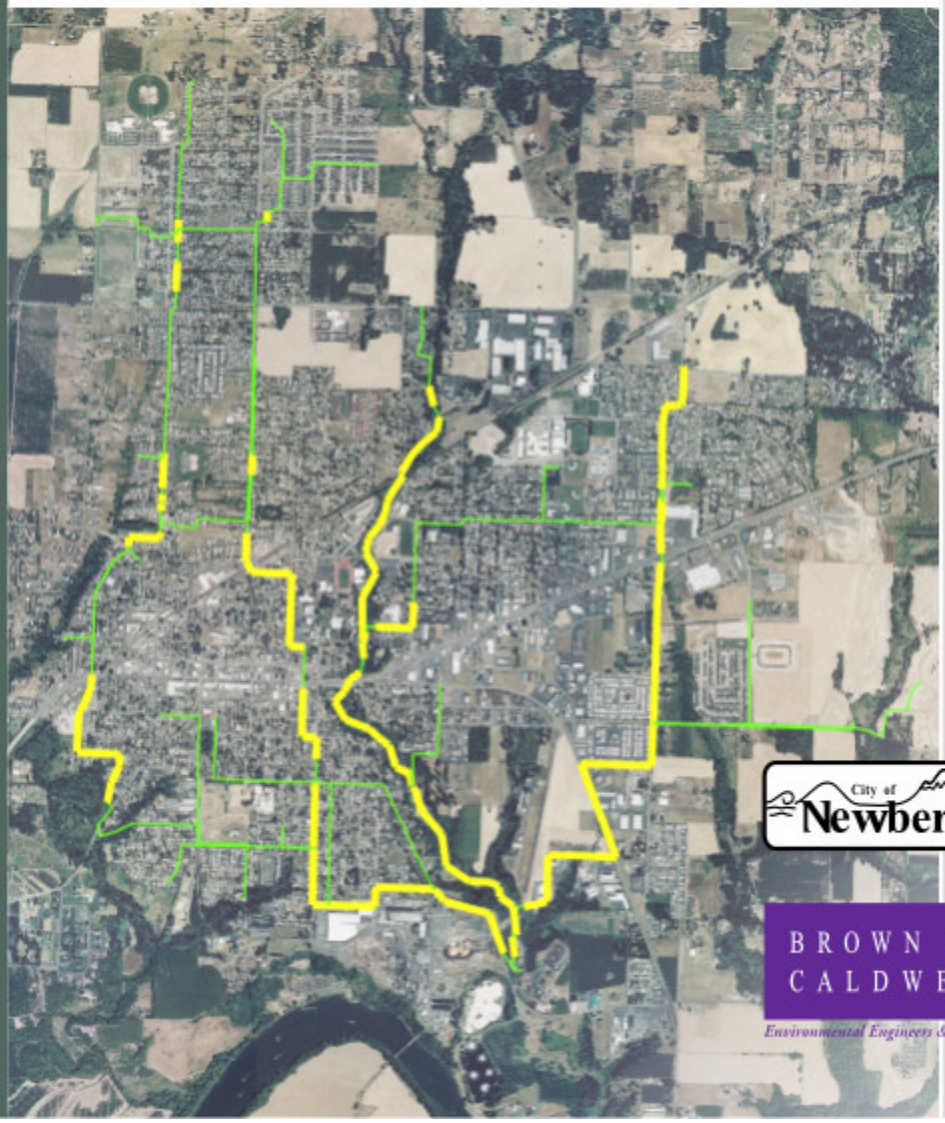
City of Newberg

Sewerage Master Plan Update 2007

Executive Summary



City of Newberg

BROWN AND CALDWELL

Environmental Engineers & Consultants

EXECUTIVE SUMMARY

The City of Newberg (City) provides wastewater collection services to over 21,000 people spread across an area of approximately 5.2 square miles. This service is provided via the sanitary sewer collection system that is owned, operated, and maintained by the City. Currently, the sanitary collection system connects to over 5,600 residential and nearly 500 commercial and industrial customers.

Demands on the sanitary collection system are expanding as Newberg's population grows. Land use and population have changed substantially since the preparation of the Sewerage Master Plan in 1985. Then, the City's population was approximately 12,000. Since then the City has experienced an average growth rate of approximately 2.6 percent with a 2007 population of over 21,000 people. This Sewerage Master Plan Update (SMPU) provides capital improvement and maintenance program recommendations for improving sanitary collection system service and for addressing the future needs of the system through the planning horizons of 2025 and 2040.

Goals

The primary goal of this SMPU is to provide guidance on the capital requirements of the sanitary collection system as required for growth through the 2025 and 2040 growth horizons. In addition, it includes recommendations to the maintenance program for improving the performance of the collection system.

To achieve the goals, the planning approach focused on three objectives:

- Accurate identification of capital needs based on the development and use of a comprehensive hydraulic model calibrated to existing dry and wet weather conditions.
- Minimization of the financial burden on ratepayers by identifying when capital requirements are required.
- Optimization of collection system performance through evaluation of operation and maintenance program needs.

Basis of Planning Summary

A number of physical factors influence the size and the location of sanitary sewer flows. These include the general history and condition of the existing facilities, topography, precipitation, planning area, and population.

General History

The City owns and maintains the sanitary sewer collection system that comprises over 73 miles of gravity pipelines, ranging in size from approximately 4 inches to 36 inches in diameter; 1,700 access structures (i.e., manholes and cleanouts), seven lift stations; and about 3 miles of sanitary force mains. The locations of the major trunk lines are shown in Figure ES-1. The trunk lines are the primary pipes for conveying sanitary flows to the Newberg Wastewater Treatment Plant (WWTP) and are the focus of the modeling effort. Although not shown, numerous smaller sewers feed into the trunk lines. While not as critical as the trunk lines for conveying flow to the WWTP, these smaller sewers that constitute 62 percent of the overall collection system have an impact on system performance (see discussion on infiltration/inflow [I/I]).

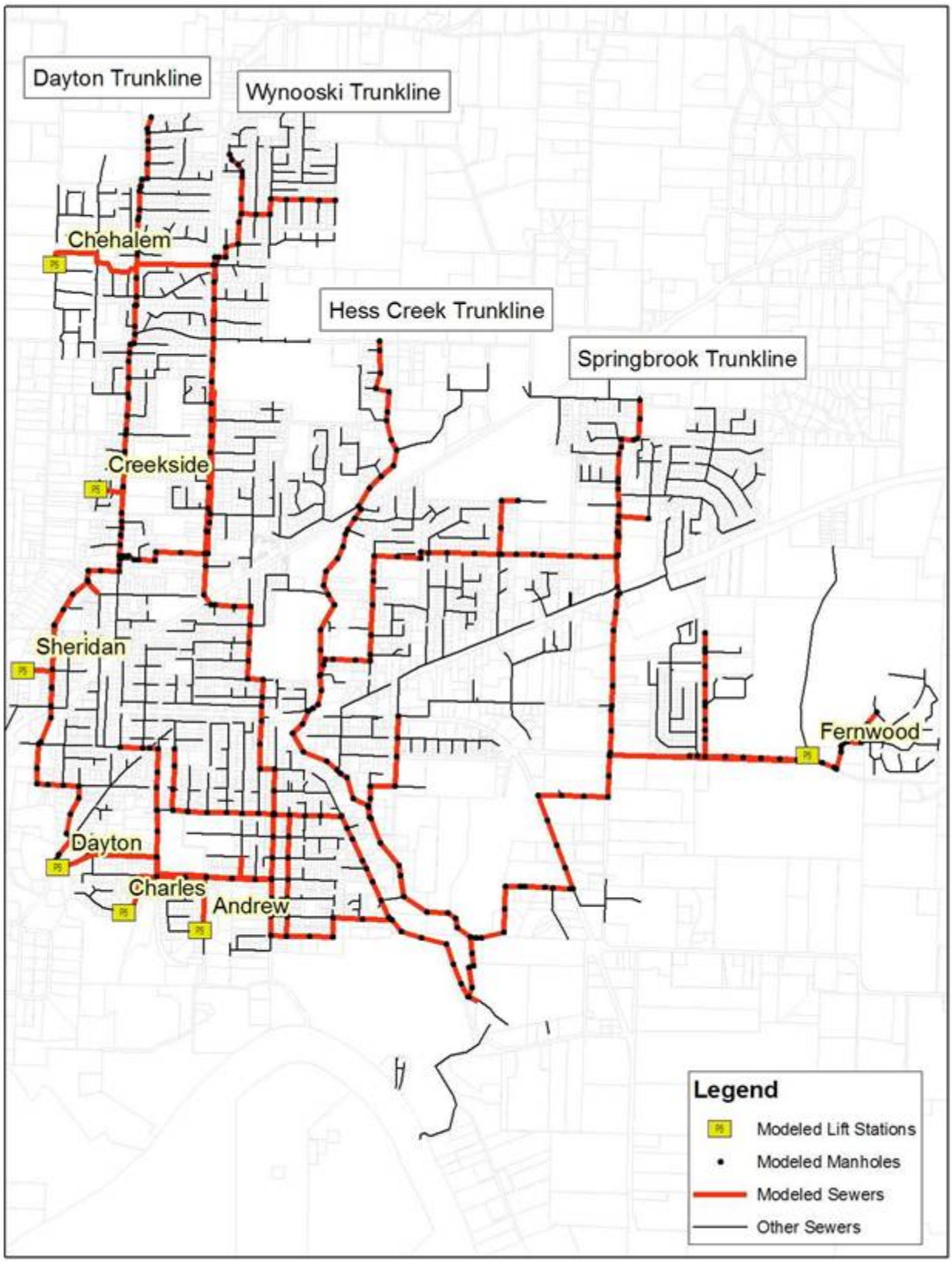


Figure ES-1. Trunk Line Map

Sewer System Condition

Figure ES-2 summarizes the age of the collection system. Approximately 62 percent of the system is less than 30 years old and is in good condition. About 16 percent of the system is over 50 years of age with many pipes in service for 80 to 90 years. While the serviceable life of a sanitary sewer is generally assumed to be at least 75 years, pipes deteriorate over time and the effects of this deterioration are evident. In addition, the older sections of the city were constructed with vitrified clay pipe. The joints in many of these clay pipes have failed, allowing stormwater and groundwater to enter into the sanitary collection system. The addition of non-sanitary flows (i.e., I/I) into the collection system decreases the available hydraulic capacity in the existing pipes and increases the size and cost of WWTP facilities.

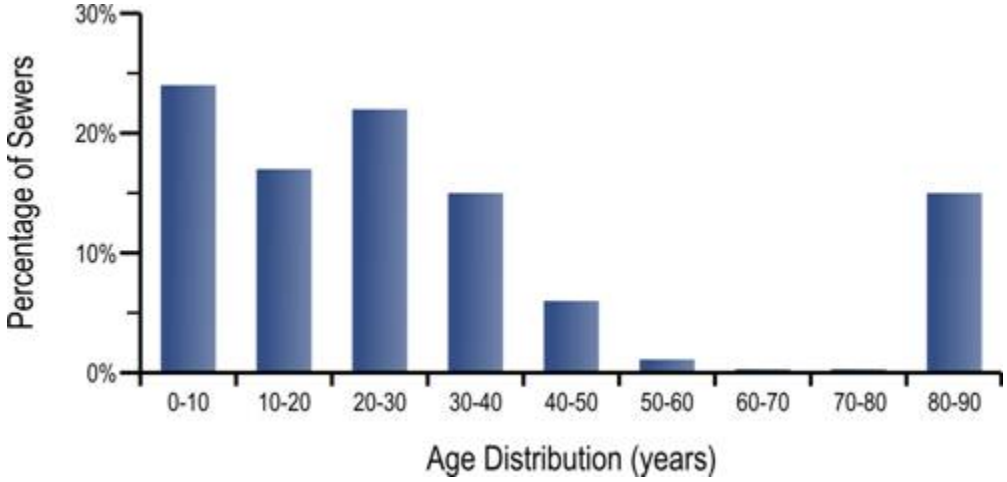


Figure ES-2. Pipe Age Distribution

Topography

Most of Newberg is relatively level with slopes of less than 3 percent, and the city lies at an elevation of about 160 feet above mean sea level. The level terrain facilitates development for residential, commercial, and industrial uses. As the city grows beyond its current Urban Growth Boundary (UGB), the hills that are located on three sides of it and the Willamette River to the south will impact growth and construction of sewer system extensions. Generally, the increased elevations in some of these areas will not hinder construction of new sanitary sewers; however, sanitary lift stations may be required in some areas to convey flow from one area to another where the topography does not provide for gravity flow or where the cost of gravity flow would be prohibitive.

Precipitation

The average annual rainfall within the city is 42 inches, with most rainfall occurring from fall through spring. The summers are typically warm and dry, particularly from July through September. The 5-year (once in 5-years recurrence interval), 24-hour, winter storm event is used for modeling in accordance with Oregon Department of Environmental Quality (DEQ) requirements for considering the effects of stormwater on the sanitary sewer collection system. The storm event includes consideration of antecedent rainfall conditions including high groundwater to accurately represent local wet winter conditions.

Planning Area and Population

The planning area for this SMPU is shown on Figure ES-3. The area includes build-out of the current UGB with inclusion of several Urban Reserve Areas (URAs) by 2025, and inclusion of the remaining currently defined URAs by 2040. The added acreage and population figures associated with this growth are listed in Table ES-1. Increased acreage and population directly impact the quantity and location of flows in the sanitary collection system.

Table ES-1. Current and Future Acreage and Population

Category	Current	Future, 2025	Future, 2040
Acreage	2,385	4,261	5,334
Population	19,797	37,962	53,002

Note: The population figures above are based on information provided by the City on equivalent dwelling units and number of people per dwelling. The total population calculated using this approach is less than the current estimated population of approximately 21,000.

Flow Model Development and Results

Flow modeling is used to simulate the flows in the sanitary collection system for both current and future planning scenarios. Flow model selection, model calibration, and analysis of the modeling results are important aspects of the flow modeling activity as discussed in the following paragraphs.

Model Selection

The City's trunk line system was modeled using InfoSWMM, a product of MWH Soft, Inc. InfoSWMM is a type of geographic information system (GIS)—a fully integrated, highly advanced, and comprehensive hydrologic, hydraulic, and water quality simulation model that can be used for modeling urban storm water and wastewater collection systems. Use of this software provides City staff with a modeling tool that is similar in structure to the MWH software used to model the City's water system. This similarity will aid City staff in use of this model.

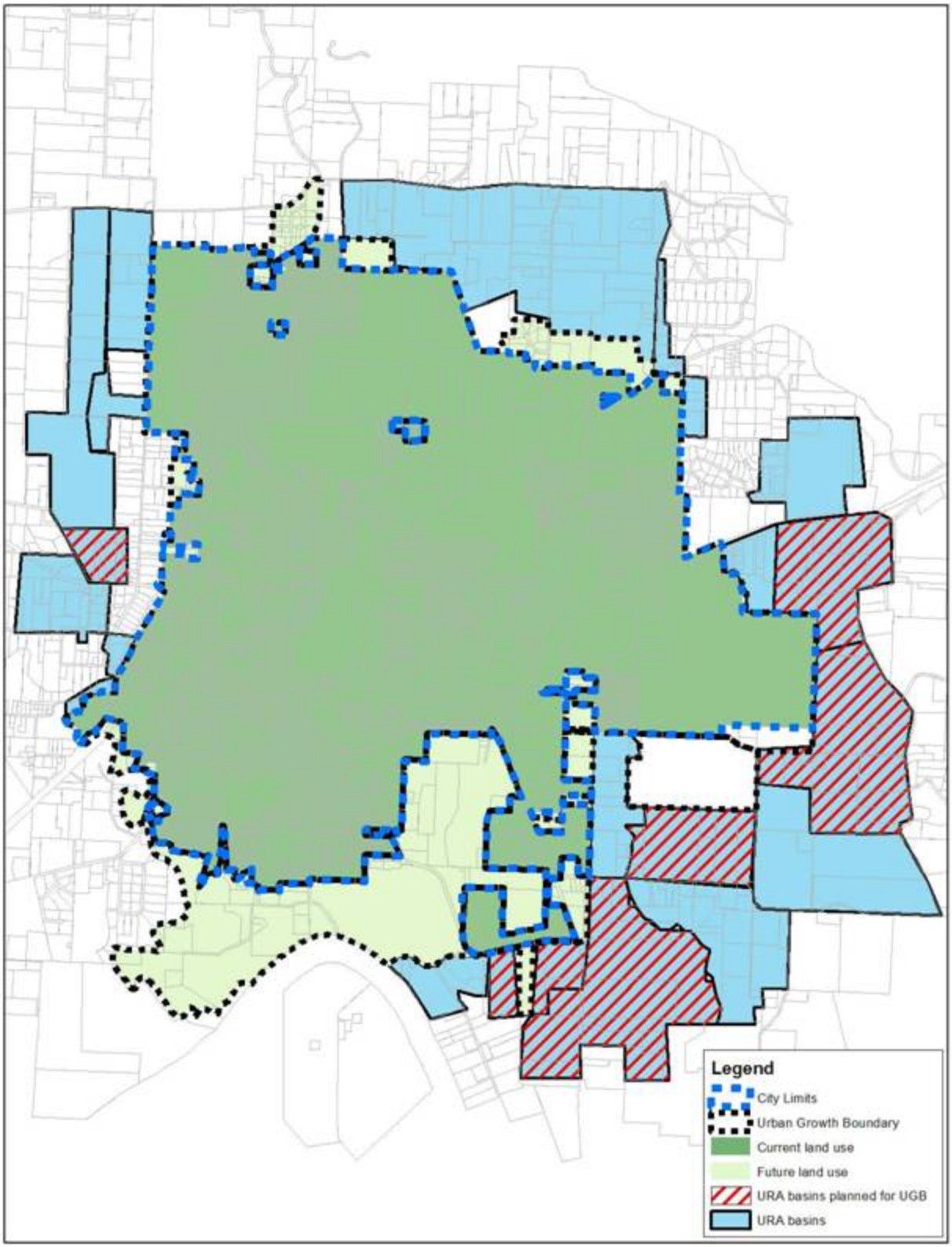


Figure ES-3. Planning Area

Flow Monitoring and Model Calibration

The City implemented a flow monitoring program in preparation for the master planning effort. Information collected from the flow monitoring program was used to calibrate the model so that it could accurately represent dry and wet weather flow conditions.

The flow monitoring revealed that large quantities of non-sanitary water entering the sanitary collection system as I/I. I/I is derived from rain and groundwater sources that enter the collection system from rain leaders, basement drains, possible cross connections with the storm drain system and at cracks and leaky joints in the piped system. Table ES-2 lists the flow monitoring results for the four major trunk line systems that are shown in Figure ES-4. I/I contributions are shown on a gallons per day (gpd) per acre basis. The dry weather (i.e., base sanitary plus ground water infiltration) flows are significantly less than the peak wet weather flows with peak wet to dry weather ratios ranging from 4.9 to 13.8. While I/I is a common problem found in collection systems throughout the Willamette Valley, DEQ considers peak wet to dry weather ratios in excess of 4 to be excessive, and requires justification for their occurrence.

Table ES-2. I/I Contributions Summary

Rank	Basin	gpd per acre	Peak flow/average flow
1	North Central (Hess Creek)	9,194	13.8
2	Wynooski	8,917	12.8
3	Dayton	6,463	8.5
4	Springbrook	2,068	4.9

Modeling Results

The model was used to develop and route flows for the existing, future 2025, and future 2040 planning scenarios. The existing modeling scenario identifies deficiencies in the collection system as it exists today. The 2025 modeling scenario identifies how growth and infill within the current UGB and added URAs will impact flows over the next approximate 20-year period. The 2040 modeling scenario is used to identify the long-term needs of the system through the inclusion of the remaining (currently) identified URAs.

Pipe capacity and replacement criteria are based on the flow capacity of the pipe. A pipe is considered to be undersized when the predicted flow exceeds the capacity of the pipe as determined by Manning's Equation. When the flow exceeds the capacity of the pipe, a surcharged pipe condition exists. Pipes in a surcharged condition have a higher potential for sanitary sewer overflows (SSOs) and sewer backups which can lead to National Pollutant Discharge Elimination System permit violations.

The model predicts that 56 pipes are undersized for the current planning horizon. As flows increase by 2025, the number of undersized pipes increases to 115, and by 2040, 149 pipes will be undersized.

Pipes that are undersized for the existing conditions and the future planning horizons are shown in Figure ES-4.

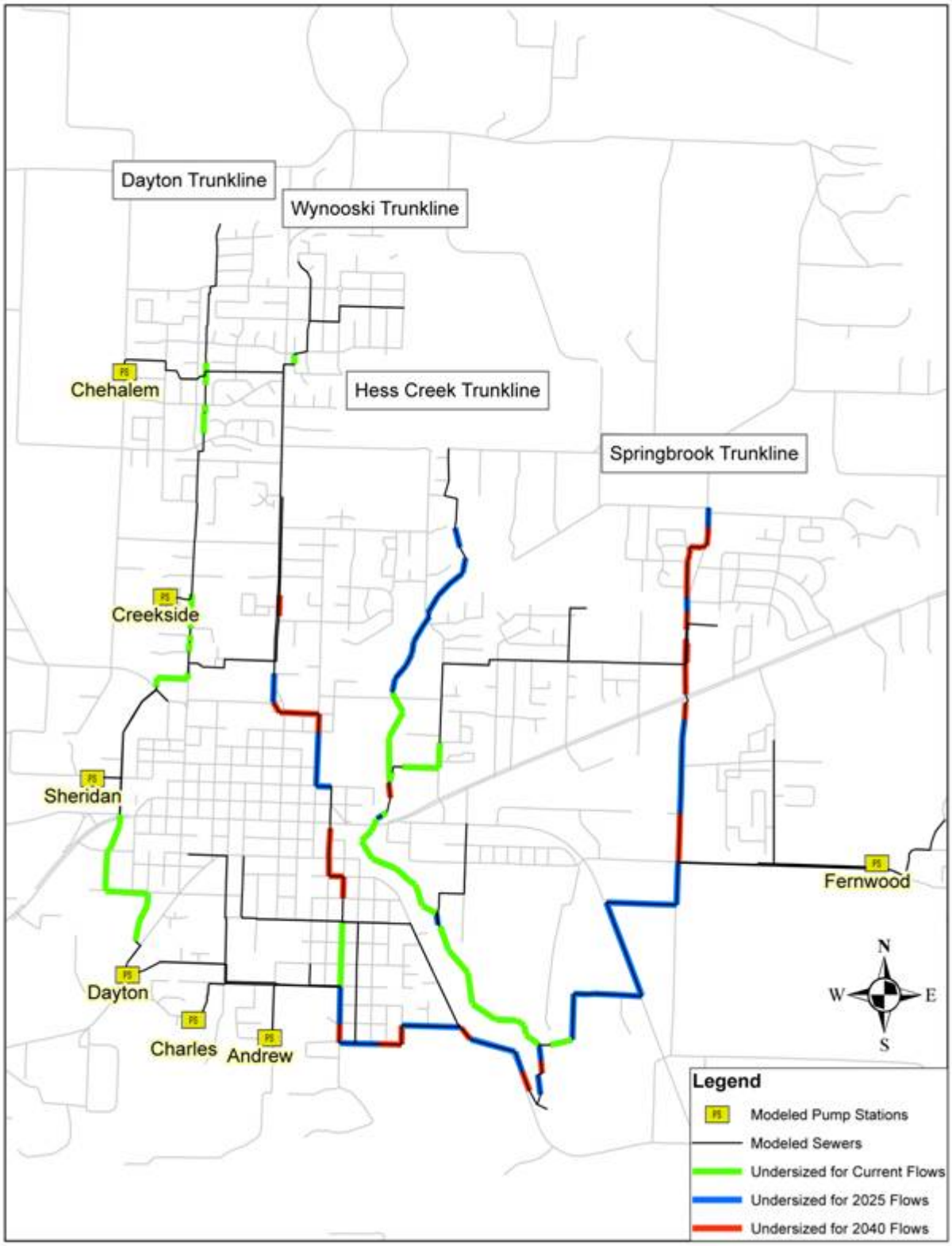


Figure ES-4. Undersized Pipes

Capital Improvement Recommendations

The capital improvement projects identified by this SMPU include projects to address existing and future system deficiencies. The projects include pipe replacements and lift station improvements for conveying the projected flows. Other improvements are recommended to address the needs of the aging elements of the collection system and to reduce the amount of I/I that enters the system.

The pipe replacement recommendations are based on sizing pipes to convey the 2040 flow. A detailed listing of the recommendations is included in Chapter 6. The recommended replacement pipes are grouped into "project packages" that facilitate design and bid activities. Each package typically includes two or more contiguous pipes with a project package cost in the range from about $300,000 to $600,000 in design and construction costs.

In addition to pipe replacement, the modeling effort identified hydraulic deficiencies at some of the City's existing lift stations. The improvements and costs for expanding the capacities of these lift stations are included in Chapter 6. The Dayton Avenue Lift Station and force main are in immediate need of upgrading to prevent future SSOs.

Another recommendation of this SMPU is the implementation of a rehabilitation and replacement (R&R) program to address the needs of an aging sanitary collection system that has structural and operational deficiencies, including conditions that allow for unacceptable levels of I/I. The R&R program will focus on restoring the pipes to good structural and operational condition while reducing the amount of I/I that enters the system. Sufficient re-investment in the sanitary collection system through the R&R program will reduce sewer maintenance requirements, decrease the potential for catastrophic failures, and delay expenditures at the WWTP.

A priority ranking of projects is included in Chapter 6. In general, the projects are ranked in accordance to when increased capacity will be required. City staff should re-prioritize the list each year to ensure that the specific needs of the City are addressed appropriately.

Table ES-3 lists the total cost of recommendations by category, including pipe replacement, lift station improvements, and collection system extensions (trunklines and lift stations) for the 2025 and 2040 planning scenarios. Also shown are the annual costs for implementing a R&R program.

Table ES-3. Total Cost of SMPU Recommendations

Component	Estimated cost of improvements, dollars
Pipe replacement, 2040	23,866,000
Lift station upgrades, 2040	5,939,000
Collection system extensions, 2025	9,641,000
Collection system extensions, 2040	21,838,000
Total	61,284,000
Annual costs	
R&R program	1,100,000

Table ES-4 lists the annual costs of recommended capital improvements for the next 10 years. This table does not include the recommended annual expenditure as required for the R&R program. As with the priority ranking of projects, City staff may need to increase or decrease the annual expenditures based on

actual need.

Table ES-4. Annual costs of recommended CIP from 2008 to 2017	
Year	Estimated cost of improvements, dollars
2008	5,119,000
2009	1,592,000
2010	1,629,000
2011	1,660,000
2012	1,599,000
2013	1,494,000
2014	1,613,000
2015	1,515,000
2016	1,718,000
2017	1,602,000

Note: Year 2008 includes the Dayton Avenue Lift Station upgrade ($3,529,000).

Maintenance Program Recommendations

The SMPU effort includes an evaluation of the existing sewer maintenance program. The results of the evaluation and specific maintenance program recommendations are documented in the *Maintenance Program Evaluation*, Brown and Caldwell, January 2007. A copy of the technical memorandum is included as Appendix A.

In summary, the City's sanitary sewer maintenance program is primarily reactive; that is, most inspections, cleaning, and repairs are performed as the result of problems typically reported by customers. A preventive maintenance program is required to identify and address sewer deficiencies before they become severe enough to cause problems to customers. A sanitary collection system that is operated from a primarily reactive management position will continue to degrade, resulting in an increase in the number of problems as the system ages, including defects that can create sinkholes, sewer backups, basement flooding, and other forms of SSOs.

While the City does implement some elements of a preventive maintenance program, preventive maintenance activities are diminished from what they were in the early 1990s when a greater number of maintenance staff were funded. To become on par with highly performing cities throughout the country, the City is encouraged to move the maintenance program toward a more proactive, preventive maintenance approach, thus providing an acceptable level of service to the community at reasonable cost.

To develop a preventive maintenance program, the City needs to provide additional maintenance staffing. Total staffing for the sanitary sewer maintenance program should be 11.20 full time equivalents (FTEs). This is an increase of 4.98 FTEs over the current level of funding. Such staffing is required to maintain the condition of the sanitary sewer system at an acceptable level of service to the community.

Funding for additional maintenance staff is required to maintain the current level of service. Without this support, sewer performance and the resulting level of service provided to the community will decline. In addition, as the City grows and the sanitary sewer system is extended to cover a larger geographic area, additional financial and resource support for the maintenance program will be required.