Sewerage Facilities Plan

City of Milwaukie

CH2M HILL

1994

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Acknowledgments

Many individuals participated in the development of the City of Milwaukie Sewerage Facilities Plan. The City would like to express its appreciation to the following members of the Citizen Advisory Committee for their participation and input into the plan.

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Tim Corbett, Director of Public Works, City of Milwaukie
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Executive Summary

Purpose

This facilities plan reports sewerage facility needs and identifies facilities to serve the City of Milwaukie (City) until the year 2010. Facilities needed for ultimate build-out are also identified. The plan includes the needs for repair, improvement, or expansion of the existing sewage collection system that is owned and operated by the City.

Findings

Study Area

The Milwaukie city limits delineate the general boundaries of the study area. However, the study area extends east to Linwood Avenue to include the currently unsewered area that flows by gravity to the Milwaukie sewage collection system.

Projected Population

Population projections for the City of Milwaukie are based on the rate of growth published by the Metropolitan Service District (METRO) in its June 1989 Regional Forecast. The year 2010 population projection is 19,717 (without annexation of new areas). *Milwaukie's Periodic Review, Comprehensive Plan Update,* projects an ultimate build-out population of 22,200.

Condition of Existing Collection System Pipelines

The average age of the sewer collection system is 30 years. No manhole overflow events have been observed. This indicates that the system is handling current flows. The collection system does not have any known street or parking lot drain connections. The system is generally in good condition, although the older sections may need repair. The City has initiated a TV inspection program for the sewers that has provided positive results. The needed repairs identified by the TV inspection program have been made.

Maintenance problems were noted at the Lakeside Apartment sewer. Grease buildup in the line is difficult to clean because of the sewer configuration. Ponding problems (low spots that do not flow freely) were noted at the 30th Avenue sewer, the Harrison Street and Highway 224 sewer, and at the manhole at the intersection of Plum Street and Sequoia Street. Odor complaints have been received about the sewer in 42nd Avenue between Fieldcrest Drive and Olsen Street. This line and the upstream section to Harvey Street have required cleaning twice a year.

Condition of Existing Pump Stations

The Harrison Street, Island Station, and Johnson Creek Boulevard Pump Stations are in good condition. The pumps and controls in the Home and Monroe Pump Station and Brookside Pump Station are in poor condition.

Projected Capacity Problems

The City's collection system was analyzed with the CH2M HILL System Analysis Model (SAM). According to the model results, the capacities of the Brookside, Harrison, Johnson Creek Boulevard, and Island Station Pump Stations are adequate for ultimate build-out. The results indicate, however, three potential capacity restrictions in the collection system at ultimate flow rates: (1) Jefferson Street to Kellogg Creek WTP interceptor, (2) S.E. Filbert Street trunk, and (3) Brookside trunk.

The capacity of the Home and Monroe Pump Station is not known. Field measurements will be needed to determine the current capacity of the pump station.

Infiltration/Inflow

Infiltration/Inflow (I/I) was evaluated by analyzing available continuously recorded flow records. The I/I flows per acre of the North, Mid, and South Milwaukie Basins were found to be above the 1,500 gallons per acre rate that was set as a design parameter in the original collection system plan for the North Clackamas Service Area (NCSA).

Milwaukie Share of Kellogg Creek WTP Influent Flow and Pollutant Load

Clackamas County Service District No. 1 provides the City with sewage treatment service at the Kellogg Creek WTP. The operating and capital costs for the plant are currently being shared in accordance with an intergovernmental agreement executed in 1970, which apportions costs on the basis of proportion of total wastewater influent flow. The strength (concentration) of pollutants in the wastewater flow from Milwaukie, however, may be different from the average strength of flow from the NCSA. The City's share of the total pollutant load (strength times flow) is an important measure to consider in the determination of the City's share of the treatment costs. The City's proportion of the pollutant load will decline as growth in NCSA outpaces the City's growth. A new agreement with CCSD1 should consider both flow and pollutant load. This would provide a more equitable way of distributing costs.

Recommendations

Based on the findings of the facilities plan, several projects were recommended. These are listed and described in Table ES-1.

Table ES-1
Recommended Projects

Project	Description	Timing	Cost[a]
Home and Monroe Pump Station	Replace pumps with 400 gpm pumps and replace controls.	Scheduled for Fiscal Year 1993-94	$60,000
S.E. Filbert Street Trunk	Negotiate to divert Brookside flow to the City of Portland.	Now	Cost of diversion
	Or extend the Brookside force main to 32 Avenue. Evaluate ownership.	Now	$200,000
Lakeside Apartment Sewer	Build 200-foot-long bypass sewer east of the apartments.	Now	$30,000
Brookside Pump Station	Negotiate an agreement to divert flow to the City of Portland Lents Trunk and abandon the pump station.	Now	$100,000
	Or replace pumps and controls.	Now	$100,000
Initiate Detailed Flow Monitoring Program	More flow monitoring information is needed for the basins.	Now	$7,000
I/I TV Inspection Program	Conduct TV inspection programs for the following basins, which are ranked by priority (highest first): (1) Brookside area, (2) North Milwaukie Basin, (3) Mid Milwaukie Basin, (4) Harmony Basin, (5) South Milwaukie Basin, (6) Lower Kellogg Basin.	Ongoing, 0 to 10 years	$800,000
Brookside Trunk	Monitor maintenance next 5 years. Replace 1,040 feet of trunk with 12-inch-diameter pipe.	5 to 10 years	$150,000
30th Avenue Sewer	TV inspect to confirm ponding problem. If confirmed, reconstruct 100 feet of line.	1 to 5 years	$15,000
Harrison Street and Highway 224 Sewer	TV inspect to confirm line has sheared. If confirmed, reconstruct.	1 to 5 years	$35,000
Plum Street and Sequoia Street	TV inspect to confirm that line is sheared at manhole. If confirmed, replace manhole.	1 to 5 years	$30,000
42nd Avenue Sewer	TV inspect to confirm it has a low point. If confirmed, reconstruct.	1 to 5 years	$15,000
Jefferson Street to Kellogg Creek WTP Interceptor	Replace with 30-inch-diameter sewer or build 21-inch-diameter relief sewer alongside the existing sewer.	5 to 10 years	$350,000
32nd Avenue to Sherrett Street Sewer	Extend sewer to currently unserved area.	1 to 5 years	$80,000

[a]Possible program cost.

Chapter 1
Introduction

Purpose

This facilities plan has been produced to ensure that adequate sewerage services are provided for the City of Milwaukie (City) until the year 2010, with consideration of the needs of ultimate build-out. The plan evaluates the needs for repair, improvement, or expansion of the existing sewage collection system that is owned and operated by the City. The system must meet the capacity requirements of future population growth.

Background

Sewage from the City of Milwaukie is treated by contract at the Kellogg Creek Wastewater Treatment Plant (WTP), which is operated by Clackamas County Service District No. 1 (CCSD1). It is assumed for this plan that CCSD1 will continue to provide sewage treatment to the City. Because of this arrangement, the City of Milwaukie Sewerage Facilities Plan was produced in conjunction with the *North Clackamas Service Area (NCSA) and City of Milwaukie Sewerage Facilities Plan.* (NCSA is a geographic portion of the CCSD1.) Future treatment needs and requirements are addressed in the NCSA facilities plan. Although the Kellogg Creek WTP is located on the banks of the Willamette River in the City, it is not owned or operated by the City.

This is the first comprehensive sewerage facilities plan for the City. Several studies, engineering reports, and plans concerning various aspects of the treatment and collection systems in the area have been written. Two engineering reports were written previously about the City sewerage system:

- *Johnson Creek Area Sanitary Sewer Study, November 1989*
- *Evaluation of Central Milwaukie and Brookside Basin Sanitary Sewers, March 1985*

This plan consolidates the relevant information from these sources with information provided by City staff.

Scope of Plan

The facilities plan study results are presented in the chapters that follow. The characteristics of the study area are described. Populations are projected based on current land use plans. An inventory of the existing collection system is taken, and conditions are assessed. Future flows are calculated based on the population projections. These projected flows form the

basis for determining future facility needs. The collection system's capacity is compared with expected peak flow at ultimate development. Potential capacity restrictions are identified and alternatives for alleviating the restrictions are presented.

Citizen Advisory Committee

The Clackamas County Board of Commissioners, the governing body for CCSD1, and the City Council of the City of Milwaukie appointed a joint citizen advisory committee for the NCSA facilities plan and Milwaukie facilities plan. The committee served as advisers on the overall facilities needs for Milwaukie and the NCSA. Their comments and concerns regarding the treatment needs and alternatives are reflected in the NCSA sewerage facilities plan. This committee did not offer concerns or comments on the City of Milwaukie collection system needs or facilities plan because the committee focused on the joint concerns of providing treatment facilities that meet both sewage treatment needs and are compatible with the surrounding community.

Chapter 2
Study Area

Study Area Boundaries and Jurisdictions

The Milwaukie city limits delineate the general boundaries of the study area. However, the study area extends east to Linwood Avenue to include the currently unsewered area that flows by gravity to the Milwaukie sewage collection system. The City is bordered by the City of Portland to the north and Kellogg Creek to the south. The Willamette River is the western boundary. Figure 2-1 shows the study area boundaries and Figure 2-2 shows the Milwaukie Service Area and the various jurisdictions involved.

The City owns and maintains a sewage collection system that connects to Clackamas County Service District 1 (CCSD1) and City of Portland sewer systems. The majority of the City's sewage goes to CCSD1 and is treated by the Kellogg Creek Wastewater Treatment Plant (WTP). However, the industrial area along Johnson Creek Boulevard and north of the old Portland Traction Company Railroad is served by the City of Portland sewer system and the sewage is treated by the Columbia Boulevard Wastewater Treatment Plant (WTP). The City holds intergovernmental agreements with the CCSD1 and the City of Portland for wholesale purchase of interceptor use and treatment service. Milwaukie also receives sewage from the City of Portland system. The portion of Portland served by Milwaukie is bounded by Johnson Creek Boulevard on the north, S.E. Roswell Street on the south, S.E. 36th Avenue on the west, and S.E. 40th Avenue on the east. The City of Portland owns and operates this system.

Milwaukie's system also receives sewage from 55 homes and 128 apartments in CCSD1 at the intersection of Price-Fuller Road and S.E. Harmony Road. See Appendix B for a list of these customers. Milwaukie's system also receives sewage from 30 dwelling units that are in the Oak Lodge Sanitary District. These customers, listed in Appendix B, are located south of the South Basin and are generally on the 18th through 27th Avenues south to Lark Street. Milwaukie has 54 dwelling units that are connected to the Oak Lodge Sanitary District System. These units, listed in Appendix B, are located on Dove Street and S.E. 25th Avenue.

Topography

An understanding of topography and surface water is important in facility planning because gravity sewers generally follow the natural drainage patterns. If overflows occur, streams and creeks usually receive the spilled sewage flow. The topography and natural drainage basins of the study area are illustrated in Figure 2-3. Ground surface slopes are generally moderate in the basins in the City.

The Lower Kellogg, Harmony, and North Milwaukie, Middle Milwaukie, and South Milwaukie basins naturally drain to the Kellogg Creek WTP.

Surface Water

Mount Scott, Kellogg, Johnson, and Spring Creeks are located in the study area. Mount Scott Creek flows into Kellogg Creek, and Kellogg Creek flows into the Willamette River. Johnson Creek flows through Milwaukie near the northern and western city limits just before it empties into the Willamette River. Spring Creek is a small stream in the western part of the City that flows into Johnson Creek.

Kellogg Lake, which is the only lake in the study area, is located on Kellogg Creek near its confluence with the Willamette River in the southern portion of the City.

Land Use

Land use patterns affect the amount of sewage generated by the community. The ultimate flow that can be generated from a parcel of land is determined by the land's use. Therefore, this sewage facilities plan is based on the existing flow plus the expected sewage flow from each type of undeveloped land, according to the land use designations, (i.e., residential, commercial, or industrial) of the *Milwaukie's Periodic Review, Comprehensive Plan Update* of 1989. The developable land inventory in the comprehensive plan was used to set the ultimate sewage flow.

The City is almost completely developed. The western and southern parts of the City are mainly commercial/industrial. The remainder is predominantly residential.

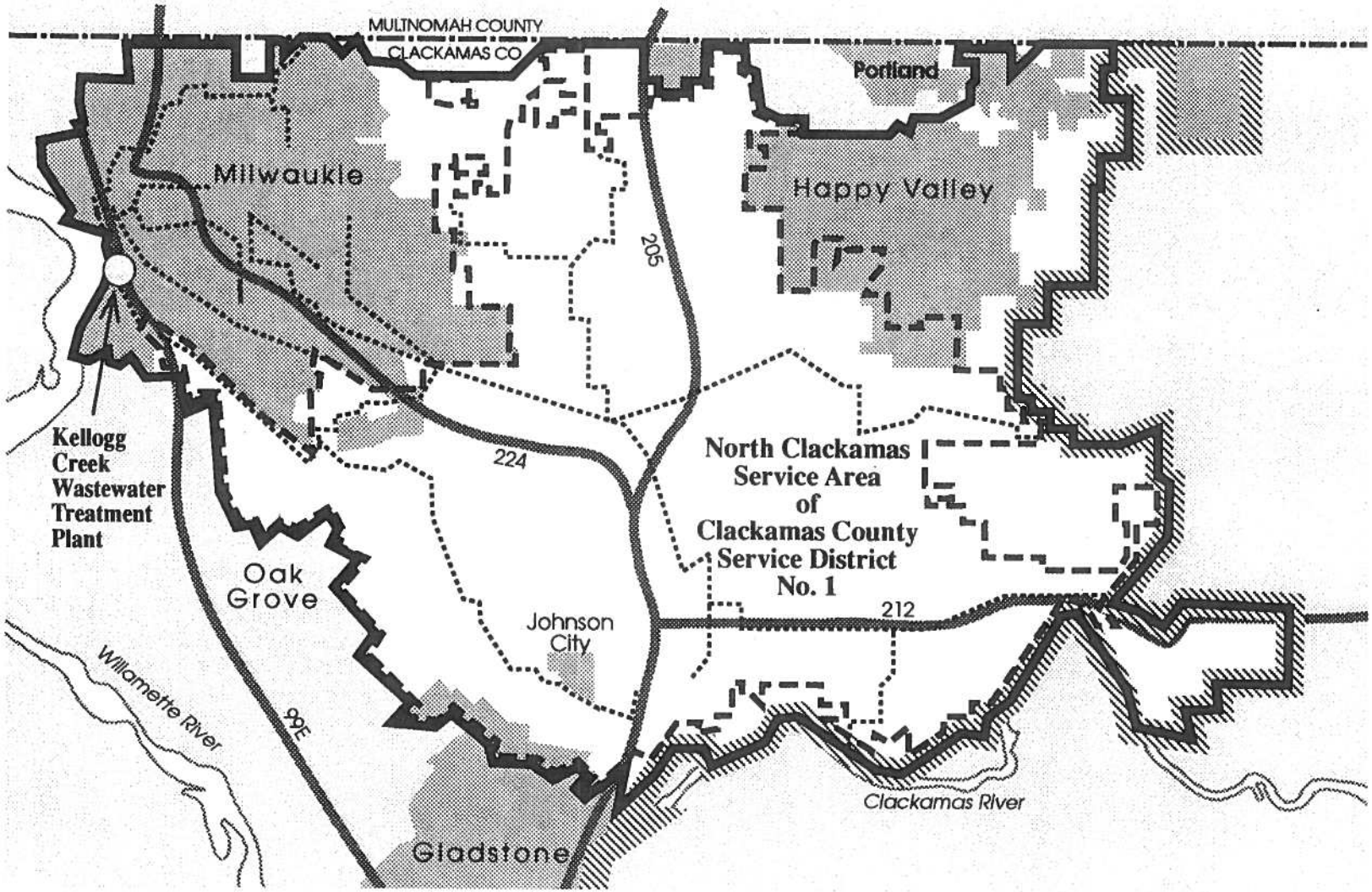
Present Population

The Portland State University Center for Population Research and Census estimated that the 1989 population of the City of Milwaukie was 18,830 and the July 1, 1992, population was 19,550. The *1990 Decennial Census, Post Census Local Review Report Review Census*, published by the U.S. Department of Commerce, Bureau of the Census, counted a population of 18,692 people and 8,100 dwellings in the City. This equates to an average household size of 2.31 people per dwelling. This report is based on the population count published by the Bureau of the Census.

Projected Population

This facilities plan projects growth in residential and commercial sewage flow in proportion to the growth in the City's population. Industrial flow is projected independently and is based on the availability of industrial land and past industrial growth.

Population projections for the City of Milwaukie are based on the rate of growth published by the Metropolitan Service District (METRO) in its June 1989 Regional Forecast. The year



LEGEND

- Study area boundary
- Urban growth boundary
- North Clackamas Service Area boundary
- Major sewer lines

Figure 2-1

Facilities Plan Study Area

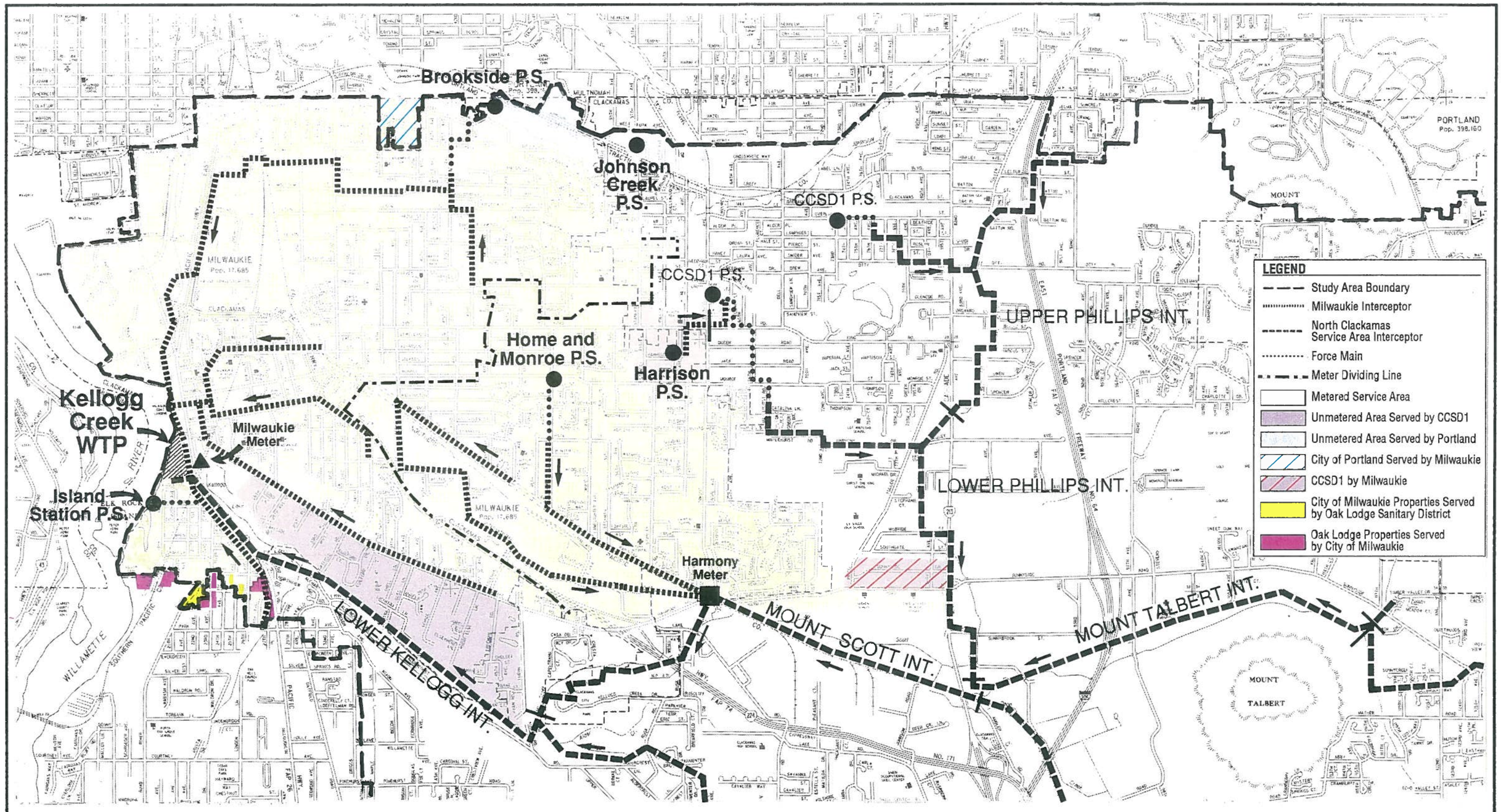


FIGURE 2-2

Service Area

CITY OF MILWAUKIE
SEWERAGE FACILITIES PLAN

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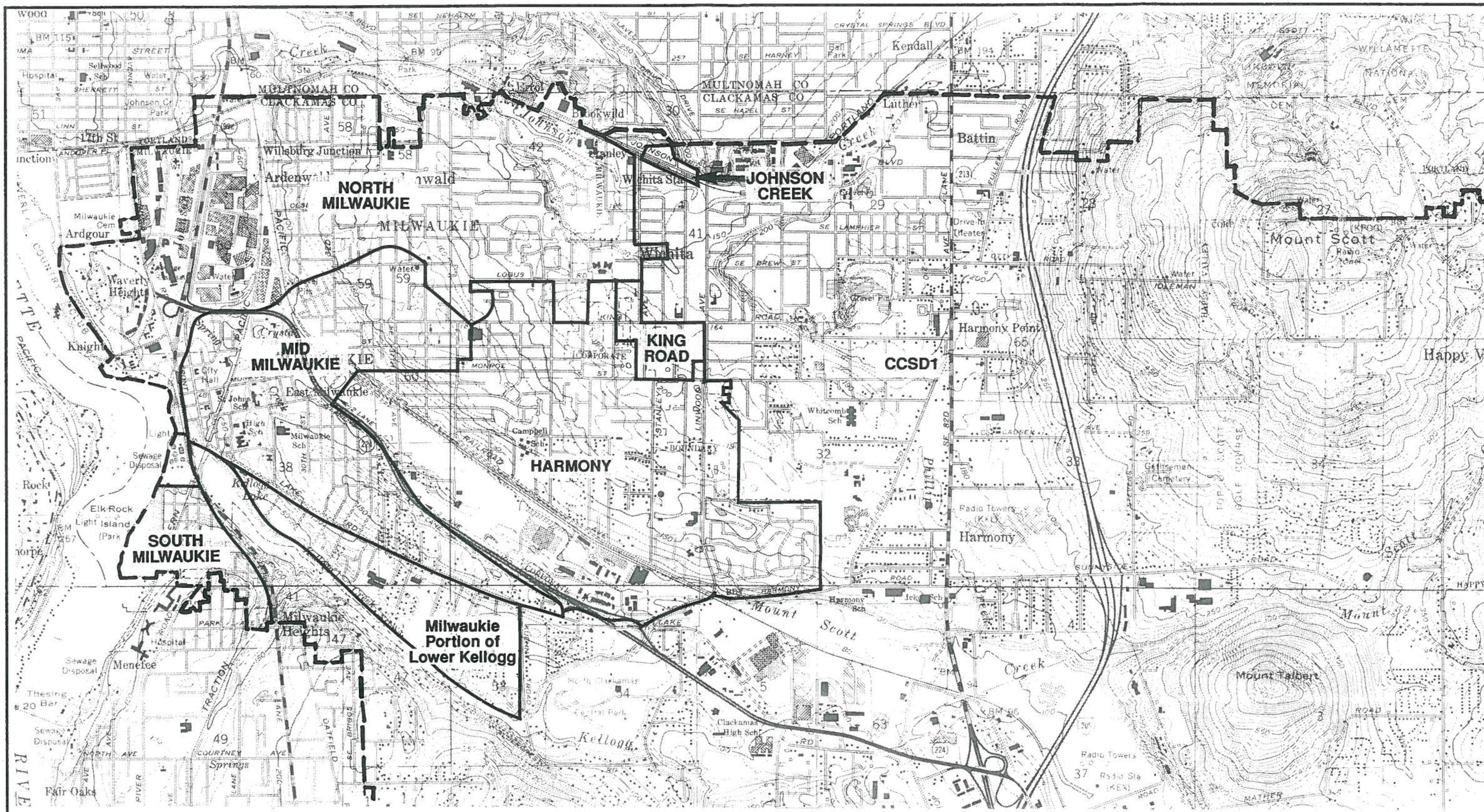

LEGEND

- Study Area Boundary
- Drainage Basin Boundary

NORTH

0 1000 2000 Feet

Approximate Scale

FIGURE 2-3

Topography and Drainage Basins

CITY OF MILWAUKIE
SEWERAGE FACILITIES PLAN

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2010 population projection is 19,717. *Milwaukie's Periodic Review, Comprehensive Plan Update* projects an ultimate (build-out) population of 22,200.

Chapter 3
Existing Collection System

Gravity Sewer System

The City's first sewers were built in 1926. Major additions were made to the system in 1947, 1958-1960, 1969, and 1972-1974. Currently, the system includes 361,400 feet of 6-inch to 24-inch-diameter sewer. Table 3-1 shows the length, oldest construction age, and average age of the sewers in the various basins of the Milwaukie sewer system. The average age of the sewer collection system is 30 years. No manhole overflow events have been documented or observed. The collection system does not have any known street or parking lot drain connections.

Table 3-1
Sewer Length and Age by Basin
Milwaukie Sewer System

Basin	Length of Sewers (feet)	Oldest Construction Date	Average Age
North Milwaukie Basin	121,000	1954	1963
Mid Milwaukie Basin	78,500	1926	1941
Harmony Basin	116,000	1954	1969
South Milwaukie Basin	17,500	1972	1973
Lower Kellogg Basin	21,000	1966	1974
King Road Basin	6,000	1972	1972
Johnson Creek Basin	1,400	1988	1988
Total	361,400		

The system is generally in good condition, although the older sections may need repair. The City has initiated a TV inspection program for the sewers that has identified major repair needs. These needs have been met through ongoing repairs, which have reduced some of the extraneous flow entering the system.

The City's system is divided into five basins; each includes an area that drains to a major trunk sewer. The existing trunk sewer system and basin limits are shown in Figure 3-1.

North Milwaukie Basin

The North Milwaukie Basin is served by a 24- to 12-inch-diameter trunk line that runs north along the Willamette River water front, crosses Johnson Creek and Main Street, and then runs east along S.E. Boyd Street, continuing along S.E. Filbert Street. The trunk line connects directly to the Kellogg Creek WTP. The flow from this basin is measured by the City's meter at the Kellogg Creek WTP. This meter measures the combined flow from the North, Mid, and South Milwaukie Basins. The North Milwaukie Basin includes 121,000 feet of pipe. The oldest sewers were built in the 1950s and comprise 30 percent of the basin.

Mid Milwaukie Basin

The Mid Milwaukie Basin serves the central part of the City. It includes the oldest part of the system, with sewers constructed between 1930 and 1960. Twenty-five percent of the basin's sewers were built before 1930; 70 percent before 1960; and 5 percent after 1960. The downtown section of the City is served by two main trunk lines: one runs up Harrison Street and the other on Washington Street. The trunk line along Lake Road serves the property between Lake Road and Highway 224. This basin has 78,500 feet of gravity sewer that connects to the North Basin Interceptor near the Kellogg Creek WTP at the foot of Jefferson Street. The flow from this basin is measured by the Milwaukie meter at the Kellogg Creek WTP in combination with the North Milwaukie and South Milwaukie basin flows.

Harmony Basin

Two trunk lines serve the Harmony Basin. The oldest, built along Railroad Avenue, serves the property to the north. The newer trunk was built in 1972 and runs along International Way. This trunk serves the western part of the basin. Both trunks connect to the CCSD1 Mount Scott Interceptor at the intersection of Railroad Avenue and Harmony Road. The basin has 116,000 feet of sewer line built between 1937 and 1981. The basin also includes the area served by the Home and Monroe Pump Station. The flow from this basin is measured by a meter on Harmony Road near the connection to the Mount Scott Trunk.

The City trunk line that flows from the east along Harmony Road also serves a portion of CCSD1. The area served includes 62 homes that front Harmony Road and Sunnyside Drive between Price-Fuller Road and S.E. 82nd Avenue. The CCSD1 system connects to the City system at the intersection of Harmony Road and Price-Fuller Road. The flow from this CCSD1 area passes through the Harmony Road meter.

South Milwaukie Basin

The South Milwaukie Basin serves the Island Station area that lies between the Willamette River, McLoughlin Boulevard, and the southern City limits. The main trunk runs along McLoughlin Boulevard from the Kellogg Creek WTP to S.E. Park Avenue. The flow from this basin is metered through the City flow meter at the Kellogg Creek WTP. This 17,500-

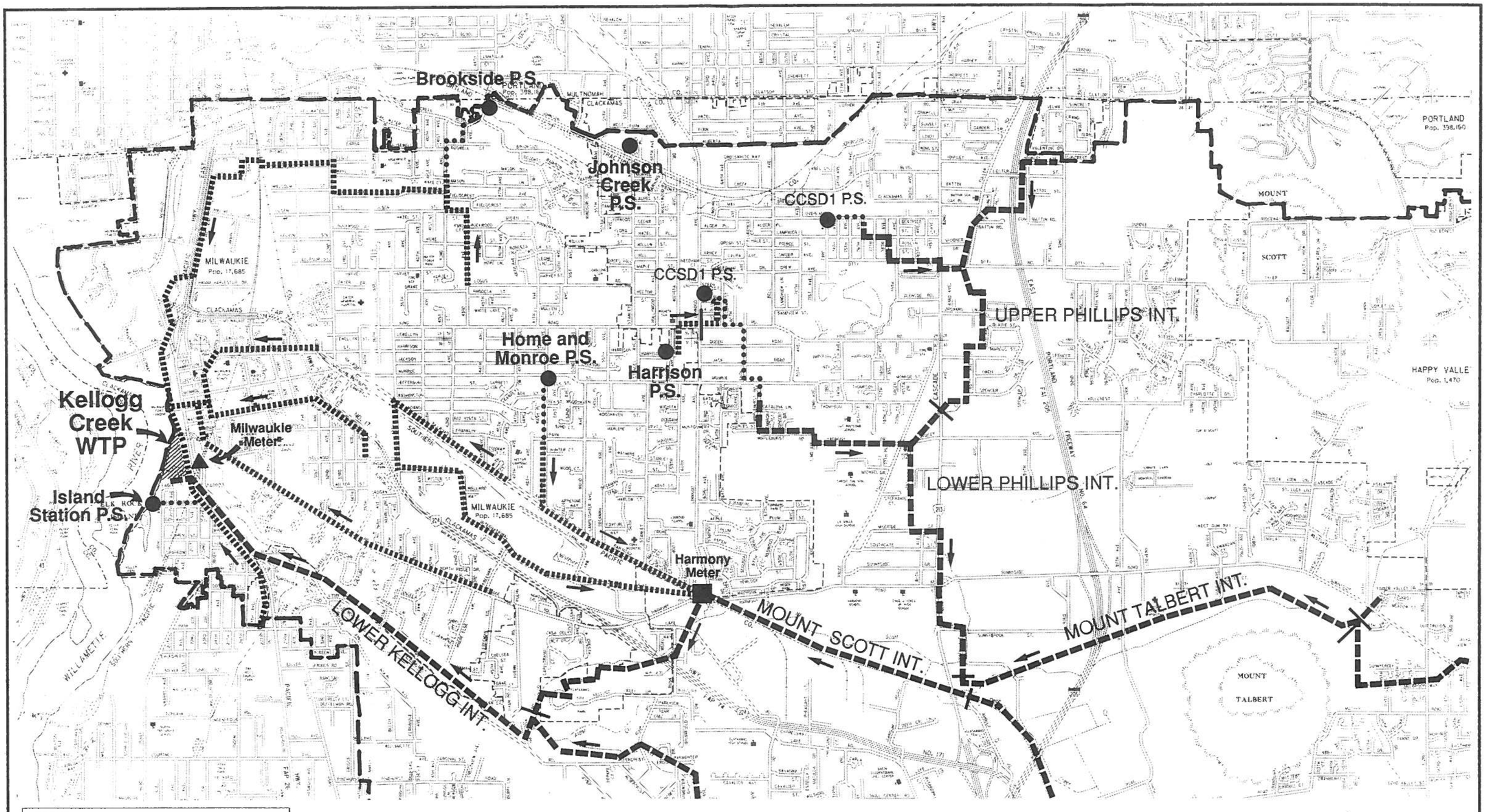

FIGURE 3-1

Existing Interceptor System

CITY OF MILWAUKIE
SEWERAGE FACILITIES PLAN

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inspected via television and found to be in good condition. The Island Station Pump Station is located in this basin. Maintenance personnel report no major maintenance problems in this basin.

Lower Kellogg Basin

The portion of the City on the northeast side of Kellogg Creek and south of Lake Road is served by lateral sewers that extend to the north and connect directly to the CCSD1 Lower Kellogg interceptor at nine locations. This area has 21,000 feet of lateral sewers built between 1972 and 1975. The area includes 1,176 dwelling units as indicated by the census count. The flow from this area is not metered. CCSD1 adds 8.577 million gallons per month to the metered flow to account for the flow from this unmetered area.

King Road Basin

The King Road Basin serves the area between S.E. King Road, S.E. Monroe Streets, S.E. Linwood Avenue, and S.E. Stanley Avenue. The flow from this area discharges unmetered to the NCSA system at the intersection of S.E. King Road and S.E. Linwood Avenue. This system was built between 1972 and 1974 and includes about 6,000 feet of sewers. Because of the system's age, it is believed to be in good condition.

Johnson Creek Boulevard Basin

The Johnson Creek Boulevard Basin comprises about 5 acres of industrial land that lies northeast of the intersection of Johnson Creek Boulevard and S.E. Stanley Avenue. The basin is served by 1,400 feet of gravity sewer that runs along Johnson Creek Boulevard and S.E. Darlington Avenue. The flow from this basin is pumped to the City of Portland's Lents Interceptor by the Johnson Creek Boulevard Pump Station. This system was built in 1988 and 1989 and is in excellent condition.

Maintenance Problems

North Milwaukie Basin

The maintenance staff has received odor complaints about the sewer in 42nd Avenue between Fieldcrest Drive and Olsen Street. This line and the upstream section to Harvey Street have required cleaning twice a year. The line is laid at a shallow grade and may have capacity problems. Further field investigation is needed.

The line that runs north on 30th Avenue between Roswell Street and Van Water Street also has odor problems. Water ponds in the mid-block manhole. Field elevation survey data show that the line has adequate grade. However, the line may be sheared just outside the mid-block manhole. This line should be TV inspected and repaired if damage is found.

Mid Milwaukie Basin

TV inspections indicate that the sewer that crosses Highway 224 at Harrison Street has a low point that ponds flow. This line has a history of surcharging.

Lower Kellogg Basin

The sewer that passes through the Lakeside Apartments requires excessive maintenance. Grease often plugs the line just upstream of the line that enters on Lakeside Street in the apartment complex. Its proximity to the apartment building restricts maintenance access. This line has been cleaned four times in the last 18 months.

Pump Stations

The City operates five pump stations (a description of each follows). Table 3-2 states the capacity needed at each station to serve the expected peak flow at build-out. These flows are based on the sewer system model results.

Table 3-2
Pump Station Required Capacity

Station	Peak Flow (gpm)
Island Station	100[a]
Home and Monroe	400
Brookside	550
Harrison	100[a]
Johnson Creek Boulevard	200

[a]The capacity needed at the Island Station Pump Station and the Harrison Pump Station is the flow rate needed to flush the force main. The peak flow generated by the homes served by these stations is not expected to reach this capacity.

Island Station Pump Station

The Island Station Pump Station is located on 19th Avenue and Blue Bird Street. This station lifts the flow and discharges to a gravity sewer in the same intersection. The station serves 39 houses that front the Willamette River along 19th Street. The station was built in 1972 and upgraded in 1991 with new pumps and controls. The station is in good condition.

Home Avenue and Monroe Street Pump Station

The pump station located at Home Avenue and Monroe Street serves 475 dwelling units. This station discharges flow through 1,400 feet of force main that runs south along Home Avenue to a gravity sewer at the intersection of Home Avenue and Park Street. This station has no overflow. If the station fails, sewage will back into customers' homes causing property damage. Therefore, this station's proper operation is critical.

The station was built in 1973 and is in poor condition. City staff is scheduled to replace the pumps, upgrade controls, and install a seal water system in Fiscal Year 1992-1993. The below-ground structure is in fair condition, but the station lid needs to be replaced. After these improvements, the station will be in good condition.

Brookside Pump Station

The Brookside Pump Station is located near the intersection of Johnson Creek Boulevard and Brookside Drive. This station serves the Brookside apartments, the Terrybrook subdivision, and further east, totaling 419 dwelling units. The station pumps its flow through a force main to a gravity sewer in S.E. 42nd Avenue near the intersection of Wake Court. The station is equipped with an overflow to Johnson Creek. The station, built in 1968, is in poor condition. The pumps and controls need replacing. Negotiations with City of Portland are in progress to eliminate this pump station.

Harrison Street Pump Station

The Harrison Street Pump Station is located at the intersection of S.E. 59th Avenue. The station serves three houses along Harrison Street between 59th and Stanley Avenue. It lifts the flow to a gravity sewer on 59th Avenue. The pumps and controls for this station were replaced in 1987 and are in good condition.

Johnson Creek Boulevard Pump Station

The Johnson Creek Boulevard Pump Station is located on Johnson Creek Boulevard near the intersection with S.E. Stanley Avenue. It pumps sewage from the area north and east of the pump station to the City of Portland, Lents Interceptor. It is equipped with two Hydronix self-priming sewage pumps. Each pump has a peak pumping capacity of 240 gallons per minute and is driven by a 3-hp electric motor. The pumps located above the wet well are housed above ground under a reinforced fiberglass hood. This pump station has no overflow. The station was built in 1988 and is in good condition. The station serves about 5 acres of industrial property and has adequate capacity.

Infiltration and Inflow

Definitions and Background

Infiltration and inflow (I/I) refers to extra flows that enter a gravity sanitary sewer system through leaks in the pipe system and direct stormwater inlets. Infiltration consists of groundwater that enters the system through leaks in the pipe and manholes. Leaks in the main lines and in service connections contribute to the flow. Leaks occur at joints and through cracks in the pipe. In older systems (built before 1960), joint leaks are common. About 30 percent of the City's sewers were built before 1960. Rubber ring pipe joints, which greatly reduce leakage, were not commonly used in sewer construction until after about 1960. Before 1960, the joints were not sealed or they were filled with mortar or packed with oakum. These joints deteriorate rapidly and are a major source of leaks. Infiltration usually increases the flow a day or two after a rainstorm and takes weeks to decrease after the storm ends. In some cases, the rain raises the water table and does not recede until the following summer.

Inflow consists of surface water that runs directly into the sanitary sewer system. Street catch basins, roof drains, and parking lot drains are common sources. Inflow usually enters the system rapidly after a rainstorm starts and causes a sharp increase in peak flow within minutes or hours, followed by a less dramatic recession over a few hours after the storm passes.

Data Available

I/I was evaluated by analyzing available continuously recorded flow records. The dry weather period flows were compared with the wet weather flows. The average dry weather flows measured at the Kellogg Creek WTP closely approximated the expected flows. The expected flows were figured by multiplying the expected per capita dry weather flow by the existing population. This indicated that, on the average, there was no dry weather infiltration. Therefore, the difference between the dry weather and wet weather flows was attributable to I/I.

I/I rates in the City collection system were determined by analyzing flow recordings taken at the main flow meter at the Kellogg Creek WTP and the Harmony Basin meter, located at the Harmony Basin connection to the Mount Scott Interceptor. Daily total flow and peak flows recorded at the main City meter on March 12 and 13, 1989, were compared with the average for September 11 through 26, 1989. Because the Harmony Basin flow meter records only total flow each day, its peak I/I rates were developed assuming that the peak-to-average ratio in Harmony Basin was the same as in the main City system.

Conclusion

Table 3-3 shows the peak infiltration and inflow rates of each basin. The North, Mid, and South Milwaukie Basins' I/I flow per acre is above the 1,500 gallons per acre rate that was

set as a design parameter in the original collection system plan for the NCSA . This higher rate is understandable because 30 percent of this system was built before 1960.

Table 3-3
Estimated Peak Infiltration and Inflow by Basin

Basin	Flow (mgd)	Gallons (per acre)
North Milwaukie[a]	2.7	2,557[b]
Mid Milwaukie	1.6	2,557[b]
South Milwaukie	0.3	2,557[b]
Harmony	1.4	1,385
Lower Kellogg	0.3	1,083
Total	6.3	2,048

[a]Includes Brookside Basin.
[b]The infiltration rates for the North, Mid, and South Milwaukie Basins on a gallons per acre basis are shown as the same figure because the rate was derived from the main Milwaukie flow meter at the Kellogg Creek WTP. This meter measures the combined flow from these three basins.

A continuing program of sewer line replacement in older sections, inspection via television, and pipeline sealing will help reduce flows. Continuing the program to disconnect catch basins and yard and parking lot drains is also needed to control I/I.

Assuming that the City's I/I control program continues to hold the I/I at current levels, the City will contribute 42 percent of the expected peak I/I at ultimate build-out. By comparison, the City's collection system represents only 27 percent of the total mainline sewer footage in the combined City-NCSA study area. On the average, Milwaukie sewers contribute 22 gallons of peak I/I per foot of sewer compared with 11 gallons per foot for the CCSD1 collection system. The City's projected contribution to average dry weather flow at ultimate build-out is 21 percent.

Milwaukie Share of Kellogg Creek WTP Influent Pollutant Load

CCSD1 provides the City with sewage treatment service at the Kellogg Creek WTP. The operating and capital cost for the plant is currently being shared in accordance with an intergovernmental agreement executed in 1970. To date, the operating costs have been shared on the basis of proportion of total wastewater flow. The strength (concentration) of pollutants in the wastewater flow from the City of Milwaukie, however, may differ from the average strength of flow from NCSA. The City's share of the total pollutant load (strength times

flow) is an important measure to consider in the determination of the City's share of the treatment costs.

Table 3-4 presents the City's percentage share of the total flows and pollutant loads in 1990, 2010, and at ultimate build-out. Percentages are presented for served residential population, equivalent dwelling units (EDU), peak flow, average annual flow, and pollutant load. The projected figures assume that the City's boundaries will not expand except in the Johnson Creek Area. The Johnson Creek Area Sewerage Facilities Plan has designated that the City serve the portion of the Johnson Creek Area west of Linwood Avenue because the topography naturally drains to the City. Its gravity sewer system can be extended into this area without pumping. The area east of Linwood Avenue naturally drains to CCSD1's system or to the City of Portland sewer system.

Overall, the City is projected to contribute a smaller share of the flow and pollutant load going to the Kellogg Creek WTP in 2010 and at ultimate build-out. As can be seen on Table 3-4, the City's percentages decline for served residential population, connected EDUs, peak flow, average annual flow, and pollutant load. The EDU figures, however, account for commercial and industrial customers by converting their numbers to the equivalent number of EDUs. For this reason, the EDU percentages are slightly higher. The strength projections shown are taken from the *Draft Sewer Rate and System Development Charge Study* prepared for Clackamas County Department of Utilities by CH2M HILL in July 1993.

The City's sewer system is much older than the District's system and contributes more infiltration and inflow, as discussed in Chapter 4. Because peak flow is mostly affected by infiltration and inflow, the City's share of the peak load is greater than the share as defined by population or by EDUs. The City's annual average flow projection is a greater proportion of the load than population or EDUs indicate. This is reflective of the annual volume of infiltration and inflow coming from the City's system.

Plant expansion could be triggered either by growth in pollutant load or by peak flow. The plant's ability to meet its summer discharge permit is affected mostly by pollutant loading, which is proportional to the number of EDUs. Projections made in the NCSA facilities plan indicate that pollutant loading will be reached first. However, peak flow projections indicate that the plant hydraulic capacity of 25 million gallons per day (mgd) could be exceeded at nearly the same time as the plant reaches its pollutant handling capacity. This peak flow capacity could be reached sooner if I/I is not controlled. The peak flow projections are based on the assumptions that I/I control programs hold the I/I rate for existing sewers at their current levels. An aggressive I/I control program will be needed to achieve this goal because the sewers will deteriorate if problems are not found and repaired.

Table 3-4
City of Milwaukie Share of Kellogg Creek WTP Influent Flow and Pollutant Load

	Milwaukie	Total Study Area	Percent
1990			
Served Population	18,692	52,910	35
Connected EDU[a]	10,830	31,255	35
Peak Flow	11.7	22.2	53
Average Annual Flow	3.2	7.5	43
Strength[b]	160 mg/L	197 mg/L	--
Pollutant Load[c]	4,270 lb/day	12,327 lb/day	34
2010			
Served Population	21,392	75,707	28
Connected EDU[a]	12,049	42,112	29
Peak Flow	13.0	26.1	50
Average Annual Flow	3.6	9.4	38
Strength[b]	160 mg/L	208 mg/L	--
Pollutant Load[c]	4,800 lb/day	16,506 lb/day	29
Ultimate			
Served Population	23,875	121,000	20
Connected EDU[a]	13,258	61,714	21
Peak Flow	14.2	36.1	39
Average Annual Flow	4.1	14.7	28
Strength[b]	160 mg/L	206 mg/L	--
Pollutant Load[c]	5,470 lb/day	25,349 lb/day	21

[a]Equivalent dwelling unit.
[b]Strength equals average of biochemical oxygen demand and suspended solids concentrations.
[c]Pollutant load equals strength times flow.

Chapter 4

Sewer System Analysis and Improvement Needs

Analysis Model

The City's collection system was analyzed with the CH2M HILL System Analysis Model (SAM). This model uses information about the sources of flow and pipeline configurations (such as sizes and grades) to calculate the capacity and expected flow of each pipe segment. It identifies pipe segments where the peak flow exceeds capacity.

Information about the City's collection system configuration was obtained from record drawings in the City's files. Records were found for about 75 percent of the system. The remainder of the system was not added to the model except for line segments needed to connect known sections of the model.

The collection system was analyzed in conjunction with the NCSA collection system, which also delivers sewage to the Kellogg Creek WTP. Information about the NCSA collection system configuration was taken from previous SAM modeling input files, the information for which was obtained from as-built records. This information was spot checked in sections where SAM indicated that capacity problems may result. Input files were corrected accordingly.

Three sources of flow were considered: sanitary connections, infiltration, and inflow. The model simulates the daily sanitary flow pattern generated by each service connection. Peak flows are determined by applying a typical flow pattern, or hydrograph, to the average flow generated by each connection. Infiltration is modeled by the program by adding a fixed rate to the system for each foot of pipe. The fixed rate varies by basin and by the size of the line segment. Inflow was not modeled because there are no known inflow sources for this system. SAM routes the flow through the pipe system to the treatment plant and adds the flow contributions along the way. Peak flow is calculated for a point in the system considering the sum of the upstream contributions and the travel time to reach the point.

Loading Analysis

Sanitary Flow

Existing customer flows were entered into the model as equivalent dwelling units (EDUs). Census dwelling unit counts were used to load the City system for residential users. Commercial and industrial users were added to the system as 12 EDUs per acre of occupied land. The average flow was set in the model by multiplying the EDUs by the flow per EDU. Peak flow was generated by applying a unit hydrograph to the average flow. The model was run for future flows by increasing the load in the model in proportion to the expected rate of population growth at 2010 and at build-out.

Future Flow

The future flows were determined from the vacant land map in Milwaukie's Periodic Review, Comprehensive Plan Update, 1989. EDUs were assigned to residential, commercial, and industrial areas based on the densities expected in the comprehensive plan.

Future flows in the NCSA system were added to the model as EDUs for each vacant or partially developed lot. This lot by lot assessment considered the zoning restrictions, lot configuration, and potential density of the parcel.

Infiltration

Infiltration rates were allocated among the basins so that the total infiltration flow for the combined City at NCSA systems equaled 15 mgd. Unsewered areas were input as a fixed rate flow of 750 gallons per acre. This rate is lower than the current infiltration rates stated in Table 3-2 because new sewer line construction technology tends to better resist the causes of infiltration.

Infiltration in sewered areas is expected to increase as new lines are built to serve subdivided land. Therefore, in the calculation for infiltration rates for the ultimate build-out flow analysis, the existing infiltrations rates are increased 10 percent.

Capacity Analysis Screening Criteria

Capacity analysis screening criteria were developed to interpret SAM output to identify line segments that may require improvements in the future. These criteria, which are described below, were developed to identify severe capacity restrictions in the existing system and are not intended as design criteria for new systems.

System Overload

Existing line segments were considered overloaded and in need of capacity improvements if the model predicted peak flows in excess of 110 percent of capacity or if overflows from manhole lids were predicted. This percentage allows for some surcharging in the sewer system. Although normal design practice is not to surcharge gravity sewers, it would be wasteful to build a new gravity sewer to fix a problem that is predicted to occur only on the peak day at ultimate build-out. Therefore, the 110 percent criterion was used. This allows some amount of surcharging during peak periods of the peak day.

Pump Stations

Each pump station in the City and in the NCSA is equipped with two pumps. The model runs, however, were based on having only one of the pumps available. It was assumed that

the system should be able to function at peak expected flow if one pump was out of service. The model, therefore, considers the second pump a standby pump.

Model Results

According to the model results, the capacities of the Brookside, Harrison, Johnson Creek Boulevard, and Island Station Pump Stations are adequate for ultimate build-out. The model results indicate, however, three potential capacity restrictions in the collection system at ultimate flow rates. These are described below under **Improvement Needs**.

Improvement Needs

Jefferson Street to Kellogg Creek WTP Interceptors

The model indicates that the 24-inch-diameter interceptor that runs from the lower end of Jefferson Street to the Kellogg Creek WTP is overloaded at peak flows today. The pipe segment has a 4.7-mgd capacity. The model predicts a peak flow rate of 7.5 mgd today. The expected peak flow will grow to 7.7 mgd in the year 2010 and 8.4 mgd at ultimate build-out.

The 24-inch-diameter interceptor from Jefferson Street to the Kellogg Creek WTP will need to be upgraded. Two alternatives can be implemented to meet the needs. The first alternative is to replace the 1,000 feet of existing 24-inch-diameter interceptor and Kellogg Creek crossing with new 30-inch-diameter pipe. This will be difficult construction. The other alternative is to build a relief sewer along side the existing line to carry the flow from the Mid Milwaukie Basin. This new line would have a 21-inch-diameter and a creek crossing siphon would be needed.

Infiltration and inflow reduction alone will not alleviate this restriction. In similar systems where the entire publicly owned collection system was replaced, the infiltration rates were reduced in half. If this level of reduction were achieved in the North and Mid Milwaukie Basins, 2.7 mgd of peak flow would be removed, but this line would still be overloaded by 1 mgd.

S.E. Filbert Street Trunk

The 15-inch-diameter line that runs in S.E. Filbert Street between 32nd Avenue and 42nd Avenue is expected to be overloaded at ultimate build-out. The model indicates that this line is operating at 100 percent capacity today and will operate at 104 percent of capacity by the year 2010.

To alleviate this potential capacity problem, the trunk line in S.E. Filbert Street could be replaced with a new 18-inch-diameter line. However, this sewer is over 20 feet deep. The

new line would be difficult to build. Another alternative would be to extend the Brookside force main to 32nd Avenue. This would bypass the Brookside Basin flow of 0.8 mgd around this constriction and alleviate the problem. Extending the 8-inch-diameter force main 2,900 feet would be far less costly than replacing the trunk line. The problem could also be eliminated if the Brookside flow were diverted to the City of Portland Lents Trunk; negotiations for this are in progress.

Brookside Trunk

The model indicates that one reach of the 10-inch line in Brookside Drive is overloaded today. By the time ultimate build-out is reached, the line in Brookside Drive downstream of S.E. Regent's Drive to the pump station will become overloaded. Ultimate build-out could be reached before 2010 if the portion of the Johnson Creek Area west of Linwood Avenue is connected as planned in the Johnson Creek Facilities Plan.

The only feasible solution to the capacity problem in the Brookside Trunk is to replace 1,040 feet of the trunk with 12-inch-diameter pipe. The new line would have to be installed at a slightly steeper grade to provide adequate capacity throughout.

Home and Monroe Pump Station

The capacity of the Home and Monroe Pump Station is not known. Field flow measurements will be needed to determine the current capacity of the pump station. However, maintenance personnel indicate that the pumps and controls in the station need replacing. The model indicates that 400 gpm pumps should be installed when the upgrade is installed. Structural modifications are not expected because this size pump will fit inside the existing structure.

Brookside Pump Station

The pumps and controls in the Brookside Pump Station are in poor condition and should be replaced. It would be less costly, however, to eliminate the pump station and build a sewer connection to the City of Portland Lents Trunk, if an agreement with Portland can be reached to allow the connection. If this alternative were implemented, an ultimate peak flow of 0.86 mgd would be diverted from the Milwaukie system. This would alleviate the capacity restriction at Filbert Street, but not the restriction in the Jefferson to Kellogg Creek WTP interceptor. If the station is retained, it should have the pumps installed so that the force main can be extended to 32nd Avenue. The pumps should have a capacity of 550 gpm to serve the ultimate flow.

Lakeside Apartment Sewer

There are maintenance problems in the existing sewer line. Grease builds up in the line before the apartments. The line is difficult to clean because of the configuration of the sewers. The sewer that runs through the Lakeside Apartments could be bypassed, thereby eliminating the maintenance problems. The existing line would be converted and turned over

apartments, from the foot of 26th Avenue directly south to the Kellogg Creek WTP interceptor. This improvement would reduce maintenance costs and disruption to the apartment's residences.

30th Avenue Sewer

About 100 feet of the line on 30th Avenue between S.E. Roswell Street and S.E. Van Water Street could be reconstructed to alleviate the ponding problem (low spot in the pipe does not drain freely; solids can collect). The new sewer would be built on a new grade to eliminate the ponding and associated odor problem. The existing line should be TV inspected prior to construction to confirm the extent of the ponding problem.

Harrison Street and Highway 224 Sewer

The sewer in Harrison Street has a ponding problem. The general grade is between 1 and 2 percent, which is far above minimum grade for this 10- and 12-inch-diameter sewer. This line should be TV inspected to see if the line has sheared near a manhole connection.

Plum Street and Sequoia Street

The manhole in Plum Street at the intersection with Sequoia Street has a ponding problem. This 250-foot-long, 8-inch-diameter line should be TV inspected and replaced if it is sheared at the manhole.

42nd Avenue Sewer

The maintenance staff has received odor complaints about the sewer in 42nd Avenue between Fieldcrest Drive and Olsen Street. This line and the upstream section to Harvey Street have required cleaning twice a year. The line should be TV inspected and replaced if it has a low point.

Sherrett Street Sewer

The area bounded by Sherrett Street, 32nd Avenue, 34th Avenue, and along Kathryn Street is not served by sanitary sewer. The Sherrett Street project is proposed to provide sewers needed to serve the property fronting these streets. This project will probably be funded by a local improvement district.

Infiltration/Inflow Reduction Program

In past years the City's closed-circuit TV inspection program has identified major I/I sources which were corrected. This inspection program should continue. The following lists basins in priority of the likely areas where I/I could be found. These basins should be inspected via the TV program in the following order.

1. Brookside

Brookside is located in a low area adjacent to Johnson Creek. The groundwater table may be above the sewer lines in this area. If I/I is reduced, the potential capacity problems in the main trunk may be avoided.

2. North Milwaukie Basin

The North Milwaukie Basin's main trunk lines also run near Johnson Creek and could be inundated most of the year with groundwater. These lines are some of the older lines and are likely to be leaking.

3. Mid Milwaukie Basin

The Mid Milwaukie Basin was identified as a high priority basin in the Evaluation of Central Milwaukie and Brookside Basin Study by Rehabco Pipe Services Inc. in 1985. This basin was selected for study because of the age of its sewers. This should be a high priority area for TV inspection.

4. Harmony Basin

The Harmony Basin is given a low priority for I/I investigation because the flow measurements indicate that its I/I rate is nearly equal to the rest of the CCSD1 system. The system serving this basin is newer than the other city basins. Groundwater is less likely to be present because the basin is located in the higher elevation of the city and away from the creeks.

5. South Milwaukie Basin

The South Milwaukie Basin has a low priority because TV inspection found that the sewers are in good condition and there are no major leaks. Also, these sewers were built between 1972 and 1974.

6. Lower Kellogg Basin

The Lower Kellogg Basin also has a low priority. Most of its sewers had TV inspections in the last year. Those inspected were found to be in good condition. The sewer lines serving this basin were built between 1972 and 1975 and should be performing as well as sewers built in CCSD1 during the same period.

Infiltration/Inflow Monitoring Program

Because there is little flow monitoring data for each basin, a detailed flow monitoring program should be initiated. A continuously recording flow meter should be installed at the bottom of each basin. It is best to have both dry weather and wet weather flow readings taken at the same manhole. The dry weather measurements should be taken between August and October, when the groundwater table is the lowest. The wet weather flow should be taken when the groundwater table is the highest, in February through April. The wet weather flow monitoring should also include a rainstorm. The flow generated in response to the storm will indicate if inflow is a problem.

The TV inspection program can be done concurrently with the flow monitoring program. Leaks will be more readily identified if the TV inspection is done during high groundwater periods. However, some leaks can be detected by the stains and marks left behind if the TV inspection is done during a dry period. Manholes should also be inspected concurrently with the TV inspection. Leaks should be recorded so they can be fixed later. The holes in manhole lids should be plugged. Manhole lids that are in gutters should be sealed to reduce the amount of runoff leaking into the sewers through the frame and cover.

After this information is gathered, a rehabilitation plan can be developed that would identify pipe repair, pipe replacement, lining, and service connection repairs. After repairs are complete, flows should be monitored so that the effectiveness can be determined. A continual program of flow monitor and repair followed by additional flow monitoring will help to identify cost-effective repair techniques and reduce I/I. This program should be a part of the City's normal operations and maintenance program for the sanitary sewer system.

The *City of Milwaukie, Oregon, Evaluation of Central Milwaukie and Brookside Basin Sanitary Sewers, March 1985 Report* outlined a rehabilitation plan for portions of the Mid Milwaukie and Brookside Basins. Although conditions have probably changed little since this plan was developed, its conclusions should be reviewed. Conclusions were based on partial TV inspection and on a limited flow monitoring. Additional TV inspection and monitoring as outlined above should be done before a major rehabilitation program is constructed. After this detailed review is completed, a rehabilitation plan can be developed.

Chapter 5
Cost Estimates

The chapter summarizes capital cost opinions developed for the City's collection system. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs may vary from the estimates presented herein.

Cost Estimating Assumptions

Collection System

The construction cost estimates for the collection system improvements are developed using pricing derived from the Tri-County Service District pipeline construction costs. The average price per foot of pipe derived from these past projects is adjusted using the *Engineering News Record* (ENR) construction. The resulting cost estimates are not based on detailed design information and are developed only to an order-of-magnitude level. An allowance for engineering, legal, administration, and other indirect costs is added to the estimate. These cost estimates are based on Spring 1993 pricing.

The cost estimate for the Johnson Creek Area sewer system is based on the cost estimates presented in the Johnson Creek Area Sewerage Facility Plan. These cost estimates were updated to the 1993 pricing level.

Collection system operating costs are based on the current collection system operating budgets for the City. The costs were increased in proportion to the additional population expected to be served.

Collection System Improvements

Table 5-1 lists the collection system projects in the City.

Table 5-1
City of Milwaukie Collection System
Project Cost Estimates

Projects	Costs
Jefferson Street to Kellogg Creek WTP Interceptors	$350,000
Brookside Trunk	150,000
Home and Monroe Pump Station	60,000
Brookside Pump Station	100,000
Brookside Force Main	200,000
Lakeside Apartment Sewer	30,000
30th Avenue Sewer	15,000
Harrison Street and Highway 224 Sewer	35,000
Plum Street and Sequoia Street	30,000
42nd Avenue Sewer	15,000
Infiltration and Inflow Projects	50,000[b]
Johnson Creek Area Sewerline[a]	1,400,000

[a]This construction will likely be funded by the property owners through a local improvement district.
[b]Note: This represents possible annual repair costs. TV inspections and study should be performed to substantiate need for I/I projects.

The annual collection system operating costs for the City are estimated at $1.9 million. These operating costs assume that the build-out population is being served. The costs are presented in 1993 dollars.

Infiltration/Inflow Reduction Costs

The cost for the I/I reduction program shown in Table 5-1 is based on the *City of Milwaukie Evaluation of Central Milwaukie and Brookside Basin Sanitary Sewers, March 1985, Report.* The rehabilitation needs outlined in this report are probably still needed, even though the report was not based on complete TV inspection and detailed flow monitoring. A more thorough investigation in these and other areas may find additional needs. The rehabilitation program for each area should be developed and budgeted after detailed TV inspection and flow monitoring is complete. The TV inspection program recommended in Chapter 4 is

included as a normal operating cost. The City should consider purchasing flow monitoring equipment. A portable flow monitor for measuring sewer flows is about $7,000.

Johnson Creek Area Costs

The costs for the Johnson Creek Area are included in Table 5-1 because these facilities will be needed in the future. However, these facilities will likely be financed by the people living in the Johnson Creek Area through a Local Improvement District assessment. Therefore, these facilities would not be included in a capital improvement plan financed by existing City customers.

Treatment System Costs

The NCSA facilities plan identifies alternatives for meeting the treatment needs through build-out. Although the City's percentage of treatment plant use will decline as the CCSD1's growth outpaces the City's growth, the City will benefit from having upgraded the treatment plant. Some proposed improvements will improve the plant's impact on the community, but will not provide additional capacity. Other improvements, such as equipment replacement and regulation upgrades, are proposed to maintain the treatment facility at its existing capacity. The cost of these types of improvements should be shared by plant users. The method for allocating the cost of the proposed improvements is being discussed by both City and CCSD1 staffs. Developing a detailed allocation of the costs for providing treatment facilities is outside the scope of this study.

Appendix A
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Clackamas County Service District No. 1 Property
Served by City of Milwaukie System

Street Address	Tax Map	Tax Lot	EDU
12345 SE Price Fuller Road	12 E 32 CD	1200	128
12449 SE Price Fuller Road	12 E 32 CD	1500	1
12451 SE Price Fuller Road	13 E 32 CD	1500	1
12332 SE Price Fuller Road	12 E 32 CD	1600	2
12212 SE Price Fuller Road	12 E 32 CD	1900	1
7506 SE Sunnyside Drive	12 E 32 CD	3500	1
7506 SE Sunnyside Drive	12 E 32 CD	3500	2
7511 Harmony Road	12 E 32 CD	3600	1
7517 Harmony Road	12 E 32 CD	3700	1
7575 Harmony Road	12 E 32 CD	3800	1
7603 Harmony Road	12 E 32 CD	3900	1
7611 Harmony Road	12 E 32 CD	4000	1
7655 Harmony Road	12 E 32 CD	4100	1
7705 Harmony Road	12 E 32 CD	4200	1
7725 SE Sunnyside Drive	12 E 32 DD	6400	1
7735 SE Sunnyside Drive	12 E 32 DD	6500	1
7855 SE Sunnyside Drive	12 E 32 DD	6600	1
7877 SE Sunnyside Drive	12 E 32 DD	6700	1
7911 SE Sunnyside Drive	12 E 32 DD	6900	1
7913 SE Sunnyside Drive	12 E 32 DD	7000	1
7917 SE Sunnyside Drive	12 E 32 DD	7100	1
7919 SE Sunnyside Drive	12 E 32 DD	7300	1
7925 SE Sunnyside Drive	12 E 32 DD	7301	1
12405 SE 80th Avenue	12 E 32 DD	7400	1
7950 SE Sunnyside Drive	12 E 32 DD	7401	1
12435 SE 80th Avenue	12 E 32 DD	7500	1
8022 SE Sunnyside Drive	12 E 32 DD	7600	1
7914 SE Sunnyside Drive	12 E 32 DD	7700	1
7928 SE Sunnyside Drive	12 E 32 DD	7800	1
7906 SE Sunnyside Drive	12 E 32 DD	7900	1
7888 SE Sunnyside Drive	12 E 32 DD	8000	1
7856 SE Sunnyside Drive	12 E 32 DD	8100	1
7736 SE Sunnyside Drive	12 E 32 DD	8200	1
7726 SE Sunnyside Drive	12 E 32 DD	8300	1
7726 SE Sunnyside Drive	12 E 32 DD	8300	1
7745 Harmony Road	12 E 32 DD	8400	1
7777 Harmony Road	12 E 32 DD	8500	1
7801 Harmony Road	12 E 32 DD	8600	1
7803 Harmony Road	12 E 32 DD	8700	1
7823 Harmony Road	12 E 32 DD	8800	2
7831 Harmony Road	12 E 32 DD	8900	1
7903 Harmony Road	12 E 32 DD	9000	1
7911 Harmony Road	12 E 32 DD	9100	1
8033 Harmony Road	12 E 32 DD	9200	1
8051 Harmony Road	12 E 32 DD	9300	1
8001 Harmony Road	12 E 32 DD	9400	1

Clackamas County Service District No. 1 Property
Served by City of Milwaukie System

Street Address	Tax Map	Tax Lot	EDU
8055 Harmony Road	12 E 32 DD	9500	1
12364 SE 80th Avenue	12 E 32 DD	9600	1
12405 SE 82nd Avenue	12 E 32 DD	9800	3
12423 SE 82nd Avenue	12 E 32 DD	9900	1
12479 SE 82nd Avenue	12 E 32 DD	10200	1
			183

Note: The customers listed above are connected to Clackamas County Service District No. 1 sewers. These sewers connect to the City of Milwaukie system at the intersection of Price Fuller Road and Harmony Road. The flow from this area passes through the Harmony Road flow meter.

Oak Lodge Sanitary District Property
Served by the City of Milwaukie System

Street Address	Tax Map	Tax Lot	EDU
12515 18th Avenue	2 IE 2AA	800	1
	I IE 35DD	6800	
12525 18th Avenue	2 IE 2AA	801	1
12410 23rd Avenue	2 IE 1BB	7700	1
PGE 23rd	2 IE 2AA	300	
12420 23rd Avenue	2 IE 1BB	7800	1
12484 23rd Avenue	2 IE 1BB	7900	1
		8000	
12495 23rd Avenue	2 IE 2AA	100	1
	I IE 35DD	7700	
		7900	
12502 23rd Avenue	2 IE 1BB	10000	1
12510 23rd Avenue	2 IE 1BB	9900	1
12556 23rd Avenue	2 IE 1BB	9700	1
		9800	
12580 23rd Avenue	2 IE 1BB	9500	1
		9600	
12601 23rd Avenue	2 EI 2AA	400	1
12606 23rd Avenue	2 IE 1BB	9500	1
12434 26th Avenue	2 IE 1BB	2000	1
12409 27th Avenue	2 IE 1BB	300	1
12412 27th Avenue	I IE 36CD	2600	1
12417 27th Avenue	2 IE 1BB	400	1
12418 27th Avenue	I IE 36 CD	2700	1
12425 27th Avenue	2 IE 1BB	500	1
12431 27th Avenue	2 IE 36CD	2800	1
12512 27th Avenue	2 IE 1BA	2500	1
12566 27th Avenue	2 IE 1BA	2600	1
12596 27th Avenue	2 IE 1BA	2700	1
12622 27th Avenue	2 IE 1BA	2800	1
1950 Lark Street	I IE 35DD	6900	1
1992 Lark Street	I IE 35DD	7000	1
2004 Lark Street	I IE 35DD	7100	1
2310 Lark Street	2 IE 1BB	7600	
2360 Lark Street	2 IE 1BB	7501	1
2380 Lark Street	2 IE 1BB	7500	1
		7701	
12611 McLoughlin Boulevard	2 IE 1BA	3300	1
12615 McLoughlin Boulevard	2 IE 1BA	3300	1
			30

Note: Oak Lodge Sanitary District bills these customers at its regular rates and pays that amount to the City of Milwaukie on a bimonthly basis.

City of Milwaukie Property
Served by Oak Lodge Sanitary District

Street Address	Tax Map	Tax Lot	EDU
2421 Dove Street	2 IE 1BB	7200	1
12504 SE 25th Avenue	2 IE 1BB	p/o4300	1
12526 SE 25th Avenue	2 IE 1BB	p/o4300	1
12548 SE 25th Avenue	2 IE 1BB	p/o4300	1
Apts	2 IE 2AA	200	30
12505 River Road	2 IE 2AA	600	20
			54

Note: Oak Lodge Sanitary District (OLSD) bills the City of Milwaukie at OLSD rates for the properties listed above.