CHAPTER 3

COLLECTION SYSTEM

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WASTEWATER COLLECTION SYSTEM

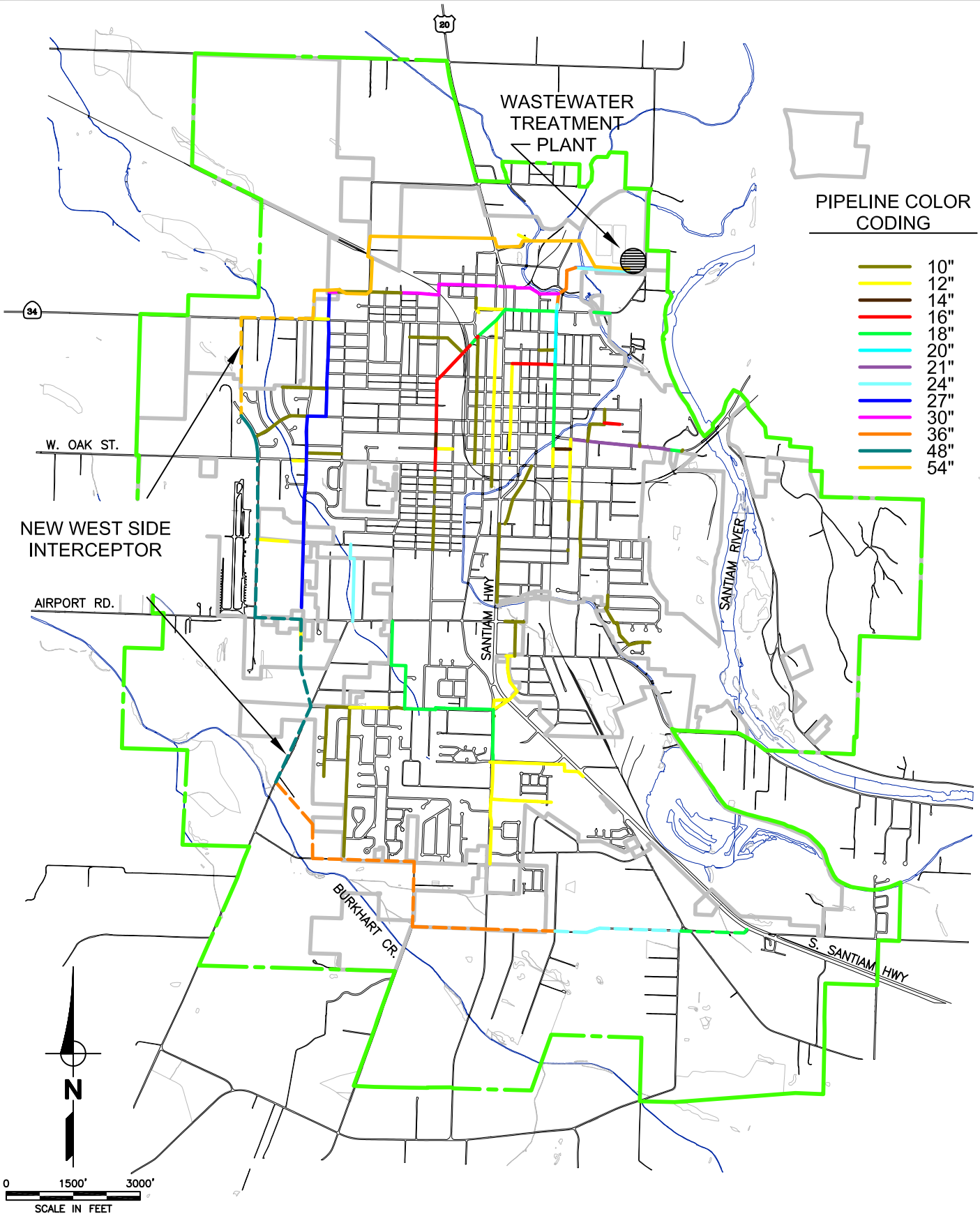
The City of Lebanon is responsible for operating and maintaining the collection system that conveys wastewater from throughout the City to the wastewater treatment plant. This chapter describes the collection system infrastructure, assesses the condition of the pipeline network, and estimates the influence of infiltration and inflow (I/I) in the system.

SYSTEM DESCRIPTION

The collection system includes three main interceptors and a lift station. The existing collection system network along with the future alignment of the West Side Interceptor are illustrated in Figure 3-1. For clarity, the 6 and 8-inch pipes are not shown. Table 3-1 provides an inventory of pipes in the collection system according to diameter.

Table 3-1. Collection System Inventory

Sewer Pipe Diameter, inches	Pipe Length, feet
6	8,900
8	150,900
10	26,500
12	19,900
14	700
16	4,200
18	10,100
20	1,200
21	2,300
24	3,200
27	8,700
30	3,900
36	1,100
54	7,650
Total	249,250



LEGEND

- CITY LIMITS
- URBAN GROWTH BOUNDARY
- FUTURE WEST SIDE INTERCEPTOR

Figure 3-1

CITY OF LEBANON

COLLECTION SYSTEM

WEST YOST & ASSOCIATES

CAD FILE: 516-00-02-FIG_3-1.dwg CFG FILE: 516-00-02-FIG_3-1.PC2 DATE: 4-1-04 VLF

Gravity Sewers

Most of Lebanon's collection system is composed of gravity sewers, generally flowing from south to north where the treatment plant is located. The existing West Side Interceptor flows south to north along 11th Street to the Harrison Street Pump Station. The pump station then lifts the wastewater into the newly constructed 54" West Side Interceptor. The East Side Interceptor flows south to north along Williams Street. The Downtown Interceptor flows south to north along 5th Street. The East Side and Downtown Interceptors converge in a 36-inch line that subsequently splits into parallel 27-inch and 24-inch pipelines that bring the wastewater flow to the influent pump station at the wastewater treatment plant (WWTP). The proposed new West Side Interceptor will serve all new development in the southern and western parts of town and will eventually eliminate the Harrison Street Pump Station. A portion of the new West Side Interceptor has been constructed along the north side of town from the WWTP to the intersection of Hansard and Harrison Street just east of the Harrison Street Pump Station.

The system was constructed in many phases during the past sixty years and the materials of construction varied from project to project. The east side and downtown interceptors installed in 1941, are of vitrified clay construction. The old West Side Interceptor is a reinforced concrete line constructed in 1965. The new West Side interceptor is also a reinforced concrete line. The older portions of the collection system were originally constructed as combined wastewater/stormwater sewers. Since 1986, the City has constructed new stormwater sewers in the older parts of town to separate catch basins from the wastewater collection system. However, the system inspections indicate that storm water inflow rates are still high in the Lebanon collection system.

Emergency Overflows

The collection system contains overflow points for bypassing wastewater during high flow or emergency conditions. The Harrison Street Pump Station overflow is designed to discharge to Burkhart Creek via a railroad ditch. The other five overflows are on sanitary sewers in 16th Street and 15th Street which discharge to Burkhart Creek via storm drains. During extreme storm events, there are also some overflows from unplanned locations. Past raw sewage bypasses have generally been the result of insufficient capacity of the Harrison Street Pump Station and insufficient pipeline capacities in the old West Side Interceptor. This situation will be corrected with completion of the proposed new West Side interceptor.

Modeling of the five-year return frequency design storm was conducted in 1997 and summarized in the report entitled, "West Side Interceptor Model Analysis and Study". The report indicated that construction of the proposed new West Side Interceptor will greatly reduce peak flow surcharging of the collection system upstream of the old West Side Interceptor. However, the modeling study predicted that insufficient pipeline capacities will still cause some overflow problems in the upper reaches of the system even after the improvements are completed. The study suggested that these capacity deficiencies might be best addressed through correction of the defects that allow excessive groundwater infiltration and stormwater inflow rather than by replacing pipelines. Another possible solution is to connect the existing West Side Interceptor to the proposed new West Side Interceptor at key points to reduce or eliminate the overflow problems in the upper reaches of the existing West Side Interceptor.

Pump Stations

The collection system contains two pump stations. The Harrison Street Pump Station lifts flow within the existing West Side Interceptor and contains two horizontal, self-priming centrifugal pumps and a standby engine generator. The pump station discharges through a 10-inch force main that runs east approximately 750 feet and discharges into the newly constructed 54-inch West Side Interceptor at the intersection of Hansard and Harrison. As noted earlier, this pump station will ultimately be abandoned and flows will be conveyed by gravity to the proposed new West Side Interceptor. The Garvard Street Pump Station is located at the intersection of Park Street and Garvard Street and lifts flow into the upper reaches of the East Side Interceptor. It serves development in and around the Pioneer School area. The pump station contains two self-priming pumps and relies on a portable backup generator. A condition of further development in the pump station service area will be the provision of permanent standby power.

The collection system discharges into the influent pump stations at the WWTP. The original influent pump station is still operational but is typically held off-line. A new influent pump station was constructed in 2002 to serve the new West Side Interceptor and generally handles the entire plant flow. These pump stations are described in greater detail in Chapter 4, Existing Wastewater Treatment System.

CONDITION ASSESSMENT

The City contracted with ADS Environmental Services (ADS) to conduct smoke testing of the collection system in November 1999. This effort was designed to locate and identify sources of I/I in the system. Infiltration is groundwater that enters the system from the surrounding soil through defective pipes, joints, or manholes. Inflow is stormwater that directly enters the system from sources such as illicit drainage connections, flooded manhole covers, roof downspouts, and other rain induced flow.

ADS tested over 190,000 feet of sewer lines and found 148 defects, ranging from manhole leaks and connected catch basins to defective service laterals and area drains. Table 3-2 provides a full summary of the I/I source defects by type. ADS also developed a flow estimate for each defect based on a worst-case scenario rain event of 1.25 inches per hour. Additional tables in Appendix A summarize the locations and inflow estimates associated with the defects discovered by ADS.

Table 3-2. I/I Source Defects by Type

Defect Type	Number
Sanitary manhole	24
Storm manhole	2
Main sewer	11
Cleanout	32
Catch basin	34
Area drain	3
Transition joint	1
Service lateral	39
Driveway drain	1
Downspout	1
Total	148

INFILTRATION AND INFLOW ANALYSIS

The following analysis of plant flow records provides an overview of the I/I flows associated with Lebanon's collection system. This analysis points to the magnitude of the I/I component of wastewater flows, quantifying the extent to which an I/I flow management program might be capable of reducing peak wet weather flows. The Environmental Protection Agency (EPA) advises that implementation of an I/I reduction program may be a useful flow management strategy if analysis shows that I/I flows exceed their guidelines.

EPA Guidance for Infiltration and Inflow

EPA guidelines for evaluating I/I are based on per capita flow rates. If the measured per capita flow at the wastewater treatment plant exceeds the EPA guideline flow rate, then the sources of infiltration or inflow in the collection system may warrant active management to reduce peak wet weather flows.

The EPA guideline for infiltration is based on a dry weather flow rate defined as the highest 7-day average flow recorded over a seven to fourteen day period during high groundwater season. In Oregon, this condition occurs during the winter when precipitation is absent for seven to fourteen days. If the flow measured during such a period exceeds the EPA's guideline of 120 gallons per capita per day (gcd), then groundwater infiltration sources may warrant the attention of an I/I reduction program. For Lebanon's population of 12,950 (2000 population estimate), the EPA guideline translates into a total system flow of 1.6 million gallons per day (mgd). Since the average dry weather flow at the Lebanon plant is 2.1 mgd or 155 gcd and there are no large industrial wastewater generators, it is apparent that groundwater infiltration is making a significant contribution to the wastewater flow. During wintertime dry periods in the recent past, 7-day average flows range between 3.04 and 4.66 mgd as summarized in Table 3-3. In each of the analyzed periods, the measured plant flow exceeded the EPA guideline of 1.5 mgd.

Table 3-3. High Groundwater Dry Weather Flows

Period	Seven-Day Average Flow, mgd	Seven-Day Average Flow, gcd	Total Precipitation, inches
12/20 to 12/31/99	3.87	299	0.00
3/6 to 3/12/00	4.66	360	0.15
4/5 to 4/11/00	3.04	235	0.00
5/15 to 5/21/00	3.27	253	0.00
Average	3.71	287	0.04
EPA Guideline	1.60	120	0.00

The EPA guideline for evaluating inflow is based on the highest daily flow recorded during a storm event. The EPA suggests that inflow problems may warrant attention if the measured high daily flow is greater than 275 gcd. For the Lebanon population, this results in a total system flow of 3.5 mgd. A review of plant records shows that the highest recorded daily flow was 13.9 mgd or 1,100 gcd in November 1998. Because EPA's infiltration and inflow guidelines are exceeded, an analysis is performed in Chapter 7, Liquid Stream Alternatives, to determine if an I/I reduction program for Lebanon's collection system is cost effective.

Estimation of I/I Contribution to Plant Flow

The contribution of I/I to the wastewater flows measured at the Lebanon WWTP can be estimated from the difference between the peak base wastewater flow rate and the current peak wet weather flow (PWWF). The current PWWF for Lebanon is 21 mgd as described in Chapter 5, Wastewater Characteristics. The base wastewater flow rate must be estimated from a per capita contribution since groundwater infiltration occurs in the collection system even during the driest days of summer. Using a per capita base flow rate of 120 gallons per day and the year 2000 service area population of 12,950, the base flow rate for Lebanon is 1.6 mgd. Plant operators typically find that the daily peak flow is twice the daily average flow due to diurnal variations in the wastewater flow. Accounting for the diurnal variation, the peak base flow rate for the City is approximately 3 mgd. Therefore, the current contribution from I/I sources to Lebanon's PWWF is 18 mgd. This figure represents the theoretical maximum by which the PWWF might be reduced through the implementation of a comprehensive I/I removal program and an aggressive sewer maintenance program that keeps sewers, manholes, and service laterals in top condition. The actual percentage of the 18 mgd that might be removed through a cost-effective I/I removal program is determined in the analysis included in Chapter 7.

Existing I/I Removal Program

The City of Lebanon is required by their NPDES permit to identify and remove sources of I/I. Thus, the City has implemented a 5-phase construction plan that began in 1998 to remove I/I sources from the collection system. The first four phases of the program consist of replacing a combined sanitary sewer system in the downtown area. The fifth and last phase of the program is to eliminate other significant sources of I/I within the collection system. The first two phases were completed and Phase 3 is scheduled to be completed during the summer of 2006. Phase 4 is scheduled for 2006/2007 and Phase 5 is scheduled for 2009/2010. Due to historical flow monitoring inaccuracies and the significant variability in rainfall from year to year, the effects of recent improvements have not been identifiable. The City is currently installing flow monitors in the collection system to establish baseline data that can be used to evaluate the effects of future I/I removal efforts.