CHAPTER 4

EXISTING WASTEWATER SYSTEM COMPONENTS

INTRODUCTION

The District owns and operates a wastewater collection system consisting primarily of collection sewers, trunk sewers, lift stations, and force mains. Treatment of the District's wastewater occurs at the King County Department of Natural Resources (KCDNR) South and West Point Treatment Plants. KCDNR will begin constructing a new regional Wastewater Treatment Facility (WWTF), called Brightwater, in 2006. Brightwater is expected to begin treating wastes from portions of both King County and Snohomish County, including portions of the District in 2010. The District's collection system serves the city of Kenmore and portions of Lake Forest Park, Bothell, Woodinville, Kirkland, and unincorporated King County. The District also transports flows from some small areas in Brier within Alderwood Water and Wastewater District's (AWWD) service area. The purpose of this chapter is to identify and describe the condition of the various components of the District's collection system.

EXISTING WASTEWATER FACILITIES

The District's wastewater facilities are discussed in the following sections with respect to treatment systems, lift stations, force mains, low pressure grinder systems, and gravity lines. The focus of these sections is to provide an overview of the District's wastewater collection system by identifying equipment, infrastructure, and capacity of various components.

WASTEWATER TREATMENT

Currently, treatment of the District's wastewater is provided by KCDNR at the South and West Point Treatment Plants. A portion of the District's flow is collected from the southeast half of the District and pumped to the South Treatment Plant via the Juanita Bay Pump Station. The flow from the northwest portion of the District is pumped to the West Point Treatment Plant via the Kenmore Pump Station. The Juanita Bay and Kenmore Pump Stations are both owned and operated by KCDNR. In 2010, the Brightwater WWTF is scheduled to begin operation. However, the new treatment facility will not treat wastewater flows from the District at that time. Sometime after 2040, flows from the northwest portion of the District, currently served by the Kenmore Pump Station, are scheduled to be rerouted to the Brightwater WWTF.

Existing System

The South Treatment Plant is located in Renton and discharges treated wastewater directly into Puget Sound. The existing outfall was constructed in 1986 to eliminate the discharge to the Duwamish River. The South Treatment Plant treats all influent to secondary standards and has a maximum month design capacity of 115 mgd. The plant is scheduled for expansion to 135 mgd by the year 2020.

The West Point Treatment Plant, located at Discovery Park in Seattle, has a maximum month capacity of 133 mgd and discharges secondary effluent into Puget Sound. Future expansion options are limited due to an agreement with local residents that permitted construction of secondary treatment facilities on the condition that future expansion beyond the new footprint be prohibited.

Most of the treated wastewater at the West Point Treatment Plant and the South Treatment Plant is discharged to the Puget Sound, although combined, the West Point Treatment Plant and the South Treatment Plant currently produce 0.75 mgd of Class A reclaimed water. Reclaimed water will continue to be considered as an alternative to disposal in all planning efforts.

Biosolids at both plants are digested to Class B standards and composted for use as soil amendment. Methane produced during this digestion process is used for plant operations, or sold.

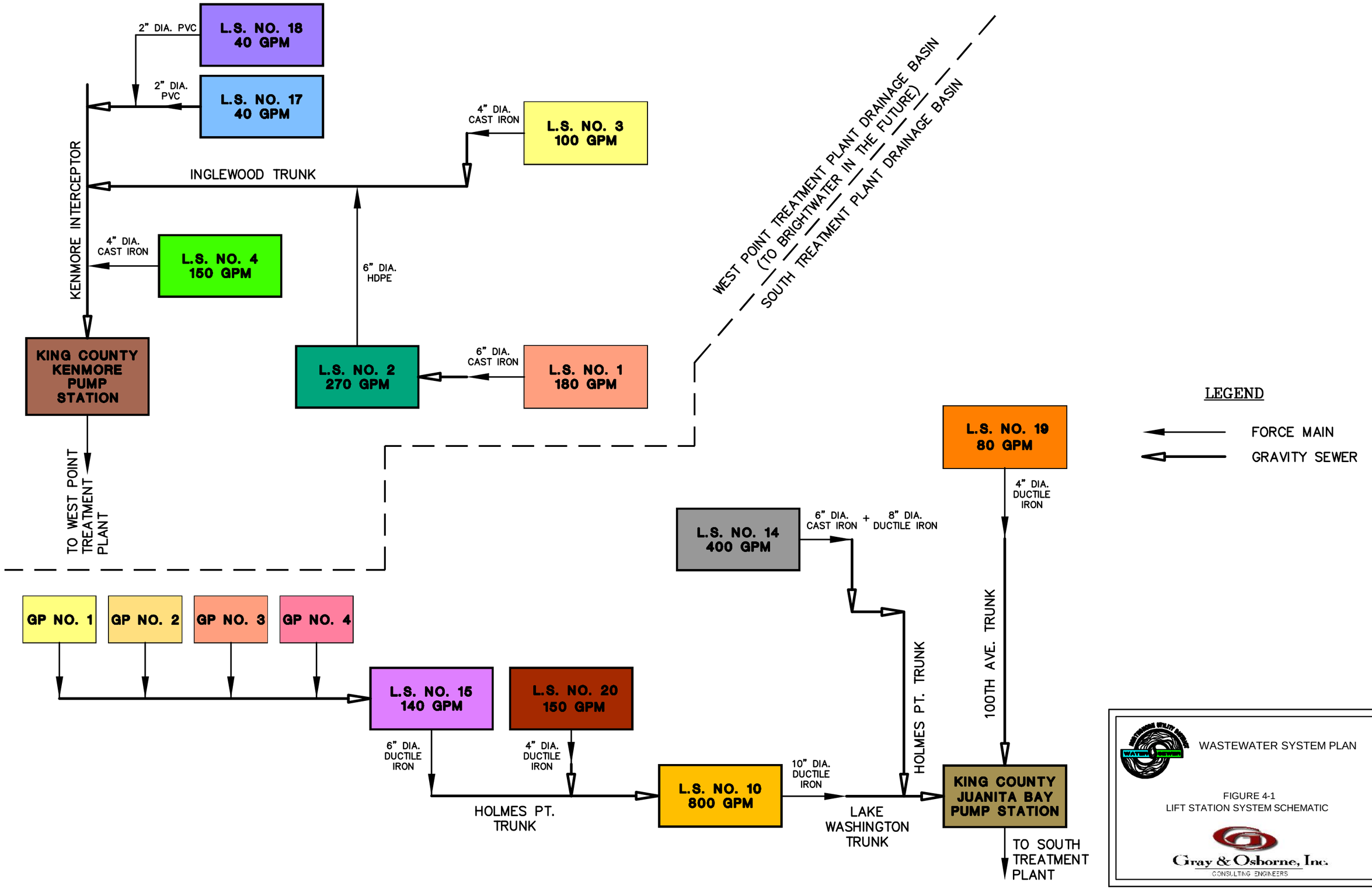
Future Plans

Due to the limited expansion opportunities at the West Point Treatment Plant, construction of a third plant was planned as part of the *King County Regional Wastewater Services Plan*. KCDNR has started construction on the Brightwater WWTF on SR 9 and 228th Street SW in Snohomish County. The plant will have a capacity of approximately 36 mgd with an outfall discharging to Puget Sound. The plant is anticipated to be completed by 2010. Expansion to 54 mgd is proposed by the year 2040.

SEWAGE LIFT STATIONS

The District operates and maintains eleven lift stations and four grinder pump units. An inventory of each sewage lift station is provided in Table 4-1. A schematic representation of the District's system of sewage lift stations is shown in Figure 4-1. Figure 4-2 shows the location of the lift stations and the collection system. Lift Station Nos. 5, 6, 7, 8, 9, 11, 12, 13, and 16 have all been replaced by gravity sewer.

Most of the lift stations have a wet well-dry well arrangement, with the exceptions of Lift Station Nos. 17 and 18, which have submersible pumps. Most of the lift stations have emergency connections for bypass pumping of the wet well. All the lift stations have



WASTEWATER SYSTEM PLAN

FIGURE 4-1
LIFT STATION SYSTEM SCHEMATIC

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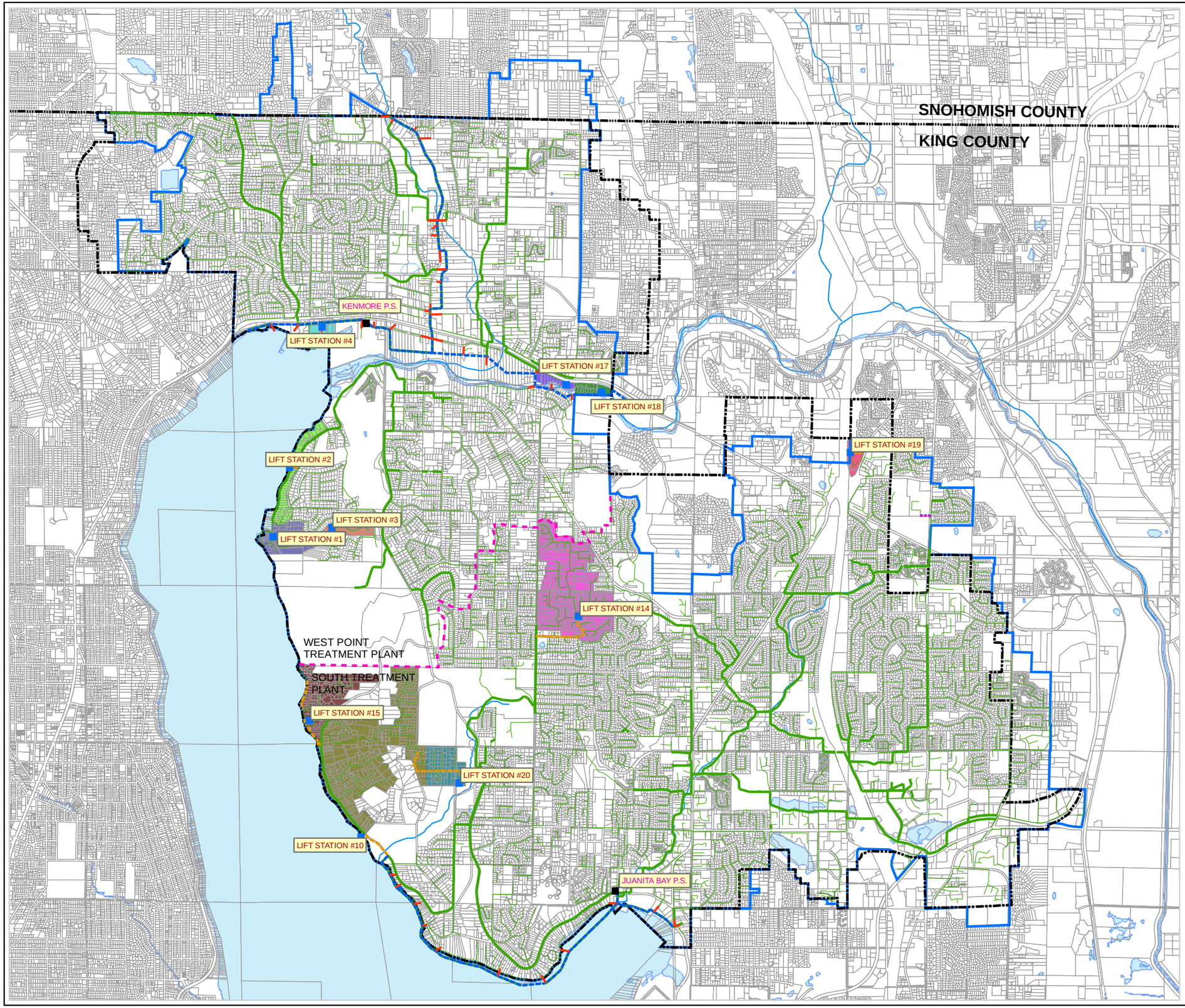

N

0 1,600 3,200 6,400 Feet

LEGEND:

- CORPORATE BOUNDARY
- SEWER SERVICE STUDY AREA BOUNDARY
- METRO INTERCEPTOR
- PRIVATE FORCE MAIN
- LIFT STATIONS
- KCDNR LIFT STATIONS
- FORCE MAIN
- GRAVITY SEWERS UNDER 10-INCH DIAMETER
- GRAVITY SEWERS 10-INCH DIAMETER AND LARGER
- KCDNR INTERCEPTOR SEWER CONNECTIONS
- KCDNR TREATMENT BOUNDARY
- COUNTY LINE

LIFT STATION BASINS:

- LIFT STATION #1
- LIFT STATION #2
- LIFT STATION #3
- LIFT STATION #4
- LIFT STATION #10
- LIFT STATION #14
- LIFT STATION #15
- LIFT STATION #17
- LIFT STATION #18
- LIFT STATION #19
- LIFT STATION #20

SOURCE: NORTHSHORE UTILITY DISTRICT

NORTHSHORE UTILITY DISTRICT WATER SEWER

WASTEWATER SYSTEM PLAN

FIGURE 4-2
COLLECTION SYSTEM

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emergency generator power capability and a telemetry alarm system that connects to the District's SCADA system. Lift Station Nos. 10 and No. 20 have permanent standby generators.

Lift Station Nos. 1 and 2 were rehabilitated in 2002. Rehabilitation of Lift Station No. 1 included replacing the sewage pumps, pump motors, the sump pump, the humidifier, the exhaust fan, and all electrical systems. Rehabilitation of Lift Station No. 2 included replacing sewage pumps, pump motors, sump pump, humidifier, exhaust fan, all electrical systems, and installation of approximately 280 lineal feet of 6-inch HDPE force main.

TABLE 4-1

Lift Station Inventory

Lift Station	Year On-line	Manufacturer/Model	Rated Capacity[1] (GPM)	TDH (Feet)	Motor Power (Hp)	Voltage/ Phase	Auxiliary Power
No. 1	2003 [3]	Smith & Loveless/4B2B	180	25	5	240/3	No[2]
No. 2	2003 [3]	Smith & Loveless/4C3B	270	100	25	240/3	No[2]
No. 3	1981	Cornell/4NNT	100	70	7.5	230/1	No[2]
No. 4	1992	Cornell/4NNT	150	15	2	230/3	No[2]
No. 10	1975	Cornell/4NHT	800	50	20	230/3	Yes[4]
No. 14	2007 [3]	Cornell/4NNT	400	89	25	240/3	Yes[3]
No. 15	1977	Cornell/4NNT	500	30	20	208/3	No[2]
No. 17	1998	Hydromatic/G2FX300	40	25	2	208/3	No[2]
No. 18	1999	Hydromatic/G2FX300	40	25	2	208/3	No[2]
No. 19	1998	Cornell/4NNT	80	38	5	208/3	No[2]
No. 20	2004	Cornell/4NHTA	150	138	20	480/3	Yes[4]

(1) All stations have two pumps. Rated capacity shown is for the station and assumes one pump is out of service.
(2) Stations have receptacle for portable generator connection.
(3) Lift Station Nos. 1 and 2 were originally brought on-line in 1968; Lift Station No. 14 was originally brought on-line in 1977. The date shown refers to the year the station was, or in the case of Lift Station No. 14, will be upgraded.
(4) Lift Station No. 10 has a permanent 70 kW propane generator and Lift Station No. 20 has a permanent 50 kW diesel generator.

New electrical systems, telemetry, and water service were also installed at both Lift Stations No. 1 and No. 2. The pumps, motors, and check valves at Lift Station No. 14 were replaced in June 2005.

Table 4-2 presents a summary of recent wet and dry month run time meter data for each lift station. Run time data are useful in two ways. It can provide a rough indication of how near to capacity the stations are running, and it can provide an indication of inflow and infiltration. As shown in Table 4-2, none of the District's lift stations appear to be approaching capacity. A complete list of lift station run time data for the months of August and December 2005 is included in Appendix F.

By comparing wet to dry season run time data, an estimate of average infiltration and inflow (I/I) can be made. A comparison between the average run time per day during August and the maximum run time per day in December can give a good indication of infiltration. A comparison between the maximum and average run time in December can give a good indication of the amount of inflow.

TABLE 4-2

Lift Station Run Time Meter Data

Lift Station Number	August 2005		December 2005	
	Average Run Time per Day[(1)] (%)	Maximum Run Time per Day[(1)] (%)	Average Run Time per Day[(1)] (%)	Maximum Run Time per Day[(1)] (%)
No. 1	1.9	2.3	2.0	3.9
No. 2	4.4	5.1	4.8	10
No. 3	7.1	17	5.4	9.2
No. 4	7.2	9.8	13	20
No. 10	5.6	6.8	8.4	25.1
No. 14	9.2	15	15	33
No. 15	1.4	1.8	1.6	3.3
No. 17	0.5	1.1	0.5	1.4
No. 18	1.5	3.3	2.5	4.6
No. 19	6.9	16	N/A[(2)]	N/A[(2)]
No. 20	0.8	1.4	1.3	3.0

Source: Northshore Utility District Run Time Data.
(1) Recorded hours per day running divided by 24 hours times 100.
(2) Data not available for this date and lift station.

FORCE MAINS

An inventory of the District's force mains is presented in Table 4-3. Force mains range in size from 2-inch diameter to 10-inch diameter.

TABLE 4-3

Force Main Inventory

Lift Station Number	Length (ft)	Diameter (in)	Material
No. 1	321	6	Cast Iron
No. 2	280	6	HDPE
No. 3	649	4	Cast Iron
No. 4	29	4	Cast Iron
No. 10	1,143	10	Ductile Iron
No. 14	2,250	6 and 8	Cast Iron and Ductile Iron
No. 15	1,075	6	Ductile Iron
No. 17	325	6	PVC
No. 18	5	2	PVC
No. 19	320	2	Ductile Iron
No. 20	2,051	4	Ductile Iron

Source: Northshore Utility District Quarter Section Maps.

LOW PRESSURE GRINDER SYSTEMS

The District owns and operates four low-pressure grinder pump stations located near the shore of Lake Washington, north of Lift Station No. 15. All four stations pump to Lift Station No. 15. The stations are 2 hp, Hydromatic duplex stations with explosion-proof pumps and red alarm lights alerting residents to notify the District when problems occur. Grinder lift station run time data are summarized in Table 4-4. A complete list of grinder lift station run time data for the months of August and December 2005 is included in Appendix F. Grinder Pump Station Nos. 1 and 2 exhibit higher flows during summer months than winter months. The locations of these stations are on the shore of Lake Washington, and the higher summer flows are likely due to higher occupancy during summer months. None of the grinder pumps are near capacity.

In addition, there are approximately 100 privately owned grinder pumps serving individual residences. The District does not own, operate, or maintain these stations. These grinder stations do not have explosion-proof pumps. The District's Standard Specifications, included in Appendix C, include the District's requirements for private grinder pumps.

TABLE 4-4

Grinder Pump Station Run Time Meter Data

Station Number	August 2005		December 2005	
	Average Daily Time Running (%)	Maximum Day Time Running (%)	Average Daily Time Running (%)	Maximum Day Time Running (%)
No. 1	8.2	18	1.4	3.1
No. 2	3.4	7.4	1.3	2.7
No. 3	1.5	3.8	3.1	5.8
No. 4	1.3	3.1	6.2	11

Source: Northshore Utility District Run Time Data.

GRAVITY LINES

The District's collection system comprises approximately 240 miles of gravity sewer pipe, ranging in size from 2 inches to 30 inches in diameter. Table 4-5 is a summary of the system's pipe sizes and the year placed in service.

Prior to the installation of PVC pipe, concrete and asbestos concrete pipe were the predominant materials of construction found in the District. About 51 percent of the system is asbestos concrete or concrete pipe, most of which was placed in service before 1974. Approximately 70 percent of the pipe installed since 1974 is PVC. A summary of the pipe material and year placed in service for the District's gravity collection system is presented in Table 4-6. Table 4-7 summarizes the District's collection system pipe material and pipe size.

KING COUNTY DEPARTMENT OF NATURAL RESOURCES INTERCEPTORS

KCDNR currently owns and manages three main interceptors within the District's sewer service area. The first is the Lake Line Interceptor, which conveys flows along the southern boundary of the District from the north end of Lake Washington to the Juanita Bay Pump Station. The second is the Swamp Creek Trunk Line, which conveys flows south from AWWD along 73rd Avenue NE to join the Kenmore Interceptor. Finally, the Kenmore Interceptor is also owned and managed by KCDNR; the Kenmore Interceptor conveys flows east and west to the Kenmore Pump Station. Figure 4-2 shows the location of District connections to KCDNR interceptors. Throughout the District there are approximately 40 manholes that connect to KCDNR interceptors.

KCDNR and the District are currently discussing the possibility that KCDNR will purchase the ULID-5 Trunk from the District. The District is in the process of investigating the capacity and need for rehabilitation of the ULID-5 Trunk, after which it is likely KCDNR will purchase the trunk line from the District. The ULID-5 trunk

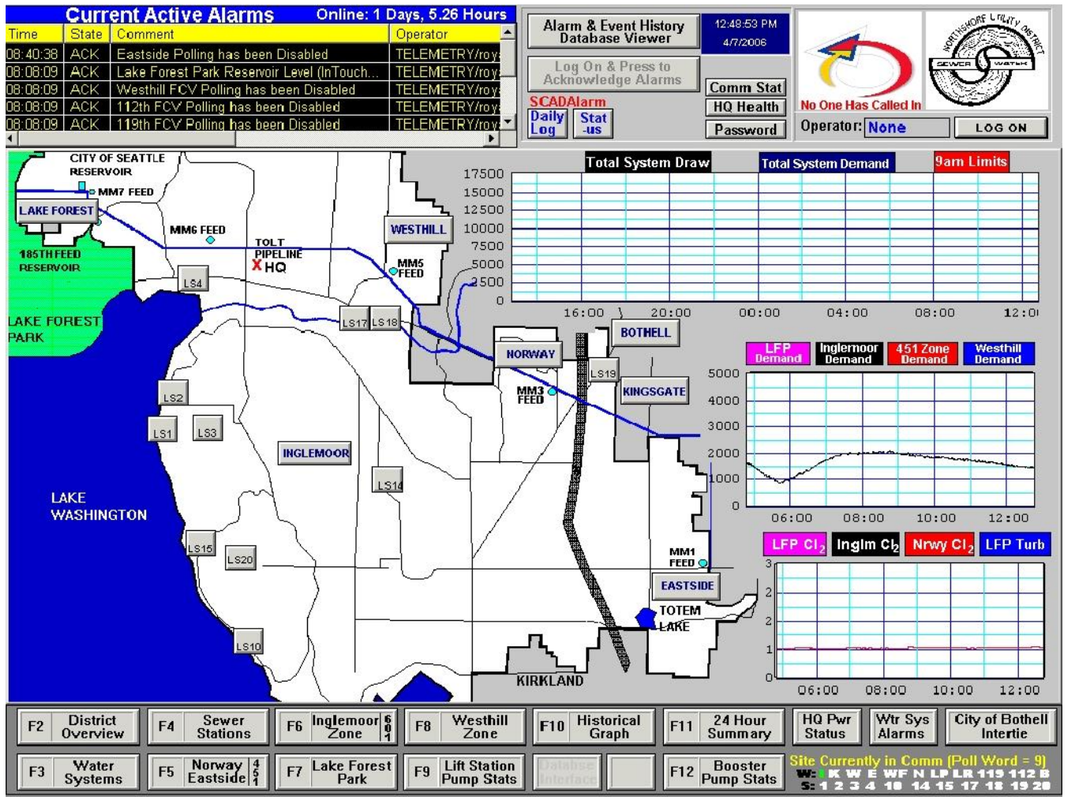
generally runs south from near the intersection of 100th Avenue NE and Simonds Road NE to the Lake Line Interceptor at KCDNR Manhole No. R15-4.

SCADA SYSTEM

The master control station for the District's Supervisory Control and Data Acquisition (SCADA) system is located at the District office. The system uses Wonderware software to provide a graphical user interface allowing the operator to monitor pump status, run time and alarm conditions at the 11 sewer lift stations. Figure 4-3 displays a color copy of the graphical user interface screen.

The SCADA system can automatically monitor the wastewater system's 11 major lift stations listed in Table 4-1 and illustrated schematically in Figure 4-1. The data management system records the SCADA monitoring data, which are stored on the District's computer system. This data can then be accessed by the operations and engineering staff to evaluate facility performance. Lift Station Nos. 1, 2, and 20 have pressure transducer level sensors, which provide continuous wet well level data. The remaining lift stations listed in Table 4-1 have a float switch to monitor and control the wet well level.

The District is currently replacing the existing telephone telemetry technology for all lift stations with radio technology. The headquarters and all remote monitoring locations will be upgraded as part of this project.



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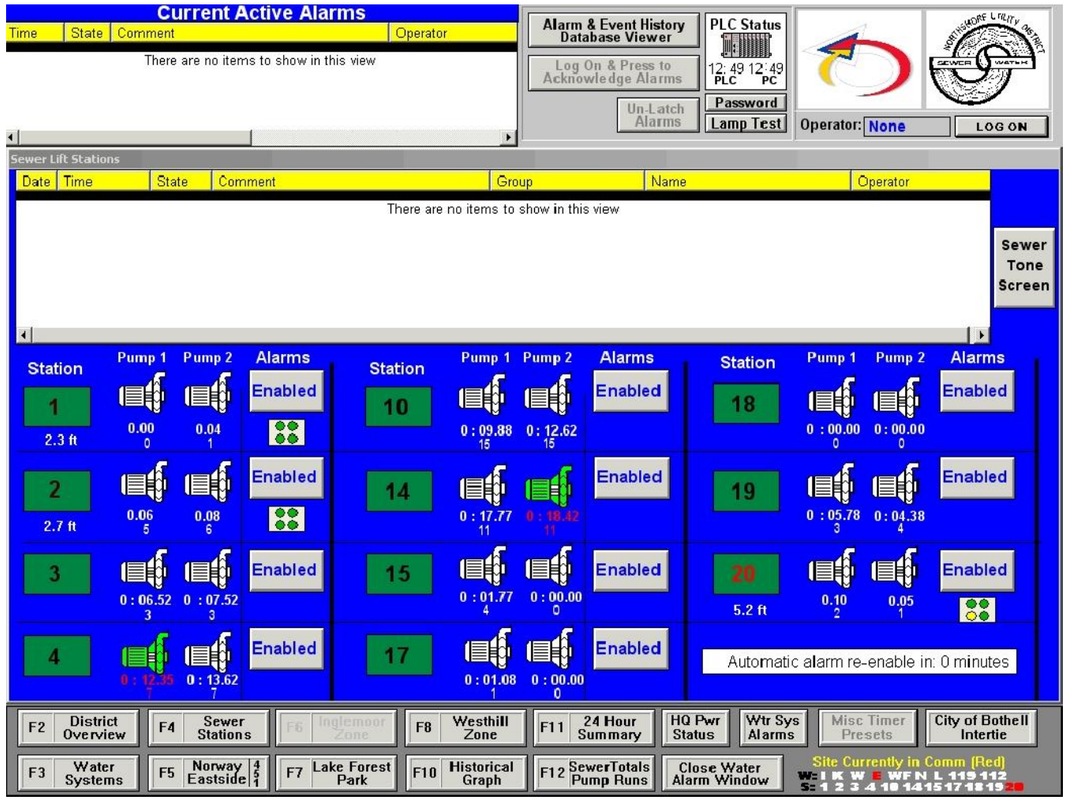

SEWER SYSTEM MAIN PAGE

WASTEWATER SYSTEM PLAN

FIGURE 4-3
SCADA SYSTEM GRAPHICAL INTERFACE SCREEN

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TABLE 4-5

Collection System Size and Year Placed in Service[(1)]

Year Placed in Service (Feet)														
Pipe Dia. (inch)	**1999-Present**	**1994-1998**	**1989-1993**	**1984-1988**	**1979-1983**	**1974-1978**	**1969-1973**	**1964-1968**	**1959-1963**	**1954-1958**	**Unknown Year**	**Total (Feet)**	**Total (Miles)**	**% Total**
< 8	780	641	399		2,824	621		1,458			316	**7,039**	**1.3**	**0.5**
8	112,216	72,338	85,396	79,773	140,446	140,005	159,387	306,660	7,893	2,517	1,644	**1,108,275**	**210**	**86**
10	30	1,334	1,521	1,792	580	1,977	14,926	29,229	894	1,309		**53,592**	**10**	**4.2**
12	1,476	155	2,078			1,267	7,004	32,225	246	1,539		**45,990**	**8.7**	**3.6**
15						8,811	1,802	17,892				**28,505**	**5.4**	**2.2**
16		2,978	168	3,550			165					**6,861**	**1.3**	**0.5**
18				2,614	1,253	6,493	2,994	5,678				**19,032**	**3.6**	**1.5**
21				2,114				3,378				**5,492**	**1.0**	**0.4**
24								2,738				**2,738**	**0.5**	**0.2**
27						768		6,367				**7,135**	**1.4**	**0.6**
30						147						**147**	**0.0**	**0.0**
> 30												**0**	**0.0**	**0.0**
Total (Feet)	**114,502**	**77,446**	**89,562**	**89,843**	**145,103**	**160,089**	**186,278**	**405,625**	**9,033**	**5,365**	**1,960**	**1,284,800**	**240**	**100**
Total (Miles)	**22**	**15**	**17**	**17**	**27**	**30**	**35**	**77**	**1.7**	**1.0**	**0.4**			
% Total	**8.9**	**6.0**	**7.0**	**7.0**	**11**	**12**	**14**	**32**	**0.7**	**0.4**	**0.2**	**100**		

Source: Northshore Utility District GIS Sewer Map.
(1) As of December 31, 2005.

TABLE 4-6

Collection System Pipe Material and Year Placed in Service[(1)]

Pipe Material	1999-Present	1994-1998	1989-1993	1984-1988	1979-1983	1974-1978	1969-1973	1964-1968	1959-1963	1954-1958	Unknown Year	Total (Feet)	Total (Miles)	% Total
Asbestos Concrete					86	3,543	22,862	32,377				**58,868**	**11**	**4.6**
Cast Iron						1,011	9,861	7,608				**18,480**	**3.5**	**1.4**
Clay							545					**545**	**0.1**	**0.0**
Concrete	44		296	1,253	2,972	77,113	148,341	347,900	8,450	5,365	368	**592,102**	**112**	**46**
Ductile Iron	21,982	12,412	13,561	16,066	11,494	17,127	1,409	177			470	**94,698**	**18**	**7.4**
HDPE	1,186	1,086	1,425	360								**4,057**	**0.8**	**0.3**
Permastrand							420					**420**	**0.1**	**0.0**
PVC	9,552	50,038	72,161	67,057	128,165	54,672	1,396	258			335	**383,634**	**73**	**30**
PVC 3034 SDR 35	80,552	13,624	738	1,485	119						787	**97,305**	**18**	**7.6**
PVC C900	407	287	786									**1,480**	**0.3**	**0.1**
PVC N-12			346									**346**	**0.1**	**0.0**
PVC Sch 40	780											**780**	**0.1**	**0.1**
Reinforced Concrete								20				**20**	**0.0**	**0.0**
Unknown Type			250	3,623	2,266	6,623	1,440	17,285	583			**32,070**	**6.1**	**2.5**
Total (Feet)	**114,503**	**77,447**	**89,563**	**89,844**	**145,016**	**155,535**	**153,006**	**365,640**	**9,033**	**5,365**	**1,960**	**1,284,800**	**240**	**100**
Total (Miles)	**22**	**15**	**17**	**17**	**27**	**29**	**29**	**69**	**1.7**	**1.0**	**0.4**			
% Total	**8.9**	**6.0**	**7.0**	**7.0**	**11**	**12**	**12**	**28**	**0.7**	**0.4**	**0.2**	**100**		

Source: Northshore Utility District GIS Sewer Map.

(1) As of December 31, 2005.

TABLE 4-7

Collection System Size and Pipe Material[(1)]

Dia. (inch)	Ductile Iron	Cast Iron	Asbestos Concrete	Concrete	Clay	Reinforced Concrete	HDPE	Permastrand	PVC	PVC 3034 SDR 35	PVC C 900	PVC N-12	PVC Sch 40	Unknown Type	Total (Feet)	Total (Miles)	% Total
< 8	2,140	1,363					356		2,113	82			780	205	**7,039**	**1.3**	**0.5**
8	75,295	10,973	44,620	471,520	545		3,701	420	376,339	96,787	1,480	346		26,249	**1,108,275**	**210**	**86**
10	3,633	2,403	8,800	33,010					3,779	30				1,937	**53,592**	**10**	**4.2**
12	2,528	3,577	1,783	36,031					781	405				885	**45,990**	**8.7**	**3.6**
15			3,407	25,098											**28,505**	**5.4**	**2.2**
16	6,696	165													**6,861**	**1.3**	**0.5**
18	4,257		260	13,835										680	**19,032**	**3.6**	**1.5**
21				3,378										2,114	**5,492**	**1.0**	**0.4**
24				2,718		20									**2,738**	**0.5**	**0.2**
27				6,513					622						**7,135**	**1.4**	**0.6**
30	147														**147**	**0.0**	**0.0**
Total (Feet)	**94,696**	**18,481**	**58,870**	**592,103**	**545**	**20**	**4,057**	**420**	**383,634**	**97,304**	**1,480**	**346**	**780**	**32,070**	**1,284,800**	**240**	**100.0**
Total (Miles)	**18**	**3.5**	**11**	**112**	**0.1**	**0.0**	**0.8**	**0.1**	**73**	**18**	**0.3**	**0.1**	**0.1**	**6.1**		**0.0**	**0**
% Total	**7.4**	**1.4**	**4.6**	**46**	**0.0**	**0.0**	**0.3**	**0.0**	**30**	**7.6**	**0.1**	**0.0**	**0.1**	**2.5**	**100**		

Source: Northshore Utility District GIS Sewer Map.

(1) As of December 31, 2005.