Engineering Report

CITY OF CANBY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

December, 1999

CURRAN-McLEOD, INC., Consulting Engineers
6655 SW Hampton Street, Suite 210
Portland, Oregon 97223

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CITY OF CANBY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXECUTIVE SUMMARY

Introduction

The Canby Wastewater Collection System Master Plan is a comprehensive plan for expanding and upgrading the City's sanitary sewer collection system. The plan applies to the City of Canby and the area within its Urban Growth Boundary (UGB). Recommendations for replacement and expansion of the existing facilities are provided. With the recommendations in this plan, the City will be able to determine the location and size of new sewers to ensure a comprehensive and cost effective expansion of the City's wastewater collection system.

Sewer System Inventory and Analysis

The first step in the planning process was to identify and inventory all of the City's existing major sewers and their respective drainage areas. The major sewers were limited to either a trunk or an interceptor sewer. Interceptor sewers are generally larger than trunk sewers and receive flow from several trunk sewers. The trunk sewers are comprised of the mainlines that collect the flow from individual neighborhoods or a collection of local neighborhood lines. The drainage basin of each major sewer is the contributing area which will drain by gravity into the sewer. The trunk and interceptor sewers and their drainage basins can be seen in Figure A-1, Appendix A.

Another important planning task was to determine the location and elevation of manholes on the trunk and interceptor sewers. The resultant data were used to calculate the capacity of the existing sewers, to determine the adequacy of the system to transport full build-out loadings and to identify system deficiencies.

There are numerous sections of sewers which have been installed at relatively flat grades. In fact, several sewer sections have been installed with adverse grades, opposite the direction of flow. Although surcharged at times, most of these sewers were determined to function adequately with proper maintenance. Their capacity to handle present and future flows was found to be sufficient with only minor intermittent surcharging. However, all sewers installed on flat grades are subject to solids accumulation which could cause blockages. These sewers will require more frequent cleaning to prevent plugging problems but will provide acceptable service.

One important exception are the sewers on South 2nd Avenue between Elm Street and Knott Street. Most of these sewers are at flat grades, and one section has a reverse grade. Under present flows these sewers have excessive surcharging with standing wastewater in manholes during peak flow periods. This unacceptable surcharging will get worse as growth continues in the southwest quadrant of the City, and will require replacement.

Existing Pumping Stations Inventory

Review of the existing pump stations shows that all but one of the stations are relative new and in good working order. The station at North 3rd Avenue and Baker Street is an older inexpensive design but operating adequately. It currently receives very minimal flows and is scheduled to be relocated and upgraded as a component of developing the adjacent industrial area. No significant problems were found in any of the existing stations or their force mains.

Future Growth Impacts

The City is anticipated to fully expand to the limits of the Urban Growth Boundary within the next 20 years. These boundaries are shown in Figure II-1.

To determine the wastewater collection facilities needed for future growth, the City's UGB area was divided into future drainage basins based on topography. Drainage basins for the existing trunk sewers had already been determined by existing development. The existing and new basins are shown on Figure A-2, Appendix A.

The next step was to determine the amount of wastewater loadings generated from each drainage basin. Estimates of present and future wastewater flows were based on zoning or designated land use. The projected wastewater flow per acre was multiplied by the acres in each zone or land use designation, and the product is the estimated wastewater flow to be transported by the collection system.

Recommended New Sewers and Pump Stations

The flow estimates derived above were used to determine the adequacy of the existing facilities and to determine the capacity needed by future sewers and pump stations. The topography of each basin was then studied to estimate the location of the future major sewers and pump stations. These proposed trunk sewers and pump stations with their force mains are illustrated in Figure A-3, Appendix A.

The length and size of the proposed future trunk sewers are based on a two foot contour map prepared in the early 70's by Clackamas County. The final design of these sewers should be based on accurate field survey data. Thus, some minor changes are to be expected. Any changes, however, must account for service to all areas within the UGB and the sewers must be able to handle all projected flows from these areas.

In addition to showing the proposed future sewers, Figure A-3 (Appendix A) also shows the recommended changes to the 'flat' sewers of the South 2nd Trunk. Approximately 3,080 feet of existing sewer should be replaced. The existing sewers are 8 and 10 inches in diameter and will be replaced with sewers 10 inches to 18 inches in diameter. All new sewers are projected to be laid at minimum grade.

Implementation and Financing

The City maintains one fund for operation, maintenance and capital construction of the wastewater collection system. Theses are derived from two sources, user fees and System Development Charges (SDCs). User fees can be used to fund operation and maintenance of the existing wastewater treatment and collection facilities. It also includes funds for capital expenses to replace existing facilities and to upgrade the performance of the existing facilities with committed capacity.

The Wastewater System Development Charge (SDC) fees are available to fund capacity building improvements. This fee can be used to reimburse costs for available existing capacity or fund construction of new capacity. As opposed to monthly user fees which are paid by the existing rate payers, SDCs are paid by new connections, through a one-time charge.

Replacement Sewers

The collection system along South 2nd Avenue between Elm and Knott Streets should be replaced within the next few years. These existing sewers have significant surcharging problems with existing flows, and new developments will add to the current flows.

Present day problems, which are manageable, will worsen in the future and will, as more development occurs, potentially result in spills or backup of residential services.

The cost to design and construct these replacement sewers totals $284,400 of which $54,420 is associated with future capacity building.

New Collection Facilities

Approximately 10 miles of new trunk or major sewers and as many as four new pump stations will be needed to serve all of the areas within the UGB. These facilities are shown in Figure A-3 (Appendix A). In addition, the Third & Baker Pump Station will require relocating, and the Willow Creek Pump Station will need to be expanded. The total cost of these improvements is estimated to be $4,024,800.00.

Private development will pay the majority of this cost through construction of infrastructure. The component of oversizing, or excess capacity, is estimated at $1,065,400. This component is eligible for SDC funding, either through a credit to the developer to offset SDC fees, or direct payment of eligible development costs. The SDC Methodology must be updated to include these eligible expenses.

SDC Fee Adjustment

The cost estimate for oversizing components, which include pipelines and pumping stations, are used to calculate the City's SDC improvement fee. These capital costs; the costs associated with oversizing replacement sewers and new collection facilities are $54,420 and $1,065,400, respectively. *Total:* $1,119.820. Prorating this cost over the amount of excess capacity generates the improvement fee per residential housing unit. Similarly, the reimbursement fee should be updated to include construction undertaken at the wastewater treatment facility and throughout the collection system over the past two years.

THE CITY OF CANBY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

I. INTRODUCTION

Study Purpose

The primary purpose of the Canby Wastewater Collection System Master Plan is to develop a comprehensive plan for expansion and upgrading of Canby's wastewater collection system. The plan will apply to the City of Canby and the area within its current Urban Growth Boundaries (UGB). The proposed wastewater collection facilities will include new facilities and expansion of the existing facilities. The proposed sewers and pump stations will be located and sized to serve the entire UGB and to maximize the use of the existing system. With this Master Plan, the City will be able to determine the location and size of new sewers for future developments.

Scope

To reach the stated purpose, we have completed the following tasks.

1. Evaluation and review of the existing sewer system.

    a. Conduct field topographical survey of major sewers.
    b. Calculate capacities of major sewers.
    c. Develop map of existing collection system.
    d. Evaluate condition of existing sewers and pumping stations

2. Projection of future wastewater flows within the UGB.

    a. Develop land use inventories.
    b. Evaluate contribution per land use designation.
    c. Quantify and evaluate I/I impacts.

3. Determination of wastewater collection system master plan.

    a. Determine drainage basins within the UGB.
    b. Develop master plan maps for gravity sewers and pump stations.

4. Financial Planning

    a. Estimate cost of needed improvements.
    b. Determine impacts to SDCs.

II. GENERAL INFORMATION

Study Area

The City of Canby is located near the confluence of the Willamette and Molalla Rivers in Clackamas County, approximately 10 miles south of the Portland metropolitan area. Being in the fertile Willamette River Valley, the City is surrounded by excellent agricultural land. The land is generally flat, supporting orchards, nurseries, and truck farming. The close proximity of Portland creates many business and residential development opportunities for Canby. The City of Salem, which is the state capital and only 30 miles to the south, also provides many opportunities.

The study area coincides with the urban growth boundaries (UGB) and is shown in Figure II-1 and in Figure A-2 in Appendix A. The UGB was developed in the City's comprehensive plan and is based on a 20 year projection of growth from the last comprehensive plan review, and includes a total area of 3,444 acres. Commercial, industrial, residential and population growth are included only to the extent of their impact on additional area required in the adopted UGB.

Environmental Conditions

Topography

Canby has rivers on three sides of its UGB, the Willamette to the north and the Molalla to the west and south. Thus, the terrain generally slopes away from the center of town towards the rivers as can be seen in Figure II-1, Area Topography. From the point of view of sewer construction, this slope is rather gentle. Even so, several sewage pump stations are and will be necessary throughout the service area.

On the east side of the City the topography rises 50 to 60 feet above the City's average elevation. The northeastern corner of the Urban Growth Boundary lies at the toe of this rise.

Climate

The Willamette Valley weather is temperate. The average high temperature is 62.5 degrees, and average low is 41.8 degrees. Maximum high temperatures are in the 90's, and the minimum low are mostly in the 20's.

The average precipitation is 41 inches with most of this coming in the six month period of November through April.

Soils

SCS Class I and II loam and sandy loam soils dominant the study area. These soils have good compressive strength and drain well. Construction in nearly all areas of the UGB can proceed year round due to the soil qualities.

Groundwater

The Canby area has two major groundwater aquifers. One is relatively shallow while the other is a deep high quality aquifer. Both aquifers have excellent water quality and are used primarily for irrigation. Groundwater is generally well below the ground surface and rarely impact construction.

Surface Water

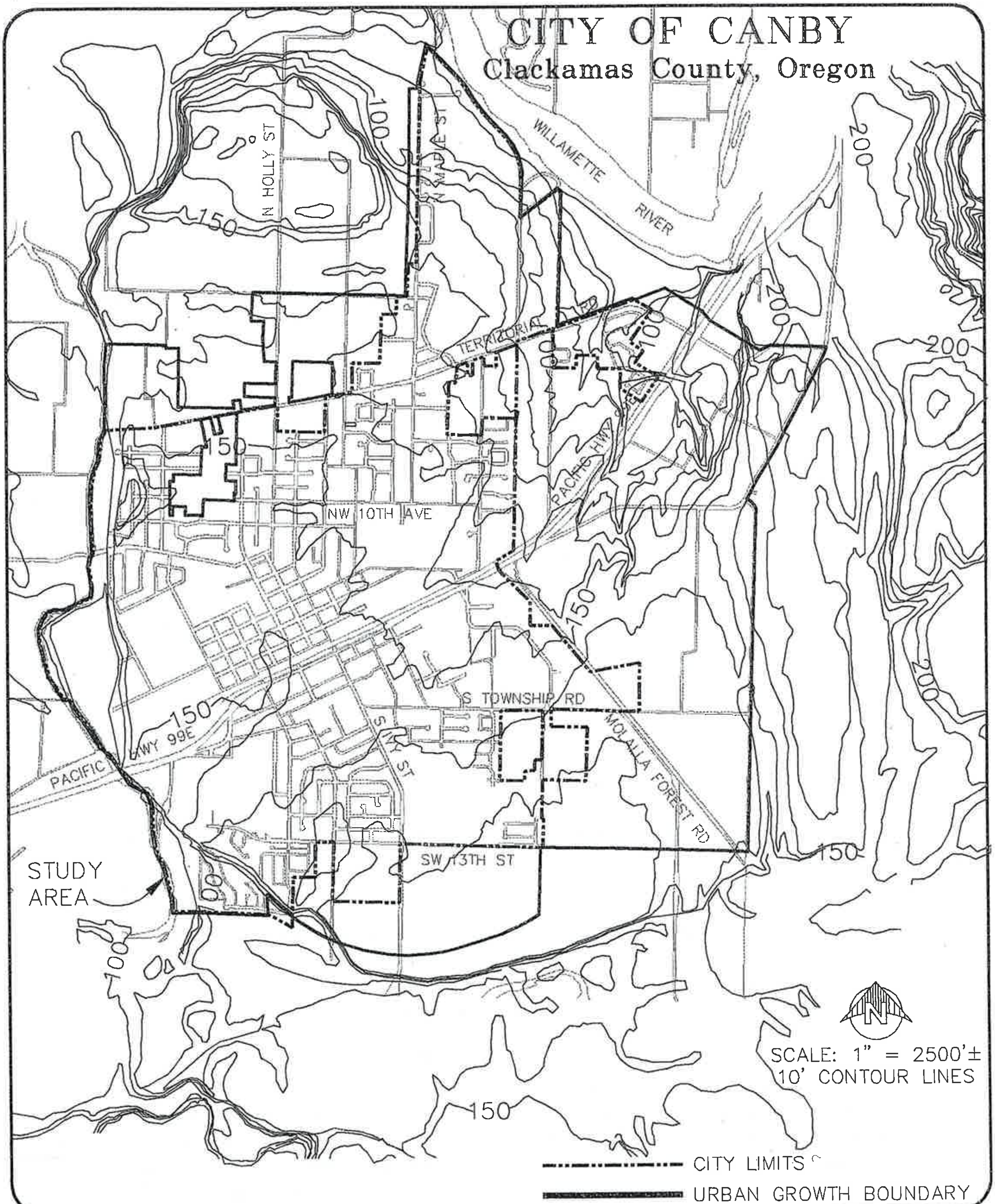
The Willamette River on the north and the Molalla River to the west and south, are important resources to the City and its neighbors. These surface waters provide the City's drinking water and are used for irrigation and recreational activities. The 100 year flood elevation for the Willamette is 87 feet at the wastewater treatment plant.

The Molalla River joins the Willamette River a few miles northwest of the City center. The Willamette River flows easterly from Canby and enters the Portland harbor at Willamette Falls.

Land Use

Land use within the City limits is governed by the Comprehensive Plan and Zoning ordinance. There are ten zoning districts as shown in Figure A-2, Appendix A. Most of the City is zoned residential. The industrial and commercial zones are generally located near the City center along Highway 99E.

The land use designations outside the City limits but within the UGB are outlined in the City's Comprehensive Plan and are also shown in Figure A-2 in Appendix A. Land use designations for this area correspond to similar use areas identified in the zoning ordinance.



CANBY WASTEWATER COLLECTION SYSTEM
MASTER PLANNING

AREA TOPOGRAPHY

CURRAN-McLEOD, Inc.

FIGURE II-1

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Infiltration and Inflow

Infiltration is defined as subsurface water which enters the wastewater collection system through cracks, open joints or other deficiencies in the collection system. It is directly influenced by the local ground water table and the structural integrity of the collection system. Infiltration can also be influenced by rainfall through rainfall induced infiltration.

Inflow is surface water, mainly storm water runoff, entering the system through roof drains, storm drains, manhole covers and other direct conduits to the sewer system. Inflow is directly influenced by storm events and usually occurs over a short period, during and after a storm event. Inflow is more easily reduced by eliminating non-sewerage connections to the system.

Most collection systems experience some degree of infiltration and inflow (I/I). Sewer systems are typically designed with additional capacity to accommodate the I/I flow. The level of acceptable I/I is a cost to benefit exercise. The tradeoff is higher treatment costs versus higher collection system repair costs.

Federal guidelines use 120 gallons per capita per day (gpcd) as a threshold value for excessive infiltration, based on the average influent flow of a 7 to 14 day non-rainfall period during the rainy season. To evaluate Canby's infiltration, we reviewed the City's treatment plant flows during the rainy seasons of 1994-95 and 1995-96. Our findings are summarized in Table III-1.

TABLE III-1
FLOWS DURING 7 TO 14 DAY LOW RAINFALL PERIODS IN RAINY SEASON

Month/Year	Days	Average Flow (mgd)	Population	Flow per Capita (gpcd)	Rainfall (inches)
1/95	8	0.88	10,600	83	0.08
2/95	9	0.87	10,600	82	0.02
2/95	10	0.89	10,600	84	0.00
3/95	15	0.86	10,600	81	0.37
12/95	9	0.83	11,200	74	0.14
1/96	8	0.91	11,200	81	0.08
2/96	7	0.87	11,200	78	0.00
2/96	7	0.90	11,200	80	0.01
3/96	7	0.85	11,200	76	0.03

As can be seen, the flow per capita never exceeds 85 gpcd which is 35 gpcd less than the guideline rate of 120 gpcd. It should be noted that during the first week of February, 1996 nearly seven inches of rain fell in a four day period. Thus, the ground was assumed to be saturated during that period. Even so, the flow per capita never exceeded 80 gpcd. Canby's sewers do not have excessive infiltration.

Federal guidelines also recommend 265 gpcd as a threshold value for excessive inflow. The facility's maximum 24-hour flow in February, 1996 was only 130 gpcd. This maximum flow per capita occurred during the four day period when nearly seven inches of rain fell. The 130 gpcd is well below the Federal threshold value for excessive inflow.

In summary, the collection system has no deficiencies related to excessive infiltration or inflow. Conversely, due to the low groundwater levels and typical piping system deficiencies, it is likely that exfiltration may be occurring. Quantifying this component is very difficult and is not obvious at any point of observable drainage.

Existing Pump Stations

The collection system utilizes seven sewage pump stations. Of the seven, six are owned and operated by the City. The seventh pump station, Village of the Lochs Pump Station, is privately owned and operated by the Village of the Lochs. Table III-2 at the end of this section summarizes the data on the seven pump stations.

There are approximately 1,000 feet of pressure sewer or force mains in the collection system. All force mains are 4 inches in diameter. The pump stations and most of the force mains are shown in Figure A-1, Appendix A. Some of the force mains are not shown because the pump station discharges into an adjacent manhole and the distance from the station to the manhole is too short for a force main line to be visible at the scale of the map.

TABLE III-2
SEWAGE PUMP STATION DATA

Pump Station	Installation Date	Pump Type and Manufacturer	Pump Design Capacities	Controls	Overflow Point	Standby Power	Force Main	Sulfide Control
Willow Creek Subdivision	August, 1991	Self Priming, Hydromatic, Model 40MPV	Two 5 hp pumps, each: 155 gpm @ 26' TDH	Floats with PLC 90-20	MH H-14, 141 feet east of PS	Receptacle for Portable Generator *	Approx. 700' of 4" dia. pipe w/ 460 gal. of storage.	None.
11th & Pine	April, 1996	Submersible, Hydromatic, Model SH150M	Two 1.5 hp pumps, each: no data	Floats with PLC 90-20	MH in cul-de-sac on 11th Ave.	Receptacle for Portable Generator	Approx. 50' of 4" dia. pipe w/ 33 gal. of storage.	None..
Shopping Center	October, 1975	Submersible, Enpo-Cornell	Two 2 hp pumps, each: approx. 50 gpm	Floats with PLC 90-20	MH Q-3 in S. Berg St. at Hwy 99E	Receptacle for Portable Generator	Approx. 30' of 4" dia. pipe w/ 20 gal. of storage.	None.
3rd & Baker	Before 1975	Submersible	Two pumps, each: approx 120 gpm	Floats with PLC 90-20	Pump Station	Receptacle for Portable Generator	Approx. 80' of 4" dia. pipe w/ 50 gal. of storage.	None.
Knight's Bridge	September, 1995	Submersible, Hydromatic, Model S4MX	Two 3 hp pumps, each: 150 gpm @ 18' TDH	Ultrasonic Level Sensor w/ PLC 90-20	Pump Station	Receptacle for Portable Generator	Approx. 40' of 4" and 110' of 6" dia. pipe w/ 190 gal. of storage.	None.
34th Street	October, 1993	Self Priming, Hydromatic, Model 30MPV	Two 5 hp pumps, each: 155 gpm @ 26' TDH	Floats with PLC 90-20	MH A-3 in NE 34th Pl.	Receptacle for Portable Generator	Approx. 3,400' of 4" dia. pipe w/ 2,200 gal. of storage.	Rotary Blower.
Village on the Lochs **	October, 1992	Submersible, Hydromatic, Model SL4RC	Two 20 hp pumps, each: 200 gpm @ 100' TDH	Floats with PLC 90-20	Pump Station	Receptacle for Portable Generator	Approx. 1,650' of 4" dia. pipe w/ 1,100 gal. of storage.	Rotary Blower.

*** Village on the Lochs Pump Station is not owned or operated by the City.*
** Portable generator provides 100 KW and is stored at the City's DPW complex.*

IV. PLANNING CRITERIA

General Considerations

In order to develop this plan, to meet the needs of the study area and to develop opinions of cost, it was necessary to prepare preliminary designs for the proposed system improvements. It must be noted that these plans are very preliminary, based on assumptions and general design criteria. Detailed pre-design analysis is necessary to develop specific designs and identify conditions that will influence the construction of the facilities.

Service Area and Planning Period

The City of Canby must be able to provide sewage collection and treatment services to all areas within its Urban Growth Boundaries (UGB), as shown in Figures II-1(Page 4) and A-2 (Appendix A). The UGB establishes the area within which the City can grow until approximately the year 2015. Therefore, the service area for this Master Plan is the UGB, and the planning horizon is the year 2015.

Drainage Basins

The UGB has been divided into drainage basins. Each basin includes the area which is being or could be served by a major sewer or pump station. The drainage basins are shown, along with their associated sewers and pump stations in Figures A-1 and A-3, which are folded into pockets in Appendix A.

Development of the drainage basin boundaries was a two step process. First, the area served by each existing trunk sewer and pump station was delineated. These preliminary basins also included areas into which the existing gravity sewers could be expanded. If the extension of an existing gravity line could not serve a particular area due to elevation problems, then a pump station with its own preliminary drainage basin was added.

The second step required calculating the capacity of each major pipe line and pump station. These capacities were compared to the future sewage flows expected from each preliminary drainage basin. (See below for discussion of Sewage Flow Projections). Some of the existing sewers were found to be inadequate to handle future flow projections while others had excess capacity. Therefore, the basin boundaries were changed, where possible, to help relieve some of the sewers with insufficient capacity and to add flow to the sewers with available capacity.

Zoning and Land Use Areas

The City's zoning and land use designations are used to develop flow projections. The City's zoning ordinance governs what activity can occur within the city limits. Experience has shown that certain activities will produce a predictable amount of sewage flow per acre. Residential areas are very predictable whereas commercial and industrial areas are much less uniform. Thus, the zoning areas are used for sewage flow projections.

Areas outside the City limits but within the UGB are divided into land use areas. Land use areas are established in the City's comprehensive plan. The types of land use areas are the same as for the zoning areas. As a general rule, an area with a particular land use designation will have the same zoning designation when the area is incorporated into the City. As a result, the same projections will be applied to the various land use designations as were applied to the various correspondence zones.

The zoning and land use areas are shown in Figure A-2 in Appendix A.

Flow Projections

General

Flow projections for each type of zoning/land use designation have been developed. These projections were first developed for the City of Canby during the design of the Redwood Interceptor and were given to the city in a letter dated January 20, 1986. A copy of the letters is in Appendix C.

The projections are summarized in the Table IV-1 below. The first thing to note is that these are peak flows. All sewers are designed for peak flows. Average daily flows can only be used for the design of wastewater treatment facilities. Obviously, each sewer or pump station must be able to handle the peak flow it will receive without surcharging or overflowing.

TABLE IV-1
PEAK FLOW PROJECTIONS PER ZONING/LAND USE AREA

Land Use	People per Acre	Sewage Flow per Person	Sewage Flow per Acre	Peak Flow in GPD/Acre		
				Domestic	I/I	Total
Agriculture	--	0	--	0	0	0
Low Density Residential	8	300	--	2,400	150	2,550
Medium Density Residential	14	300	--	4,200	150	4,350
High Density Residential	20	300	--	6,000	`50	6,150
Private - Recreational	--	0	--	0	0	0
Public Owned	30	25	--	750	150	900
Downtown Commercial	50	25	--	1,250	150	1,400
Convenience Commercial	50	25	--	1,250	150	1,400
Residential Commercial	50	25	--	1,250	150	1,400
Highway Commercial	50	25	--	1,250	150	1,400
Commercial Manufacturing	--	--	1,500	1,500	150	1,650
Light Industrial	--	--	3,000	3,000	150	3,150
Heavy Industrial	--	--	3,000	3,000	150	3,150
Flood-Steep Slopes	2	300	--	600	150	750

To develop the above peak flow projections, assumptions about the following items were made: the number of people per acre, the peak flow per person and, for manufacturing and industrial, peak sewage flow per acre. An important assumption is the peak flow per person. The average per capita flow was 100 gallons per day (gpd) as documented in the Canby Supplemental Wastewater Treatment Facilities Plan. For sewer design, a peaking factor of 3 is assumed. Therefore, the peak flow of 300 gallons per capita per day (gpcd) is used for projections.

Another assumption is the 150 gpd per acre for infiltration and inflow (I/I). As was stated earlier, Canby has very little I/I; therefore, we have assumed a very modest amount of I/I.

The total projected peak flow for each zoning designation is thus the number of acres times the sewage flow per acre.

Drainage Basin Projected Flows

To determine the projected sewage flow into a particular trunk sewer, the zoning/land use areas were superimposed on the drainage basins. The acreage of each type of zoning/land use designation which could be served by a particular segment of sewer was inventoried. Then the acres served were multiplied by the projected flows for the appropriate zoning/land use designation. These projected flows are listed in Tables B-1 and B-2 in Appendix B under the column labeled Sewage Flow.

The Cumulative Sewage Flows, as listed in Tables B-1 and B-2 (Appendix B) are the sums of the sewage flows received in a particular sewer segment plus all of the flows from the upstream sewer segments.

These sewage flow projections assume that the service areas will develop to the densities shown in Table IV-1 (Page 11). This is a conservative approach when also considering the peaking factor of three. Most service areas in medium size communities do not reach full development or build-out during the planning period. There is typically a 5% vacancy factor which does not get developed and thus slightly reduces the expected density.

Proposed Sewer Design Criteria

For this Master Plan, proposed gravity sewers were sized and located to maintain minimum velocities and grades. Minimum grades help prevent solids in the sewage from settling in the pipeline. If a pipe is installed at less than the minimum grade, the velocities in the sewer can become so low that solids settle out and cause blockages.

The Manning's formula was used to determine the capacities of proposed gravity sewers. Manning's roughness coefficient was assumed to be 0.013. Proposed manholes are assumed to be spaced no more than every 400 feet with average distances between manholes assumed to be 300 feet.

Proposed new sewers were sized to have approximately 25% surplus capacity. The minimum acceptable size municipal sewer is an 8-inch diameter pipeline to minimize plugging.

The following table IV-2 lists pipeline size, minimum slope and maximum line capacity.

TABLE IV-2
MINIMUM GRAVITY SEWER LINE GRADES AND CAPACITIES

Pipe Line Size (Inches)	Minimum Grade (Percent)	Capacity (MGD)
8	0.40%	0.50
10	0.28%	0.75
12	0.22%	1.08
15	0.15%	1.62
18	0.12%	2.36

Proposed Pump Station and Force Main Design Criteria

Pumps must be sized to handle the future peak flows with one pump out of service. This requires one pump to be redundant to provide backup during mechanical failure of the other pump or pumps. The pump station wet well must be sized large enough to provide adequate run time to protect the pump motors and must be small enough to prevent the sewage from becoming septic between pump cycles. New pressure sewers or force mains were sized using the Hazen-Williams formula with a roughness coefficient of 130 and maintaining a velocity of between 2 and 7 feet per second.

V. SEWER SYSTEM MASTER PLAN

General

The following subsections describe the problems within each of the drainage basins of Canby's existing sewer system. Problems created by both the existing and projected wastewater flows were reviewed. The problems were determined through discussions with the City's staff and by examination of the data and calculations in Tables B-1 and B-2 in Appendix B.

Solutions to the problems are also discussed. If replacement of existing facilities is the recommended solution, the replacement facilities are described. The general priority of each solution is also discussed.

Finally, the need for expansion within each drainage basin and the facilities to meet that expansion are presented.

To facilitate the discussion of each basin, information from Tables B-1 and B-2 (Appendix B) is presented in each subsection along with a basin map showing the existing system and the proposed expansions and/or improvements.

Sewer Capacities

General

As discussed previously under Existing Gravity sewers, we determined the capacities of the main trunk lines based on recent survey data. These capacities are shown in Tables B-1 and B-2 (Appendix B).

There are several sewer sections which have negative slopes. The capacities of these sections have not been calculated as indicated by an 'N/A' in Tables B-1 and B-2 (Appendix B). The capacity of these sewers is dependent upon the extent of surcharging.

Peak wastewater flows for each section of the trunk sewers were estimated based on the assumptions presented in the previous section, Planning Criteria. The amount of wastewater flow in a particular sewer section is the summation of the wastewater entering through the service laterals, infiltration, inflow and all upstream sewer flows. These cumulative flows are shown in Table B-1 for existing conditions and Table B-2 for future conditions (Appendix B).

Remaining Capacities

The remaining capacity of an existing sewer is the difference between the cumulative flow for that sewer section and its capacity. This subtraction has been done and the results are shown in Tables B-1 and B-2 (Appendix B).

As can be seen in the tables, most sewers have excess capacity for both existing and future flows. Some, however, do not. The wastewater in these sewers will not be open channel flow but rather will be supported by surcharged conditions.

Surcharging

The capacity of a gravity sewer is defined as the amount of wastewater which will freely flow through it with the depth of wastewater being equal to the inside diameter of the pipe. Additional wastewater will require the depth of wastewater to be greater than the pipe diameter. Thus, the wastewater will back-up, and the sewer will become surcharged.

In Tables B-1 and B-2 (Appendix B), the surcharged condition is indicated when the remaining capacity of a sewer is a negative number. The amount of surcharging increases as the value of the negative number increases.

Based on some assumptions about the hydraulic conditions in a surcharged sewer, we have made rough estimates of the depth of surcharging. As shown in Tables B-1 and B-2 (Appendix B), the surcharging may affect more than one sewer section. A section with insufficient capacity can backup several other sections. Eventually, the wastewater surcharges high enough to flow through the undersized sewer unless it breaches the surface of a manhole or overflow.

Minimum Grade

Many sections of the Canby sewer system were installed at less than the recommended minimum grade. As discussed under Planning Criteria, each size of sewer has a minimum grade which is considered necessary to create velocities which will help prevent solids deposition in the pipe or manhole. Throughout the following discussions, this recommended grade is referred to as the minimum grade.

Sewer Replacements and Extensions

Recommendations for sewer replacements and extensions are made in the following subsections for each drainage basin . The size of the recommended sewers are based on the criteria presented in the previous section, Planning Criteria, with the minimum acceptable size of 8" diameter.

Cost Estimates

Cost estimates for the proposed new collection facilities and the replacement or upgrade of existing facilities are shown in Table B-3 in Appendix B. These estimates include construction and engineering costs. They do not include interest or financing costs. The assumptions used to make these estimates include the following.

Gravity sewers which are 8 and 10 inches in diameter are assumed to be PVC. Gravity sewers 12 inches and larger are assumed to be reinforced concrete or PVC. An average depth of excavation is assumed for each section of sewer and is shown in Table B-3 (Appendix B). The backfill for gravity sewers is assumed to be 50% selected backfill. Roadway repair is also estimated to be required 50%

of the time. Manholes and house laterals are included in the per foot cost of pipe installation. For each foot of sewer main, one foot of 4-inch PVC lateral pipe is assumed to be installed.

Pump stations will have self priming pumps located above the wet well; or, the stations will employ submersible pumps located in the wet well. Dry wells are not assumed to be necessary. Force mains for the pump stations are assumed to be PVC with all necessary check valves, gate valves, air release valves and cleanouts.

The cost estimates are broken down into actual costs, replacement costs and oversize costs. The actual costs are the total cost to design and construct the proposed facilities. Replacement costs are estimates of the costs to replace existing sewers with a sewer of similar diameter. Oversize costs are the estimated cost differences between installing a standard 8-inch sewer and a larger diameter sewer. Oversize costs can also be the difference between replacing an existing sewer with the same diameter sewer and a larger diameter sewer. The need for a larger diameter sewer stems from the need to accommodate future upstream development. A thorough discussion of these costs is provided in the next chapter, Implementation and Financing.

As with Table B-1 and B-2 information from Table B-3 (Appendix B) is presented in each subsection to facilitate the discussion of each basin.

1. Elm Street Trunk Sewer

General

The Elm Street Trunk has five sections of sewers which do not have sufficient capacity to flow without surcharging. These same sewers do not have the recommended minimum grade for an 8-inch sewer, which is 0.0040 feet per foot (ft/ft). Table V-1a on the following page highlights these sewer sections.

Sewer Capacity

The lack of sewer capacity is primarily due to the pumping station at the Village of the Lochs. The station can pump 0.29 million gallons per day (mgd) with just one pump. The maximum expected flow rate for the trunk line totals only 0.54 mgd, as shown in the Cumulative Flows column under Future Conditions in Table V-1a. Thus, the pumping station accounts for more than half of the maximum total flow rate. Obviously, without the pumping station, the trunk's gravity sewers would not surcharge.

Fortunately, the pumping station operates only a few minutes every hour to handle the sewage flow from the Village of the Lochs. Thus, the Elm Street Trunk sewer surcharges only a few minutes every hour during peak flow times.

We estimate that the amount of surcharging is minimal. The maximum depth of surcharging in the manholes is expected to be less than two feet during future peak flows. This amount of surcharging occurring only a few minutes every hour is not expected to be a problem.

Minimum Grade

Even though many of the sewers have been installed at less than minimum grade, none of sewers in the Elm Street Trunk have had excessive plugging problems. One reason for this is the flushing action of the Village of the Lochs pumping station. The periodic high flows flush out any settled solids before they cause a problem.

Sewer Replacements and Extensions

We do not recommend replacing any pipes in the Elm Street Trunk. However, we do expect the trunk to be extended to the south end of the trunk's drainage basin. This extension will be accomplished by developers.

Cost Estimates

The estimated engineering and construction cost for the 8-inch diameter sewer extensions for the Elm Street Trunk is $60,000. A breakdown of the project costs and improvements are shown in Table V-1b.

TABLE V-1a
ELM STREET TRUNK SEWER
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		**Sewer**			**Existing Conditions**		**Future Conditions**	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
Extend Village of the Lochs Sewer							0.01	
Village of the Lochs Pump Station - 2 pumps ea. @ 200 gpm					0.29		0.29	
Extend sewer east from manhole U-5							0.32	
U-5	U-4	0.0057	8	0.59	0.29	0.30	0.32	0.26
U-4	U-3	0.0065	8	0.63	0.29	0.33	0.33	0.30
U-3	U-2	0.0048	8	0.54	0.31	0.23	0.34	0.33
U-2	U-1	0.0077	8	0.68	0.32	0.36	0.35	0.33
U-1	R-18	0.0054	8	0.57	0.33	0.24	0.37	0.21
Extend Sewer north as shown in Figure V-1							0.42	
R-18	**R-19**	0.0023	8	0.37	0.40	**-0.03**	0.48	**-0.11**
R-19	**R-20**	0.0026	8	0.40	0.44	**-0.05**	0.53	**-0.13**
R-20	R-21	0.0112	8	0.82	0.44	0.38	0.53	0.30
R-21	R-22	0.0091	8	0.74	0.45	0.29	0.53	0.21
R-22	**R-23**	0.0028	8	0.41	0.45	**-0.04**	0.54	**-0.12**
R-23	**R-24**	0.0039	8	0.48	0.46	0.03	0.54	**-0.05**
R-24	**R-25**	0.0034	8	0.45	0.46	**-0.01**	0.54	**-0.09**
R-25	R-26	0.0051	8	0.55	0.46	0.09	0.54	0.01

TABLE V-1b
ELM STREET TRUNK SEWER
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

			Actual		**Replacement**		**Oversize**	
Item Description	**Size (In)**	**Length (ft)**	**Unit Cost ($/ft)**	**Total Cost ($)**	**Unit Cost ($/ft)**	**Total Cost ($)**	**Unit Cost ($/ft)**	**Total Cost ($)**
New sewer east from Manhole U-5.	8	800	50	40,000	-	-	0	0
New sewer north as shown on Figure V-1.	8	400	50	20,000	-	-	0	0

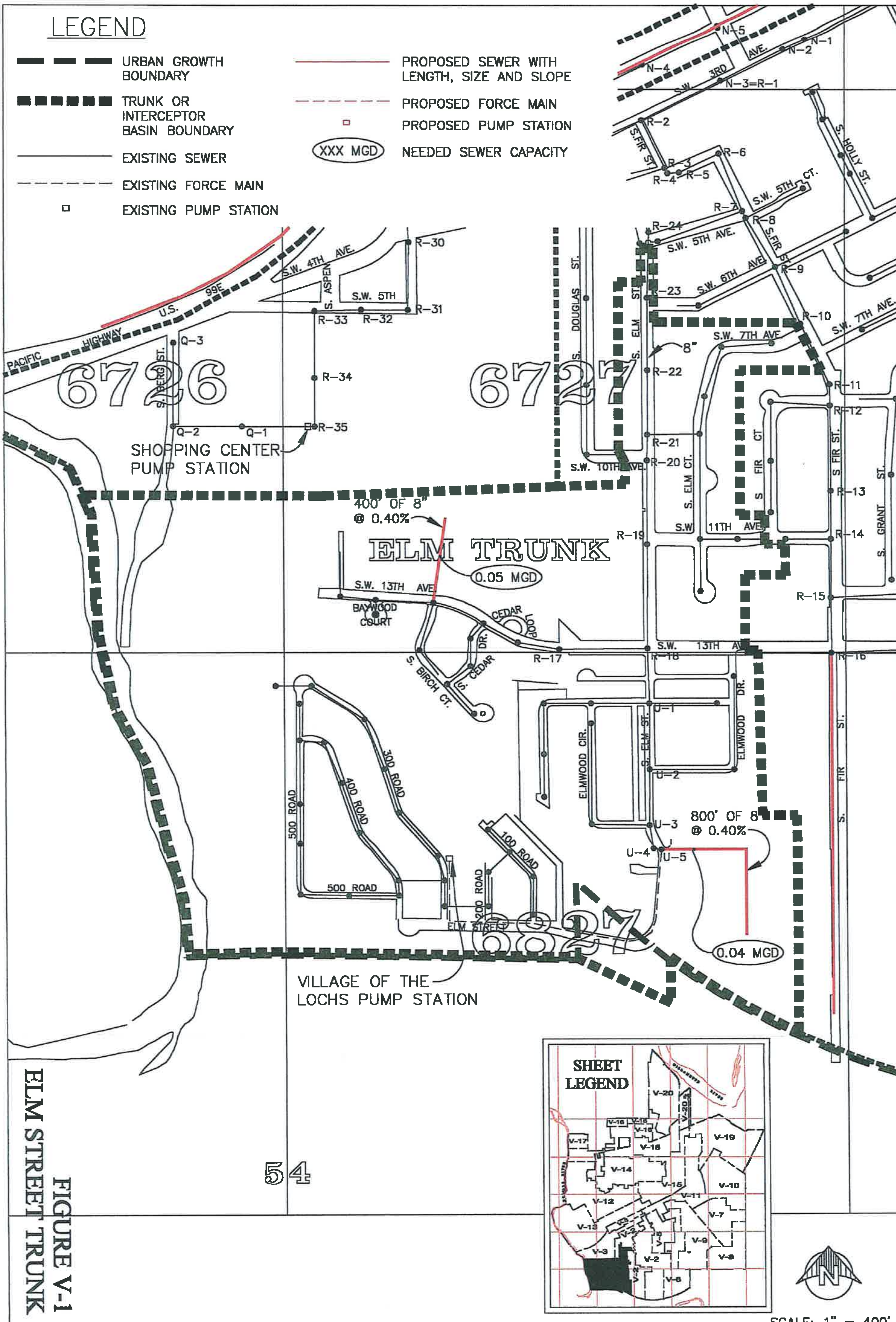

FIGURE V-1
ELM STREET TRUNK

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2. Fir Street Trunk Sewer

General

The slopes of the sewer sections as listed in Table V-2a reveal that five sections of the Fir Street Trunk sewer are below minimum grade. However, because of minimal sewage flows, no surcharging is expected to occur.

Sewer Capacity

The existing sewers have the capacity to flow by gravity without surcharging for the present and future peak flows.

Minimum Grade

The five sewer sections with less than minimum grade combined with the minimal loadings, will require that these sections be cleaned more frequently than other sections. Unfortunately, the terrain of the drainage area is very flat and will not allow steeper slopes. The sewer sections which are immediately upstream or downstream of the five (5) flat sections are at or just slightly steeper than minimum grade. Thus, reinstalling the sewers to minimum grade would be a substantial and extensive undertaking.

Sewer Replacement and Extensions

We do not recommend replacing any pipes in the Fir Street Trunk. However, we do expect the trunk to be extended to the south end of the drainage basin. This extension will be accomplished by private development.

The flat terrain of the drainage area may cause problems for extending the Fir Trunk sewer. As shown in Figure V-2, the trunk sewer needs to be extended south to serve the entire drainage basin. Several branch sewers will need to be installed from the extended trunk sewer. These sewers may need to extend into locally low areas. Extending the minimum size sewer, 8-inch, at its minimum grade, may cause the sewer to become too shallow to adequately serve homes constructed in the low areas.

The low areas are located south of S.W. 13th Avenue between Fir and Ivy Streets. During the design of sewers in these areas, an accurate survey needs to be done. More detailed topographic information is necessary to accurately determine whether or not there is sufficient grade. If not, some of the low areas may need to be filled or other routes utilized.

Estimated Costs

The estimated engineering and construction costs for the 8-inch diameter sewer extensions for the Fir Street Trunk total $85,000. A breakdown of the project and the cost of the extension is shown in Table V-2b.

TABLE V-2a
FIR STREET TRUNK SEWER
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Sewer			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Extend sewer south from manhole R-16							0.15	
R-16	R-15	0.0031	8	0.43	0.04	0.39	0.18	0.25
R-15	R-14	0.0043	8	0.51	0.05	0.46	0.19	0.32
R-14	R-13	0.0030	8	0.43	0.06	0.37	0.20	0.22
R-13	R-12	0.0035	8	0.46	0.07	0.39	0.21	0.25
R-12	R-11	0.0027	8	0.40	0.08	0.32	0.23	0.18
R-11	R-10	0.0043	8	0.51	0.09	0.42	0.24	0.27
R-10	R-9	0.0054	8	0.57	0.10	0.47	0.24	0.33
R-9	R-8	0.0038	8	0.48	0.11	0.37	0.25	0.22
R-8	R-7	0.0049	8	0.54	0.11	0.43	0.25	0.29
R-7	R-6	0.0040	8	0.49	0.12	0.37	0.26	0.23
R-6	R-5	0.0044	8	0.51	0.13	0.39	0.27	0.24
R-5	R-4	0.0067	8	0.64	0.13	0.51	0.27	0.36
R-4	R-3	0.0043	8	0.51	0.13	0.38	0.27	0.24
R-3	R-2	0.0052	8	0.56	0.15	0.41	0.29	0.27
R-2	R-1	0.0039	8	0.48	0.16	0.32	0.31	0.18
R-1	N-2	0.0042	8	0.50	0.18	0.32	0.33	0.18
N-2	N-1	0.0031	8	0.43	0.20	0.23	0.35	0.09
N-1	O-40	0.0040	8	0.49	0.22	0.27	0.36	0.13
O-40	O-39	0.0113	8	0.83	0.23	0.60	0.37	0.46

TABLE V-2b
FIR STREET TRUNK SEWER
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from Manhole R-1.	8	1700	50	85,000	-	-	0	

3. Ivy Street Trunk Sewer

General

Seven sections in the Ivy Street Trunk sewer have grades significantly less than the minimum. All but one of the sections are in the upper reaches of the trunk sewer from manhole S-10 to manhole S-18. Fortunately, the flow of wastewater in these upstream sewers is very low. Thus, if the sewers are kept clean, their capacity, even with the relatively flat grades, will be more than adequate, and surcharging and blockages should not occur.

Sewer Capacities

As shown on Table V-3a on Page 22, the Ivy Street Trunk has and will have adequate capacities for its present and expected flows.

Minimum Grades

The low flow rates and the sewers with less than minimum grade will cause the wastewater to flow at low velocities. These low velocities allow more solids to settle. Thus, more frequent cleaning will be necessary.

One segment of the Ivy Street Trunk sewer, which starts at manhole O-31, has an adverse slope. This negative slope, causes the sewer to have standing wastewater.

Sewer Replacements and Extensions

The sewer sections upstream of manhole S-18 and downstream of manhole S-10 have grades much greater than the minimum. Therefore, if the branch sewers and house laterals also have sufficient grade, many of the sewers could be re-installed at, or very near, minimum grade. However, the cost of replacing the sewers will be much greater than the cost of frequent cleaning.

During times of low flows, the wastewater in section O-31, which has the negative slope, will travel very slowly. This will allow solids to settle. Fortunately the sewer section is very short, only 35 feet long. This will minimize any problems which might occur. No action is recommended to repair this negative slope.

Figure V-2 on page 23 shows the extension of the Ivy Trunk sewer to the south. Like the Fir Trunk extension, the Ivy Trunk extension may need to serve some local low areas. The same concerns discussed above for the Fir Trunk sewer apply to the Ivy Trunk, namely a detailed survey to assure adequate depth of sewers.

Cost Estimates

The cost estimates of the sewer extension of the Ivy Street Trunk are $75,000 and are shown in Table V-3b.

TABLE V-3a
IVY STREET TRUNK SEWER
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Extend sewer south from manhole S-19							0.20	
S-19	S-18	0.0075	8	0.67	0.03	0.64	0.23	0.44
S-18	S-17	0.0027	8	0.40	0.03	0.37	0.23	0.18
S-17	S-16	0.0035	8	0.46	0.03	0.43	0.23	0.23
S-16	S-15	0.0041	8	0.50	0.11	0.38	0.31	0.19
S-15	S-14	0.0029	8	0.42	0.13	0.29	0.33	0.09
S-14	S-13	0.0047	8	0.53	0.13	0.40	0.33	0.20
S-13	S-12	0.0028	8	0.41	0.15	0.26	0.35	0.06
S-12	S-11	0.0033	8	0.45	0.15	0.29	0.35	0.10
S-11	S-10	0.0032	8	0.44	0.17	0.27	0.37	0.07
S-10	S-3	0.0036	8	0.47	0.19	0.28	0.38	0.08
S-3	S-4	0.0081	8	0.70	0.19	0.51	0.39	0.31
S-4	S-2	0.0062	8	0.61	0.22	0.39	0.42	0.20
S-2	O-29	0.0039	8	0.48	0.24	0.24	0.44	0.05
O-29	O-30	0.0046	8	0.53	0.26	0.27	0.45	0.07
O-30	O-31	0.0047	8	0.53	0.27	0.26	0.47	0.06
O-31	O-32	-0.0009	8	N/A	0.29	-0.00	0.48	-0.00
O-32	O-33	0.0057	8	0.59	0.30	0.29	0.50	0.09

TABLE V-3b
IVY STREET TRUNK SEWER
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer south from Manhole S-1.	8	1500	50	75,000	-	-	0	0

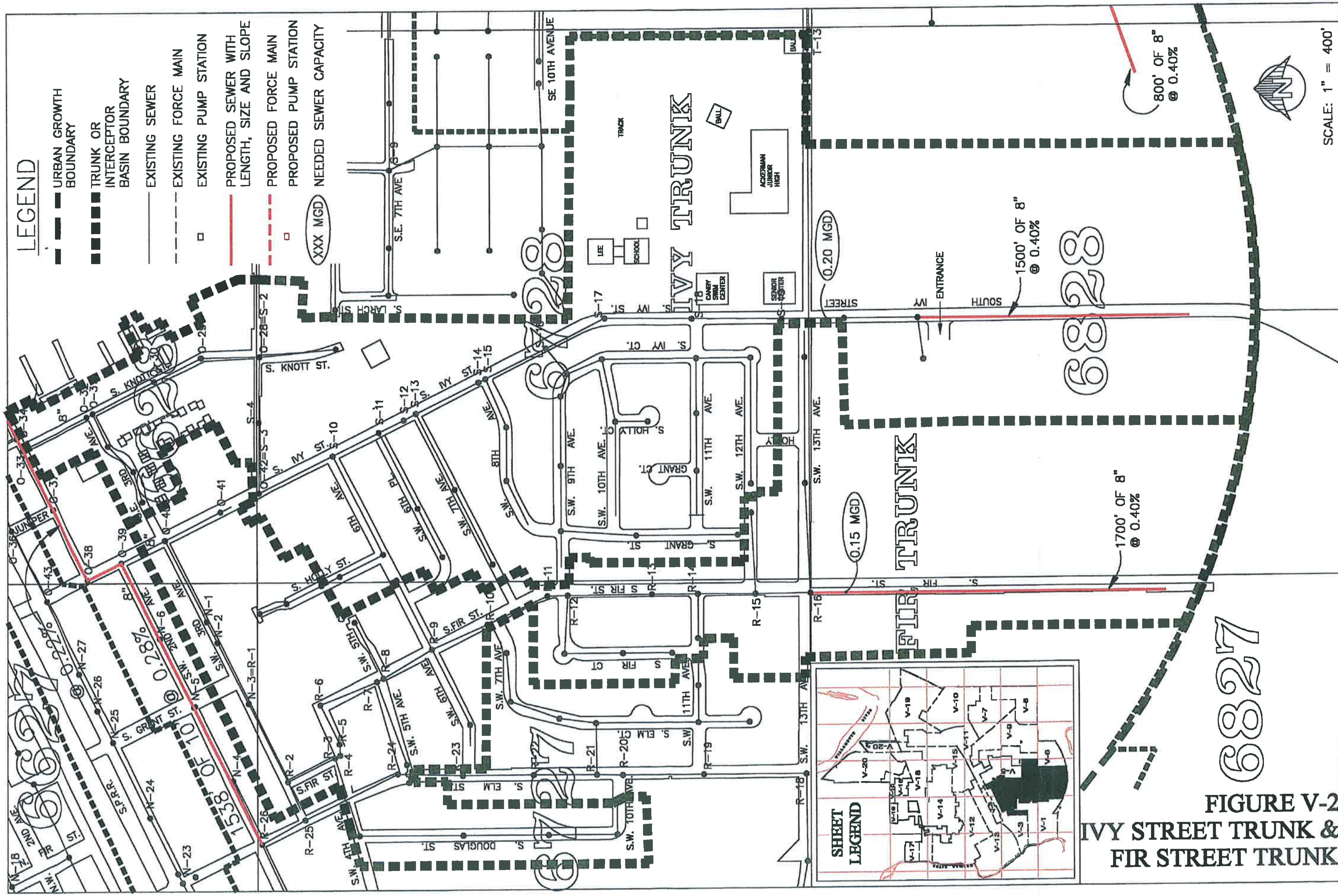

FIGURE V-2
IVY STREET TRUNK & FIR STREET TRUNK

3.1 South 99E Trunk

General

The South 99E Trunk is shown in Figure V-3. All of the sewers in this South 99E Trunk have less than minimum grade as shown in Table V-3.1a. However, because of low flows, none of the sewers should experience surcharging.

Sewer Replacements and Extensions

The lowest section of this trunk has a steep slope of 0.96%. Replacement of this sewer with a flatter sewer would allow some of the other sections to be laid at steeper slopes. However, there may be many underground obstacles which would prevent relaying the sewer at a greater slope. Also, construction in Highway 99E would be very difficult and expensive. No revisions to the South 99E Trunk are recommended.

TABLE V-3.1a
SOUTH 99E TRUNK EXISTING CONDITIONS
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions	
Upstream MH No.	Downstream MH No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)
N-23	N-24	0.0022	8	0.36	0.02	0.35
N-24	N-25	0.0030	8	0.43	0.02	0.40
N-25	N-26	0.0027	8	0.40	0.02	0.38
N-26	N-27	0.0016	8	0.31	0.03	0.28
N-27	O-43	0.0023	8	0.37	0.03	0.34
O-43	O-36	0.0027	8	0.40	0.03	0.37
O-36	O-35	0.0096	8	0.76	0.04	0.72

4. South 2nd Avenue Trunk Sewer

General

The South 2nd Avenue Trunk receives flow from three other trunk sewers, Elm, Fir and Ivy as shown in Figure V-3. The first trunk to enter is the Elm Street Trunk at manhole R-26. Subsequently, the Fir Street Trunk enters at manhole O-39, and the Ivy Street Trunk enters at manhole O-33.

The additional flows from these other trunks means that the South 2nd Avenue Trunk carries significant wastewater flows. These flows are shown in the Cumulative Flows column in Table V-4a.

The other concern with the S. 2nd Avenue Trunk is the flat terrain of its drainage basin. The average slope of S. 2nd Avenue from Elm Street to Locust Street is only 0.25%. This is less than the recommended grades for 8-inch and 10-inch diameter sewers, which are 0.40% and 0.28%, respectively.

Minimum Grade

In part because of the flat terrain, seventeen (17) out of twenty one (21) sewer sections of the S. 2nd Avenue Trunk are at less than minimum grade as shown on Table V-4a. In fact one section has an adverse slope.

The relatively flat sewers will mean that the wastewater will be traveling at low velocity and solids will tend to settle out. Thus, frequent cleaning will be required in these sewer sections, and the potential for blockages will increase.

The flatter slopes and thus the lower velocities will reduce the capacity of these sewers, as discussed below.

Sewer Capacities

As shown in Table V-4a, manhole R-26 is where the Elm Street Trunk discharges into the S. 2nd Avenue Trunk. All of the sewers downstream from manhole R-26 do not have enough capacity for either present or future flows. All of these sewer sections must surcharge to allow the wastewater to pass through.

A manhole which becomes surcharged because of its downstream sewer will affect its upstream sewer and manhole. Because of all the sewers downstream from manhole R-26 follow one after the other, the surcharging in one sewer will increase the amount of surcharging in the upstream sewers. This cumulative effect will create some very significant surcharging in the S. 2nd Avenue Trunk.

Looking again at Table V-4a, the last two sewer sections on the S. 2nd Avenue Trunk have less than half the needed capacities for the future flows and are inadequate for the existing flows. These sections will also create significant surcharging. Add this to the cumulative effect of the adjacent undersized sewers, and the depth of surcharging could become more than five or six feet deep. This is an unacceptable amount of surcharging and will impact the services.

It should be noted that Table V-4a is based on peak flows. During times of average flow, the surcharging depths in these sewers will be greatly reduced.

There are three factors which can reduce the velocity of wastewater in a sewer pipe: low flow, less than minimum grade and surcharging. All three of these conditions will exist in the sewers upstream of manhole R-26 and will greatly increase the amount of solids settling out and into the pipes. Problems with plugging will be much more frequent in this part of the S. 2nd Avenue Trunk.

Finally, the S. 2nd Avenue Trunk discharges into manhole O-35, which is the first manhole of the Redwood Interceptor. The capacities of the first two sections of the Redwood Interceptor are, like the S. 2nd Avenue Trunk, significantly less than the expected flows. Thus, the surcharging and plugging problems found in the S. 2nd Avenue Trunk will also be in the first two sections of the Redwood Interceptor.

It should be noted that the first three sections of the Redwood Interceptor, as defined in this report were constructed at less than minimum slopes and originally discharged across highway 99E into the North 3rd Avenue Trunk. In 1989, the Redwood Interceptor Construction Project was undertaken that intercepted these flows and diverted them east along 99E into the Redwood System. A complete evaluation of the Redwood Interceptor is presented later in this section.

Sewer Replacements and Extensions

Resolution of the south 2nd Avenue Trunk deficiencies will require rerouting or reconstruction of the collection system in this area. Two feasible alternatives were identified.

The first alternative diverts some of the flows away from the S. 2nd Avenue Trunk. In particular, we looked at diverting wastewater flows from the Elm Street Trunk to the Fir Street Trunk, from the Fir Street Trunk to the Ivy Street Trunk and from the Ivy Street Trunk to the Locust Street Trunk. Each one of these diversions would allow some of the wastewater to bypass surcharged sections of the S. 2nd Avenue Trunk.

The second alternative was the replacement of many of the S. 2nd Avenue Trunk sewers with larger diameter sewers.

TABLE V-4a
SOUTH 2nd AVENUE TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacities (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacities (mgd)**
Q-3	Q-2	0.0034	8	0.45	0.03	0.42	0.03	0.42
Q-2	Q-1	0.0060	8	0.60	0.06	0.54	0.06	0.54
Q-1	R-35	0.0066	8	0.63	0.10	0.53	0.10	0.53
Shopping Center Pump Sta. - 2 pumps ea. @ 55 gpm					0.08		0.08	
R-35	R-34	0.0011	8	0.26	0.09	0.17	0.09	0.17
R-34	R-33	0.0037	8	0.47	0.09	0.38	0.09	0.38
R-33	R-32	0.0048	8	0.54	0.10	0.44	0.10	0.44
R-32	R-31	0.0022	8	0.36	0.11	0.26	0.11	0.26
R-31	R-30	0.0027	8	0.40	0.12	0.29	0.12	0.29
R-30	R-29	0.0031	8	0.43	0.13	0.30	0.13	0.30
R-29	R-28	0.0020	8	0.35	0.14	0.20	0.14	0.20
R-28	R-27	0.0025	8	0.39	0.15	0.24	0.15	0.24
R-27	R-26	0.0025	8	0.39	0.16	0.23	0.16	0.23
Elm Trunk Sewer enters MH R-26					0.48		0.57	
R-26	**N-4**	0.0051	8	0.55	0.49	0.07	0.58	**-0.03**
N-4	**N-5**	-0.0003	8	N/A	0.50	**-0.00**	0.59	**-0.00**
N-5	**N-6**	0.0028	8	0.41	0.51	**-0.10**	0.61	**-0.19**
N-6	**O-39**	0.0026	8	0.40	0.52	**-0.12**	0.61	**-0.22**
Fir Trunk Sewer enters MH O-39					0.74		0.98	
O-39	**O-38**	0.0019	10	0.61	0.74	**-0.13**	0.99	**-0.37**
O-38	**O-37**	0.0019	10	0.61	0.75	**-0.13**	0.99	**-0.37**
O-37	**O-33**	0.0015	10	0.55	0.76	**-0.22**	1.00	**-0.46**
Ivy Trunk Sewer enters MH O-33					1.06		1.50	
O-33	**O-34**	0.0003	10	0.24	1.06	**-0.82**	1.50	**-1.26**
O-34	**O-35**	0.0015	10	0.55	1.06	**-0.52**	1.50	**-0.95**

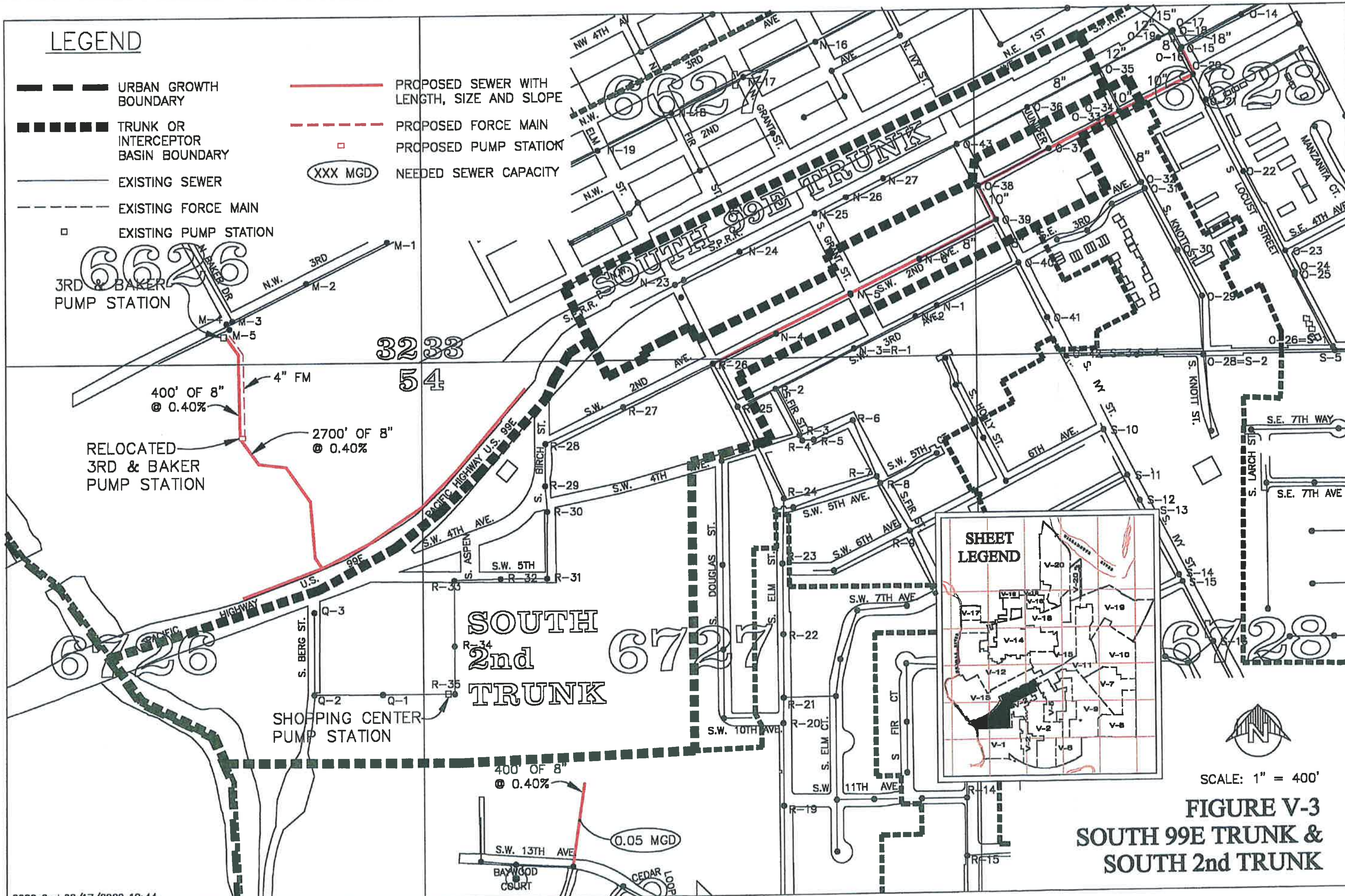

FIGURE V-3
SOUTH 99E TRUNK &
SOUTH 2nd TRUNK

Alternative One - Flow Diversion

- Elm to Fir Street Trunk Diversion

  The Elm Street Trunk enters the S. 2nd Avenue Trunk upstream of the Fir Street Trunk connection. However, the Elm Street Trunk sewers are all lower than any of the nearby sewers on the Fir Street Trunk line. Thus, no connection could be made from the Elm Street Trunk to the Fir Street Trunk.

- Fir to Ivy Street Trunk Diversion

  The Fir Street Trunk sewers are higher than the Ivy Street Trunk sewers. The Fir Street Trunk manhole O-40 is two blocks away from the manhole O-32 which is on the Ivy Street Trunk. Manhole O-40 is approximately 2½ feet higher than manhole O-32. Thus, sufficient grade exists to connect the Fir Street Trunk to the Ivy Street Trunk.

  We calculated the impact of connecting manhole O-40 to manhole O-32 and found that both the Ivy Street Trunk and the S. 2nd Avenue Trunk would surcharge. The problem is that the sewers downstream of where Ivy connects to S. 2nd do not have the capacity for the expected flows.

  To prevent this surcharging, the existing S. 2nd Avenue sewers would need to be replaced from Manholes O-32 to O-19. Unfortunately, some of these sewers are on Highway 99E. To avoid very expensive construction on Highway 99E, only the pipe between manholes O-33 to O-32 would be replaced. Then, a new sewer would be installed down South 2nd Avenue to Locust Street and then down Locust Street to the Redwood Interceptor at manhole O-15. This route is shown on Figure V-4 as Alternative One and includes the Proposed Route Common to Alternatives One and Two.

  The remaining capacities of the sewers after implementation of a diversion of Fir to Ivy Street Trunk have been calculated and are shown in table V-4b. The data on the replacement sewers are highlighted in bold. The cost estimate for Alternative One equals $140,200.00 as shown in Table V-4b.1.

TABLE V-4b
ALTERNATIVE 1 - FLOW DIVERSION
SOUTH 2ND TRUNK REPLACEMENT SEWERS
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer from MH 0-40 to 0-32	12"	700'	74	51,800	-	-	74	51,800
Replace sewer from MH 0-31 to 0-34	12"	400'	100	44,000	62	24,800	48	19,200
New sewer from MH 0-34 to O-15	12"	600	74	44,400	-	-	-	44,400

The advantage of the Fir to Ivy Trunk diversion is that it cuts the expected surcharging in half. This can be seen by comparing the Remaining Capacities columns in Tables V-4a and V-4c. Alternative One would also reduce possible plugging problems.

The disadvantage of a Fir to Ivy Trunk diversion is that it does not eliminate the surcharging in the sewers upstream of Manhole 0-33. Over 2,000 feet of sewers with less than minimum grade would remain and cause surcharging and related maintenance impacts. As a result, this option is not recommended.

TABLE V-4c
ALTERNATIVE 1 - FLOW DIVERSION
SOUTH 2nd TRUNK REPLACEMENT SEWERS

Sewer Section		Pipe			Future Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
Fir Trunk						
N-2	N-1	0.0031	8	0.43	0.35	0.09
N-1	O-40	0.0040	8	0.49	0.36	0.13
0-40	**0-32**	**0.0033**	**8**	**0.45**	**0.37**	**0.08**
Ivy Trunk						
0-30	0-31	0.0047	8	0.53	0.47	0.06
0-31	**0-32**	**0.0040**	**8**	**0.49**	**0.48**	**0.01**
Fir Trunk Sewer enters MH O-32					**0.85**	
O-32	**O-33**	**0.0050**	**10**	**1.00**	**0.87**	**0.13**
South 2nd Trunk						
R-27	R-26	0.0025	8	0.39	0.16	0.23
Elm Trunk Sewer MH R-26					0.57	
R-26	N-4	0.0051	8	0.55	0.58	-0.03
N-4	N-5	-0.0003	8	N/A	0.59	-0.00
N-5	N-6	0.0028	8	0.41	0.60	-0.19
N-6	O-39	0.0026	8	0.40	0.61	-0.21
O-39	O-38	0.0019	10	0.61	0.61	-0.00
O-38	O-37	0.0019	10	0.61	0.62	-0.01
O-37	O-33	0.0015	10	0.55	0.63	-0.08
Ivy Trunk Sewer enters MH O-33					1.50	
O-33	**O-34**	**0.0044**	**12**	**1.52**	**1.50**	**0.02**
O-34	**O-20**	**0.0045**	**12**	**1.54**	**1.50**	**0.04**
Locust Trunk Sewer enters MH O-20						
O-20	**O-15**	**0.0013**	**18**	**2.43**	**0.02**	**2.41**
Redwood Interceptor						
South 99E Trunk Sewer enters mh O-35					0.04	
O-35	O-19	0.0035	12	1.35	0.04	1.31
O-19	O-18	0.0039	12	1.43	0.04	1.39
O-18	O-17	0.0267	18	11.03	0.04	10.98
O-17	O-15	0.0031	18	3.76	0.04	3.71
South 2nd Trunk Sewer enters mh O-15						
O-15	O-14	0.0020	18	3.02	0.05	2.97

- Ivy to Locust Street Trunk Diversion

    Diverting some of the Ivy Street Trunk flow into the Locust Street Trunk sewers could be helpful. Three different connection points to make this diversion were studied.

    The first connection point is from Ivy Street Trunk manhole S-2 to Locust Street Trunk manhole O-26. Unfortunately, the elevation of manhole S-2 is approximately two feet lower than manhole O-26. Thus, this connection point will not work.

    Secondly, Ivy Street Trunk manhole S-16 is near one of the new Township Village's manholes which are connected to the Locust Trunk. However, not enough fall exists between the two manholes to allow a connection.

    The third potential connection point is between Ivy manhole S-14 and Locust manhole S-9 via sewers located in SE 7th Avenue. A test calculation of the hydraulics was made assuming that the connection was possible. Unfortunately, the Locust Street Trunk has two sections of sewer which are well below minimum grade and can barely handle the existing flows. Additional flows from the Ivy Street Trunk to the Locust Street Trunk would cause these two 'flat' sewers to surcharge significantly. These two sections start at manholes O-23 and O-22 as shown in Tables B-1 and B-2.

    The diversion at this connection point is not considered feasible for several reasons. First, the diversion would create new points of surcharging in the Locust Street Trunk. Second, it would only remove wastewater from four sections of problem sewers in the S. 2nd Avenue Trunk and Redwood Interceptor. Thus, the surcharging in S. 2nd Avenue Trunk would not be significantly reduced. Third, sufficient grade to make the connection is questionable.

    Therefore, a diversion of Ivy Street Trunk into the Locust Street Trunk is not a feasible alternative.

Alternative Two - Sewer Replacement

Diversion of sewage flows around parts of the S. 2nd Avenue Trunk does not correct the numerous problems with that trunk. However, almost all of the problems can be corrected by reinstalling the sewers in question at steeper slopes. Sufficient elevation difference exists to do this.

Replacing many of existing sewers in the S. 2nd Avenue Trunk has been studied in detail. This alternative is shown on Figure V-4, and the data on the replacement sewers is listed in Table V-4e (bold print). The basic proposal is to replace the sewers from manhole O-39 on the S. 2nd Avenue Trunk to the manhole O-15 on the Redwood Interceptor. Like Alternative One, new sewers will be constructed in Locust Street and in South 2nd Avenue from Locust to Knott to avoid construction in Highway 99E.

Alternative Two also can include replacement of sewers upstream of manhole O-39 to manhole R-26, where the Elm Street Trunk connects. This extension of Alternative Two would replace the sewer sections with adverse slope.

As can be seen in Table V-4e, the proposed sewer replacements can all be installed at minimum grade and will eliminate any surcharging. Thus, the advantage of Alternative Two is that it totally eliminates the trouble spots in the South 2nd Avenue Trunk.

The disadvantage of Alternative Two is the higher cost, as shown in Table V-4d. The cost of Alternative Two without replacing the sewers upstream of manhole O-39 is estimated to be $161,360. This is $13,610 more than the cost of Alternative One.

The estimated cost of replacing the sewers upstream of manhole O-39 to manhole R-26 is $123,040. Thus, the total cost to replace the sewers from R-26 to O-15 is estimated to be $284,400 and is shown in Table V-4d. Alternative Two with its extension would eliminate all of the problems in this part of the South 2nd Avenue Trunk and is the recommended solution.

TABLE V-4d
ALTERNATIVE 2 - SEWER REPLACEMENT
SOUTH 2nd AVENUE
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
Replace sewer from MH R-26 to O-39.	10	1,538	80	123,040	70	107,660	10	15,380
Replace sewer from MH O-39 to O-33.	12	846	110	93,060	80	67,680	30	25,380
Replace sewer from MH O-33 to O-20.	15	549	100	54,900	80	43,920	20	10,980
Replace sewer from MH O-20 to O-15.	18	134	100	13,400	80	10,720	20	2,680

TABLE V-4e
ALTERNATIVE 2 - SEWER REPLACEMENT
SOUTH 2nd AVENUE TRUNK REPLACEMENT SEWERS

Sewer Section		**Pipe**			**Future Conditions**	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
South 2nd Trunk						
Shopping Center Pump Station - 2 pumps ea. @ 55 gpm					0.08	
R-35	R-34	0.0011	8	0.26	0.09	0.17
R-34	R-33	0.0037	8	0.47	0.09	0.38
R-33	R-32	0.0048	8	0.54	0.10	0.44
R-32	R-31	0.0022	8	0.36	0.11	0.26
R-31	R-30	0.0027	8	0.40	0.12	0.29
R-30	R-29	0.0031	8	0.43	0.13	0.30
R-29	R-28	0.0020	8	0.35	0.14	0.20
R-28	R-27	0.0025	8	0.39	0.15	0.24
R-27	R-26	0.0025	8	0.39	0.16	0.23
Elm Trunk Sewer enters MH R-26					0.57	
R-26	**N-4**	**0.0028**	**10**	**0.74**	**0.58**	**0.16**
N-4	**N-5**	**0.0028**	**10**	**0.74**	**0.59**	**0.15**
N-5	**N-6**	**0.0028**	**10**	**0.74**	**0.60**	**0.14**
N-6	**O-39**	**0.0028**	**10**	**0.74**	**0.61**	**0.13**
Fir Trunk Sewer enters MH O-39					0.98	
O-39	**O-38**	**0.0022**	**12**	**1.07**	**0.99**	**0.09**
O-38	**O-37**	**0.0022**	**12**	**1.07**	**0.99**	**0.09**
O-37	**O-33**	**0.0022**	**12**	**1.07**	**1.00**	**0.07**
Ivy Trunk Sewer enters MH O-33					1.50	
O-33	**O-34**	**0.0015**	**15**	**1.61**	**1.50**	**0.11**
O-34	**O-20**	**0.0015**	**15**	**1.61**	**1.50**	**0.11**
Locust Trunk Sewer enters MH O-20					1.94	
O-20	**O-15**	**0.0013**	**18**	**2.43**	**1.96**	**0.48**
Redwood Interceptor						
99E Trunk Sewer enters MH O-35					0.04	
O-35	O-19	0.0035	12	1.35	0.04	1.31
O-19	O-18	0.0039	12	1.43	0.04	1.39
O-18	O-17	0.0267	18	11.03	0.04	10.98
O-17	O-15	0.0031	18	3.76	0.04	3.71
South 2nd Trunk Sewer enters MH O-15					2.00	
O-15	O-14	0.0020	18	3.02	2.01	1.01

- Sewers Upstream of Manhole R-26

  There are many sewer sections upstream of manhole R-26 which are below minimum grade. These sewers should not be a serious problem but will require more frequent cleaning than sewers at minimum grade. The flushing action of the Shopping Center Pumping Station will help keep these sewers clean. This will be especially true if the downstream sewers are replaced with sewers which have adequate capacity and minimum grades, as recommended in Alternative Two.

  When solids do settle out in these upstream sewers, the loss of sewer capacity should not be a serious problem due to the low flows in these sections. Even though the South 2nd Trunk sewers upstream of manhole R-26 may need to have more frequent cleaning than other parts of the sewer system, our conclusion is that replacement of these sewers is not warranted at this time.

  However, it should be noted that Alternative Two would allow sufficient grade to replace many of the sewers upstream of manhole R-26 with steeper grades, Alternative One would not.

- Extension of South 2nd Avenue Trunk Sewer

  The most upstream end of the South 2nd Trunk sewer ends at the Molalla River bank, and the Urban Growth Boundary runs along the Molalla River. Thus, no major expansion of the South 2nd Trunk is anticipated with this study.

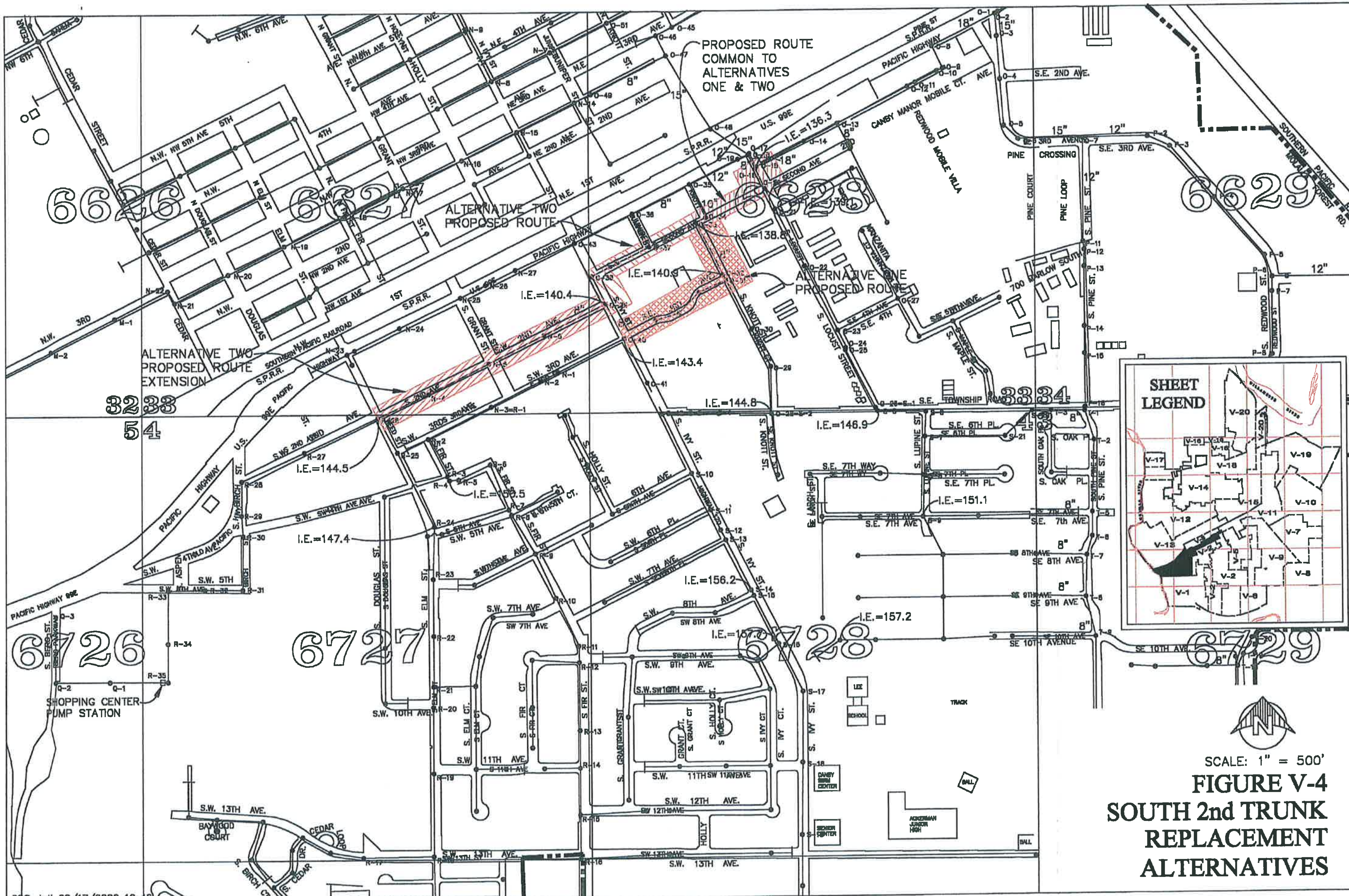

FIGURE V-4
SOUTH 2nd TRUNK
REPLACEMENT
ALTERNATIVES

5. Locust Street Trunk

Figure V-5 shows the Locust Street Trunk sewer system. Four sewer sections of the Locust Trunk as shown in Table V-5a are significantly less than minimum grade. No regular surcharging is expected to occur because of low wastewater flows, however more frequent flushing of structural solids may be required.

Sewer Replacements and Extensions

Of the four flat sewer sections, three cannot be relaid at steeper slopes. Branch sewers connected to the three sections prevent changing the slope of the trunk sewer. However, one section starting at manhole S-6 could be relaid. The existing slope of this section is 0.30%. We do not expect any serious problems from such a grade on only one section of sewer. We, therefore, do not recommend replacement of this section.

All of the Locust Street Trunk drainage basin has sewers. Thus, no extension of this trunk will occur.

TABLE V-5a
LOCUST STREET TRUNK
EXISTING CONDITIONS

Sewer Section		Pipe			Existing Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
S-9	S-8	0.0037	8	0.47	0.09	0.39
S-8	S-7	0.0031	8	0.43	0.10	0.33
S-7	S-6	0.0045	8	0.52	0.15	0.37
S-6	S-5	0.0030	8	0.43	0.15	0.27
S-5	O-26	0.0057	8	0.59	0.15	0.43
O-26	O-25	0.0041	8	0.50	0.17	0.32
O-25	O-24	0.1071	8	2.54	0.17	2.37
O-24	O-23	0.0054	8	0.57	0.19	0.38
O-23	O-22	0.0030	8	0.43	0.38	0.05
O-22	O-21	0.0032	8	0.44	0.40	0.04
O-21	O-20	0.0050	8	0.55	0.42	0.13
O-20	O-16	0.0081	8	0.70	0.44	0.26
O-16	O-18	0.0066	8	0.63	0.44	0.19

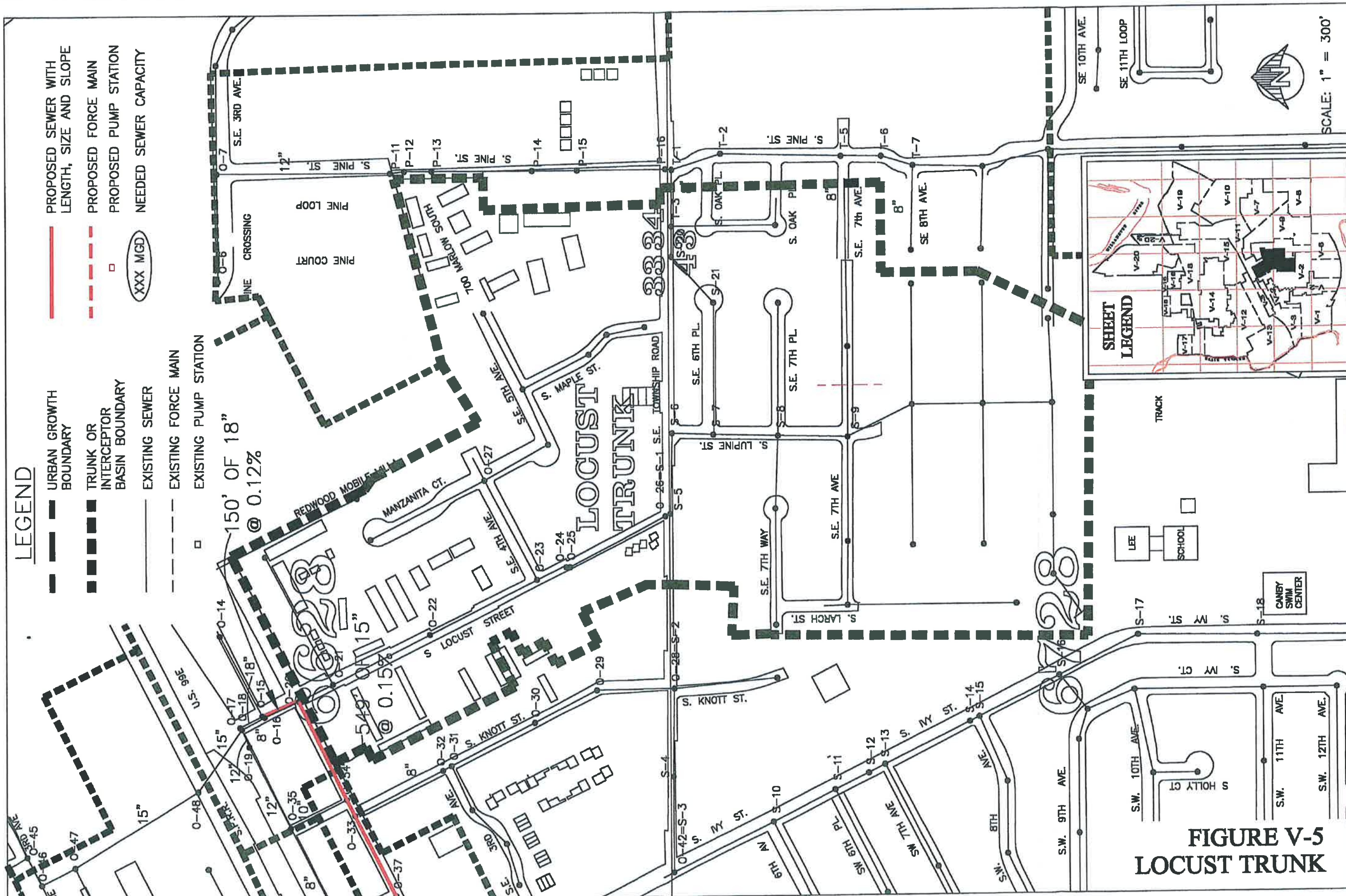

FIGURE V-5
LOCUST TRUNK

6. South Pine Street Trunk

General

The South Pine Street Trunk is a new sewer. All of the collection sewers were installed above minimum grade and have sufficient capacity for future flows as shown in Table V-6a.

Sewer Replacement and Extensions

The Tofte Farms development extended the South Pine Street Trunk in 1996. The extension extended nearly to the southern limit of the drainage basin. As show in Figure V-6, approximately 800 feet of 8-inch sewer is needed to fully extend this trunk to the south.

Several acres east of Tofte Farms can flow into the South Pine Street Trunk. Extension of the new branch sewers should be adequate to accomplish this. However, the most southeast corner of the drainage basin may be too low for access by gravity sewer.

There are several ways to correct this potential problem:

- The low areas can be filled and homes placed on higher ground.
- Use the low areas for drainage control and/or treatment.
- Use small individual pumps for homes in low areas.

Before any of these solutions are attempted, the first step would be to conduct topographic land surveys to assess whether adequate grade exists.

Cost Estimates

The estimated engineering and construction costs for these 8-inch diameter sewer extensions total $40,000, as shown in Table V-6b.

TABLE V-6a
SOUTH PINE STREET TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
W-7	W-6	0.0040	8	0.49	0.01	0.49	0.09	0.41
W-6	W-5	0.0040	8	0.49	0.01	0.48	0.09	0.40
W-5	W-4	0.0040	8	0.49	0.03	0.46	0.11	0.38
W-4	W-3	0.0040	8	0.49	0.05	0.44	0.13	0.36
W-3	W-2	0.0040	8	0.49	0.07	0.42	0.15	0.34
W-2	W-1	0.0040	8	0.49	0.08	0.41	0.16	0.33
W-1	T-12	0.0020	12	1.02	0.09	0.93	0.17	0.85
T-12	T-11	0.0023	12	1.10	0.13	0.97	0.21	0.89
T-11	T-10	0.0024	12	1.12	0.15	0.98	0.23	0.90
T-10	T-9	0.0040	12	1.45	0.16	1.29	0.24	1.21
T-9	T-8	0.0038	8	0.48	0.17	0.30	0.25	0.22
T-8	T-7	0.0050	8	0.55	0.19	0.36	0.27	0.28
T-7	T-6	0.0055	8	0.58	0.20	0.37	0.28	0.29
T-6	T-5	0.0043	8	0.51	0.21	0.30	0.29	0.22
T-5	T-2	0.0065	8	0.63	0.22	0.41	0.30	0.33
T-2	T-1	0.0034	8	0.45	0.24	0.22	0.31	0.14
T-1	P-16	0.0034	8	0.45	0.24	0.22	0.31	0.14
P-16	P-15	0.0066	12	1.86	0.25	1.61	0.33	1.53
P-15	P-14	0.0067	12	1.87	0.27	1.60	0.35	1.52
P-14	P-13	0.0047	12	1.57	0.29	1.28	0.37	1.20
P-13	P-12	0.0043	12	1.50	0.29	1.21	0.37	1.13
P-12	P-11	0.0269	12	3.75	0.29	3.46	0.37	3.38
P-11	O-7	0.0103	12	2.32	0.39	1.94	0.47	1.86

TABLE V-6b
SOUTH PINE STREET TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer from MH T-1	8	800	50	40,000	-	-	0	0

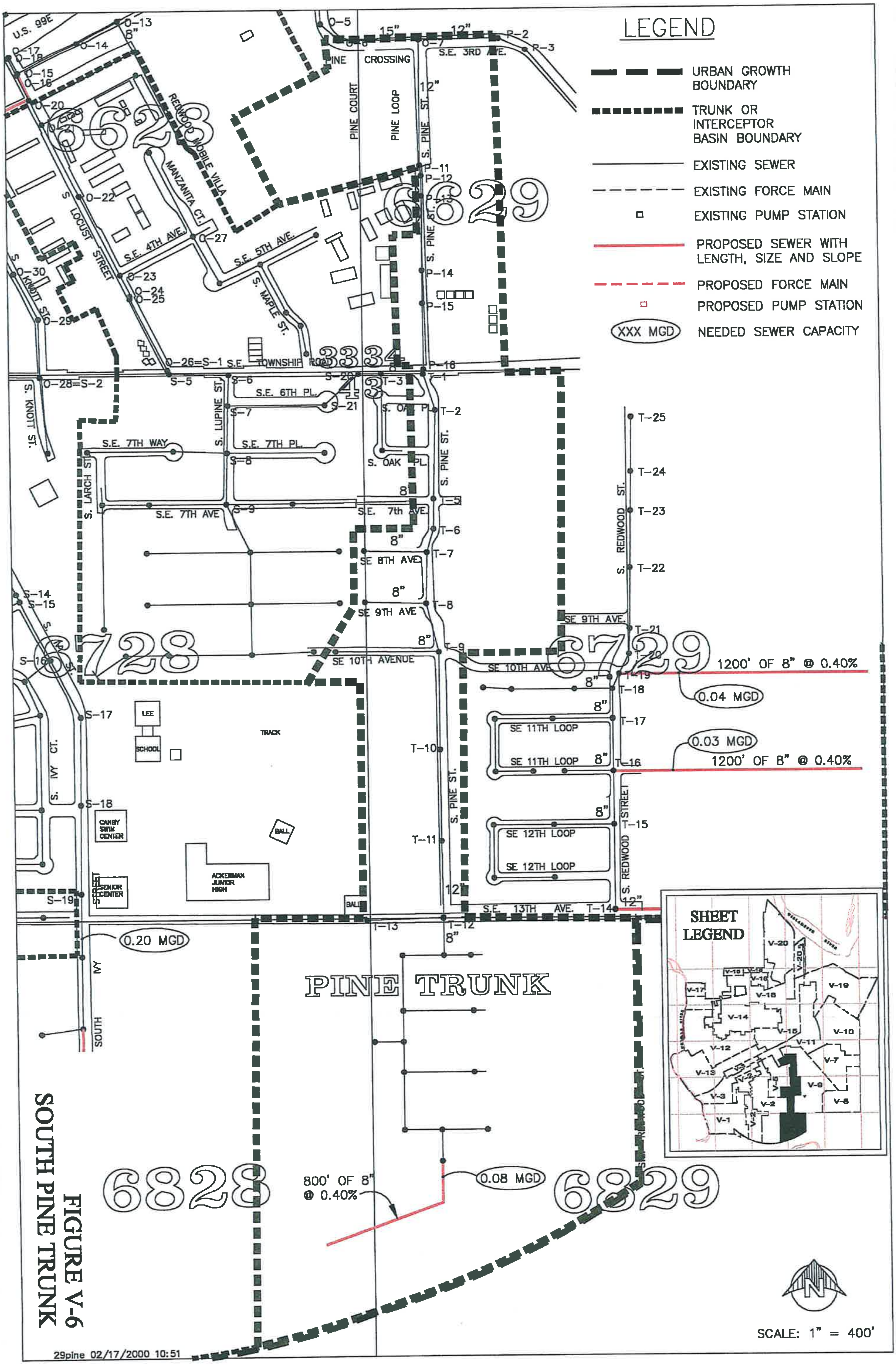

FIGURE V-6
SOUTH PINE TRUNK

7. South 4th Avenue Trunk

General

The South 4th Avenue Trunk is a very new sewer and is shown in Figure V-7. In fact, it was being designed and constructed as this report was being developed. All of the new sewers are 12-inch in diameter as shown in Table V-7a and are at or above minimum grade. No surcharging due to future flows is expected.

Sewer Replacements and Extensions

As shown in Figure V-7, several hundred feet of 8-inch and 10-inch pipe will be necessary to extend service into this basin. Looking more closely at Table V-7a shows that the expected flows from this drainage area are significantly less than the capacity of the proposed sewers.

Most all of the South 4th Avenue Trunk drainage basin is or will be zoned manufacturing. Predicting sewage flows for manufacturing areas is more difficult than for residential or commercial areas. Manufacturing facilities discharge a very wide range of flows. Sewer designs with a reserve capacity of 50% or more are common with main line sewers installed to serve future manufacturing areas.

A second reason for the additional sewer capacity is the potential to serve areas outside the current UGB by gravity sewer. Southeast of the current UGB has the greatest potential for accommodating future growth. This sewer capacity, if not committed to manufacturing loads will provide service to a larger area.

Cost Estimates

The estimated engineering and construction costs for the 8-inch and 10-inch diameter sewer extensions total $363,000, and are shown in Table V-7b. Oversize component of this extension is $19,500.

TABLE V-7a
SOUTH 4th AVENUE TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream	Downstream MH No.	Slope (ft/ft)	Size (in)	Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Extend sewer from Manhole P-22							0.32	
P-22	P-21	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-21	P-20	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-20	P-19	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-19	P-18	0.0024	12	1.12	0.08	1.04	0.40	0.72
P-18	P-6	0.0110	12	2.40	0.08	2.32	0.40	2.00

TABLE V-7b
SOUTH 4th AVENUE TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from manhole P-22.	10	1,500	62	93,000	-	-	13	19,500
New sewers as shown on Figure V-7.	8	5,400	50	270,000	-	-	0	0

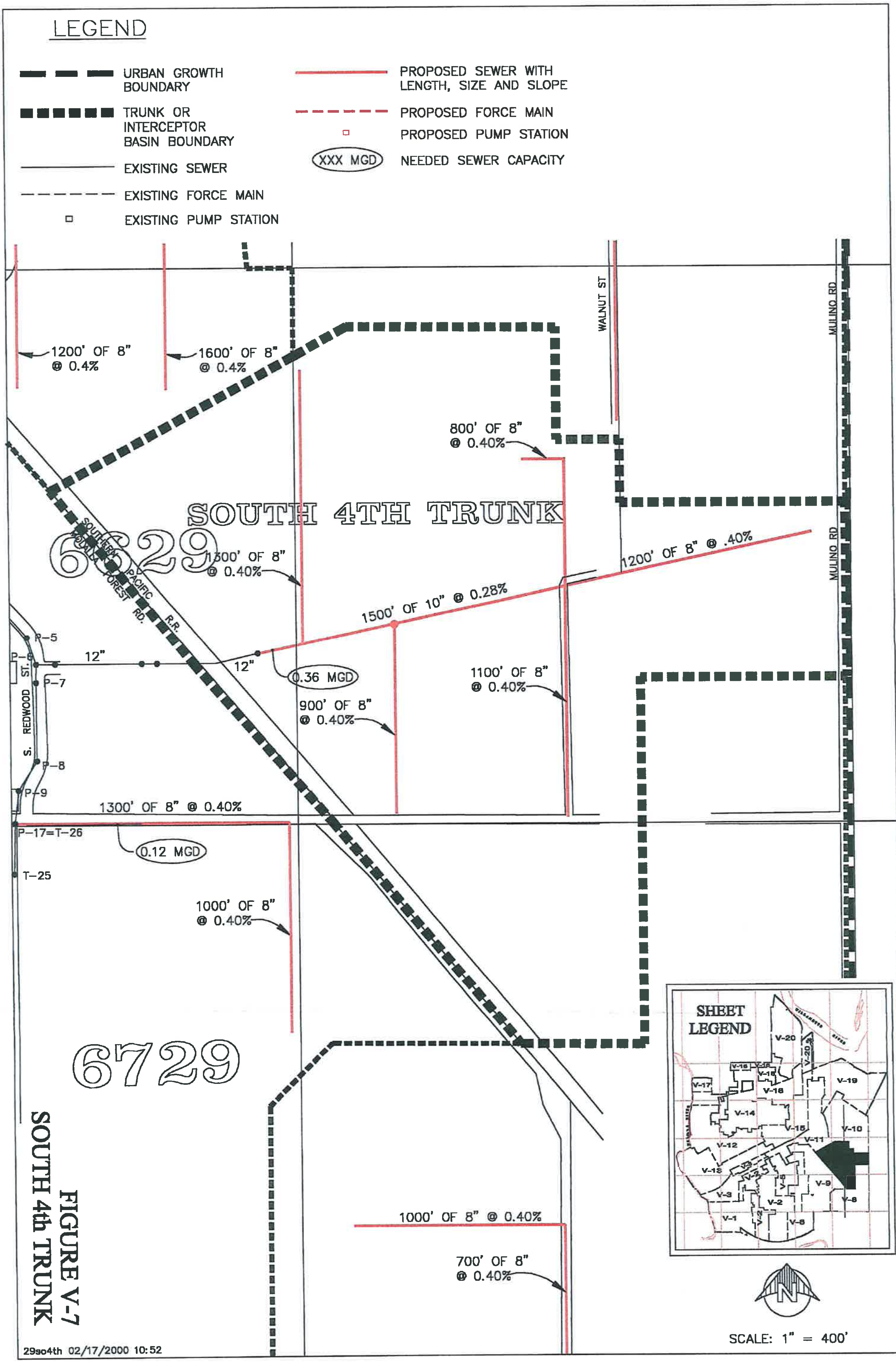

FIGURE V-7
SOUTH 4th TRUNK

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8. Mulino Road Pump Station

General

This drainage basin does not have any existing sanitary sewers and is located in the southeast corner of Canby's UGB. The topography of the basin drains towards the intersection of Mulino Road and SE 13th Avenue. A drainage ditch which is a tributary of the Molalla River passes under the intersection. A pump station near this corner will be necessary to transport the areas wastewater into the South Redwood Trunk sewer. The proposed name for this station is the Mulino Road Pump Station.

Sewer Replacements and Extensions

As shown in Figure V-8, the Mulino Road Pump Station could be located northwest of the roadway intersection. This location is just outside of the UGB but is necessary because of the two roadways, the drainage ditch and the Oregon Pacific Railroad, all of which cross at this corner. The exact location must be determined after an accurate field survey has been completed during the design of the station. A location further southwest, which would be closer to the Molalla River, could be beneficial to serve land south of S.E. 13th Avenue and north of the drainage ditch. This area is currently outside of the UGB and is outside of the service area under this study.

A 6-inch diameter force main would be ultimately needed for the proposed pump station, which mandates a minimum capacity of 265 gpm. This is shown in Figure V-8.

Also shown in Figure V-8 are two 8-inch gravity sewers which would drain into the pump station. The full extent of these trunk sewers must be determined by topographic field surveys.

Similar to the discussion about the pump station location, the possibility of serving land outside the UGB could influence the size and location of the proposed trunk sewers. This is especially true of the sewer which would drain the area north of the station. There may be a significant area which could drain to the station which is currently outside of the UGB. The size and slope of the proposed northern trunk sewer could be influenced by this other land incorporated into the UGB at a future date.

Cost Estimates

The estimated engineering and construction costs for these 8-inch diameter sewer extensions total $290,000as shown in Table V-8a. The cost estimate for the proposed pump station and force main equals $221,600.

TABLE V-8
MULINO ROAD PUMP STATION
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer north from Mulino P.S.	8	3,000	50	150,000	-	-	0	0
New sewer west from Mulino P.S.	8	2,800	50	140,000	-	-	0	0
Mulino Road Pump Station				160,000	-	-		160,000
Mulino Road P.S. Force Main	6	2,200	28	61,600	-	-	28	61,600

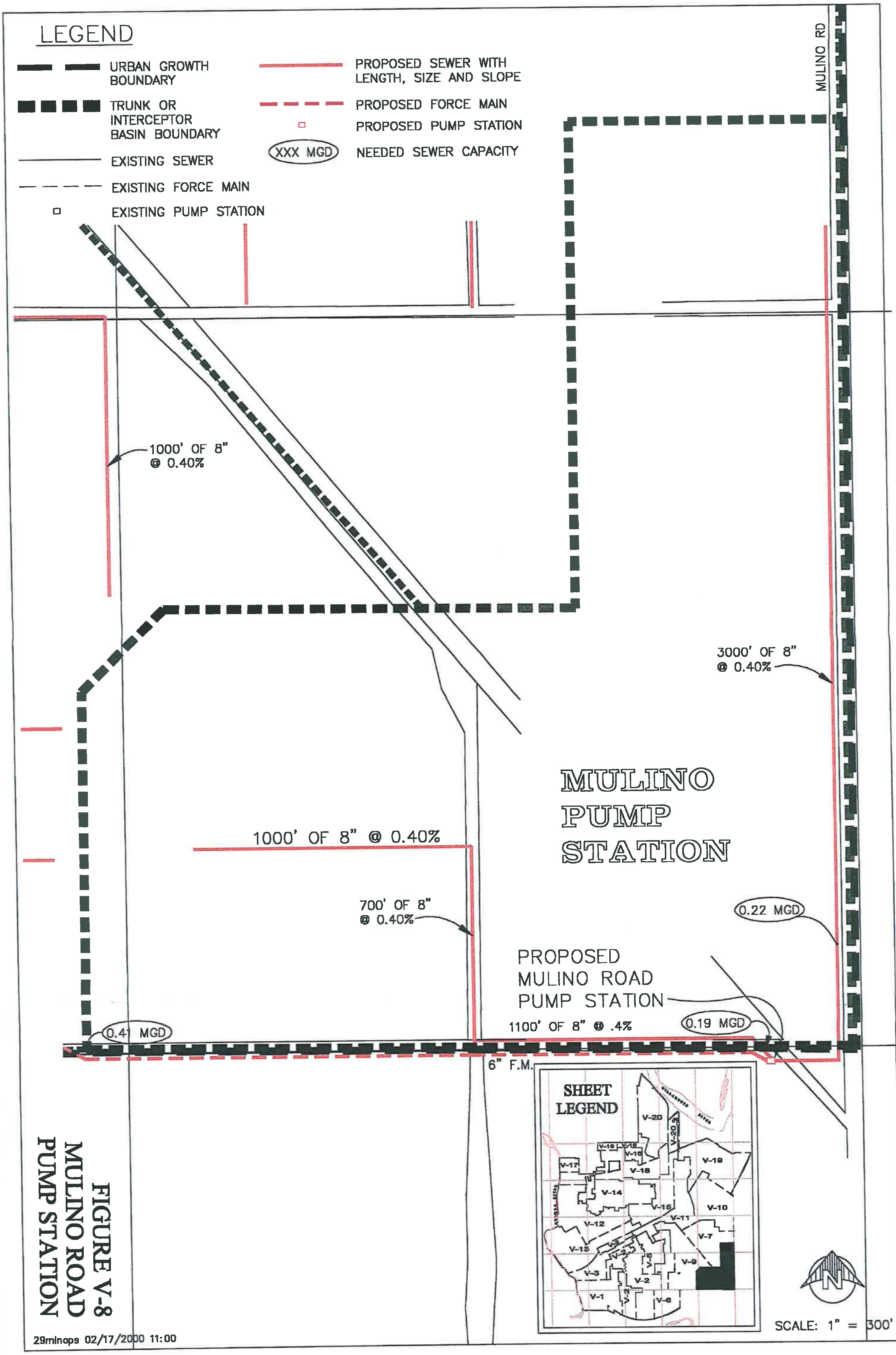

FIGURE V-8
MULINO ROAD
PUMP STATION

9. South Redwood Street Trunk

General

South Redwood Street Trunk sewer shown in Figure V-9 was constructed in 1990 and, like the South Pine Trunk, is a relatively new sewer. All of its reaches are at minimum grade or steeper and are either 12 or 15 inches in diameter as shown in Table V-9a.

This trunk receives the sewage from the South 4th Avenue Trunk and from the South Pine Street Trunk and discharges into the Redwood Interceptor. In the future it will carry the sewage from the proposed Mulino Road Pump Station.

Sewer Capacities

Table V-9a shows that the South Redwood Street Trunk sewer will have the capacity to handle all expected flows from its drainage basin within the UGB. There are two (2) sections which will just handle the expected future peak flows. These sewer sections start with the manholes, P-4 and P-2. Investigation into our records on these two (2) sections shows that they were installed at slightly flatter slopes than was shown on the contract drawings. Even so, no problems are expected from the South Redwood Trunk sewer.

Sewer Extensions

Figure V-9 at the end of this section shows that several sewers need to be constructed to serve the undeveloped portions of the South Redwood Street Trunk Drainage Basin. These proposed sewers may be able to be extended further depending upon actual elevations. As always, an accurate topographic survey needs to be completed to determine the limits of the gravity sewers. Greater extension of these gravity sewers will reduce the amount of sewage which will need to be pumped by the proposed Mulino Road Pump Station.

Cost Estimates

The estimated engineering and construction costs for these sewer extensions total $251,800, as shown in Table V-9b.

TABLE V-9a
SOUTH REDWOOD STREET TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Future Mulino Pump Sta. pumps to new sewer from MH T-14							0.41	
Extend sewer east from MH T-14							0.44	
T-14	T-15	0.0028	12	1.21	0.02	1.19	0.45	0.76
T-15	T-16	0.0058	12	1.74	0.04	1.71	0.47	1.27
Extend sewer east from MH T-16							0.51	
T-16	T-17	0.0075	12	1.98	0.04	1.94	0.52	1.47
T-17	T-18	0.0131	12	2.62	0.06	2.56	0.53	2.09
T-18	T-19	0.0083	12	2.09	0.08	2.01	0.55	1.54
Extend sewer east from MH T-19							0.59	
T-19	T-20	0.0029	12	1.23	0.08	1.15	0.59	0.65
T-20	T-21	0.0031	12	1.27	0.10	1.18	0.60	0.67
T-21	T-22	0.0028	12	1.21	0.10	1.11	0.61	0.60
T-22	T-23	0.0038	12	1.41	0.11	1.30	0.62	0.79
T-23	T-24	0.0035	12	1.35	0.12	1.23	0.63	0.73
T-24	T-25	0.0035	12	1.35	0.13	1.23	0.64	0.72
T-25	T-26	0.0035	12	1.35	0.14	1.22	0.64	0.71
Extend sewer east from MH T-26							0.76	
T-26	P-9	0.0191	12	3.16	0.16	3.00	0.79	2.37
P-9	P-8	0.0141	12	2.72	0.19	2.53	0.82	1.90
P-8	P-7	0.0100	12	2.29	0.21	2.08	0.83	1.46
P-7	P-6	0.0091	12	2.18	0.21	1.98	0.83	135
South 4th Trunk Sewer enters MH P-6							1.23	
P-6	P-5	0.0122	12	2.53	0.30	2.23	1.25	1.28
P-5	P-4	0.0103	12	2.32	0.31	2.01	1.26	1.06
P-4	P-3	0.0033	12	1.31	0.34	0.97	1.29	0.02
P-3	P-2	0.0077	12	2.01	0.34	1.67	1.29	0.72
P-2	O-7	0.0033	12	1.31	0.35	0.96	1.30	0.01
South Pine Trunk Sewer enters MH O-7							1.77	
O-7	O-6	0.0023	15	1.99	0.75	1.24	1.78	0.21
O-6	O-5	0.0029	15	2.23	0.75	1.48	1.78	0.45
O-5	O-4	0.0031	15	2.31	0.76	1.55	1.79	0.52
O-4	O-3	0.0028	15	2.20	0.77	1.42	1.80	0.39
O-3	O-2	0.0035	15	2.46	0.77	1.68	1.80	0.65

TABLE V-9b
SOUTH REDWOOD STREET TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from manhole T-14.	12 10	200 1,000	74 62	14,800 62,000	-	-	25 13	5,000 13,000
New sewer east from manhole T-16.	8	1,200	50	60,000	-	-	0	0
New sewer east from manhole T-16.	8	2,300	50	115,000	-	-	0	0

TABLE V-6b
SOUTH PINE STREET TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer from MH T-1	8	800	50	40,000	-	-	0	0

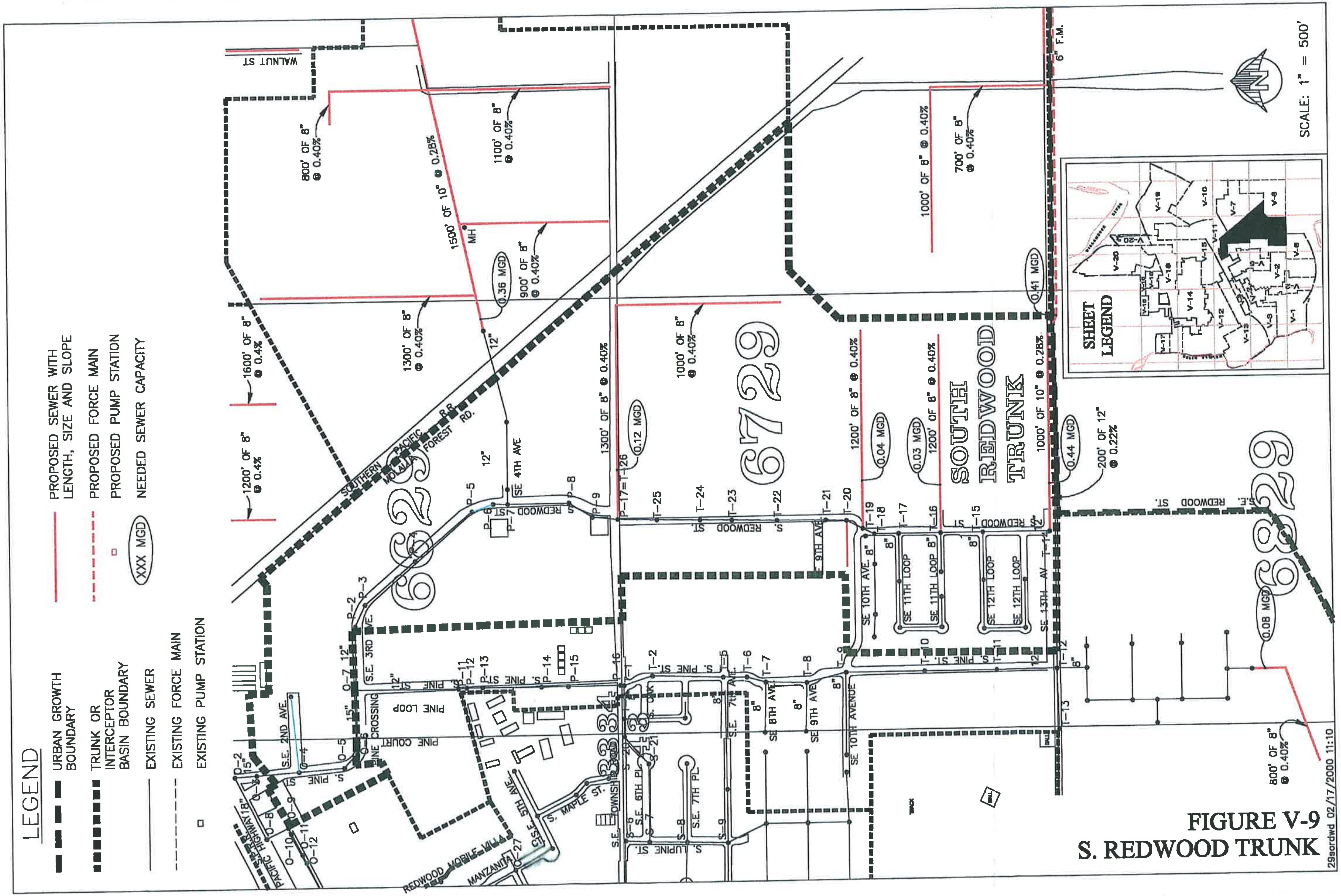

FIGURE V-9
S. REDWOOD TRUNK

7. South 4th Avenue Trunk

General

The South 4th Avenue Trunk is a very new sewer and is shown in Figure V-7. In fact, it was being designed and constructed as this report was being developed. All of the new sewers are 12-inch in diameter as shown in Table V-7a and are at or above minimum grade. No surcharging due to future flows is expected.

Sewer Replacements and Extensions

As shown in Figure V-7, several hundred feet of 8-inch and 10-inch pipe will be necessary to extend service into this basin. Looking more closely at Table V-7a shows that the expected flows from this drainage area are significantly less than the capacity of the proposed sewers.

Most all of the South 4th Avenue Trunk drainage basin is or will be zoned manufacturing. Predicting sewage flows for manufacturing areas is more difficult than for residential or commercial areas. Manufacturing facilities discharge a very wide range of flows. Sewer designs with a reserve capacity of 50% or more are common with main line sewers installed to serve future manufacturing areas.

A second reason for the additional sewer capacity is the potential to serve areas outside the current UGB by gravity sewer. Southeast of the current UGB has the greatest potential for accommodating future growth. This sewer capacity, if not committed to manufacturing loads will provide service to a larger area.

Cost Estimates

The estimated engineering and construction costs for the 8-inch and 10-inch diameter sewer extensions total $363,000, and are shown in Table V-7b. Oversize component of this extension is $19,500.

TABLE V-7a
SOUTH 4th AVENUE TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream	Downstream MH No.	Slope (ft/ft)	Size (in)	Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Extend sewer from Manhole P-22							0.32	
P-22	P-21	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-21	P-20	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-20	P-19	0.0022	12	1.07	0.04	1.03	0.36	0.71
P-19	P-18	0.0024	12	1.12	0.08	1.04	0.40	0.72
P-18	P-6	0.0110	12	2.40	0.08	2.32	0.40	2.00

TABLE V-7b
SOUTH 4th AVENUE TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from manhole P-22.	10	1,500	62	93,000	-	-	13	19,500
New sewers as shown on Figure V-7.	8	5,400	50	270,000	-	-	0	0

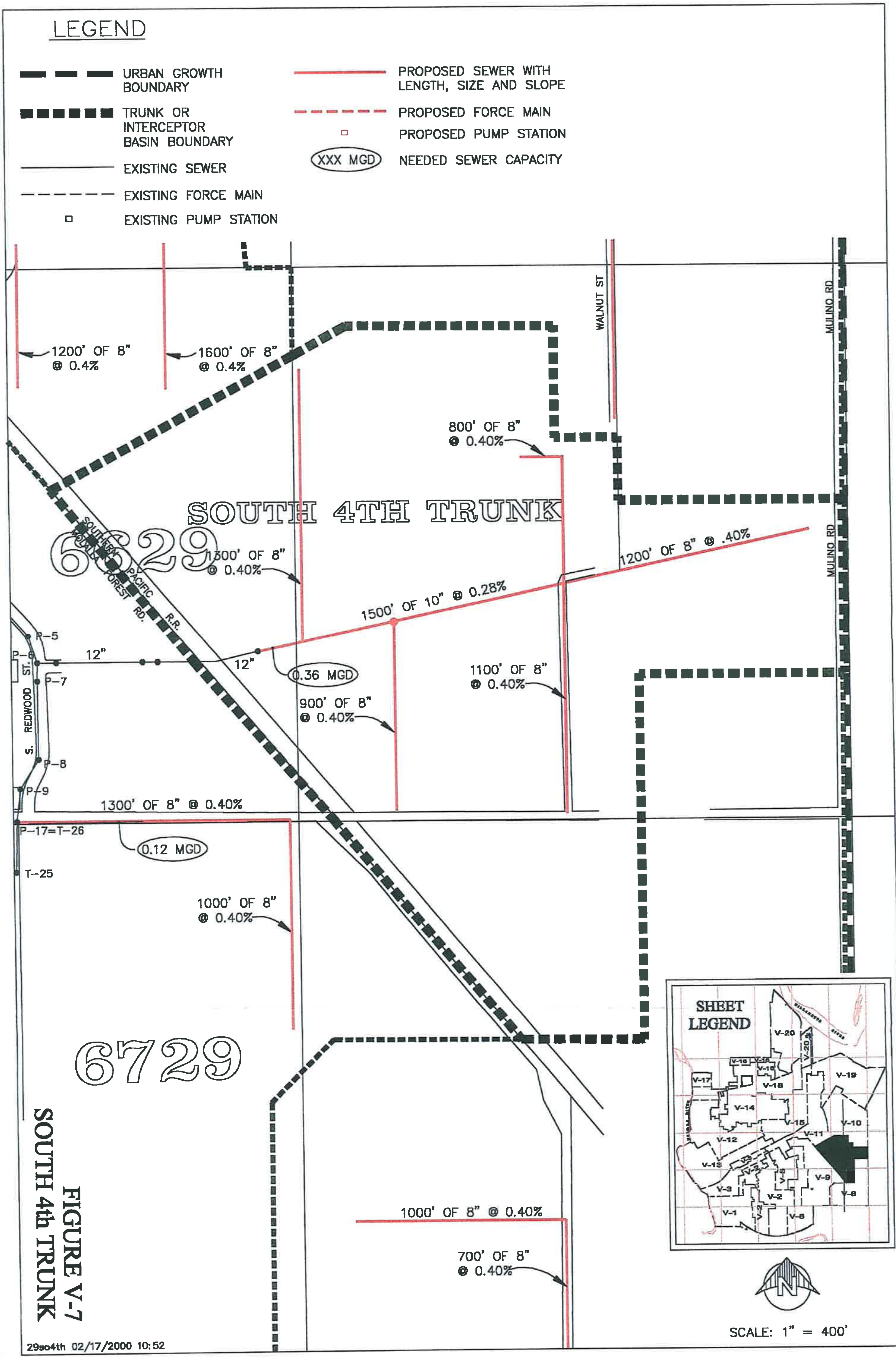

FIGURE V-7
SOUTH 4th TRUNK

8. Mulino Road Pump Station

General

This drainage basin does not have any existing sanitary sewers and is located in the southeast corner of Canby's UGB. The topography of the basin drains towards the intersection of Mulino Road and SE 13th Avenue. A drainage ditch which is a tributary of the Molalla River passes under the intersection. A pump station near this corner will be necessary to transport the areas wastewater into the South Redwood Trunk sewer. The proposed name for this station is the Mulino Road Pump Station.

Sewer Replacements and Extensions

As shown in Figure V-8, the Mulino Road Pump Station could be located northwest of the roadway intersection. This location is just outside of the UGB but is necessary because of the two roadways, the drainage ditch and the Oregon Pacific Railroad, all of which cross at this corner. The exact location must be determined after an accurate field survey has been completed during the design of the station. A location further southwest, which would be closer to the Molalla River, could be beneficial to serve land south of S.E. 13th Avenue and north of the drainage ditch. This area is currently outside of the UGB and is outside of the service area under this study.

A 6-inch diameter force main would be ultimately needed for the proposed pump station, which mandates a minimum capacity of 265 gpm. This is shown in Figure V-8.

Also shown in Figure V-8 are two 8-inch gravity sewers which would drain into the pump station. The full extent of these trunk sewers must be determined by topographic field surveys.

Similar to the discussion about the pump station location, the possibility of serving land outside the UGB could influence the size and location of the proposed trunk sewers. This is especially true of the sewer which would drain the area north of the station. There may be a significant area which could drain to the station which is currently outside of the UGB. The size and slope of the proposed northern trunk sewer could be influenced by this other land incorporated into the UGB at a future date.

Cost Estimates

The estimated engineering and construction costs for these 8-inch diameter sewer extensions total $290,000as shown in Table V-8a. The cost estimate for the proposed pump station and force main equals $221,600.

TABLE V-8
MULINO ROAD PUMP STATION
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer north from Mulino P.S.	8	3,000	50	150,000	-	-	0	0
New sewer west from Mulino P.S.	8	2,800	50	140,000	-	-	0	0
Mulino Road Pump Station				160,000	-	-		160,000
Mulino Road P.S. Force Main	6	2,200	28	61,600	-	-	28	61,600

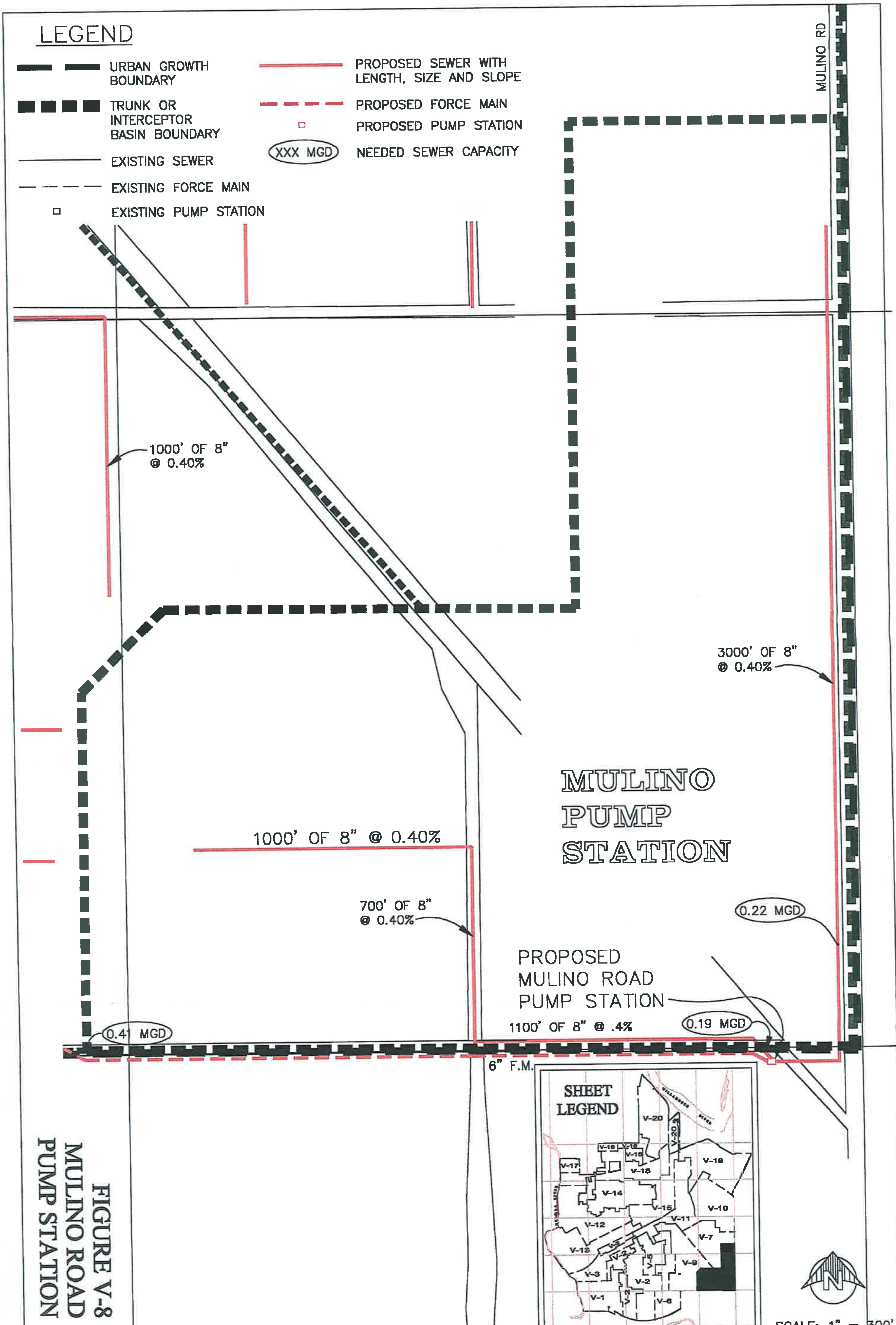

FIGURE V-8
MULINO ROAD PUMP STATION

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9. South Redwood Street Trunk

General

South Redwood Street Trunk sewer shown in Figure V-9 was constructed in 1990 and, like the South Pine Trunk, is a relatively new sewer. All of its reaches are at minimum grade or steeper and are either 12 or 15 inches in diameter as shown in Table V-9a.

This trunk receives the sewage from the South 4th Avenue Trunk and from the South Pine Street Trunk and discharges into the Redwood Interceptor. In the future it will carry the sewage from the proposed Mulino Road Pump Station.

Sewer Capacities

Table V-9a shows that the South Redwood Street Trunk sewer will have the capacity to handle all expected flows from its drainage basin within the UGB. There are two (2) sections which will just handle the expected future peak flows. These sewer sections start with the manholes, P-4 and P-2. Investigation into our records on these two (2) sections shows that they were installed at slightly flatter slopes than was shown on the contract drawings. Even so, no problems are expected from the South Redwood Trunk sewer.

Sewer Extensions

Figure V-9 at the end of this section shows that several sewers need to be constructed to serve the undeveloped portions of the South Redwood Street Trunk Drainage Basin. These proposed sewers may be able to be extended further depending upon actual elevations. As always, an accurate topographic survey needs to be completed to determine the limits of the gravity sewers. Greater extension of these gravity sewers will reduce the amount of sewage which will need to be pumped by the proposed Mulino Road Pump Station.

Cost Estimates

The estimated engineering and construction costs for these sewer extensions total $251,800, as shown in Table V-9b.

TABLE V-9a
SOUTH REDWOOD STREET TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Future Mulino Pump Sta. pumps to new sewer from MH T-14							0.41	
Extend sewer east from MH T-14							0.44	
T-14	T-15	0.0028	12	1.21	0.02	1.19	0.45	0.76
T-15	T-16	0.0058	12	1.74	0.04	1.71	0.47	1.27
Extend sewer east from MH T-16							0.51	
T-16	T-17	0.0075	12	1.98	0.04	1.94	0.52	1.47
T-17	T-18	0.0131	12	2.62	0.06	2.56	0.53	2.09
T-18	T-19	0.0083	12	2.09	0.08	2.01	0.55	1.54
Extend sewer east from MH T-19							0.59	
T-19	T-20	0.0029	12	1.23	0.08	1.15	0.59	0.65
T-20	T-21	0.0031	12	1.27	0.10	1.18	0.60	0.67
T-21	T-22	0.0028	12	1.21	0.10	1.11	0.61	0.60
T-22	T-23	0.0038	12	1.41	0.11	1.30	0.62	0.79
T-23	T-24	0.0035	12	1.35	0.12	1.23	0.63	0.73
T-24	T-25	0.0035	12	1.35	0.13	1.23	0.64	0.72
T-25	T-26	0.0035	12	1.35	0.14	1.22	0.64	0.71
Extend sewer east from MH T-26							0.76	
T-26	P-9	0.0191	12	3.16	0.16	3.00	0.79	2.37
P-9	P-8	0.0141	12	2.72	0.19	2.53	0.82	1.90
P-8	P-7	0.0100	12	2.29	0.21	2.08	0.83	1.46
P-7	P-6	0.0091	12	2.18	0.21	1.98	0.83	135
South 4th Trunk Sewer enters MH P-6							1.23	
P-6	P-5	0.0122	12	2.53	0.30	2.23	1.25	1.28
P-5	P-4	0.0103	12	2.32	0.31	2.01	1.26	1.06
P-4	P-3	0.0033	12	1.31	0.34	0.97	1.29	0.02
P-3	P-2	0.0077	12	2.01	0.34	1.67	1.29	0.72
P-2	O-7	0.0033	12	1.31	0.35	0.96	1.30	0.01
South Pine Trunk Sewer enters MH O-7							1.77	
O-7	O-6	0.0023	15	1.99	0.75	1.24	1.78	0.21
O-6	O-5	0.0029	15	2.23	0.75	1.48	1.78	0.45
O-5	O-4	0.0031	15	2.31	0.76	1.55	1.79	0.52
O-4	O-3	0.0028	15	2.20	0.77	1.42	1.80	0.39
O-3	O-2	0.0035	15	2.46	0.77	1.68	1.80	0.65

TABLE V-9b
SOUTH REDWOOD STREET TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from manhole T-14.	12 10	200 1,000	74 62	14,800 62,000	-	-	25 13	5,000 13,000
New sewer east from manhole T-16.	8	1,200	50	60,000	-	-	0	0
New sewer east from manhole T-16.	8	2,300	50	115,000	-	-	0	0

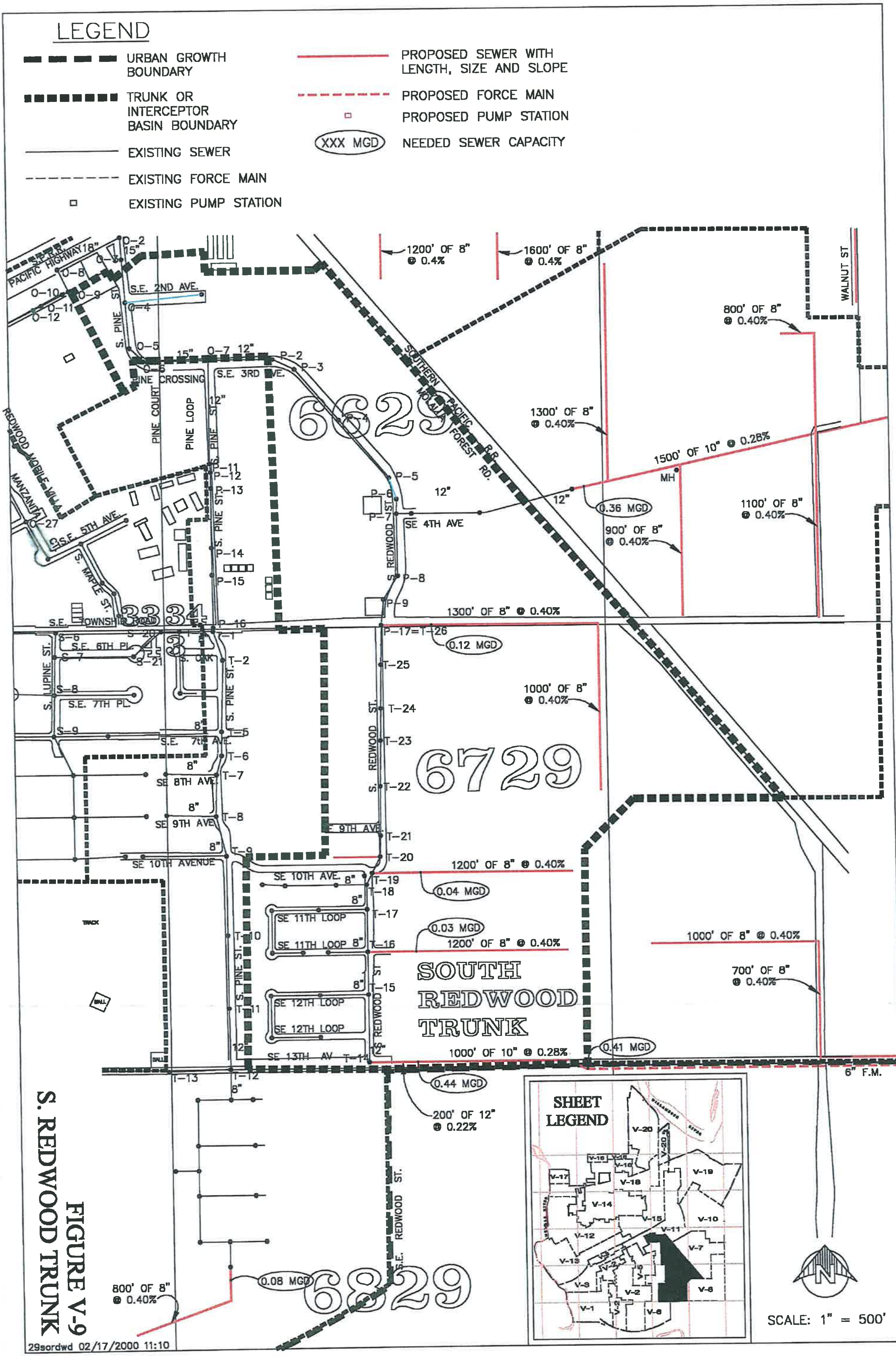

FIGURE V-9
S. REDWOOD TRUNK

10. Redwood Pump Station

General

There are no existing sanitary sewers in this drainage basin. A ditch within the basin crosses S.E. 1st Avenue a few hundred feet east of Highway 99E. The depression created by this drainage way will need a pumping station to transport the wastewater from the drainage area to the Redwood Interceptor. The proposed name for the station is the Redwood Pump Station.

Sewer Extensions

Figure V-10 shows the proposed station to be located on the east side of the drainage ditch. Because the station will have to serve both sides of the ditch, it could be located on either side. However, most of the flow will come from the east.

A 10-inch sewer will need to be extended from the station to the east. This sewer will have several 8-inch branch/trunk sewers as shown.

To serve the entire drainage basin, the force main from the Redwood Pumping Station will need to be 6 inches in diameter to accommodate an ultimate capacity of 400 gpm.

Cost Estimates

The cost estimates for the sewer extensions, pump station and force main are shown in Table V-10 and total $627,600.

TABLE V-10
REDWOOD PUMP STATION
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from Redwood P.S.	10	1,500	62	93,000	-	-	13	19,500
New sewers as shown on Figure V-10.	8	6,100	50	305,000	-	-	0	0
New sewer west form Redwood P.S.	8	1,000	50	50,000	-	-	0	0
Redwood Pump Station				160,000				160,000
Redwood P.S. Force Main	6	700	28	19,600	-	-	28	19,600

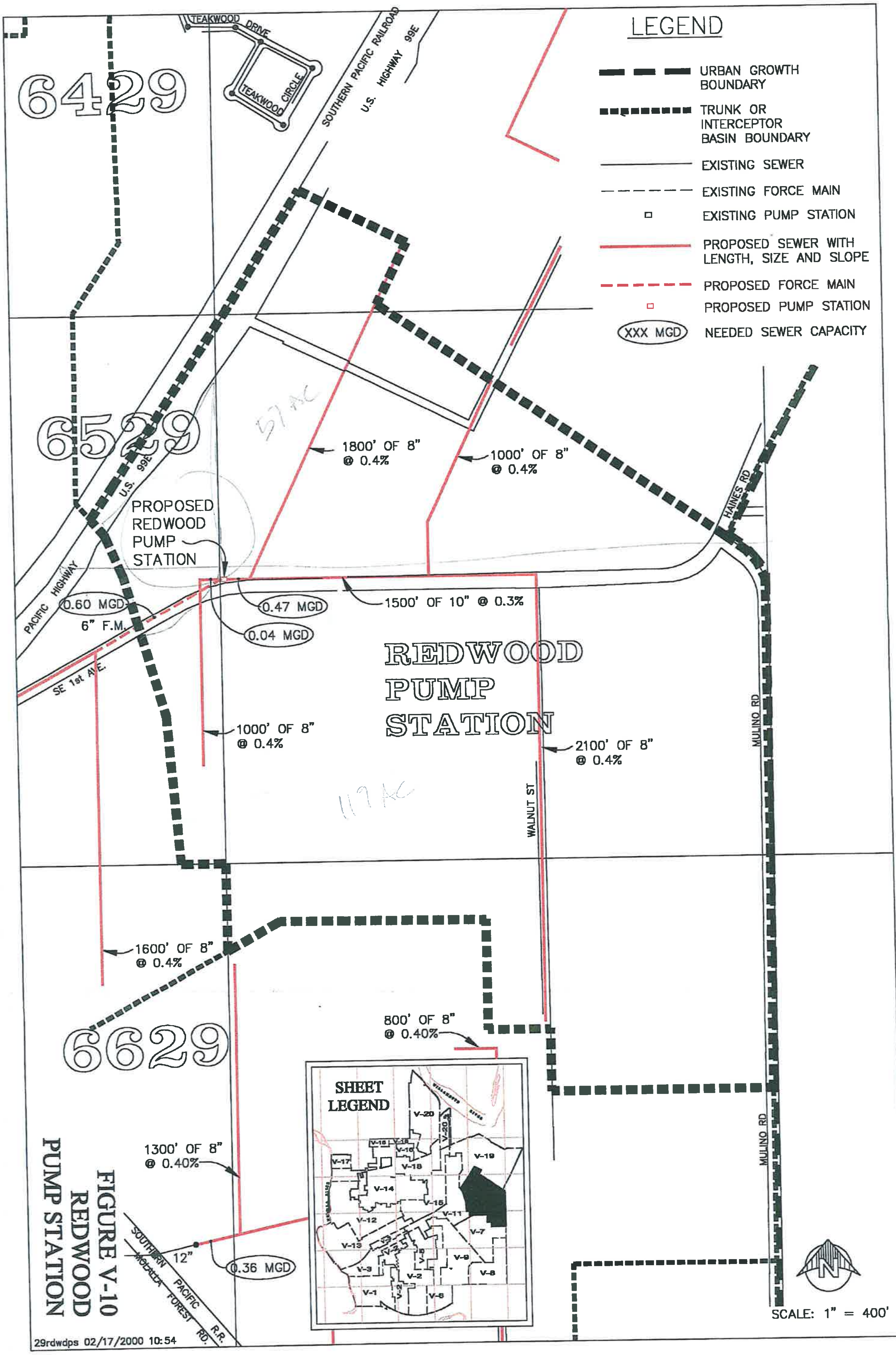

FIGURE V-10
REDWOOD
PUMP STATION

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11. Redwood Street Interceptor

Existing Sewers

The Redwood Interceptor has 12-, 15-, 18- and 21-inch diameter sewers as shown in Table V-11a and Figure V-11 at the end of this section. The 15-inch and larger pipes are relatively new having been constructed in 1988.

Minimum Grade

Only section O-2 is at less than minimum grade. Even so, the volume of wastewater which flows through it will be enough to minimize any settlement of solids. Special maintenance should not be needed.

Sewer Capacities

The 12-inch diameter sewers are older and will have surcharging problems due to future flows as shown in Table V-11a. These problems and their possible solutions are addressed under the South 2nd Avenue Trunk previously discussed.

The 18-inch diameter pipe has three sections which may surcharge at design peak flows. These sections start with the manholes O-2, L-23 and L-7. The O-2 section is a very short section (29 feet) of sewer which is at less than minimum grade. The L-23 and L-7 sections were installed in a casing pipe which was bored and jacked under the Molalla Forest Railroad.

The sewer section O-2 should not cause any problems. We estimate that, even with peak flows, a very small amount of surcharging will overcome the capacity restriction of the flat sloped sewer. At flows less than peak, which is most of the time, no surcharging will be needed.

The two sewer sections L-23 and L-7 are expected to surcharge only with future peak flows. Again, we estimate that only a small amount of surcharging will occur. The commercial users connected upstream of these sections will not be affected by that amount of surcharging.

Sewer Replacements and Extensions

No replacement or corrective construction is recommended for the Redwood Interceptor.

As shown in Figure V-11, trunk sewers are proposed to be extended out from manhole L-6. The most easterly trunk will receive the discharge of the proposed Redwood Pump Station.

Cost Estimates

The estimated engineering and construction costs for these sewer extensions total $205,600, as shown in Table V-11b.

TABLE V-11a
REDWOOD STREET INTERCEPTOR SEWERS
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
99E Trunk Sewer enters MH O-35					0.04		0.04	
South 2nd Trunk Sewer enters MH O-35					1.10		1.54	
O-35	**O-19**	0.0035	12	1.35	1.11	0.24	1.54	**-0.19**
O-19	**O-18**	0.0039	12	1.43	1.11	0.32	1.54	**-0.11**
Locust Trunk Sewer enters MH O-18					1.54		1.98	
O-18	O-17	0.0267	18	11.03	1.54	9.48	1.98	9.05
O-17	O-15	0.0031	18	3.76	1.54	2.21	1.98	1.78
O-15	O-14	0.0020	18	3.02	1.55	1.47	1.99	1.03
O-14	O-13	0.0029	18	3.63	1.56	2.07	2.00	1.64
O-13	O-12	0.0026	18	3.44	1.58	1.87	2.01	1.43
O-12	O-11	0.0042	18	4.37	1.58	2.80	2.01	2.36
O-11	O-10	0.0023	18	3.24	1.58	1.65	2.02	1.22
O-10	O-9	0.0125	18	7.54	1.58	5.96	2.02	5.53
O-9	O-8	0.0039	18	4.21	1.58	2.63	2.02	2.19
O-8	O-2	0.0021	18	3.09	1.59	1.51	2.02	1.07
South Redwood Trunk Sewer enters MH O-2					2.36		3.82	
O-2	**O-1**	0.0007	18	1.79	2.36	**-0.57**	3.82	**-2.04**
O-1	L-23	0.0041	18	4.32	2.38	1.94	3.84	0.48
L-23	**L-7**	0.0020	18	3.02	2.38	0.64	3.84	**-0.82**
L-7	**L-24**	0.0021	18	3.09	2.38	0.71	3.85	**-0.76**
L-24	L-6	0.0044	18	4.48	2.39	2.09	3.85	0.62
Redwood P.S. will pump into new sewer from MH L-6							4.45	
Extend sewer east from MH L-6							4.51	
Extend sewer south from MH L-6							4.57	
L-6	L-5	0.0071	18	5.69	2.40	3.29	4.58	1.11
L-5	L-4	0.0072	18	5.73	2.41	3.32	4.59	1.14
L-4	L-3	0.0070	18	5.65	2.44	3.20	4.63	1.02
L-3	L-2	0.0074	18	5.81	2.48	3.32	4.66	1.14
L-2	L-1	0.0078	18	5.96	2.52	3.44	4.70	1.26
L-1	H-13	0.0253	15	6.60	2.56	4.04	4.74	1.86
H-13	H-12	0.0259	15	6.68	2.59	4.09	4.78	1.90
H-12	H-11	0.0029	21	5.48	2.67	2.81	4.85	0.63
H-11	H-1	0.0027	21	5.29	2.67	2.62	4.85	0.44

TABLE V-11b
REDWOOD STREET INTERCEPTOR
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New sewer east from MH L-6	12	800	74	59,200	-	-	20	16,000
	8	1,600	50	80,000			0	0
New sewer south from MH L-6	8	1,200	50	60,000	-	-	0	0

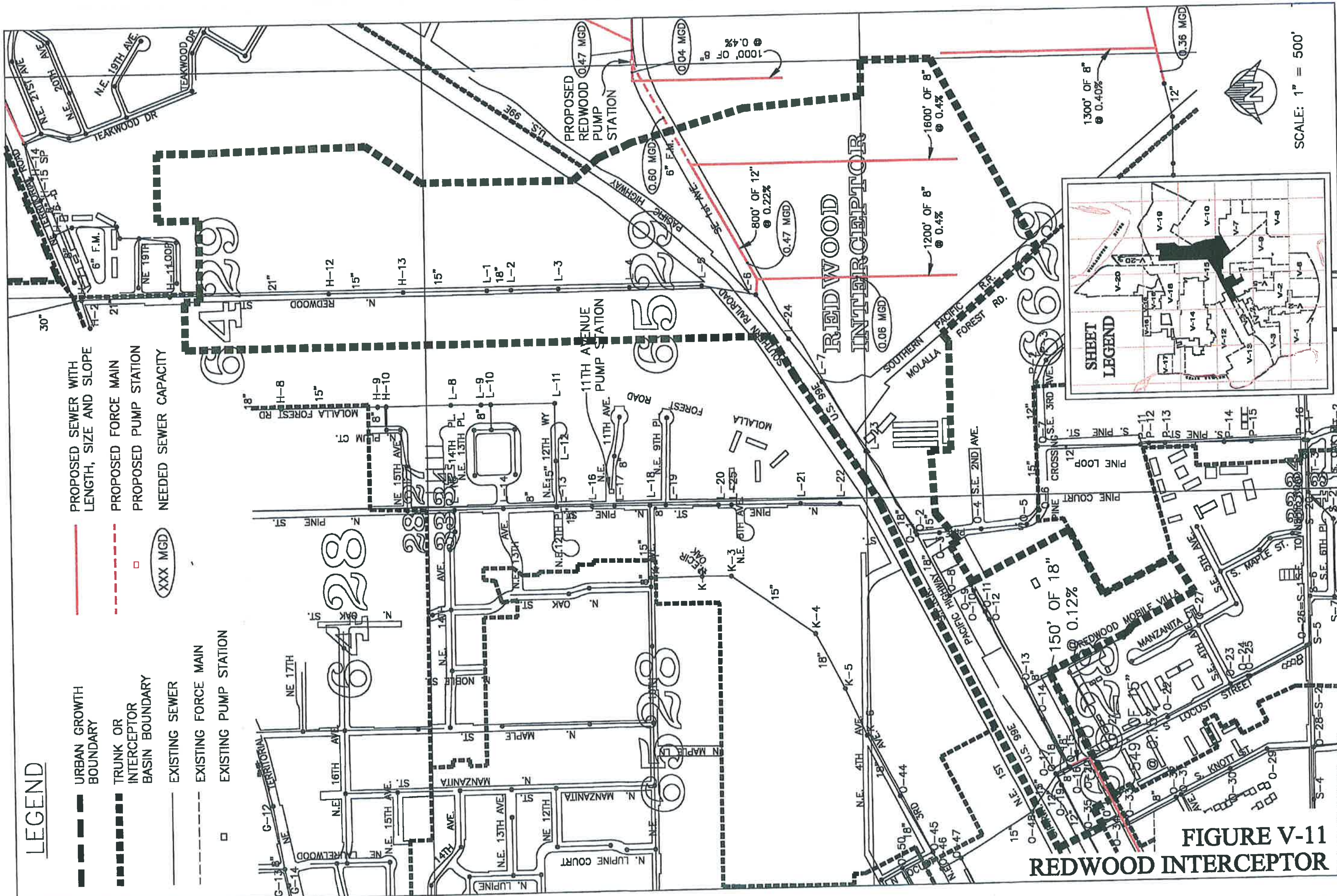

FIGURE V-11
REDWOOD INTERCEPTOR

12. Knight's Bridge Road Trunk

General

Much of the Knight's Bridge Road Trunk was constructed with Canby's original wastewater collection system and is located in the center of downtown. Because of the flat terrain in the area, many of the sections of pipe were laid at less than recommended minimum grade.

Minimum Grade

The Knight's Bridge Road Trunk sewer sections which are below minimum grade begin with the manhole numbers I-1 to I-4, J-6 and N-12 to O-51. In fact, one of these sections, J-6, has an adverse grade indicating that the pipe slopes in the wrong direction.

One concern with these sewers is that solids will tend to settle out of the wastewater more easily than sewers laid at minimum grade. This of course means more frequent cleaning. Even so, these sewers are old and have been functioning fine for many years. Because future growth is limited in this basin, we expect the sewers to continue to operate adequately.

Sewer Capacities

Several sewer sections do not have adequate capacity for the existing and future flows without surcharging including J-6 thru O-51, as shown in Table V-12. All but one of these sections has less than minimum grade. We estimate that the maximum surcharging will be approximately two feet.

Because the flows include the discharge of the Knight's Bridge Pumping Station, the impact of this flow must be considered. The calculations for Table V-12 assume that the full impact of the operating pump will be experienced at manhole J-6 as if the pumps were adjacent to the manhole. However, the reality is that this flow will be dampened by traveling through nearly 2,000 feet of gravity sewer with several bends. Thus, the estimate of the depth of surcharging is conservative and could be less.

Another consideration is that the surcharging will only occur when the station is operating. The station operates only a few minutes every hour. Thus, any surcharging which does occur is short lived. We do not expect the surcharging to be a serious problem, however, if problems arise, minimizing the pump run cycle should reduce the problem.

Sewer Replacements

We do not recommend replacing any of the Knight's Bridge Road Trunk sewers. Surcharging will be minimal and will allow adequate flow through the sewers. The only difficulty may be the need to clean the sewer more frequently.

Having made our recommendation, we must point out that several sewer sections in the Knight's Bridge Road Trunk have grades steeper than the minimum. Thus, some sections with less than minimum grade could possibly be relaid at steeper grades.

In particular, the sewer section which begins with the manhole J-6. This section slopes in the wrong direction. However, the sections before and after this one have slopes much steeper than minimum grade. It may be possible to replace 600 to 900 feet of sewer all at minimum grade or higher. If replacement is considered, the branch sewers which connect to the trunk sewer must be checked to see if they would allow the trunk to be re-graded. This should not be pursued unless the surcharging causes operational problems.

Sewer Extensions

The Knight's Bridge Road Trunk sewer will not have any major extensions to serve its area within the UGB.

TABLE V-12
KNIGHT'S BRIDGE ROAD TRUNK
EXISTING CONDITIONS

Sewer Section		Pipe			Existing Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
I-1	I-2	0.0032	8	0.44	0.08	0.36
I-2	I-3	0.0036	8	0.47	0.09	0.37
I-3	I-4	0.0027	8	0.40	0.10	0.30
I-4	I-5	0.0037	8	0.47	0.12	0.35
I-5	I-6	0.0101	8	0.78	0.30	0.48
Knight's Bridge Pump Station - 2 pumps ea. @ 150 gpm					0.22	
I-7	I-8	0.0037	8	0.47	0.24	0.23
I-8	J-2	0.0060	8	0.60	0.24	0.36
J-2	J-3	0.0035	8	0.46	0.25	0.21
J-3	J-4	0.0049	8	0.54	0.25	0.29
J-4	J-5	0.0059	8	0.60	0.26	0.34
J-5	J-6	0.0063	8	0.62	0.27	0.35
J-6	**N-12**	-0.0002	8	N/A	0.32	**-0.00**
N-12	N-11	0.0048	8	0.54	0.34	0.20
N-11	N-10	0.0038	8	0.48	0.36	0.12
N-10	N-9	0.0026	8	0.40	0.39	0.01
N-9	N-8	0.0033	8	0.45	0.42	0.03
N-8	**N-7**	0.0034	8	0.45	0.53	**-0.08**
N-7	**O-51**	0.0028	8	0.41	0.53	**-0.12**
O-51	**O-50**	0.0030	8	0.43	0.54	**-0.12**
O-50	O-47	0.0098	8	0.77	0.55	0.22

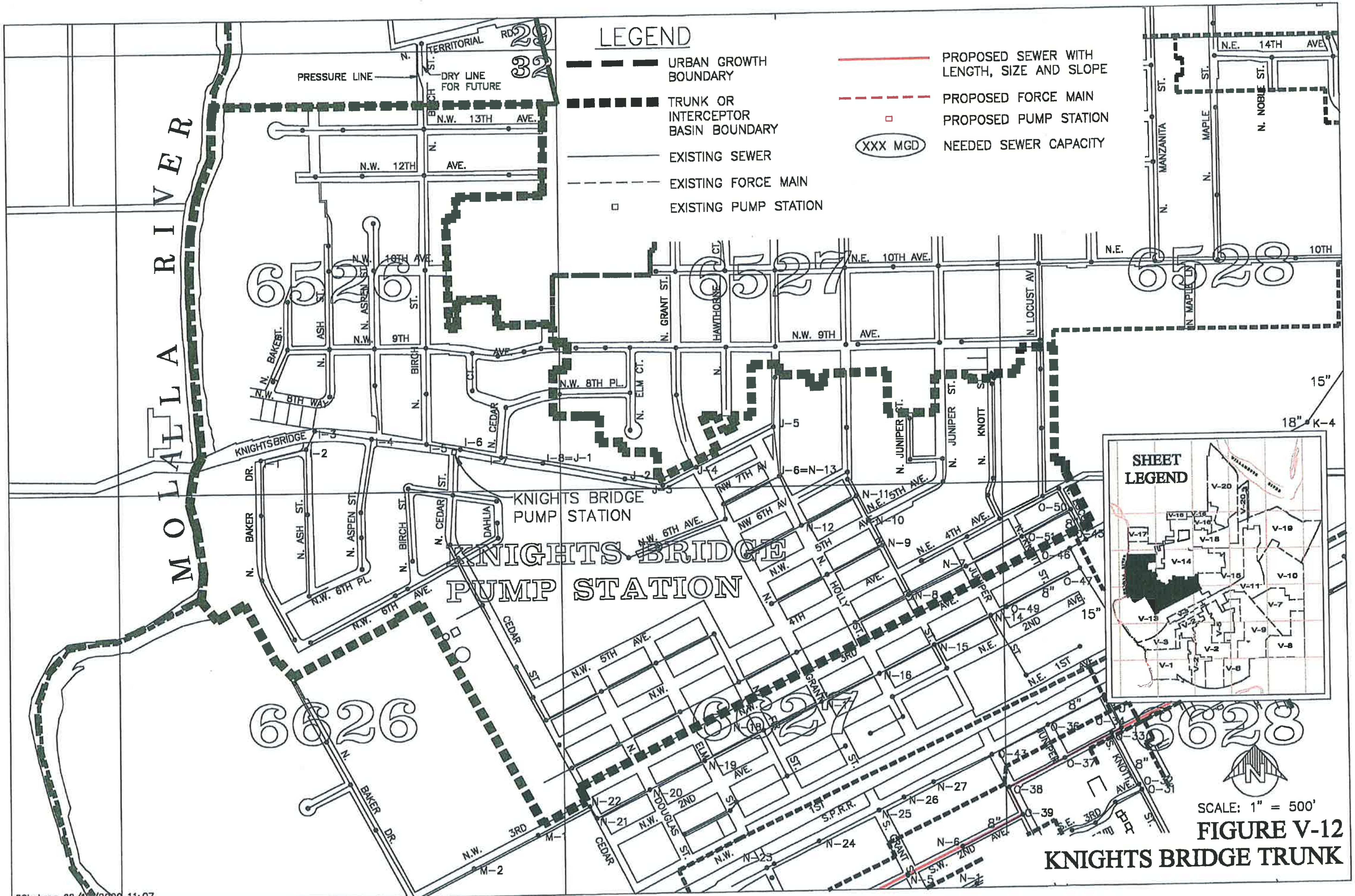

FIGURE V-12
KNIGHTS BRIDGE TRUNK

13. North 3rd Avenue Trunk

General

Much of the North 3rd Avenue Trunk, which is shown on Figure V-13, was constructed with the original sewer system and is located in the center of downtown. The terrain in that area is flat, and so most of the sewers were laid at less than minimum grade.

Minimum Grade

Only five of the fifteen sections of the North 3rd Avenue Trunk sewer are at minimum grade or more as shown in Table V-13a . The flat sewers will, of course, allow solids to settle out more easily and may require more frequent cleaning.

Sewer Capacities

Existing flows can be transported by all sewers on the North 3rd Avenue Trunk. Only two of these flat sewers will have deficiencies for future flows. The two sections are N-22 and N-14. Only minor surcharging (less than six inches) will occur in these sections due to future peak flows.

Sewer Replacement and Extensions

Even though the gravity sewers are old, they have been functioning with minimal problems. We do not recommend replacing any reaches.

We have, however, reviewed the possibility of moving the existing Third and Baker Pumping Station about 400 feet south. The new location would allow it to serve the area north of Highway 99E and south of 3rd Avenue. The proposed relocation point and new sewers are shown in Figure V-13.

Cost Estimates

The total estimate for the expanding the Third & Baker Pump Station's service area equals $239,400. A breakdown of the improvements is shown in Table V-13b.

TABLE V-13a
NORTH 3rd AVENUE TRUNK
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
Third & Baker Pump Sta. - 2 pumps ea. @ est'd. 100 gpm					0.14			
M-3	M-2	0.0052	8	0.56	0.19	0.37	0.19	0.37
Expand and Relocate Third and Baker Pump Station							0.35	
M-2	M-1	0.0020	8	0.35	0.19	0.16	0.35	0.00
M-1	N-22	0.0030	8	0.43	0.19	0.24	0.35	0.08
N-22	**N-21**	0.0009	8	0.23	0.19	0.04	0.35	**-0.11**
N-21	N-20	0.0054	8	0.57	0.19	0.38	0.35	0.22
N-20	N-19	0.0041	8	0.50	0.20	0.30	0.36	0.14
N-19	N-18	0.0037	8	0.47	0.20	0.27	0.36	0.11
N-18	N-17	0.0026	8	0.40	0.22	0.17	0.38	0.01
N-17	N-16	0.0027	8	0.40	0.23	0.17	0.39	0.02
N-16	N-15	0.0025	8	0.39	0.23	0.15	0.39	0.00
N-15	N-14	0.0030	8	0.43	0.25	0.18	0.41	0.02
N-14	**O-49**	0.0019	8	0.34	0.25	0.08	0.41	**-0.07**
O-49	O-47	0.0029	8	0.42	0.26	0.16	0.42	0.00
O-47	O-46	0.0025	15	2.07	0.28	1.79	0.44	1.63
O-46	O-45	0.0213	15	6.06	0.28	5.77	0.44	5.62

TABLE V-13b
NORTH 3rd AVENUE TRUNK
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
Relocate Third & Baker Pump Station				70,000	-	-	- 0	70,000
Third & Baker P. S. Force Main	4	600	24	14,400	-	-	24	14,400
New sewer from Third & Baker P.S.	8	3,100	50	155,000	-	-	0	0

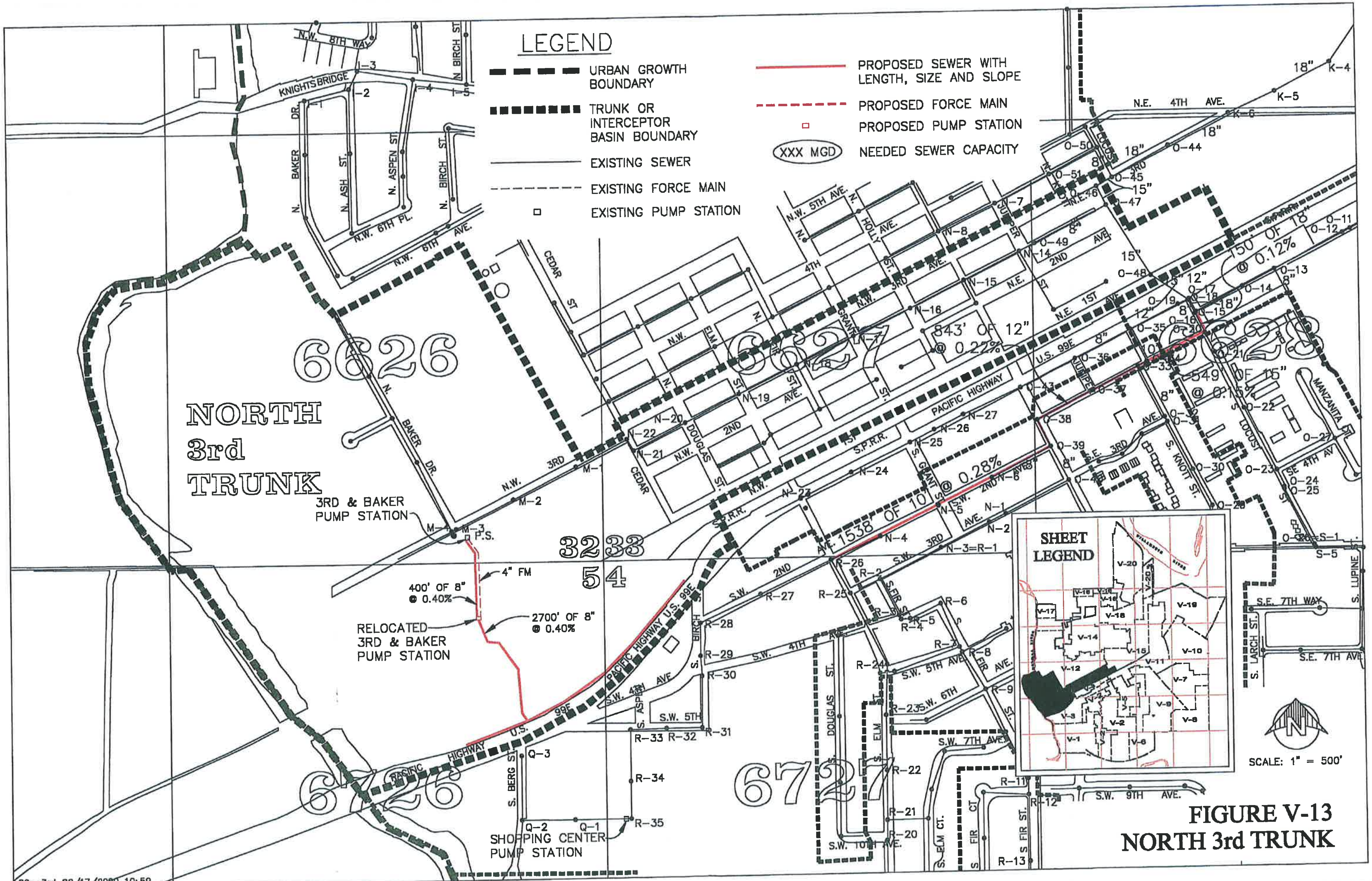

FIGURE V-13
NORTH 3rd TRUNK

14. North 10th Avenue Trunk

General

The North 10th Trunk sewer would not be extended, even if the UGB expands. Only minor in-fill will occur within the trunk's drainage basin. Because no expansion is expected and no serious sewer problems exists, no survey data was collected on this trunk.

The drainage basin collected by the North 10^{th} Avenue trunk sewer is essentially at full buildout. Only minor additions will be generated as in-fill occurs. No survey data were collected on this trunk

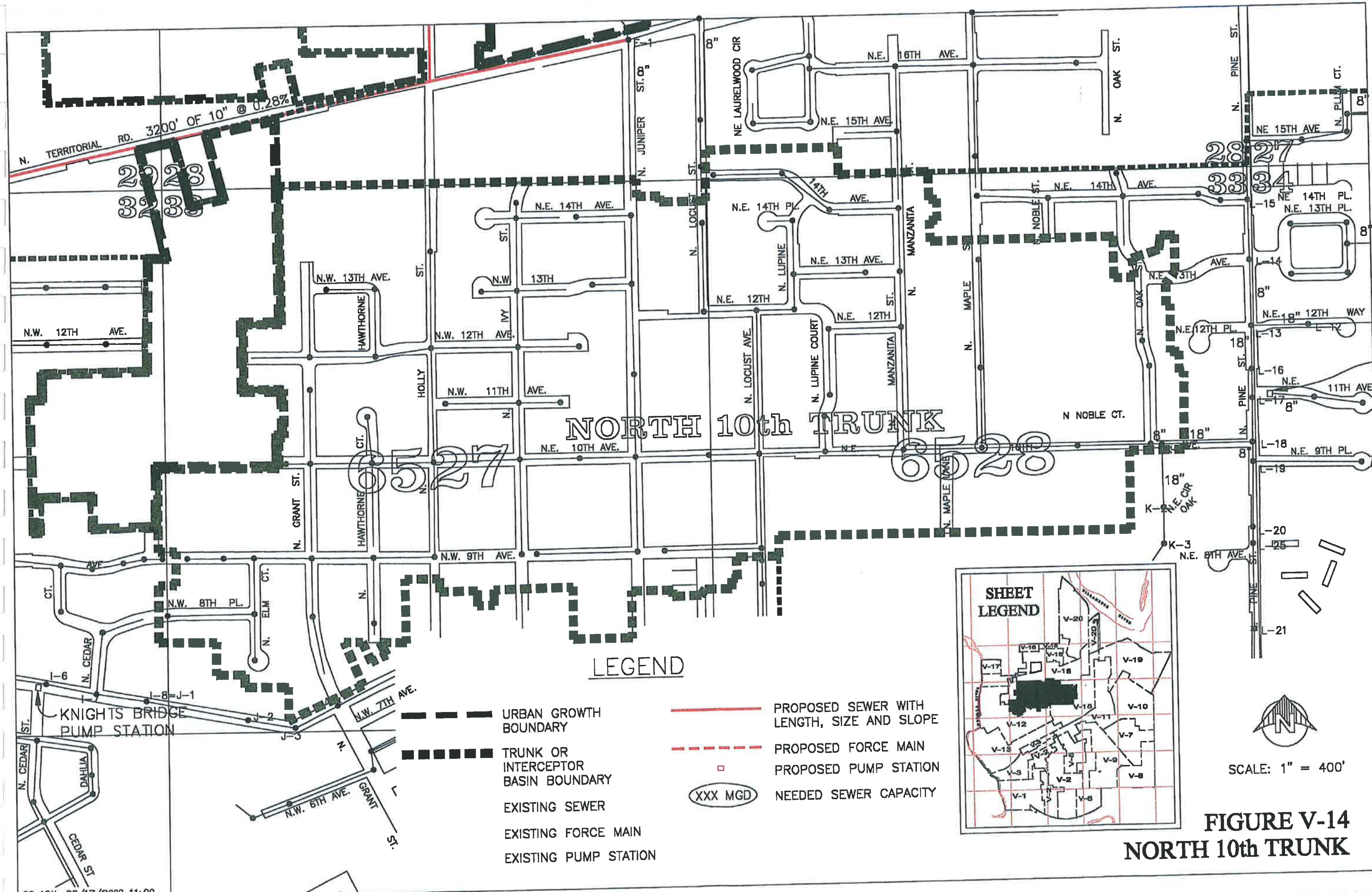

FIGURE V-14
NORTH 10th TRUNK

15. Molalla Interceptor

General

The Molalla Interceptor shown in Figure V-15 was the original interceptor sewer for the Canby sewer system. Its sewers are 15 inch and 18 inch in diameter. A summary of the sewers is shown in Table V-15a. The interceptor receives the flow from four trunk sewers, Knight's Bridge Road, North 3rd Avenue, North 10th Avenue and Territorial Road.

Minimum Grade

Table V-15a shows that only section O-45 has a slope less than minimum grade. In fact, the slope of section O-45 is adverse. This slope will cause more solids than normal to settle out, but the size of the pipe will accommodate a large amount of solids and still provide adequate capacity for the expected sewage flow. Even so, frequent cleaning may be necessary in this sewer section, as with other negatively sloped sewers.

The cost of the extra cleaning will be much less than the cost to relay the 18-inch at minimum grade. At least three sections of sewers would need to be replaced to allow the sewer to be installed at minimum grade. Thus, we do not recommend correcting the grade of this sewer.

Sewer Capacity

Looking at Table V-15a, one sewer section, O-45, is expected to have surcharging. The amount of surcharging however, is expected to be less than the crown of the pipe with future peak flows. This should not create any problems.

Sewer Replacement and Extensions

No replacement of the Molalla Interceptor sewers is recommended, and no expansion is required.

TABLE V-15a
MOLALLA INTERCEPTOR
WASTEWATER FLOW AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Knight's Bridge Trunk Sewer enters MH O-45					0.55		0.55	
North 3rd Trunk Sewer enters MH O-45					0.84		0.99	
O-45	**O-44**	- 0.0005	18	N/A	0.85	**-0.00**	1.00	**-0.00**
O-44	K-6	0.0014	18	2.52	0.90	1.62	1.06	1.46
K-6	K-5	0.0019	18	2.94	0.91	2.03	1.07	1.88
K-5	K-4	0.0019	18	2.94	0.92	2.03	1.07	1.87
K-4	K-3	0.0094	18	4.02	0.92	3.10	1.08	2.94
K-3	K-2	0.0023	18	1.99	0.93	1.06	1.09	0.90
K-2	K-1	0.0037	18	2.52	0.93	1.59	1.09	1.43
North 10th Trunk enters MH K-1					1.43		1.59	
K-1	L-18	0.0025	18	2.07	1.44	0.63	1.60	0.47
L-18	L-17	0.0025	18	2.07	1.57	0.51	1.73	0.35
L-17	**l-16**	0.0014	18	1.55	1.58	**-0.03**	1.74	**-0.18**
L-16	L-13	0.0045	18	2.78	1.58	1.20	1.74	1.04
L-13	L-12	0.0152	18	5.12	1.65	3.46	1.81	3.31
L-12	L-11	0.0057	18	3.13	1.66	1.47	1.82	1.32
L-11	L-10	0.0057	18	3.13	1.70	1.43	1.86	1.28
L-10	L-9	0.0061	18	3.24	1.71	1.53	1.87	1.37
L-9	L-8	0.0054	18	3.05	1.72	1.33	1.88	1.17
L-8	H-10	0.0051	18	2.96	1.74	1.23	1.89	1.07
H-10	H-9	0.0258	18	6.67	1.74	4.93	1.89	4.77
H-9	H-8	0.0021	18	1.90	1.75	0.16	1.90	0.00
H-8	H-7	0.0020	18	3.02	1.76	1.26	1.91	1.10
H-7	H-4	0.0023	18	3.24	1.76	1.48	1.91	1.32
Territorial Interceptor Sewer enters MH H-4					0.53		1.15	
H-4	H-3	0.0206	15	5.96	2.29	3.67	3.07	2.88
H-3	H-2	0.0369	15	7.97	2.29	5.68	3.08	4.90
H-2	H-1	0.0099	15	4.13	2.30	1.83	3.08	1.05

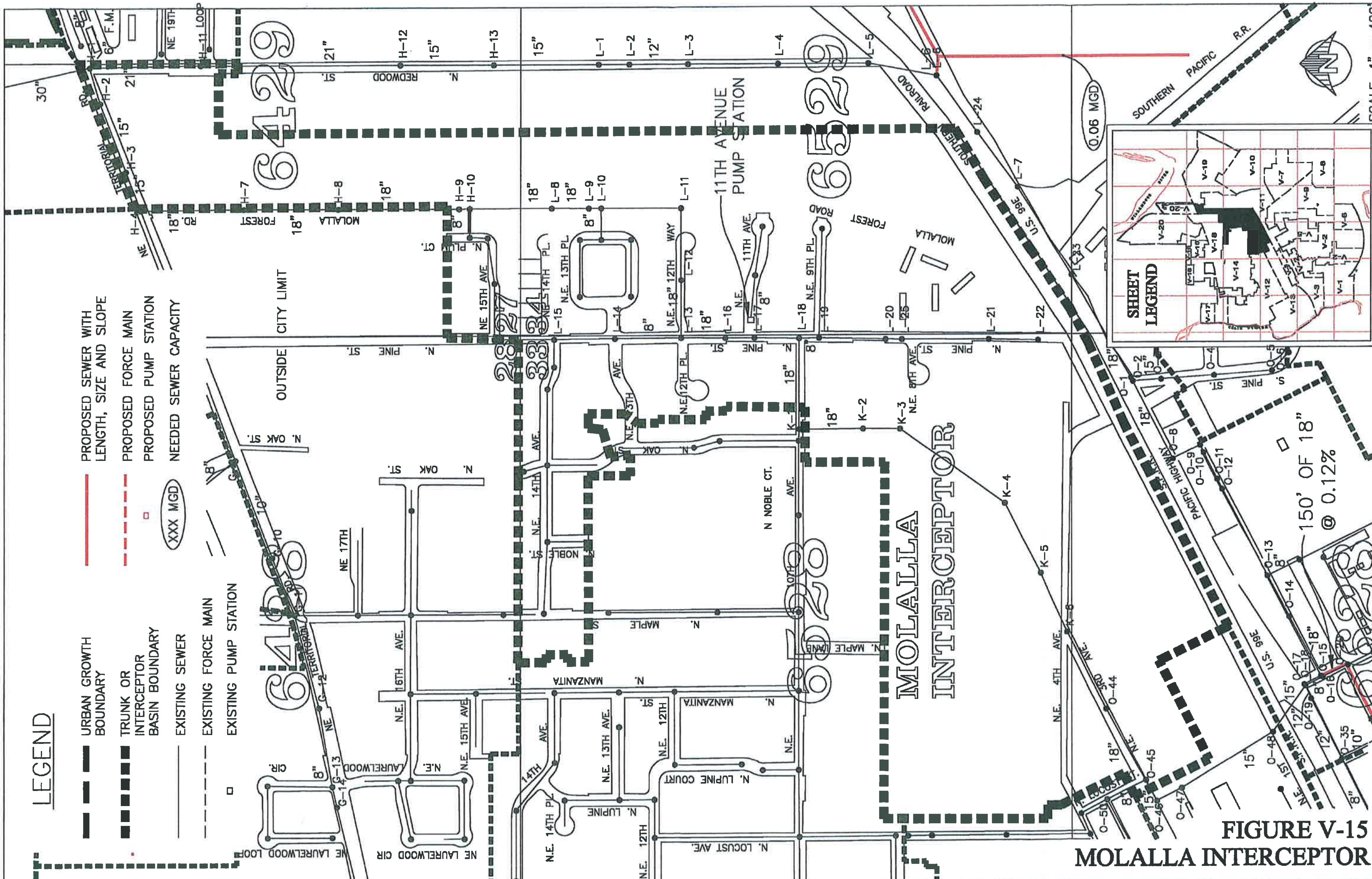

FIGURE V-15
MOLALLA INTERCEPTOR

16. North 22nd Avenue Pump Station

General

The Urban Growth Boundary includes several fringe areas where the topography falls away from the planned infrastructure improvements. One of these areas is centered on North Holly Street at North 22nd Avenue. This localized depression encompasses approximately 20 acres where the ground elevation is not adequate to provide gravity sewer service. As a result, a small pump station is anticipated to be required if this area is to develop.

Sewer Extensions

The drainage basin of the proposed North 22nd Avenue Pump Station is shown on Figure V-16 at the end of this section. This basin area is dependent upon the infrastructure provided in adjacent basins.

The drainage basin will require approximately 1,300 feet of 8-inch gravity sewer and depending upon the ultimate pump station location, approximately 1,400 feet of a small force main. The use of a 3-inch or smaller force main will require that grinder type pumps be used at the station. Grinder pumps will reduce the size of all solids to allow them to pass through the small force main.

Cost Estimates

The estimated cost to install the gravity sewer is $65,000. The cost of the pump station and its force main is estimated to total $158,000. A breakdown of these costs are shown in Table V-16a.

TABLE V-16a
NORTH 22nd AVENUE PUMP STATION
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New Sewer east from N. 22nd Pump Station	8	1,300	50	65,000	-	-	0	0
North 22nd Pump Station				130,000	-	-	-	130,000
North 22nd Force Main	3	1,400	20	28,000	-	-	20	28,000

16.1 North 22nd Avenue Trunk

General

The North 22nd Avenue Trunk sewer is 8 inches in diameter and has slopes greater than the minimum grade as shown in Table V-16.1a. No unusual problems were noted with this trunk.

Sewer Extensions

The trunk is expected to be extended as far west as the topography will permit.

When the North 22nd Avenue Pump Station is added to the system as discussed in the previous section, an increase in sewage flows will occur in the North 22nd Avenue Trunk. The projected flow conditions are shown in Table V-16.1a.

Cost Estimates

As shown on Figure V-16 approximately 1,300 feet of 8-inch sewer can be extended from the existing manhole G-1. The cost estimate for this sewer is $65,000.

TABLE V-16.1a
NORTH 22nd AVENUE TRUNK
WASTEWATER FLOW AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)
Future N. 22nd Pump Station into MH G-1							0.03	
Extend sewer west form MH G-1							0.03	
G-1	G-2	0.0041	8	0.50	0.01	0.49	0.06	0.43
G-2	G-4	0.0042	8	0.50	0.01	0.49	0.07	0.43
G-4	G-5	0.0041	8	0.50	0.03	0.46	0.09	0.41
G-5	G-6	0.0045	8	0.52	0.04	0.48	0.10	0.42
G-6	G-7	0.0046	8	0.53	0.05	0.48	0.10	0.42
G-7	G-8	0.0043	8	0.51	0.06	0.45	0.12	0.39
G-8	G-9	0.0057	8	0.59	0.07	0.51	0.13	0.46

TABLE V-16.1b
NORTH 22ND AVENUE TRUNK SEWER

ESTIMATED ENGINEERING AND CONSTRUCTION COST						
Item Description	**Size**	**Length**	**Actual**		**Replacement**	**Oversize**
New Sewer west of MH GI	8"	1300'	Unit $50	Total $65,000	-	-

16.2 North 20th Avenue Trunk

General

The North 20th Avenue Trunk sewer is 8 inches in diameter and has slopes greater than the minimum grade. A summary of the sewer diameters and slopes are tabulated in Table V-16.2a. No unusual problems are expected with this trunk.

Cost Estimates

As shown on Figure V-16 approximately 700 feet of 8-inch sewer can be extended from the existing manhole G-18 to serve this area. The cost estimate for this sewer is $35,000.

TABLE V-16.2a
NORTH 20th AVENUE TRUNK
WASTEWATER FLOW AN D SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
G-18	G-17	0.0073	8	0.66	0.03	0.63	0.06	0.60
G-17	G-16	0.0080	8	0.69	0.04	0.66	0.07	0.63
G-16	G-11	0.0069	8	0.64	0.04	0.60	0.07	0.57

TABLE V-16.2b
NORTH 20TH AVENUE TRUNK SEWER

ESTIMATED ENGINEERING AND CONSTRUCTION COST						
Item Description	Size	Length	Actual		Replacement	Oversize
New sewer west of MH G-18	8"	700'	Unit $50	Total $35,000	-	-

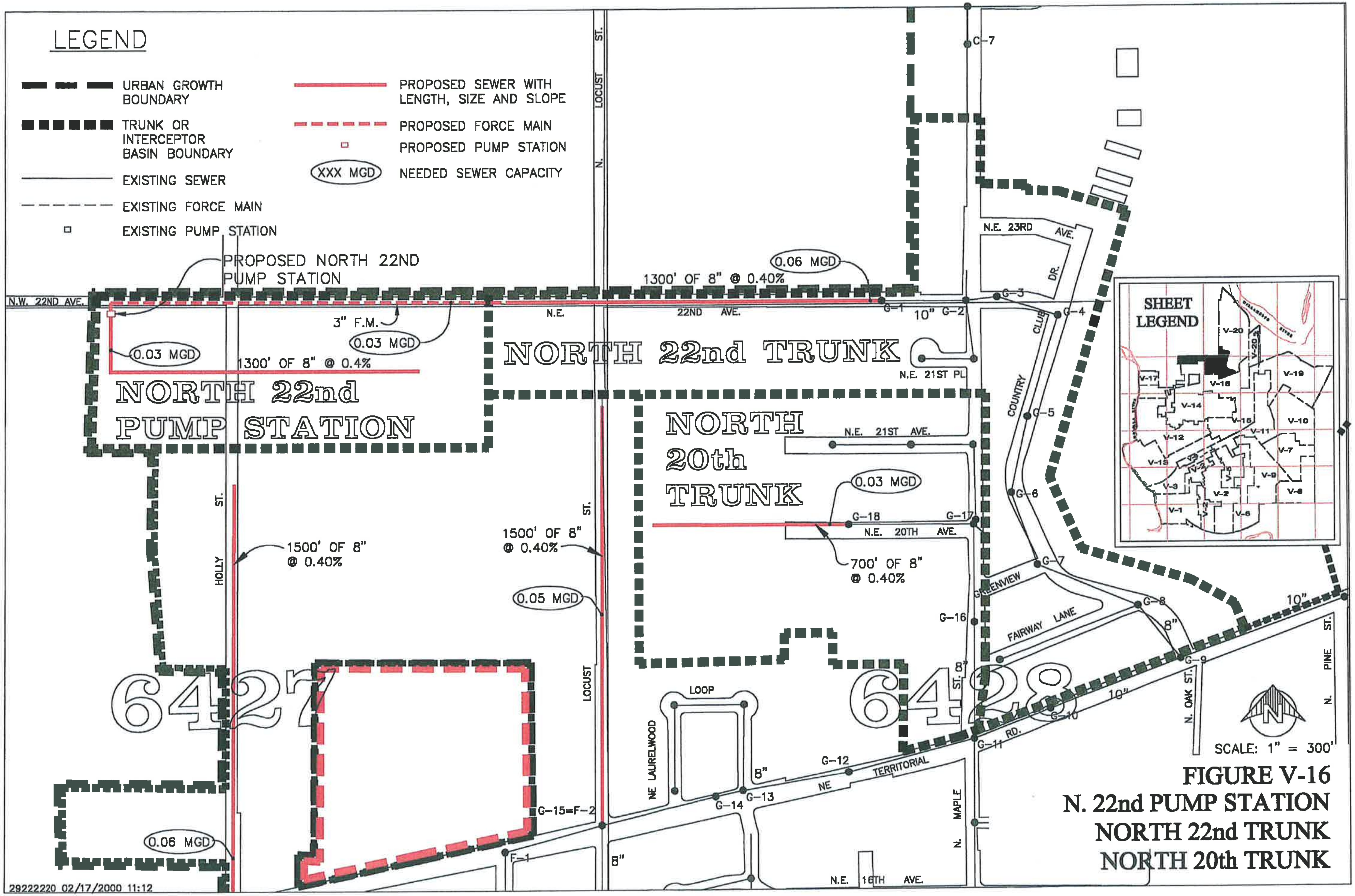

FIGURE V-16
N. 22nd PUMP STATION
NORTH 22nd TRUNK
NORTH 20th TRUNK

17. North Birch Pump Station

General

This drainage basin serves the northwest corner of the UGB where, similar to the North 22nd Avenue pump station basin, the local topography falls away from the planned infrastructure of the adjacent basins. The topography slopes toward the Molalla River and away from the existing sewers from Territorial Road, creating a localized depressed area of approximately 20 acres. There are no existing sewers in this basin.

Sewer Extensions

The ground along North Birch Street slopes away from the City's existing sewers. Thus, the Territorial Interceptor sewer cannot be extended to serve the homes in this area by gravity. As shown in Figure V-17, we recommend the North Birch Street Pump Station to serve this area.

Cost Estimates

Approximately 1,300 feet of 8-inch sewer, a pump station and its force main would be needed to serve this area. The total estimated cost of the sewer and pump station is $228,600. Table V-17 provides a breakdown of the construction and engineering cost estimates.

UGB Considerations

The same arguments which apply to the proposed North 22nd Pump Station apply to the proposed North Birch Street Pump Station. The ground around the proposed site slopes toward the north and west, which is away from the City's existing sewers. The low point for this area is several hundred feet north and west of the proposed site for the North Birch Pump Station. The best location for a pump station in this area would be near the Molalla River.

Similar to in the North 22nd Avenue Pump Station, the cost of installing and operating this small pump station is very expensive for the number of acres in the basin. Inclusion of alternative areas in the UGB which can be served by gravity or by a larger pump station would be more cost effective in terms of cost per serviced acre.

TABLE V-17a
NORTH BIRCH STREET PUMP STATION
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New Sewer east from N. Birch Pump Station	8	1,300	50	65,000	-	-	0	0
North Birch Pump Station				130,000	-	-	-	130,000
North Birch Force Main	4	1,400	24	33,600	-	-	24	33,600

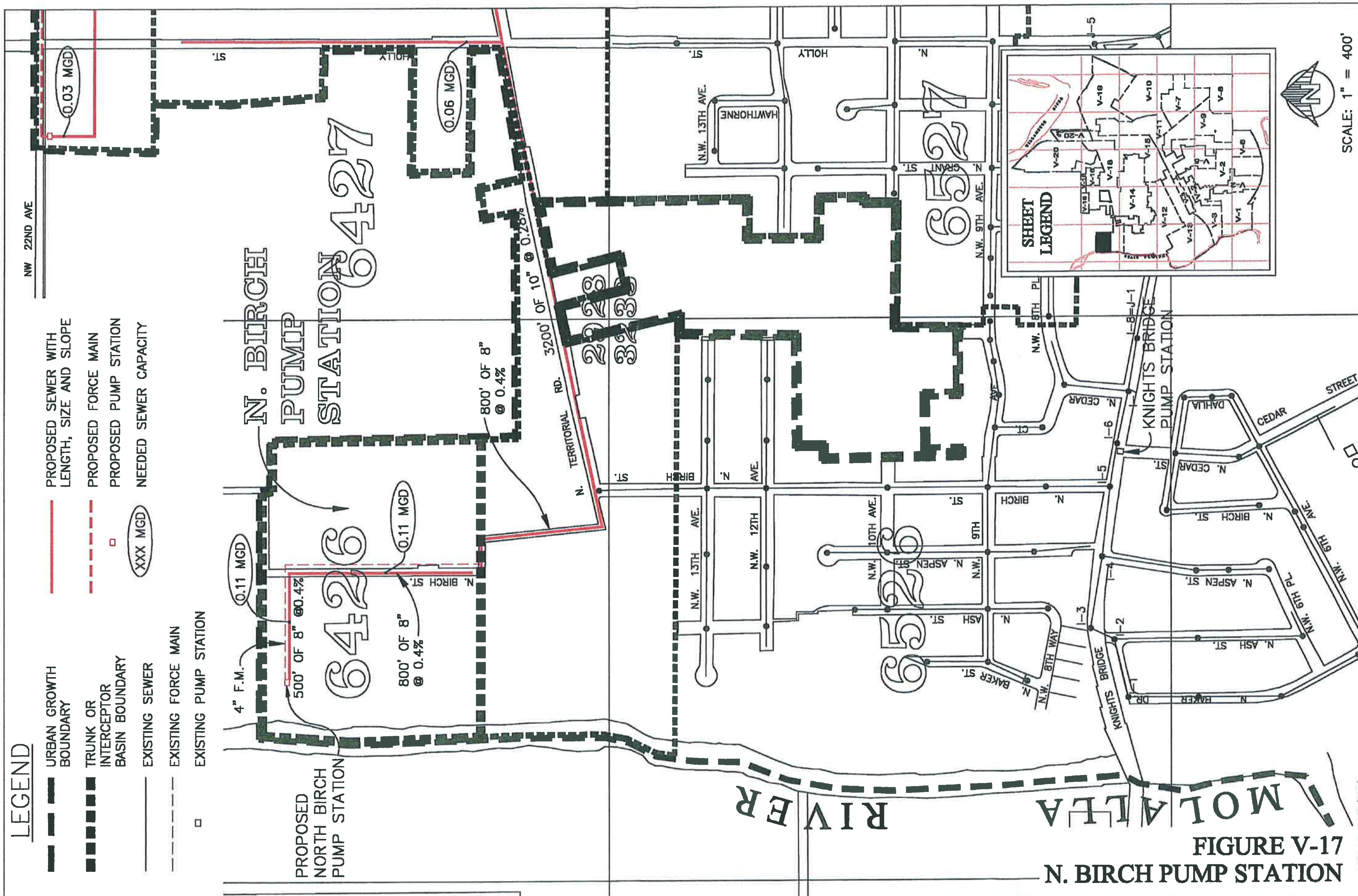

FIGURE V-17
N. BIRCH PUMP STATION

18. Territorial Road Interceptor

Existing Sewers

The Territorial Road Interceptor collects wastewater from the North 22nd Avenue and the North 20th Avenue Trunks and, in the future, from the proposed North Birch Street and North 22nd Avenue Pump Stations. The interceptor includes 10- and 12-inch diameter pipelines, as shown in Figure V-18.

Minimum Grade

All of the pipes on this interceptor have slopes at or above the minimum grades.

Sewer Capacities

As shown in Table V-18a, the Territorial Road Interceptor has significantly more capacity than any of the expected flows. No unusual problems are expected with this sewer.

Sewer Replacement and Extensions

No replacements are recommended.

The interceptor will extend down Territorial Road to North Birch Street and then north up North Birch, as shown in Figure V-18.

The slope of the sewer extension will be established by the existing fall between manhole F-1 and the existing manhole at North Birch Street. This slope will require that 3,200 feet of 10-inch sewer at 0.28 percent slope be installed along North Territorial Road and 800 feet of 8-inch line at 0.4 percent slope be installed along North Birch Street.

Cost Estimate

The cost for the sewer extension is estimated to be $313,400 as shown in Table V-18b.

TABLE V-18a
TERRITORIAL ROAD INTERCEPTOR
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacity (mgd)
Future N. Birch Street Pump Sta. pumps to new sewer from MH F-1							0.11	
Extend sewer north from new sewer extended from MH F-1							0.17	
Extend sewer west from MH F-1							0.49	
F-1	G-15	0.0040	10	0.89	0.03	0.86	0.52	0.38
Extend sewer north form MH G-15							0.57	
G-15	G-14	0.0036	10	0.84	0.04	0.81	0.58	0.27
G-14	G-13	0.0048	10	0.98	0.04	0.94	0.58	0.40
G-13	G-12	0.0040	10	0.89	0.07	0.82	0.61	0.28
G-12	G-11	0.0071	10	1.19	0.09	1.10	0.63	0.56
North 20th Trunk Sewer enters MH G-11					0.13		0.70	
G-11	G-10	0.0043	10	0.92	0.28	0.64	0.85	0.07
G-10	G-9	0.0047	10	0.96	0.29	0.67	0.86	0.10
North 22nd Trunk Sewer enters MH G-9					0.36		0.99	
G-9	H-6	0.0110	10	1.48	0.41	1.06	1.04	0.44
H-6	H-5	0.0094	12	2.22	0.47	1.75	1.10	1.12
H-5	H-4	0.0085	12	2.11	0.53	1.58	1.15	0.96

TABLE V-18b
TERRITORIAL ROAD INTERCEPTOR
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	Size (In)	Length (ft)	Actual		Replacement		Oversize	
			Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)	Unit Cost ($/ft)	Total Cost ($)
New Sewer west from manhole F-1	10 8	3,200 800	62 50	$198,400 $40,000	- -	- -	13 0	$41,600 0
New sewer north from manhole G-1	8	1,500	50	$75,000	-	-	0	0

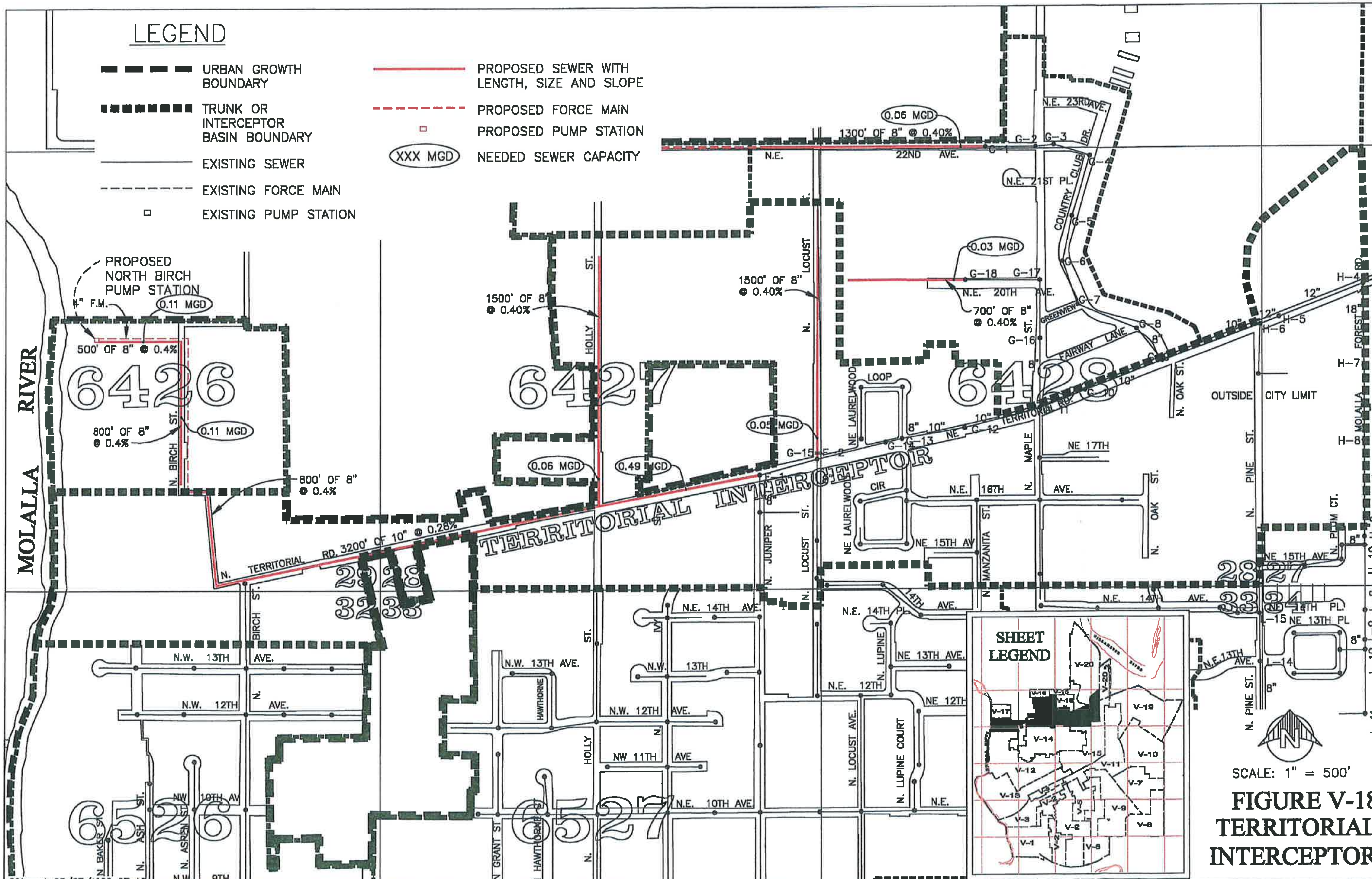

FIGURE V-18
TERRITORIAL INTERCEPTOR

19. Willow Creek Interceptor

General

The Willow Creek Interceptor discharges into the Willow Creek Pump Station. The pump station serves an apartment complex and two new housing developments. One of the developments is on the east side of Willow Creek. The Willow Creek Interceptor carries the sewage from the east side development to the pump station. Figure V-19 at the end of this section shows the Willow Creek Interceptor.

Minimum Grade

The interceptor is 8 inches in diameter and has less than minimum grade in the sewer section starting with manhole H-14 as shown in Table V-19a.

Sewer Capacities

Because the existing flows are quite low, the sewer section with less than minimum grade, H-14, has capacity without surcharging. However, with future peak flows as shown in Table V-19a, the wastewater flows are expected to increase substantially and will cause some surcharging (less than six inches) in this section.

Sewer Replacements and Extensions

The increased flows from future development in the drainage basin of the Willow Creek Interceptor will require the capacity of the pump station to be increased. Also, the force main may need to be increased from 4 inches to 6-inches in diameter.

In order to connect the pump station to the entire drainage basin, a gravity mainline must be bored or jacked under the Southern Pacific Railroad and Highway 99E. The cost for this construction will be very high compared to normal sewer installation costs. A 10-inch sewer at minimum grade will have more than enough capacity to carry the expected sewage flows from the drainage basin on the east side of Highway 99E.

The estimated costs of all the proposed sewer extensions for the Willow Creek Interceptor, and to upgrade the existing pump station and increase the size of the force main is estimated to be $422,800, with an oversize component of $127,200. A breakdown of the estimated costs is tabulated in Table V-19b.

TABLE V-19a
WILLOW CREEK INTERCEPTOR
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		**Pipe**			**Existing Conditions**		**Future Conditions**	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
Extend sewer east from MH H-14							0.47	
H-14	**H-15**	0.0028	8	0.41	0.11	0.30	0.59	**-0.18**
Willow Creek Pump Station					0.22		0.59	
Exist. 4-inch force main					0.22	0.17		
New 6-inch force main for expanded Willow Creek Pump Sta.							0.59	0.30

TABLE V-19b
WILLOW CREEK INTERCEPTOR
ESTIMATED ENGINEERING AND CONSTRUCTION COSTS

Item Description	**Size (In)**	**Length (ft)**	**Actual**		**Replacement**		**Oversize**	
			Unit Cost ($/ft)	**Total Cost ($)**	**Unit Cost ($/ft)**	**Total Cost ($)**	**Unit Cost ($/ft)**	**Total Cost ($)**
New Sewer east from MH H-17	8 10	1,500 800	50 62	75,000 49,600	- -	- -	0 13	0 10,400
Jack or bore new sewer under Southern Pacific RR and Highway 99E.	10	300	200	60,000	-	-	50	15,000
New Sewer south as shown in Figure V-19.	8	2,400	50	120,00 0	-	-	0	0
Expand Willow Creek P.S.				100,00 0	-	-		100,000
Replace exist. Willow Creek P.S. Force Main	6	650	28	18,200	-	-	28	18,200

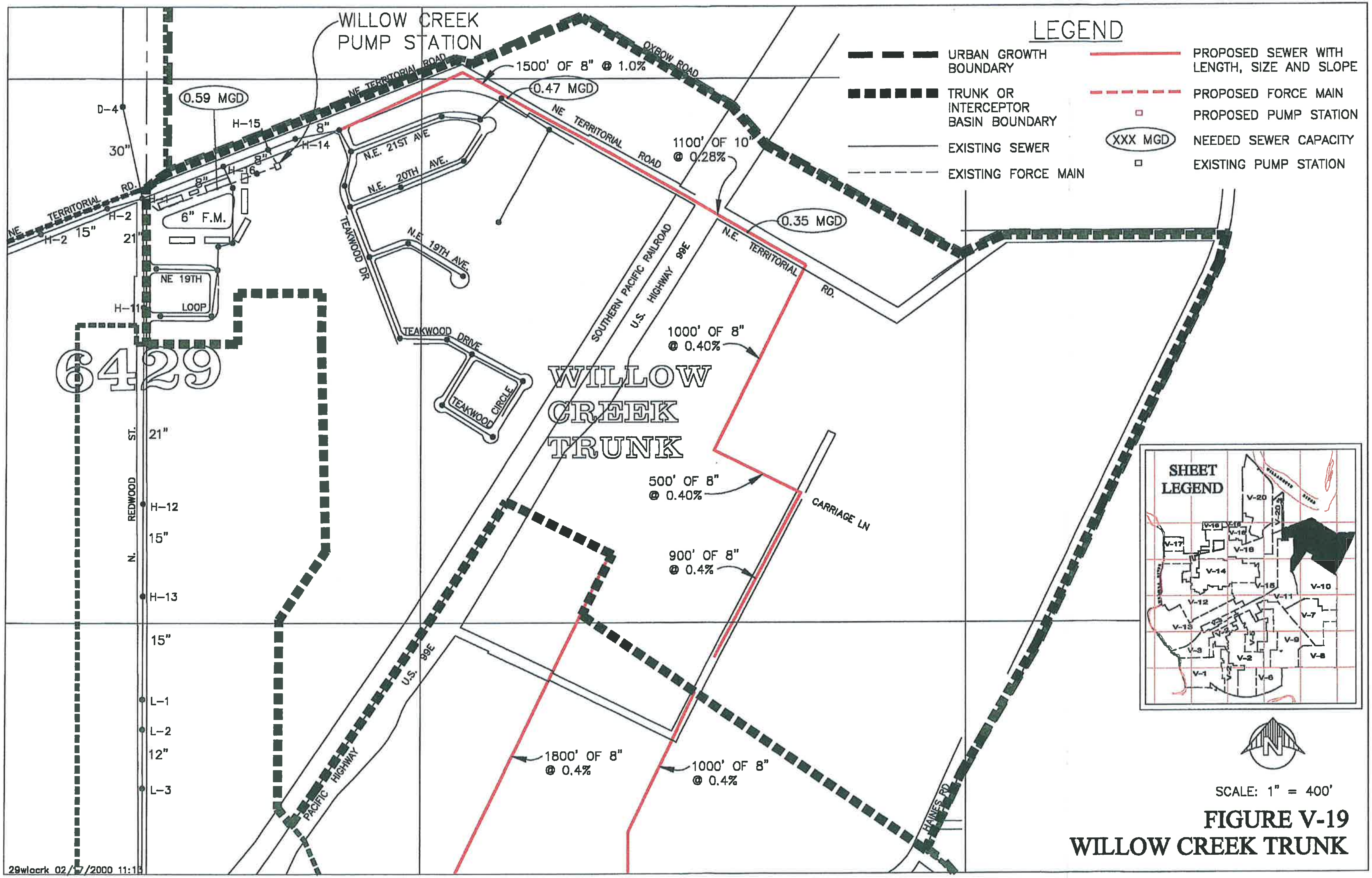

FIGURE V-19
WILLOW CREEK TRUNK

20. Plant Interceptor

General

The Plant Interceptor is a new sewer built as a part of the Redwood Interceptor project and has 30-inch diameter sewers. This interceptor collects all flows from all trunks and interceptor for the entire Urban Growth Boundary.

Sewer Capacities

As shown in Table V-20a, the sewers have more than minimum grade and more than enough capacity for future peak flows. The interceptor's capacity is approximately 10.5 million gallons per day (mgd), which provides an excess capacity over future flows of about 2.0 mgd. The Plant Interceptor is shown at the end of this section on Figure V-20.

TABLE V-20a
PLANT INTERCEPTOR
WASTEWATER FLOWS AND SEWER CAPACITIES

Sewer Section		Pipe			Existing Conditions		Future Conditions	
Upstream MH. No.	Downstream MH. No.	Slope (ft/ft)	Size (in)	Capacity (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)
Territorial Interceptor enters MH H-1					2.30		3.08	
Redwood Interceptor enters MH H-1					4.97		7.92	
Willow Creek Force Main enters MH H-1					5.19		8.52	
H-1	D-4	0.0016	30	10.54	5.22	5.32	8.55	1.99
D-4	D-3	0.0015	30	10.21	5.25	4.96	8.58	1.62
D-3	D-2	0.0015	30	10.21	5.28	4.93	8.61	1.59
D-2	D-1	0.0017	30	10.86	5.31	5.56	8.64	2.22

20.1 North 34th Avenue Trunk

General

The North 34th Avenue Trunk sewer discharges into the North 34th Avenue Pump Station. The pump station and the trunk sewer serve the housing developments along North 34th Avenue and North Maple Street as shown in Figure V-20.

Minimum Grade

The trunk is all 8-inch diameter sewers and has slopes equal to or greater than the minimum grade.

Sewer Capacities

As shown in Table V-20.1 the trunk has capacity for all expected flows. No unusual problems are expected with this trunk.

Sewer Replacements and Extensions

As shown in Figure V-20, the drainage basin for this trunk is limited by the UGB. Because future expansion of the UGB in this area is not expected, no extension of the sewer projected is expected.

TABLE V-20.1
NORTH 34th TRUNK EXISTING CONDITIONS

Sewer Section		Pipe			Existing Conditions	
Upstream MH. No.	**Downstream MH. No.**	**Slope (ft/ft)**	**Size (in)**	**Capacity (mgd)**	**Cumulative Flows (mgd)**	**Remaining Capacity (mgd)**
C-6	C-5	0.0049	8	0.54	0.04	0.50
C-5	C-4	0.0053	8	0.57	0.05	0.52
C-4	C-3	0.0098	8	0.77	0.06	0.71
C-3	C-2	0.0186	8	1.06	0.07	0.99
C-2	C-1	0.0018	8	0.33	0.08	0.25
C-1	A-7	0.0227	8	1.17	0.09	1.08
A-7	A-6	0.0232	8	1.18	0.10	1.08
A-6	A-5	0.0047	8	0.53	0.11	0.42
A-5	A-4	0.0062	8	0.61	0.12	0.49
A-4	A-3	0.0067	10	1.15	0.14	1.01
A-3	A-2	0.0042	12	1.48	0.16	1.32
A-2	A-1	0.3691	12	13.92	0.16	13.76
34th Street Pump Station - 2 pumps ea. @ 155 gpm					0.22	

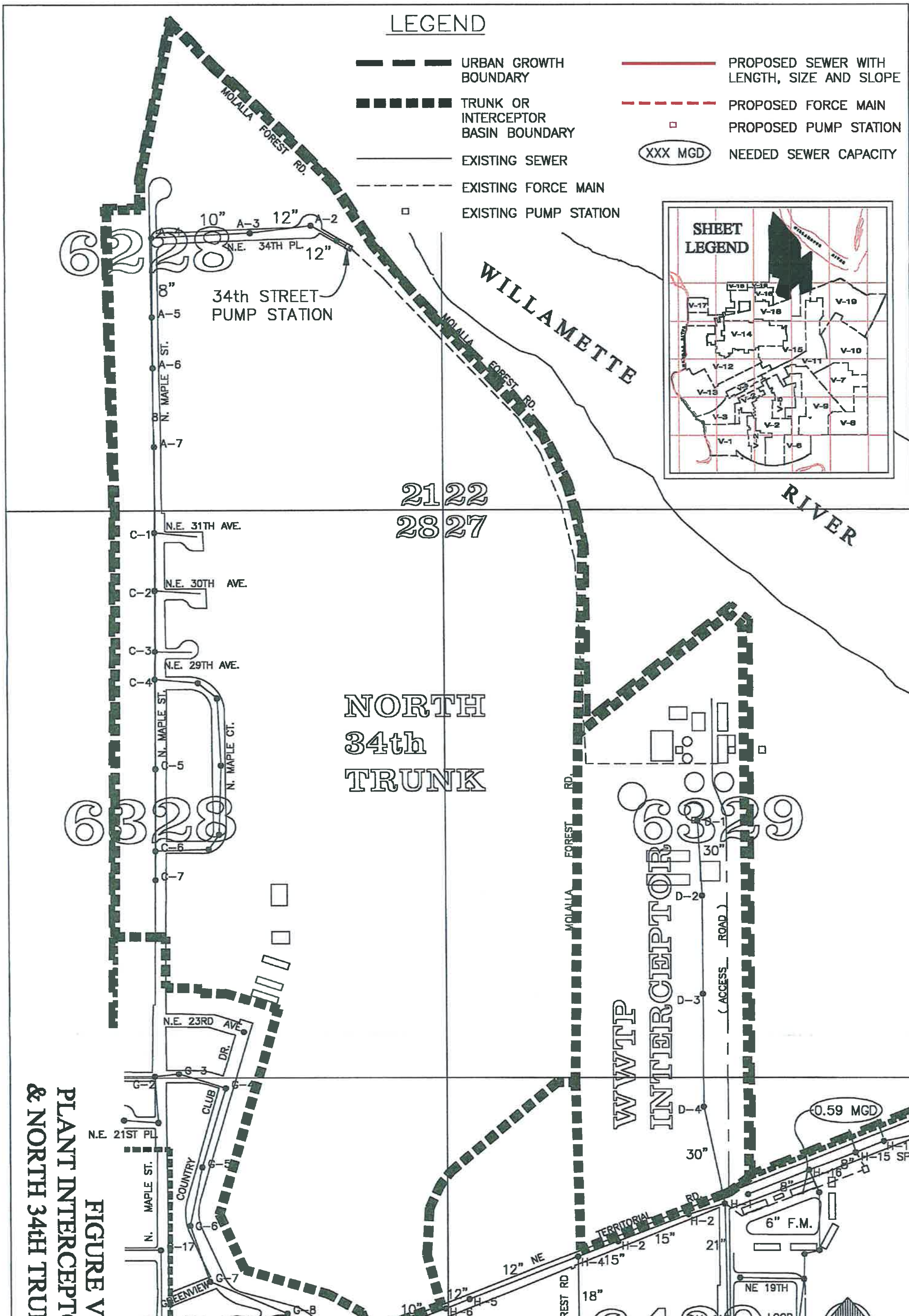

FIGURE V-20
PLANT INTERCEPTOR
& NORTH 34tH TRUNK

VI. IMPLEMENTATION AND FINANCING

Implementation

In the previous section, entitled Sewer System Master Plan, we describe the sewers, pump stations and force mains which will need to be built over the next 15 to 20 years. These facilities are shown in Figure A-3, Appendix A. The described sewers are all main or trunk sewers; no estimate of the need for lateral or branch sewers was made. As this component will be constructed as component of the private development.

Developers will install the majority of the proposed new sewers, while the City will likely oversee construction of the new pump stations and force mains. The City will also be required to compensate developers for the cost to oversize a sewer, as discussed below. Who actually constructs a sewer or pump station will depend on many political and economic questions and will be determined during the planning stage of each project.

Design standards are a useful tool in helping developers construct good quality sanitary sewers. The City has adopted construction standards which are attached in Appendix E. These standards are a component of the City's Public Street Improvement Design Manual and Standard Specifications.

Replacement facilities will be constructed by the City. We are recommending that the City replace approximately 3,100 feet of sewers in South 2nd Avenue. The engineering and construction costs to replace the recommended sewers are estimated to be $229,980. This figure is the sum of the actual total costs for the replacement sewers listed under South 2nd Trunk in Table B-4 in Appendix B.

Implementation Schedule

Only replacement of existing facilities can be scheduled. New facilities to expand the sewer system are dependent on where and when development occurs. The amount of development which will occur within Canby's UGB will vary considerably from area to area and from year to year. The City will need to constantly monitor the rate and patterns of growth to insure that the necessary improvements are implemented.

The proposed replacement of the existing South 2nd Trunk sewers is recommended as soon as possible. As shown in Table B-1, the sewers of concern are prone to surcharging with existing wastewater flows. New developments are being built today which will discharge wastewater into the South 2nd Trunk. Thus, the present day problems will get worse in the future and will, as more development occurs, become health risks with wastewater surcharging and possibly overflowing.

City Accounts

Sewer Reserve Fund

The City maintains a "Sewer Construction Reserve Fund" where monies from both user fees and system development charges (SDC) are accumulated for capital improvement projects.

Monthly User Fee

Revenues from the user fees can be used to pay for all costs associated with the system this includes the operation and maintenance of the wastewater treatment plant and collection system, as well as all of the capital expenses needed to replace, upgrade or expand the plant and collection system. Operation and maintenance costs include: salaries and benefits for treatment plant and Public Works Department personnel; power for plant and pump stations; chemicals; laboratory expenses to ensure proper operation of the treatment plant and compliance with the City's NPDES Waste Discharge Permit; vehicles including their gasoline and maintenance; communication expenses; educational expenses; and miscellaneous expenses. To pay for the capital expenses of replacing existing facilities, the user fee includes a factor for the depreciation of equipment and structures, including sewers. Like wise, the user fee includes a factor for the capital expenses which are expected to be required for ongoing operation the treatment plant.

Monthly user fees are based upon the type of service.

System Development Charges

System Development Charges (50L) are one time fees collected from all new connections to the system. These fees are dedicated to an adopted capital improvement plan and required to be expended only on these components. All SDC fees are related to the capital cost of providing capacity.

The SDC is comprised of two components, a reimbursement fee and an improvement fee. The reimbursement fee essentially reimburses the system for the cost of existing capacity, including financing costs. The improvement fee provides a mechanism to collect funds for future needed Capacity building.

The magnitude of the SDC is based on the cost of service. For reimbursement, all existing capacity is inventoried, the cost identified and then prorated according to the amount of capacity used for a new connection. Improvements are inventoried, costs estimated and the cost again prorated by the amount of capacity consumed by a new connection.

The magnitude of the SDC is based on the cost of service. For reimbursement, all existing capacity is inventoried, the cost identified and then prorated according to the amount of capacity used for a new connection. Improvements are inventoried, costs estimated and the cost again prorated by the amount of capacity consumed by a new connection.

A copy of the 1996 SDC Update is in Appendix D. It provides a detailed description of how monies from the SDCs can be spent.

Capital Improvement Costs

General

Table B-3 in Appendix B lists the cost estimates for capital improvements recommended by this Master Plan. These cost estimates are broken down into actual costs, replacement costs and oversize costs. The following subsections describe these three different costs.

Actual Costs

Actual costs are estimates of the costs to design and construct the proposed facilities. These estimates do not include interest or financing costs.

The average depth of excavation is assumed for each section of sewer and is shown in Table B-3. (Appendix B).The backfill for gravity sewers is assumed to be 50% selected backfill. Roadway repair is also estimated to be required 50% of the time. Manholes and house laterals to the property line are included in the 'per foot' cost of pipe installation. For each foot of sewer main, one foot of 4-inch PVC lateral pipe is assumed to be installed. A breakdown of the 'per foot' cost estimate for an 8-inch in diameter pipe is shown in the following Table VI-1.

TABLE VI-1
ESTIMATE FOR ONE FOOT OF 8-INCH SANITARY SEWER

Description	Units	Quantity	Unit Price	Costs
8" PVC Sewer	ft	1.0	$7.00	$7.00
Common Excavation	cys	1.1	$12.00	$13.00
Bedding & Select Backfill	cys	0.9	$12.00	$11.00
Native Backfill	cys	0.2	$5.00	$1.00
Roadway Repair	sys	0.4	$10.00	$4.00
Manhole	ea	1/300	$2,000.00	$7.00
Mobil., Permits, Ins., Bonds & Engineering			Lump Sum	$7.00
Total Estimated Costs				**$50.00**

Pump stations will have suction lift pumps located above the wet well, or employ submersible pumps located in the wet well. Dry wells are not assumed to be necessary. Force mains for the pump stations are assumed to be PVC with all necessary check valves, gate valves, air release valves and cleanouts.

The total actual costs are estimated to be $4,024,800, as shown at the end of Table B-3 (Appendix B). These costs do not include the cost of branch sewers; i.e., the sewers required to collect each lot of each development only trunk and interceptor sewers and pump stations with force mains were included as inventoried herein.

Replacement Costs

The replacement costs listed for each Trunk sewer in Table V1-2a are estimates of the costs to replace existing sewers with a like diameter sewer. The actual costs are estimates for the larger diameter sewers needed to accommodate future flows. The difference between the actual and replacement costs is the oversize cost component.

The replacement costs represent the cost of replacing a deficient section of existing sewer with a like diameter sewer. These costs will need to be funded through sources other than SDCs, since they are not directly related to future development.

Oversize Cost

Most new facilities will be paid for by developers. However, a developer should be required to only to pay for the sewers which will serve his development. Residential development will typically require an 8-inch diameter sewer. An 8-inch sewer, however, may not be large enough for additional developments which will be located upstream of the present development.

The City may, in those cases, require that the developer install a sewer larger than the 8-inch sewer. The larger sewer would be sized to handle all flows from future developments within the drainage basin. The oversizing cost, which is the cost difference between installing an 8-inch sewer and the larger diameter sewer, should be funded through the use of SDC monies to pay for the oversizing costs.

As shown in Table B-3, most of the proposed new sewers do not require more than an 8-inch diameter sewer. Those that do are summarized in the Table VI-2.

Also, listed as an oversize cost in Table VI-2 are the proposed new pump stations and their force mains. All of the these stations are for future development, including the largest portion of the Third & Baker Pump Station. The stations are expected to serve more than one development. Thus, the cost of the station and its force main are included in the calculation of the improvement fee.

TABLE VI-2
OVERSIZE COMPONENT PROPOSED TRUNK SEWERS

Trunk and Item Description	Size (in)	Actual Costs	Replacement Costs	Oversize Costs
South 2nd Trunk				
Replace sewer from MH R-26 to O-39	10	$123,040	$107,660	$15,380
Replace sewer from MH O-39 to O-33	12	93,060	67,680	25,380
Replace sewer from MH O-33 to O-20	15	54,900	43,920	10,980
Replace sewer from MH O-20 to O-15	18	13,400	10,720	2,680
South 4th Trunk				
New sewer east from MH P-22	10	93,000		19,500
Mulino Road Pump Station				
Mulino Road P.S. Force Main	6	61,600		61,600
Mulino Road Pump Station		160,000		160,000
South Redwood Trunk				
New sewer east from MH T-14	12	14,800		5,000
	10	62,000		13,000
Redwood Pump Station				
New sewer east from Redwood P.S.	10	93,000		19,500
Redwood Pump Station		160,000		160,000
Redwood P.S. Force Main	6	19,600		19,600
Redwood Interceptor				
New sewer east from MH L-6	12	59,200		16,000
North 3rd Trunk				
Relocate Third & Baker Pump Station		70,000		70,000
Third & Baker P.S. Force Main	4	14,400		14,400
North 22nd Pump Station				
North 22nd Pump Station		130,000		130,000
North 22nd Force Main	3	28,000		28,000
North Birch Pump Station				
North Birch Pump Station		130,000		130,000
North Birch Force Main	4	33,600		33,600
Territorial Interceptor				
New sewer west from MH F-1	10	198,400		41,600
Willow Creek Interceptor				
New sewer east form MH H-17	10	49,600		10,400
Jack and bore new sewer under Southern Pacific Railroad and High way 99E	10	60,000		15,000
Expand Will Creek Pump Station		100,000		100,000
Replace Willow Creek P.S. Force Main	6	18,200		18,200
TOTAL		$1,839,800.00	$229,980	$1,119,820

APPENDIX A

Figure A-1: Existing Sanitary Sewer

Figure A-2: Zoning & Land Use Map

Figure A-3: Proposed Sanitary Sewer Map

APPENDIX B

Sewer Capacities and Cost Estimates

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
Elm Trunk											
Village of the Lochs Pump Station - 2 pumps ea. @ 200 gpm								0.28800			
U-5	162.31	U-4	162.10	37	0.0057	8	0.59	0.28800	0.29	0.30	
U-4	162.10	U-3	161.37	112	0.0065	8	0.63	0.00510	0.29	0.33	
U-3	161.37	U-2	160.18	250	0.0048	8	0.54	0.01275	0.31	0.23	
U-2	160.18	U-1	157.70	321	0.0077	8	0.68	0.01275	0.32	0.36	
U-1	157.70	R-18	156.28	261	0.0054	8	0.57	0.01275	0.33	0.24	0
R-18	155.78	R-19	154.64	488	0.0023	8	0.37	0.06673	0.40	-0.03	6
R-19	154.64	R-20	153.60	400	0.0026	8	0.40	0.04445	0.44	-0.05	4
R-20	153.60	R-21	152.31	115	0.0112	8	0.82	0.00000	0.44	0.38	
R-21	152.31	R-22	149.57	302	0.0091	8	0.74	0.00505	0.45	0.29	0
R-22	149.57	R-23	148.64	337	0.0028	8	0.41	0.00505	0.45	-0.04	4
R-23	148.64	R-24	147.43	310	0.0039	8	0.48	0.00383	0.46	0.03	1
R-24	147.43	R-25	145.77	491	0.0034	8	0.45	0.00383	0.46	-0.01	2
R-25	145.77	R-26	144.75	200	0.0051	8	0.55	0.00000	0.46	0.09	
Fir Trunk											
R-16	161.15	R-15	160.34	260	0.0031	8	0.43	0.03869	0.04	0.39	
R-15	160.54	R-14	159.47	250	0.0043	8	0.51	0.00919	0.05	0.46	
R-14	159.47	R-13	158.72	249	0.0030	8	0.43	0.00919	0.06	0.37	
R-13	158.72	R-12	157.29	403	0.0035	8	0.46	0.00919	0.07	0.39	
R-12	157.29	R-11	157.03	98	0.0027	8	0.40	0.01530	0.08	0.32	
R-11	157.03	R-10	155.63	329	0.0043	8	0.51	0.00919	0.09	0.42	
R-10	155.63	R-9	154.02	298	0.0054	8	0.57	0.00919	0.10	0.47	
R-9	154.02	R-8	153.08	246	0.0038	8	0.48	0.00919	0.11	0.37	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
R-8	153.08	R-7	152.91	35	0.0049	8	0.54	0.00000	0.11	0.43	
R-7	152.91	R-6	151.76	290	0.0040	8	0.49	0.00919	0.12	0.37	
R-6	151.76	R-5	150.84	207	0.0044	8	0.51	0.00919	0.13	0.39	
R-5	150.84	R-4	150.48	54	0.0067	8	0.64	0.00000	0.13	0.51	
R-4	150.48	R-3	150.36	28	0.0043	8	0.51	0.00000	0.13	0.38	
R-3	150.36	R-2	149.06	249	0.0052	8	0.56	0.01827	0.15	0.41	
R-2	149.06	R-1	147.28	458	0.0039	8	0.48	0.01827	0.16	0.32	
R-1	147.28	N-2	145.91	329	0.0042	8	0.50	0.01874	0.18	0.32	
N-2	145.91	N-1	145.56	114	0.0031	8	0.43	0.01827	0.20	0.23	
N-1	145.56	O-40	143.80	436	0.0040	8	0.49	0.01860	0.22	0.27	
O-40	143.40	O-39	140.76	234	0.0113	8	0.83	0.00549	0.23	0.60	
Ivy Trunk											
S-19	163.26	S-18	160.04	428	0.0075	8	0.67	0.03150	0.03	0.64	
S-18	160.04	S-17	158.90	422	0.0027	8	0.40	0.00000	0.03	0.37	
S-17	158.90	S-16	157.79	316	0.0035	8	0.46	0.00000	0.03	0.43	
S-16	157.74	S-15	156.49	307	0.0041	8	0.50	0.08270	0.11	0.38	
S-15	156.39	S-14	156.24	52	0.0029	8	0.42	0.01785	0.13	0.29	
S-14	156.24	S-13	154.62	342	0.0047	8	0.53	0.00276	0.13	0.40	
S-13	154.62	S-12	154.46	58	0.0028	8	0.41	0.01785	0.15	0.26	
S-12	154.46	S-11	154.01	136	0.0033	8	0.45	0.00000	0.15	0.29	
S-11	153.91	S-10	153.05	265	0.0032	8	0.44	0.01785	0.17	0.27	
S-10	150.70	S-3	149.41	362	0.0036	8	0.47	0.01785	0.19	0.28	
S-3	149.41	S-4	146.90	311	0.0081	8	0.70	0.00255	0.19	0.51	
S-4	146.90	S-2	144.98	311	0.0062	8	0.61	0.02895	0.22	0.39	
S-2	144.78	O-29	143.74	268	0.0039	8	0.48	0.02245	0.24	0.24	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
O-29	143.59	O-30	142.46	248	0.0046	8	0.53	0.01461	0.26	0.27	
O-30	142.41	O-31	140.89	322	0.0047	8	0.53	0.01461	0.27	0.26	
O-31	140.89	O-32	140.92	35	-0.0009	8	N/A	0.01461	0.29	N/A	1
O-32	140.92	O-33	138.94	350	0.0057	8	0.59	0.01461	0.30	0.29	
South 2nd Trunk											
Q-3	144.80	Q-2	143.45	392	0.0034	8	0.45	0.02504	0.03	0.43	
Q-2	143.45	Q-1	141.50	323	0.0060	8	0.60	0.03854	0.06	0.54	
Q-1	141.50	R-35	139.25	342	0.0066	8	0.63	0.03394	0.10	0.53	
Shopping Center Pump Station - 2 pumps ea. @ 55 gpm								0.07920			
R-35	151.25	R-34	150.99	227	0.0011	8	0.26	0.00688	0.09	0.17	
R-34	150.99	R-33	149.88	298	0.0037	8	0.47	0.00688	0.09	0.38	
R-33	149.88	R-32	148.83	219	0.0048	8	0.54	0.00638	0.10	0.44	
R-32	148.83	R-31	148.37	210	0.0022	8	0.36	0.00638	0.11	0.26	
R-31	148.37	R-30	147.47	333	0.0027	8	0.40	0.01240	0.12	0.29	
R-30	147.47	R-29	147.09	123	0.0031	8	0.43	0.01240	0.13	0.30	0
R-29	147.09	R-28	146.78	153	0.0020	8	0.35	0.01240	0.14	0.20	4
R-28	146.63	R-27	145.57	429	0.0025	8	0.39	0.00742	0.15	0.24	7
R-27	145.57	R-26	144.45	444	0.0025	8	0.39	0.00742	0.16	0.23	18
Elm Trunk Sewer enters mh R-26 - see Note 1 below								0.31628			
R-26	144.45	N-4	142.58	365	0.0051	8	0.55	0.01078	0.48	0.07	29
N-4	142.58	N-5	142.69	400	-0.0003	8	N/A	0.01078	0.50	N/A	39
N-5	142.69	N-6	141.66	365	0.0028	8	0.41	0.01078	0.51	-0.10	23
N-6	141.66	O-39	140.61	408	0.0026	8	0.40	0.01078	0.52	-0.12	22
Fir Trunk Sewer enters mh O-39								0.22515			
O-39	140.41	O-38	140.06	182	0.0019	10	0.61	0.00210	0.74	-0.13	19

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
O-38	140.06	O-37	139.35	380	0.0019	10	0.61	0.00210	0.75	-0.13	18
O-37	139.35	O-33	138.94	281	0.0015	10	0.55	0.01485	0.76	-0.22	17
Ivy Trunk Sewer enters mh O-33								0.30075			
O-33	138.84	O-34	138.79	149	0.0003	10	0.24	0.00000	1.06	-0.82	14
O-34	138.69	O-35	138.36	221	0.0015	10	0.55	0.00070	1.06	-0.52	7
99E Trunk											
N-23	146.23	N-24	145.37	394	0.0022	8	0.36	0.01603	0.02	0.35	
N-24	145.37	N-25	144.26	376	0.0030	8	0.43	0.00448	0.02	0.40	
N-25	144.26	N-26	143.77	182	0.0027	8	0.40	0.00343	0.02	0.38	
N-26	143.77	N-27	143.47	182	0.0016	8	0.31	0.00343	0.03	0.28	
N-27	143.47	O-43	142.55	400	0.0023	8	0.37	0.00343	0.03	0.34	
O-43	142.55	O-36	141.53	379	0.0027	8	0.40	0.00366	0.03	0.37	
O-36	141.53	O-35	138.21	347	0.0096	8	0.76	0.00366	0.04	0.72	
Locust Trunk											
S-9	151.09	S-8	150.11	265	0.0037	8	0.47	0.08570	0.09	0.39	
S-8	149.71	S-7	149.00	229	0.0031	8	0.43	0.01650	0.10	0.33	
S-7	148.90	S-6	148.24	147	0.0045	8	0.52	0.04511	0.15	0.37	
S-6	147.94	S-5	147.05	293	0.0030	8	0.43	0.00510	0.15	0.27	
S-5	146.85	O-26	146.73	21	0.0057	8	0.59	0.00000	0.15	0.43	
O-26	146.63	O-25	145.02	396	0.0041	8	0.50	0.02050	0.17	0.32	
O-25	144.42	O-24	142.92	14	0.1071	8	2.54	0.00000	0.17	2.37	
O-24	142.92	O-23	142.29	116	0.0054	8	0.57	0.02005	0.19	0.38	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
O-23	142.29	O-22	140.99	428	0.0030	8	0.43	0.18249	0.38	0.05	
O-22	140.99	O-21	139.81	371	0.0032	8	0.44	0.02050	0.40	0.04	
O-21	139.81	O-20	139.06	150	0.0050	8	0.55	0.02050	0.42	0.13	
O-20	139.06	O-16	137.97	134	0.0081	8	0.70	0.02050	0.44	0.26	
O-16	137.97	O-18	137.36	93	0.0066	8	0.63	0.00000	0.44	0.19	
South Pine Trunk											
W-7	172.57	W-6	171.85	180	0.0040	8	0.49	0.00540	0.01	0.49	
W-6	171.65	W-5	170.55	274	0.0040	8	0.49	0.00460	0.01	0.48	
W-5	170.45	W-4	169.85	150	0.0040	8	0.49	0.01910	0.03	0.46	
W-4	169.75	W-3	169.15	150	0.0040	8	0.49	0.02380	0.05	0.44	
W-3	169.05	W-2	167.95	274	0.0040	8	0.49	0.02200	0.07	0.42	
W-2	167.75	W-1	166.96	198	0.0040	8	0.49	0.00260	0.08	0.41	
W-1	166.76	T-12	166.03	370	0.0020	12	1.02	0.01660	0.09	0.93	
T-12	163.83	T-11	162.92	404	0.0023	12	1.10	0.03655	0.13	0.97	
T-11	162.92	T-10	161.85	440	0.0024	12	1.12	0.01490	0.15	0.98	
T-10	161.85	T-9	160.08	441	0.0040	12	1.45	0.01490	0.16	1.29	
T-9	160.08	T-8	159.17	241	0.0038	8	0.48	0.01443	0.17	0.30	
T-8	159.17	T-7	157.93	247	0.0050	8	0.55	0.01443	0.19	0.36	
T-7	157.93	T-6	157.29	117	0.0055	8	0.58	0.01443	0.20	0.37	
T-6	157.29	T-5	156.68	143	0.0043	8	0.51	0.00718	0.21	0.30	
T-5	156.68	T-2	153.91	428	0.0065	8	0.63	0.00718	0.22	0.41	
T-2	153.91	T-1	153.25	194	0.0034	8	0.45	0.01691	0.24	0.22	
T-1	153.25	P-16	147.25	18	0.0034	8	0.45	0.00000	0.24	0.22	
P-16	147.25	P-15	145.15	319	0.0066	12	1.86	0.01691	0.25	1.61	
P-15	145.15	P-14	144.07	161	0.0067	12	1.87	0.01691	0.27	1.60	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
P-14	144.07	P-13	142.38	357	0.0047	12	1.57	0.01691	0.29	1.28	
P-13	142.38	P-12	141.96	98	0.0043	12	1.50	0.00545	0.29	1.21	
P-12	141.96	P-11	140.59	51	0.0269	12	3.75	0.00000	0.29	3.46	
P-11	140.59	O-7	134.15	628	0.0103	12	2.32	0.09570	0.39	1.94	
South 4th Trunk											
P-22	147.53	P-21	147.03	230	0.0022	12	1.07	0.04000	0.04	1.03	
P-21	146.93	P-20	146.31	281	0.0022	12	1.07	0.00000	0.04	1.03	
P-20	146.21	P-19	146.05	72	0.0022	12	1.07	0.00000	0.04	1.03	
P-19	145.95	P-18	144.95	410	0.0024	12	1.12	0.03938	0.08	1.04	
P-18	144.85	P-6	143.75	100	0.0110	12	2.40	0.00000	0.08	2.32	
South Redwood Trunk											
T-14	167.44	T-15	166.27	411	0.0028	12	1.21	0.01785	0.02	1.19	
T-15	166.27	T-16	164.81	250	0.0058	12	1.74	0.01785	0.04	1.71	
T-16	164.81	T-17	162.95	248	0.0075	12	1.98	0.00893	0.04	1.94	
T-17	162.95	T-18	160.02	223	0.0131	12	2.62	0.01785	0.06	2.56	
T-18	160.02	T-19	159.01	122	0.0083	12	2.09	0.01530	0.08	2.01	
T-19	159.01	T-20	158.69	110	0.0029	12	1.23	0.00000	0.08	1.15	
T-20	158.09	T-21	157.70	126	0.0031	12	1.27	0.01785	0.10	1.18	
T-21	157.70	T-22	156.89	294	0.0028	12	1.21	0.00789	0.10	1.11	
T-22	156.89	T-23	155.86	272	0.0038	12	1.41	0.00789	0.11	1.30	
T-23	155.86	T-24	155.20	191	0.0035	12	1.35	0.00789	0.12	1.23	
T-24	155.20	T-25	154.29	262	0.0035	12	1.35	0.00789	0.13	1.23	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
T-25	154.29	T-26	153.45	240	0.0035	12	1.35	0.00789	0.14	1.22	
T-26	153.45	P-9	151.00	128	0.0191	12	3.16	0.02771	0.16	3.00	
P-9	151.00	P-8	148.78	158	0.0141	12	2.72	0.02771	0.19	2.53	
P-8	148.78	P-7	144.55	421	0.0100	12	2.29	0.01459	0.21	2.08	
P-7	144.55	P-6	143.75	88	0.0091	12	2.18	0.00000	0.21	1.98	
South 4th Trunk Sewer enters mh P-6								0.07938			
P-6	143.75	P-5	142.31	118	0.0122	12	2.53	0.01459	0.30	2.23	
P-5	142.31	P-4	137.98	421	0.0103	12	2.32	0.01459	0.31	2.01	
P-4	137.98	P-3	136.59	418	0.0033	12	1.31	0.02771	0.34	0.97	
P-3	136.59	P-2	135.49	143	0.0077	12	2.01	0.00000	0.34	1.67	
P-2	135.49	O-7	134.15	407	0.0033	12	1.31	0.01335	0.35	0.96	
South Pine Trunk Sewer enters mh O-7								0.38688			
O-7	134.15	O-6	133.31	364	0.0023	15	1.99	0.00731	0.75	1.24	
O-6	133.31	O-5	132.97	116	0.0029	15	2.23	0.00492	0.75	1.48	
O-5	132.97	O-4	132.10	277	0.0031	15	2.31	0.00354	0.76	1.55	
O-4	132.10	O-3	131.38	255	0.0028	15	2.20	0.01617	0.77	1.42	
O-3	131.38	O-2	130.99	111	0.0035	15	2.46	0.00000	0.77	1.68	

Redwood Interceptor

99E Trunk Sewer enters mh O-35								0.03812			
South 2nd Trunk Sewer enters mh O-35								1.06281			
O-35	138.21	O-19	136.94	361	0.0035	12	1.35	0.00509	1.11	0.25	
O-19	136.94	O-18	136.76	46	0.0039	12	1.43	0.00000	1.11	0.32	
Locust Trunk Sewer enters mh O-18								0.43695			
O-18	136.56	O-17	136.32	9	0.0267	18	11.03	0.00000	1.54	9.48	
O-17	136.32	O-15	136.02	98	0.0031	18	3.76	0.00000	1.54	2.21	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
O-15	135.92	O-14	135.27	320	0.0020	18	3.02	0.00922	1.55	1.47	
O-14	135.27	O-13	134.57	244	0.0029	18	3.63	0.00922	1.56	2.07	
O-13	134.57	O-12	133.37	470	0.0026	18	3.44	0.01424	1.58	1.87	
O-12	133.37	O-11	133.15	53	0.0042	18	4.37	0.00000	1.58	2.80	
O-11	133.15	O-10	132.82	142	0.0023	18	3.24	0.00712	1.58	1.65	
O-10	132.82	O-9	132.32	40	0.0125	18	7.54	0.00000	1.58	5.96	
O-9	132.32	O-8	131.83	125	0.0039	18	4.21	0.00140	1.58	2.63	
O-8	131.83	O-2	130.99	409	0.0021	18	3.09	0.00140	1.59	1.51	
South Redwood Trunk Sewer enters mh O-2								0.77353			
O-2	130.99	O-1	130.97	29	0.0007	18	1.79	0.00000	2.36	-0.57	1
O-1	130.97	L-23	128.67	561	0.0041	18	4.32	0.01761	2.38	1.94	
L-23	128.67	L-7	127.63	508	0.0020	18	3.02	0.00000	2.38	0.64	
L-7	127.63	L-24	126.93	327	0.0021	18	3.09	0.00660	2.38	0.71	
L-24	126.93	L-6	125.45	334	0.0044	18	4.48	0.00383	2.39	2.09	
L-6	125.45	L-5	122.91	357	0.0071	18	5.69	0.00938	2.40	3.29	
L-5	122.91	L-4	119.77	434	0.0072	18	5.73	0.01141	2.41	3.32	
L-4	119.77	L-3	116.78	430	0.0070	18	5.65	0.03704	2.44	3.20	
L-3	116.78	L-2	114.68	285	0.0074	18	5.81	0.03704	2.48	3.32	
L-2	114.68	L-1	113.55	145	0.0078	18	5.96	0.03704	2.52	3.44	
L-1	113.55	H-13	100.86	501	0.0253	15	6.60	0.03704	2.56	4.04	
H-13	100.86	H-12	89.27	448	0.0259	15	6.68	0.03704	2.59	4.09	
H-12	89.27	H-11	86.47	951	0.0029	21	5.48	0.07407	2.67	2.81	
H-11	86.47	H-1	85.09	510	0.0027	21	5.29	0.00000	2.67	2.62	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
Knight's Bridge Trunk											
I-1	150.14	I-2	149.23	281	0.0032	8	0.44	0.08100	0.08	0.36	
I-2	149.13	I-3	148.60	149	0.0036	8	0.47	0.01275	0.09	0.37	
I-3	148.60	I-4	147.58	375	0.0027	8	0.40	0.00714	0.10	0.30	
I-4	147.58	I-5	146.36	331	0.0037	8	0.47	0.02040	0.12	0.35	
I-5	146.36	I-6	144.69	165	0.0101	8	0.78	0.17927	0.30	0.48	
Knight's Bridge Pump Station - 2 pumps ea. @ 150 gpm								0.21600			
I-7	152.91	I-8	152.02	240	0.0037	8	0.47	0.02485	0.24	0.23	
I-8	152.02	J-2	149.01	499	0.0060	8	0.60	0.00381	0.24	0.36	
J-2	149.01	J-3	148.20	231	0.0035	8	0.46	0.00383	0.25	0.21	
J-3	148.05	J-4	146.92	229	0.0049	8	0.54	0.00255	0.25	0.29	
J-4	146.92	J-5	143.96	499	0.0059	8	0.60	0.00893	0.26	0.34	
J-5	144.74	J-6	142.86	298	0.0063	8	0.62	0.01020	0.27	0.35	0
J-6	142.86	N-12	142.94	330	-0.0002	8	N/A	0.05472	0.32	N/A	17
N-12	143.44	N-11	141.76	352	0.0048	8	0.54	0.01505	0.34	0.20	9
N-11	141.76	N-10	141.21	145	0.0038	8	0.48	0.02295	0.36	0.12	21
N-10	141.21	N-9	140.72	185	0.0026	8	0.40	0.02751	0.39	0.01	23
N-9	140.72	N-8	139.62	329	0.0033	8	0.45	0.02626	0.42	0.03	23
N-8	139.62	N-7	138.25	407	0.0034	8	0.45	0.11642	0.53	-0.08	24
N-7	138.25	O-51	137.28	350	0.0028	8	0.41	0.00182	0.53	-0.12	17
O-51	137.28	O-50	136.34	317	0.0030	8	0.43	0.00800	0.54	-0.12	8
O-50	136.14	O-47	134.21	196	0.0098	8	0.77	0.00677	0.55	0.22	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
North 3rd Trunk											
Third & Baker Pump Station - 2 pumps ea. @ an estimated 100 gpm								0.14400			
M-3	151.12	M-2	149.09	393	0.0052	8	0.56	0.18847	0.19	0.37	
M-2	149.09	M-1	148.22	429	0.0020	8	0.35	0.00000	0.19	0.16	
M-1	148.22	N-22	147.17	345	0.0030	8	0.43	0.00000	0.19	0.24	
N-22	147.17	N-21	147.08	99	0.0009	8	0.23	0.00000	0.19	0.04	
N-21	147.08	N-20	145.06	376	0.0054	8	0.57	0.00560	0.19	0.38	
N-20	145.06	N-19	143.49	380	0.0041	8	0.50	0.00506	0.20	0.30	
N-19	143.49	N-18	142.07	384	0.0037	8	0.47	0.00506	0.20	0.27	
N-18	142.07	N-17	141.07	381	0.0026	8	0.40	0.02056	0.22	0.17	
N-17	141.07	N-16	140.03	385	0.0027	8	0.40	0.00506	0.23	0.17	
N-16	140.03	N-15	139.16	346	0.0025	8	0.39	0.00506	0.23	0.15	
N-15	139.16	N-14	137.96	403	0.0030	8	0.43	0.01332	0.25	0.18	
N-14	137.96	O-49	137.75	108	0.0019	8	0.34	0.00602	0.25	0.08	
O-49	137.75	O-47	136.32	499	0.0029	8	0.42	0.00506	0.26	0.16	
O-47	135.42	O-46	135.09	133	0.0025	15	2.07	0.02529	0.28	1.79	
O-46	135.09	O-45	133.66	67	0.0213	15	6.06	0.00000	0.28	5.77	
Molalla Interceptor											
Knight's Bridge Trunk Sewer enters mh O-45								0.54967			
North 3rd Trunk Sewer enters mh O-45								0.28456			
O-45	133.66	O-44	133.88	435	-0.0005	18	N/A	0.01260	0.85	N/A	4
O-44	133.88	K-6	133.27	440	0.0014	18	2.52	0.05635	0.90	1.62	
K-6	133.27	K-5	132.73	286	0.0019	18	2.94	0.00630	0.91	2.03	
K-5	132.73	K-4	132.03	378	0.0019	18	2.94	0.00630	0.92	2.03	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer			Wastewater	Cumulative	Remaining	Approx. - Surcharge
Upstream		Downstream		Length	Slope	Size	Capacity	Flow	Flows	Capacities	Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
K-4	132.03	K-3	126.28	614	0.0094	18	6.54	0.00630	0.92	5.62	
K-3	126.28	K-2	125.84	194	0.0023	18	3.24	0.00630	0.93	2.31	
K-2	125.84	K-1	124.69	307	0.0037	18	4.10	0.00630	0.93	3.17	
North 10th Trunk enters mh K-1								0.50324			
K-1	123.74	L-18	122.77	394	0.0025	18	3.37	0.00561	1.44	1.93	
L-18	122.77	L-17	122.23	213	0.0025	18	3.37	0.12562	1.57	1.81	
L-17	122.23	l-16	122.04	140	0.0014	18	2.52	0.01046	1.58	0.95	1
l-16	122.24	L-13	121.28	211	0.0045	18	4.53	0.00434	1.58	2.94	
L-13	121.28	L-12	117.06	278	0.0152	18	8.32	0.06962	1.65	6.67	
L-12	117.06	L-11	115.09	345	0.0057	18	5.09	0.00700	1.66	3.43	
L-11	115.09	L-10	112.91	385	0.0057	18	5.09	0.03988	1.70	3.39	
L-10	112.91	L-9	112.55	59	0.0061	18	5.27	0.01224	1.71	3.56	
L-9	112.55	L-8	111.59	179	0.0054	18	4.96	0.01132	1.72	3.23	
L-8	111.59	H-10	109.76	362	0.0051	18	4.82	0.01132	1.74	3.08	
H-10	109.76	H-9	107.72	79	0.0258	18	10.84	0.00000	1.74	9.10	
H-9	107.72	H-8	106.49	579	0.0021	18	3.09	0.01132	1.75	1.35	1
H-8	106.49	H-7	105.61	450	0.0020	18	3.02	0.01132	1.76	1.26	
H-7	105.61	H-4	104.57	461	0.0023	18	3.24	0.00000	1.76	1.48	
Territorial Interceptor Sewer enters mh H-4								0.52535			
H-4	104.57	H-3	100.42	201	0.0206	15	5.96	0.00433	2.29	3.67	
H-3	100.42	H-2	87.47	351	0.0369	15	7.97	0.00443	2.29	5.68	
H-2	87.47	H-1	85.54	195	0.0099	15	4.13	0.00443	2.30	1.83	
North 20th Trunk											
G-18	129.47	G-17	126.23	445	0.0073	10	1.20	0.02848	0.03	1.17	
G-17	126.23	G-16	123.44	350	0.0080	10	1.26	0.00765	0.04	1.22	
G-16	123.44	G-11	120.56	417	0.0069	10	1.17	0.00765	0.04	1.13	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
North 22nd Trunk											
G-1	129.26	G-2	128.02	300	0.0041	8	0.50	0.00672	0.01	0.49	
G-2	128.02	G-4	126.60	342	0.0042	8	0.50	0.00672	0.01	0.49	
G-4	126.60	G-5	125.06	377	0.0041	8	0.50	0.02017	0.03	0.46	
G-5	125.06	G-6	123.78	284	0.0045	8	0.52	0.00672	0.04	0.48	
G-6	123.78	G-7	122.51	278	0.0046	8	0.53	0.00672	0.05	0.48	
G-7	122.51	G-8	120.85	388	0.0043	8	0.51	0.01345	0.06	0.45	
G-8	120.85	G-9	119.46	243	0.0057	8	0.59	0.01345	0.07	0.51	
Territorial Road Interceptor											
F-1	128.78	G-15	127.36	353	0.0040	10	0.89	0.02810	0.03	0.86	
G-15	127.36	G-14	125.85	423	0.0036	10	0.84	0.01061	0.04	0.81	
G-14	125.85	G-13	125.37	99	0.0048	10	0.98	0.00000	0.04	0.94	
G-13	125.37	G-12	123.85	380	0.0040	10	0.89	0.02848	0.07	0.82	
G-12	123.85	G-11	120.56	463	0.0071	10	1.19	0.01989	0.09	1.10	
North 20th Trunk Sewer enters mh G-11								0.04378			
G-11	120.56	G-10	119.28	295	0.0043	10	0.92	0.14896	0.28	0.64	
G-10	119.28	G-9	116.96	497	0.0047	10	0.96	0.01253	0.29	0.67	
North 22nd Trunk Sewer enters mh G-9								0.07395			
G-9	116.96	H-6	110.27	606	0.0110	10	1.48	0.04579	0.41	1.06	
H-6	110.27	H-5	109.14	120	0.0094	12	2.22	0.05663	0.47	1.75	
H-5	109.14	H-4	104.57	540	0.0085	12	2.11	0.05663	0.53	1.58	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
Willow Creek Interceptor											
H-14	74.15	H-15	73.16	351	0.0028	8	0.41	0.11441	0.11	0.30	
Willow Creek Pump Station - 2 pumps ea. @ 155 gpm								0.22320			
W.C.P.S.		H-1	86.49			4 F.M.	0.89		0.22		
Plant Interceptor											
Molalla Interceptor enters mh H-1								2.29651			
Redwood Interceptor enters mh H-1								2.66720			
Willow Creek Force Main enters mh H-1								0.22320			
H-1	84.64	D-4	83.91	4[illegible]1	0.0016	30	10.54	0.02984	5.22	5.32	
D-4	83.91	D-3	83.12	529	0.0015	30	10.21	0.02984	5.25	4.96	
D-3	83.12	D-2	82.44	452	0.0015	30	10.21	0.02984	5.28	4.93	
D-2	82.44	D-1	81.86	347	0.0017	30	10.86	0.02984	5.31	5.56	
North 34th Trunk											
C-7	120.89	C-6	120.25	134	0.0048	8	0.54	0.02805	0.03	0.51	
C-6	120.25	C-5	118.39	379	0.0049	8	0.54	0.01055	0.04	0.50	
C-5	118.39	C-4	116.21	415	0.0053	8	0.57	0.01055	0.05	0.52	
C-4	116.21	C-3	114.93	130	0.0098	8	0.77	0.01055	0.06	0.71	
C-3	114.93	C-2	109.64	285	0.0186	8	1.06	0.01055	0.07	0.99	
C-2	109.64	C-1	104.74	2690	0.0018	8	0.33	0.01055	0.08	0.25	
C-1	104.74	A-7	95.70	398	0.0227	8	1.17	0.01055	0.09	1.08	

TABLE B-1

EXISTING SEWERS CAPACITIES
EXISTING WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
A-7	95.70	A-6	87.23	364	0.0232	8	1.18	0.01055	0.10	1.08	
A-6	87.23	A-5	86.12	236	0.0047	8	0.53	0.01055	0.11	0.42	
A-5	86.12	A-4	83.54	414	0.0062	8	0.61	0.01055	0.12	0.49	
A-4	83.54	A-3	80.52	451	0.0067	10	1.15	0.01696	0.14	1.01	
A-3	80.52	A-2	79.28	297	0.0042	12	1.48	0.01696	0.16	1.33	
A-2	79.28	A-1	N.A.	215	0.3691	12	13.91	0.00000	0.16	13.75	
34th Street Pump Station - 2 pumps ea. @ 155 gpm								0.22320			

Treatment Plan Influent Pump Station

Plant Interceptor Sewer enters station	5.45944
34th Street Pump station enters station	0.15695
WWTP Sewers enter station	
Peak Influent Flow into Plant =	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer			Wastewater	Cumulative	Remaining	Approx. Surcharge
Upstream		Downstream		Length	Slope	Size	Capacity	Flow	Flows	Capacities	Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
Elm Trunk											
Village of the Lochs Pump Station - 2 pumps ea. @ 200 gpm								0.28800			
Extend sewer east from manhole U-5								**0.03400**			
Extend Village of the Lochs sewer								**0.01271**			
U-5	162.31	U-4	162.1	37	0.0057	8	0.59	0.28800	0.32	0.26	
U-4	162.1	U-3	161.37	112	0.0065	8	0.63	0.00510	0.33	0.30	
U-3	161.37	U-2	160.18	250	0.0048	8	0.54	0.01275	0.34	0.20	
U-2	160.18	U-1	157.7	321	0.0077	8	0.68	0.01275	0.35	0.33	0
U-1	157.7	R-18	156.28	261	0.0054	8	0.57	0.01275	0.37	0.21	9
Extend sewer north as shwon on Figure 3								0.04900			
R-18	155.78	R-19	154.64	488	0.0023	8	0.37	0.06673	0.48	-0.11	19
R-19	154.64	R-20	153.6	400	0.0026	8	0.40	0.04445	0.53	-0.13	10
R-20	153.6	R-21	152.31	115	0.0112	8	0.82	0.00000	0.53	0.30	0
R-21	152.31	R-22	149.57	302	0.0091	8	0.74	0.00505	0.53	0.21	7
R-22	149.57	R-23	148.64	337	0.0028	8	0.41	0.00505	0.54	-0.12	22
R-23	148.64	R-24	147.43	310	0.0039	8	0.48	0.00383	0.54	-0.05	13
R-24	147.43	R-25	145.77	491	0.0034	8	0.45	0.00383	0.54	-0.09	9
R-25	145.77	R-26	144.75	200	0.0051	8	0.55	0.00000	0.54	0.01	
Fir Trunk											
Extend sewer south from manhole R-16								**0.14500**			
R-16	161.15	R-15	160.34	260	0.0031	8	0.43	0.03869	0.18	0.25	
R-15	160.54	R-14	159.47	250	0.0043	8	0.51	0.00919	0.19	0.32	
R-14	159.47	R-13	158.72	249	0.0030	8	0.43	0.00919	0.20	0.22	
R-13	158.72	R-12	157.29	403	0.0035	8	0.46	0.00919	0.21	0.25	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						
Upstream		Downstream						Wastewater	Cumulative	Remaining	Approx. Surcharge
MH. No.	Elev.	MH. No.	Elev.	Length (ft)	Slope (ft/ft)	Size (in)	Capacity (mgd)	Flow (mgd)	Flows (mgd)	Capacities (mgd)	Depth (in)
R-12	157.29	R-11	157.03	98	0.0027	8	0.40	0.01530	0.23	0.18	
R-11	157.03	R-10	155.63	329	0.0043	8	0.51	0.00919	0.24	0.27	
R-10	155.63	R-9	154.02	298	0.0054	8	0.57	0.00919	0.24	0.33	
R-9	154.02	R-8	153.08	246	0.0038	8	0.48	0.00919	0.25	0.22	
R-8	153.08	R-7	152.91	35	0.0049	8	0.54	0.00000	0.25	0.29	
R-7	152.91	R-6	151.76	290	0.0040	8	0.49	0.00919	0.26	0.23	
R-6	151.76	R-5	150.84	207	0.0044	8	0.51	0.00919	0.27	0.24	
R-5	150.84	R-4	150.48	54	0.0067	8	0.64	0.00000	0.27	0.36	
R-4	150.48	R-3	150.36	28	0.0043	8	0.51	0.00000	0.27	0.24	
R-3	150.36	R-2	149.06	249	0.0052	8	0.56	0.01827	0.29	0.27	
R-2	149.06	R-1	147.28	458	0.0039	8	0.48	0.01827	0.31	0.18	
R-1	147.28	N-2	145.91	329	0.0042	8	0.50	0.01874	0.33	0.18	
N-2	145.91	N-1	145.56	114	0.0031	8	0.43	0.01827	0.35	0.09	
N-1	145.56	O-40	143.8	436	0.0040	8	0.49	0.01860	0.36	0.13	
O-40	143.4	O-39	140.76	234	0.0113	8	0.83	0.00549	0.37	0.46	
Ivy Trunk											
Extend sewer south from manhole S-19								**0.19600**			
S-19	163.26	S-18	160.04	428	0.0075	8	0.67	0.03150	0.23	0.44	
S-18	160.04	S-17	158.9	422	0.0027	8	0.40	0.00000	0.23	0.18	
S-17	158.9	S-16	157.79	316	0.0035	8	0.46	0.00000	0.23	0.23	
S-16	157.74	S-15	156.49	307	0.0041	8	0.50	0.08270	0.31	0.19	
S-15	156.39	S-14	156.24	52	0.0029	8	0.42	0.01785	0.33	0.09	
S-14	156.24	S-13	154.62	342	0.0047	8	0.53	0.00276	0.33	0.20	
S-13	154.62	S-12	154.46	58	0.0028	8	0.41	0.01785	0.35	0.06	
S-12	154.46	S-11	154.01	136	0.0033	8	0.45	0.00000	0.35	0.10	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer			Wastewater	Cumulative	Remaining	Approx. Surcharge
Upstream		Downstream		Length	Slope	Size	Capacity	Flow	Flows	Capacities	Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
S-11	153.91	S-10	153.05	265	0.0032	8	0.44	0.01785	0.37	0.07	
S-10	150.7	S-3	149.41	362	0.0036	8	0.47	0.01785	0.38	0.08	
S-3	149.41	S-4	146.9	311	0.0081	8	0.70	0.00255	0.39	0.31	
S-4	146.9	S-2	144.98	311	0.0062	8	0.61	0.02895	0.42	0.20	
S-2	144.78	O-29	143.74	268	0.0039	8	0.48	0.02245	0.44	0.05	
O-29	143.59	O-30	142.46	248	0.0046	8	0.53	0.01461	0.45	0.07	
O-30	142.41	O-31	140.89	322	0.0047	8	0.53	0.01461	0.47	0.06	
O-31	140.89	O-32	140.92	35	-0.0009	8	N/A	0.01461	0.48	N/A	2
O-32	140.92	O-33	138.94	350	0.0057	8	0.59	0.01461	0.50	0.09	
South 2nd Trunk											
Q-3	144.8	Q-2	143.45	392	0.0034	8	0.45	0.02504	0.03	0.43	
Q-2	143.45	Q-1	141.5	323	0.0060	8	0.60	0.03854	0.06	0.54	
Q-1	141.5	R-35	139.25	342	0.0066	8	0.63	0.03394	0.10	0.53	
Shopping Center Pump Station - 2 pumps ea. @ 55 gpm								0.07920			
R-35	151.25	R-34	150.99	227	0.0011	8	0.26	0.00688	0.09	0.17	12
R-34	150.99	R-33	149.88	298	0.0037	8	0.47	0.00688	0.09	0.38	14
R-33	149.88	R-32	148.83	219	0.0048	8	0.54	0.00638	0.10	0.44	26
R-32	148.83	R-31	148.37	210	0.0022	8	0.36	0.00638	0.11	0.26	38
R-31	148.37	R-30	147.47	333	0.0027	8	0.40	0.01240	0.12	0.29	43
R-30	147.47	R-29	147.09	123	0.0031	8	0.43	0.01240	0.13	0.30	52
R-29	147.09	R-28	146.78	153	0.0020	8	0.35	0.01240	0.14	0.20	56
R-28	146.63	R-27	145.57	429	0.0025	8	0.39	0.00742	0.15	0.24	59
R-27	145.57	R-26	144.45	444	0.0025	8	0.39	0.00742	0.16	0.23	70
Elm Trunk Sewer enters mh R-26 - see Note 1 below								0.41199			
R-26	144.45	N-4	142.58	365	0.0051	8	0.55	0.01078	0.58	-0.03	81

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
N-4	142.58	N-5	142.69	400	-0.0003	8	N/A	0.01078	0.59	N/A	86
N-5	142.69	N-6	141.66	365	0.0028	8	0.41	0.01078	0.60	-0.19	65
N-6	141.66	O-39	140.61	408	0.0026	8	0.40	0.01078	0.61	-0.22	59
Fir Trunk Sewer enters mh O-39								0.37015			
O-39	140.41	O-38	140.06	182	0.0019	10	0.61	0.00210	0.99	-0.37	50
O-38	140.06	O-37	139.35	380	0.0019	10	0.61	0.00210	0.99	-0.37	46
O-37	139.35	O-33	138.94	281	0.0015	10	0.55	0.01485	1.00	-0.46	38
Ivy Trunk Sewer enters mh O-33								0.49675			
O-33	138.84	O-34	138.79	149	0.0003	10	0.24	0.00000	1.50	-1.26	30
O-34	138.69	O-35	138.36	221	0.0015	10	0.55	0.00070	1.50	-0.95	17
99E Trunk											
N-23	146.23	N-24	145.37	394	0.0022	8	0.36	0.01603	0.02	0.35	
N-24	145.37	N-25	144.26	376	0.0030	8	0.43	0.00448	0.02	0.40	
N-25	144.26	N-26	143.77	182	0.0027	8	0.40	0.00343	0.02	0.38	
N-26	143.77	N-27	143.47	182	0.0016	8	0.31	0.00343	0.03	0.28	
N-27	143.47	O-43	142.55	400	0.0023	8	0.37	0.00343	0.03	0.34	
O-43	142.55	O-36	141.53	379	0.0027	8	0.40	0.00366	0.03	0.37	
O-36	141.53	O-35	138.21	347	0.0096	8	0.76	0.00366	0.04	0.72	
Locust Trunk											
Extend sewer south from manhole S-9											
S-9	151.09	S-8	150.11	265	0.0037	8	0.47	0.08570	0.09	0.39	
S-8	149.71	S-7	149	229	0.0031	8	0.43	0.01650	0.10	0.33	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
S-7	148.9	S-6	148.24	147	0.0045	8	0.52	0.04511	0.15	0.37	
S-6	147.94	S-5	147.05	293	0.0030	8	0.43	0.00510	0.15	0.27	
S-5	146.85	O-26	146.73	21	0.0057	8	0.59	0.00000	0.15	0.43	
O-26	146.63	O-25	145.02	396	0.0041	8	0.50	0.02050	0.17	0.32	
O-25	144.42	O-24	142.92	14	0.1071	8	2.54	0.00000	0.17	2.37	
O-24	142.92	O-23	142.29	116	0.0054	8	0.57	0.02005	0.19	0.38	
O-23	142.29	O-22	140.99	428	0.0030	8	0.43	0.18249	0.38	0.05	
O-22	140.99	O-21	139.81	371	0.0032	8	0.44	0.02050	0.40	0.04	
O-21	139.81	O-20	139.06	150	0.0050	8	0.55	0.02050	0.42	0.13	
O-20	139.06	O-16	137.97	134	0.0081	8	0.70	0.02050	0.44	0.26	
O-16	137.97	O-18	137.36	93	0.0066	8	0.63	0.00000	0.44	0.19	
South Pine Trunk											
Extend sewers east and south from manhole W-7								**0.07990**			
W-7	172.57	W-6	171.85	180	0.0040	8	0.49	0.00540	0.09	0.41	
W-6	171.65	W-5	170.55	274	0.0040	8	0.49	0.00460	0.09	0.40	
W-5	170.45	W-4	169.85	150	0.0040	8	0.49	0.01910	0.11	0.38	
W-4	169.75	W-3	169.15	150	0.0040	8	0.49	0.02380	0.13	0.36	
W-3	169.05	W-2	167.95	274	0.0040	8	0.49	0.02200	0.15	0.34	
W-2	167.75	W-1	166.96	198	0.0040	8	0.49	0.00260	0.16	0.33	
W-1	166.76	T-12	166.03	370	0.0020	12	1.02	0.01660	0.17	0.85	
T-12	163.83	T-11	162.92	404	0.0023	12	1.10	0.03655	0.21	0.89	
T-11	162.92	T-10	161.85	440	0.0024	12	1.12	0.01490	0.23	0.90	
T-10	161.85	T-9	160.08	441	0.0040	12	1.45	0.01490	0.24	1.21	
T-9	160.08	T-8	159.17	241	0.0038	8	0.48	0.01443	0.25	0.22	
T-8	159.17	T-7	157.93	247	0.0050	8	0.55	0.01443	0.27	0.28	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
T-7	157.93	T-6	157.29	117	0.0055	8	0.58	0.01443	0.28	0.29	
T-6	157.29	T-5	156.68	143	0.0043	8	0.51	0.00718	0.29	0.22	
T-5	156.68	T-2	153.91	428	0.0065	8	0.63	0.00718	0.30	0.33	
T-2	153.91	T-1	153.25	194	0.0034	8	0.45	0.01691	0.31	0.14	
T-1	153.25	P-16	147.25	18	0.0034	8	0.45	0.00000	0.31	0.14	
P-16	147.25	P-15	145.15	319	0.0066	12	1.86	0.01691	0.33	1.53	
P-15	145.15	P-14	144.07	161	0.0067	12	1.87	0.01691	0.35	1.52	
P-14	144.07	P-13	142.38	357	0.0047	12	1.57	0.01691	0.37	1.20	
P-13	142.38	P-12	141.96	98	0.0043	12	1.50	0.00545	0.37	1.13	
P-12	141.96	P-11	140.59	51	0.0269	12	3.75	0.00000	0.37	3.38	
P-11	140.59	O-7	134.15	628	0.0103	12	2.32	0.09570	0.47	1.86	
South 4th Trunk											
Extend sewer from manhole P-22								**0.32300**			
P-22	147.53	P-21	147.03	230	0.0022	12	1.07	0.04000	0.36	0.71	
P-21	146.93	P-20	146.31	281	0.0022	12	1.07	0.00000	0.36	0.71	
P-20	146.21	P-19	146.05	72	0.0022	12	1.07	0.00000	0.36	0.71	
P-19	145.95	P-18	144.95	410	0.0024	12	1.12	0.03938	0.40	0.72	
P-18	144.85	P-6	143.75	100	0.0110	12	2.40	0.00000	0.40	2.00	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
South Redwood Trunk											
Future Mulino Pump Station pumps into new sewer extended from manhole T-14								**0.40700**			
Extend sewer east from manhole T-14								**0.03000**			
T-14	167.44	T-15	166.27	411	0.0028	12	1.21	0.01785	0.45	0.76	
T-15	166.27	T-16	164.81	250	0.0058	12	1.74	0.01785	0.47	1.27	
Extend sewer east from manhole T-16								**0.03400**			
T-16	164.81	T-17	162.95	248	0.0075	12	1.98	0.00893	0.52	1.47	
T-17	162.95	T-18	160.02	223	0.0131	12	2.62	0.01785	0.53	2.09	
T-18	160.02	T-19	159.01	122	0.0083	12	2.09	0.01530	0.55	1.54	
Extend sewer east from manhole T-19								**0.03700**			
T-19	159.01	T-20	158.69	110	0.0029	12	1.23	0.00000	0.59	0.65	
T-20	158.09	T-21	157.7	126	0.0031	12	1.27	0.01785	0.60	0.67	
T-21	157.7	T-22	156.89	294	0.0028	12	1.21	0.00789	0.61	0.60	
T-22	156.89	T-23	155.86	272	0.0038	12	1.41	0.00789	0.62	0.79	
T-23	155.86	T-24	155.2	191	0.0035	12	1.35	0.00789	0.63	0.73	
T-24	155.2	T-25	154.29	262	0.0035	12	1.35	0.00789	0.64	0.72	
T-25	154.29	T-26	153.45	240	0.0035	12	1.35	0.00789	0.64	0.71	
Extend sewer east from manhole T-26								**0.11800**			
T-26	153.45	P-9	151	128	0.0191	12	3.16	0.02771	0.79	2.37	
P-9	151	P-8	148.78	158	0.0141	12	2.72	0.02771	0.82	1.90	
P-8	148.78	P-7	144.55	421	0.0100	12	2.29	0.01459	0.83	1.46	
P-7	144.55	P-6	143.75	88	0.0091	12	2.18	0.00000	0.83	1.35	
South 4th Trunk Sewer enters mh P-6								0.40238			
P-6	143.75	P-5	142.31	118	0.0122	12	2.53	0.01459	1.25	1.28	
P-5	142.31	P-4	137.98	421	0.0103	12	2.32	0.01459	1.26	1.06	
P-4	137.98	P-3	136.59	418	0.0033	12	1.31	0.02771	1.29	0.02	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream						Wastewater	Cumulative	Remaining	Surcharge
MH. No.	Elev.	MH. No.	Elev.	Length (ft)	Slope (ft/ft)	Size (in)	Capacity (mgd)	Flow (mgd)	Flows (mgd)	Capacities (mgd)	Depth (in)
P-3	136.59	P-2	135.49	143	0.0077	12	2.01	0.00000	1.29	0.72	
P-2	135.49	O-7	134.15	407	0.0033	12	1.31	0.01335	1.30	0.01	
South Pine Trunk Sewer enters mh O-7								0.46679			
O-7	134.15	O-6	133.31	364	0.0023	15	1.99	0.00731	1.78	0.21	
O-6	133.31	O-5	132.97	116	0.0029	15	2.23	0.00492	1.78	0.45	
O-5	132.97	O-4	132.1	277	0.0031	15	2.31	0.00354	1.79	0.52	
O-4	132.1	O-3	131.38	255	0.0028	15	2.20	0.01617	1.80	0.39	
O-3	131.38	O-2	130.99	111	0.0035	15	2.46	0.00000	1.80	0.65	
Redwood Interceptor											
99E Trunk Sewer enters mh O-35								0.03812			
South 2nd Trunk Sewer enters mh O-35								1.49952			
O-35	138.21	O-19	136.94	361	0.0035	12	1.35	0.00509	1.54	-0.19	6
O-19	136.94	O-18	136.76	46	0.0039	12	1.43	0.00000	1.54	-0.11	1
Locust Trunk Sewer enters mh O-18								0.43695			
O-18	136.56	O-17	136.32	9	0.0267	18	11.03	0.00000	1.98	9.05	
O-17	136.32	O-15	136.02	98	0.0031	18	3.76	0.00000	1.98	1.78	
O-15	135.92	O-14	135.27	320	0.0020	18	3.02	0.00922	1.99	1.03	
O-14	135.27	O-13	134.57	244	0.0029	18	3.63	0.00922	2.00	1.64	
O-13	134.57	O-12	133.37	470	0.0026	18	3.44	0.01424	2.01	1.43	
O-12	133.37	O-11	133.15	53	0.0042	18	4.37	0.00000	2.01	2.36	
O-11	133.15	O-10	132.82	142	0.0023	18	3.24	0.00712	2.02	1.22	
O-10	132.82	O-9	132.32	40	0.0125	18	7.54	0.00000	2.02	5.53	
O-9	132.32	O-8	131.83	125	0.0039	18	4.21	0.00140	2.02	2.19	
O-8	131.83	O-2	130.99	409	0.0021	18	3.09	0.00140	2.02	1.07	
South Redwood Trnk Sewer enters mh O-2								1.80244			

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
O-2	130.99	O-1	130.97	29	0.0007	18	1.79	0.00000	3.82	-2.04	1
O-1	130.97	L-23	128.67	561	0.0041	18	4.32	0.01761	3.84	0.48	
L-23	128.67	L-7	127.63	508	0.0020	18	3.02	0.00000	3.84	-0.82	5
L-7	127.63	L-24	126.93	327	0.0021	18	3.09	0.00660	3.85	-0.76	2
L-24	126.93	L-6	125.45	334	0.0044	18	4.48	0.00383	3.85	0.62	
Future Redwood Pump Station pumps into new sewer extended from manhole L-6								**0.60200**			
Extend sewer east from manole L-6								**0.05500**	0.66		
Extend sewer south from manhole L-6								**0.06000**			
L-6	125.45	L-5	122.91	357	0.0071	18	5.69	0.00938	4.58	1.11	
L-5	122.91	L-4	119.77	434	0.0072	18	5.73	0.01141	4.59	1.14	
L-4	119.77	L-3	116.78	430	0.0070	18	5.65	0.03704	4.63	1.02	
L-3	116.78	L-2	114.68	285	0.0074	18	5.81	0.03704	4.66	1.14	
L-2	114.68	L-1	113.55	145	0.0078	18	5.96	0.03704	4.70	1.26	
L-1	113.55	H-13	100.86	501	0.0253	15	6.60	0.03704	4.74	1.86	
H-13	100.86	H-12	89.27	448	0.0259	15	6.68	0.03704	4.78	1.90	
H-12	89.27	H-11	86.47	951	0.0029	21	5.48	0.07407	4.85	0.63	
H-11	86.47	H-1	85.09	510	0.0027	21	5.29	0.00000	4.85	0.44	
Knight's Bridge Trunk											
I-1	150.14	I-2	149.23	281	0.0032	8	0.44	0.08100	0.08	0.36	
I-2	149.13	I-3	148.6	149	0.0036	8	0.47	0.01275	0.09	0.37	
I-3	148.6	I-4	147.58	375	0.0027	8	0.40	0.00714	0.10	0.30	
I-4	147.58	I-5	146.36	331	0.0037	8	0.47	0.02040	0.12	0.35	
I-5	146.36	I-6	144.69	165	0.0101	8	0.78	0.17927	0.30	0.48	
Knight's Bridge Pump Station - 2 pumps ea. @ 150 gpm								0.21600			

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
I-7	152.91	J-1	152.02	240	0.0037	8	0.47	0.02485	0.24	0.23	
J-1	152.02	J-2	149.01	499	0.0060	8	0.60	0.00381	0.24	0.36	
J-2	149.01	J-3	148.2	231	0.0035	8	0.46	0.00383	0.25	0.21	
J-3	148.05	J-4	146.92	229	0.0049	8	0.54	0.00255	0.25	0.29	
J-4	146.92	J-5	143.96	499	0.0059	8	0.60	0.00893	0.26	0.34	
J-5	144.74	J-6	142.86	298	0.0063	8	0.62	0.01020	0.27	0.35	0
J-6	142.86	N-12	142.94	330	-0.0002	8	N/A	0.05472	0.32	N/A	17
N-12	143.44	N-11	141.76	352	0.0048	8	0.54	0.01505	0.34	0.20	9
N-11	141.76	N-10	141.21	145	0.0038	8	0.48	0.02295	0.36	0.12	21
N-10	141.21	N-9	140.72	185	0.0026	8	0.40	0.02751	0.39	0.01	23
N-9	140.72	N-8	139.62	329	0.0033	8	0.45	0.02626	0.42	0.03	23
N-8	139.62	N-7	138.25	407	0.0034	8	0.45	0.11642	0.53	-0.08	24
N-7	138.25	O-51	137.28	350	0.0028	8	0.41	0.00182	0.53	-0.12	17
O-51	137.28	O-50	136.34	317	0.0030	8	0.43	0.00800	0.54	-0.12	8
O-50	136.14	O-47	134.21	196	0.0098	8	0.77	0.00677	0.55	0.22	

North 3rd Trunk

Extend sewer south from relocated Third & Baker P.S.								**0.15700**			
M-3	151.12	M-2	149.09	393	0.0052	8	0.56	0.18847	0.19	0.37	
Expand & Relocate Third & Baker Pump Station								**0.34547**			
M-2	149.09	M-1	148.22	429	0.0020	8	0.35	0.00000	0.35	0.00	
M-1	148.22	N-22	147.17	345	0.0030	8	0.43	0.00000	0.35	0.08	
N-22	147.17	N-21	147.08	99	0.0009	8	0.23	0.00000	0.35	-0.11	2
N-21	147.08	N-20	145.06	376	0.0054	8	0.57	0.00560	0.35	0.22	
N-20	145.06	N-19	143.49	380	0.0041	8	0.50	0.00506	0.36	0.14	
N-19	143.49	N-18	142.07	384	0.0037	8	0.47	0.00506	0.36	0.11	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations				Sewer							Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
N-18	142.07	N-17	141.07	381	0.0026	8	0.40	0.02056	0.38	0.01	
N-17	141.07	N-16	140.03	385	0.0027	8	0.40	0.00506	0.39	0.02	
N-16	140.03	N-15	139.16	346	0.0025	8	0.39	0.00506	0.39	-0.00	1
N-15	139.16	N-14	137.96	403	0.0030	8	0.43	0.01332	0.41	0.02	
N-14	137.96	O-49	137.75	108	0.0019	8	0.34	0.00602	0.41	-0.07	2
O-49	137.75	O-47	136.32	499	0.0029	8	0.42	0.00506	0.42	0.00	
O-47	135.42	O-46	135.09	133	0.0025	15	2.07	0.02529	0.44	1.63	
O-46	135.09	O-45	133.66	67	0.0213	15	6.06	0.00000	0.44	5.62	

Molalla Interceptor

Knight's Bridge Trunk Sewer enters mh O-45								0.54967			
North 3rd Trunk Sewer enters mh O-45								0.44156			
O-45	133.66	O-44	133.88	435	-0.0005	18	N/A	0.01260	1.00	N/A	5
O-44	133.88	K-6	133.27	440	0.0014	18	2.52	0.05635	1.06	1.46	
K-6	133.27	K-5	132.73	286	0.0019	18	2.94	0.00630	1.07	1.88	
K-5	132.73	K-4	132.03	378	0.0019	18	2.94	0.00630	1.07	1.87	
K-4	132.03	K-3	126.28	614	0.0094	18	6.54	0.00630	1.08	5.46	
K-3	126.28	K-2	125.84	194	0.0023	18	3.24	0.00630	1.09	2.15	
K-2	125.84	K-1	124.69	307	0.0037	18	4.10	0.00630	1.09	3.01	
North 10th Trunk enters mh K-1								0.50324			
K-1	123.74	L-18	122.77	394	0.0025	18	3.37	0.00561	1.60	1.77	
L-18	122.77	L-17	122.23	213	0.0025	18	3.37	0.12562	1.73	1.65	
L-17	122.23	l-16	122.04	140	0.0014	18	2.52	0.01046	1.74	0.79	2
l-16	122.24	L-13	121.28	211	0.0045	18	4.53	0.00434	1.74	2.79	
L-13	121.28	L-12	117.06	278	0.0152	18	8.32	0.06962	1.81	6.51	
L-12	117.06	L-11	115.09	345	0.0057	18	5.09	0.00700	1.82	3.28	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
L-11	115.09	L-10	112.91	385	0.0057	18	5.09	0.03988	1.86	3.24	
L-10	112.91	L-9	112.55	59	0.0061	18	5.27	0.01224	1.87	3.40	
L-9	112.55	L-8	111.59	179	0.0054	18	4.96	0.01132	1.88	3.08	
L-8	111.59	H-10	109.76	362	0.0051	18	4.82	0.01132	1.89	2.93	
H-10	109.76	H-9	107.72	79	0.0258	18	10.84	0.00000	1.89	8.95	
H-9	107.72	H-8	106.49	579	0.0021	18	3.09	0.01132	1.90	1.19	2
H-8	106.49	H-7	105.61	450	0.0020	18	3.02	0.01132	1.91	1.10	
H-7	105.61	H-4	104.57	461	0.0023	18	3.24	0.00000	1.91	1.32	
Territorial Interceptor Sewer enters mh H-4								1.15235			
H-4	104.57	H-3	100.42	201	0.0206	15	5.96	0.00433	3.07	2.88	
H-3	100.42	H-2	87.47	351	0.0369	15	7.97	0.00443	3.08	4.90	
H-2	87.47	H-1	85.54	i95	0.0099	15	4.13	0.00443	3.08	1.05	
North 22nd Trunk											
Future North 22nd Pump Station pumps into new sewer extended from manhole G-1								**0.03000**			
Extend sewer west from manhole G-1								**0.02700**			
G-1	129.26	G-2	128.02	300	0.0041	8	0.50	0.00672	0.06	0.43	
G-2	128.02	G-4	126.6	342	0.0042	8	0.50	0.00672	0.07	0.43	
G-4	126.6	G-5	125.06	377	0.0041	8	0.50	0.02017	0.09	0.41	
G-5	125.06	G-6	123.78	284	0.0045	8	0.52	0.00672	0.10	0.42	
G-6	123.78	G-7	122.51	278	0.0046	8	0.53	0.00672	0.10	0.42	
G-7	122.51	G-8	120.85	388	0.0043	8	0.51	0.01345	0.12	0.39	
G-8	120.85	G-9	119.46	243	0.0057	8	0.59	0.01345	0.13	0.46	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
North 20th Trunk											
Extend sewer west from manhole G-18								**0.03100**			
G-18	129.47	G-17	126.23	445	0.0073	10	1.20	0.02848	0.06	1.14	
G-17	126.23	G-16	123.44	350	0.0080	10	1.26	0.00765	0.07	1.19	
G-16	123.44	G-11	120.56	417	0.0069	10	1.17	0.00765	0.07	1.09	
Territorial Road Interceptor											
Future North Birch Pump Station pumps into new sewer extended from manhole F-1								**0.10600**			
Extend sewer north from new sewer extended from manhole F-1								**0.06100**			
Extend sewer west from manhole F-1								**0.31900**			
F-1	128.78	G-15	127.36	353	0.0040	10	0.89	0.02810	0.51	0.38	
Extend sewer north from manhole G-15								**0.05300**			
G-15	127.36	G-14	125.85	423	0.0036	10	0.84	0.01061	0.58	0.27	
G-14	125.85	G-13	125.37	99	0.0048	10	0.98	0.00000	0.58	0.40	
G-13	125.37	G-12	123.85	380	0.0040	10	0.89	0.02848	0.61	0.28	
G-12	123.85	G-11	120.56	463	0.0071	10	1.19	0.01989	0.63	0.56	
North 20th Trunk Sewer enters mh G-11								0.07478			
G-11	120.56	G-10	119.28	295	0.0043	10	0.92	0.14896	0.85	0.07	
G-10	119.28	G-9	116.96	497	0.0047	10	0.96	0.01253	0.86	0.10	
North 22nd Trunk Sewer enters mh G-9								0.13095			
G-9	116.96	H-6	110.27	606	0.0110	10	1.48	0.04579	1.04	0.44	
H-6	110.27	H-5	109.14	120	0.0094	12	2.22	0.05663	1.10	1.12	
H-5	109.14	H-4	104.57	540	0.0085	12	2.11	0.05663	1.15	0.96	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations Upstream MH. No.	Upstream Elev.	Downstream MH. No.	Downstream Elev.	Length (ft)	Sewer Slope (ft/ft)	Sewer Size (in)	Capacity (mgd)	Wastewater Flow (mgd)	Cumulative Flows (mgd)	Remaining Capacities (mgd)	Approx. Surcharge Depth (in)
Willow Creek Interceptor											
Extend sewer east from manhole H-14 - see Note 3 below								0.47700			
H-14	74.15	H-15	73.16	351	0.0028	8	0.41	0.11441	0.59	-0.18	5
Expand exist. Willow Creek Pump Station								0.59141			
New 6-inch force main for expanded Willow Creek P.S.									0.59		
Plant Interceptor											
Molalla Interceptor enters mh H-1								3.08051			
Redwood Interceptor enters mh H-1								4.84982			
Willow Creek Force Main enters mh H-1								0.59141			
H-1	84.64	D-4	83.91	461	0.0016	30	10.54	0.02984	8.55	1.99	
D-4	83.91	D-3	83.12	529	0.0015	30	10.21	0.02984	8.58	1.62	
D-3	83.12	D-2	82.44	452	0.0015	30	10.21	0.02984	8.61	1.59	
D-2	82.44	D-1	81.86	347	0.0017	30	10.86	0.02984	8.64	2.22	

TABLE B-2

EXISTING SEWERS CAPACITIES
FUTURE WASTEWATER FLOWS
CANBY, OREGON

Sewer Invert Elevations					Sewer						Approx.
Upstream		Downstream		Length	Slope	Size	Capacity	Wastewater Flow	Cumulative Flows	Remaining Capacities	Surcharge Depth
MH. No.	Elev.	MH. No.	Elev.	(ft)	(ft/ft)	(in)	(mgd)	(mgd)	(mgd)	(mgd)	(in)
North 34th Trunk											
C-7	120.89	C-6	120.25	134.41	0.0048	8	0.54	0.02805	0.03	0.51	
C-6	120.25	C-5	118.39	379.22	0.0049	8	0.54	0.01055	0.04	0.50	
C-5	118.39	C-4	116.21	415.14	0.0053	8	0.57	0.01055	0.05	0.52	
C-4	116.21	C-3	114.93	130.35	0.0098	8	0.77	0.01055	0.06	0.71	
C-3	114.93	C-2	109.64	284.63	0.0186	8	1.06	0.01055	0.07	0.99	
C-2	109.64	C-1	104.74	2690.02	0.0018	8	0.33	0.01055	0.08	0.25	
C-1	104.74	A-7	95.7	398.02	0.0227	8	1.17	0.01055	0.09	1.08	
A-7	95.7	A-6	87.23	364.4	0.0232	8	1.18	0.01055	0.10	1.08	
A-6	87.23	A-5	86.12	235.79	0.0047	8	0.53	0.01055	0.11	0.42	
A-5	86.12	A-4	83.54	413.81	0.0062	8	0.61	0.01055	0.12	0.49	
A-4	83.54	A-3	80.52	451.28	0.0067	10	1.15	0.01696	0.14	1.01	
A-3	80.52	A-2	79.28	297.23	0.0042	12	1.48	0.01696	0.16	1.33	
A-2	79.28	A-1	N.A.	214.77	0.3691	12	13.91	0.00000	0.16	13.75	
34th Street Pump Station - 2 pumps ea. @ 155 gpm								0.22320			

Treatment Plan Influent Pump Station

Plant Interceptor Sewer enters station
34th Street Pump station enters station
WWTP Sewers enter station
Peak Influent Flow into Plant =

TABLE B-3

**PROPOSED COLLECTION SYSTEM
COST ESTIMATES
Canby, Oregon**

Trunk Name	Item Description	Size (in)	Length (ft)	Average Depth (ft)	Actual Unit Cost ($/ft)	Actual Total Cost ($)	Replacement Unit Cost ($/ft)	Replacement Total Cost ($)	Oversize Unit Cost ($/ft)	Oversize Total Cost ($)
Elm Trunk										
	New sewer east from manhole U-5	8	800	7	$50	$40,000	-	-	$0	$0
	New sewer north as shown on Fig. V	8	400	7	$50	$20,000				
Fir Trunk										
	New sewer south from manhole R-1	8	1700	7	$50	$85,000	-	-	$0	$0
Ivy Trunk										
	New sewer south from manhole S-1	8	1500	7	$50	$75,000	-	-	$0	$0
South 2nd Trunk										
	Replace exist. sewer from mh. R-26 to O-39	10	1538	10	$80	$123,040	$70	$107,660	$10	$15,380
	Replace exist. sewer from mh. O-39 to O-33	12	846	13	$110	$93,060	$80	$67,680	$30	$25,380
	Replace exist. sewer from mh. O-33 to O-20	15	549	11	$100	$54,900	$80	$43,920	$20	$10,980
	Replace exist. sewer from mh. O-20 to O-15	18	134	10	$100	$13,400	$80	$10,720	$20	$2,680
South Pine Trunk										
	New sewer south from manhole T-1	8	800	7	$50	$40,000	-	-	$0	$0
South 4th Trunk										
	New sewer east from manhole P-22	10	1500	10	$62	$93,000	-	-	$13	$19,500
	New sewers as shown on Fig. V	8	5400	7	$50	$270,000	-	-	$0	$0

TABLE B-3

PROPOSED COLLECTION SYSTEM
COST ESTIMATES
Canby, Oregon

Trunk Name	Item Description	Size (in)	Length (ft)	Average Depth (ft)	Actual Unit Cost ($/ft)	Actual Total Cost ($)	Replacement Unit Cost ($/ft)	Replacement Total Cost ($)	Oversize Unit Cost ($/ft)	Oversize Total Cost ($)
Mulino Road Pump Station										
	New sewer north from Mulino P.S.	8	3000	7	$50	$150,000	-	-	$0	$0
	New sewer west from Mulino P.S.	8	2800	7	$50	$140,000	-	-	$0	$0
	Mulino Road Pump Station					$160,000				$160,000
	Mulino Road P.S. Force Main	6	2200	3	$28	$61,600	-	-	$28	$61,600
South Redwood Trunk										
	New sewer east from manhole T-14	12	200	12	$74	$14,800	-	-	$25	$5,000
		10	1000	10	$62	$62,000	-	-	$13	$13,000
	New sewer east from manhole T-16	8	1200	7	$50	$60,000	-	-	$0	$0
	New sewer east from manhole T-26	8	2300	7	$50	$115,000	-	-	$0	$0
Redwood Pump Station										
	New sewer east from Redwood P.S.	10	1500	10	$62	$93,000	-	-	$13	$19,500
	New sewers as shown on Fig. V	8	6100	7	$50	$305,000	-	-	$0	$0
	New sewer west from Redwood P.S.	8	1000	7	$50	$50,000	-	-	$0	$0
	Redwood Pump Station					$160,000				$160,000

TABLE B-3

PROPOSED COLLECTION SYSTEM
COST ESTIMATES
Canby, Oregon

Trunk Name	Item Description	Size (in)	Length (ft)	Average Depth (ft)	Actual Unit Cost ($/ft)	Actual Total Cost ($)	Replacement Unit Cost ($/ft)	Replacement Total Cost ($)	Oversize Unit Cost ($/ft)	Oversize Total Cost ($)
	Redwood P. S. Force Main	6	700	3	$28	$19,600	-	-	$28	$19,600
Redwood Interceptor										
	New sewer east from manhole L-6	12	800	10	$74	$59,200	-	-	$20	$16,000
		8	1600	7	$50	$80,000	-	-	$0	$0
	New sewer south from manhole L-6	8	1200	7	$50	$60,000	-	-	$0	$0
North 3rd Trunk										
	Relocate Third & Baker Pump Station					$70,000				$70,000
	Third & Baker P.S. Force Main	4	600	3	$24	$14,400	-	-	$24	$14,400
	New sewer east from Third & Baker P.S.	8	3100	10	$50	$155,000	-	-	$0	$0
North 22nd Pump Station										
	New sewer east from N. 22nd P.S.	8	1300	7	$50	$65,000	-	-	$0	$0
	North 22nd Pump Station					$130,000				$130,000
	North 22nd Force Main	3	1400	3	$20	$28,000	-	-	$20	$28,000
North 22nd Trunk										
	New sewer west from manhole G-1	8	1300	7	$50	$65,000	-	-	$0	$0

TABLE B-3

PROPOSED COLLECTION SYSTEM COST ESTIMATES Canby, Oregon

Trunk Name	Item Description	Size (in)	Length (ft)	Average Depth (ft)	Actual Unit Cost ($/ft)	Actual Total Cost ($)	Replacement Unit Cost ($/ft)	Replacement Total Cost ($)	Oversize Unit Cost ($/ft)	Oversize Total Cost ($)
North 20th Trunk										
	New sewer west from manhole G-18	8	700	7	$50	$35,000	-	-	$0	$0
North Birch Pump Station										
	New sewer east from N. Birch P.S.	8	1300	7	$50	$65,000	-	-	$0	$0
	North Birch Pump Station					$130,000				$130,000
	North Birch Force Main	4	1400	3	$24	$33,600			$24	$33,600
Territorial Interceptor										
	New sewer west from manhole F-1	10	3200	10	$62	$198,400	-	-	$13	$41,600
		8	800	7	$50	$40,000	-	-	$0	$0
	New sewer north from manhole G-1	8	1500	7	$50	$75,000	-	-	$0	$0
Willow Creek Interceptor										
	New sewer east from manhole H-17	8	1500	10	$50	$75,000	-	-	$0	$0
		10	800	10	$62	$49,600	-	-	$13	$10,400
	Jack and bore new sewer under Southern Pacific Railroad and Highway 99E	10	300	10	$200	$60,000	-	-	$50	$15,000
	New sewer south as shown in Fig. V	8	2400	7	$50	$120,000	-	-	$0	$0

TABLE B-3

PROPOSED COLLECTION SYSTEM COST ESTIMATES
Canby, Oregon

Trunk Name	Item Description	Size (in)	Length (ft)	Average Depth (ft)	Actual Unit Cost ($/ft)	Actual Total Cost ($)	Replacement Unit Cost ($/ft)	Replacement Total Cost ($)	Oversize Unit Cost ($/ft)	Oversize Total Cost ($)
	Expand Willow Creek Pump Station					$100,000	-	-		$100,000
	Replace exist. Willow Creek P.S. Force Mai	6	650	3	$28	$18,200	-	-	$28	$18,200
				Totals =		$4,024,800		$229,980		$1,119,820

APPENDIX C

Design Flows

CURRAN-McLEOD, INC.
CONSULTING ENGINEERS

7460 S.W. HUNZIKER ROAD, SUITE D
PORTLAND, OREGON 97223
PHONE (503) 684-3478

January 29, 1986

Mr. Wayne Klem
Public Works Director
City of Canby
P.O. Box 930
Canby, Oregon 97013

RE: **Redwood Interceptor Design**

Dear Rusty:

This letter is to summarize the design flows generated for the Redwood Interceptor Sewer and to resolve the remaining conflicts regarding connection to the existing system and pipeline alignment.

Design Flows

We have generated a flow for each area within the U.G.B., which includes a very modest amount for infiltration and inflow, as well as the domestic contribution. Each area is broken down by the land use designation, and the following flows projected:

LAND USE	ACRES	PEAK FLOW IN G/D/AC			TOTAL FLOW (MGD)
		I/I	DOMESTIC	TOTAL	
Agricultural	43.9	0	0	0	0.000
Low Density Residential	1,808.5	150	2,400	2,550	4.612
Medium Density Residential	97.7	150	4,200	4,350	0.425
High Density Residential	259.0	150	6,000	6,150	1.593
Private - Recreational	149.8	0	0	0	0.000
Public Owned	240.2	150	750	900	0.216
Downtown Commercial	58.0	150	1,250	1,400	0.081
Convenience Commercial	2.0	150	1,250	1,400	0.003
Residential Commercial	17.8	150	1,250	1,400	0.025
Highway Commercial	109.0	150	1,250	1,400	0.153
Commercial Manufacturing	71.6	150	1,500	1,650	0.118
Light Industrial	394.2	150	3,000	3,150	1.242
Heavy Industrial	94.3	150	3,000	3,150	0.297
Flood-Steep Slopes	82.0	150	600	750	0.062
TOTAL ACRES	3,428.0		TOTAL PEAK FLOW		8.827

The above flows are based upon 150 gpd/acre infiltration for all sewered areas; Low Density Residential 8 people/gross acre, 300 gpcd; Medium Density Residential 14 people/gross acre, 300 gpcd; High Density Residential 20 people/gross acre, 300 gpcd; Agricultural and Private-Recreational contributions are negligible; Public Owned is based upon 30 people/gross acre, 25 gpcd; Commercial use 50 people/gross acre, 25 gpcd; Commercial Manufacturing 1,500 gallons/gross acre; Industrial 3,000 gallons /gross acre and Flood-Steep Slopes 2 people/gross acre, 300 gpcd.

This projection estimates peak instantaneous flows at 8.827 MGD at the treatment plant.

Please review these figures and respond, as soon as possible, if you would like any modifications. Additional factor of safety will be included when sizing the pipeline simply by the necessity of utilizing standard manufactured pipe sizes.

Alignment Modifications

Our design is currently delayed pending resolution of the Hellhake easement situation. From our past discussions, the alignment as originally accepted by Mr. Hellhake is now unacceptable to him.

My recommendation is to terminate any negotiations with Mr. Hellhake, and to utilize the existing easement along Highway 99E. This option appears to be roughly comparable to an alignment behind the residence, and eliminates the need to negotiate an easement.

To complete the alignment along the existing easement, a property survey should be completed to determine the northerly property line. If the City terminates negotiations with Mr. Hellhake, as recommended, we need to be absolutely positive of our alignment. The additional cost for this survey was included in the cost estimate for Option "C", and can be completed within a few days of your authorization to proceed. Total cost of the additional survey work is estimated at approximately $600.00.

Sewage Treatment Plant Wetwell/Pump Station Analysis

The existing wetwell/ pump station at the sewage treatment plant will not be adequate to accommodate the new interceptor sewer, and should be modified as a portion of this construction.

In order to utilize the existing wetwell, the pipe should enter the structure approximately 24" above the minimum water surface elevation. This allows an operational range for the pumps without surcharging the influent line and creating the potential for solids deposition and odor problems. In order to accomplish this orientation with the existing wetwell, the invert of the new line must be at an elevation of approximately 82 feet. This would provide less than 3 feet of cover over the interceptor in some areas, and would limit the service area.

In addition, this wetwell only contains approximately 350 gallons per foot of storage capacity. In order to accommodate the future pump capacities, which will be in the range of 2,800 gpm each, the wetwell must be enlarged. Ultimately, the wetwell/pump station should include three variable speed pumps to provide full redundancy in the event of a pump failure, with minimum operational storage of approximately 2,500 gallons.

Ideally, the mechanically cleaned bar screen and grit removal units should be incorporated into the schematic prior to any pumping operations. These units could be designed into the new structure.

In summary, the invert of the new interceptor sewer is designed to enter into a new wetwell/pump station structure. This structure will be located on the east side of the access road on the south end of the treatment plant site.

Please review these matters and respond with any changes you would like or any questions you may have.

Very truly yours,

CURRAN-McLEOD, INC.

Curt J. McLeod, P.E.

CJM:bnn

APPENDIX D

Wastewater Systems Development Charges

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LIST OF TABLES

SUMMARY

Since Canby adopted its current waste water SDC in 1991, it has reconstructed and expanded the waste water treatment plant and updated the fixed-asset-accounting records. These changes affect the amount of the waste water SDC.

Also, the Canby Utility Board, which operates the Canby water utility, completed a study of water usage by meter size and by type of residential customer.[1] We use these data to revise the 3/4-inch meter equivalency tables for non-residential developments, and to more accurately assess multi-family residential developments.

A waste water SDC may consist of a reimbursement fee, an improvement fee, or both. The current SDC is a reimbursement fee only. The proposed SDC includes both the reimbursement fee and the improvement fee. Table 1 compares the current and proposed SDCs by meter size and shows the proposed SDC by housing unit for multi-family developments.

Table 1
Current and Proposed Waste Water SDCs

			Proposed SDC					
			By Meter Size			By MF		
Meter Size	Proposed Equivalent 3/4" Meters	Existing SDC	Reimburse-ment Fee	Improve-ment Fee	Total SDC	Unit 98%	Change $	Change %
3/4"	1	$1,200	$520	$500	$1,020	$998	($180)	-15%
1"	2	2,626	1,040	1,000	2,040	998	(586)	-22%
1 ½"	5	4,989	2,600	2,500	5,100	998	111	2%
2"	10	7,646	5,200	5,000	10,200	998	2,554	33%
3"	25	13,714	13,000	12,500	25,500	998	11,786	86%
4"	35	21,796	18,200	17,500	35,700	998	13,904	64%

Source: Raymond J. Bartlett, Economic & Financial Analysis.

[1]Canby Utility Board, ____________________, prepared by Curran-McLeod, Inc., Appendix C.

I THE CURRENT SDC

Table 2 shows the current schedule of systems development charges for wastewater. It is an improvement fee, only. At the time we wrote the methodology, several components of the city's sewage treatment plant were operating at capacity. A reimbursement fee was inappropriate.

Table 2
Current Waste Water Systems Development Charge

Meter Size	Equivalent 3/4" Meters	Existing SDC Reimbursement Fee	Improvement Fee	Total SDC
3/4"	1	$0	$1,200	$1,200
1"	2.2		2,626	2,626
1 ½"	4.2		4,989	4,989
2"	6.4		7,646	7,646
3"	11.4		13,714	13,714
4"	18.2		21,796	21,796

Source: City of Canby, *Sewer Utility Financial Forecast and Rate Analysis*, prepared by Raymond J. Bartlett, Economic & Financial Analysis, October 1991, page 30.

The current SDC is assessed according to the size of a water meter to be installed in the development. Except in rare circumstances, sewage flow increases with water usage and customers obtain larger meters to use more water. Also, engineers design water and waste water systems to meet peaking demands. Large-size meters have a greater capacity to contribute to peak water and waste water demands than smaller-size meters. In the current methodology, an equivalency table is used to determine peak demands for meters larger than 3/4-inches in diameter. For example, a 1-inch meter will discharge as much water as 2.2 3/4-inch meters; therefore, the SDC for a 1-inch meter is 2.2 multiplied by the SDC for a 3/4-inch meter.

II THE PROPOSED SDC

The city proposes to make three changes to the SDC.

1. Add a reimbursement fee to the SDC
2. Revise the 3/4-inch meter equivalents for 1-inch and larger meters
3. Assess multi-family developments based on the greater of the meter SDC or on the number of residential units

First, the City has expanded the waste water system. Since 1991, the city has made major capital improvements to the treatment plant, which it paid for by issuing a $4.1 million revenue bond in 1992. These improvements increased the treatment capacity from about 1.1 million gallons per day (mgd) to about 2.0 mgd. Now that the city has excess capacity, it can assess a reimbursement fee for completed projects, and an improvement fee for projects to be constructed after fiscal year 1995.

Second, the City will change the schedule of 3/4-inch meter equivalents by meter size. The current SDC is assessed according to size of water meter size, which is a rough measure of actual sewage generation. The Canby Utility Board (CUB), which operates the water system in Canby, recently analyzed water usage by meter size and found water usage by customers with large size meters (2-inches and larger) is more than shown in the current SDC schedule. Table 3 compares the current and proposed 3/4-inch meter equivalents, and the current SDC using both schedules of meter equivalencies.

Table 3
Current and Proposed 3/4-inch Meter Equivalents

	3/4 Meter Equivalents			Current Improvement Fee Based 3/4 Meter Equivalents		
Meter Size	Current	Proposed	% Current	Current	Proposed	% Change
3/4"	1	1	100%	$1,200	$1,200	0%
1"	2.2	2	91%	2,640	2,400	-9%
1 ½"	4.2	5	119%	5,040	6,000	19%
2"	6.4	10	156%	7,680	12,000	56%
3"	11.4	25	219%	13,680	30,000	119%
4"	18.2	35	192%	21,840	42,000	92%

Source: Raymond J. Bartlett, Economic & Financial Analysis. Curran-McLeod, Inc., and Canby Utility Board data.

Third, the CUB study established a basis for assessing multi-family developments according to either the number of residential units or the meter size. In winter months when outdoor watering is at a minimum, multi-family residents use about as much water as single-family residents on a 3/4-inch meter. The Census reports about the same number of persons per housing unit for multi-family as for single family, 2.72 persons/household and 2.78 persons/household. Therefore, a multifamily housing unit will produce about 98 percent as much sewage flow as a single family housing unit.

The proposed SDC accounts for the capital improvements made and to be made, the amount of water consumed by meter size, and the amount of water consumed by multi-family developments.

A. REIMBURSEMENT FEE

A reimbursement fee "...means a fee for costs associated with capital improvements already constructed or under construction." [ORS 223.314 (3)]. Tables 4 and 5 show the calculation of the reimbursement fee.

Table 4 shows the capital costs of the waste water system to be allocated to future development. The depreciated present value of the city's fixed assets in waste water facilities amounts to $4,938,682, see Table 4. In Appendix A we derive this value by inflating the original cost of the fixed assets in the waste water system and by subtracting accumulated depreciation. We inflate the depreciation to 1995 dollars. Also, Appendix A shows we eliminated all assets that have been in operation longer than their depreciable life.

In fiscal year 1995, the city completed a reevaluation of fixed assets in the sewer system. In its 1995 audit, the city's auditors found that "...fixed assets accounting records of the Sewer Fund did not agree with amounts reported in the previous year's audited financial statements." The audit goes on to say "...and, the City now has sufficiently detailed fixed assets accounting records supporting balances reported in the June 30, 1995, audited financial statements." The data for prior investments is incomplete. The city's new fixed assets accounting system specifically records only those facilities that the city staff could positively identify, dated, and valued. A review of those records show that most of the inventoried assets are at the treatment plant and at major pump stations in the collection system. The city did not include any of the collection system in the fixed assets records. To estimate the value of the collection system built by the city, the city's engineer provided a present value and year of construction for the three major sewer lines that they built with city sewer revenues. We depreciated these assets for years in service.

Since the city is currently using 53 percent of the sewage system, only 47 percent of the total value ($2,321,180) is used to calculate the reimbursement fee. The excess capacity amounts to 940,000 gallons per day of treatment capacity. The reimbursement fee is therefore, $2.469 per gallon per day of capacity (i.e., $2,321,180 / 940,000 gallons per day).

Table 4
Calculation of Proposed Reimbursement Fee

	Current $ Value, 1995	
Treatment Plant & Pump Stations, Net of Depreciation	$4,192,231	
Collection System, Net of Depreciation and Contrib. Capital	746,451	
Fixed Assets, Net of depreciation	4,938,682	
Current Usage	53%	1,060,000 mgd
Excess Capacity	47%	940,000 mgd
Total Available	100%	2,000,000 mgd
Value of Excess Capacity	$2,321,180	
Reimbursement Fee per Gallon	$2.469 $/gallon	
Reimbursement Fee per Cubic Foot	$18.472 $/cubic foot	
Average Daily Winter Water Usage, Single-family on 3/4-inch meter	28 cubic feet/day	
Reimbursement Fee, Single-family House, or 3/4" Meter	$520	

Source: City of Canby, Annual Financial Report for Fiscal Year 1995, and Appendix A, compiled by Raymond J. Bartlett, Economic & Financial Analysis.
Note: one cubic foot equals 7.48 gallons.

Single-family homes on a 3/4-inch water meter use an average of 841 cubic feet of water per winter month (November through April). At 7.48 gallons per cubic foot, the reimbursement fee for a single-family residence will be $520 ($2.469 x 7.48 g/cf x 841 cf/month / 30 days, and rounded to the nearest $10).

Table 5 shows the schedule of reimbursement fees by meter size and by multi-family residential unit. In a study of water consumption by commercial and multi-family customers, CUB determined the equivalent amount of water each size meter used compared with a 3/4-inch meter. Also, the study showed that whatever meter size, the average multi-family housing unit uses about 98 percent as much water as a single family housing unit.

Since 1991, the city has determined the waste water SDC on meter size. From CUB's findings, however, Canby proposes to assess its waste water reimbursement fee on new multi-family developments as the greater of meter size or number housing units. Also, for additions to existing multi-family developments, the city will assess the per unit SDC for each new housing unit.

Table 5
Proposed Reimbursement Fee

Meter Size	Proposed Equivalent 3/4" Meters	Proposed Reimbursement Fee By Meter Size	By M-F Unit 98%
3/4"	1	$520	$509
1"	2	1,040	509
1 ½"	5	2,600	509
2"	10	5,200	509
3"	25	13,000	509
4"	35	18,200	509

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Note: Canby Utility Board determined 3/4" meters equivalents from actual usage by meter size. According to the 1990 Census, multiple-family residences have about as many persons per household (PPH) as single-family: 2.72 persons to 2.78 persons.

B. IMPROVEMENT FEE

Table 6 shows the list of future capital improvements and their cost in 1996 dollars. The city needs these improvements to fully realize the increase in treatment capacity to 2 mgd. Each project is allocated according to benefit to existing and future development. Only that portion allocated to future development is used to calculate the improvement fee. All of the projects except the new *Aeration Basin & Support Facilities* are allocated based on the percentage of unused capacity in the treatment plant (47 percent). Existing development will use 53 percent of these proposed improvements. The *Aeration Basin & Support Facilities* will be built only if needed and only to benefit future development, therefore, 100 percent of its cost is used to calculate the improvement fee.

The sum of the capital costs on the capital improvements list allocated to future development ($2,251,930) divided by the quantity of unused and future capacity (940,000 gallons per day) equals the improvement fee per gallon of usage per day, $2.396. Based on average household use of 841 cubic feet per month, the improvement fee per housing unit on a 3/4-inch meter is $500 ($2.396/gallon/day x 7.48 cf / gallon x 841cf / month x 30 days). This amount also applies to single-family residents on a 3/4-inch meter.

Table 7 compares the current and proposed improvement fees, and calculates the improvement fee based on meter size or on the number of housing units in a multiple-family building. Currently, Canby applies the improvement fee based only on meter size. Based on the CUB demand analysis, multi-family developments will be assessed as the greater of meter size or of number of residential units. The city will assess the improvement fee for non-residential developments (or residential developments on meters larger than 3/4-inch) based on CUB's determination of average usage by meter size, also shown in Table 7.

Table 6
Capital Improvements List and Calculation of Waste Water Improvement Fee

List of Capital Improvements	Total Costs	Attributable To New Development $	Attributable To New Development %
UV Basin Cover	$45,000	$21,150	47%
Additional Covers & Odor Control	240,000	$112,800	47%
Sludge Dewatering Facilities	500,000	$235,000	47%
Screening Compactor & Dewatering	25,000	$11,750	47%
New Aeration Basin & Support Facilities	1,820,000	$1,820,000	100%
System Planning	109,000	$51,230	47%
Total	$2,739,000	$2,251,930	82%
	Gallons/day		
Used Capacity	1,060,000		
Excess Capacity	940,000		
Total Capacity	2,000,000		
Improvement Fee			
Per Gallon of ADW Flow		$2.396	
Per Cubic Foot		$17.921	
Improvement Fee; Single-Family House, 3/4" Meter		$500	

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Table 7
Current and Proposed Improvement Fee by Meter Size, by Number of Residential Units

Meter Size	Proposed Equivalent 3/4" Meters	By Meter Size Improvement Fee Existing	Proposed	By M-F Unit 98%	Change $	%
3/4"	1	$1,200	$500	$489	($700)	-58%
1"	2	2,626	1,000	489	(1,626)	-62%
1 ½"	5	4,989	2,500	489	(2,489)	-50%
2"	10	7,646	5,000	489	(2,646)	-35%
3"	25	13,714	12,500	489	(1,214)	-9%
4"	35	21,796	17,500	489	(4,296)	-20%

Source: Raymond J. Bartlett, Economic & Financial Analysis.
Note: Meter equivalents are based on CUB figures.

C. IMPROVEMENT FEE CREDIT POLICY

The SDC statutes require the city to have a credit policy for the improvement fee (but not for the reimbursement fee). Usually, when a developer builds an improvement on the list of capital improvements used to create the improvement fee (shown on Table 6), then the city must credit the developer for the cost of making the improvement. The credit reduces the amount of the improvement fee owing on the development.

A capital improvement must meet three conditions to qualify for a credit.

First, the improvement must be on the list of capital improvements for SDC funding (Table 6). If it is not on the list then it does NOT qualify for a credit.

Second, the city must require the public improvement to be built as a condition of development approval. That is, the city must specifically state to the developer (preferably in writing) that unless the developer builds the improvement, the city will deny the proposed development permits to build.

Third, the public improvement (or portions of it) must either be off-site of the proposed development, or on-site but with excess capacity.

Two criteria determine the value of the credit. First only the cost of that portion of the improvement that exceeds the minimum standard facility size or capacity needed by the development can count toward the credit. Second, the total value of the credit cannot exceed the amount of the improvement fee, unless the city takes extraordinary actions.

When the credit exceeds the improvement fee, then the government may (but it does not have to provide for any further credit) apply the remainder against subsequent phases of the original development. Also, the statute ". . . shall not prohibit a unit of government from providing a greater credit, or from establishing a system providing for the transferability of credits, or from providing a credit for a capital improvement not identified in the plan [meaning those shown on Table 6], or from providing a share of the costs of such improvement by other means, if a unit of government so chooses." [ORS 223.304 (4)(b)] If the city uses these extraordinary credits indiscriminately, then the SDC will become a very inequitable charge on those who do pay it. If it uses these credits excessively, then it destroys the revenue producing purposes of the SDC.

Since all of the improvements shown on Table 6 involve the treatment plant, which private developers are unlikely to build, no credits likely will be given for the current or proposed SDC. Generally, in waste water systems the only type of improvement credit is when the list of capital improvements includes portions of the collection system and a developer builds a part of these improvements. Then only for the over-sizing of the lines.

III USES OF SDC REVENUES

SDC revenues can be used only for capital improvements. The city may use the reimbursement fee revenues on any sewer related capital expenditure including replacement of existing facilities, purchase of new facilities, and repayment of indebtedness.

The improvement fee revenues cannot be spent to replace existing facilities. They may be spent on purchasing new facilities that increase either performance or service provided by existing facilities, or to acquire new facilities, or on indebtedness used to purchase those facilities. Also, these revenues must be spent such that ". . .The portion of such improvements funded by the improvement fees must be related to current or projected development." [ORS 223.307 (2)] For example, since only 47 percent of the cost of the proposed UV Covers is included in the SDC improvement fee, then only 47 percent of the cost should be paid for with improvement fee revenues. The remaining 53 percent must come from other sources such as user fee revenues.

The revenues from either fee cannot be used to pay for administrative buildings unless it is an incidental cost of a larger sewer improvement. The city can use any SDC revenues to pay the cost of developing and administering the SDC program.

Beyond these legislated restrictions on the uses of SDC revenues, the City pledged its SDC revenues to repayment of its 1992 Series Sewer Revenue Bonds (Resolution No. 521, *Authorizing the issuance of Sewer Revenue Bonds, Series 1992).* While these bonds are outstanding (through year 2018), the city pledges to use the gross revenues of the sewer system, including revenues from systems development charges, ". . . to the payment of principal and interest on all Bonds." [Resolution No. 521, Section 10 page 18] Resolution No. 521 goes on to stipulate that only after meeting all of its operating and maintenance costs, debt service on the bonds, funding of a reserve account, and other bond-related expenses, can the net revenues of the system be used for any other purposes.

IV SUMMARY OF CHANGES

We propose three changes for the SDC. First, the city creates an improvement fee and decreases the current reimbursement fee. When we made the current SDC findings, the city had no excess treatment capacity on which to develop a reimbursement fee. Since then, the city has made significant improvements in the treatment plant and expanded its capacity. As a result the value of the improvements and the excess capacity allow for a reimbursement fee.

The second change is in how the city will apply the SDC. We have changed the number of 3/4-inch meter equivalents for 1-inch and larger water meters to averages developed by the Canby Utility Board that operates the water system. Also, since multi-family housing units use about 98 percent as much water as single-family units on a 3/4-inch water meter in winter, the SDC for multi-family developments will be based on the number of housing units or the meter size, whichever is greater.

Third, the current SDC does not include any portions of the collection system in the improvement fee. In the proposed reimbursement fee, we include those portions of the collection system that the city built.

Table 7 summarizes the current and proposed SDC by meter size. The total SDC for 3/4-inch, 1-inch, and 1 ½-inch meter sizes installed in single-family residential and non-residential commercial developments will decrease from the current SDC. The total SDC for 2-inch and larger size meters will increase for these types of development The proposed changes result for two reasons. First, the planned capital improvements in the current SDC cost less to construct than had been expected. Second, the CUB water demand study shows that customers on large-size meters (2-inches and larger) consume more water than had been known when we formulated the current SDC. As a result, the cost of a 3/4-inch meter equivalent shifts from small-size to larger-size meters.

For multi-family developments the proposed SDC may increase or decrease from the current SDC depending upon the size meter installed and the number of units in a proposed development. For example, a 28-unit apartment complex with a 2-inch water meter would pay $7,646 currently. Using the proposed SDC by number of units, the development would pay $27,944 (i.e., $998/unit x 28 units). A duplex on a 1-inch meter would pay $2,626 currently, and only $1,980 using the proposed SDC for a 1-inch meter. Notice that the city assesses the SDC as the greater of the meter size or number of units. For a duplex on a 1.5-inch meter, the SDC by meter size is greater than the SDC by number of units.

APPENDIX

Notes to the Appendix:
Following is an itemized list of fixed assets currently in use by the waste water utility. For each asset, the columns show the year installed, the original acquisition cost, the 1995 book value (i.e., the original cost minus accumulated depreciation), the expected life, the replacement value in 1995 dollars, and the depreciated value in 1995 dollars. We determined the 1995 dollar value by applying the Construction Cost Index provided by the *Engineering News Record* using January of each year. The following equation determines the depreciated value in 1995 dollars.

$$\textit{Depreciated Value 1995 \$'s} = \frac{\textit{Replacement Value}}{\textit{Expected Life x (1995 - Year Installed)}}$$

Because the data used in the 1995 audit were updated since the beginning of fiscal year 1996, we had to adjust the totals in the appendix by reducing the amount 1.1 percent. We show the correction at the end of the Appendix table.

Since the auditors included none of the collection system in the 1995 audit, we estimated these values separately at the end of the Appendix table. We include only three major sewer lines. The city's consulting engineers estimated the replacement cost of these lines in 1995 dollars, determined the year installed, and we depreciated the replacement costs by the number of years in services.

Construction Cost Index as of January,

1947	0.368	1957	0.661	1967	0.971	1977	2.322	1987	4.0441
1948	0.411	1958	0.695	1968	1.035	1978	2.488	1988	4.1585
1949	0.442	1959	0.727	1969	1.136	1979	2.674	1989	4.2575
1950	0.45	1960	0.759	1970	1.222	1980	2.915	1990	4.35
1951	0.5	1961	0.78	1971	1.369	1981	3.139	1991	4.4475
1952	0.51	1962	0.799	1972	1.556	1982	3.449	1992	4.5508
1953	0.546	1963	0.825	1973	1.711	1983	3.687	1993	4.7206
1954	0.571	1964	0.858	1974	1.806	1984	3.825	1994	4.9674
1955	0.599	1965	0.886	1975	1.958	1985	3.853	1995	5.0673
1956	0.632	1966	0.923	1976	2.142	1986	3.9151	1996	5.1418

Source: Data Resources Incorporated, *Engineering News Record.*

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
CENCO Model 95470-16	1984	$224.65	$0.00	10	302	0
HACH - Model 2300	1992	$2,000.00	$1,600.00	10	2,260	1,582
Corning - pH/Ion	1984	$299.53	$0.00	10	403	0
Blue M Model DV-5000-2	1992	$2,000.00	$1,600.00	10	2,260	1,582
Electromantle -MA	1990	$234.50	$140.70	10	277	139
Hanna Model 8733	1988	$83.37	$33.35	10	103	31
OHAUS Port-O-Gram Model # C301P	1990	$281.40	$168.84	10	333	166
HACH Model 41100-52	1988	$166.75	$66.70	10	206	62
CENCO Model 34532-1	1984	$112.32	$0.00	10	151	0
EIMCO	1977	$242.72	$0.00	15	537	0
ISCO Model 2700	1987	$2,570.59	$1,370.98	8	3,268	0
Primary Clarifier, Equipment	1980	$60,500.00	$38,028.57	35	106,717	60,981
Furnas, PC Vault	1982	$7,904.92	$1,580.98	15	11,785	1,571
Furnass	1987	$7,568.00	$4,036.27	15	9,622	4,490
Walles & Turnan 44-11	1987	$2,788.00	$1,486.93	15	3,545	1,654
AQUA-Aerobic FS0015	1982	$17,965.73	$3,593.15	15	26,783	3,571
AQUA-Aerobic FS0015	1982	$17,967.73	$3,593.55	15	26,786	3,572
G E - Motor Control Center	1972	$11,342.45	$0.00	15	37,481	0
Hydromatic 40 MPV - AB Recirc.	1972	$4,000.00	$0.00	15	13,218	0
Portable Generator, 85 KVA, 850KR1R	1972	$36,000.00	$0.00	15	118,962	0
Hydromatic Trash Pump, 40EP-VH4D	1982	$10,000.00	$2,000.00	15	14,908	1,988
7MV-B	1987	$8,568.62	$4,569.93	15	10,894	5,084
6MV-B	1987	$6,426.47	$3,427.45	15	8,171	3,813
6MV-B	1987	$5,000.00	$2,666.67	15	6,357	2,967
ISCO Model 2100	1982	$2,155.89	$431.18	15	3,214	429
Homelite Model 662	1992	$1,800.00	$1,560.00	15	2,034	1,627
EMPAC - 386	1992	$1,700.00	$1,020.00	5	1,921	768
Viewsonic - color	1992	$450.00	$270.00	5	508	203
Panasonic KXP1180	1992	$275.00	$165.00	5	311	124
Metal Double Pesestal	1987	$465.79	$302.76	20	592	355
Power Distribution Bldg. Structure	1971	$44,000.00	$15,085.71	35	165,259	51,938
Power Distribution Bldg, Miss Equip.	1994	$153,657.55	$143,413.71	15	159,052	148,449
Ded. $2000 from Canby Ex Final Paym	1995	$2,720.40	$2,720.40	35	2,760	2,760
Sink & Eyewash Install - P&L	1995	$247.00	$247.00	10	251	251
Eyewash Install - RAS Cl2	1995	$413.58	$413.58	10	420	420
RP-BP Install	1995	$213.00	$213.00	10	216	216
Intrusion/Smoke System	1995	$619.50	$619.50	7	629	629
Sludge Pump Controler	1995	$440.02	$440.02	5	446	446
Air Dryer/Controler - Bar Scr.	1995	$224.16	$224.16	5	227	227
Desks,Chairs, etc For New Office	1995	$3,195.04	$3,195.04	10	3,242	3,242
Map Folder	1995	$289.00	$289.00	25	293	293
IDE Controler Card	1995	$35.00	$35.00	3	36	36
CPU Fan-2	1995	$50.00	$50.00	3	51	51
Mini-Tower Case	1995	$60.00	$60.00	3	61	61
Fan & CMOS battery	1995	$65.00	$65.00	3	66	66
New Cables, Connectors	1995	$100.00	$100.00	5	101	101
Network Interface Card	1995	$125.00	$125.00	5	127	127
Inst/Engin Labofor Upgrade Digiboard	1995	$130.00	$130.00	3	132	132
Novell Connect 1.0 SW, Install & Prg	1995	$2,000.00	$2,000.00	3	2,029	2,029
486DX2-66 Mother board	1995	$195.00	$195.00	3	198	198
Reachout Modem Host & Viewer	1995	$199.00	$199.00	3	202	202
4 MEG Memory Upgrade HP4 printer	1995	$220.00	$220.00	5	223	223
Backup Tapes - DAT	1995	$225.00	$225.00	3	228	228
Installation & Eng. For Tape Backup	1995	$260.00	$260.00	5	264	264
4 MEG RAM memory	1995	$260.00	$260.00	5	264	264
Eng/Labor install Backup System	1995	$260.00	$260.00	3	264	264
Phone/FAX\Modem switch	1995	$280.00	$280.00	3	284	284
Reachout Network (4-User)	1995	$295.00	$295.00	3	299	299
CD ROM Drive	1995	$330.00	$330.00	3	335	335
Modem 28.8 Microcom	1995	$375.00	$375.00	3	381	381
Faxserve For Novell (5 user)	1995	$650.00	$650.00	3	660	660
Novell 4.12 - File Server - Main	1995	$650.00	$650.00	3	660	660
Upgrade DigiBoard	1995	$675.00	$675.00	3	685	685

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
12 MEG RAM memory	1995	$780.00	$780.00	3	791	791
28.8 Modem (Microcom)	1995	$500.00	$500.00	3	507	507
28.8 Modem (Microcom)	1995	$500.00	$500.00	3	507	507
ProComm +, Install & Program	1995	$1,000.00	$1,000.00	3	1,015	1,015
DOS 6.22, Windows for Work Groups	1995	$1,200.00	$1,200.00	3	1,218	1,218
Engineering/Labor	1995	$2,400.00	$1,200.00	3	2,435	2,435
Norton AntiVirus for Netware + inst	1995	$1,200.00	$1,200.00	3	1,218	1,218
SCSI Hard Drive	1995	$1,660.00	$1,660.00	3	1,684	1,684
2 Gig Tape Backup system	1995	$1,825.00	$1,825.00	3	1,852	1,852
Modem Setup, NW Connect User Setup	1995	$2,325.00	$2,325.00	3	2,359	2,359
Transfer Switch & Breaker	1995	$8,446.00	$8,446.00	10	8,570	8,570
Phase I Bond Construction	1994	$1,484.00	$1,441.60	35	1,536	1,492
Rebuild Sec. Generator & Electrical	1995	$9,272.17	$9,272.17	15	9,408	9,408
Phase I Bond Construction Liq Damag	1994	$3,480.00	$3,380.57	35	3,602	3,499
Sec. Generator Startup & Voltage Set	1995	$257.78	$257.78	15	262	262
Workshop Manual	1995	$31.35	$31.35	15	32	32
Phase I Bond Construction	1994	$1,161.00	$1,161.00	35	1,202	1,167
Engineering Services KB Lift Station	1995	$3,264.00	$3,264.00	35	3,312	3,312
Engineering Services Phase I Design	1995	$1,161.00	$1,161.00	35	1,178	1,178
Engineering Services KB Lift Station	1995	$500.00	$500.00	15	507	507
Engineering Services KB Lift Station	1995	$76.00	$76.00	35	77	77
Engineering Services KB Lift Station	1995	$446.00	$446.00	35	453	453
Engineering Services KB Lift Station	1995	$742.00	$742.00	25	753	753
Secondary Gen. Transfer SW Design	1995	$304.00	$304.00	15	308	308
Secondary Gen. Transfer SW Design	1995	$494.00	$494.00	15	501	501
Secondary Gen. Transfer SW Design	1995	$212.00	$212.00	15	215	215
Engineering Services KB Lift Station	1995	$1,484.00	$1,484.00	35	1,506	1,506
Engineering Services KB Lift Station	1995	$1,484.00	$1,484.00	35	1,506	1,506
ISE NH3-N Probe	1995	$393.75	$393.75	3	400	400
New BOD Incubator	1995	$2,463.00	$2,463.00	15	2,499	2,499
Analyitical Balence	1995	$2,667.17	$2,667.17	10	2,706	2,706
Eye Wash station	1995	$196.28	$196.28	15	199	199
7' Aluminum Tri-Pod	1995	$650.00	$650.00	7	660	660
2752-G50 Extractor II	1995	$1,950.00	$1,950.00	7	1,979	1,979
SP2 UPS	1995	$100.00	$100.00	5	101	101
SP1 UPS Backup	1995	$260.00	$260.00	5	264	264
#4 Swing Top Receptacle (3)	1995	$278.43	$278.43	15	283	283
Torpedo Receptable(1)	1995	$92.05	$92.05	25	93	93
D33H8 Discharge Silencer #4 Blower	1995	$1,285.43	$1,285.43	15	1,304	1,304
7MLV-BHC Blower	1995	$4,160.93	$4,160.93	7	4,222	4,222
Control Switch - Replacement	1995	$48.00	$49.00	5	49	49
Input/Output Card - SP2	1995	$798.22	$798.22	5	810	810
Controller SP2 & PW Pump Controls	1995	$195.00	$195.00	5	198	198
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
PLC & WW Control Engineering	1995	$215.83	$119.17	15	219	219
N- Clarifier SB Monitor Remote -W W	1995	$130.00	$130.00	10	132	132
S- Clarifier SB Monitor Remote -W W	1995	$130.00	$130.00	10	132	132
Eff. Totalizer PCL Prog for WW	1995	$195.00	$195.00	15	198	198
TS Pump PID Control to SP2	1995	$195.00	$195.00	15	198	198
3PSS Poly Valve Feed Control	1995	$334.00	$334.00	5	339	339
GE 90-20 PLC Spare	1995	$613.20	$613.20	5	622	622
WonderWare Upgrade & Install	1995	$4,570.00	$285.00	15	4,637	4,637
RAS Pump WW Programing (PLC)	1995	$455.00	$455.00	15	462	462
WW Prg Totalizer from SP2/Batchmate	1995	$650.00	$650.00	15	660	660
WW Prg LS Remote Control-HR Meters	1995	$715.00	$715.00	15	726	726
RAS VFD #1 Remote Control	1995	$750.00	$750.00	15	761	761
RAS VFD #2 Remote Control	1995	$750.00	$750.00	15	761	761
Water Service Alarm/Shut Off	1995	$785.00	$785.00	15	797	797
GE Advantage Motor Starter	1995	$789.10	$789.10	15	801	801

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
UV lamp Module Cleaning Tank	1995	$1,250.00	$1,250.00	15	1,268	1,268
GE9030 240 Card, Rem. Reset RAS Pump	1995	$798.22	$798.22	15	810	810
Blower Control/Alarm Prg/Engineer	1995	$981.25	$981.25	15	996	996
2 GE Advantage Starters -New/Install	1995	$1,165.70	$1,115.70	15	1,183	1,183
2 GE Advantage Starters -New/Install	1995	$1,165.70	$1,115.70	15	1,183	1,183
Remote Control Programing	1995	$1,495.00	$1,495.00	15	1,517	1,517
Remote Control Programing	1995	$1,495.00	$1,495.00	15	1,517	1,517
Remote Control Programing	1995	$1,495.00	$1,495.00	15	1,517	1,517
RAS Mannual Controller Build&Instal	1995	$2,209.69	$2,209.69	15	2,242	2,242
Remote Control Programing	1995	$1,495.00	$1,495.00	15	1,517	1,517
GE 90-30 Anag Cards -RAS Pump Contr	1995	$1,214.00	$1,214.00	5	1,232	1,232
Window Blinds for Cont Rm & Lab	1995	$994.00	$994.00	35	1,009	1,009
Starter Rewind to 24V Sec Gen Conv	1995	$310.00	$310.00	10	315	315
AD50-UL-C Air Compress Refrig Unit	1995	$1,490.00	$1,490.00	15	1,512	1,512
Knott St. Sewer Repair	1995	$3,721.57	$0.00	0	3,776	0
Safety Signs	1995	$666.95	$666.95	15	677	677
KB LS Pump #2 Rebuild	1995	$1,681.00	$1,681.00	15	1,706	1,706
Rebuild PS DD Pump	1995	$1,711.35	$1,711.35	10	1,737	1,737
Phase I Bond Construction	1994	$135,281.40	$131,416.22	35	140,031	136,030
Rebuild Pump #1	1995	$1,090.00	$1,090.00	10	1,106	1,106
Rebuild Pump #2 SCLS	1995	$1,486.00	$1,486.00	10	1,508	1,508
Start/Stop Switch P&L	1995	$80.00	$80.00	10	81	81
Start/Stop Switch P&L	1995	$80.00	$80.00	10	81	81
Cover for Secondary Generator	1995	$2,411.00	$2,411.00	35	2,446	2,446
Install VFD for SS Trans Pump	1995	$2,261.67	$2,261.67	15	2,295	2,295
Wiring Upgrade	1995	$103.40	$103.40	35	105	105
Wiring Upgrade	1995	$298.52	$298.52	35	303	303
Wiring Upgrade	1995	$342.41	$342.14	35	347	347
Wiring Control Upgrade	1995	$423.36	$423.36	35	430	430
Wiring Upgrade - Blower Alarm/Crtl	1995	$816.57	$816.57	35	829	829
WT60W White Wastebaskets (4)	1995	$85.08	$85.08	15	86	86
Diffuser Replacement Parts	1995	$250.00	$250.00	8	254	254
RAS Pump Reset Relays & Calibrate	1995	$251.00	$251.00	5	255	255
Water Service Pump Replacement	1995	$1,588.00	$1,588.00	10	1,611	1,611
Water Service Pump Replacement	1995	$1,036.67	$1,036.67	10	1,052	1,052
Phase I Improvments -Final Payment	1995	$135,281.40	$135,281.40	35	137,270	137,270
Phase I Improvments - Landscaping BD	1995	$315.00	$315.00	35	320	320
Cabnet work in Control Bldg.	1995	$950.00	$950.00	35	964	964
YSI	1994	$900.00	$810.00	10	932	838
34th Street, Structure	1993	$24,000.00	$23,314.29	35	26,141	24,648
34th Street, Equipmemt	1993	$15,000.00	$14,000.00	15	16,338	14,160
Willow Creek, Structure	1993	$15,000.00	$14,571.43	35	16,338	15,405
Willow Creek, Equipmemt	1993	$15,000.00	$14,000.00	15	16,338	14,160
Knights Bridge, Structure	1964	$20,000.00	$2,857.14	35	119,855	13,698
Knights Bridge, Equipment	1964	$8,000.00	$0.00	15	47,942	0
Shopping Center, Structure	1975	$8,000.00	$3,657.14	35	21,008	9,004
Shopping Center, Equipment	1975	$8,000.00	$0.00	15	21,008	0
3rd & Baker Drive, Structure	1970	$8,000.00	$2,514.29	35	33,662	9,618
3rd & Baker Drive, Equipmemt	1970	$8,000.00	$0.00	15	33,662	0
11th & Pine LS, Structure	1980	$8,000.00	$4,800.00	35	14,111	8,064
11th & Pine LS, Equipment	1980	$8,000.00	$0.00	15	14,111	0
Headworks/ Control Bldg. - Structure	1994	$286,000.00	$281,600.00	65	296,041	291,487
Headworks/ Control Bldg. - Equipment	1994	$78,000.00	$72,800.00	15	80,738	75,356
Lab, Structure	1984	$57,200.00	$40,857.14	35	76,892	52,726
Primary Sludge Vault, Structure	1981	$80,000.00	$50,285.71	35	131,043	78,626
Primary Sludge Vault, Equipment	1984	$29,000.00	$9,666.67	15	38,984	10,396
Primary Clarifier, Structure	1981	$121,000.00	$76,057.14	35	198,203	118,922
Aeration Basin, Structure	1970	$220,000.00	$205,168.54	35	925,692	264,484
Aeration Basin, Equipment	1970	$66,500.00	$0.00	15	279,812	0
Secondary Clarifier-N, Structure	1994	$176,000.00	$170,971.43	35	182,179	176,974
Secondary Clarifier - S, Structure	1994	$176,000.00	$170,971.43	35	182,179	176,974
RAS Pump Station, Structure	1994	$35,200.00	$34,194.29	35	36,436	35,395
RAS Pump Station, Equipment	1994	$1,000.00	$933.33	15	1,035	966

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
UV Basin, Structure	1994	$132,000.00	$128,228.57	35	136,634	132,731
UV Basin, Equipment	1994	$165,000.00	$154,000.00	15	170,793	159,407
Stabilized Sludge Tank Structure	1970	$165,000.00	$51,857.14	35	694,269	198,363
DFlow,403-3D-DI, Equipment PUMP	1994	$25,000.00	$23,333.33	15	25,878	24,153
MUltiranger Plus- PL313	1994	$2,500.00	$2,250.00	10	2,588	2,329
Wash Tank, Structure	1971	$88,000.00	$30,171.43	35	330,517	103,877
Wash Tank, Equipment	1994	$32,000.00	$29,866.67	15	33,123	30,915
North Storage Pond	1994	$66,000.00	$64,114.29	35	68,317	66,365
Storage Ponds, Equipment	1994	$11,000.00	$10,685.71	35	11,386	11,061
South Storage Pond	1994	$66,000.00	$64,114.29	35	68,317	66,365
Blower Building, Structure	1986	$35,200.00	$27,154.29	35	46,229	34,342
Blower Building, Equipment	1987	$66,000.00	$35,200.00	15	83,915	39,160
Flamable Storagre, Structure	1980	$15,400.00	$9,240.00	35	27,164	15,522
Solids Handling Building, Structure	1994	$198,000.00	$192,342.86	35	204,952	199,096
Lime Silo, Structure	1994	$99,000.00	$94,050.00	20	102,476	97,352
Lime Silo, Equipment	1994	$16,500.00	$15,400.00	15	17,079	15,941
Gas Storage Shed - Hoses & Tools	1982	$2,000.00	$1,314.29	35	2,982	1,874
Empac - 486-33	1994	$3,000.00	$2,400.00	5	3,105	2,484
Barnstead, A-1013-M8116268	1985	$1,506.00	$0.00	10	2,010	0
4 Object, UNILUX, KYOWA	1989	$2,800.00	$1,400.00	10	3,382	1,353
DO Meter, YSI - F9103634	1989	$1,150.00	$575.00	10	1,389	556
Wheaton, Model 8000	1992	$2,437.00	$1,949.60	10	2,753	1,927
Kenmore, Model 15.1	1985	$1,163.84	$465.54	15	1,553	518
Low Temp Hotpoint, Model 46-04502	1988	$3,095.00	$1,238.00	10	3,827	1,148
YSI, 54A - 10957	1994	$575.00	$517.50	10	595	536
Thermolyne, Model 1500	1985	$1,223.00	$0.00	10	1,632	0
Corning, Model 255 -2503	1993	$2,900.00	$2,610.00	10	3,159	2,527
IEC Clinical	1986	$595.62	$119.12	10	782	78
All American, Model 25X	1993	$350.00	$315.00	10	381	305
Lab Conco	1985	$1,223.00	$0.00	10	1,632	0
Boekel	1985	$355.69	$0.00	10	475	0
Euathern, Model 213-116	1991	$515.90	$361.13	10	596	358
Mettler, Model H31AR	1985	$2,800.00	$0.00	10	3,737	0
000M385619	1994	$3,500.00	$2,800.00	5	3,623	2,898
Panasonic, Model KX-p1191	1990	$430.00	$0.00	5	508	0
VWR, Model SA55NNXGITC	1985	$1,500.72	$0.00	10	2,003	0
Acid Storage	1991	$562.80	$393.96	10	651	390
GAS TEK	1991	$2,063.58	$1,444.51	10	2,386	1,431
GE, Model P5Crr56CEN	1994	$1,470.14	$1,323.13	10	1,522	1,370
GE 8000 Line	1994	$25,000.00	$22,500.00	10	25,878	23,290
SP1	1994	$35,000.00	$31,500.00	10	36,229	32,606
RS Pump #1	1994	$15,000.00	$13,500.00	10	15,527	13,974
RS Pump #2	1994	$15,000.00	$14,000.00	15	15,527	14,492
RS Pump #3	1994	$15,000.00	$13,500.00	10	15,527	13,974
Vulcan, Mechanical	1994	$20,000.00	$18,000.00	10	20,702	18,632
Vulcan	1994	$10,000.00	$9,000.00	10	10,351	9,316
Sampler, 800SL, Model 3000-INF	1994	$3,200.00	$2,880.00	10	3,312	2,981
Ultra Sonic OCM III, Flow Meter -INF	1994	$2,500.00	$2,250.00	10	2,588	2,329
HW, Purafil	1994	$25,000.00	$22,500.00	10	25,878	23,290
Smith & Loveless	1994	$20,000.00	$18,000.00	10	20,702	18,632
Goodman, Model 15	1994	$13,000.00	$11,700.00	10	13,456	12,111
Mitac, 486-66	1994	$4,500.00	$3,600.00	5	4,658	3,726
Royal	1994	$900.00	$720.00	5	932	745
HP Laserjet IV	1994	$1,800.00	$1,440.00	5	1,863	1,491
Mitac - 486-66	1994	$4,500.00	$3,600.00	5	4,658	3,726
GS24X8DA	1994	$1,300.00	$1,213.33	15	1,346	1,256
Whirlpool, Model MH7100ZYB-0	1994	$400.00	$373.33	15	414	386
Hotpoint	1994	$500.00	$466.67	15	518	483
Hotpoint	1994	$500.00	$466.67	15	518	483
Barnstead Nanopure, Model D4744	1994	$2,900.00	$2,610.00	10	3,002	2,702
Royce Interface Level, Model 2511	1994	$5,000.00	$4,500.00	10	5,176	4,658
Royce Interface Level, Model 2500	1994	$5,000.00	$4,500.00	10	5,176	4,658
Kaman, RAS Pump Control	1994	$7,000.00	$6,300.00	10	7,246	6,521

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
Kaman	1994	$7,000.00	$6,300.00	10	7,246	6,521
Secondary Clarifier Drive, North	1994	$45,000.00	$42,000.00	15	46,580	43,475
Secondary Clarifier N - Equipment	1994	$40,000.00	$36,000.00	10	41,404	37,264
Secondary Clarifier Drive, South	1994	$45,000.00	$40,500.00	10	46,580	41,922
Secondary Clarifier S Equipment	1994	$40,000.00	$36,000.00	10	41,404	37,264
Model 200 DFAA Generator	1994	$45,000.00	$40,500.00	10	46,580	41,922
OT400 Switch Gear	1994	$15,000.00	$13,500.00	10	15,527	13,974
GE 8000, Model 4-948997	1994	$20,000.00	$18,000.00	10	20,702	18,632
RS Pump Hoist, Model 5334	1994	$1,500.00	$1,350.00	10	1,553	1,397
Milltronics OCM III Ultra Sonic	1994	$2,500.00	$2,250.00	10	2,588	2,329
Sampler - Influent, Model 300	1994	$3,000.00	$2,700.00	10	3,105	2,795
American Sigma Samp. Enclosure	1994	$500.00	$450.00	10	518	466
Budget, 1/2 Ton Overhead Crane	1994	$4,600.00	$4,293.33	15	4,762	4,444
7 Station Comdial Phone System	1994	$4,500.00	$4,050.00	10	4,658	4,192
SandPiper	1994	$8,000.00	$7,200.00	10	8,281	7,453
2- Hydrostal, Model D4K-S-DOS	1994	$15,000.00	$13,500.00	10	15,527	13,974
Clarifier Alge Brushes	1994	$8,500.00	$7,650.00	10	8,798	7,919
Clarifier Alge Brushes	1994	$8,500.00	$7,650.00	10	8,798	7,919
PolyBlend, Stranco, Model 10-4.5	1994	$5,000.00	$4,500.00	10	5,176	4,658
Lightrin Dara Mix, Model E77R3026T	1994	$750.00	$675.00	10	776	699
Chem Taner Tank	1994	$2,000.00	$1,800.00	10	2,070	1,863
Chem Taner Tank	1994	$2,000.00	$1,800.00	10	2,070	1,863
Borneman Pump, Model EH675-P1	1994	$10,000.00	$9,000.00	10	10,351	9,316
Borneman Pump, Model EH-236-P1	1994	$10,000.00	$9,000.00	10	10,351	9,316
Wet Sludge Loadout	1994	$25,000.00	$22,500.00	10	25,878	23,290
DF TSTP, Model 403-2D-D1	1994	$27,000.00	$24,300.00	10	27,948	25,153
Eimco, 2 Meter GBT	1994	$110,000.00	$99,000.00	10	113,862	102,476
Wemco Hydrostal, Model D4X-DE3A4	1994	$12,000.00	$10,800.00	10	12,421	11,179
Kaman, RAS Pump Control	1994	$8,500.00	$7,650.00	10	8,798	7,919
Kaman, PPC	1994	$8,500.00	$7,650.00	10	8,798	7,919
Kaman, LP	1994	$8,500.00	$7,650.00	10	8,798	7,919
Kaman, TSP	1994	$8,500.00	$7,650.00	10	8,798	7,919
Process Water Pump	1994	$4,000.00	$3,600.00	10	4,140	3,726
Process Water Pressure Tank	1994	$3,000.00	$2,700.00	10	3,105	2,795
DFlow, TSTP, 403-2D-D1	1994	$25,000.00	$22,500.00	10	25,878	23,290
SP-2 Panel, GE 90-30 PLC	1994	$8,000.00	$7,200.00	10	8,281	7,453
STSP, VFD	1994	$8,500.00	$7,650.00	10	8,798	7,919
Pond Trans Pump, Model 403-3D-D1	1994	$25,000.00	$22,500.00	10	25,878	23,290
Pond transfer Bldg. - Structure	1994	$5,000.00	$4,857.14	35	5,176	5,028
Para Fil Air Scrubber	1994	$25,000.00	$22,500.00	10	25,878	23,290
Anoxic Zone Mixer	1994	$5,000.00	$4,500.00	10	5,176	4,658
Desk & Chair	1994	$435.00	$391.50	10	450	405
Desk/chair, 36x72	1994	$1,060.00	$1,007.00	20	1,097	1,042
Bookcase/Oak	1994	$299.00	$284.05	20	309	294
Filing Cabnet	1994	$127.00	$120.65	20	131	125
Filing Cabnet	1994	$127.00	$120.65	20	131	125
Map Hanger	1994	$289.00	$274.55	20	299	284
Table & Chairs, 42x42	1994	$510.00	$484.50	20	528	502
Furnas, PS Vault	1982	$2,500.00	$500.00	15	3,727	497
Dylastir Model 25103	1984	$93.60	$0.00	10	126	0
Waring	1984	$112.32	$0.00	10	151	0
Letter, 2 Drawer	1978	$58.35	$11.67	20	121	18
Letter, 4 Drawer	1986	$129.57	$77.74	20	170	94
Steno	1982	$97.92	$39.17	20	146	51
Steno	1976	$64.43	$6.44	20	155	8
Missellaneous	1988	$10,000.00	$4,000.00	10	12,365	3,709
5 Folding	1976	$44.45	$4.45	20	107	5
Metal, Upholstereed	1985	$87.24	$47.98	20	116	58
folding	1976	$33.32	$3.33	20	80	4
Swievel Arm	1976	$88.86	$8.89	20	213	11
Side - Upholstered	1976	$48.87	$4.89	20	117	6
Legal, 4 Drawer	1985	$158.62	$87.24	20	212	106
Sub. Sump Pump	1989	$320.41	$213.61	15	387	232

Description	Year Installed	Original Acquisition Cost	1995 Book Value	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
Sub Pump - Spare	1979	$189.36	$0.00	15	364	0
Process Pipe, Valves, & Fittings	1981	$5,097.23	$679.63	15	8,349	557
3 Set	1978	$152.22	$30.44	20	315	47
1 Set	1978	$50.74	$10.15	20	105	16
Air Compressors D255-A	1982	$20,000.00	$4,000.00	15	29,816	3,975
SandPiper SB3-A	1982	$7,500.00	$1,500.00	15	11,181	1,491
Process Piping	1982	$6,960.00	$1,392.00	15	10,376	1,383
Pipes & Valves	1972	$19,500.00	$0.00	15	64,438	0
Work Bench	1976	$222.16	$22.22	20	533	27
Wrenches, Hammers, Saws, Etc.	1982	$2,500.00	$500.00	15	3,727	497
4 Drawer Legal	1987	$169.38	$110.10	20	215	129
Wood - three tier	1987	$118.57	$77.07	20	151	90
Steno	1987	$122.80	$79.82	20	156	94
Metal - Upholstered	1987	$93.16	$60.55	20	118	71
Letter - 2 Drawer	1987	$97.39	$63.30	20	124	74
Business machine	1987	$169.38	$110.10	20	215	129
40 MPV, 4" x 4"100 gpm, 25' Head	1981	$4,842.00	$645.60	15	7,931	529
Alarm System - Old System	1991	$979.00	$783.20	15	1,132	830
Hydromatic Submersible, 3-hp	1972	$1,458.32	$0.00	15	4,819	0
Hydromatic Submermisable, 3-hp	1972	$1,458.32	$0.00	15	4,819	0
Alarm system	1974	$817.50	$0.00	15	2,327	0
Alarm System	1976	$415.61	$0.00	15	998	0
Alarm System	1972	$324.07	$0.00	15	1,071	0
Alarm System	1979	$1,402.00	$0.00	15	2,696	0
Chain Link, 3-Wire Safety	1972	$4,462.00	$0.00	20	14,745	0
Walkway & Parking Area	1972	$2,339.16	$0.00	20	7,730	0
DD Pump, Sandpiper, 2"	1990	$1,000.00	$733.33	15	1,182	788
10 Foot Boat For AB Maintenance	1987	$1,000.00	$650.00	20	1,271	763
PUMP, Trailer Mounted, Hydronix 4"	1987	$3,500.00	$1,866.67	15	4,450	2,077
ISCO, Model 3700	1991	$2,800.00	$2,240.00	15	3,237	2,374
Sandpiper 3" Waste Pump	1982	$7,500.00	$1,500.00	15	11,181	1,491
RPBP on City Water	1992	$400.00	$346.67	15	452	362
Underground	1982	$91,657.00	$36,662.80	20	136,643	47,825
PC DOS Based Software	1992	$8,000.00	$4,800.00	5	9,039	3,616
Corning, Model 107	1987	$375.00	$112.50	10	477	95
HACH COD Digester	1987	$175.00	$52.50	10	223	45
Group of Miscellaneous Glassware	1992	$18,000.00	$14,400.00	10	20,338	14,236
Metler - Table Type	1982	$1,050.00	$0.00	10	1,565	0
Miscellaneous Minor Lab Equipment	1987	$12,000.00	$3,600.00	10	15,257	3,051
15 KVA Portable, For LS	1985	$25,000.00	$0.00	10	33,362	0
SAD Aerator #1	1982	$20,000.00	$4,000.00	15	29,816	3,975
SAD Aerator #2	1982	$27,500.00	$0.00	10	40,997	0
Stabil-Therm	1987	$1,025.00	$307.50	10	1,303	261
Boekel	1984	$425.00	$0.00	10	571	0
HACH - Analog Type	1972	$2,700.00	$0.00	10	8,922	0
Corning	1985	$875.00	$0.00	10	1,168	0
With Heater & Mixer	1985	$390.00	$0.00	10	520	0
Bod Incubator	1971	$1,600.00	$0.00	10	6,009	0
Piping, Primary Clarifier	1982	$2,000.00	$400.00	15	2,982	398
Total		$4,721,472.05	$3,659,160.31		7,481,916	4,239,884
Audit, 1995			$3,618,034.00	26		
Difference			$41,126.31	1.1%	Adj. Value	4,192,231

Collection System	Year Installed	Expected Life	Replacement Value in 1995	Depreciated Value in 1995
Redwood Insutrial Sewer	1989	50	783,112	689,139
Township Road Interceptor	1994	50	24,600	24,108
South Pine Street Oversizing	1995	50	33,204	33,204
				746,451

APPENDIX E

Sanitary Sewer
Design Standards

CITY OF CANBY
PUBLIC STREET IMPROVEMENTS

DESIGN MANUAL AND STANDARD SPECIFICATIONS

1. <u>Requirements for Public Street Improvements</u>

1.1 Public street improvements are conditioned through the development review process, City ordinances and other policies adopted by the City. No public street improvements or utility construction shall commence prior to the City of Canby and Canby Utility Board approval of the construction plans. Designs submitted for approval shall be stamped by a Registered Professional Engineer licensed to practice in the State of Oregon.

1.2 Submittal requirements consist of design plans, grading plans, erosion control plans and other information as required for street or utility construction, including paving, curbs and sidewalks, sanitary sewer and storm drainage.

1.3 The current revision of the Standard Specifications and Drawings for Public Works Construction, Oregon Chapter, APWA are hereby adopted and incorporated as part of this document by reference except as modified herein.

2. <u>Design Plan Format</u>

2.1 The plans shall be submitted on 24" x 36" or larger plans sheets.

2.2 Vicinity Maps shall be located on the first sheet of all plans and shall show the location of the project with respect to the nearest major street intersection..

2.3 A north arrow shall be shown on each plan view sheet of the plans and adjacent to any other drawing which is not oriented the same as other drawings on the sheet.

2.4 Plan scales shall be 1"= 1'V, 1"= 10'H: 1"= 2'V, 1"= 20'H; 1"= 4'V, 1"= 40'H; or 1"= 5'V, 1"= 50'H for all drawings except details.

2.5 Letter size shall not be smaller than 0.10 inch high.

2.6 The location and elevation of a National Geodetic Survey, United States Geological Survey, State Highway or Clackamas County bench mark shall be shown. No other datum shall be used without permission of the City of Canby or Canby Utility Board. Temporary bench marks and elevations shall be shown on the plans.

2.7 A title block shall appear on each sheet of the plan set and shall be placed in the lower right-hand corner of the sheet, across the bottom edge of the sheet or across the right-hand edge of the sheet. The title block shall include the names of the project, the engineering firm, the owner, the sheet title and the sheet number.

2.8 The seal of the Registered Professional Engineer responsible for preparation of the plans shall appear on the each sheet.

2.9 The description and date of all revisions to the plans shall be shown on each sheet affected, and shall be approved and dated by a Registered Professional Engineer as evidenced by signature or initial.

2.10 Plan views shall show the following:

a. Right-Of-Way, property, tract, and easement lines.

b. Subdivision name, lot numbers, street names and other identifying labels. Developer's name, address and phone number. Subdivision and street names are subject to approval of the City Planning Department.

c. Location and stationing of existing and proposed street centerlines and faces of curb.

d. Horizontal alignment and curve data of street centerlines and curb returns including Radius, Delta and Length.

e. Existing underground utilities and vegetation in conflict with the construction or operation of the street.

f. Match lines with sheet number references.

g. Street stationing to be noted at 100 foot intervals.

h. Top of curve elevations along curb returns at quarter-deltas.

I. Location of the low points of street grades and curb returns.

j. Sidewalk ramp locations or general note requiring ramps at each pedestrian accessible location.

k. Crown lines along portions of streets transitioning from one typical section to another.

l. Centerline stationing of all intersecting streets.

m. Location and description of existing survey monuments, including but not limited to, section corners, quarter corners and donation land claim corners.

n. Legend.

2.11 Profile views shall show the following:

a. Stationing, elevations, vertical curve data and slopes for center of streets or top of curbs. For offset or superelevation cross sections; both curbs shall be profiled. Where curbs are not to be constructed, centerline of street and ditch inverts shall be shown.

b. Original ground along the centerline and if necessary at the edges of the right-of-way if grade differences are significant.

c. Centerline of existing streets for a distance of at least one hundred fifty (150) feet each way at intersections with proposed streets and past the limits of construction.

d. Vertical alignment of streets.

e. The top of curve for all cul-de-sacs, eyebrows and curb returns

3. <u>Review Procedure</u>

3.1 Ten (10) sets of complete plans shall be submitted for review by the City of Canby and Canby Utility Board. This review is to check that the all required information has been submitted.

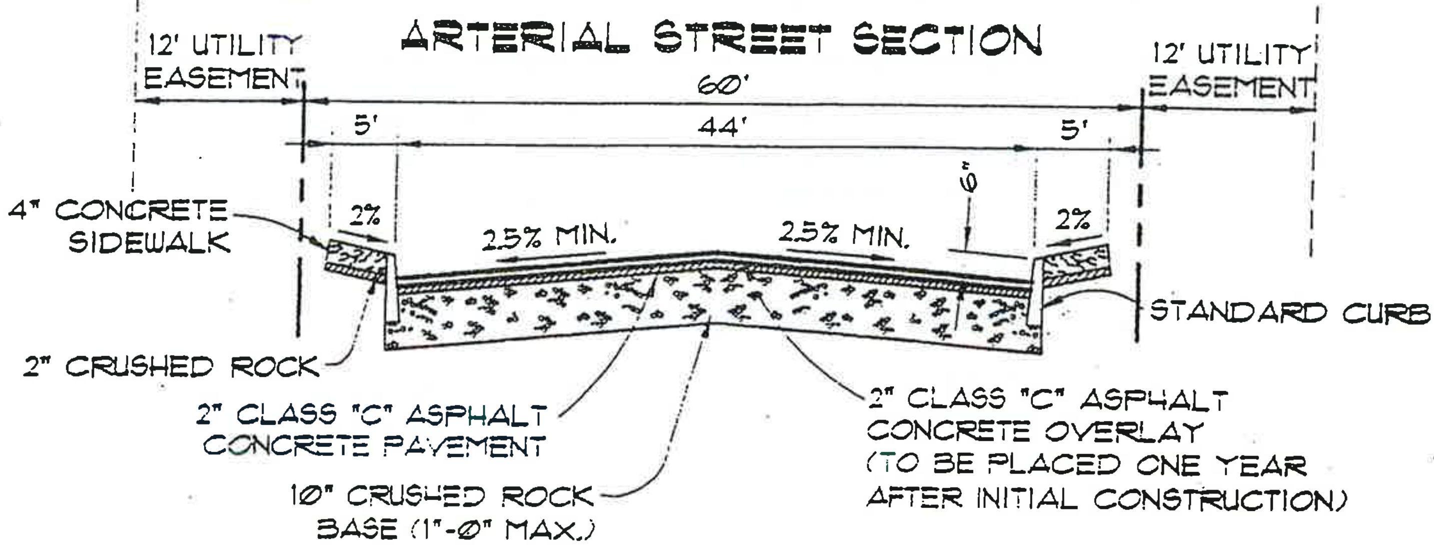
3.2 Upon completion of the detailed review by the City, the City will return one (1) set of plans with "Red Line" comments. After the deign Engineer has completed all revisions, ten (10) revised plans and the original "Red Line" plans shall be returned to the City for construction approval.

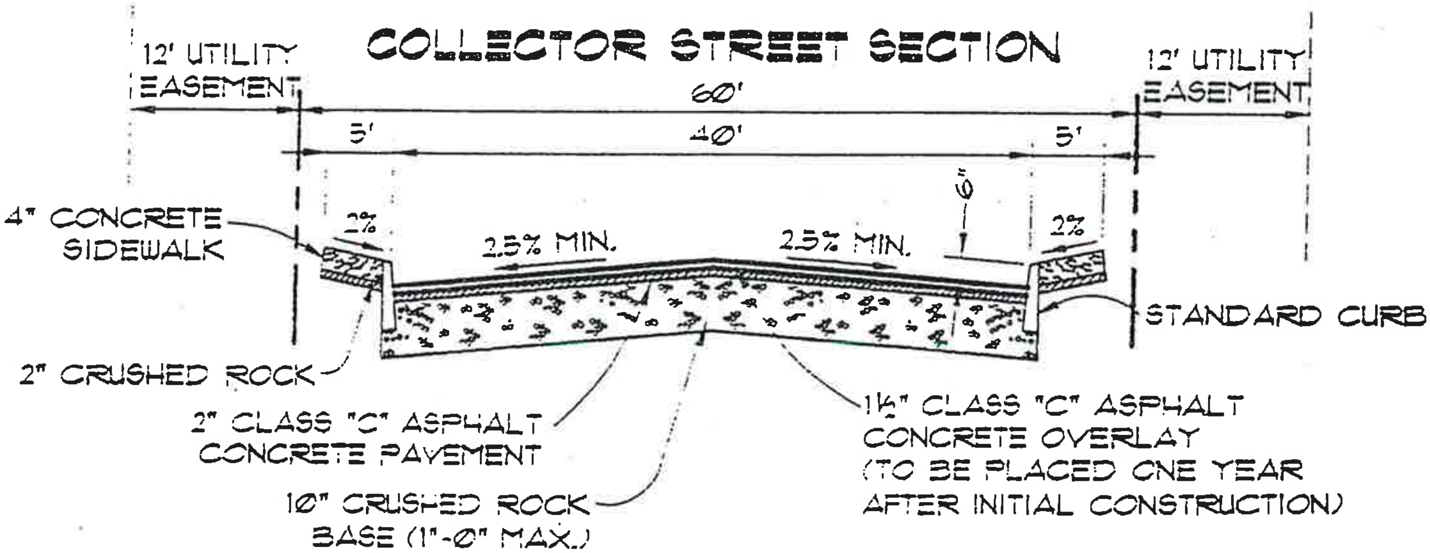
4. <u>As-Built Drawings</u>

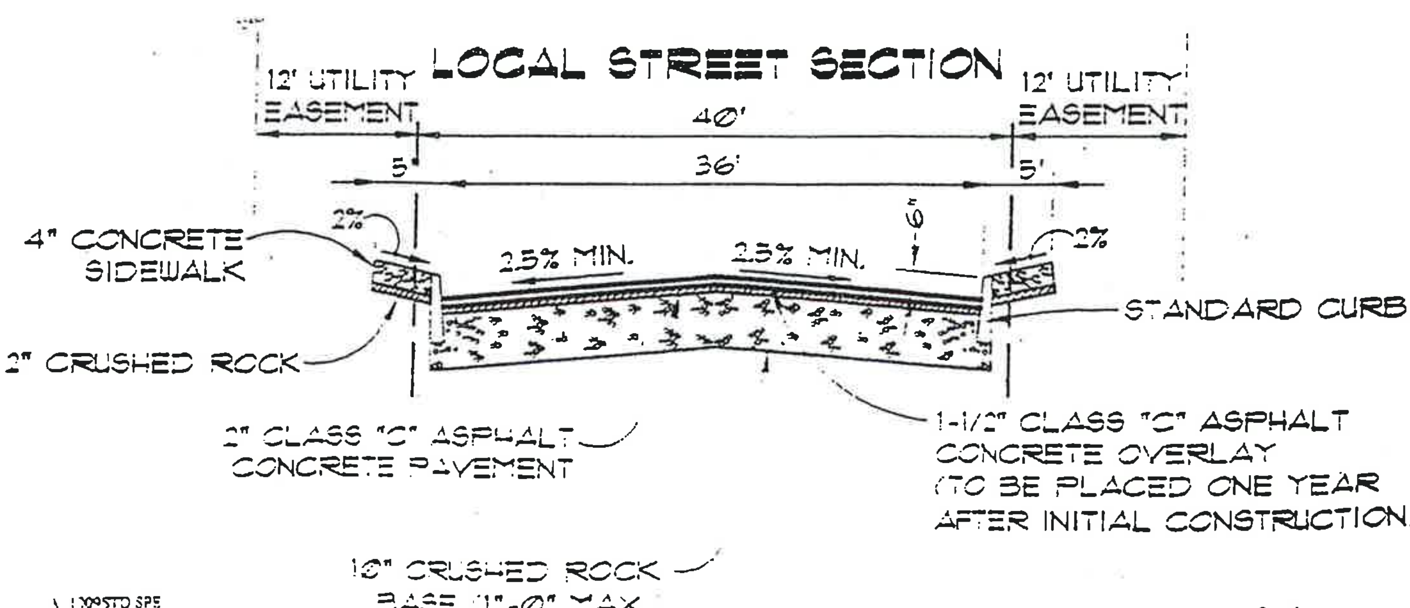
4.1 Following completion of construction, the design Engineer shall submit to the City of Canby and/or Canby Utility Board as applicable, two (2) sets of As-builts blue lines, one (1) complete set of reproducible as-built drawings and one (1) set on electronic media in AutoCad format if used on the project. As-built drawings shall describe any and all revisions to the previously approved construction plans shall indicate the limits of any surplus material placed as fill on building sites, and shall be accompanied by a certification letter from the design Engineer, indicating that the as-builts are accurate.

5. Street Design

5.1 Typical Street Sections:







5.2 Horizontal alignment shall meet the following requirements.

a. Centerline alignment of improvements should be parallel to the centerline of the right-of-way.

b. Centerline of a proposed street extension shall be aligned with the existing street centerline.

c. The following are guidelines for minimum horizontal curve radius:

Arterial Streets	-	250 feet
Collector Streets	-	200 feet
Local Streets	-	150 feet

5.3 Vertical alignment shall meet the following requirements.

a. Minimum tangent street gradients shall be one-half (0.5) percent along the crown and curb.

b. Maximum street gradients shall be fifteen (15) percent for collector, and local streets, and ten (10) percent for arterials. Grades in excess of fifteen (15) percent must be approved by the City Engineer on an individual basis.

c. Local streets intersecting with a collector or greater functional classification street or streets intended to be posted with a stop sign shall provide a landing averaging two (2) percent or less. Landings are that portion of the street within fifty (50) feet of the edge of the intersecting street at full improvement.

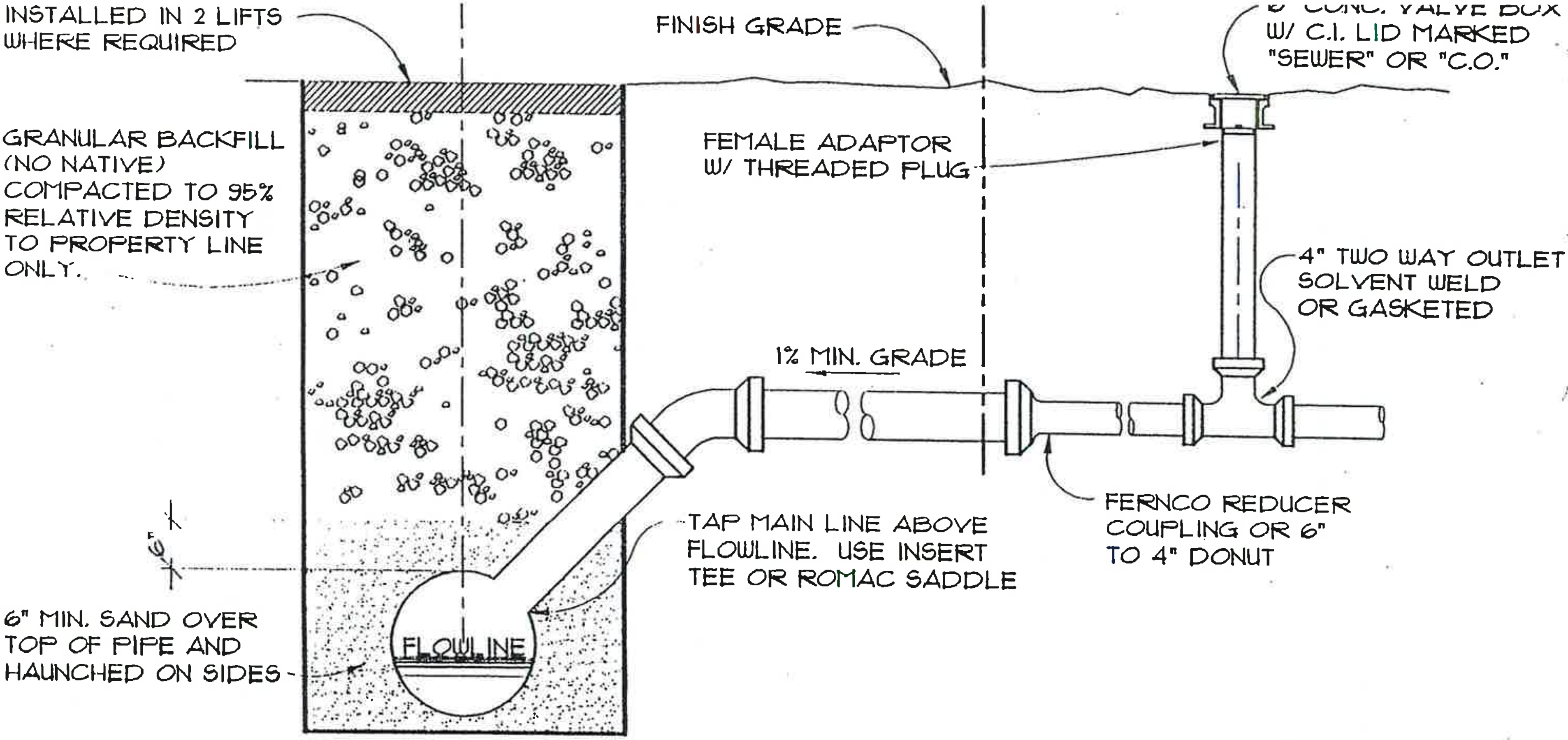
d. Grade changes of more than one (1) percent shall be accomplished with vertical curves, with minimum length of fifty (50) feet.

e. At street intersections, the crown of the major (higher classification) street shall continue through the intersection. The roadway section of the minor street will flatten to match the major street at the curbline.

f. Street grades, intersections and superelevation transitions shall be designed to not allow concentrations of stormwater to flow over the pavement.

5.4 Angels between intersecting streets shall meet the following requirements.

a. The interior angle at intersecting streets shall be kept as near to ninety (90) degrees as possible and in no case shall it be less than seventy-five (75) degrees.



NOTES:

1. WASHED FILL SAND SHALL BE USED TO BED PIPE ON LATERAL SERVICE AND MUST HAVE 6" MIN. COVER AT LEAST TO THE PROPERTY LINE.
2. GRANULAR BACKFILL WILL BE NO LARGER THAN 1"-0" TO THE PROPERTY LINE. PEA ROCK WILL NOT BE ALLOWED UNLESS APPROVED BY THE CITY.
3. A TRACE WIRE OF 18AWG. WILL BE SECURED AT THE MAIN LINE RUNNING UP TO THE CLEANOUT AT GROUND LEVEL, THEN BACK DOWN TO LATERAL SERVICE LINE, THEN TO THE CLEANOUT AT THE FOUNDATION OF STRUCTURE.
4. 36" MIN. DEPTH IS REQUIRED UNLESS OTHERWISE APPROVED BY THE CITY.

CITY OF CANBY
TYPICAL SANITARY SEWER SERVICE

NTS

SSCONECT

7.3 Minimum Design Standards

a. Only public right-of-ways runoff shall, by design, be collected and disposed within the public storm drainage system. Upon development, runoff from private properties shall not be permitted to discharge to public storm sewer facilities.

b. **A sump shall be provided on all storm drain collection systems prior to entering a drywell or piping system.** Catch basin design shall include removable baffle plate and debris sump as shown on the attached standard drawing **or alternatively , a sedimentation manhole with minimum 24" sump may be installed to intercept flow prior to entering a drywell or piping system.**

c. Drywell design shall be a minimum of 26 feet deep, with the bottom 10' perforated. Site specific designs will be allowed with adequate analysis submitted by a registered Engineer demonstrating adequate capacity;

d. In the absence of detailed hydrogeological analysis, drywells shall be located to collect up to approximately one half acre of runoff. Gutter flow shall be limited to 400-500 lineal feet; and,

e. Pipeline construction shall conform to the same standards as Sanitary Sewer Construction.

7.4 Materials

a. Drywells shall be constructed of perforated concrete pipe conforming to ASTM-478 or asphalt coated corrugated metal pipe. one piece 12 gauge, with standard flat top and manhole access;

b. Storm drainage pipelines shall be rubber ring concrete pipe conforming to ASTM C-14 or C-76 as required, polyvinyl chloride (PVC) gravity sewer conforming to ASTM D-3034 SDR 35, or smooth bore polyethylene (P.E.) pipe conforming to the standards of AASHTO M-294 Type S and ASTM F-667, Hancor ADS N-12 or equal; and,

c. Catch basins shall be cast-in-place or precast conforming to the City of Canby standard drawing or ODOT Type G2 inlet with sump.

8. <u>Construction Specifications</u>

8.1 All public improvement shall be inspected by an Oregon Registered Engineer or a qualified individual under the supervision of an Oregon Registered Engineer. The City will not authorize work to begin on public improvements without designation of an engineer's inspector by the owner or developer. All inspection costs including required testing shall be paid by the owner or developer.

An Engineer whose firm, or any member of the firm, has an interest in the development for which the improvements are required cannot be designated engineer's inspector unless full disclosure and prior approvals are granted. The engineer's inspectors relationship to the project must be solely that of a professional service nature.

8.2 Construction services provided by the City shall be limited to:

a. Liaison between the inspecting engineer and the City.
b. General monitoring of work progress.
c. Observation of all performance testing.
d. Participate in final inspection for acceptance of improvements.

8.3 The following minimum activities are required of the designated inspector:

a. Maintain a project log book which contains at least the following information:

1. Job number and name of engineer and designers;
2. Date and time of site visits;
3. Weather conditions, including temperature;
4. A description of construction activities;
5. Statements of directions to change plans, specifications, stop work, reject materials or other work quality actions;
6. Public agency contacts which result in plan changes or other significant actions;
7. Perceived problems and action taken;
8. General remarks;
9. Final and staged inspections;
10. Record all material, soil and compaction tests.

b. The inspecting engineer shall obtain and use a copy of City-approved construction plans and specifications;

c. Review and approve all pipe, aggregate, concrete, A.C. and other materials to ensure their compliance with City standards;

d. Approve all plan or specification changes in writing and obtain City approval;

e. Monitor and concur in construction activities to ensure end products meet City specifications;

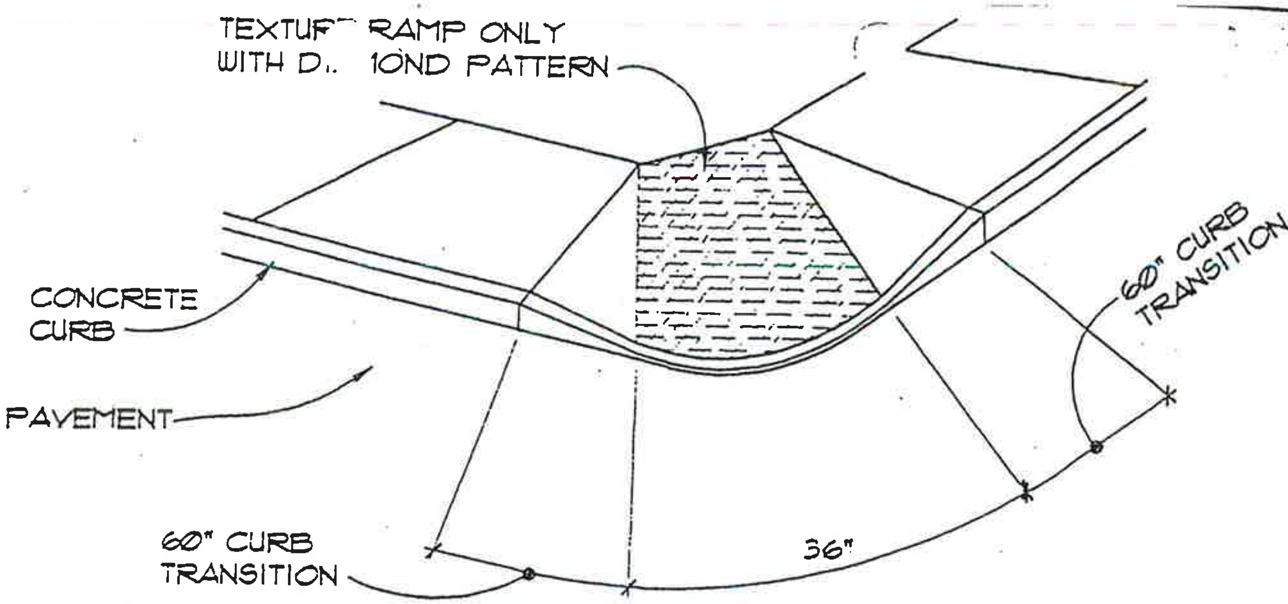
f. Perform or have performed material, composition and other tests required to ensure City specifications are met; and,

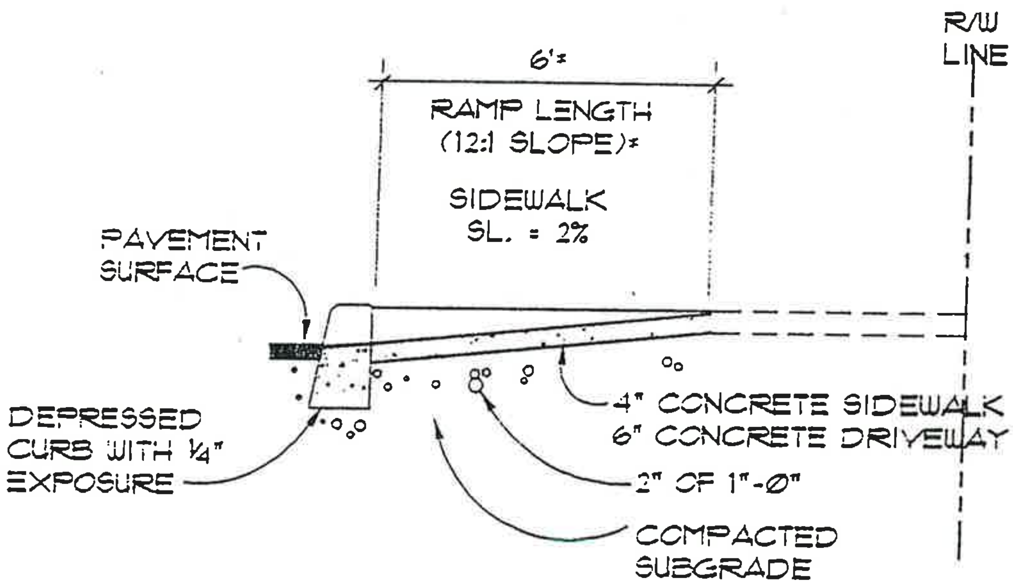
g. For pavement construction, perform the following stage inspections and record date of each:

1. Curbs are built to line and grade;
2. Subgrade meets grade and compaction specifications;
3. Base rock meets grade and compaction specifications;
4. Wearing course meets grade and compaction specifications. The City shall be given twenty-four (24) hour notice of impending stage inspections.

h. The contractor is responsible for observing the safety of the work and of all persons and property coming into contact with the work. The contractor shall conduct his work in such a manner as to comply with all the requirements prescribed by the Oregon Occupational Safety and Health Administration (OSHA).

8.4 The City Inspector's role is not one of supervision or safety management, but is one of watchful care only. Nothing contained in this section or elsewhere in this book shall be interpreted to obligate the City to act in any situation, nor shift the owner's responsibility for safety compliance to the City. No responsibility for the safety of the work or for construction means, methods, techniques, sequences or procedures shall attach to the City by virtue of its action or inaction under this section.





* FOR CURB AND SIDEWALKS LESS THAN 6' WIDE, DEPRESS BACK OF WALK AS REQUIRED TO MAINTAIN 12:1 SLOPE ON ALL RAMPED SURFACES

NOTES:

CONCRETE SHALL BE 3300 P.S.I. AT 28 DAYS, 6 SACK MIX, SLUMP RANGE 1½" TO 3".

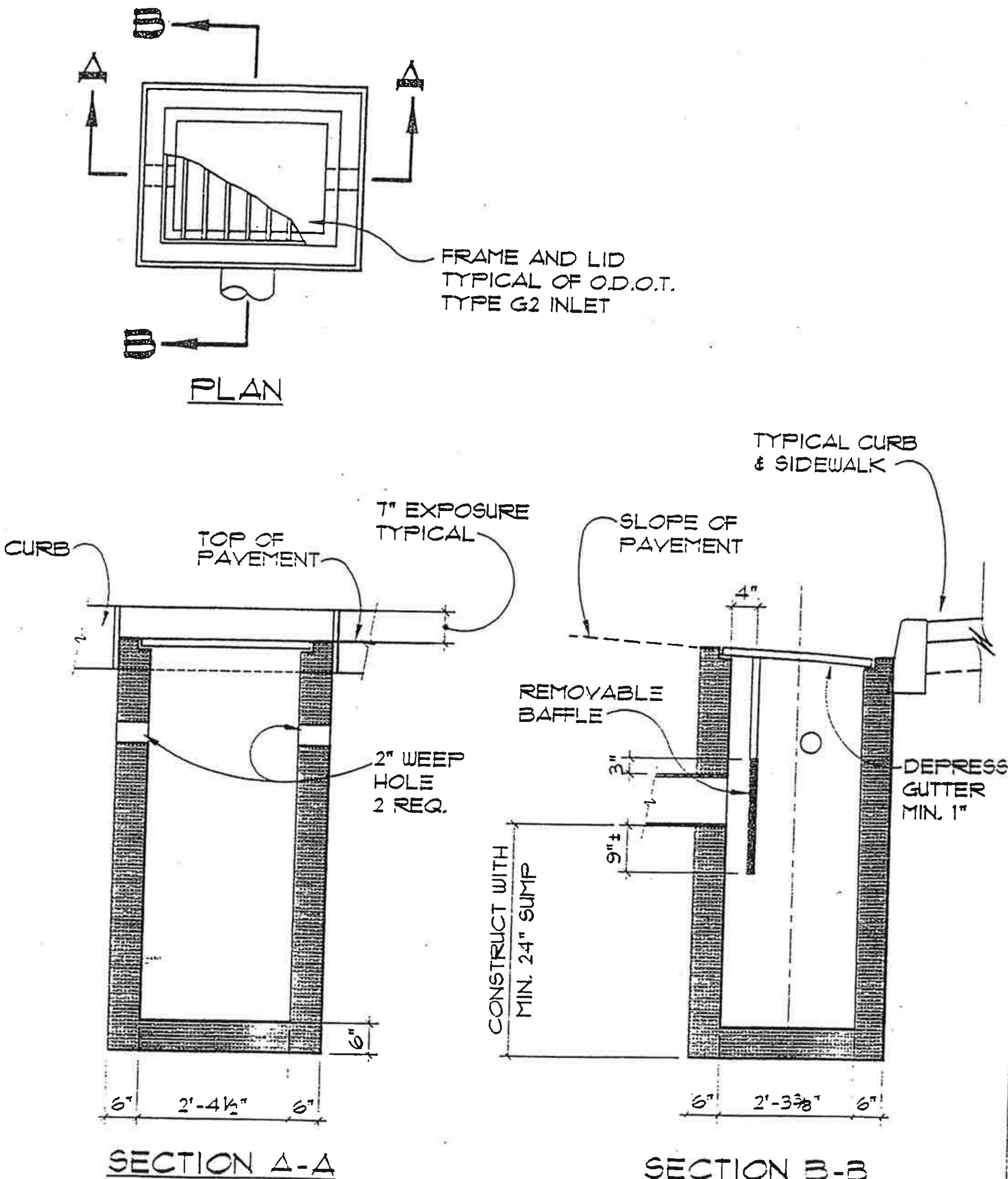
PROVIDE CONTRACTION JOINT ON EACH SIDE OF THE RAMP

ALL CONSTRUCTION TO CONFORM TO ANSI A117.1-1980

CITY OF CANBY
TYPICAL SIDEWALK AND DRIVEWAY RAMP DETAIL

N.T.S.

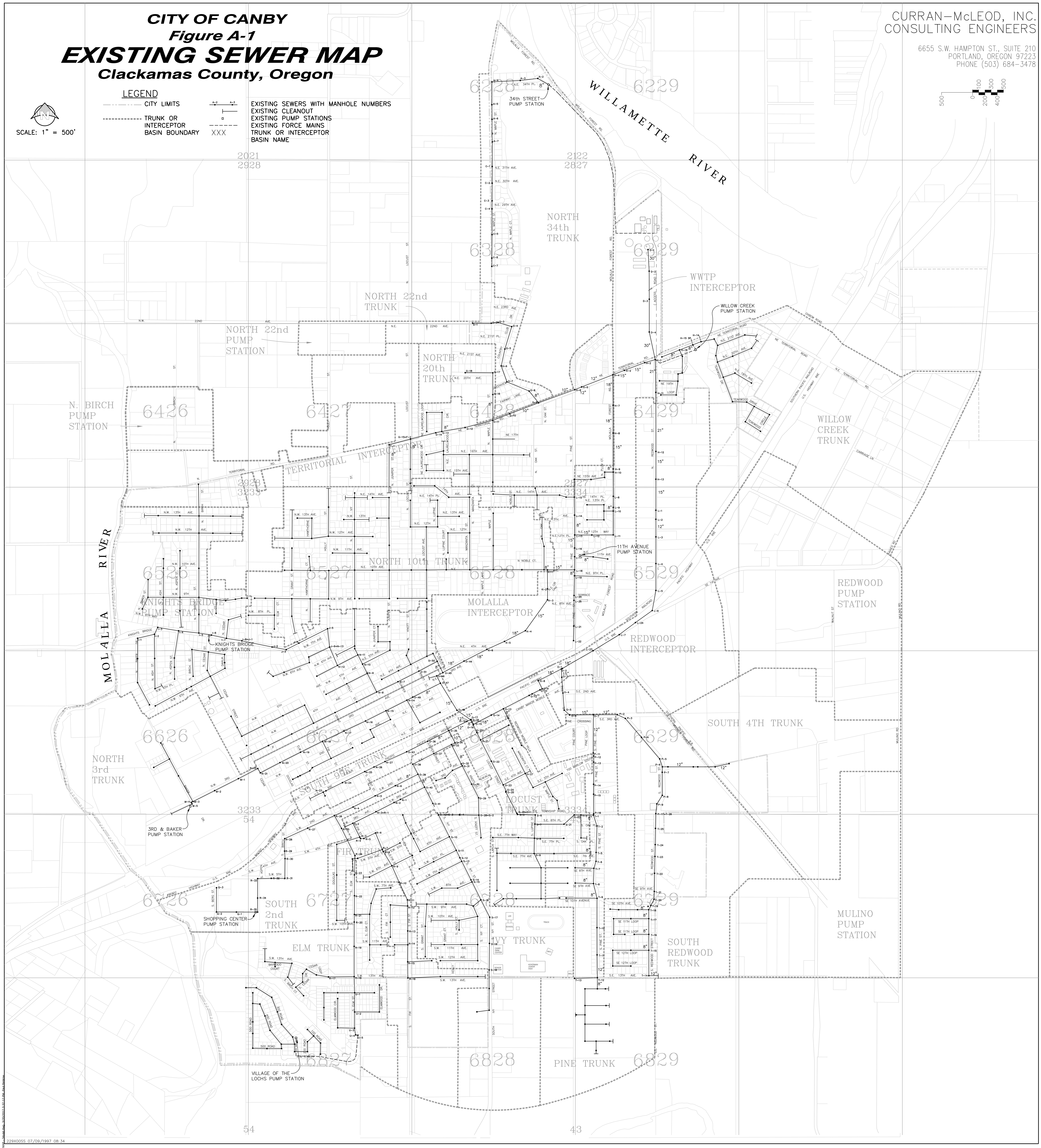
D: ACAD12\CMI CANBY 03RAMP 03/12/1996 13:46



CITY OF CANBY
SEDIMENTATION CATCH BASIN

NTS

129FIG1


CITY OF CANBY
Figure A-1
EXISTING SEWER MAP
Clackamas County, Oregon
CURRAN–McLEOD, INC.
CONSULTING ENGINEERS
6655 S.W. HAMPTON ST., SUITE 210
PORTLAND, OREGON 97223
PHONE (503) 684-3478
LEGEND
CITY LIMITS
TRUNK OR INTERCEPTOR BASIN BOUNDARY
EXISTING SEWERS WITH MANHOLE NUMBERS
EXISTING CLEANOUT
EXISTING PUMP STATIONS
EXISTING FORCE MAINS
TRUNK OR INTERCEPTOR BASIN NAME
XXX
SCALE: 1" = 500'
WILLAMETTE RIVER
MOLALLA RIVER
34th STREET PUMP STATION
NORTH 34th TRUNK
WWTP INTERCEPTOR
WILLOW CREEK PUMP STATION
NORTH 22nd TRUNK
NORTH 22nd PUMP STATION
NORTH 20th TRUNK
N. BIRCH PUMP STATION
TERRITORIAL INTERCEPTOR
WILLOW CREEK TRUNK
NORTH 10th TRUNK
11TH AVENUE PUMP STATION
KNIGHTS BRIDGE PUMP STATION
MOLALLA INTERCEPTOR
REDWOOD INTERCEPTOR
REDWOOD PUMP STATION
SOUTH 4TH TRUNK
NORTH 3rd TRUNK
SOUTH 9th TRUNK
LOCUST TRUNK
3RD & BAKER PUMP STATION
FIR TRUNK
SOUTH 2nd TRUNK
SHOPPING CENTER PUMP STATION
ELM TRUNK
IVY TRUNK
SOUTH REDWOOD TRUNK
MULINO PUMP STATION
PINE TRUNK
VILLAGE OF THE LOCHS PUMP STATION
6228
6229
6328
6329
6426
6427
6428
6429
6526
6527
6528
6529
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6627
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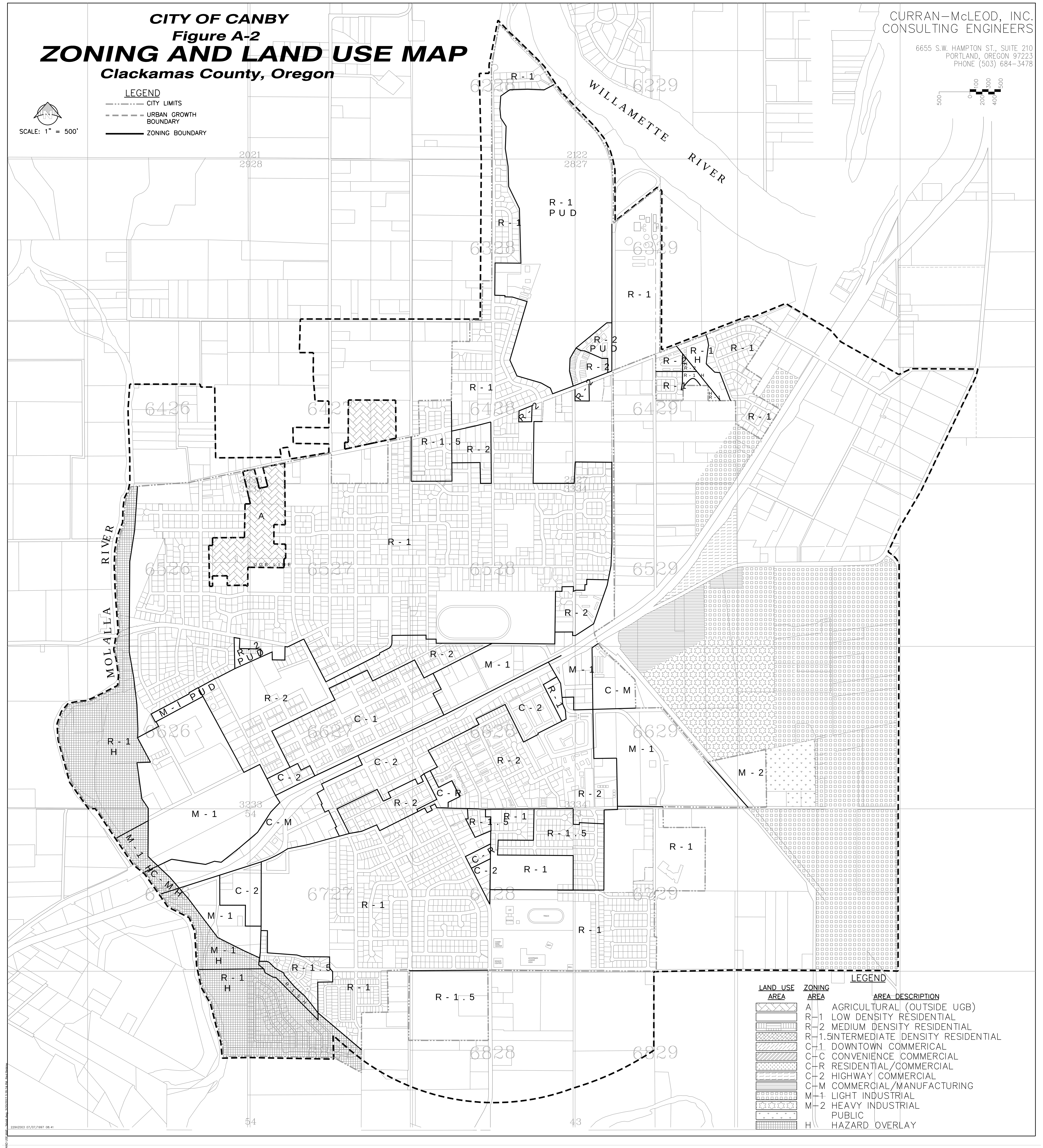
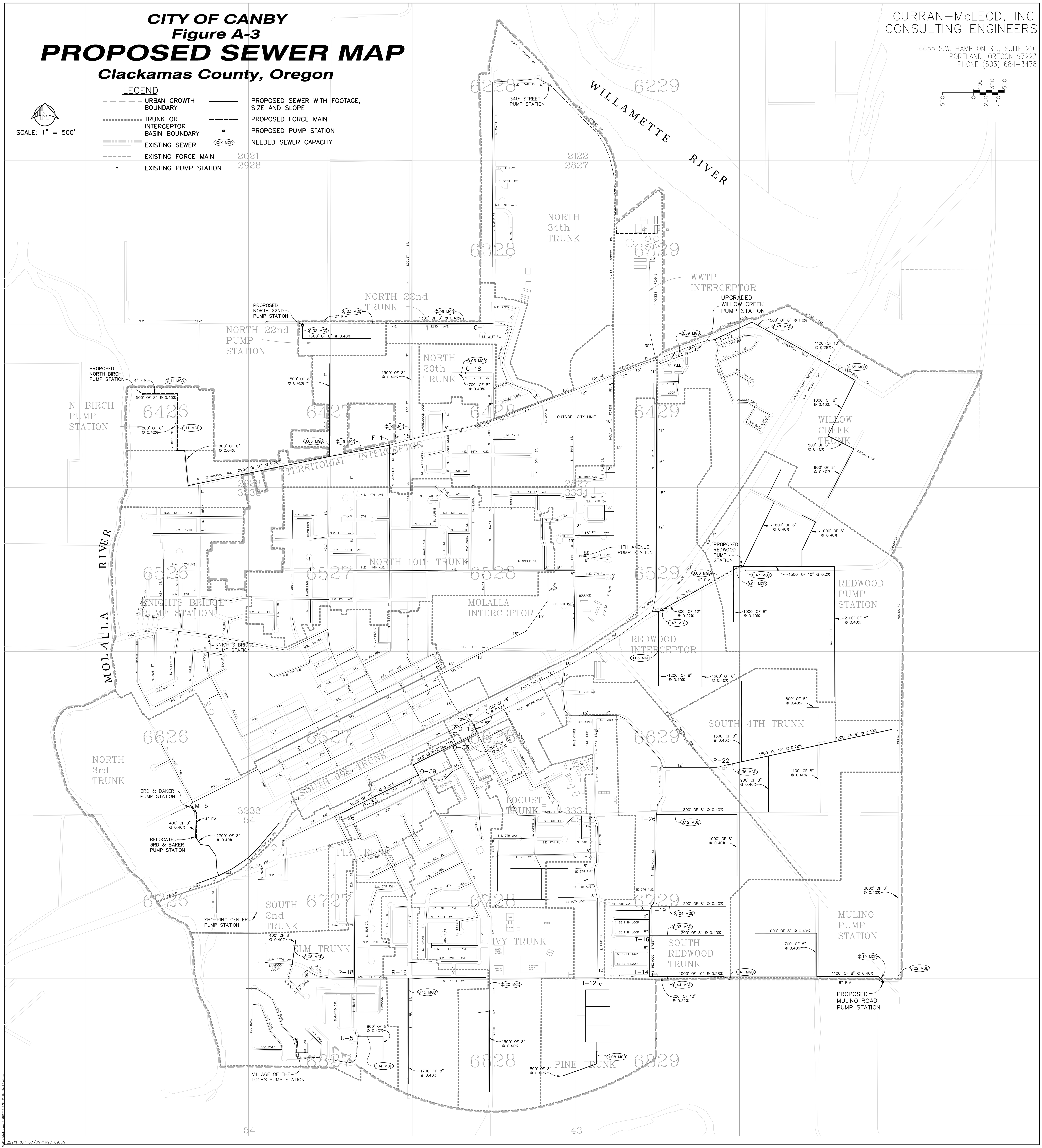
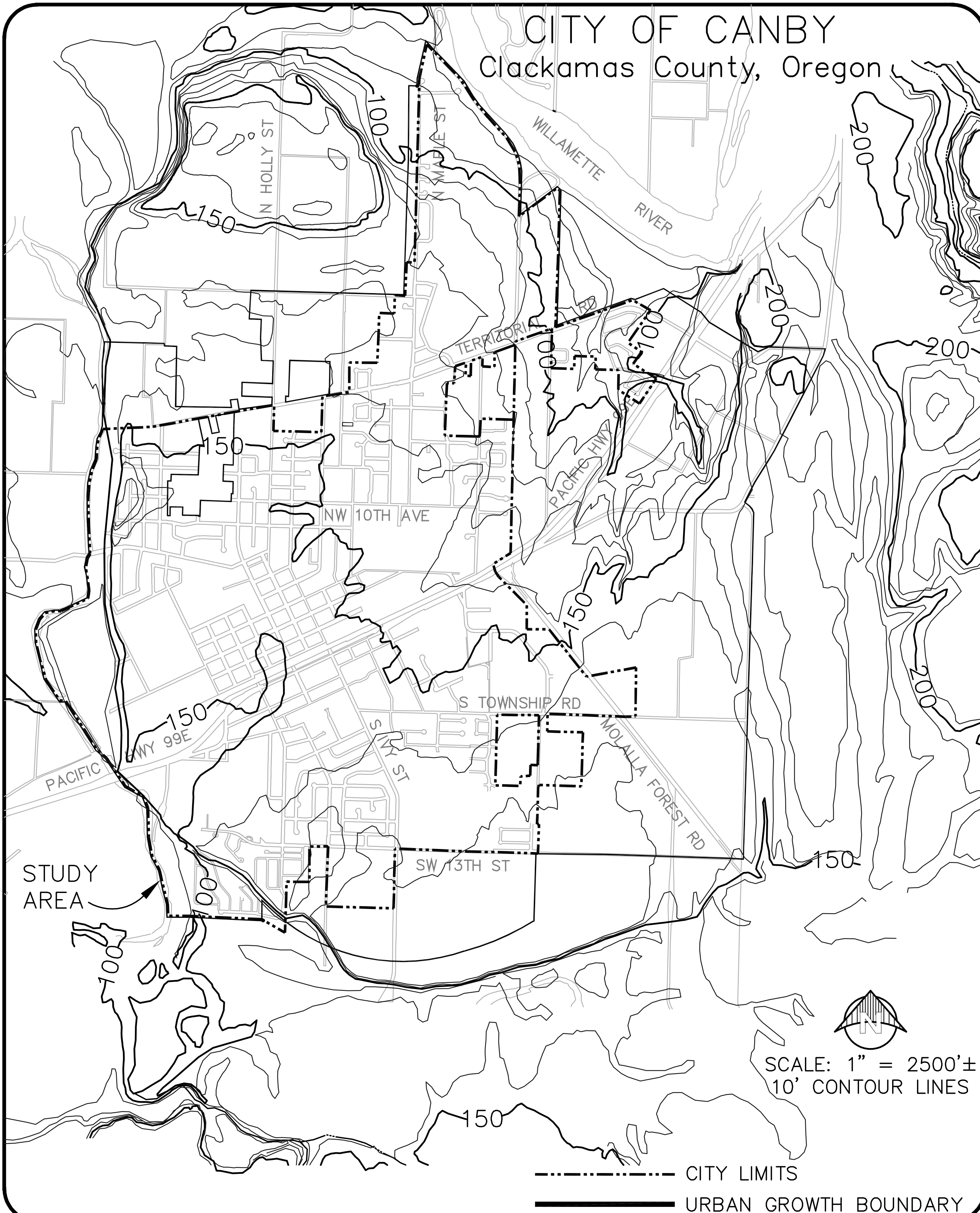
6629
6726
6727
6728
6729
6827
6828
6829
2021
2928
2122
2827
54
43
229K0055 07/09/1997 08:34


CITY OF CANBY
Figure A-2
ZONING AND LAND USE MAP
Clackamas County, Oregon
LEGEND
CITY LIMITS
URBAN GROWTH BOUNDARY
ZONING BOUNDARY
SCALE: 1" = 500'
CURRAN-McLEOD, INC.
CONSULTING ENGINEERS
6655 S.W. HAMPTON ST., SUITE 210
PORTLAND, OREGON 97223
PHONE (503) 684-3478
WILLAMETTE RIVER
MOLALLA RIVER
R - 1 PUD
R - 2 PUD
M - 1 PUD
M - 1 HC-MH
R - 1 H
M - 1 H
C - 1
C - 2
C - M
C - R
M - 1
M - 2
R - 1
R - 1 . 5
R - 2
A
LEGEND
LAND USE AREA
ZONING AREA
AREA DESCRIPTION
A AGRICULTURAL (OUTSIDE UGB)
R-1 LOW DENSITY RESIDENTIAL
R-2 MEDIUM DENSITY RESIDENTIAL
R-1.5 INTERMEDIATE DENSITY RESIDENTIAL
C-1 DOWNTOWN COMMERICAL
C-C CONVENIENCE COMMERCIAL
C-R RESIDENTIAL/COMMERCIAL
C-2 HIGHWAY COMMERCIAL
C-M COMMERCIAL/MANUFACTURING
M-1 LIGHT INDUSTRIAL
M-2 HEAVY INDUSTRIAL
PUBLIC
H HAZARD OVERLAY


CITY OF CANBY
Figure A-3
PROPOSED SEWER MAP
Clackamas County, Oregon
LEGEND
URBAN GROWTH BOUNDARY
TRUNK OR INTERCEPTOR BASIN BOUNDARY
EXISTING SEWER
EXISTING FORCE MAIN
EXISTING PUMP STATION
PROPOSED SEWER WITH FOOTAGE, SIZE AND SLOPE
PROPOSED FORCE MAIN
PROPOSED PUMP STATION
NEEDED SEWER CAPACITY
SCALE: 1" = 500'
CURRAN-McLEOD, INC.
CONSULTING ENGINEERS
6655 S.W. HAMPTON ST., SUITE 210
PORTLAND, OREGON 97223
PHONE (503) 684-3478
WILLAMETTE RIVER
MOLALLA RIVER
NORTH 34th TRUNK
WWTP INTERCEPTOR
UPGRADED WILLOW CREEK PUMP STATION
NORTH 22nd TRUNK
NORTH 22nd PUMP STATION
NORTH 20th TRUNK
N. BIRCH PUMP STATION
TERRITORIAL INTERCEPTOR
WILLOW CREEK TRUNK
NORTH 10th TRUNK
MOLALLA INTERCEPTOR
KNIGHTS BRIDGE PUMP STATION
REDWOOD PUMP STATION
REDWOOD INTERCEPTOR
SOUTH 4TH TRUNK
NORTH 3rd TRUNK
SOUTH 9th TRUNK
LOCUST TRUNK
FIR TRUNK
SOUTH 2nd TRUNK
ELM TRUNK
IVY TRUNK
SOUTH REDWOOD TRUNK
MULINO PUMP STATION
PINE TRUNK
PROPOSED MULINO ROAD PUMP STATION
VILLAGE OF THE LOCHS PUMP STATION
SHOPPING CENTER PUMP STATION
RELOCATED 3RD & BAKER PUMP STATION
OUTSIDE CITY LIMIT
229XPROP 07/09/1997 09:39



CANBY WASTEWATER COLLECTION SYSTEM
MASTER PLANNING

AREA TOPOGRAPHY

CURRAN–McLEOD, Inc.

FIGURE II–1

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29FIG001 07/09/1997 08:15

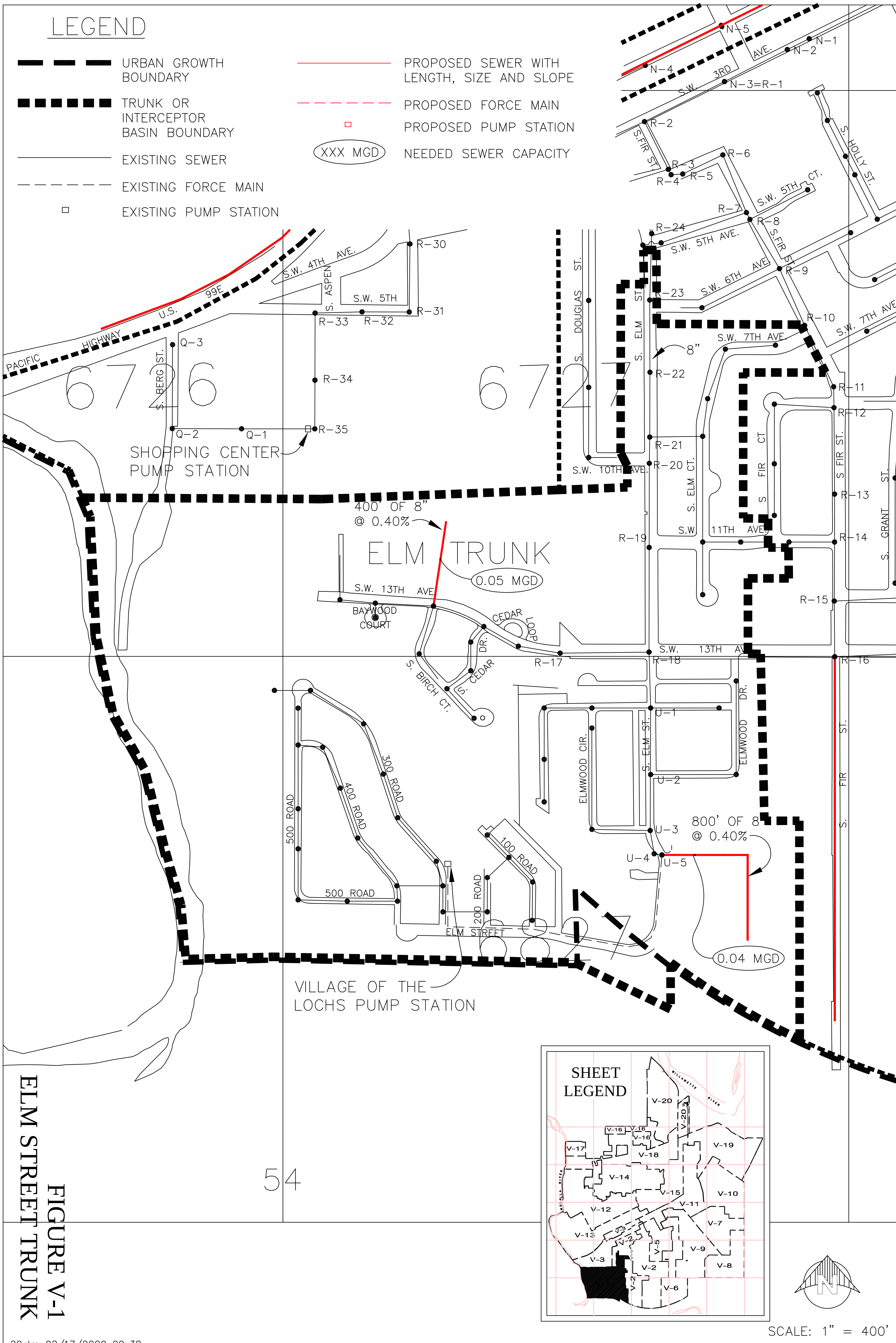


FIGURE V-1
ELM STREET TRUNK

O:\Archives\Archived - CAD_Tom_CM\CMI\CANBY\SSMASTR\29elm.dwg, 3/20/2017 10:45:03 AM, Paul Beskow

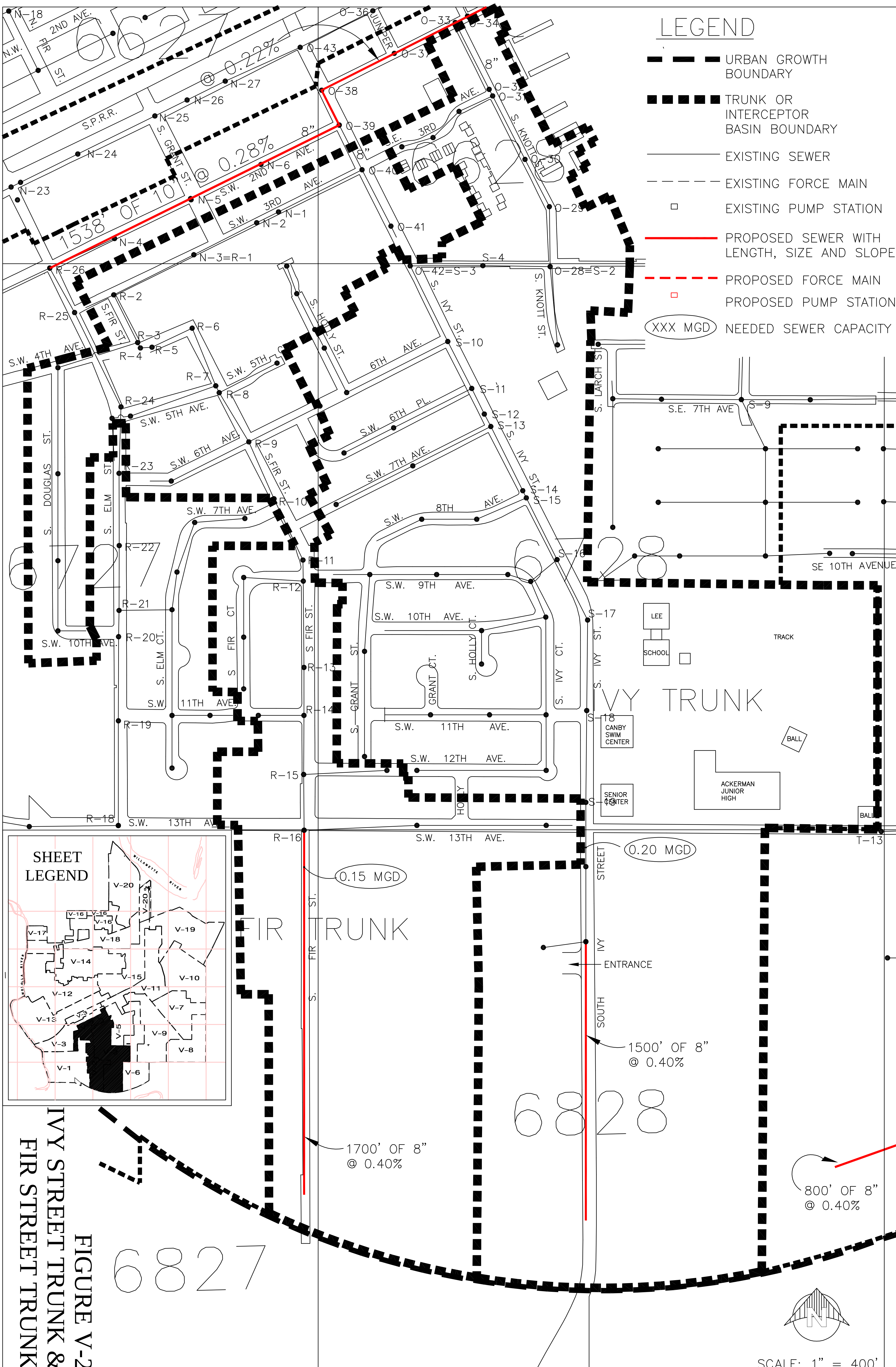
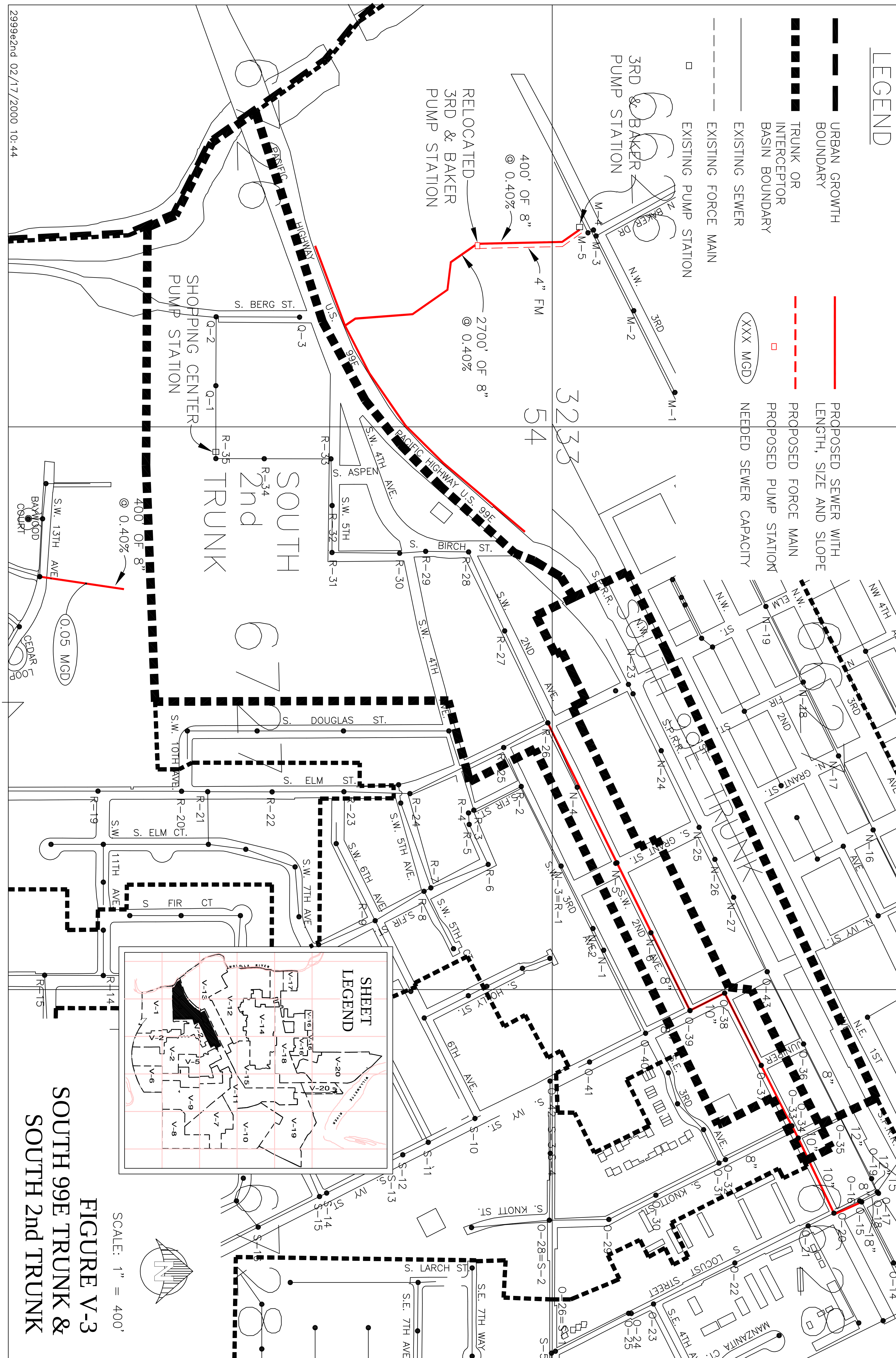


FIGURE V-2
IVY STREET TRUNK & FIR STREET TRUNK

29firivy 05/26/1999 13:36

J:\Canby\1009\1009 SSEWER MP FIGURES\V-2 IVY_FIR ST TRUNKS.dwg, 3/20/2017 1:29:13 PM, Paul Beskow


LEGEND
URBAN GROWTH BOUNDARY
TRUNK OR INTERCEPTOR BASIN BOUNDARY
EXISTING SEWER
EXISTING FORCE MAIN
EXISTING PUMP STATION
PROPOSED SEWER WITH LENGTH, SIZE AND SLOPE
PROPOSED FORCE MAIN
PROPOSED PUMP STATION
XXX MGD
NEEDED SEWER CAPACITY
3RD & BAKER PUMP STATION
RELOCATED 3RD & BAKER PUMP STATION
400' OF 8" @ 0.40%
4" FM
2700' OF 8" @ 0.40%
SHOPPING CENTER PUMP STATION
SOUTH 2nd TRUNK
SOUTH 99E TRUNK
400' OF 8" @ 0.40%
0.05 MGD
PACIFIC HIGHWAY U.S. 99E
SHEET LEGEND
SCALE: 1" = 400'
FIGURE V-3
SOUTH 99E TRUNK &
SOUTH 2nd TRUNK
2999e2nd 02/17/2000 10:44

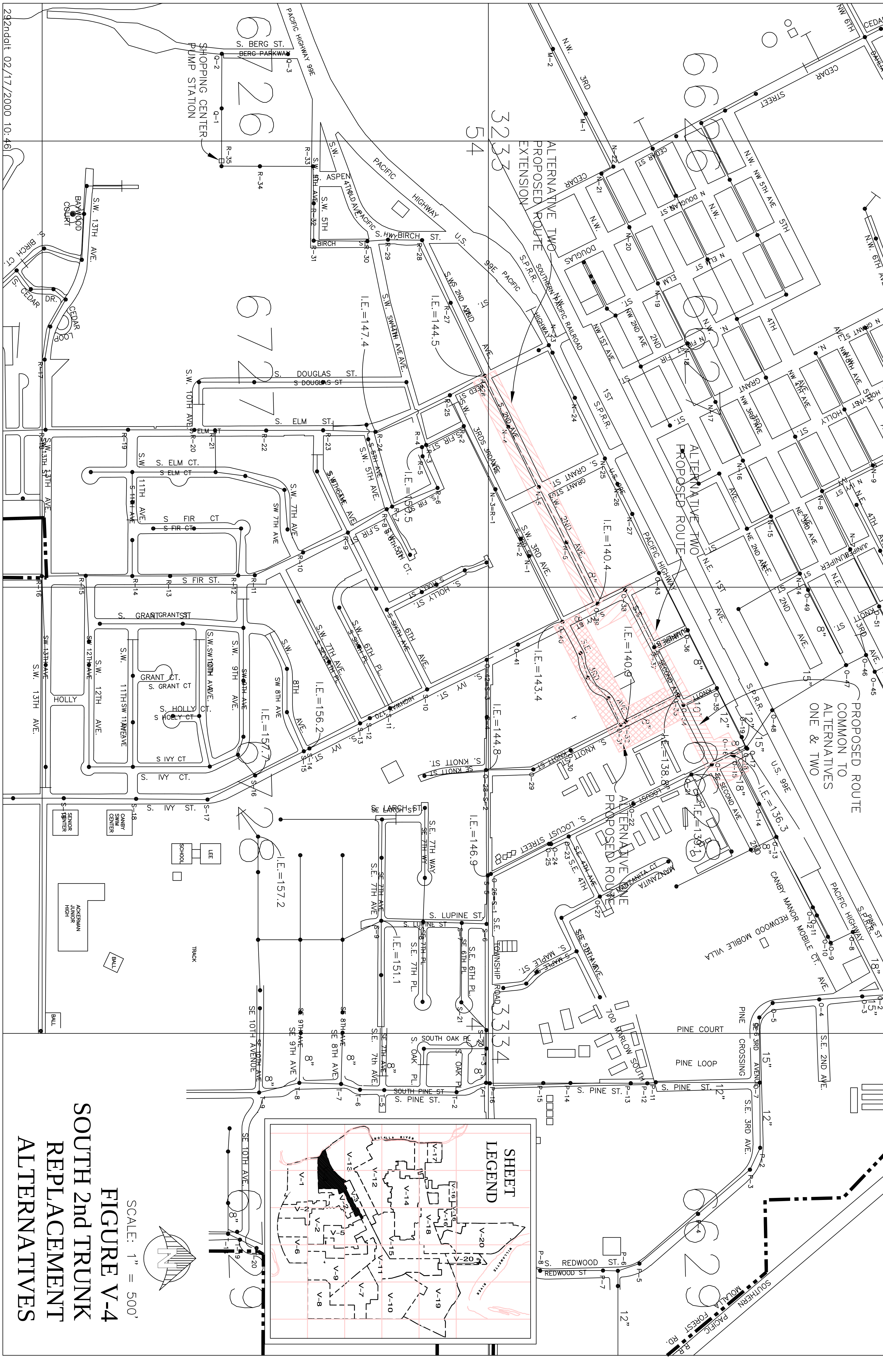


FIGURE V-4
SOUTH 2nd TRUNK
REPLACEMENT
ALTERNATIVES

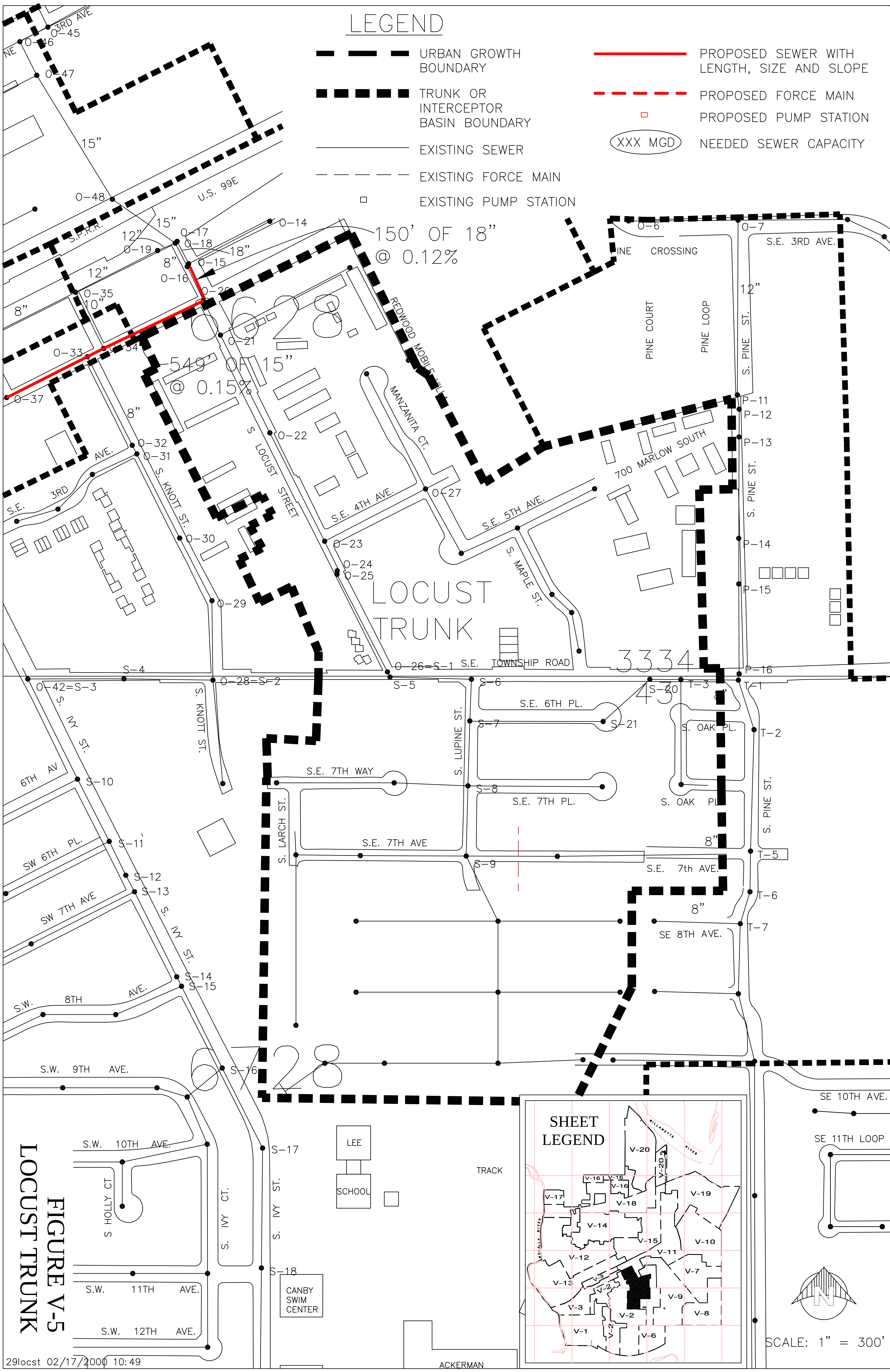


FIGURE V-5 LOCUST TRUNK

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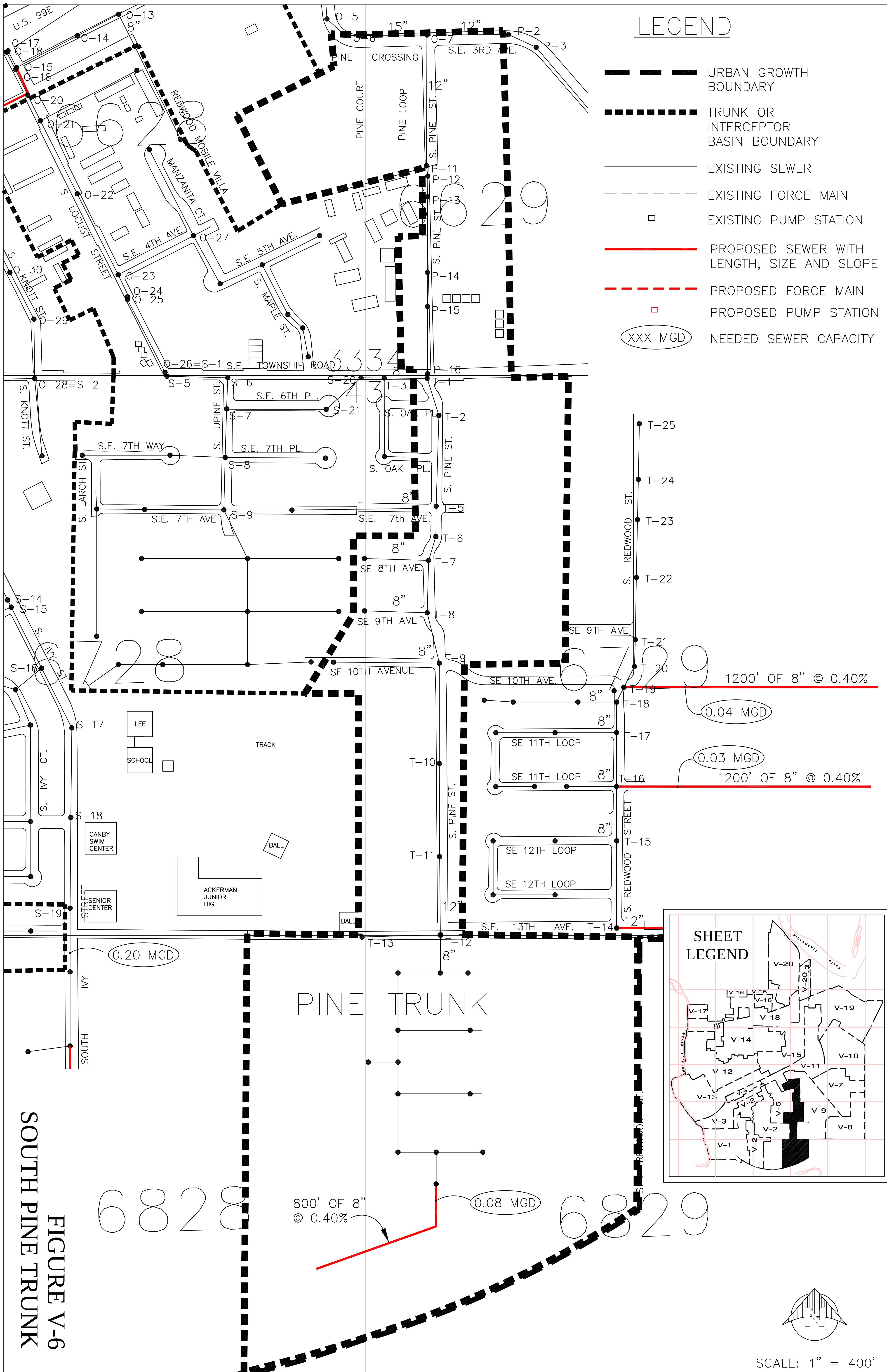

FIGURE V-6
SOUTH PINE TRUNK

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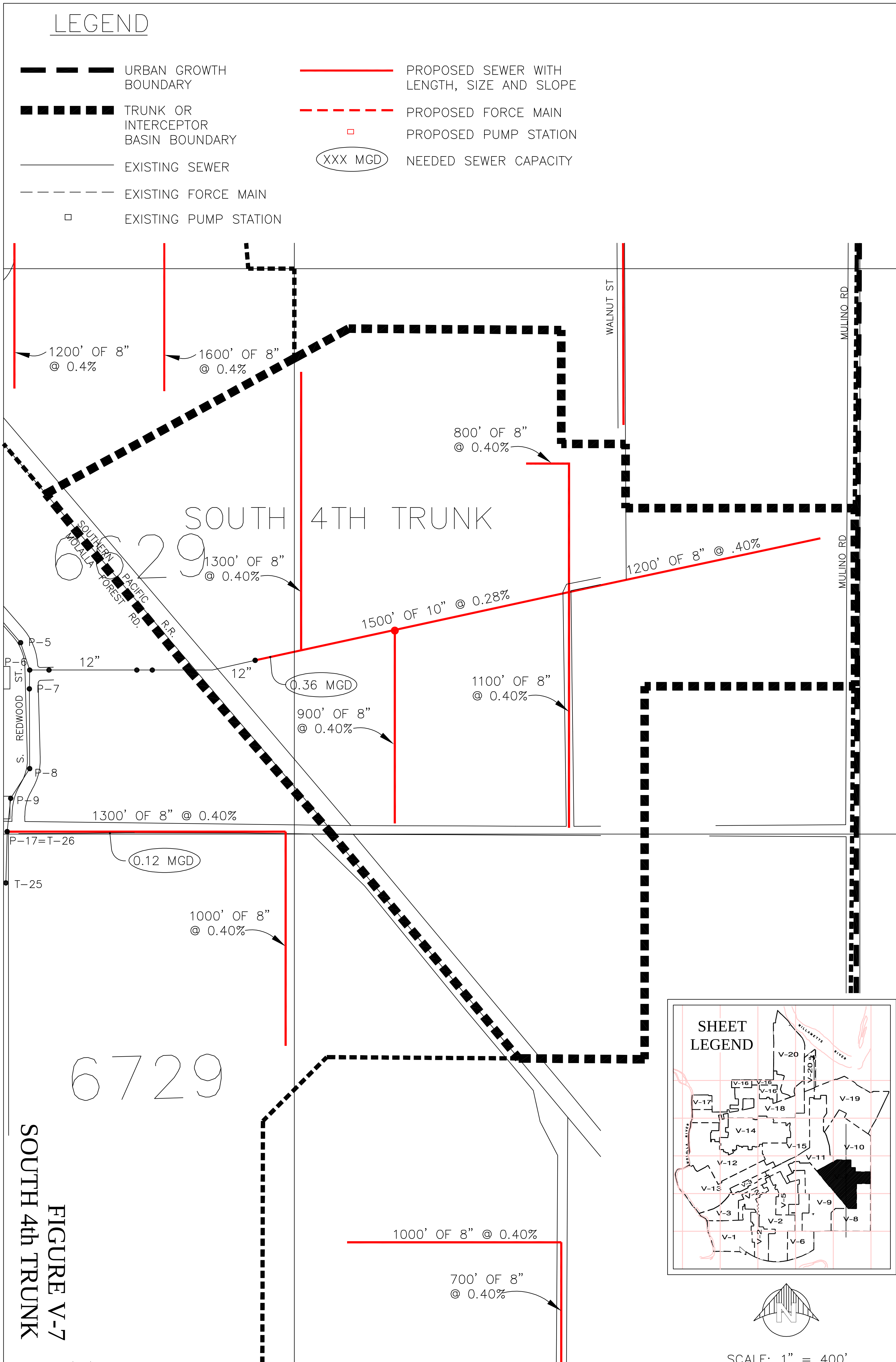

FIGURE V-7
SOUTH 4th TRUNK

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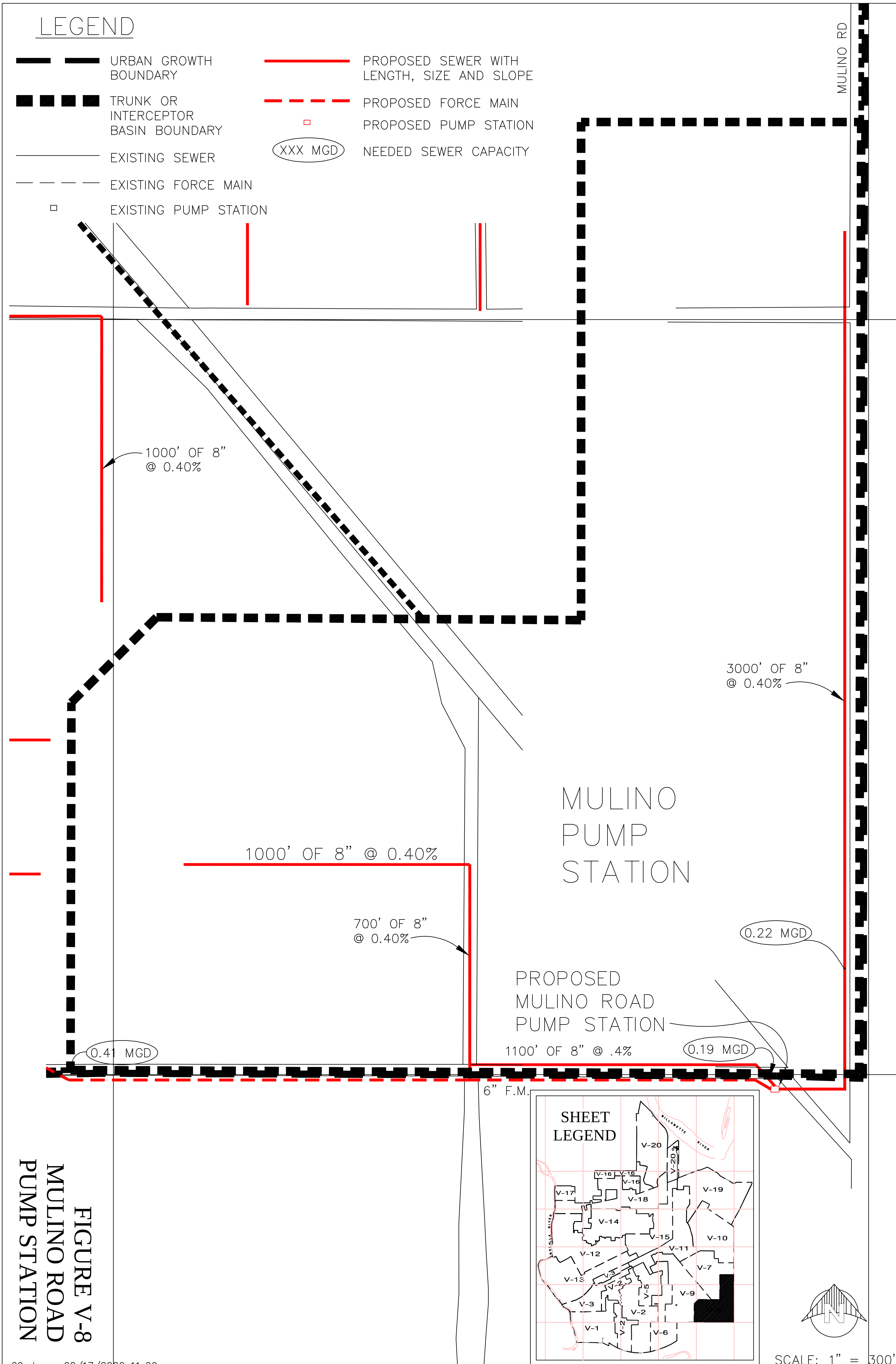


FIGURE V-8
MULINO ROAD
PUMP STATION

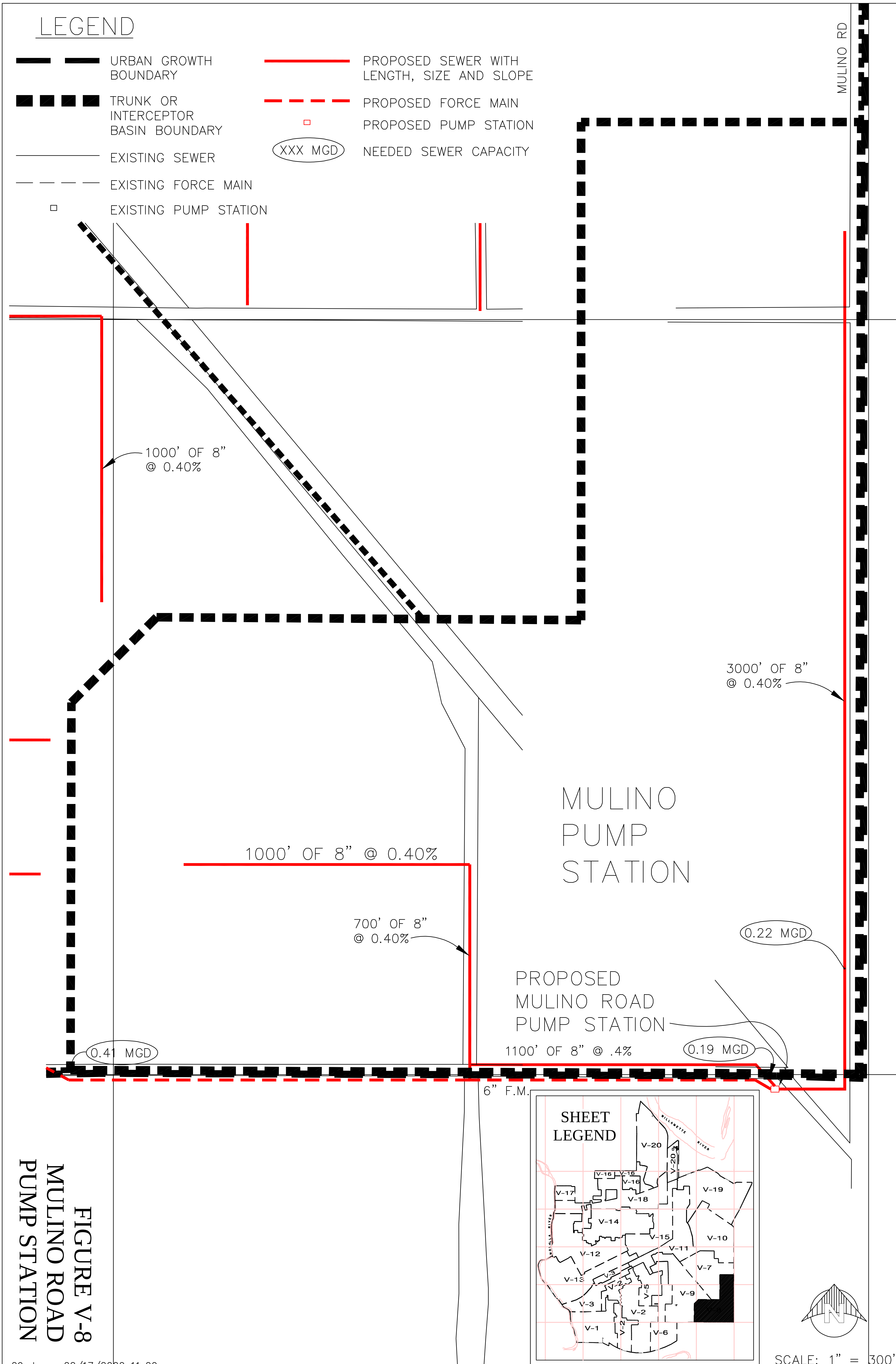


FIGURE V-8
MULINO ROAD PUMP STATION

LEGEND

- URBAN GROWTH BOUNDARY
- TRUNK OR INTERCEPTOR BASIN BOUNDARY
- EXISTING SEWER
- EXISTING FORCE MAIN
- EXISTING PUMP STATION
- PROPOSED SEWER WITH LENGTH, SIZE AND SLOPE
- PROPOSED FORCE MAIN
- PROPOSED PUMP STATION
- XXX MGD — NEEDED SEWER CAPACITY

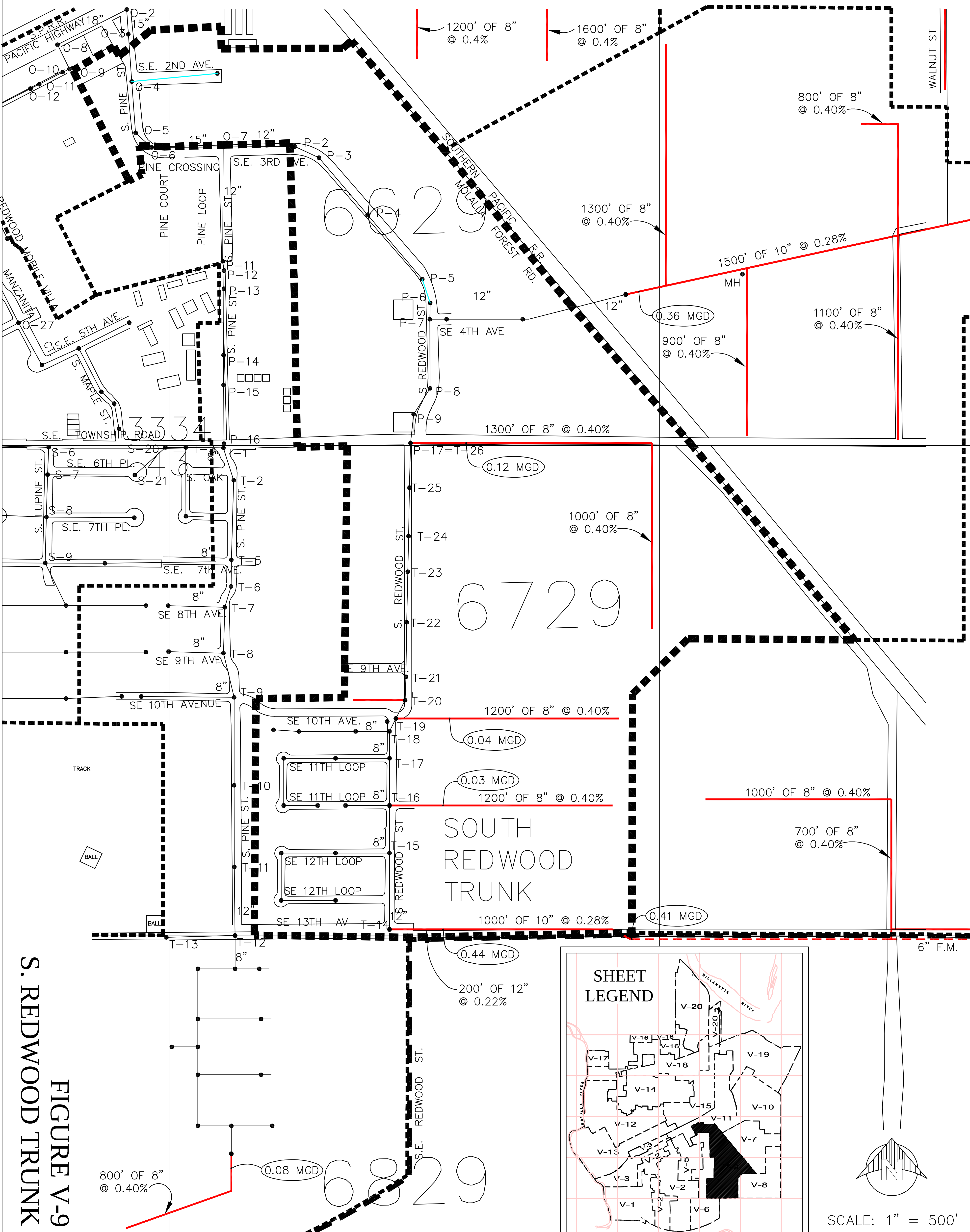


FIGURE V-9
S. REDWOOD TRUNK

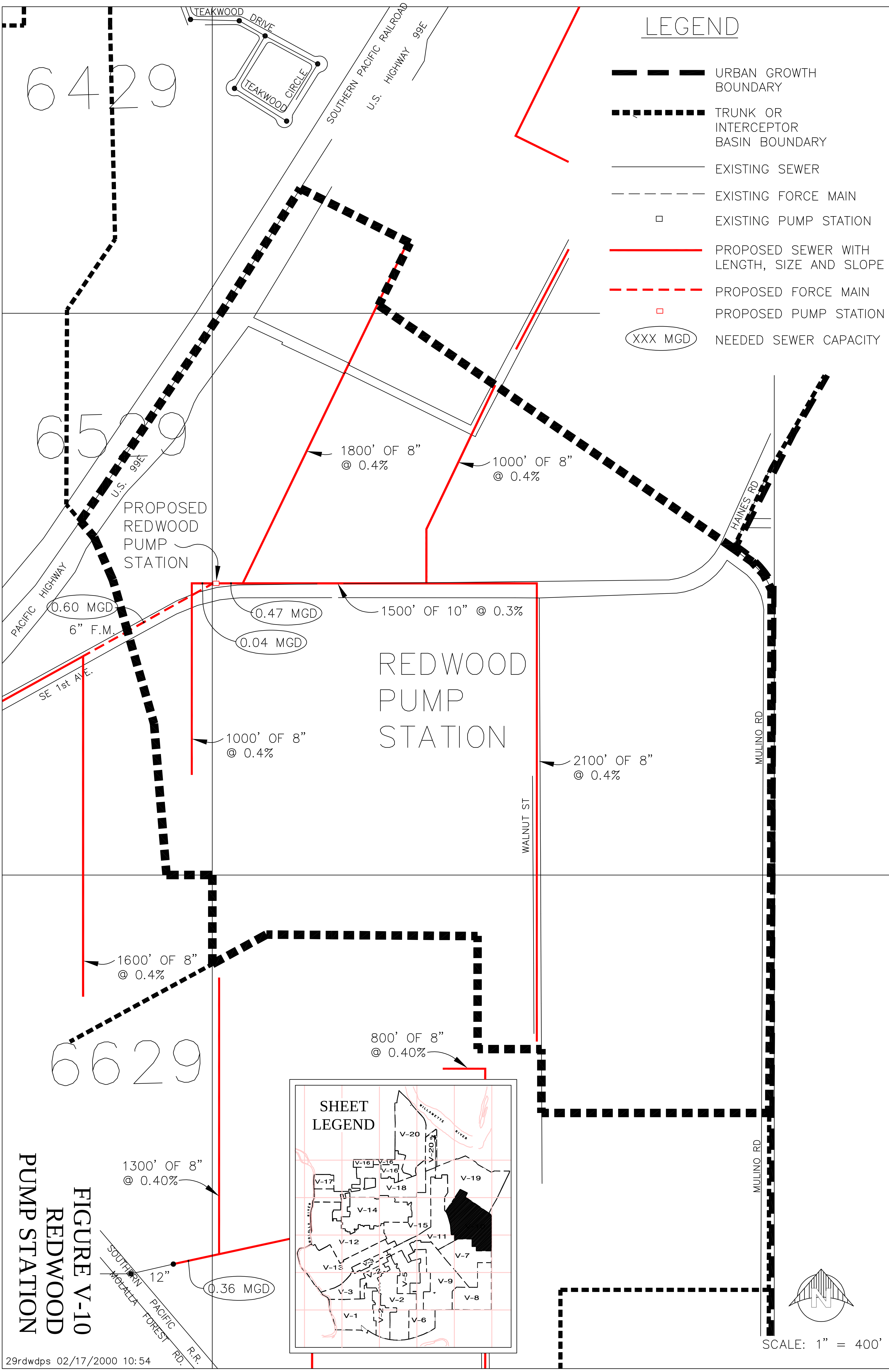


FIGURE V-10
REDWOOD PUMP STATION

J:\Canby\1009\1009 SSEWER MP FIGURES\V-10 REDWOOD PS.dwg, 3/20/2017 1:21:45 PM, Paul Beskow

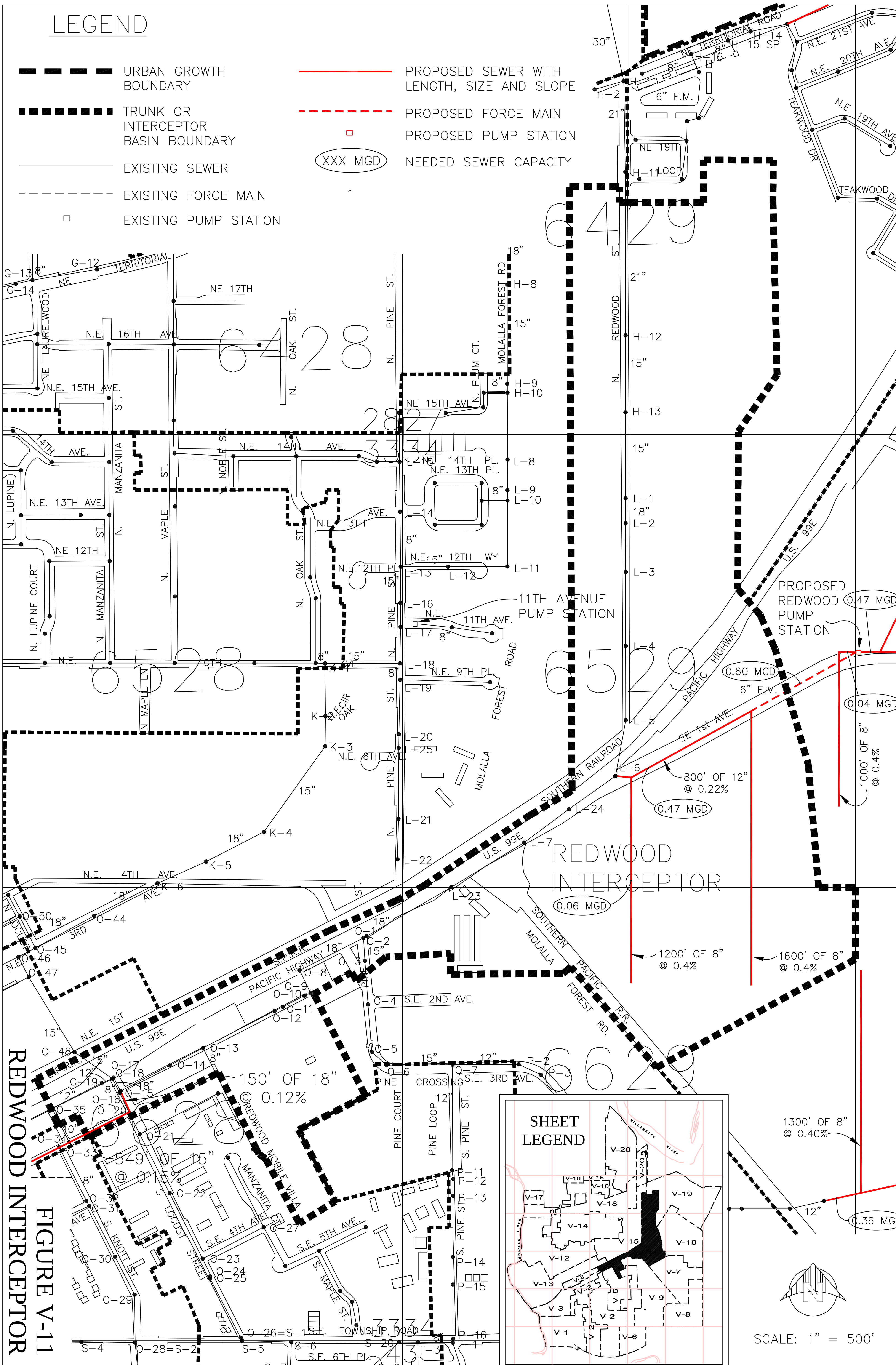


FIGURE V-11
REDWOOD INTERCEPTOR

J:\Canby\1009\1009 SSEWER MP FIGURES\V-11 REDWOOD INTERCEPTOR.dwg, 3/20/2017 1:22:21 PM, Paul Beskow

29rdwdnt 02/17/2000 10:55

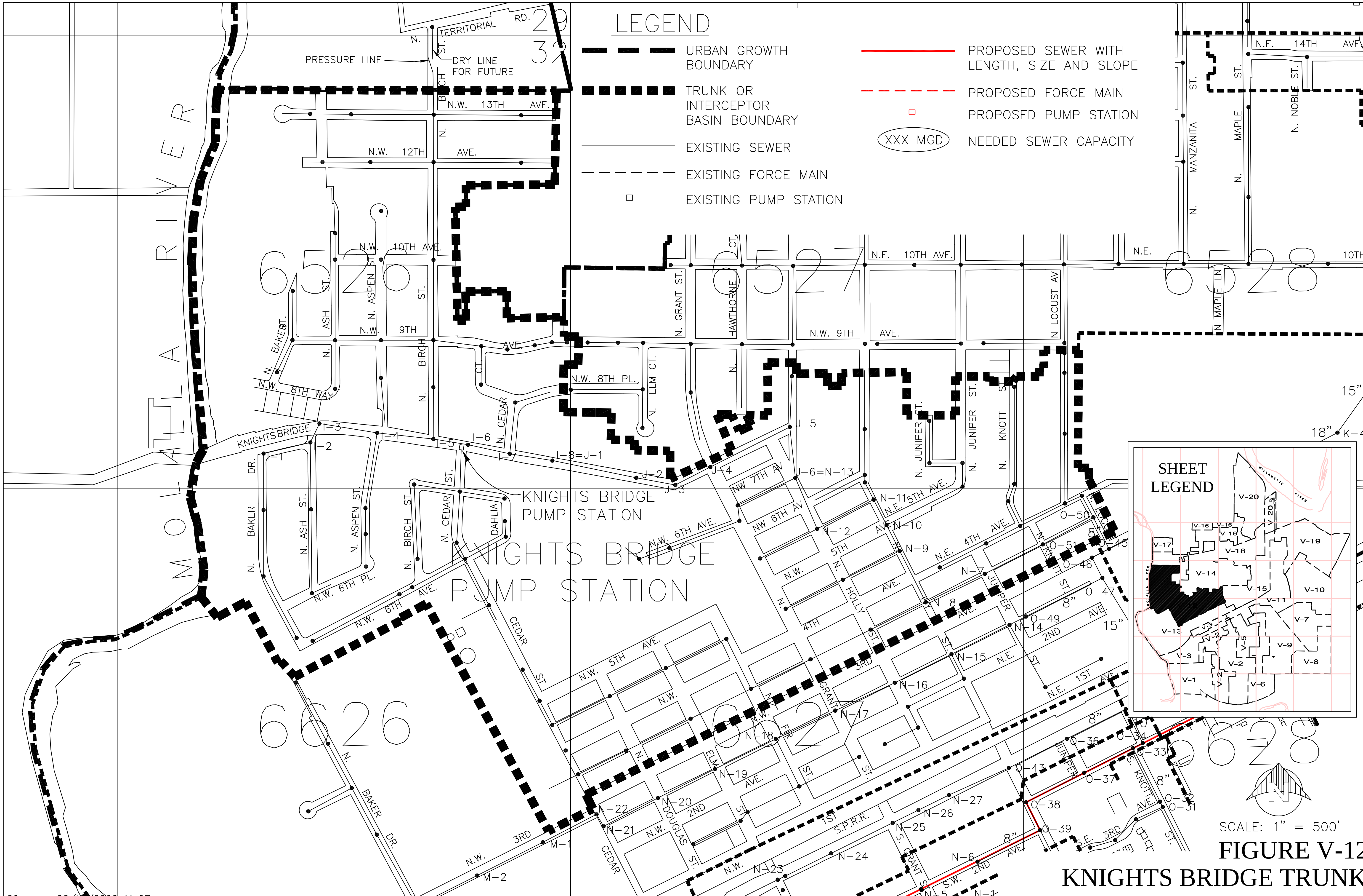
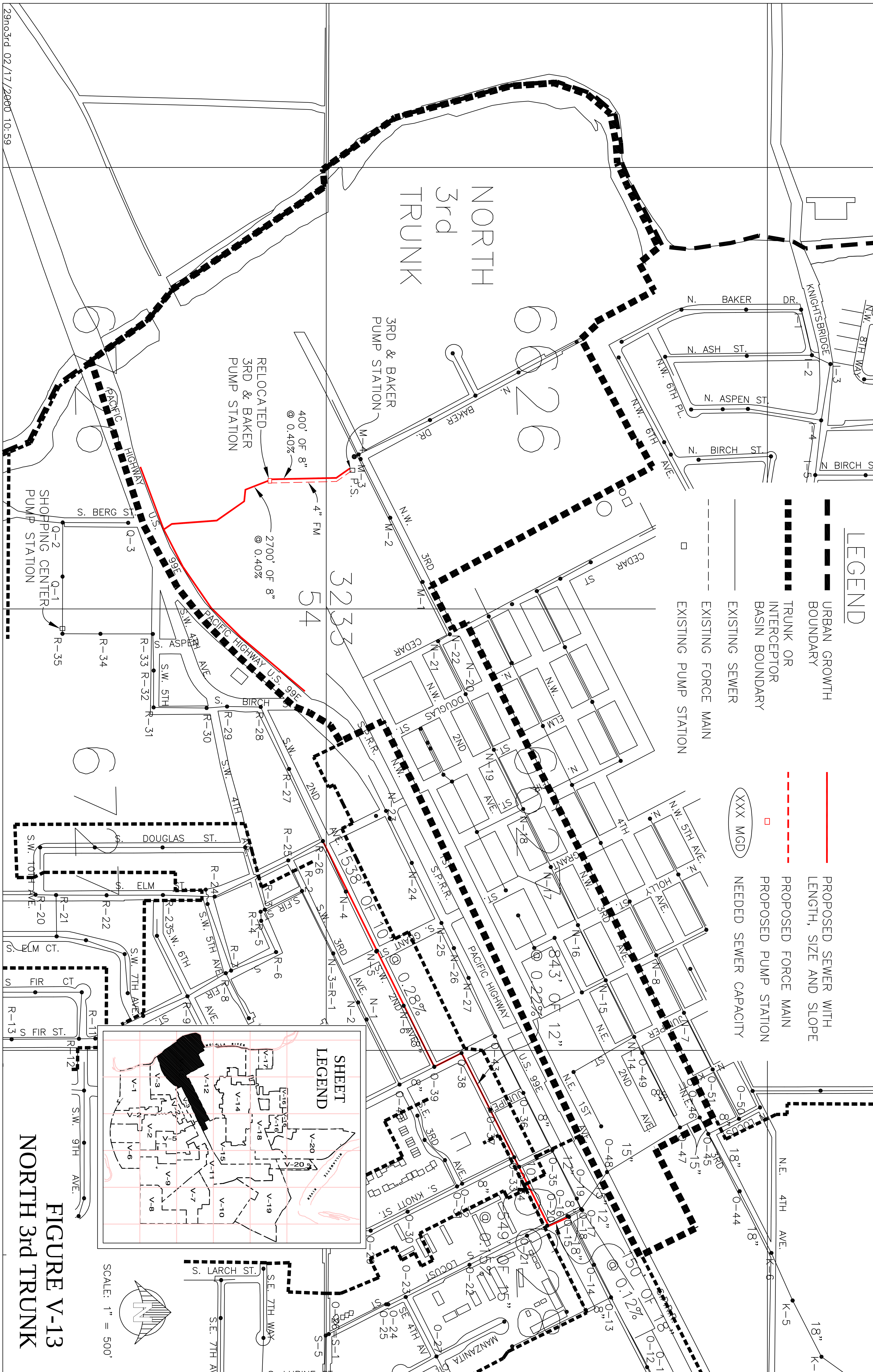


FIGURE V-12
KNIGHTS BRIDGE TRUNK

J:\Canby\1009\1009 SSEWER MP FIGURES\V-13 3RD ST TRUNK.dwg, 3/20/2017 1:19:31 PM, Paul Beskow



J:\Canby\1009\1009 SSEWER MP FIGURES\V-14 10TH ST TRUNK.dwg, 3/20/2017 1:18:39 PM, Paul Beskow

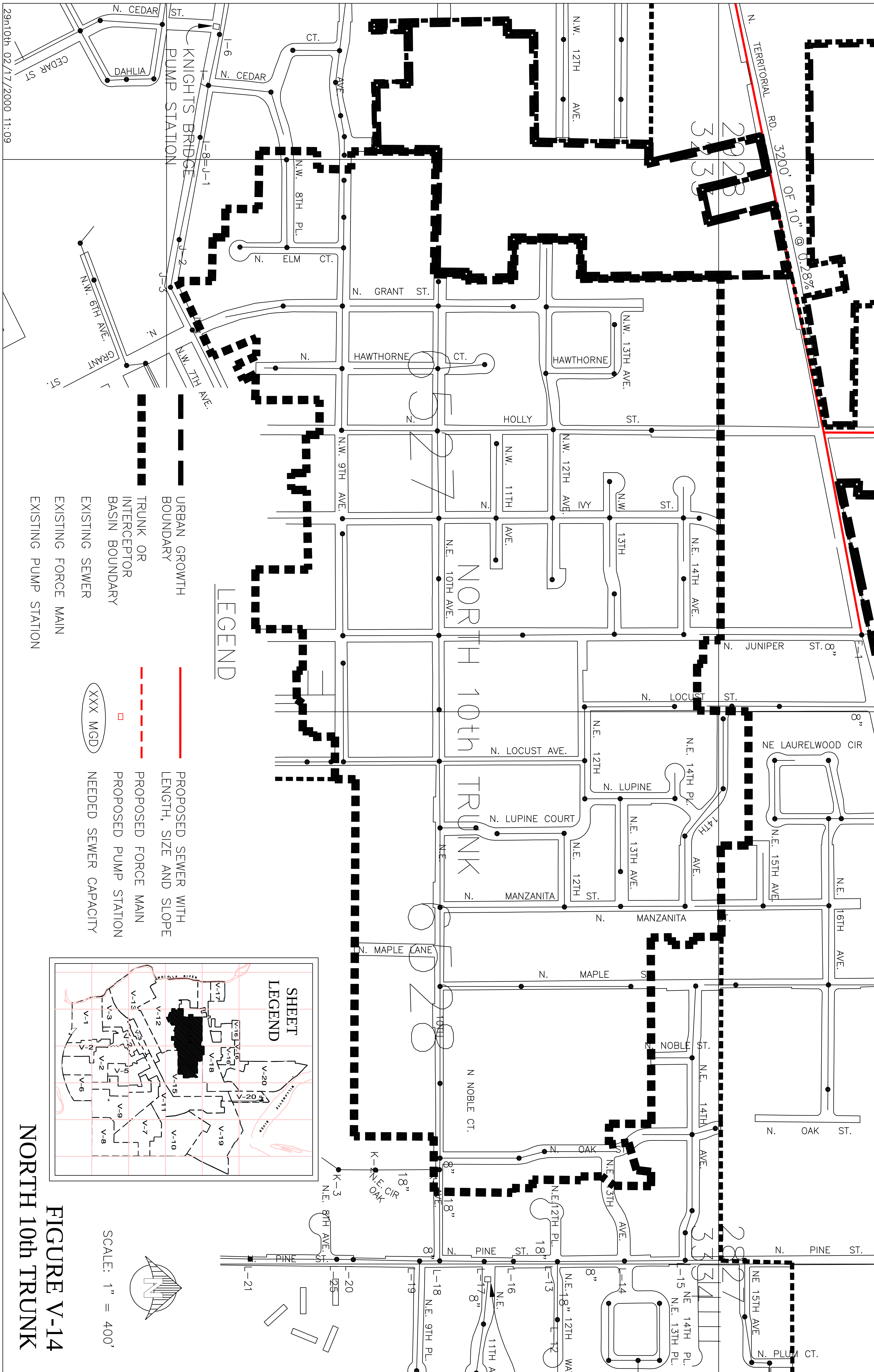


FIGURE V-14
NORTH 10th TRUNK

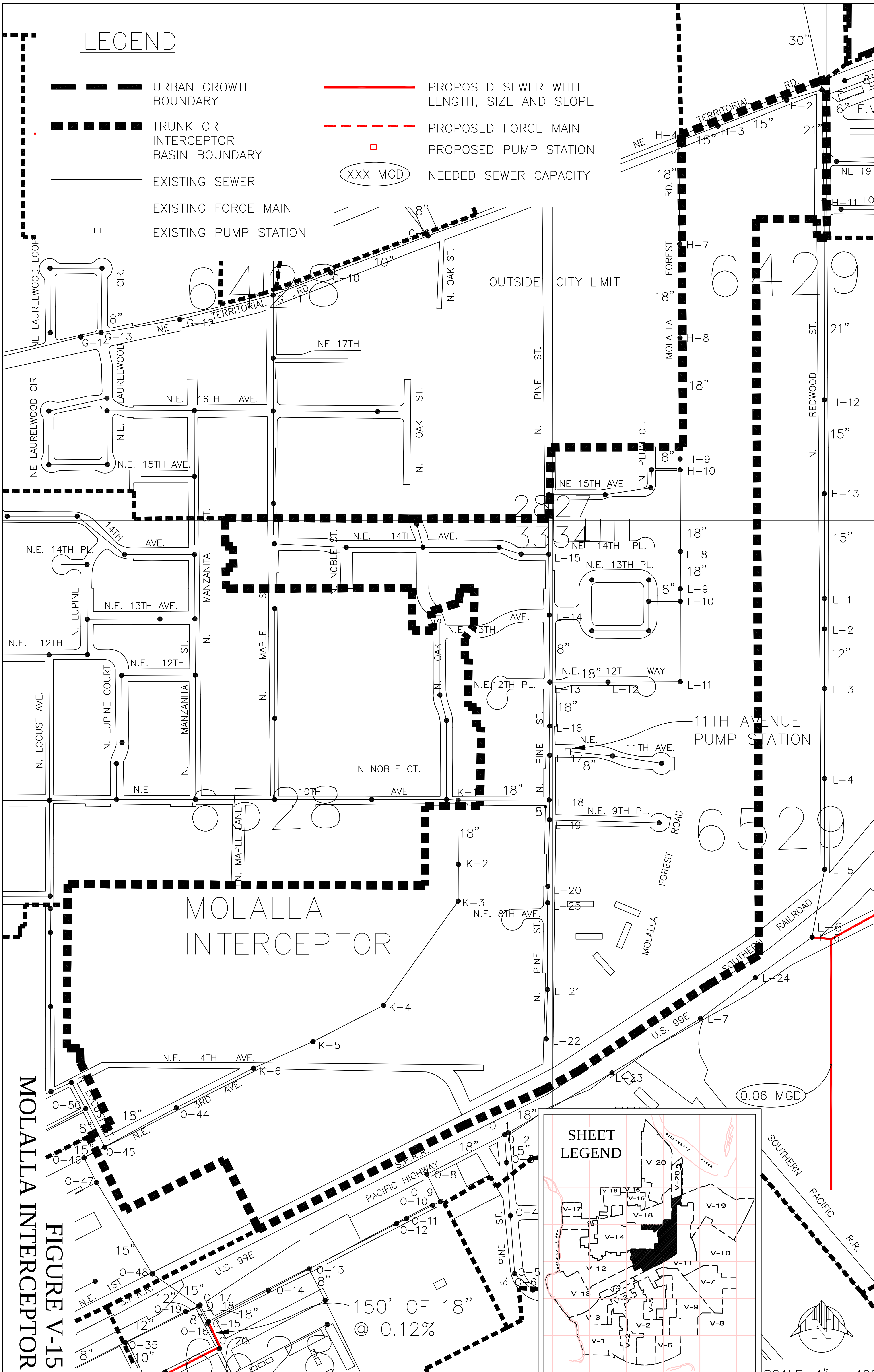


FIGURE V-15
MOLALLA INTERCEPTOR

J:\Canby\1009\1009 SSEWER MP FIGURES\V-15 MOLALLA INTERCEPTOR.dwg, 3/20/2017 1:17:47 PM, Paul Beskow

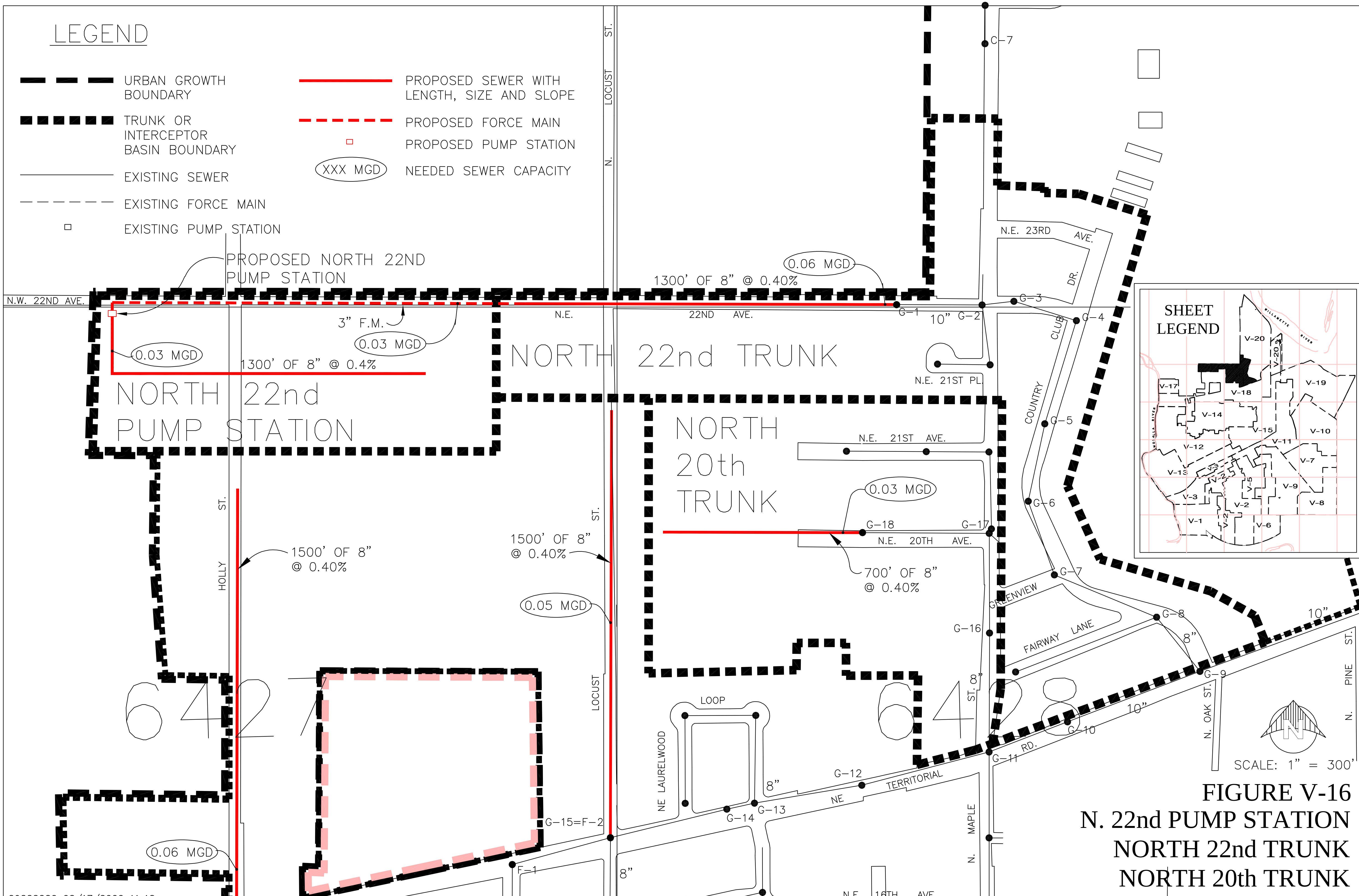


FIGURE V-16
N. 22nd PUMP STATION
NORTH 22nd TRUNK
NORTH 20th TRUNK

J:\Canby\1009\1009 SSEWER MP FIGURES\V-16 22ND PS_22ND TRUNK_20TH TRUNK.dwg, 3/20/2017 1:16:50 PM, Paul Beskow

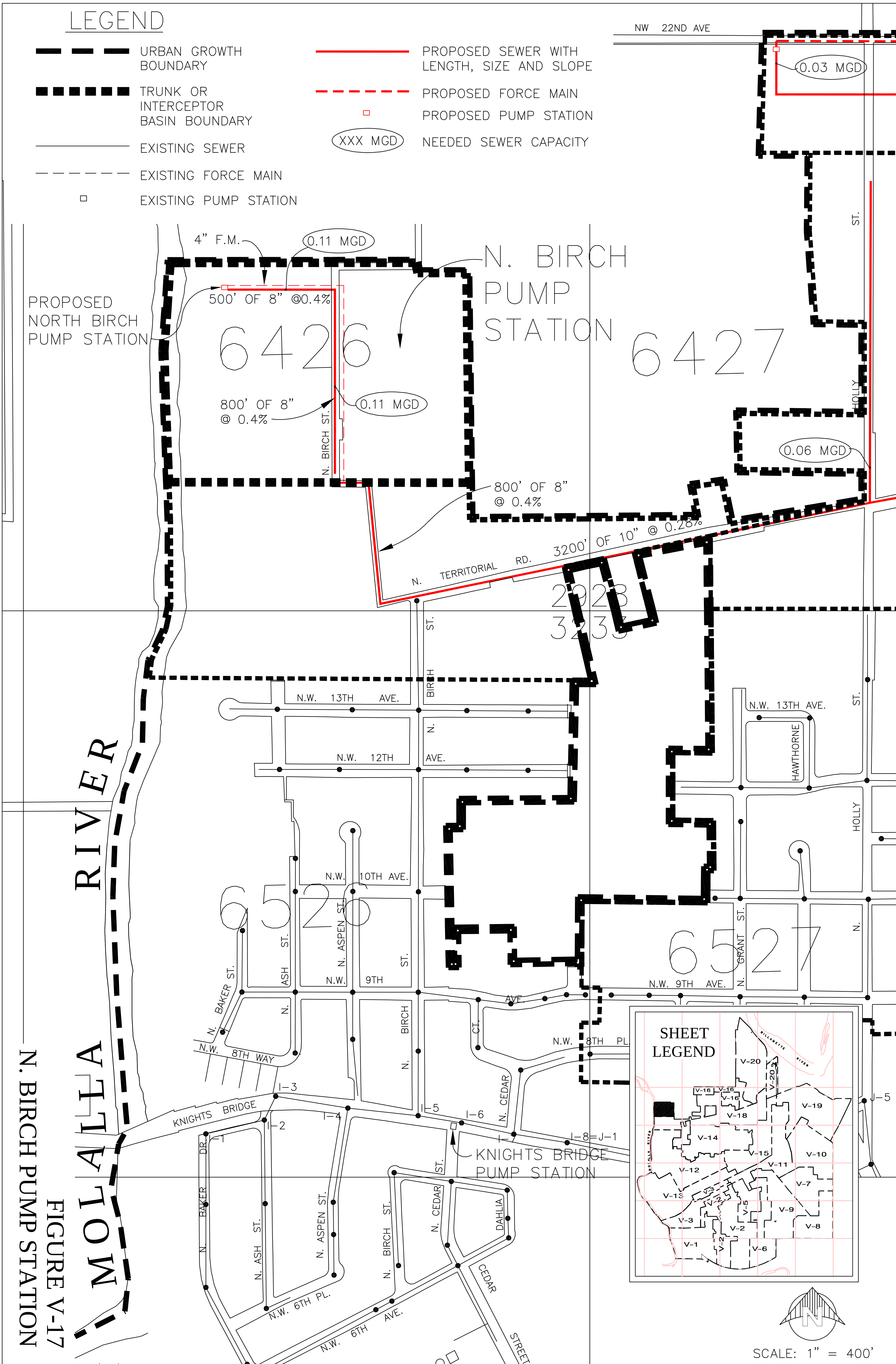
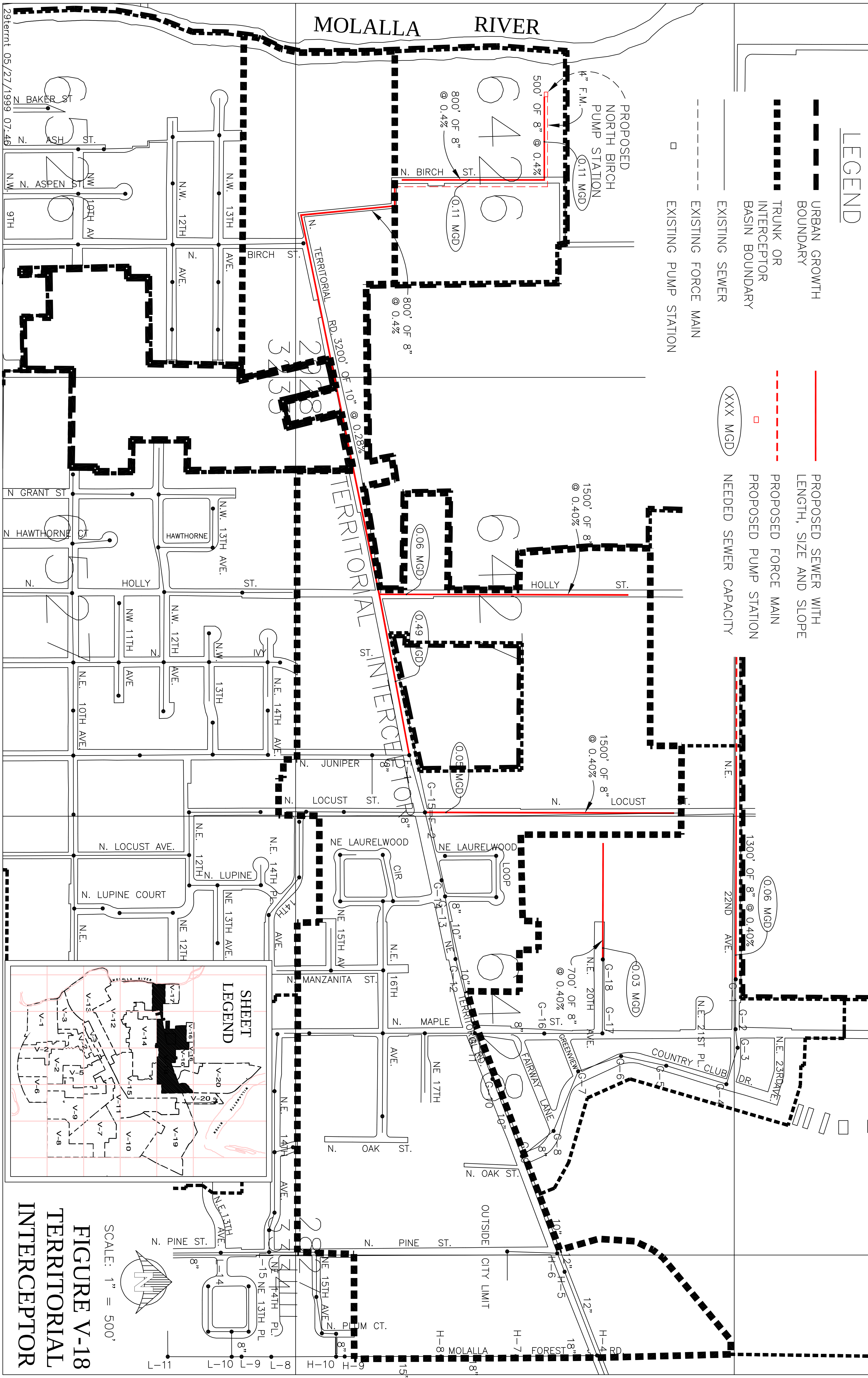


FIGURE V-17
N. BIRCH PUMP STATION

J:\Canby\1009\1009 SSEWER MP FIGURES\V-17 BIRCH PS.dwg, 3/20/2017 1:15:54 PM, Paul Beskow

J:\Canby\1009\1009 SSEWER MP FIGURES\V-18 TERRITORIAL INT.dwg, 3/20/2017 1:15:05 PM, Paul Beskow



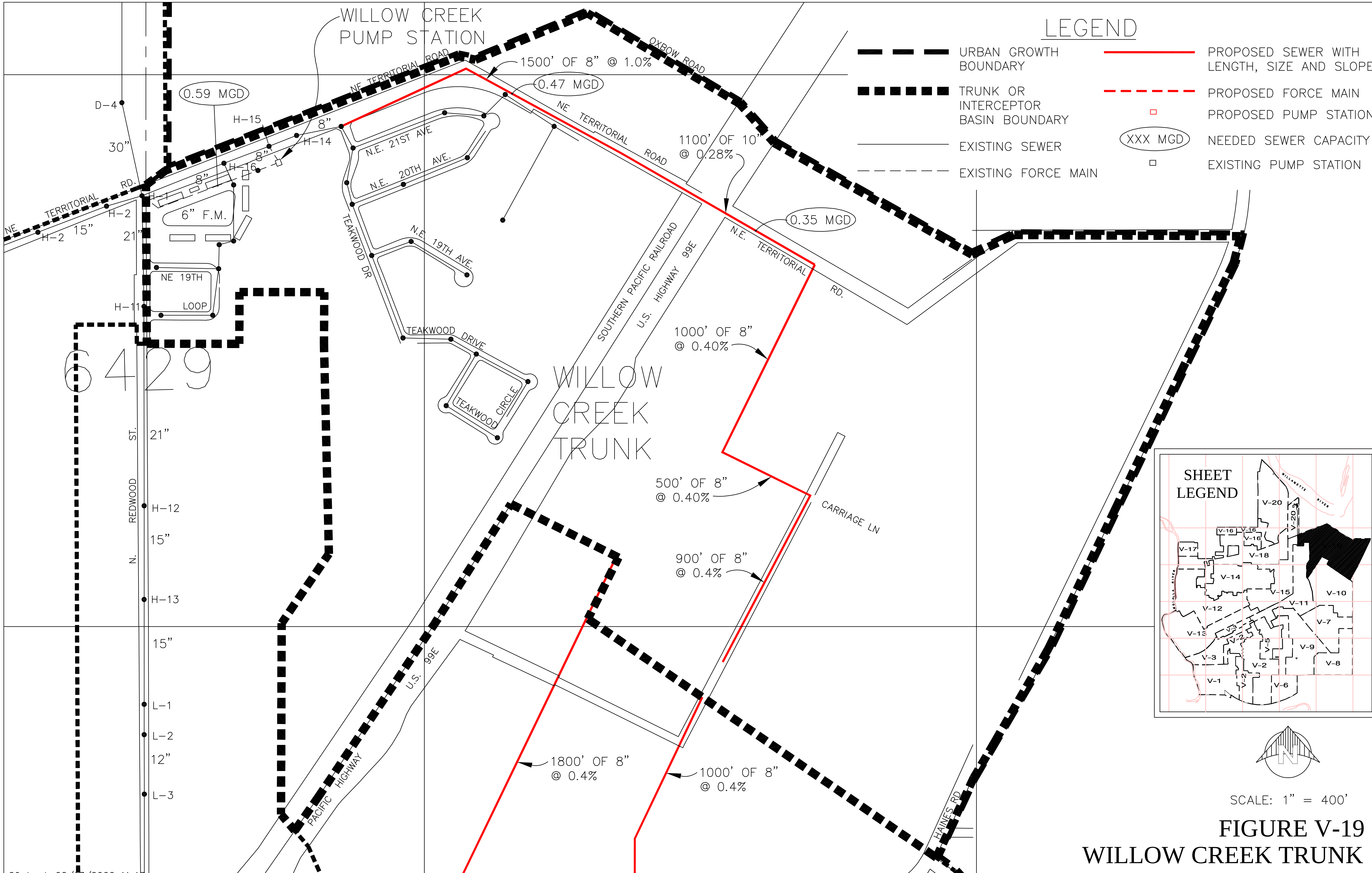


FIGURE V-19
WILLOW CREEK TRUNK

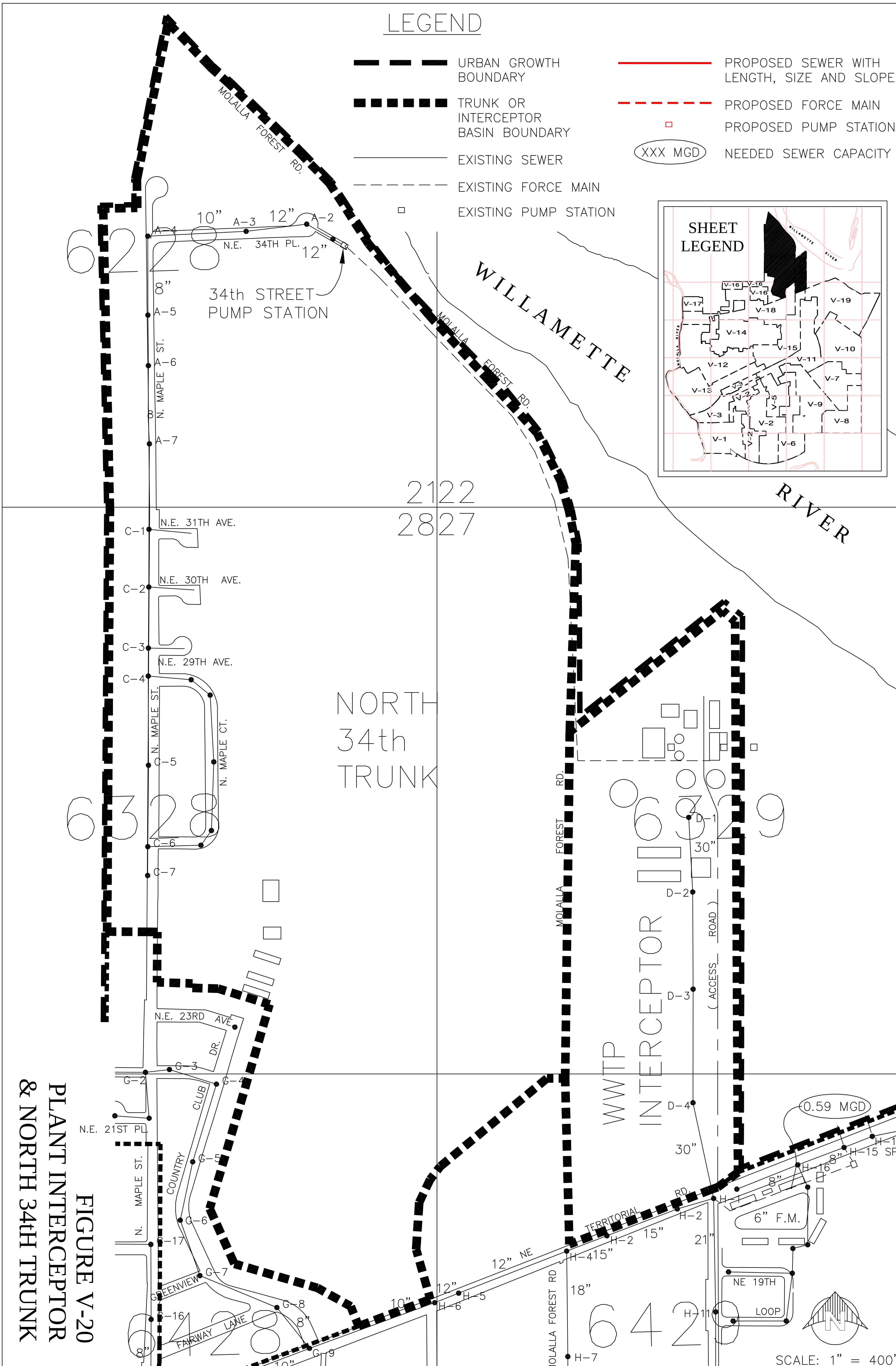


FIGURE V-20
PLANT INTERCEPTOR
& NORTH 34th TRUNK