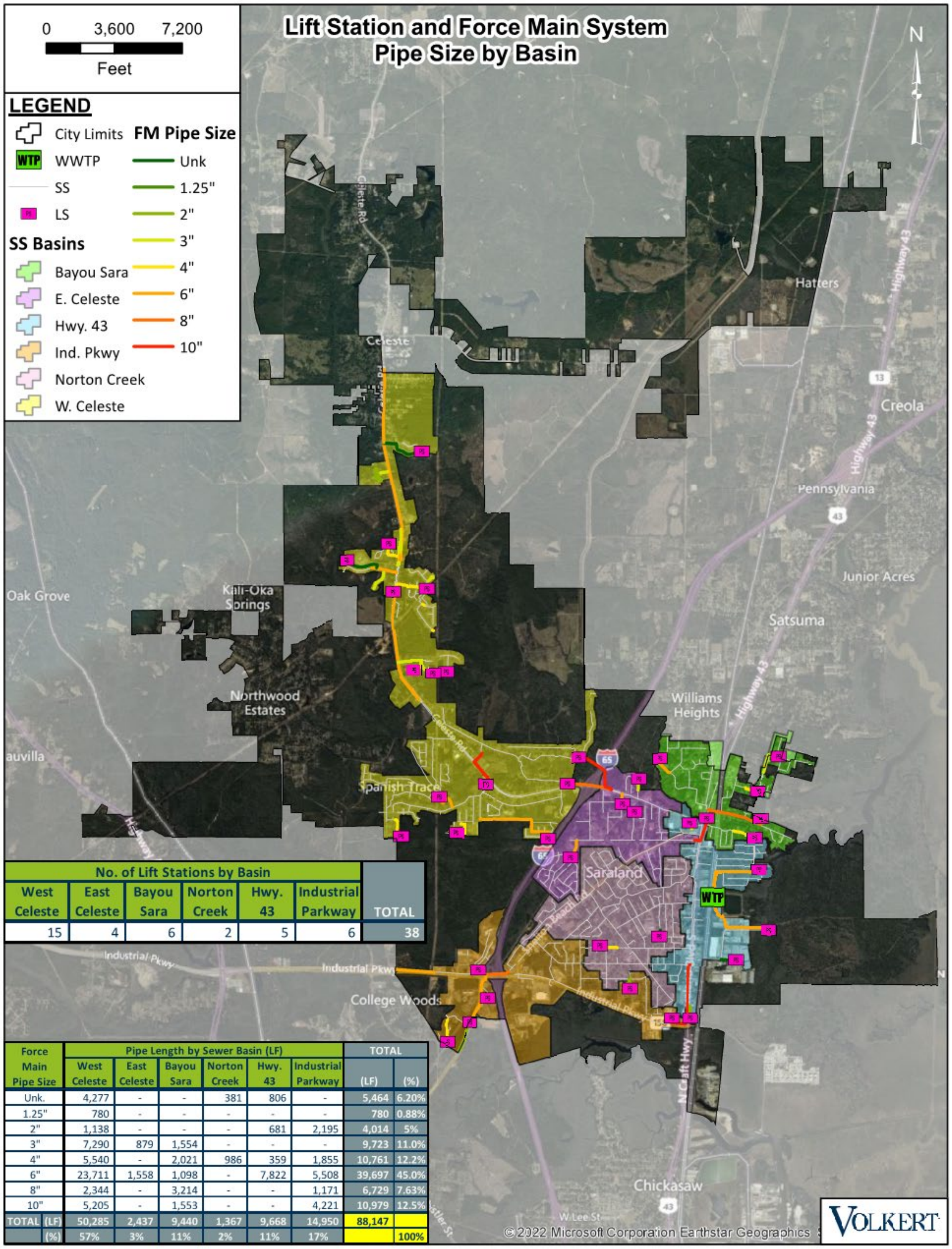
Lift Station Name	Sewer Basin	Wet Well Area (SF)	Force Main Size (in.)	Pump Data (Design)			
				No. of Pumps	HP	Capacity (GPM)	TDH (ft.)
Camelot	E. Celeste	28.27	3”	2	5	150	27
Cedar St.	Bayou Sara	63.62	4”	2	20	725	41
Celeste Rd.	Hwy. 43	28.27	4”	2	-	-	-
Charleston Ridge	W. Celeste	28.27	4”	2	10	-	-
Chase Dr.	W. Celeste	78.54	6”	2	15	756	35
Deer Run	W. Celeste	78.64	10”	3	25	1215	40
DeLisa Dr.	E. Celeste	28.27	3”	2	5	125	21
Edgefield	Ind. Pkwy.	12.57	1.25”	2	2	-	-
Exxon	Ind. Pkwy.	28.27	4”	2	10	100	92
Fairfield	Bayou Sara	28.27	3”	2	2	52	33
Ferry Ave.	Bayou Sara	19.63	4”	2	-	-	-
First Ave.	Norton Creek	28.27	4”	2	3	119	24
Forest Ave.	W. Celeste	28.27	6”	2	7.5	200	30
Graham St.	E. Celeste	28.27	6”	2	7.5	335	28.9
Jubilee Dr.	Ind. Pkwy.	28.27	4”	2	3	80	24
Kalifield	Ind. Pkwy.	28.27	4”	2	10	-	-
Landfill	W. Celeste	28.27	4”	2	3	125	11
Laredo Dr.	W. Celeste	19.63	4”	2	5	119	36
Mignionette	Hwy. 43	28.27	6”	2	20	350	85
Oakridge	W. Celeste	7.07	1.25”	2	2	58	105
Park St.	Ind. Pkwy.	78.64	8”	3	30	1206	50
Police Club	Hwy. 43	28.27	4”	2	10	200	40
Popeyes	Hwy. 43	19.63	2”	2	2	52	33
Saraland Ave.	Bayou Sara	28.27	4”	2	5	245	27
Saraland Learning Center	W. Celeste	38.48	4”	-	25	-	-
Scott Dr.	E. Celeste	28.27	6”	2	5	260	27
Selena	W. Celeste	19.63	4”	2	3	100	23
Shelton Beach	Ind. Pkwy.	28.27	6”	2	7.5		
Smoke Ave.	Bayou Sara	28.27	2”	2	2	125	25
Spanish Trace	W. Celeste	63.61	8”	2	20	960	42
Strange St.	Norton Creek	-	-	-	-	-	-
Telegraph	Bayou Sara	78.64	8”	2	25	1475	35
Twin Lakes	W. Celeste	12.57	3”	2	10	50	132
Twin Lakes #2	W. Celeste	12.57	3”	2	3	-	-
Weatherby	W. Celeste	28.27	4”	2	7.5	150	40
Willow Walk	W. Celeste	19.63	4”	2	5	400	50
Woodlands	W. Celeste	50.27	4”	2	17	-	-

Table 2.6. below provides a breakdown of pipe pressure force mains by length and sizes by sewer basin. Pipe material information is not available for the pressure force mains.

Table 2.6.: Pressure Force Main Size by Basin

Pressure Force Main Pipe Size		Pipe Length by Sewer Basin (LF)						TOTAL	
		West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.		4,277	-	-	381	806	-	5,464	6.2%
1.25”		780	-	-	-	-	-	780	0.88%
2”		1,138	-	-	-	681	2,195	4,014	4.6%
3”		7,290	879	1,554	-	-	-	9,723	11%
4”		5,540	-	2,021	986	359	1,855	10,761	12%
6”		23,711	1,558	1,098	-	7,822	5,508	39,697	45%
8”		2,344	-	3,214	-	-	1,171	6,729	7.6%
10”		5,205	-	1,553	-	-	4,221	10,979	12%
TOTAL	(LF)	50,285	2,437	9,440	1,367	9,668	14,950	88,147	
	(%)	57%	2.8%	11%	1.6%	11%	17%		100%

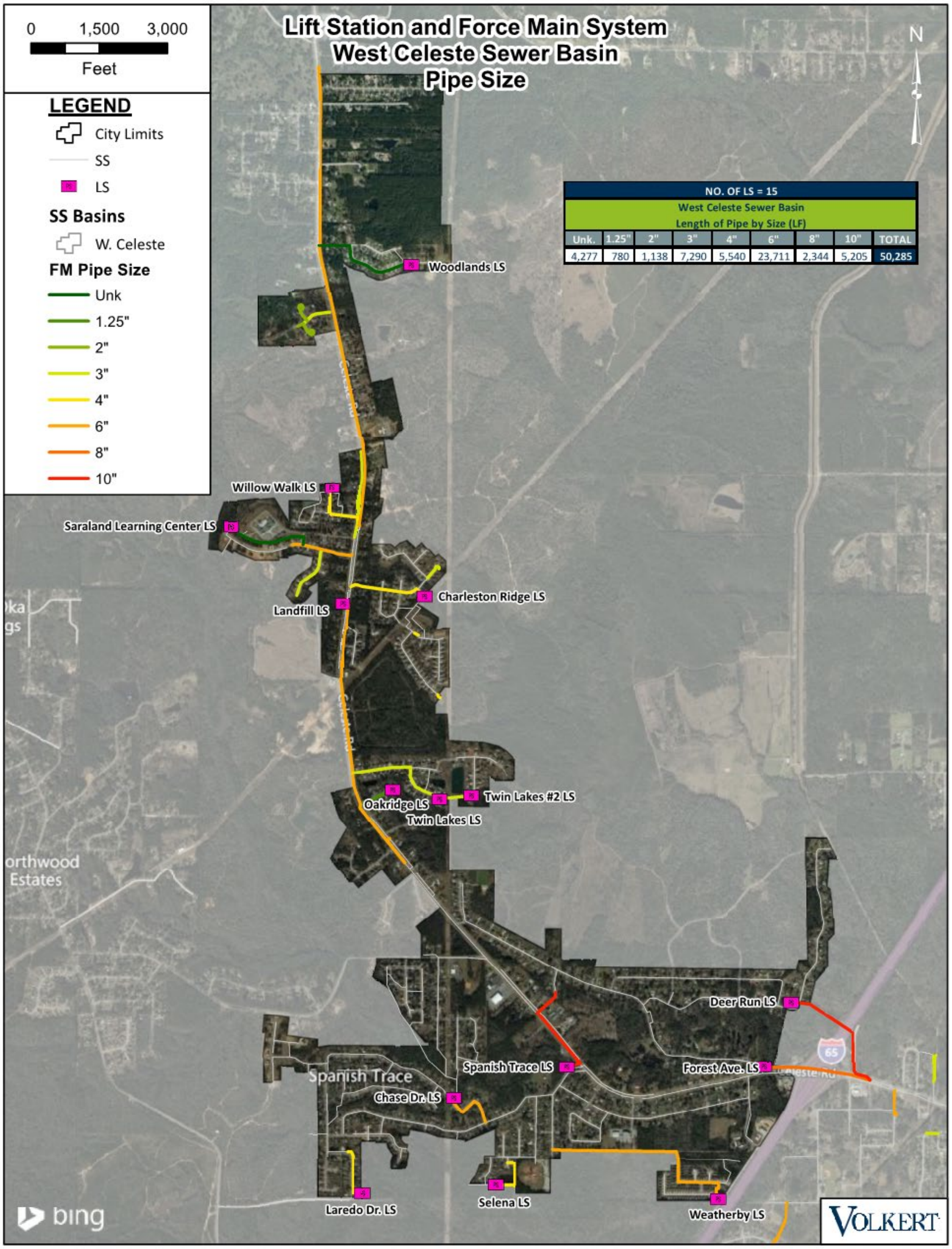
The West Celeste Sewer Basin contains the largest quantity of force main with 50,285 LF of various sized pipe. This accounts for approximately 57% of the total pressure force main piping within the system. Additionally, 6” pipe is the most commonly used pressure force main size totaling approximately 39,697 LF of pipe, accounting for about 45% of the total system piping. This information is visually represented in Figures 2.17. – 2.23. on the following pages.



No. of Lift Stations by Basin						
West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	TOTAL
15	4	6	2	5	6	38

Force Main Pipe Size		Pipe Length by Sewer Basin (LF)						TOTAL	
		West Celeste	East Celeste	Bayou Sara	Norton Creek	Hwy. 43	Industrial Parkway	(LF)	(%)
Unk.		4,277	-	-	381	806	-	5,464	6.20%
1.25"		780	-	-	-	-	-	780	0.88%
2"		1,138	-	-	-	681	2,195	4,014	5%
3"		7,290	879	1,554	-	-	-	9,723	11.0%
4"		5,540	-	2,021	986	359	1,855	10,761	12.2%
6"		23,711	1,558	1,098	-	7,822	5,508	39,697	45.0%
8"		2,344	-	3,214	-	-	1,171	6,729	7.63%
10"		5,205	-	1,553	-	-	4,221	10,979	12.5%
TOTAL	(LF)	50,285	2,437	9,440	1,367	9,668	14,950	88,147	
	(%)	57%	3%	11%	2%	11%	17%		100%

Figure 2.17.: Lift Station and Pressure Force Main Pipe Size by Basin



NO. OF LS = 15								
West Celeste Sewer Basin Length of Pipe by Size (LF)								
Unk.	1.25"	2"	3"	4"	6"	8"	10"	TOTAL
4,277	780	1,138	7,290	5,540	23,711	2,344	5,205	50,285

Figure 2.18.: Lift Stations and Pressure Force Main Pipe Sizes – West Celeste Sewer Basin

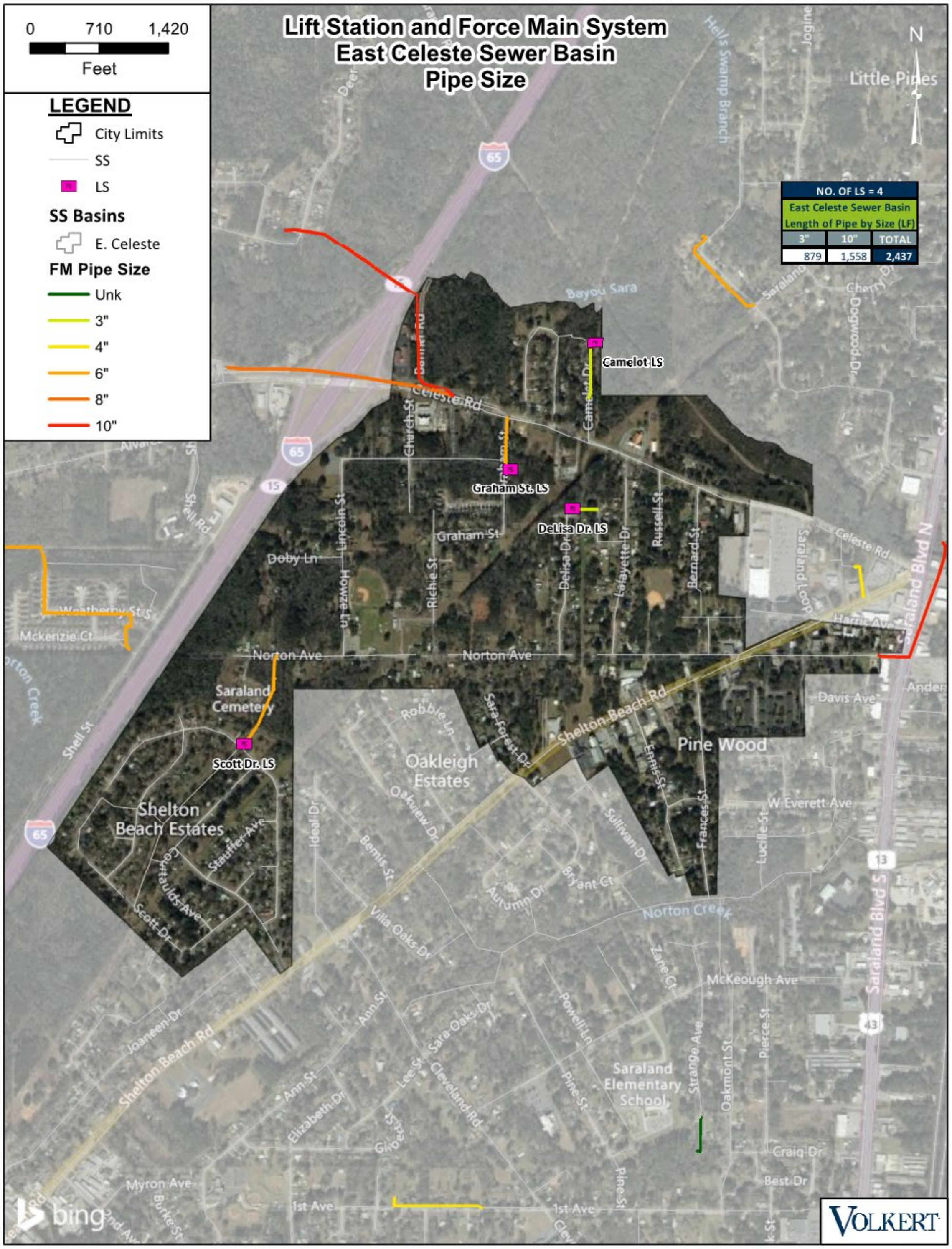


Figure 2.19.: Lift Stations and Pressure Force Main Pipe Sizes – East Celeste Sewer Basin

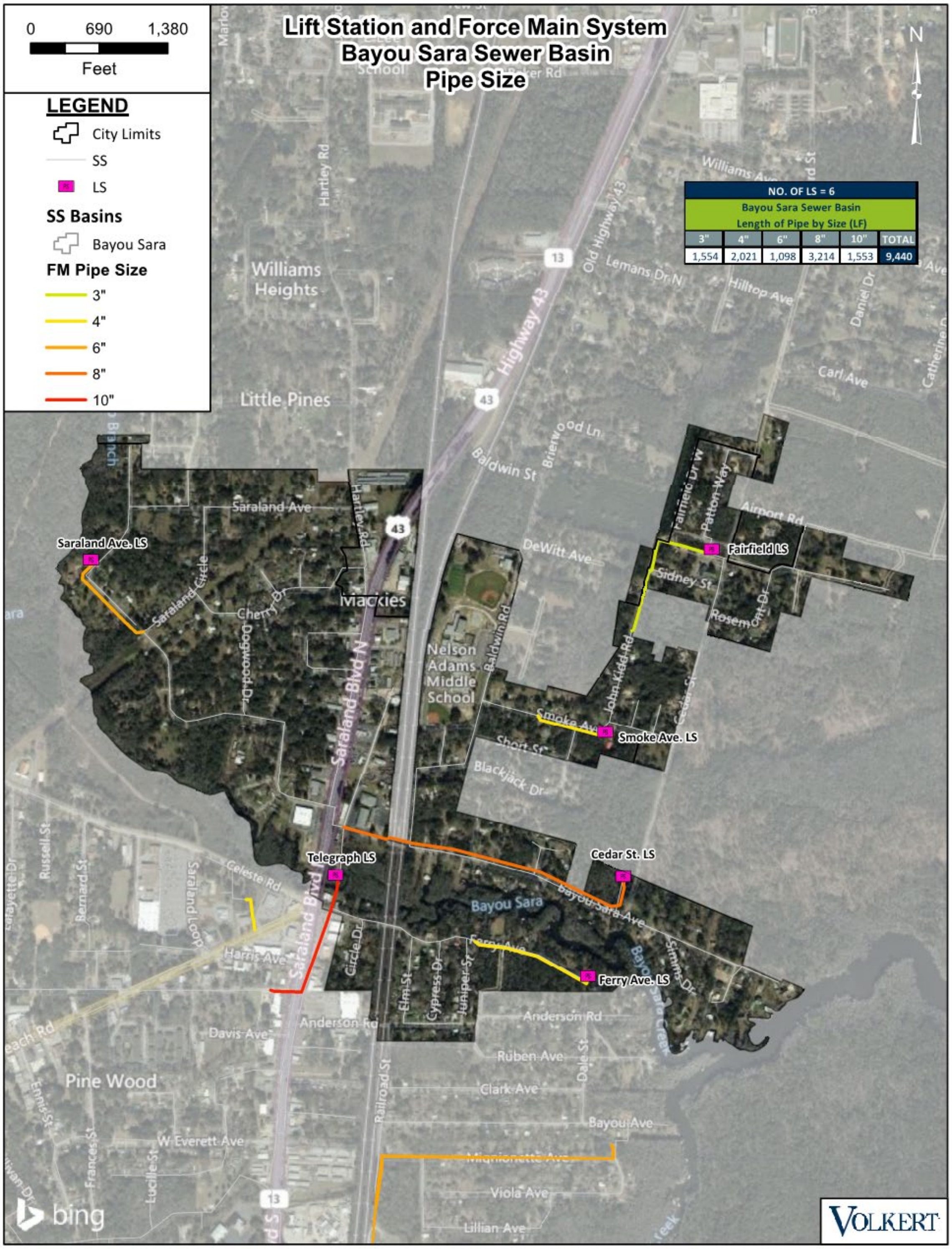


Figure 2.20.: Lift Stations and Pressure Force Main Pipe Sizes – Bayou Sara Sewer Basin

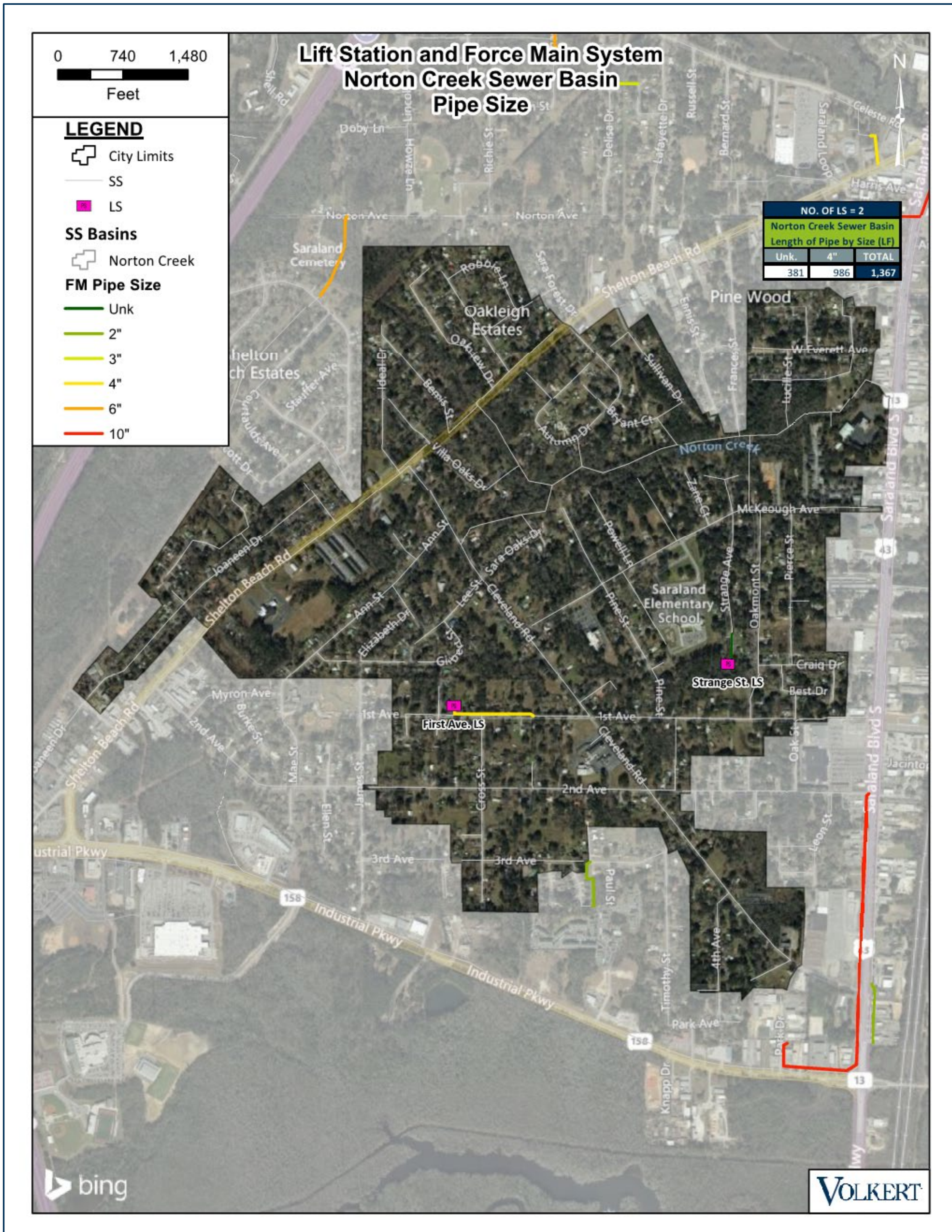


Figure 2.21.: Lift Stations and Pressure Force Main Pipe Sizes – Norton Creek Sewer Basin

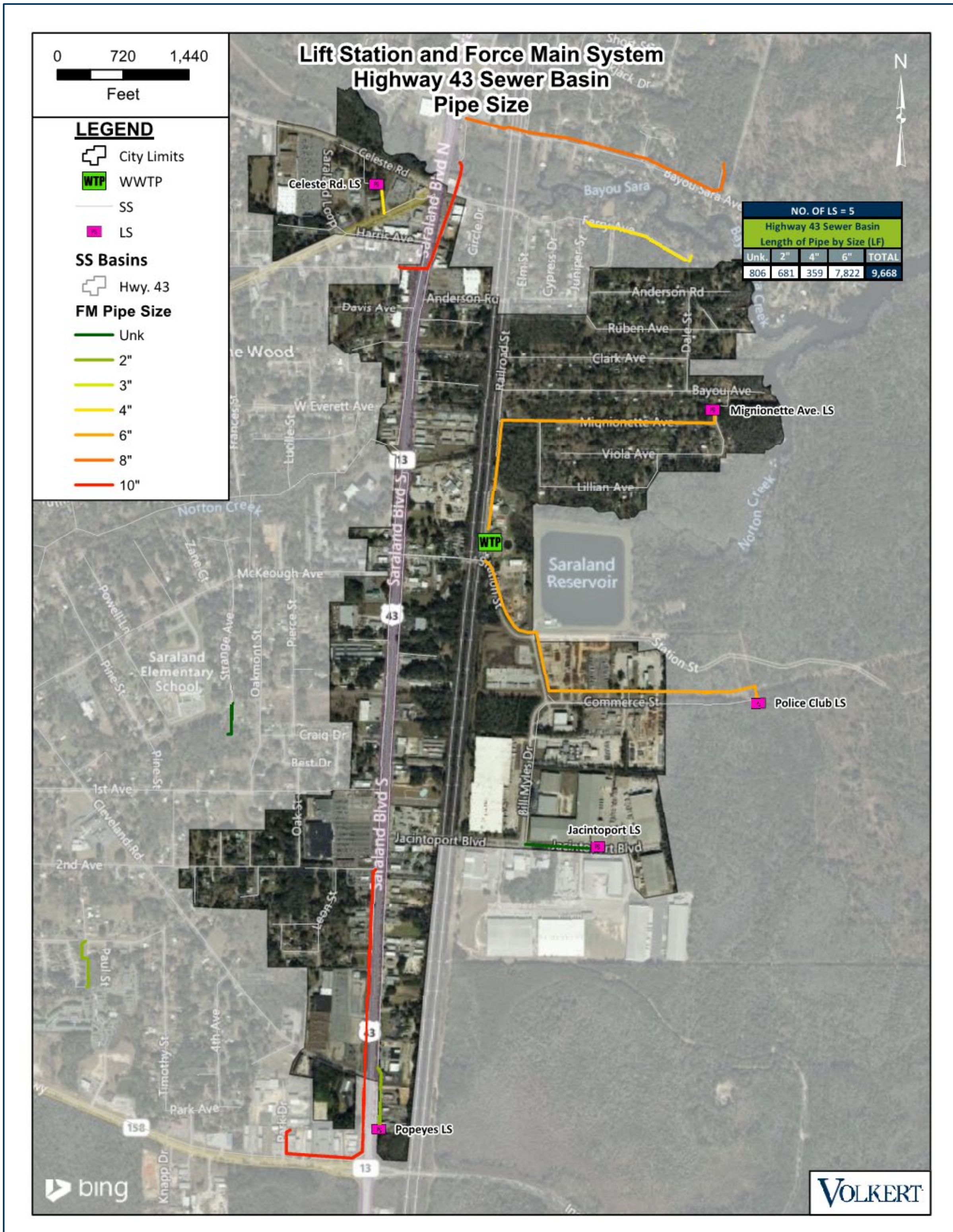


Figure 2.22.: Lift Stations and Pressure Force Main Pipe Sizes – Highway 43 Sewer Basin

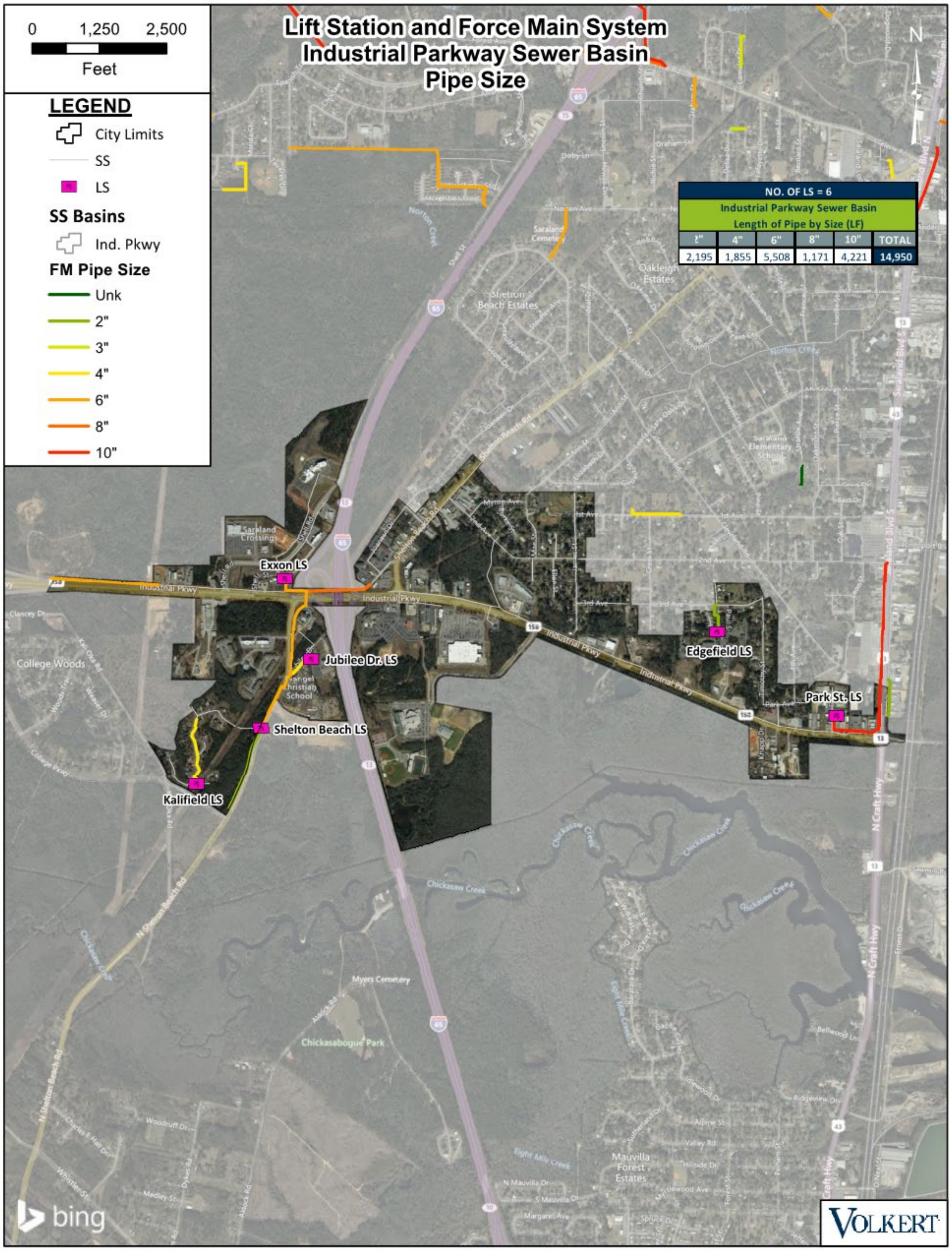


Figure 2.23.: Lift Stations and Pressure Force Main Pipe Sizes – Industrial Parkway Sewer Basin

SECTION 3 – COLLECTION SYSTEM DEMAND FORECASTS

3.1. City of Saraland Master Plan and Current City of Saraland Zoning Requirements

The *City of Saraland Master Plan*, found in Appendix C, was submitted by Thompson Engineering and approved by the City Council in 2014. This document was developed with the intent to establish guidelines for planning of future growth and development within the community, including public policy development in terms of transportation, utilities, land use, recreation, and housing.

Currently, the City of Saraland has four main zoning types: 1) residential, 2) business, 3) industrial, and 4) medical. Each zoning type is comprised of different districts. According to the City of Saraland's Municipal Code, Sec. 26-131, the purpose of the various zoning types and districts is five-fold:

1. Provide a residential environment free of incompatible uses and safe from natural and manmade hazard.
2. Promote, where possible, planned residential, commercial, and industrial areas in appropriate locations with appropriate standards and minimum service cost to local government.
3. Provide a compact convenient urban pattern for urban areas.
4. Provide a level of flexibility of control sufficient to promote innovation and creativity in community development and to encourage maximum living comfort and convenience at the lowest cost.
5. Promote the comprehensive plan for the city.

Table 3.1. summarizes the various zoning types and districts and the most current zoning map is shown in Figure 3.1. These zoning districts and zoning map were considered while determining future growth areas.

Table 3.1.: City of Saraland Zoning Districts

Zoning Type	District Code	District Type
Residential	R1	Low Density Single Family
	R1-A	Patio
	R2	Medium Density Single Family
	R3	Limited Multi-Family
	R4	High Density Single and Multi-Family
	R5	Mobile Home
Business	B1	Local
	B2	General
	B3	Professional
Industrial	M1	Light
	M2	General
Medical	MD	Medical

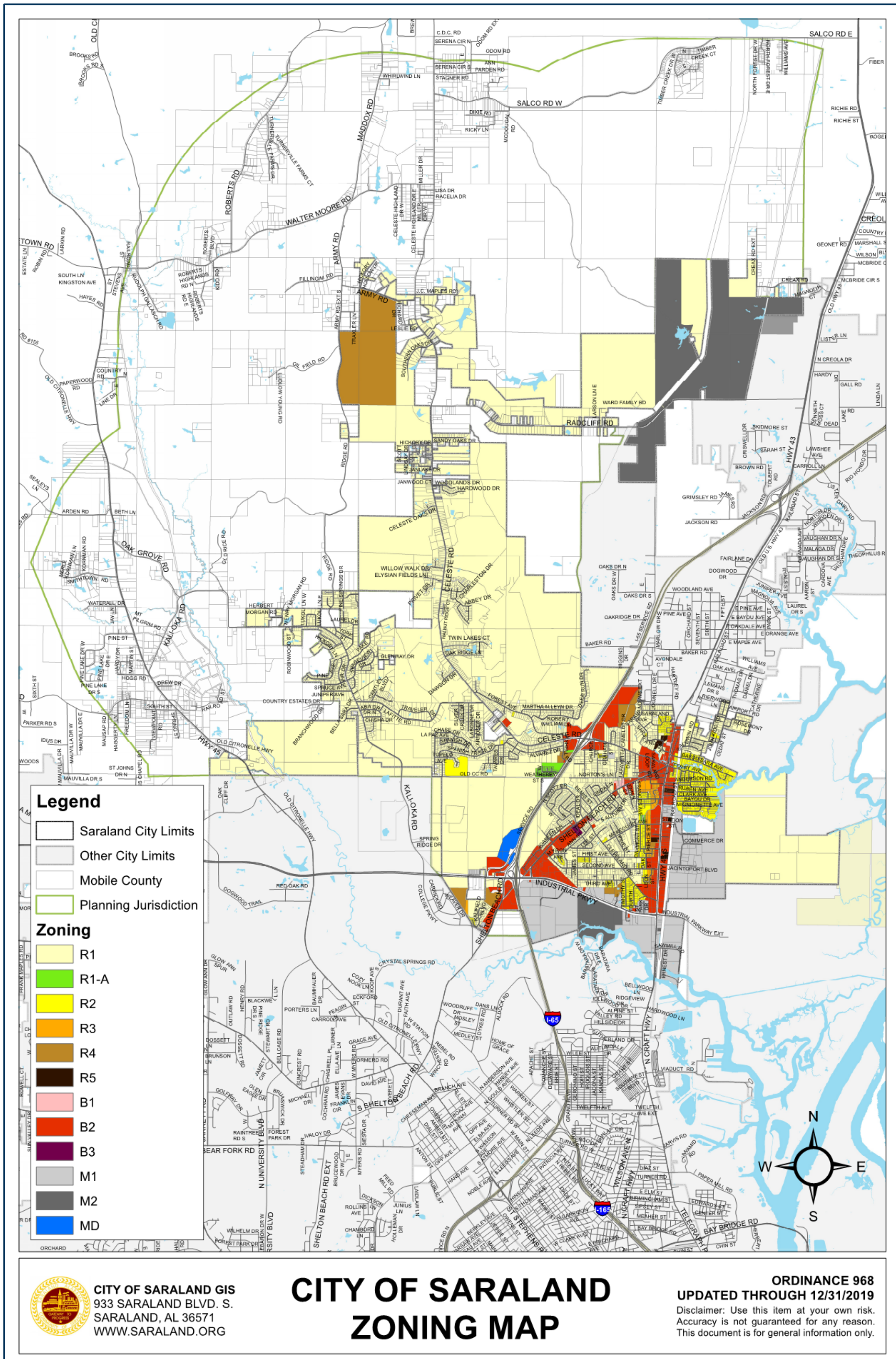


Figure 3.1.: City of Saraland Zoning Map

Both, the *City of Saraland Master Plan* and the current City of Saraland zoning map were reviewed and considered while determining potential future capacity needs for the *Sanitary Sewer Collection System Master Plan*.

3.2. Future Growth Projections

The geometric growth equation provided below was used to determine future growth projections. 2010 and 2020 U.S. Census population data was used to determine the growth rate during that 10-year time period. The calculated growth rate was then used to determine future population growth projections. Table 3.2. provides a summary of the projected population growth of the City of Saraland in 5-year increments up to the year 2050 and Figure 3.2. illustrates this information graphically.

Geometric Growth Equation

$$P_t = P_0(1+r)^t$$

where, P_t = population at time t, P_0 = population at t = 0, r = growth rate, and t = time period

Table 3.2.: Estimated Population Through 2050

Year	Population
2010	*13,405
2020	*16,171
2025	17,761
2030	19,508
2035	21,426
2040	23,533
2045	25,847
2050	28,389

* Data taken from U.S. Census

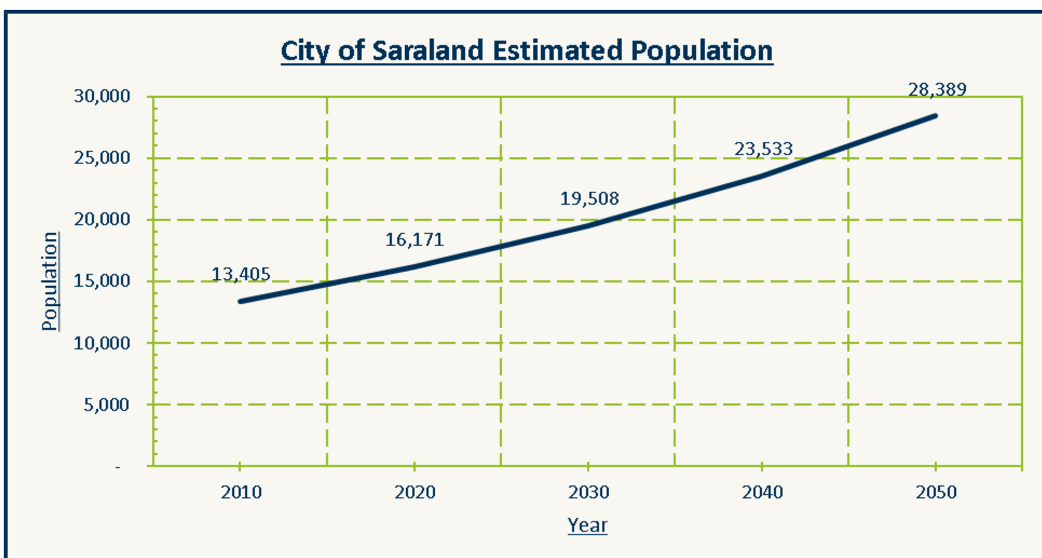


Figure 3.2.: Estimated Population for the City of Saraland

3.3. FUTURE SANITARY SEWER DEMAND PROJECTIONS

The population projections determined in Section 4.2. were converted into sanitary sewer demand forecasts using both a sewered population index (SPI) and a flow forecast index (FFI). The SPI, equation provided below, is determined by dividing the 2021 customers by the 2021 population. The SPI is held constant and multiplied by the projected population to determine the projected sewered population.

Sewered Population Index

$$SPI = C/P$$

Where, *SPI* = sewer population index, *C* = customers, and *P* = population

The 2021 average annual daily flow (AADF) was divided by the average 2021 sewered population to establish the FFI. The FFI is held constant and multiplied by the projected sewered population to determine the projected future sanitary sewer demands. Presented below is the FFI equation. Table 3.3. provides a summary of the projected sanitary sewer demands through 2050 and Figure 3.3. presents this information graphically.

Flow Forecast Index

$$FFI = AADF/P_s$$

where, FFI = flow forecast index, *AADF* = average annual daily flow, and P_s = sewered population

Table 3.3.: Projected Sanitary Sewer Demands

Year	Population	Sewered Population	*Average Annual Daily Flow (GPD)
2021	**16,477**	**4,880**	**2,390,000**
SPI = 0.296			
FFI = 491			
2025	17,761	5,260	2,580,000
2030	19,508	5,778	2,840,000
2035	21,426	6,346	3,120,000
2040	23,533	6,970	3,420,000
2045	25,847	7,655	3,760,000
2050	28,389	8,408	4,130,000

* Rounded to nearest 10,000

Most of the City of Saraland on the east side of the I-65 interstate highway is completely built-out. Therefore, a substantial majority of the growth within the Saraland City Limits will occur to the west side of I-65. To provide sewer to these growth areas, the existing West Celeste Sewer Basin and the western part of the Industrial Parkway Sewer Basin will require expansion. Additionally, new sewer basins will need to be developed. Approximately 9,000 acres of land are available for potential development within Saraland's city limits. Based on the City of Saraland's current zoning map, a majority of this new development will be low-density, single family housing.

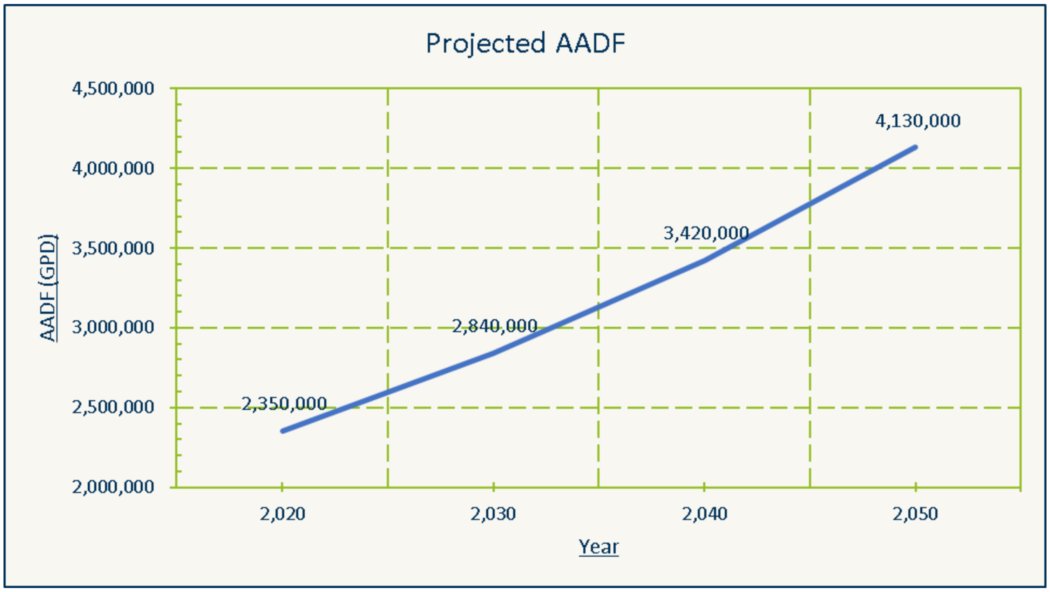


Figure 3.3.: Projected Sanitary Sewer Demands

As previously discussed, an assessment of the Saraland WWTP was not performed as a part of this Master Plan. However, the projected AADF shows that the WWTP's current permitted capacity of 2,600,000 GPD may be exceeded within a couple of years.

SECTION 4 – COLLECTION SYSTEM EVALUATIONS

4.1. Gravity Sewer Capacity Theory

A number of factors shall be considered when determining gravity sewer capacity, including but not limited to pipe size, material, and age; pipe slope; and depth of flow through the pipe. Since the normal flow of gravity sewer pipe is open to ambient air pressure, Manning's equation for open channel flows is used to determine the pipe's capacity and considers the parameters mentioned above to determine the pipe's capacity. Table 4.1. provides the Manning's roughness coefficient values of common sanitary sewer pipe materials that are newly installed.

Manning's Equation for Open-Chanel Flow

$$Q = \frac{1.49}{n} * A * R^{2/3} * S^{1/2}$$

where, Q = flow through pipe (ft.^{3}/s) = $A * v$
n = Manning's roughness coefficient (unitless)
A = cross-sectional area of flow (ft.^{2})
R = hydraulic radius (ft.) = A/P_w
S = slope of pipe (ft./ft.)
v = velocity (ft./s)
P_w = wetted perimeter (ft.)

Table 4.1.: Manning's Roughness Coefficients

Pipe Material	Manning's Roughness Coefficient, *n*, of New Pipe
PVC/HDPE	0.009
Ductile Iron (New)	0.012
Vitrified Clay	0.011 – 0.017

Table 4.2. on the following page summarizes the recommended minimum and maximum pipe slope for various pipe sizes when full pipe is encountered. The minimum and maximum slopes were calculated based on velocities of 2 ft./s, 10 ft./s, and 15 ft./s. The assumed Manning's roughness coefficient of n = 0.013 was used, as recommended by *The Ten-States Standards*, and considers increased energy losses due to pipe degradation over time as well as other factors.

Table 4.2.: Minimum and Maximum Pipe Slopes (ft./ft.)

Pipe Size	Minimum, at v = 2 ft./s	Maximum, at v = 10 ft./s	Maximum, at v = 15 ft./s	Pipe Size	Minimum, at v = 2 ft./s	Maximum, at v = 10 ft./s	Maximum, at v = 15 ft./s
6"	0.0049	0.12	0.27	16"	0.0013	0.033	0.074
8"	0.0033	0.083	0.19	18"	0.0011	0.028	0.063
10"	0.0025	0.062	0.14	21"	0.00092	0.023	0.052
12"	0.0019	0.048	0.11	24"	0.00077	0.019	0.043
15"	0.0014	0.036	0.081	30"	0.00057	0.014	0.032

Generally, gravity sewer design shall consider the following:

- Design for peak dry weather flows
- For sewers ≤ 15" in diameter, design for flows at 50% full pipe
- For sewers > 15" in diameter, design for flows at 75% full pipe
- Minimum velocity of 2 ft./s to achieve scouring velocity for self-cleansing of solids
- Maximum velocity of 10 ft./s preferable, but an absolute maximum velocity of 15 ft./s to prohibit abrasion of pipe material, pipe displacement potential, and release of hydrogen sulfide (H_2S) gas potential.

4.2. Lift Station and Force Main Capacity Theory

A number of factors shall be considered when determining lift station capacity. This includes the quantity of flow entering the lift station; the normal operating volume, which is the volume within the wet well between the "All Pumps Off" elevation and the "Pump 1 On" elevation; and the emergency storage volume, which is typically the volume within the wet well between the "High Level Alarm" elevation and the lowest invert elevation entering the wet well. There are many other factors that go into lift station design including sizing of pumps and the design of electrical, instrumentation, and controls equipment but these details will not be discussed in detail within this report.

Since the force main conveys fluid under pressure (known as closed-channel flow), the capacity of the pressure force main is determined using the Continuity Equation provided below, which states the quantity of flow is equal to the product of the inside diameter of the pipe and the velocity of the fluid passing through it.

Continuity Equation for Closed-Channel Flow

$$Q = v * A$$

where, Q = flow through pipe (ft.^{3}/s)
v = velocity (ft./s)
A = inside area of pipe (ft.^{2})

The Ten-States Standards recommends the velocity of fluid conveyed by a pressure force main shall be at least 2 ft./s to achieve scouring or self-cleansing velocity and no greater than 8 ft./s. to avoid high head loss, excessive surge pressures and water hammer, and to protect valves. Table 4.3. on the following page summarizes the flow capacities using these minimum and maximum velocities and nominal pipe areas.

It should be noted that the inside diameter (and ultimately the inside area) of pipe for the same nominal pipe size vary based on pipe material, dimension ratios (DR), pressure class (PC), etc. For example, the inside diameter of 6-in. PVC C900, DR 25, is approximately 6.35 in. and the inside area is approximately 31.65 in^2. A 6-inch PVC C900, DR 14, has an inside pipe diameter of approximately 5.91 in. and an approximate inside area of 27.47 in^2. The minimum and maximum flows in this example can vary by 24 – 96 gpm, respectively, and the range of variations can be more exaggerated with larger pipe sizes.

Table 4.3.: Minimum and Maximum Pipe Flow-Pressure Pipe

Nominal Pipe Size (in.)	$Q_{(min.)}$ at v = 2 ft./s (ft.^{3}/s)	$Q_{(min.)}$ at v = 2 ft./s (gpm)	$Q_{(max.)}$ at v = 8 ft./s (ft.^{3}/s)	$Q_{(max.)}$ at v = 8 ft./s (gpm)
*2"	0.04	20	0.17	78
*3"	0.10	44	0.39	176
4"	0.17	78	0.70	313
6"	0.39	176	1.57	705
8"	0.70	313	2.79	1,253
10"	1.09	490	4.36	1,958
12"	1.57	705	6.28	2,820

* 2" and 3" pipe sizes are not recommended except in grinder lift stations containing low-pressure force mains.

4.3. Sanitary Sewer Flow Study

CSL Services, Inc. was subcontracted to perform a sanitary sewer flow study to determine the amount of infiltration and inflow (I/I) entering SWSS's sewer collection system. Infiltration can be defined as the entry of extraneous *groundwater* into the sewer system through pathways including but not limited to improperly connected or defective pipes, joints, connections, service laterals, or manhole walls. Inflow can be defined as the entry of extraneous *rainwater* into the sewer system through pathways including but not limited to roof down spouts, drains, manhole lids, storm drain cross-connections, service laterals, cleanouts, or stormwater runoff. I/I directly impacts the collection system due to the increase of system flows and may lead to sanitary sewer overflows (SSOs). SSOs are a release of untreated or partially treated sewage into the environment when the sewer infrastructure capacity is exceeded and these releases may be harmful to any persons or ecosystems with which the sewage comes into contact.

The study was performed in two phases and included the installation, data collection and analysis, and removal of six flow monitors for each phase. Depth and velocity readings were collected by the flow monitors in 15-minute intervals. Additionally, a rain gauge was installed at the Saraland WWTP to quantify rainfall intensity and duration throughout the entire study period. The Phase 1 study period was 90 days and was completed between March 18, 2021 and June 15, 2021. The Phase 2 study period was 60 days and was completed between June 17, 2021 and August 18, 2021. All collected data was analyzed and a Final Report was submitted to Volkert, Inc.

Table 4.4. provides a summary of the flow monitor installation locations and the total length of pipe from which data was collected for each phase. Figures 4.1. and 4.2. provide an overview of the study areas illustrating the information provided in Table 4.4. In the figures, the dots represent the manhole locations in which a flow monitor was installed and the lines represent the upstream piping being collected by the corresponding flow monitor of the same color, i.e. the flow monitor installed at the location represented by the red dot collected data from all upstream sewer flows identified

by the red lines.

Table 4.4.: Flow Monitor Installation Summary

PHASE 1		PHASE 2	
Installation Location (MH No.)	Upstream Pipe Length (LF)	Installation Location (MH No.)	Upstream Pipe Length (LF)
43-00-102	7,598	EC-00-001	229,602
BS-22-001	40,693	NC-00-001	34,195
EC-00-001	31,513	NC-00-023	8,244
EC-00-029	157,450	NC-00-039	30,641
IP-03-113	44,252	NC-00-095	12,907
NC-00-001	103,629	NC-00-114	17,571

The following subsections provide a summary of the Sanitary Sewer Flow Study and the complete final report, as submitted by CSL Services, Inc. is provided in Appendix D.

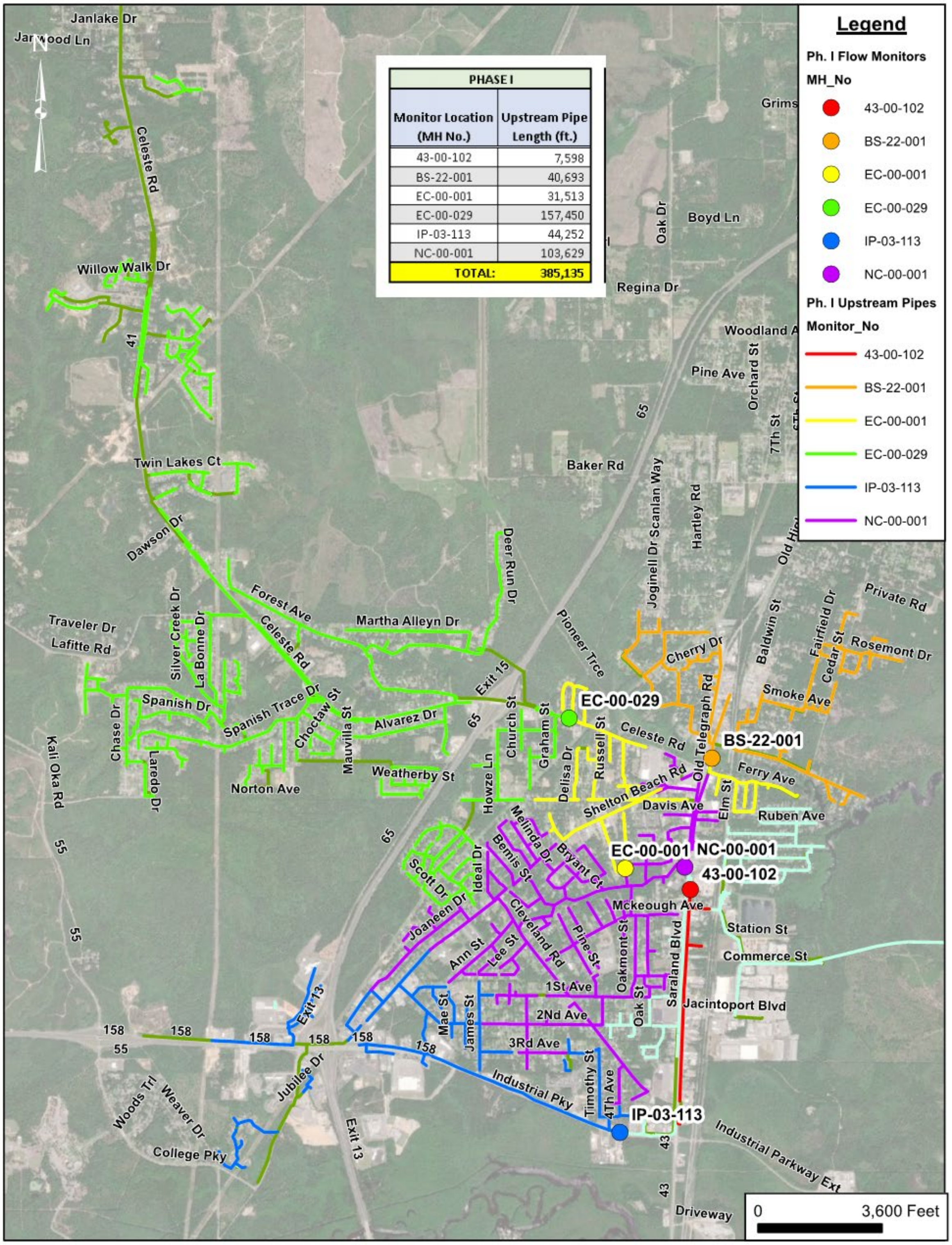
4.3.1. Phase I Results

The results of the Phase 1 study are only representative to the specific rain events captured during the study period. All rain events were less than a 2-year, 24-hour event, but linear regression analyses were performed to estimate information based on various rain events, where necessary.

The Phase 1 Sanitary Sewer Flow Study included the installation and data collection of six flow monitors. The total length of pipe for which data was captured totaled 385,135 LF. Table 4.5. provides a summary of the Phase 1 flow study. The areas of concern are highlighted in red. The first column provides the manhole number in which a flow monitor was installed. The second column provides the upstream pipe length from which the respective flow monitor is collecting data. The third column shows if buildup of silt, debris, gravel, or grease was present. MHs BS-22-001 and EC-00-001 were the only monitoring location that provided evidence of buildup. This buildup of material may be due to many factors including but not limited to broken pipes or manholes sections, improperly connected pipe joints or manhole seams, faulty cleanouts or missing cleanout caps, or sewer velocities less than the 2.0 feet per second (fps) scouring velocity.

The fourth column provides the peak dry weather water depth/pipe diameter percentages. The water depth/pipe diameter parameter is a measure of the cross sectional pipe flow area, in percentage, during peak dry weather conditions. Ideally, this value should be less than 75%. The pipes entering MH 43-00-102 and EC-00-001 exceed the 75% threshold and indicates potential capacity concerns at these locations. The pipe entering MH 43-00-102 flows at about 83% full during peak dry weather conditions and the pipe entering MH EC-00-001 flows at about 76% full during peak dry weather conditions.

The fifth column provides the peak dry weather velocities, in fps. This value should be at least equal to the scouring velocity of 2.0 fps to prevent buildup of organic material within the sewer. Peak dry weather flows coming into MHs 43-00-102, BS-22-001, IP-03-113, and NC-00-001 are all below the minimum scouring velocity.



PHASE I	
Monitor Location (MH No.)	Upstream Pipe Length (ft.)
43-00-102	7,598
BS-22-001	40,693
EC-00-001	31,513
EC-00-029	157,450
IP-03-113	44,252
NC-00-001	103,629
TOTAL:	385,135

Figure 4.1.: Phase 1 Flow Study System Overview

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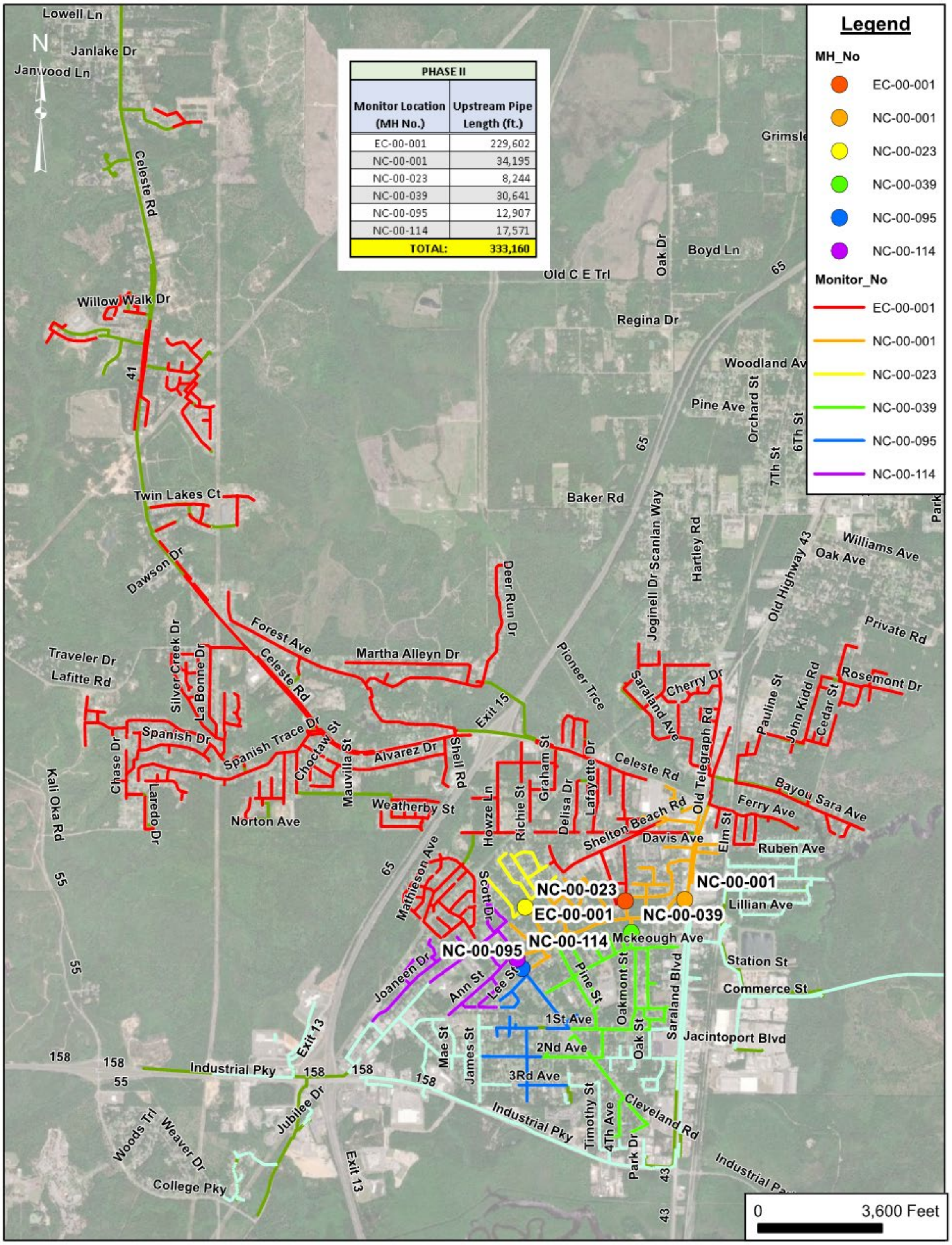

PHASE II	
Monitor Location (MH No.)	Upstream Pipe Length (ft.)
EC-00-001	229,602
NC-00-001	34,195
NC-00-023	8,244
NC-00-039	30,641
NC-00-095	12,907
NC-00-114	17,571
TOTAL:	333,160

Figure 4.2.: Phase 2 Flow Study System Overview

VOLKERT

The sixth column provides the net rainfall-derived infiltration and inflow (RDII) per LF, given in terms of gallons per day per linear foot of pipe (GPD/LF), for a 2-year, 24 hour rain event. RDII is the extraneous flow that enter the sewer as a direct result of rain events and excludes sewer flows. Ideally, the RDII value should be less than 5 GPD/LF. As shown in Table 4.5., all monitoring locations exceeded this threshold. The greatest quantity of RDII are found in the upstream piping collected by MHs 43-00-102 and EC-00-001. MH 43-00-102 has a net RDII per LF of 81.73 GPD/LF. Multiplying this number by the 7,598 LF of upstream pipe equates to approximately 620,985 GPD of RDII. For MH EC-00-001, the net RDII per LF is 30.83 GPD/LF and a total RDII of approximately 971,546 GPD. The total RDII contribution for all monitoring locations is equal to approximately 4,362,587 GPD.

The eighth column provides the percentage of peak water depth/depth of manhole and column nine states whether the manhole surcharges during wet weather events. Only one monitoring location, MH BS-22-001, does not show manhole surcharging during the rain events captured during the study period. For all other monitoring locations, the manholes were surcharged. During manhole surcharging, flows entering the manhole exceed the flows exiting the manhole. This creates a water level rise in the manhole itself and can eventually lead to SSOs at storm events greater than those captured during the study period.

Table 4.5.: Phase 1 Flow Study Summary

(1) Installation Location (MH No.)	(2) Upstream Pipe Length (LF)	(3) Silt, Debris, Gravel, or Grease Present	(4) Peak Dry Weather Water Depth/Diameter (%)	(5) Peak Dry Weather Velocity (fps)	(6) Net RDII Per LF (GPD/LF)	(7) Net RDII (GPD)	(8) Peak Water Depth/Depth of Manhole (%)	(9) Surcharge
43-00-102	7,598	No	83%	1.47	81.73	620,985	61%	Yes
BS-22-001	40,693	Yes	63%	1.48	6.96	283,223	16%	No
EC-00-001	31,513	Yes	76%	2.11	30.83	971,546	52%	Yes
EC-00-029	157,450	No	45%	3.26	9.71	1,528,840	15%	Yes
IP-03-113	44,252	No	36%	1.98	9.12	403,578	69%	Yes
NC-00-001	103,629	No	42%	1.92	5.35	554,415	62%	Yes
TOTALS	**385,135**	**-**	**-**	**-**	**Avg.=11.33**	**4,362,587**	**-**	**-**

4.3.2. Phase II Results

The results of the Phase 2 study are only representative to the specific rain events captured during the study period. All rain events were less than a 2-year, 24-hour event, but linear regression analyses were performed to estimate information based on various rain events, where necessary.

The Phase 2 Sanitary Sewer Flow Study included the installation and data collection of six flow monitors. The total length of pipe for which data was captured totaled 333,160 LF. Table 4.6. provides a summary of the Phase 2 flow study. Similar to the Phase 1 results, the areas of concern are highlighted in red. The first column provides the manhole number in which a flow monitor was installed. The second column provides the upstream pipe length from which the respective flow monitor is collecting data. The third column shows if buildup of silt, debris, gravel, or grease was present. MH EC-00-001 was the only monitoring location that provided evidence of buildup. This buildup of material may be due to many factors including but not limited to broken pipes or manholes sections, improperly connected pipe joints or manhole seams, faulty cleanouts or missing cleanout caps, or sewer velocities less than the 2.0 fps scouring velocity.

The fourth column provides the peak dry weather water depth/pipe diameter percentages. The water depth/pipe diameter parameter is a measure of the cross sectional pipe flow area, in percentage, during peak dry weather conditions. Ideally, this value should be less than 75%. For the Phase 2 study period, no monitoring locations exceeded the 75% threshold. However, EC-00-001 was at approximately 73%. In the Phase 1 study period, this same location was approximately 76%, verifying potential capacity issues.

The fifth column provides the peak dry weather velocities, in fps. This value should be at least equal to the scouring velocity of 2.0 fps to prevent buildup of organic material within the sewer. With the exception of MH NC-00-039, all other monitoring locations were below the 2.0 fps minimum scouring velocity.

The sixth column provides the net RDII per LF, given in terms of GPD/LF, for a 2-year, 24 hour rain event. RDII is the extraneous flow that enter the sewer as a direct result of rain events and excludes sewer flows. Ideally, the RDII value should be less than 5 GPD/LF. As shown in Table 4.6., all monitoring locations exceeded this threshold. The greatest quantity of RDII are found in the upstream piping collected by MHs NC-00-023, NC-00-095, and NC-00-114. MH NC-00-023 has a net RDII per LF of 49.12 GPD/LF, MH NC-00-095 has a net RDII per LF of 19.25 GPD/LF, and MH NC-00-114 has a net RDII per LF of 25.16 GPD/LF. Multiplying these numbers by their respective upstream pipe length, MH NC-00-023 contributed approximately 404,945 GPD, MH NC-00-095 contributed approximately 248,460 GPD, and MH NC-00-114 contributed approximately 447,358 GPD of excess water to the collection system. In total, the contribution of water added to the collection system by the captured rain events was approximately 3,329,052 GPD.

The eighth column provides the percentage of peak water depth/depth of manhole and column nine states whether the manhole surcharges during wet weather events. All monitoring locations show manhole surcharging during the rain events captured during the study period. During manhole surcharging, flows entering the manhole exceed the flows exiting the manhole. This creates a water level rise in the manhole itself and can eventually lead to SSOs at storm events greater than those captured during the study period.

Table 4.6.: Phase 2 Flow Study Summary

(1) Installation Location (MH No.)	(2) Upstream Pipe Length (LF)	(3) Silt, Debris, Gravel, or Grease Present	(4) Peak Dry Weather Water Depth/Diameter (%)	(5) Peak Dry Weather Velocity (fps)	(6) Net RDII Per LF (GPD/LF)	(7) Net RDII (GPD)	(8) Peak Water Depth/Depth of Manhole (%)	(9) Surcharge
EC-00-001	229,602	Yes	73%	1.64	7.48	1,717,423	54%	Yes
NC-00-001	34,195	No	40%	1.91	6.92	236,629	64%	Yes
NC-00-023	8,244	No	9.0%	1.38	49.12	404,945	34%	Yes
NC-00-039	30,641	No	43%	2.08	8.95	274,237	53%	Yes
NC-00-095	12,907	No	19%	1.88	19.25	248,460	33%	Yes
NC-00-114	17,571	No	34%	1.78	25.46	447,358	58%	Yes
TOTALS	**333,160**	**-**	**-**	**-**	**Avg. 19.53**	**3,329,052**	**-**	**-**

4.4. SANITARY SEWER OVERFLOWS

A review of the SSOs that were reported to ADEM between 2017 – 2021 was performed. A total of 43 SSOs occurred during this time period and can be attributed to and categorized into the following four causes: 1) heavy rain/power outage, 2) blockage/grease, 3) mechanical failure, and 4) broken line.

The data show the most reported SSOs in one calendar year occurred in 2021 with a total of 15 incidences. Of these 15 incidences, a total of 12 were caused by heavy rain/power outages. Likewise, the most commonly reported causes of SSOs during the five-year review period were heavy rain/power outages with a total of 28 out of 43 incidences (+/- 65%). All of the reported power outages were directly attributed to lift stations being without power due to hurricanes.

Table 4.7. summarizes the data collected during the five-year SSO report review period and further details the number of SSOs reported and their causes by year. Furthermore, Figure 4.3. and Figure 4.4. summarize this data graphically into categories by year and by cause, respectively.

Table 4.7.: Total SSOs by Year and Cause.

SSO Category Type	2017	2018	2019	2020	2021	Total
Heavy Rain/Power Outage	1	2	5	8	12	**28**
Blockage/Grease	0	1	4	0	1	**6**
Mechanical Failure	0	1	1	3	1	**6**
Broken Line	0	0	1	1	1	**3**
TOTAL	**1**	**4**	**11**	**12**	**15**	**43**

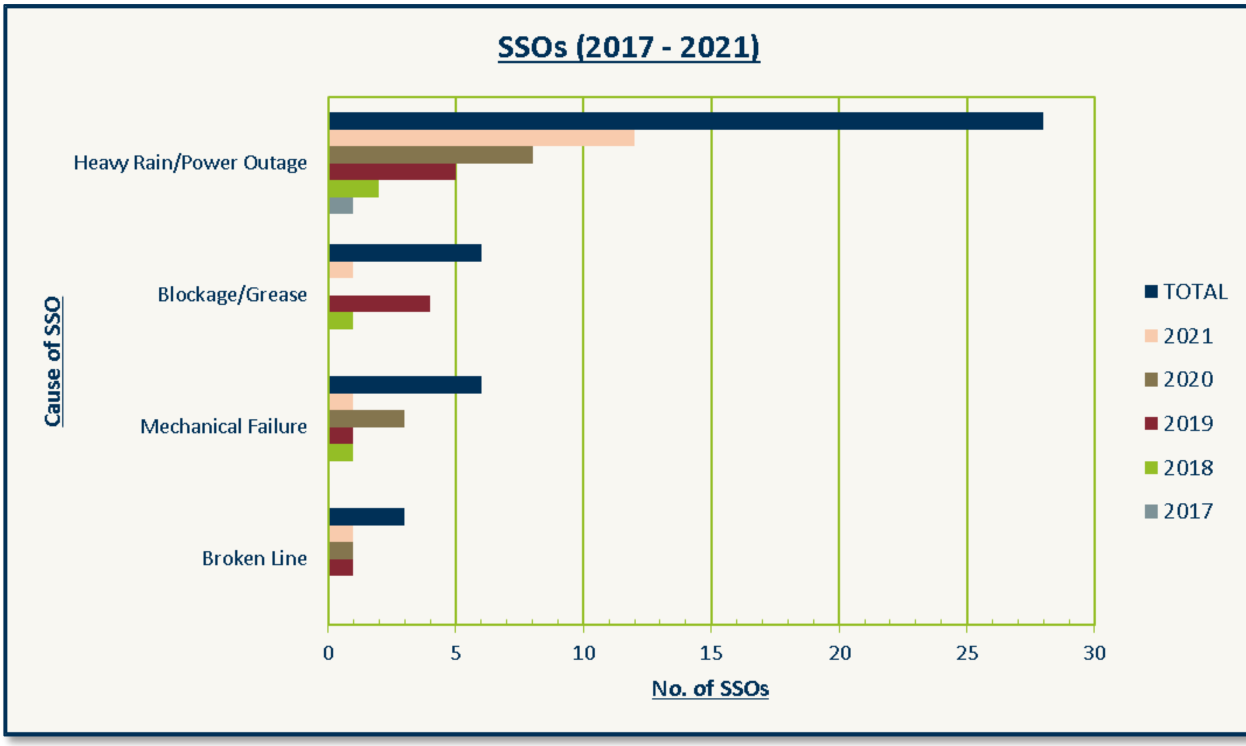

Figure 4.3.: Total Reported SSOs from 2017 – 2021, by Year and Cause

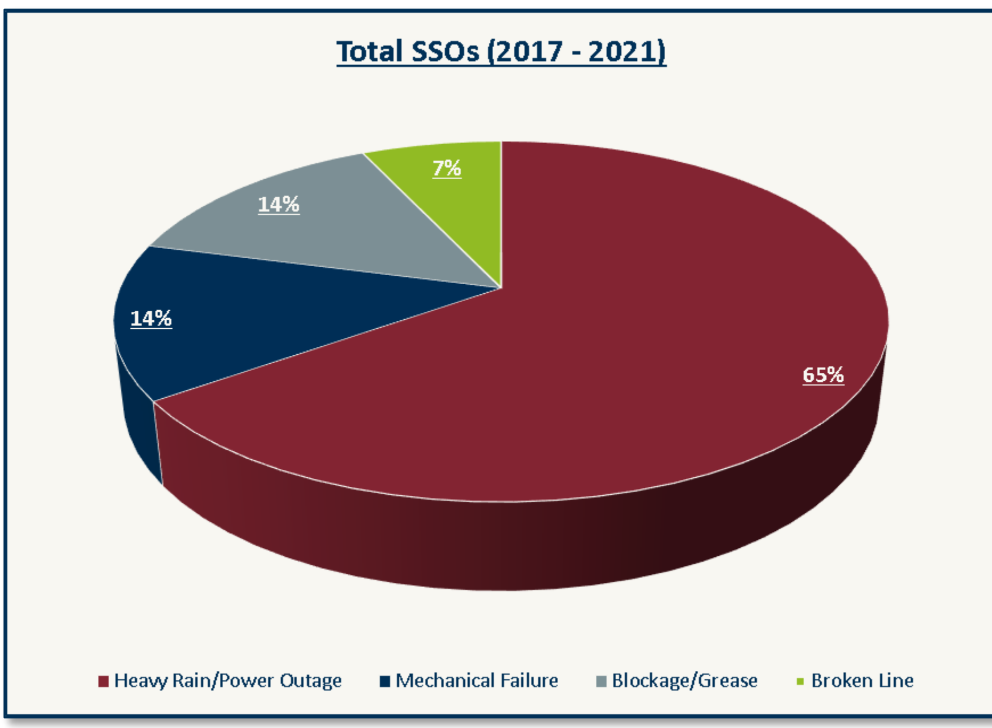

Figure 4.4.: Percentage of Total Reported SSOs from 2017 – 2021, by Cause

SECTION 5 – RECOMMENDATIONS AND IMPLEMENTATION

While best efforts have been made to ensure the projects listed in this section are prioritization at the time of this study, the highly corrosive nature of sanitary sewer system infrastructure as well as the continuing growth in residential and commercial developments within the City of Saraland may dictate changes to these priorities. The projects listed in this section are divided into four main Priority Categories:

1. **Immediate Priority** – Projects listed under this category have been identified as currently having the most significant operational, maintenance, and/or capacity impact potential. It is recommended these projects be implemented within the next one-to-three years, as budgeting permits.

2. **Short-Term Priority** – Projects listed under this category have been identified as currently having moderate operational, maintenance, and/or capacity impact potential. It is recommended that these projects be implemented within the next three-to-ten years, as budgeting permits.

3. **Intermediate-Term Priority** – Projects listed under this category have been identified as currently having minimal operational, maintenance, and/or capacity impact potential. It is recommended that these projects be implemented within the next ten-to-fifteen years, as budgeting permits.

4. **Long-Term Priority/Monitor** – Projects listed under this category have been identified as currently having the least significant operational, maintenance, and/or capacity impact potential. It is recommended that these areas continue to be proactively monitored and maintained.

5.1. GRAVITY SEWER COLLECTION SYSTEM

The first three Priority Categories for the gravity sewer collection system are further divided into Priority Areas which provide further prioritization breakdown within each respective Priority Category. The fourth Priority Category, Long-Term Priority/Monitor, is not divided into Priority Areas due to the relative nature of these areas having little to no current operational, maintenance, or capacity issues. Therefore, these areas are equally weighted in terms of operational and maintenance needs.

Figure 5.1. on the following page provides a Priority Category overview of the gravity collection system and Table 5.1. provides cost summaries for each Priority Category. The subsections that follow provide further details into each Priority Category and their respective Priority Areas. More detailed costs estimates for each Priority Category and Priority Area can be found in Appendix E.

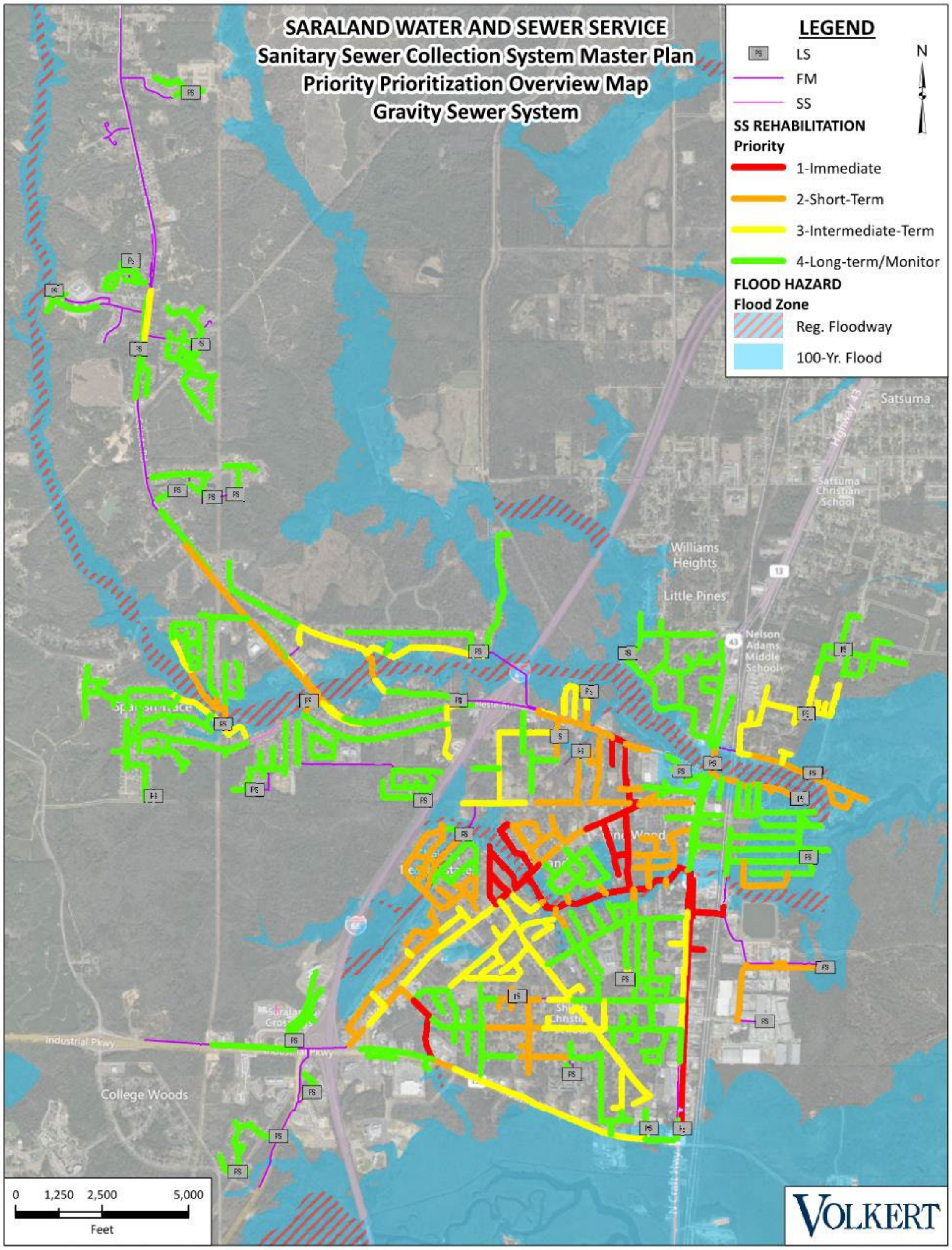

Figure 5.1.: Gravity Sewer Priority Categories Overview Map

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Table 5.1.: Gravity Sewer Priority Category Cost Summaries

Priority Category	Engineering (13%)	Construction	CEI (6%)	Total Project Costs
1-Immediate Priority	$1,755,000	$13,481,000	$811,000	$16,047,000
2-Short-Term Priority	$1,970,000	$15,097,000	$1,207,000	$18,274,000
3-Intermediate-Term Priority	$2,567,000	$19,657,000	$1,190,000	$23,414,000
4-Long-Term/Monitor Priority	$48,000	$362,000	$22,000	$432,000
TOTAL	$6,340,000	$48,597,000	$3,230,000	$58,167,000

Due to lack of available information of actual pipe condition and available capacity, the costs provided are based on worst-cast scenario of replacement or rehabilitation and unit pricing is based on current market conditions. Opportunities should exist to reduce some of these costs, including inspection services and/or certain construction tasks being performed in-house by qualified SWSS staff using appropriate means and methods.

Furthermore, smoke testing, CCTV inspection, or other condition and capacity assessments should be performed prior to or in conjunction with engineering design to identify actual infrastructure condition and capacity as well as to define actual project requirements for replacement and/or rehabilitation.

5.1.1. Immediate Priority Category

Priority Category 1 – Immediate Priority is divided into seven (7) Priority Areas. The Priority Area costs and associated project boundaries are provided in Table 5.2. and Figure 5.2., respectively.

Table 5.2.: Gravity Sewer Priority Areas for Immediate Priority Category.

Priority Area	Engineering (13%)	Construction	CEI (6%)	Total Project Costs
1	$780,000	$5,997,000	$360,000	$7,137,000
2	$42,000	$318,000	$20,000	$380,000
3	$585,000	$4,498,000	$270,000	$5,353,000
4	$56,000	$429,000	$26,000	$511,000
5	$171,000	$1,313,000	$79,000	$1,563,000
6	$69,000	$528,000	$32,000	$629,000
7	$52,000	$398,000	$24,000	$474,000
TOTAL	$1,755,000	$13,481,000	$811,000	$16,047,000

The priority areas that require substantial capital costs, namely, Priority Areas 1, 3, and 5, can be phased into smaller and more feasible projects based on annual budgetary restrictions.

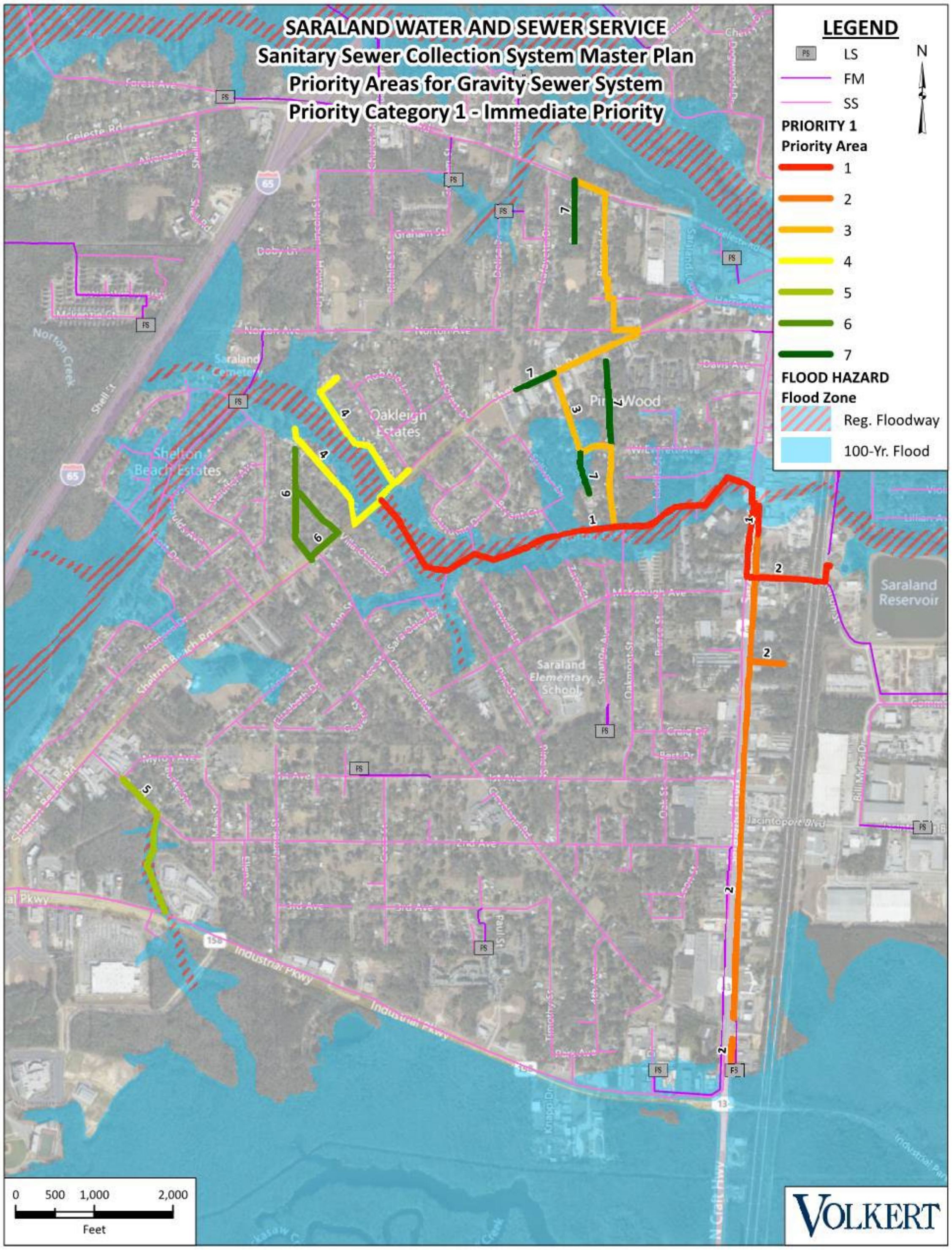

Figure 5.2.: Gravity Sewer Priority Areas for Immediate Priority Category

Priority Area 1

Priority Area 1 includes approximately 430 linear feet (LF) of 8” sewer, 6600 LF of 24” sewer, 1450 LF of 30” trunk main, and 33 manholes (MHs) running along Norton Creek beginning at Shelton Beach Road and ending at the Saraland WWTP. This is the #1 Priority Area due to its criticality within the system. This trunk main conveys approximately 75% of all sewer flows within the City of Saraland. This trunk main is also a significant contributor to I&I due to its close proximity to Norton Creek. Additionally, there is a siphon sewer segment with reversed-slope near Highway 43 that constricts flow.

The engineering design, construction, and CEI costs for this project total approximately $7,100,000. This project was submitted for funding through the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies (RESTORE) of the Gulf Coast States Act on March 4, 2022. The application is currently under review by the appropriate authorities and final award determinations have yet to be released.

Priority Area 2

Priority Area 2 includes approximately 7600 LF of 8” sewer and 23 MHs running along Highway 43 between the Popeye’s restaurant just north of Industrial Pkwy./State Road (SR) 158 and Mitchell Container Service. This area is a significant contributor to I&I, accounting for approximately 621,000 gallons per day (GPD) of rainfall-derived I&I during the course of a 2-yr./24-hr. storm event.

The engineering design, construction, and CEI costs for this project total approximately $380,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as cured-in-place pipe (CIPP) rehabilitation or pipe replacement shall be pursued.

Priority Area 3

Priority Area 3 includes approximately 430 LF of 18” sewer, 5900 LF of 21” sewer, and 24 MHs beginning at Celeste Rd. near Russell St. and ending at Norton Creek at the end of Frances St. This area is of extreme importance due to its criticality in conveying all flows along Celeste Rd. to the west of I-65. Additionally, this area has both capacity and O&M issues, including frequent surcharging and occurrences of SSOs, low velocities during dry weather and wet weather flows, areas of poor hydraulic conditions due to alignment, and areas of concern with improper bypassing installations.

The engineering design, construction, and CEI costs for this project total approximately $5,400,000. It is recommended that a complete manhole survey initially be performed for this area to determine the hydraulic profile of the existing sewer followed by CCTV inspection to determine the sewer’s condition. Based upon the information gathered in these initial phases of work, corrective actions shall be pursued.

Priority Area 4

Priority Area 4 includes approximately 4300 LF of 8" sewer and 14 MHs running along Oakview Dr., Bemis St., and a portion along Shelton Beach Rd. This area is a significant contributor to I&I, accounting for approximately 405,000 GPD of rainfall-derived I&I during the course of a 2-yr./24-hr. storm event. Additionally, there appears to be low velocities during both dry weather and wet weather flow conditions.

The engineering design, construction, and CEI costs for this project total approximately $511,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 5

Priority Area 5 includes approximately 1900 LF of 18" sewer and 8 MHs running along 2nd Ave., through wetlands located to the west of Tractor Supply Co., and south to SR 158. This area shows signs of substantial I&I contribution, with its being located within the wetlands. There also appears to be beaver dams contributing to significant ponding along the sewer main alignment, further contributing to I&I. In addition, this section conveys flows along SR 158 on the west side of I-65 and the surrounding industries.

The engineering design, construction, and CEI costs for this project total approximately $1,600,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 6

Priority Area 6 includes approximately 1250 LF of 8" sewer, 1500 LF of 10" sewer, and 10 MHs running along Ideal Dr., Center St., and a portion of Shelton Beach Rd. This area contributes approximately 70,000 GPD of rainfall-derived I&I during the course of a 2-yr./24-hr. storm event.

The engineering design, construction, and CEI costs for this project total approximately $629,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as cured-in-place pipe (CIPP) rehabilitation or pipe replacement shall be pursued.

Priority Area 7

Priority Area 7 includes approximately 785 LF of 8" sewer, 1100 LF of 12" sewer, 1100 LF of 21" sewer, and 8 MHs. This Priority Area includes gravity sewer on Russell St., a section of Shelton Beach Rd. between Allen Cir. and Ennis St., a section of Ennis St. south of West Everett Ave., and a section of Frances St. between Shelton Beach Rd. and West Everett Ave. The engineering design, construction, and CEI costs for this project total approximately $474,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

5.1.2. Short-Term Priority Category

Priority Category 2 – Short-Term Priority is divided into fifteen (15) Priority Areas. The Priority Area costs and associated project boundaries are provided in Table 5.3. and Figure 5.3., respectively.

Table 5.3.: Gravity Sewer Priority Areas for Short-Term Priority Category.

Priority Area	Engineering (13%)	Construction	CEI (6%)	Total Project Costs
1	$193,000	$1,479,000	$89,000	$1,761,000
2	$263,000	$2,019,000	$122,000	$2,404,000
3	$146,000	$1,120,000	$68,000	$1,334,000
4	$143,000	$1,098,000	$66,000	$1,307,000
5	$52,000	$394,000	$24,000	$470,000
6	$251,000	$1,928,000	$116,000	$2,295,000
7	$34,000	$260,000	$16,000	$310,000
8	$42,000	$320,000	$20,000	$382,000
9	$92,000	$704,000	$43,000	$839,000
10	$35,000	$268,000	$17,000	$320,000
11	$437,000	$3,360,000	$202,000	$3,999,000
12	$96,000	$735,000	$45,000	$876,000
13	$57,000	$434,000	$27,000	$518,000
14	$67,000	$508,000	$31,000	$606,000
15	$62,000	$470,000	$29,000	$561,000
TOTAL	$1,970,000	$15,097,000	$1,207,000	$18,274,000

The priority areas that require substantial capital costs can be phased into smaller and more feasible projects based on annual budgetary restrictions.

Priority Area 1

Priority Area 1 includes approximately 11,200 LF of 8" sewer and 47 MHs. This area, Shelton Beach Estates, has been previously identified as a high I&I area in which a systematic CIPP rehabilitation program has already begun. Phase I has already been completed, Phase II design is to begin soon, and Phase III has been submitted for grant funding through the Community Development Block Grant (CDBG) program. Phase III has been included in the cost estimate along with the remaining sections to be rehabilitated since it has not been approved for funding.

The engineering design, construction, and CEI costs for this project total approximately $1,761,000. It is recommended that SWSS continue to pursue grant funding opportunities and systematically rehabilitate the Shelton Beach Estates neighborhood.

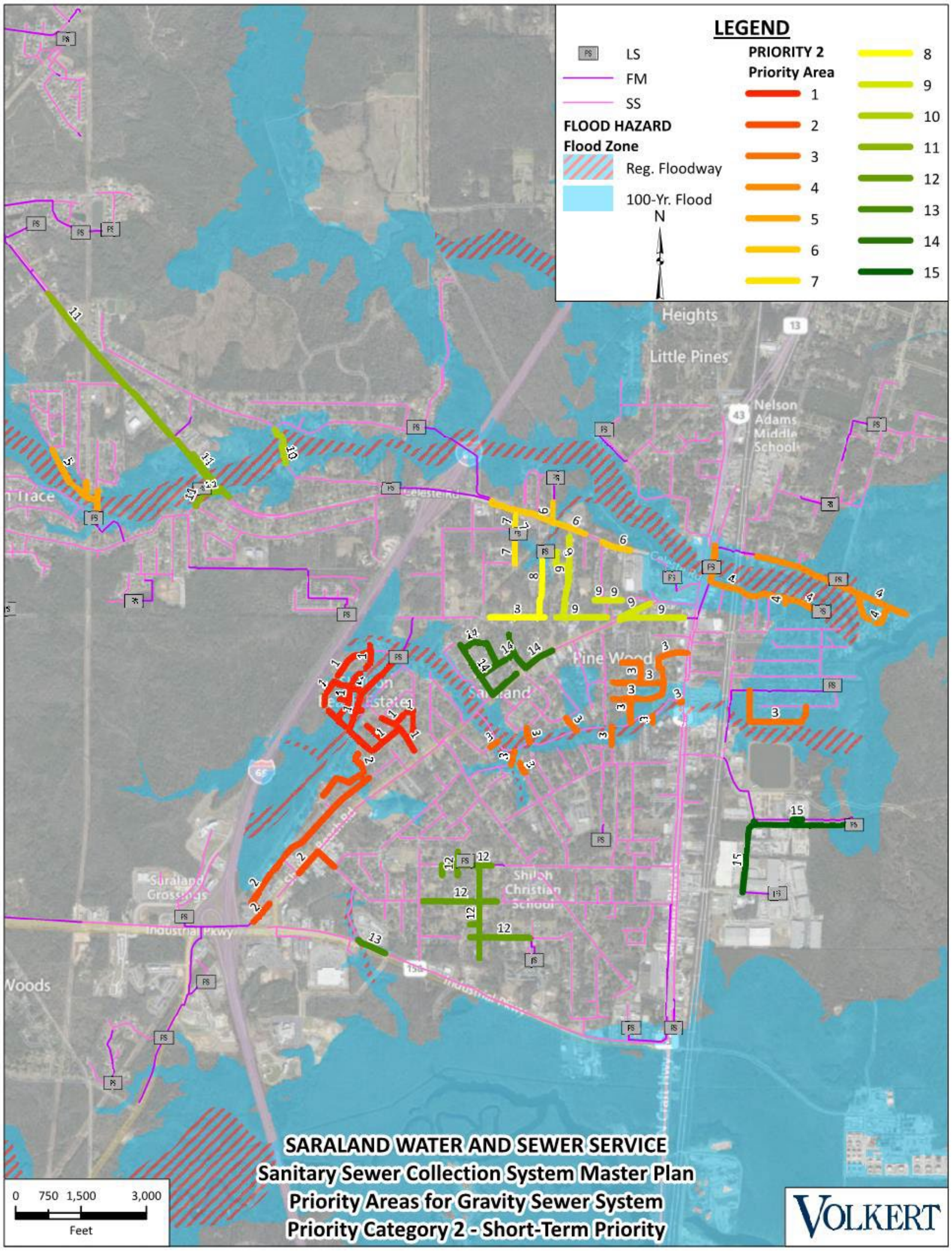

Figure 5.3.: Gravity Sewer Priority Areas for Short-Term Priority Category

Priority Area 2

Priority Area 2 includes approximately 1700 LF of 8" sewer, 200 LF of 10" sewer, 1200 LF of 18" sewer, and 33 MHs. The engineering design, construction, and CEI costs for this project total approximately $2,404,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 3

Priority Area 3 includes approximately 7700 LF of 8" sewer, 300 LF of 10" sewer, 1900 LF of 12" sewer, and 40 MHs. The engineering design, construction, and CEI costs for this project total approximately $1,334,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 4

Priority Area 4 includes approximately 8000 LF of 8" sewer, 500 LF of 16" sewer, and 38 MHs. The engineering design, construction, and CEI costs for this project total approximately $1,307,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 5

Priority Area 5 includes approximately 2650 LF of 8" sewer and 11 MHs. The engineering design, construction, and CEI costs for this project total approximately $470,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 6

Priority Area 6 includes approximately 470 LF of 8" sewer, 700 LF of 12" sewer, 2300 LF of 18" sewer, and 14 MHs. The engineering design, construction, and CEI costs for this project total approximately $2,295,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued. Additionally, assessments should be performed as developments occur along Celeste Rd. to ensure adequate capacity is available. Sewer upsizing may be required.

Priority Area 7

Priority Area 7 includes approximately 1000 LF of 8" sewer, 150 LF of 12" sewer, and 5 MHs. The engineering design, construction, and CEI costs for this project total approximately $310,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 8

Priority Area 8 includes approximately 2800 LF of 8” sewer and 10 MHs. The engineering design, construction, and CEI costs for this project total approximately $382,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 9

Priority Area 9 includes approximately 4900 LF of 8” sewer, 1500 LF of 18” sewer, and 19 MHs. The engineering design, construction, and CEI costs for this project total approximately $839,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 10

Priority Area 10 includes approximately 950 LF of 8” sewer and 6 MHs. The engineering design, construction, and CEI costs for this project total approximately $320,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 11

Priority Area 11 includes approximately 7900 LF of 8” sewer, 470 LF of 12” sewer, and 24 MHs. The engineering design, construction, and CEI costs for this project total approximately $3,999,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued. Additionally, this area should be assessed for adequate capacity for any new developments along Celeste Rd.

Priority Area 12

Priority Area 12 includes approximately 7800 LF of 8” sewer and 24 MHs. The engineering design, construction, and CEI costs for this project total approximately $876,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 13

Priority Area 13 includes approximately 700 LF of 18” sewer and 3 MHs. The engineering design, construction, and CEI costs for this project total approximately $518,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 14

Priority Area 14 includes approximately 5700 LF of 8" sewer and 20 MHs. The engineering design, construction, and CEI costs for this project total approximately $606,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

Priority Area 15

Priority Area 15 includes approximately 4400 LF of 8" sewer and 12 MHs. The engineering design, construction, and CEI costs for this project total approximately $561,000. It is recommended that initial smoke testing and/or CCTV be performed to identify potential structural defects, illegal taps, or other causes for the significant I&I factors. Once the location(s) are identified, corrective actions such as CIPP rehabilitation or pipe replacement shall be pursued.

5.1.3. Intermediate-Term Priority Category

Priority Category 3 – Intermediate-Term Priority is divided into twenty-five (25) Priority Areas. The Priority Area costs and associated project boundaries are provided in Table 5.4. and Figure 5.4., respectively. These areas have not shown significant I&I but there condition and capacity should be established and repairs or upgrades completed as necessary.

Table 5.4.: Gravity Sewer Priority Areas for Intermediate-Term Priority Category.

Priority Area	Engineering (13%)	Construction	CEI (6%)	Total Project Costs	Priority Area	Engineering (13%)	Construction	CEI (6%)	Total Project Costs
1	$121,000	$924,000	$56,000	$1,101,000	14	$53,000	$402,000	$25,000	$480,000
2	$385,000	$2,959,000	$178,000	$3,522,000	15	$20,000	$153,000	$10,000	$183,000
3	$37,000	$279,000	$17,000	$333,000	16	$73,000	$557,000	$34,000	$664,000
4	$63,000	$483,000	$29,000	$575,000	17	$52,000	$400,000	$24,000	$476,000
5	$26,000	$195,000	$12,000	$233,000	18	$47,000	$360,000	$22,000	$429,000
6	$36,000	$275,000	$17,000	$328,000	19	$44,000	$337,000	$21,000	$402,000
7	$76,000	$582,000	$35,000	$693,000	20	$17,000	$128,000	$8,000	$153,000
8	$518,000	$3,977,000	$239,000	$4,734,000	21	$30,000	$228,000	$14,000	$272,000
9	$441,000	$3,389,000	$204,000	$4,034,000	22	$28,000	$213,000	$13,000	$254,000
10	$47,000	$359,000	$22,000	$428,000	23	$41,000	$309,000	$19,000	$369,000
11	$89,000	$679,000	$41,000	$809,000	24	$25,000	$190,000	$12,000	$227,000
12	$108,000	$824,000	$50,000	$982,000	25	$17,000	$127,000	$8,000	$152,000
13	$173,000	$1,328,000	$80,000	$1,581,000					
TOTAL	$2,120,000	$16,253,000	$980,000	$19,353,000	TOTAL	$447,000	$3,404,000	$210,000	$4,061,000

The priority areas that require substantial capital costs can be phased into smaller and more feasible projects based on annual budgetary restrictions.

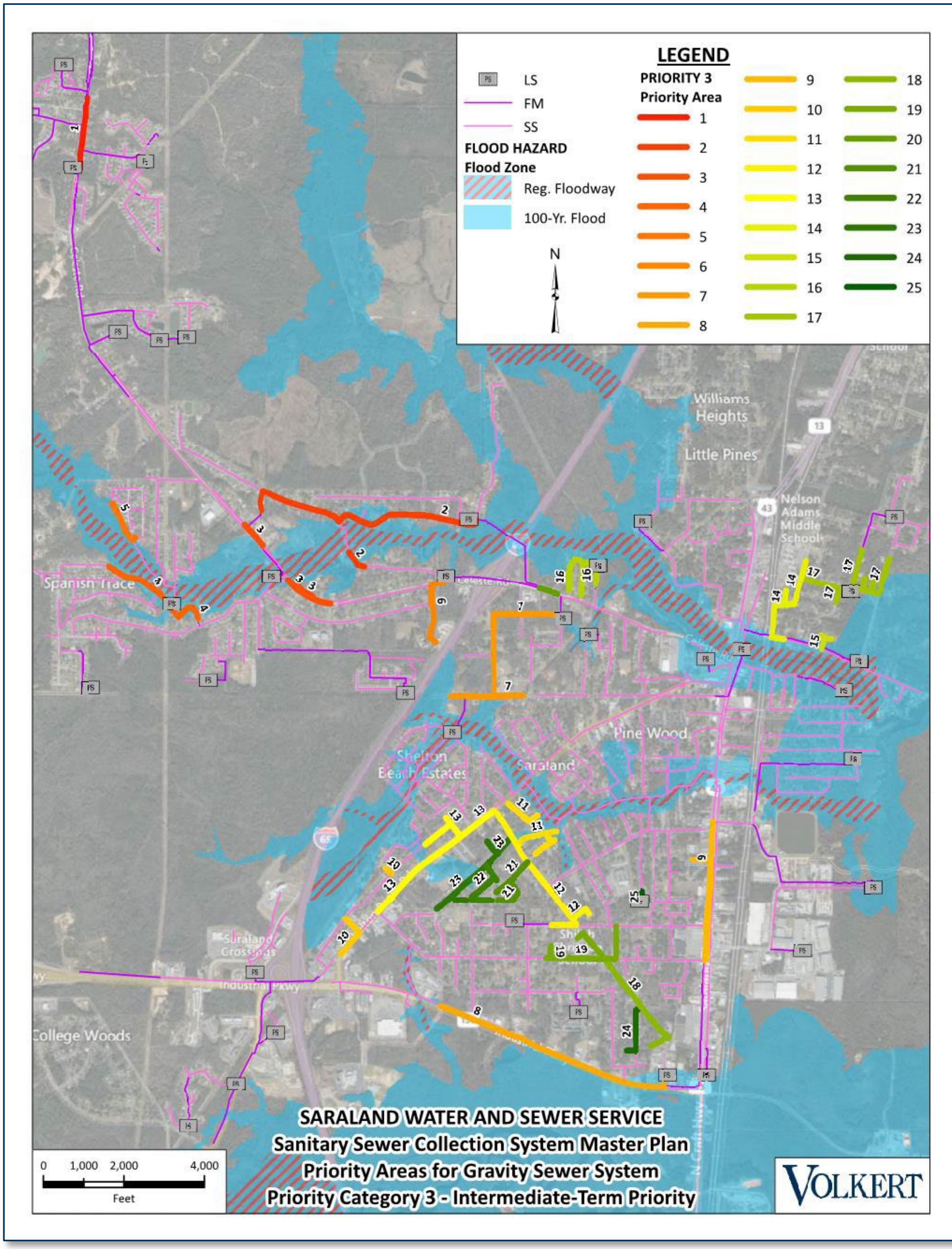

Figure 5.4.: Gravity Sewer Priority Areas for Intermediate-Term Priority Category

Priority Area 1

Priority Area 1 includes approximately 1900 LF of 8” sewer and 8 MHs. The engineering design, construction, and CEI costs for this project total approximately $1,101,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 2

Priority Area 2 includes approximately 550 LF of 8” sewer, 6450 LF of 15” sewer, and 29 MHs. The engineering design, construction, and CEI costs for this project total approximately $3,522,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 3

Priority Area 3 includes approximately 2500 LF of 8” sewer and 11 MHs. The engineering design, construction, and CEI costs for this project total approximately $333,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 4

Priority Area 4 includes approximately 2500 LF of 8” sewer, 520 LF of 12” sewer, and 17 MHs. The engineering design, construction, and CEI costs for this project total approximately $575,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 5

Priority Area 5 includes approximately 1130 LF of 8” sewer and 5 MHs. The engineering design, construction, and CEI costs for this project total approximately $233,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 6

Priority Area 6 includes approximately 2030 LF of 10” sewer and 7 MHs. The engineering design, construction, and CEI costs for this project total approximately $328,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 7

Priority Area 7 includes approximately 1100 LF of 8” sewer, 4400 LF of 12” sewer, and 17 MHs. The engineering design, construction, and CEI costs for this project total approximately $693,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 8

Priority Area 8 includes approximately 6350 LF of 18” sewer and 19 MHs. The engineering design, construction, and CEI costs for this project total approximately $4,734,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 9

Priority Area 9 includes approximately 3900 LF of 21” sewer and 12 MHs. The engineering design, construction, and CEI costs for this project total approximately $4,034,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 10

Priority Area 10 includes approximately 1430 LF of 8” sewer and 7 MHs. The engineering design, construction, and CEI costs for this project total approximately $428,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 11

Priority Area 11 includes approximately 1800 LF of 8” sewer, 1100 LF of 10” sewer, and 13 MHs. The engineering design, construction, and CEI costs for this project total approximately $809,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 12

Priority Area 12 includes approximately 1700 LF of 8” sewer, 3050 LF of 10” sewer, and 17 MHs. The engineering design, construction, and CEI costs for this project total approximately $982,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 13

Priority Area 13 includes approximately 2220 LF of 8” sewer, 2250 LF of 10” sewer, 760 LF of 18” sewer, and 19 MHs. The engineering design, construction, and CEI costs for this project total approximately $1,581,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 14

Priority Area 14 includes approximately 3050 LF of 8” sewer and 10 MHs. The engineering design, construction, and CEI costs for this project total approximately $480,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 15

Priority Area 15 includes approximately 550 LF of 8” sewer and 4 MHs. The engineering design, construction, and CEI costs for this project total approximately $183,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 16

Priority Area 16 includes approximately 2700 LF of 8” sewer and 14 MHs. The engineering design, construction, and CEI costs for this project total approximately $664,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 17

Priority Area 17 includes approximately 4830 LF of 8” sewer and 20 MHs. The engineering design, construction, and CEI costs for this project total approximately $476,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 18

Priority Area 18 includes approximately 3040 LF of 8” sewer and 10 MHs. The engineering design, construction, and CEI costs for this project total approximately $429,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 19

Priority Area 19 includes approximately 3900 LF of 8" sewer and 12 MHs. The engineering design, construction, and CEI costs for this project total approximately $402,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 20

Priority Area 20 includes approximately 470 LF of 8" sewer and 2 MHs. The engineering design, construction, and CEI costs for this project total approximately $153,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 21

Priority Area 21 includes approximately 2000 LF of 8" sewer and 8 MHs. The engineering design, construction, and CEI costs for this project total approximately $272,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 22

Priority Area 22 includes approximately 1770 LF of 8" sewer and 7 MHs. The engineering design, construction, and CEI costs for this project total approximately $254,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 23

Priority Area 23 includes approximately 3420 LF of 8" sewer and 14 MHs. The engineering design, construction, and CEI costs for this project total approximately $369,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 24

Priority Area 24 includes approximately 1400 LF of 8" sewer and 6 MHs. The engineering design, construction, and CEI costs for this project total approximately $227,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

Priority Area 25

Priority Area 25 includes approximately 310 LF of 8" sewer and 2 MHs. The engineering design, construction, and CEI costs for this project total approximately $152,000. It is recommended that smoke testing and CCTV be performed to identify potential structural defects, illegal taps, factors for I&I as well as capacity related issues. Once the location(s) are identified, corrective actions such as CIPP rehabilitation, pipe replacement, or upgrades shall be pursued.

5.1.4. Long-Term/Monitoring Category

Priority Category 4 – Long-Term/Monitor Priority is not divided into separate Priority Areas since these areas pose the least significant operational, maintenance, and/or capacity impact potential. Areas identified under this category are intended to undergo proactive maintenance and inspection and rehabilitation or upgrades should be performed as necessary. Table 5.5. and Figure 5.5. provide costs and monitoring areas, respectively.

Table 5.5.: Gravity Sewer Priority Areas for Long-Term/Monitor Priority Category.

Priority Area	Engineering (13%)	Construction	CEI (6%)	Total Project Costs
N/A	$48,000	$362,000	$22,000	$432,000
TOTAL	$48,000	$362,000	$22,000	$432,000

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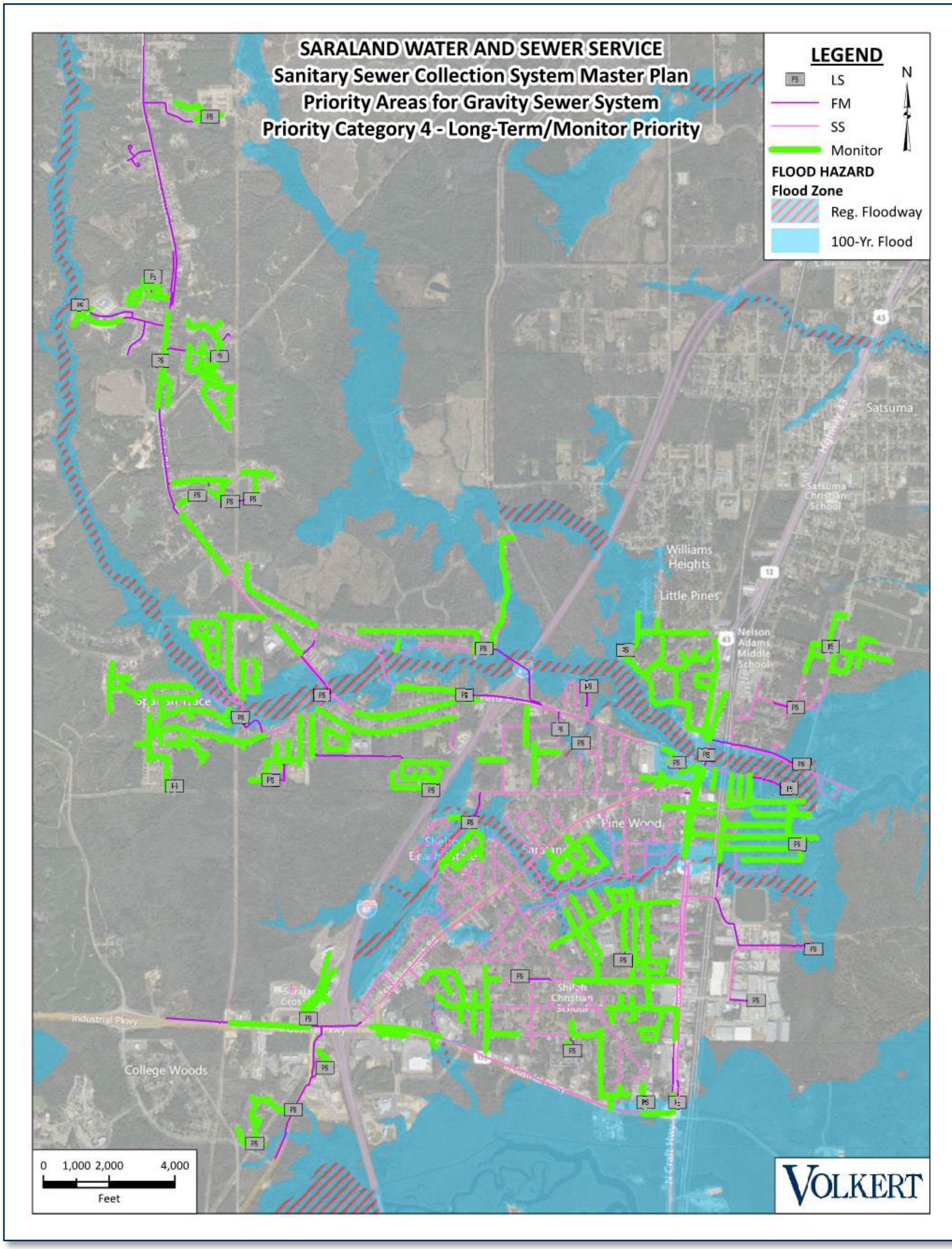


Figure 5.5.: Gravity Sewer Long-Term/Monitor Priority Category

5.2. Lift Stations

The lift station priorities are categorized into the same four (4) primary Priority Categories as the gravity sewer collection system. However, unlike the gravity sewer collection system priorities, the lift station priorities are not divided into separate Priority Areas. Instead, the lift stations are prioritized in ascending order with the highest priority lift station having the smallest number, beginning with 1, and the lowest priority lift station having the largest number, ending with 37.

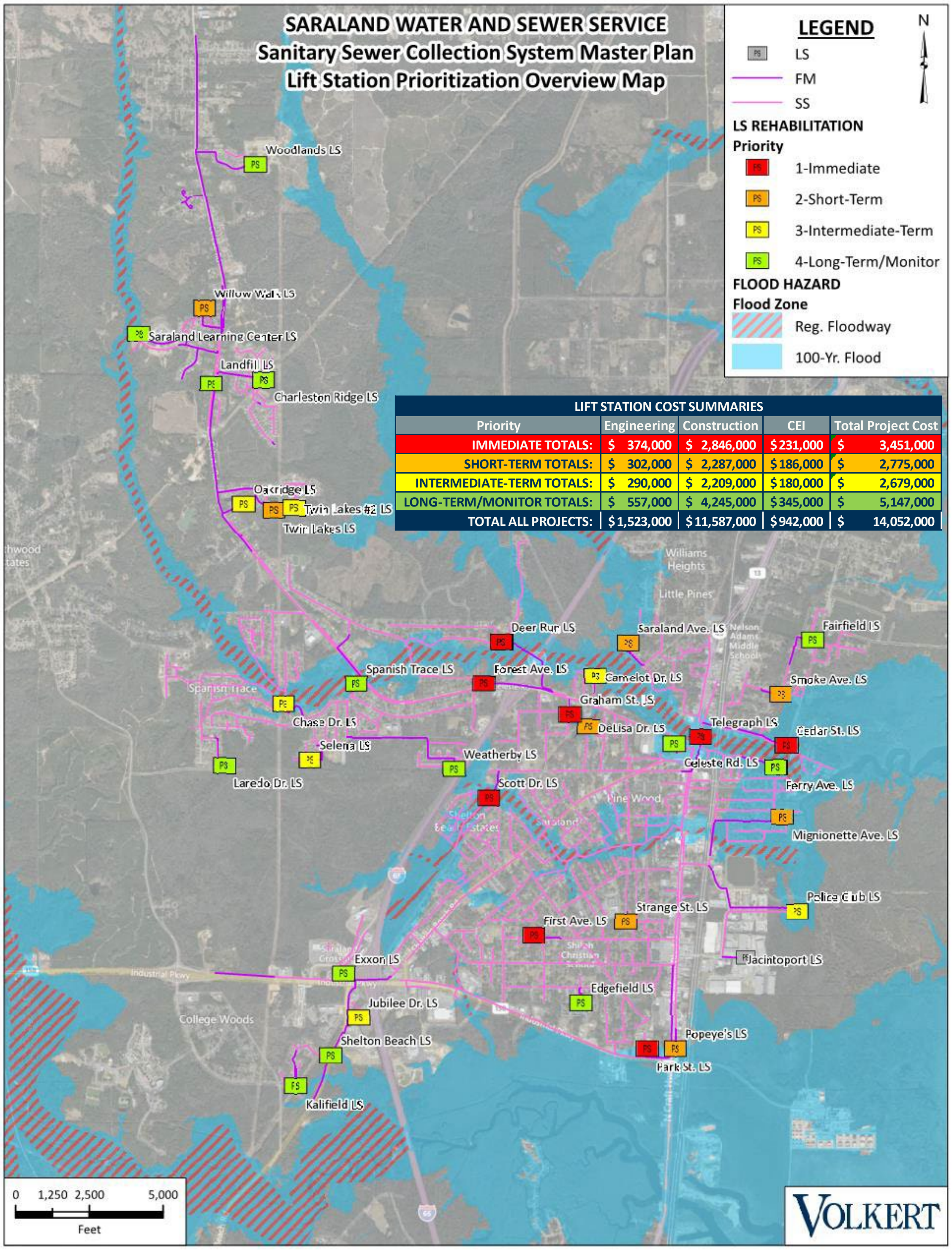
The lift stations prioritized in Table 5.6. are based on the following:

- Pump draw down tests
- Operational data collected from the Missions Communications network
- Vicinity to flood zones
- Backup power availability
- Discussions with SWSS field operations and maintenance staff

Table 5.6.: Lift Station Priority Category Cost Summaries

Priority Category	No. of Lift Stations	Engineering (13%)	Construction	CEI (8%)	Total Project Costs
1 – Immediate	8	$374,000	$2,846,000	$231,000	$3,451,000
2 – Short-Term	8	$302,000	$2,287,000	$186,000	$2,775,000
3 – Intermediate-Term	7	$290,000	$2,209,000	$180,000	$2,679,000
4 – Long-Term/Monitor	14	$557,000	$4,245,000	$345,000	$5,147,000
TOTALS	37	$1,523,000	$11,587,000	$942,000	$14,052,000

Figure 5.6. presents the Lift Station Prioritization Overview Map illustrating each lift station, their respective Priority Category, and location within the system. Figures 5.7. – 5.10. on the following pages illustrate each of the lift stations by Priority Category and includes their respective improvement costs. More detailed costs estimates for each lift station can be found in Appendix F.



LIFT STATION COST SUMMARIES

Priority	Engineering	Construction	CEI	Total Project Cost
IMMEDIATE TOTALS:	$ 374,000	$ 2,846,000	$ 231,000	$ 3,451,000
SHORT-TERM TOTALS:	$ 302,000	$ 2,287,000	$ 186,000	$ 2,775,000
INTERMEDIATE-TERM TOTALS:	$ 290,000	$ 2,209,000	$ 180,000	$ 2,679,000
LONG-TERM/MONITOR TOTALS:	$ 557,000	$ 4,245,000	$ 345,000	$ 5,147,000
TOTAL ALL PROJECTS:	$ 1,523,000	$ 11,587,000	$ 942,000	$ 14,052,000

Figure 5.6.: Lift Station Prioritization Overview Map

5.2.1. Immediate Priority Category

Priority 1 – Telegraph Lift Station

This project includes converting the existing suction lift station into a submersible pump lift station; installing a backup generator and automatic transfer switch (ATS); electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $488,000.

Priority 2 – First Ave. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $393,000.

Priority 3 – Cedar St. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $437,000.

Priority 4 – Park St. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $580,000.

Priority 5 – Graham St. LS

This project includes converting the existing suction lift station into a submersible pump lift station; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $297,000.

Priority 6 – Forest Ave. LS

This project includes converting the existing suction lift station into a submersible pump lift station; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $305,000.

Priority 7 – Deer Run Dr. LS

This project includes converting the existing suction lift station into a submersible pump lift station; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $560,000.

Priority 8 – Scott Dr. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $391,000.

Table 5.7. provides a cost summary for each of these lift station priorities and Figure 5.7. illustrates the locations.

Table 5.7.: Lift Station Immediate Priority Category Cost Summary

PRIORITY CATEGORY 1 – IMMEDIATE PRIORITY					
Priority	Name of Lift Station	Engineering (13%)	Construction	CEI (8%)	Total Project Costs
1	Telegraph	$53,000	$402,000	$33,000	$488,000
2	First Ave.	$43,000	$324,000	$26,000	$393,000
3	Cedar St.	$47,000	$361,000	$29,000	$437,000
4	Park St.	$63,000	$478,000	$39,000	$580,000
5	Graham St.	$32,000	$245,000	$20,000	$297,000
6	Forest Ave.	$33,000	$251,000	$21,000	$305,000
7	Deer Run Dr.	$61,000	$462,000	$37,000	$560,000
8	Scott Dr.	$42,000	$323,000	$26,000	$391,000
	TOTALS:	$374,000	$2,846,000	$231,000	$3,451,000

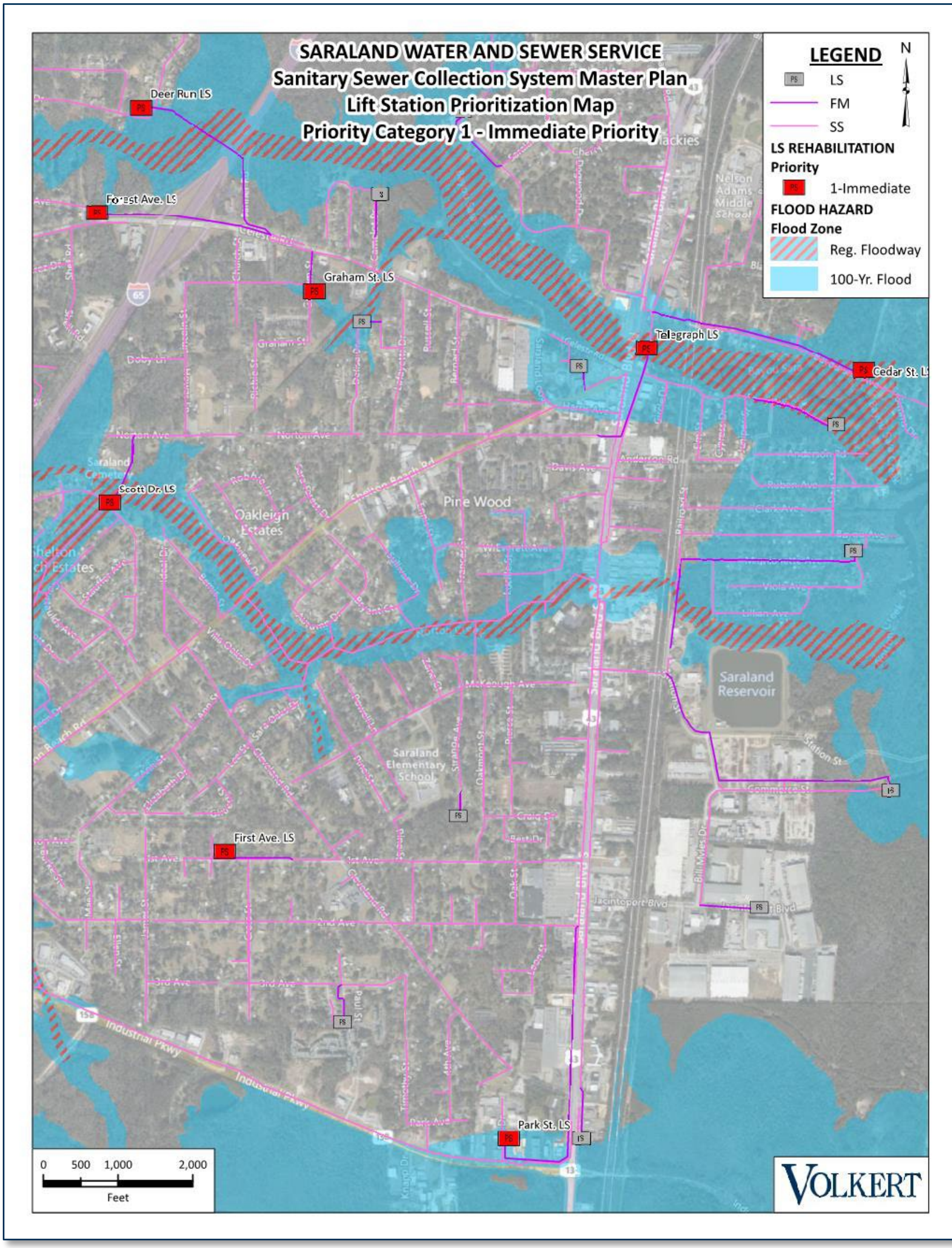


Figure 5.7.: Immediate Priority Category – Lift Stations

5.2.2. Short-Term Priority Category

Priority 9 – DeLisa LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $350,000.

Priority 10 – Mignionette LS

This project includes converting the existing suction lift station into a submersible pump lift station; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $402,000.

Priority 11 – Strange St. LS

This project includes relocating the lift station out of the main roadway; pump upgrades; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $329,000.

Priority 12 – Twin Lakes LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $348,000.

Priority 13 – Willow Walk LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $333,000.

Priority 14 – Saraland Ave. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $362,000.

Priority 15 – Smoke Ave. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $340,000.

Priority 16 – Popeye's LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $311,000.

Table 5.8. provides a cost summary for each of these lift station priorities and Figure 5.8. illustrates the locations.

Table 5.8.: Lift Station Short-Term Priority Category Cost Summary

PRIORITY CATEGORY 2 – SHORT-TERM PRIORITY					
Priority	Name of Lift Station	Engineering (13%)	Construction	CEI (8%)	Total Project Costs
9	DeLisa	$38,000	$288,000	$24,000	$350,000
10	Mignionette	$44,000	$331,000	$27,000	$402,000
11	Strange St.	$36,000	$271,000	$22,000	$329,000
12	Twin Lakes	$38,000	$287,000	$23,000	$348,000
13	Willow Walk	$36,000	$275,000	$22,000	$333,000
14	Saraland Ave.	$39,000	$299,000	$24,000	$362,000
15	Smoke Ave.	$37,000	$280,000	$23,000	$340,000
16	Popeye's	$34,000	$256,000	$21,000	$311,000
	TOTALS:	$302,000	$2,287,000	$186,000	$2,775,000

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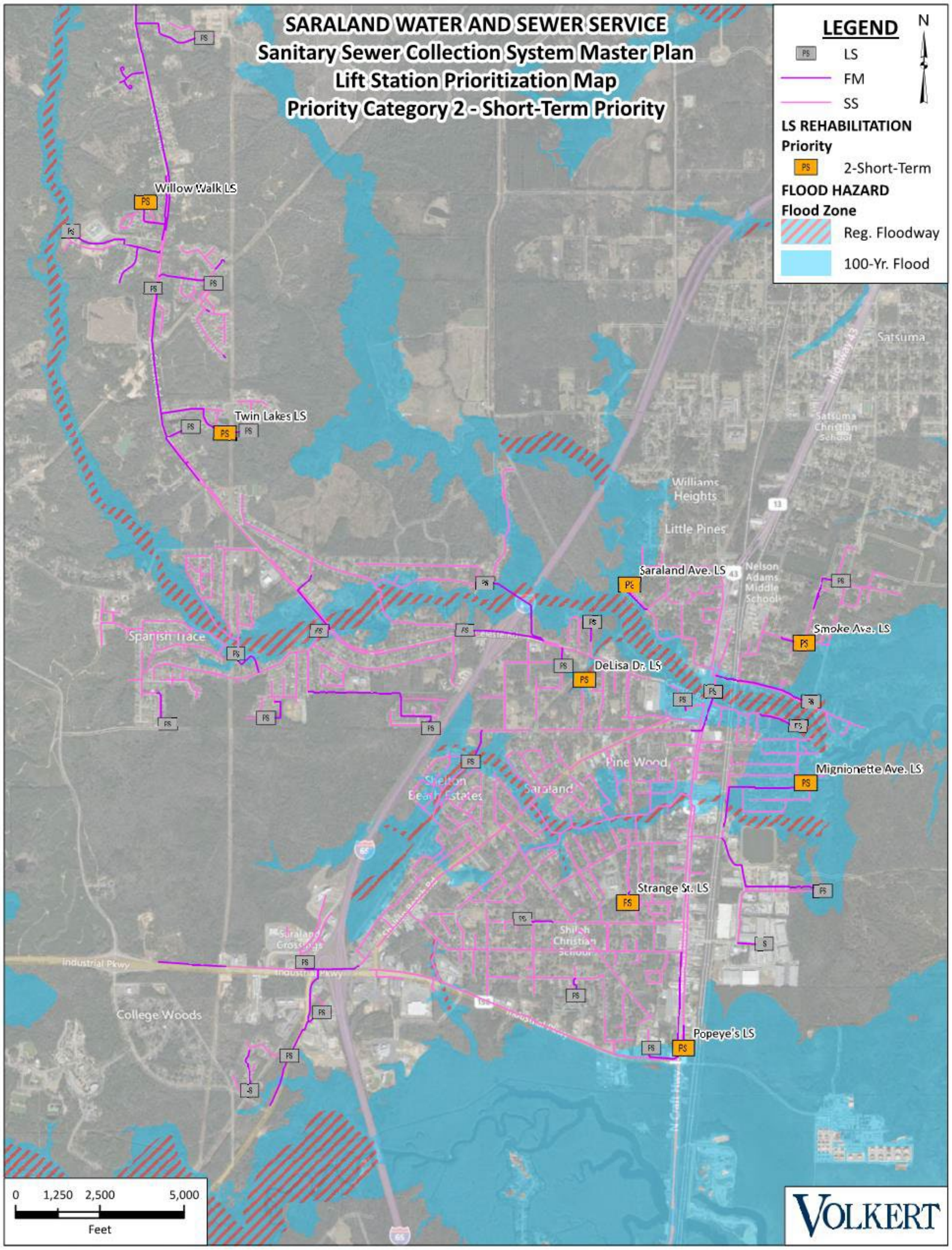

Figure 5.8.: Short-Term Priority Category – Lift Stations

5.2.3. Intermediate-Term Priority Category

Priority 17 – Camelot Dr. LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $359,000.

Priority 18 – Selena LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $509,000.

Priority 19 – Jubilee Dr. LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $354,000.

Priority 20 – Chase Dr. LS

This project includes converting the existing suction lift station into a submersible pump lift station; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $449,000.

Priority 21 – Police Club LS

This project includes converting the existing suction lift station into a submersible pump lift station; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $380,000.

Priority 22 – Oakridge LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $302,000.

Priority 23 – Twin Lakes #2 LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $326,000.

Table 5.9. provides a cost summary for each of these lift station priorities and Figure 5.9. illustrates the locations.

Table 5.9.: Lift Station Intermediate-Term Priority Category Cost Summary

PRIORITY CATEGORY 3 – INTERMEDIATE-TERM PRIORITY					
Priority	Name of Lift Station	Engineering (13%)	Construction	CEI (8%)	Total Project Costs
17	Camelot Dr.	$39,000	$296,000	$24,000	$359,000
18	Selena	$55,000	$420,000	$34,000	$509,000
19	Jubilee Dr.	$38,000	$292,000	$24,000	$354,000
20	Chase Dr.	$49,000	$370,000	$30,000	$449,000
21	Police Club	$41,000	$313,000	$26,000	$380,000
22	Oakridge	$33,000	$249,000	$20,000	$302,000
23	Twin Lakes #2	$35,000	$269,000	$22,000	$326,000
	TOTALS:	$290,000	$2,209,000	$180,000	$2,679,000

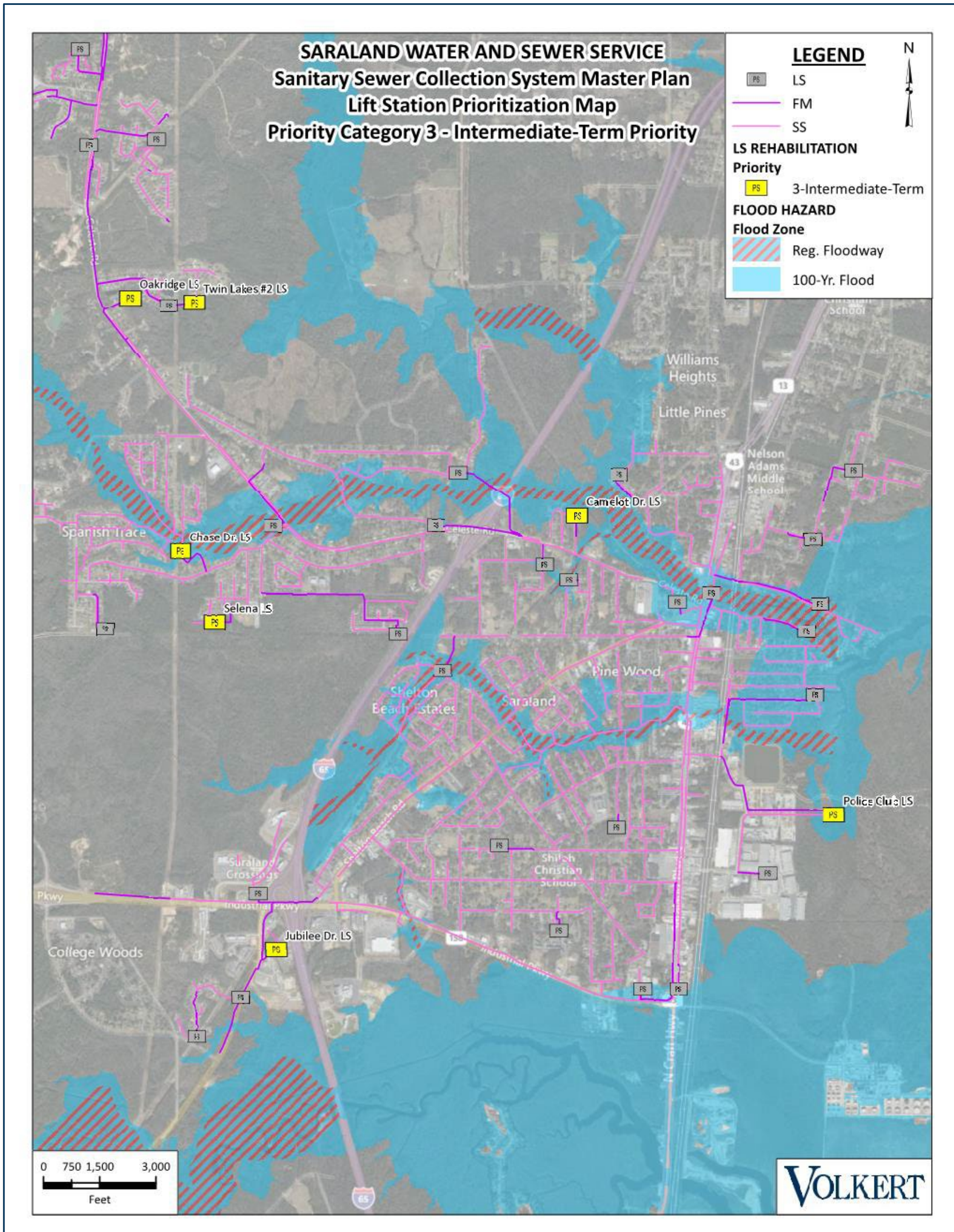

Figure 5.9.: Intermediate-Term Priority Category – Lift Stations

5.2.4. Long-Term/Monitoring Category

Priority 24 – Weatherby LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $362,000.

Priority 25 – Spanish Trace LS

This project includes upgrading the submersible pumps; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $434,000.

Priority 26 – Fairfield LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $391,000.

Priority 27 – Exxon LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $414,000.

Priority 28 – Laredo Dr. LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $347,000.

Priority 29 – Charleston Ridge LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $416,000.

Priority 30 – Celeste Rd. LS

This project includes upgrading the submersible pumps; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $286,000.

Priority 31 – Landfill LS

This project includes upgrading the submersible pumps; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $296,000.

Priority 32 – Ferry Ave. LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $397,000.

Priority 33 – Shelton Beach LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $361,000.

Priority 34 – Saraland Learning Center LS

This project includes upgrading the submersible pumps; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $315,000.

Priority 35 – Kalifield LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $406,000.

Priority 36 – Edgefield LS

This project includes upgrading the submersible pumps; installation of a backup generator and ATS; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $350,000.

Priority 37 – Woodlands LS

This project includes upgrading the submersible pumps; electrical, instrumentation, and controls upgrades; wet well lining; and replacement of piping and valves, as necessary. The engineering design, construction, and CEI costs for this project total approximately $372,000.

Table 5.10. provides a cost summary for each of these lift station priorities and Figure 5.10. illustrates the locations.

Table 5.10.: Lift Station Long-Term/Monitor Priority Category Cost Summary

PRIORITY CATEGORY 4 – LONG-TERM/MONITOR PRIORITY					
Priority	Name of Lift Station	Engineering (13%)	Construction	CEI (8%)	Total Project Costs
24	Weatherby	$39,000	$299,000	$24,000	$362,000
25	Spanish Trace	$47,000	$358,000	$29,000	$434,000
26	Fairfield	$42,000	$323,000	$26,000	$391,000
27	Exxon	$45,000	$341,000	$28,000	$414,000
28	Laredo Dr.	$38,000	$286,000	$23,000	$347,000
29	Charleston Ridge	$45,000	$343,000	$28,000	$416,000
30	Celeste Rd.	$31,000	$236,000	$19,000	$286,000
31	Landfill	$32,000	$244,000	$20,000	$296,000
32	Ferry Ave.	$43,000	$327,000	$27,000	$397,000
33	Shelton Beach	$39,000	$298,000	$24,000	$361,000
34	Saraland Learning Center	$34,000	$260,000	$21,000	$315,000
35	Kalifield	$44,000	$335,000	$27,000	$406,000
36	Edgefield	$38,000	$288,000	$24,000	$350,000
37	Woodlands	$40,000	$307,000	$25,000	$372,000
	TOTALS:	$557,000	$4,245,000	$345,000	$5,147,000

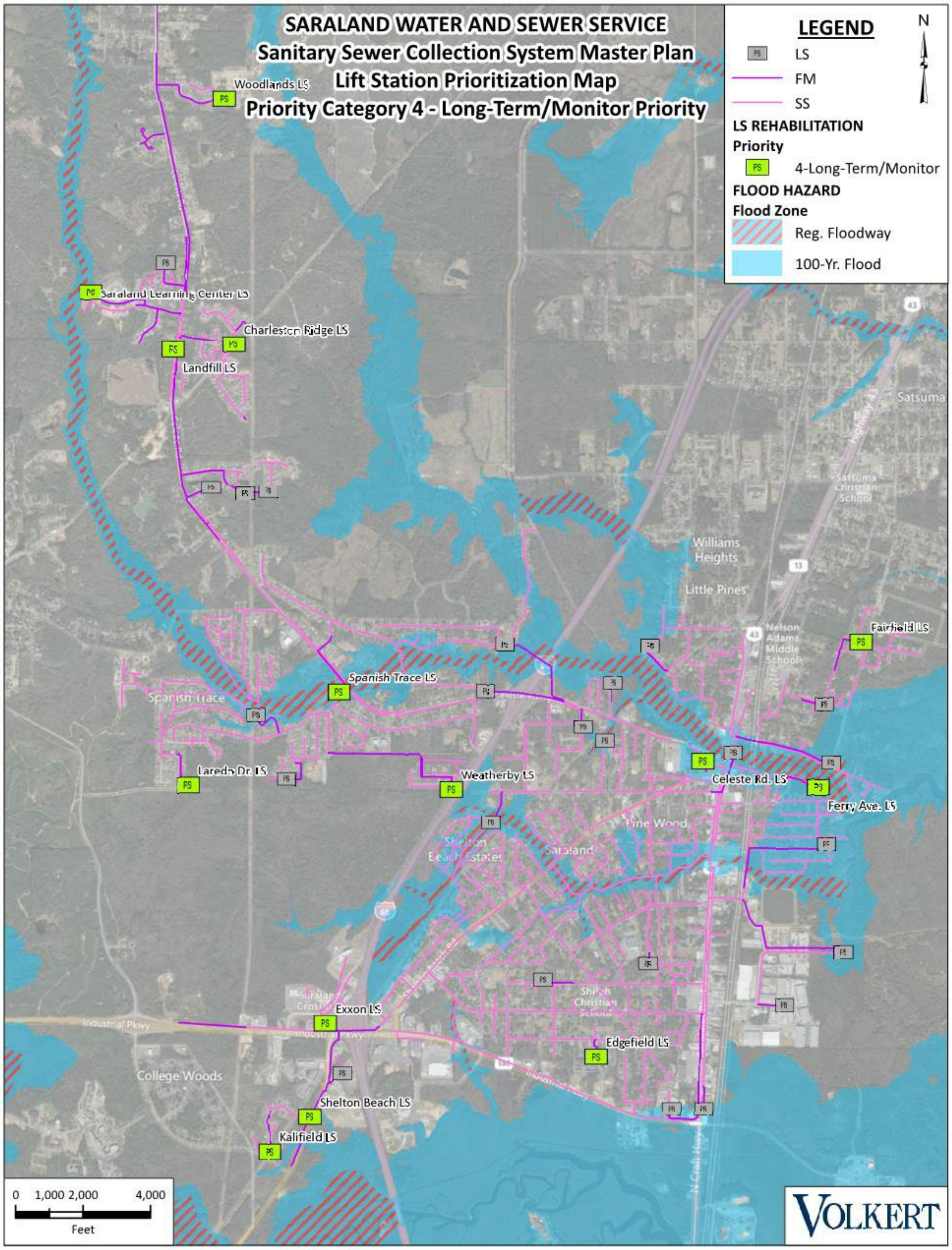

Figure 5.10.: Long-Term/Monitor Priority Category – Lift Stations

5.3. Other Recommendations

The following subsections are other optional recommendations SWSS should consider as a part of their best management practices. The implementation of some or all of these recommendations will greatly benefit the utility as well as their existing and future customers.

5.3.1. Capacity, Management, Operation, and Maintenance (CMOM) Program

Capacity, Management, Operation, and Maintenance (CMOM) programs were first developed by the EPA and is a dynamic yet flexible framework for municipalities to identify and incorporate widely-accepted wastewater industry practices to 1) better manage, operate, and maintain sanitary sewer collection systems; 2) investigate capacity constrained areas of the collection system; and 3) respond to SSO events.

The implementation of a CMOM program will allow SWSS to provide a high level of service to customers while reducing regulatory noncompliance issues by providing a more proactive approach to collection system operations and maintenance through the use of a computerized maintenance management system (CMMS). According to the US EPA, the implementation of a CMOM program has proven added-value through cost savings by reducing overtime hours necessary for emergency response and emergency repair costs, minimizing likelihood of receiving fines imposed by permitting authorities, reducing insurance premiums, and lessening the probability of lawsuits.

The CMOM planning framework covers operation and maintenance planning, capacity assessment and assurance, capital improvement planning, and financial management planning. The information collected and maintained are used to identify and track CMOM activities, performance goals, and overall system condition and efficiency.

5.3.2. Manhole Surveys

As previously discussed in this report elsewhere, the ownership of the sanitary sewer collection system was transferred from the City of Saraland to the Board in 2017. During this transition, limited record information was provided to the Board. This has resulted in substantial gaps of available information that is critical to the efficient and effective management of the collection system.
The purpose of performing manhole surveys is to capture the sizes and critical elevations of manholes and sewer lines within the system. This information can then be incorporated into SWSS's geographical information system (GIS) and used for a variety or purposes, including but not limited to infrastructure location accuracy, system modeling, and asset and maintenance management. This information can be collected separately or in conjunction with closed-circuit television inspection services described in the following subsection.

5.3.3. Annual Services Contract for CCTV Inspection and Mainline Cleaning

Closed-circuit television (CCTV) inspection and mainline cleaning will allow SWSS to identify the material type, size, and internal condition (i.e. root intrusion, cracked or broken pipes, offset joints, corrosion, blockages, illegal or improper connection, etc.) of the collection system infrastructure being inspected. Understanding these characteristics aids in identifying potential likelihood and risk of failure as well as identifying potential I/I hot spots within the system. This contract can be separate from or in conjunction with the mainline and manhole lining annual contract discussed in the following subsection.

5.3.4. Annual Services Contract for Mainline and Manhole Lining

Implementing an annual services contract for mainline and manhole lining will allow SWSS to perform minor point repairs and lining, as necessary, efficiently and effectively to reduce system operation and maintenance impacts without having to go through a typical design-bid-build process for each repair/lining location. This can be separate from or in conjunction with the CCTV inspection and mainline cleaning annual contract discussed above.

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