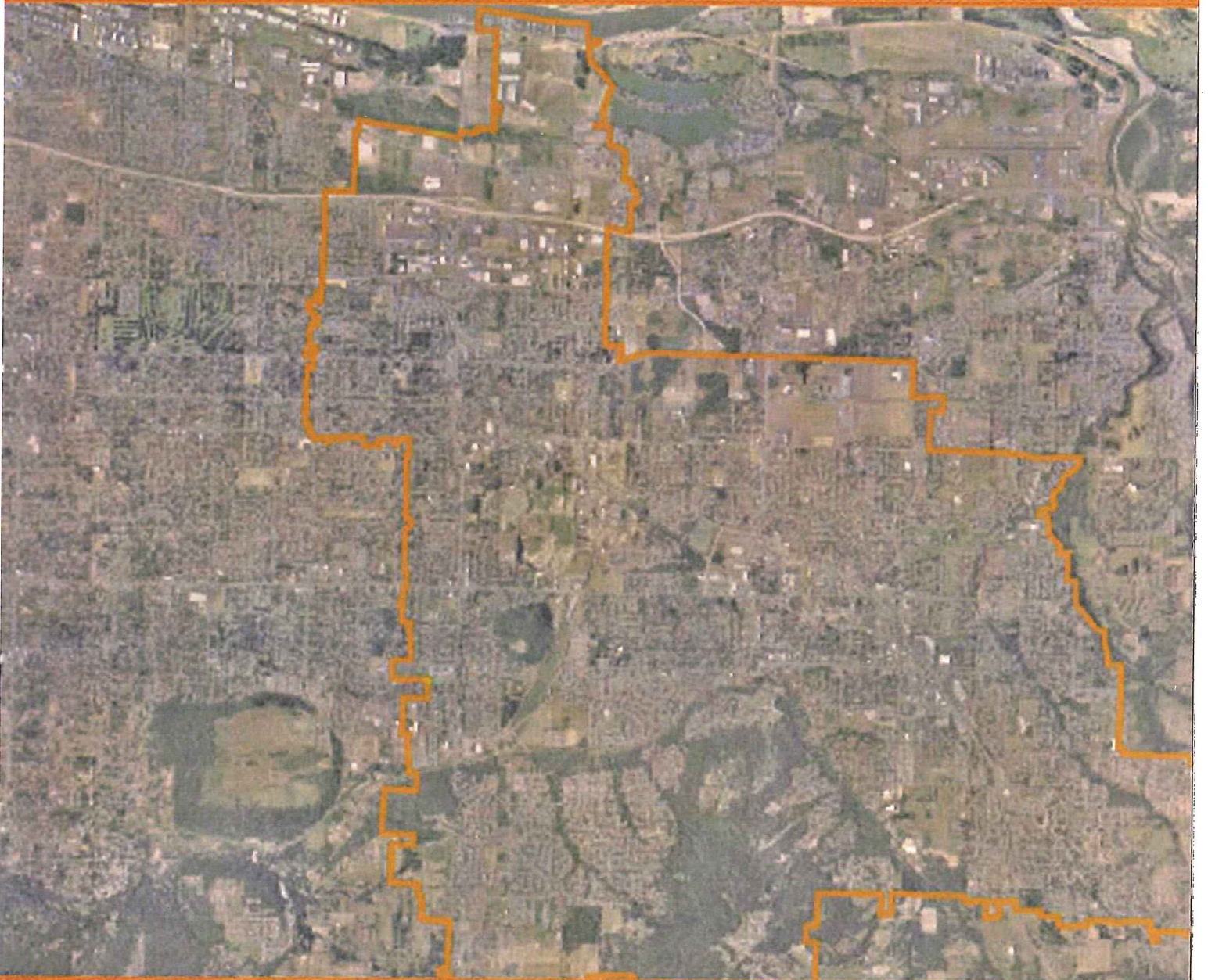


Wastewater Pump Station Master Plan

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EXHIBIT

A.3

CITY OF GRESHAM
WASTEWATER PUMP STATION MASTER PLAN
TECHNICAL MEMORANDUM
NO. 6

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1.0 INTRODUCTION

The purpose of this technical memorandum (TM) is to discuss the options of extending sewer services to two selected areas currently not served by the City of Gresham's gravity sewer system. The first area is located in the northeast City limits near 282nd Avenue, and extending from Chase Road north to Powell Valley Road. Secondly, the City has expressed interest in assisting the Sam Barlow High School to alleviate their costly wastewater pumping requirements.

Several options were developed and compared for how to best serve these areas. Because these areas are too low in elevation to be served by the gravity system, all options presented in this TM include installation of a pump station. Cost estimates were developed to assist the City in selecting the best option. The service areas, potential service options, estimated project costs, and a summary of recommendations are described below.

2.0 SERVICE AREAS

The City is concerned about serving the area around 282nd Avenue near Powell Valley Road. This area includes properties both within City limits and currently outside the City. The service areas of interest were reviewed for their potential contributing wastewater flows following the methods previously established in the Pump Station Master Plan. Current flows were determined based on number of dwelling units, as these areas are fairly undeveloped. Future flows were estimated based on zoning information, as provided by Metro and shown in Figure 1 below.

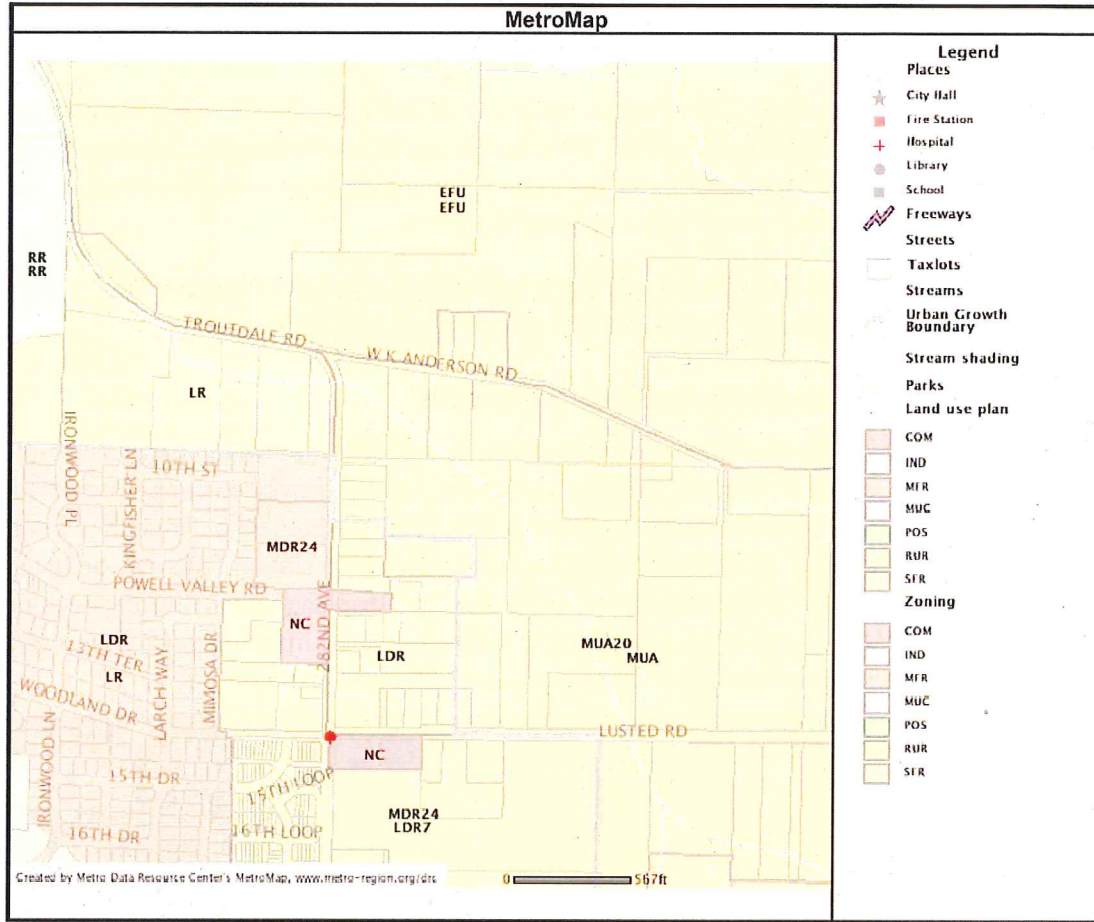


Figure 1 - Metro map of County Zoning

Following the method for estimating flow as presented in the City's Wastewater Master Plan, flows for future conditions were based on flow factors of 1,287 gallons/acre/day (gpad) for low-density residential areas and 4,400 gpad for multi-family residential areas. Peak flows were estimated using a peaking factor of 3.

2.1 Areas within City Limits

To estimate flow requirements of a potential pump station, the areas within the City limits were organized into three sub-areas: a partially developed subdivision near Powell Valley Road, a 7-acre section of land, and a 17-acre area.

2.1.1 Partially Developed Subdivision North of Powell Valley Road

The City would like to provide sewer service to an area that includes several lots from a partially developed subdivision north of Powell Valley Road and west of 282nd Avenue, as outlined in yellow in Figure 2. From the GIS data, the subdivision appears to have several connecting private sewer laterals installed in the front, back, and side yards of the lots. This unusual configuration is probably due to the difficulty in obtaining adequate elevation to

discharge to the nearby public gravity sewer system. The City desires to install a gravity system that will alleviate the difficulties associated with extensive private sewer laterals.

This area also includes two larger lots, one of which appears to serve as the parking lot to an adjacent Extended Care Facility that is currently served by the City gravity system. This parcel is zoned for multi-family residential. The other large lot in this area is a low-density residential zoned parcel with one dwelling unit.

Combining the estimated flows in this area yields a peak wastewater flow of approximately 19,000 gpd and a future flow of 35,000 gpd when fully developed.

2.1.2 7-Acre Parcel North of Lusted Road

The City would also like to provide service to a 7-acre area within City limits that appears to be at an elevation too low to be served by the current gravity sewer system. Based on topographic contours shown on the City GIS data, the parcels outlined in red in Figure 2 were included in this area to be served by a new pump station. This low-density residential zoned area contains about nine parcels, with five dwelling units currently developed. Based on current land use and zoning, peak wastewater flows from this area were estimated to be 3,000 gallons per day (gpd) currently and 27,000 gpd in the future.

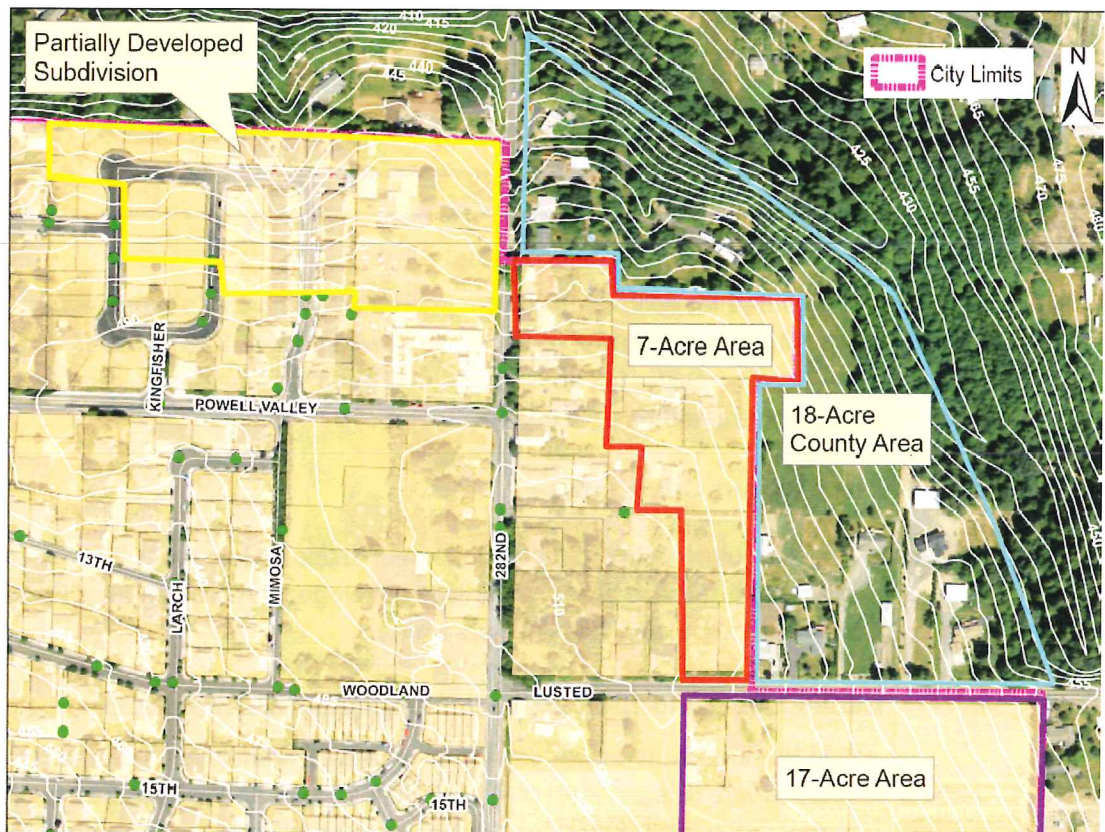


Figure 2 - Service Areas North

2.1.3 17-Acre Parcel South of Lusted Road

Another area within City limits that is too low in elevation to flow to the gravity system is the area south of Lusted Road, east of 282nd Avenue, and just west of the City limits as shown in Figure 3. This 17-acre undeveloped area is zoned for multi-family residential flows. As such, current flows are non-existent and future peak flows are estimated at 218,000 gpd under full development conditions.

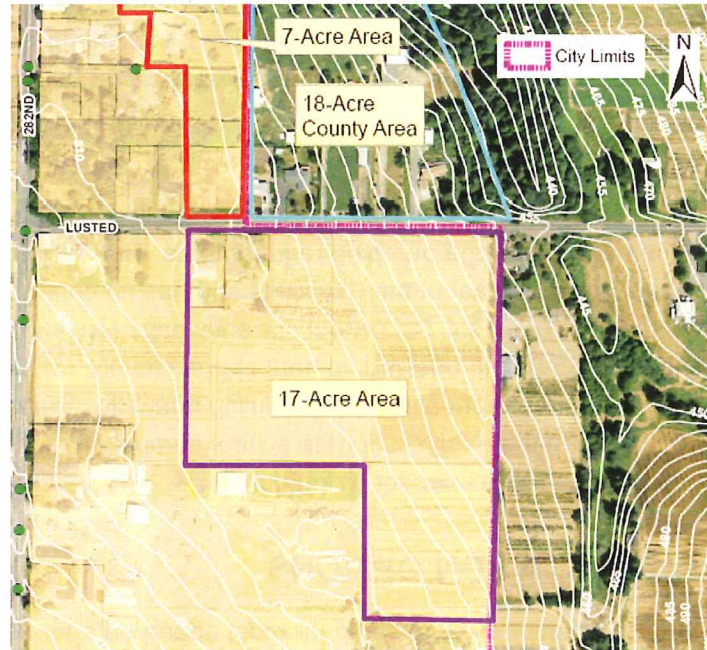


Figure 3 - Service Areas South

2.1.4 2.1.4 Areas within City Limits Summary

Table 1 provides a summary of the zoning and estimated current and future peak flows for the areas within City limits. These flows are used below for sizing the potential pump stations.

Table 1 Summary of Service Areas Wastewater Pump Station Master Plan City of Gresham			
Service Area	Zoning	Current Peak Flow (gpd)	Future Peak Flow (gpd)
Partially Developed Subdivision	Low Density Residential & Multi-family Residential	19,000	35,000
7-Acre Area	Low Density Residential	3,000	27,000
17-Acre Area	Multi-family Residential	0	218,000

2.2 County Areas North of Lusted Road

The City could include some county parcels (not within the City Limits) that could benefit from a pump station within the vicinity. Several county lots adjacent to the City limits were reviewed for their potential to contribute flows to the City gravity system should they be annexed into the City. Parcels assumed to have potential to contribute flows in the future are delineated in blue in Figure 2. As seen in the figure, this 18-acre area is limited to the east by Beaver Creek. The parcels within this area are currently zoned as agricultural use. It was assumed that if these areas were annexed, the zoning would be low-density residential, yielding future peak flows of approximately 68,000 gpd.

2.3 Sam Barlow High School

Additionally, the City has expressed interest in assisting the Sam Barlow High School to alleviate their costly sewage pumping requirements. The Sam Barlow High School is located about one mile east of the City limits and has no connection to a sewer system. According to school officials, the school currently pays roughly \$50,000 annually, \$25,000 for staffing and \$25,000 in trucking, to haul approximately 15,000 to 18,000 gpd of wastewater to the treatment plant. Daily hauling quantities were not available at the time of this study; therefore the analyses for the school pumping needs are approximated. Peak flows of 20,000 gpd were used for sizing pumps.

3.0 PUMP STATION OPTIONS

Two main pump station locations appear most appropriate for serving the areas of concern within the City, both of which are located on 282nd Avenue. However, a third potential location arises with the possibility of the Sam Barlow High School requiring a pump station. This option is discussed within the Sam Barlow High School options below.

The pump station locations included in this study were selected based on elevation and available open space according to the City GIS data and aerial photos. All pump station options consider the significant increase in future flows, especially due to the 17-acre parcel south of Lusted Road. Pumping requirements are estimated using DEQ standards for pump stations, including specifying a 4-inch minimum diameter force main with velocities between 3 and 8 feet per second. Proposed piping generally aligns with open space and driveways or private roads, and avoids conflicts with existing structures while maintaining required elevations.

3.1 Option 1 - Pump Station on 282nd Avenue within City Limits

This first pump station option locates the pump station just inside the City limits on 282nd Avenue as shown in Figure 3. Gravity sewer mains that discharge to this pump station could serve the partially developed subdivision, the 7-acre area, and, if a gravity line is extended along Beaver Creek, the 17-acre area as well. Potential gravity sewer lines are shown as dashed red lines in Figure 3. The proposed gravity line delineated along the

creek is located as such to maintain low elevations and avoid conflicts with existing buildings. A flow evaluation shows that an 8-inch diameter pipe would suffice for current and future flows.

At this location, the pump station ground elevation is roughly 445 feet according to the City GIS data. A force main from this pump station would need to extend roughly 550 feet to reach the nearest manhole in 282nd Avenue (Manhole 3558-6-125), with an invert elevation of 486.5. A pump station in this location would need to have a firm capacity of approximately 120 gpm @ 58 feet total dynamic head (TDH) to serve the current peak City flows. To accommodate future City flows, the pump station should allow adequate room to increase capacity to 250 gpm @ 75 feet TDH.

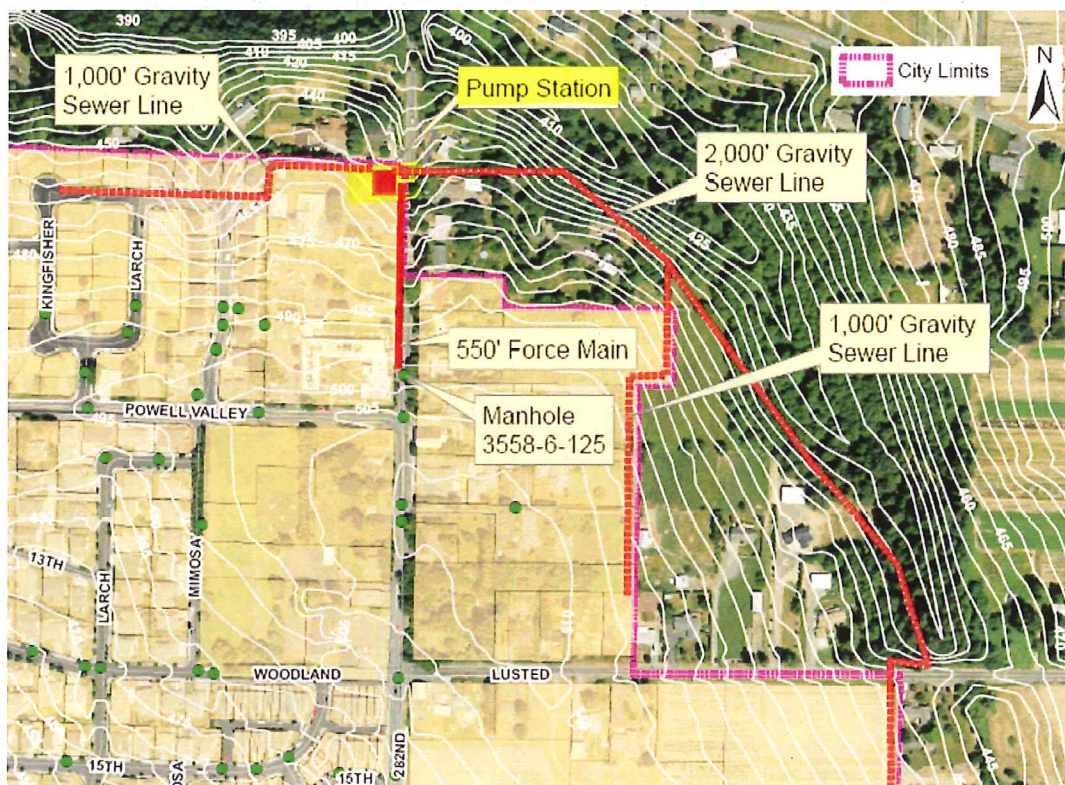


Figure 4 - Pump Station Option 1

Installing a pump station at this location could provide service to the areas within the existing City limits. The City would need to purchase property for the pump station and acquire several easements, including those outside the City limits for extending the gravity mains on private property. This location for the pump station limits the ability to serve any properties north of the proposed gravity pipe alignment because of elevation limitations. However, this option places the pump station at the highest elevation possible, thereby minimizing pumping head requirements.

3.2 Option 2 - Pump Station on 282nd Avenue at Creek Crossing

Another potential location for a pump station is near the Beaver Creek crossing on 282nd Avenue as shown in Figure 5. Similar to the option described above, gravity sewer lines could extend along Beaver Creek to the pump station at this location and serve all areas within the current City boundaries. The pump station surface elevation would be approximately 405, adding about 40 feet of pumping head as compared to Option 1. Figure 5 shows the pump station located on the east side of 282nd Avenue. Locating the pump station on the west side appears feasible as well. The location could also be shifted to the north side of the stream crossing, closer to the intersection of 282nd Avenue and Troutdale Road; however, this would require an unnecessary stream crossing with the gravity pipe and force main. The force main for this option would need to extend approximately 800 feet to reach the nearest manhole in 282nd Street.

Locating the pump station outside of the City limits allows service of several areas outside the current City boundary, should these parcels eventually annex to the City. With these potential additional flows, the pump station would need to be sized to have a firm capacity of 120 gpm @ 101 feet TDH and allow a future capacity increase to 400 gpm @ 105 feet TDH. Construction of the pump station in this location may be difficult due to the proximity to a riparian area and steep slopes. Additionally, this pump station location will require longer gravity mains, a longer force main, and a higher pumping head.

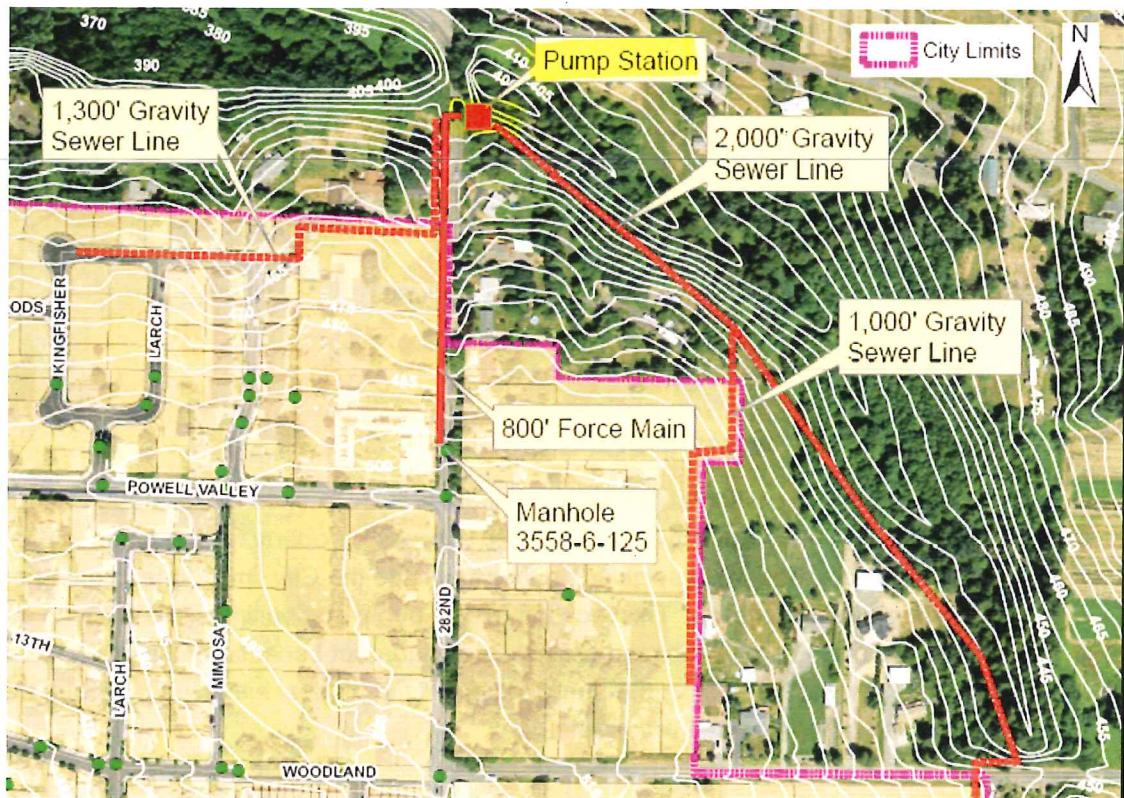


Figure 5 - Pump Station Option 2

3.3 Sam Barlow High School Pump Station Options

On behalf of the Sam Barlow High School, the City has requested that a net present worth cost comparison be prepared for assessing construction of a pump station to serve the school. Limited information was provided to develop a complete analysis of this potential service area.

3.3.1 Sam Barlow High School Pump Station & Lusted Road Gravity Line

From discussion with the City, it appears that a pump station at the school is needed to lift wastewater from the current holding tank to the elevation of Lusted Road prior to any gravity flow towards the City. Given the flows identified and estimated pumping head, a compact proprietary pump station would be adequate for this application. The actual location and elevation of the current holding tank are unknown at the time of this study, therefore an assumed static head of 20-feet was used to estimate pumping head requirements. Assuming peak flows of 20,000 gpd, a firm capacity of 120 gpm @ 20 feet TDH is estimated to provide adequate capacity for the anticipated flows and meet DEQ standards. The school will need to identify an adequate location for the pump station depending on the location and elevation of the current holding tank.

Reaching the City sewer system also requires that a gravity sewer main be constructed along Lusted Road from the school to the Beaver Creek crossing. From aerial photos it appears that the existing road right-of-way has adequate room for this construction outside of the pavement. The school would need to obtain a permit from Multnomah County to have the sewer line in the Lusted Road right-of-way. This permit and additional land use permits are anticipated to be inexpensive and minor in scope.

3.3.2 Extension to the City System

Given the topography of Lusted Road, based on the City's GIS data, the school will be unable to pump from the school all the way to the City system due to a natural low point in Lusted Road at its crossing of Beaver Creek. A force main crossing a natural low point such as this will result in ponding of wastewater in the force main, which can lead to odors and pipe corrosion. Two alternatives were developed to identify the best option for extending the school sewer system to the City sewer once the school flows have reached this low point at Beaver Creek.

① One option relies on a new gravity sewer main along Beaver Creek north of Lusted Road to the proposed pump station in 282nd Avenue, as discussed above. If this gravity line were installed to serve the 17-acre area, the school could also discharge wastewater to this line. Figure 6 depicts this option. The potential pump station on 282nd Avenue, summarized above as Option 1 and Option 2 to serve the areas within the City Limits, would need to be appropriately sized to handle the school flows.

② The second option is to construct a second pump station near the Beaver Creek crossing as presented in Figure 7. A pump station with the ability to pump 120 gpm @ 44 feet TDH

is calculated to be adequate for this location (if serving only the school). This pump station could be located on the northwest corner of a large lot, just inside City limits as shown in Figure 7. Surface elevations in this area are approximately 450 feet. The force main would need to extend from Lusted Road to the nearest manhole in 282nd Avenue (Manhole 3558-6-108) with an invert elevation of 481.15 feet.

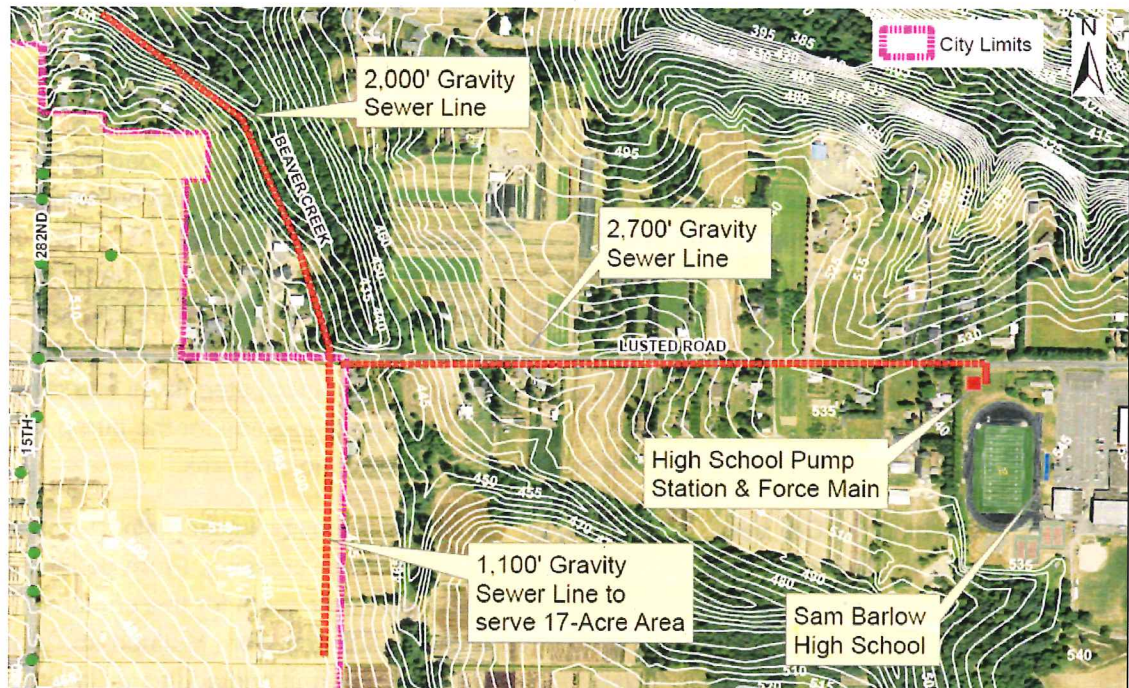


Figure 6 - Sam Barlow High School Option A

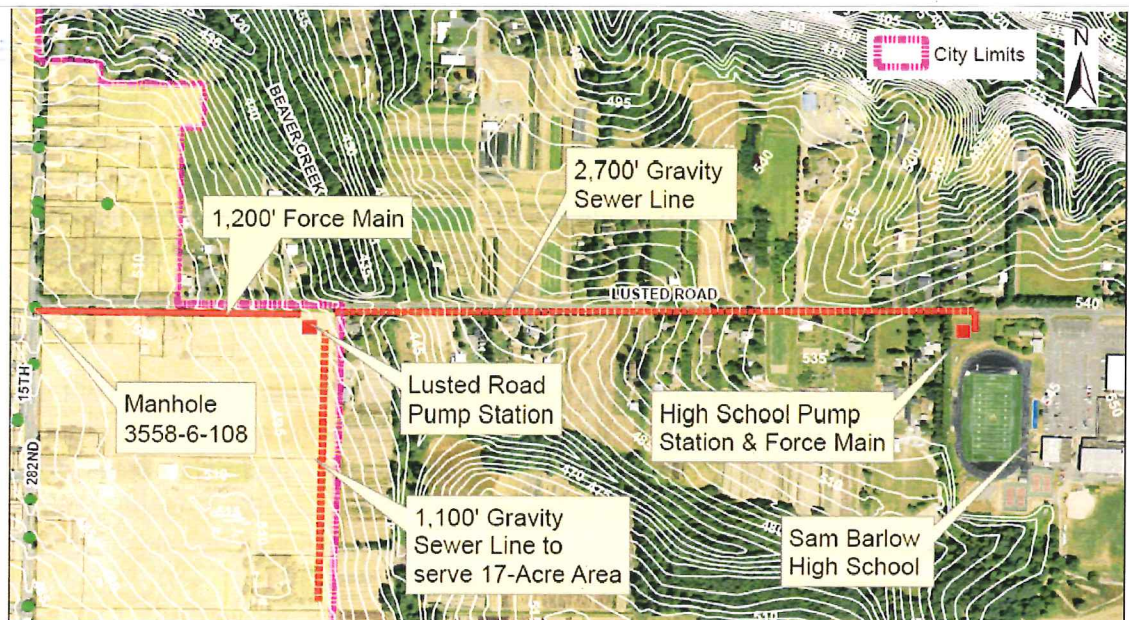


Figure 7 - Sam Barlow High School Option B

3.4 Combined City and School Pump Station at Lusted Road

Given the option of a pump station at Lusted Road for the High School warrants consideration of serving City areas with the same pump station. Figure 7 shows a potential gravity line from the 17-acre area within the City that requires sewer service. If a pump station were constructed in this location, it could serve the 17-acre area when development occurs, avoiding the need for a gravity main along Beaver Creek north of Lusted Road. As current flows from this area are non-existent, the pump station would need to be constructed to meet current school flows and allow for larger pumps to be added in the future. If the area were to be fully developed as multi-family residences, the additional flow would require a pump station to have a capacity of 300 gpm @ 41 feet of TDH. Large future flows would require replacing the force main with a larger pipe.

Additionally, the pump station in 282nd Avenue would not need to be increased to handle the future flows coming from this area. A cost comparison of these alternatives is presented below.

4.0 COST ESTIMATES

Cost estimates were prepared for each feasible alternative in order to identify the most economical solution. The alternatives were then evaluated using a net present worth (NPW) cost comparison considering a 50-year life. Estimates include initial capital costs, annual O&M, and pump replacement every 25 years. The net present worth costs were developed by projecting costs from the recommended year of implementation back to current dollars using a discount rate of 3%.

Capital Costs: Capital Costs were developed using a Class 4 budget estimate, as established by the American Association of Cost Estimators (AACE). This level of estimate is used for feasibility studies and assumes a 1% to 15% level of project definition. Project cost estimates include verbal quotes from local pump station manufacturers for major project components and allowances for other elements.

As all of the pump stations identified in this study have a large ratio of future flows to current flows, the pump stations have been sized to meet future flow requirements. This means that the pump stations are sized to handle larger pumps and piping, but may be initially installed with smaller pumps. For simplicity, the time frame for increasing pump capacity to accommodate future flows assumes that full development will occur in 25 years, concurrent with pump replacement for wear and tear. Pump station estimated costs assume that adequate electrical services are available onsite and electrical components are estimated at 30% of pumping requirements.

All gravity sewer lines are assumed to be 8-inch diameter, consistent with City design standards. Force mains are assumed to be no smaller than 4-inches in order to meet DEQ requirements to pass a 3-inch ball through the system. Construction of piping near Beaver

Creek assumes open pipe trenching and includes tree removal, and hydroseeding of backfill.

Once direct costs were developed, the cost estimates were increased to reflect unknown construction conditions and other cost increases in the form of indirect costs. Indirect costs are assigned as a percentage of total direct costs as shown in Table 2. Estimates for the various projects do not include right of way or easement costs, other than those amounts included in the 25% Engineering/Legal/Admin adjustment factor.

Table 2 Indirect Costs Wastewater Pump Station Master Plan City of Gresham	
Contingency	Percentage in Estimate
General Contingency	30%
General Conditions	15%
General Contractor Overhead	15%
Engineering/Legal/ Administration	25%

Annual Costs: Annual costs for maintaining pump stations were estimated based on similar sized pump stations as estimated in the Pump Station Master Plan. Total O&M costs are assumed to be approximately \$6,000 annually, depending on the pump station size.

4.1 Costs of City Pumping Options

The estimated costs for the key project elements to serve the Service Areas for the City are summarized in Table 3. These costs were used to develop the NPW cost comparison shown in Table 4 below.

The results of the NPW cost comparison are shown in Table 4 below. The capital expenditures for the years 2010, 2035, and 2055 reflect the initial construction, future capacity expansion, and replacement of pumps, respectively. The initial construction in 2010 includes the costs of constructing a pump station and installing the necessary infrastructure to reach all areas to be served, which includes over 5,000 feet of 8-inch diameter gravity sewer pipe.

As seen in the table, the NPW of constructing a pump station on 282nd Avenue inside the City limits compared to outside the City limits is not significantly less, despite the difference in pumping head requirements. Differences in pump sizes are not significant compared to the overall capital expense of these two projects.

The option to construct two pump stations has a higher NPW, as expected. To present the simplest scenario for this option, the cost estimate excludes construction of a gravity line along Beaver Creek where it serves only county areas. Serving the county areas would require an additional \$343,000 of infrastructure along Beaver Creek. The costs in this

scenario reflect a much smaller 282nd Avenue Pump Station because flows from the 17-acre area would not be directed to that pump station.

Table 3 Capital Cost Estimate for City Pumping Options Wastewater Pump Station Master Plan City of Gresham	
Item	Estimated Capital Cost (In 2008 dollars)
Gravity Sewer Systems:	
Partially Developed Subdivision (1,000 LF)	\$211,000
7-Acre Area (1,800 LF)	\$342,000
17-Acre Area (1,100 LF)	\$211,000
Beaver Creek Gravity Line (1,200 LF)	\$343,000
Pump Stations:	
282nd Ave. Pump Station inside City Limits	\$477,000
4" Force Main (500 LF)	\$65,000
282nd Ave. Pump Station near Beaver Creek	\$533,000
4" Force Main (800 LF)	\$104,000
Lusted Road Pump Station	\$505,000
4" Force Main (1200 LF)	\$156,000

Table 4 NPW Cost Comparison for City Pump Station Options Wastewater Pump Station Master Plan City of Gresham					
Pump Station Location	Annual O&M	Capital Expenditures			Net Present Worth
		2010	2035	2055	
282nd Avenue inside City Limits	\$155,000	\$1,555,000	\$45,000	\$21,000	\$1,755,000
282nd Avenue outside City Limits	\$170,000	\$1,645,000	\$76,000	\$21,000	\$1,890,000
Two Pump Stations: 282nd Avenue and Lusted Road	\$300,000	\$1,684,000 ⁽¹⁾	\$137,000	\$32,000	\$2,122,000 ⁽¹⁾
⁽¹⁾ Cost does not include gravity sewer pipe along entire length of Beaver Creek (additional \$343,000).					

4.2 Costs of Sam Barlow High School Pumping Options

Several assumptions were made for estimating the cost of a pump station at the Sam Barlow High School, as some information was unavailable at the time of this report. The cost estimate assumes that a school pump station would need to pump peak flows of 20,000 gpd at 20-feet of head through a 100 foot long, 4-inch force main to reach a gravity line in Lusted Road. Estimates for the pump station are based on quotes of a Smith & Loveless manufactured pump station set on top of a 5-ft diameter, 15-ft deep wet well to be constructed. This concept assumes that the school can direct flows from the current holding tank to a new wet well. Construction of a gravity line in Lusted Road assumes construction can occur in the gravel shoulder without impacting the existing paved road.

Table 5 presents the final cost estimates for the three main elements of a pump station at the school including installing a pump station and force main at the school and constructing a gravity line in Lusted Road from the school to Beaver Creek. The estimated total cost for these elements is approximately \$688,000.

Table 5 Capital Cost Estimate for Sam Barlow High School Pumping Options Wastewater Pump Station Master Plan City of Gresham	
Item	Estimated Capital Cost
Gravity Line in Lusted Road (2,500')	\$525,000
Pump Station at School	\$150,000
4-inch Force Main at school (100')	\$13,000
Total Estimated Cost	\$688,000
Note: Costs for pump stations include costs for force main construction	

As discussed above, the two options for reaching the City gravity system include either discharging to a gravity line along Beaver Creek, or installing a second pump station adjacent to Lusted Road. As these options overlap with the City pumping possibilities, the costs for these options are the same as presented in Table 4 above. Compared to the flows anticipated from unsewered areas within the City limits, especially future flows, the school wastewater flows do not significantly increase the pumping requirements of the City pump stations.

Table 6 presents the NPW costs estimated for continuing the current process of hauling waste to installing a pump station and gravity line. With current annual hauling costs of \$50,000, the 50-year net present worth of continuing the current system is \$1,329,000. This cost does not include any school administration, legal or other related costs. The NPW of installing a pump station and extending a gravity line to Beaver Creek along Lusted Road is estimated at \$931,000. This is the net present worth prior to any costs associated with constructing a pump station on Lusted Road or a gravity pipe along Beaver Creek. The results show that continuing to haul the wastewater for the next 50 years has a 43% higher

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NPW than installing and operating a pump station at the school. The NPW cost of pumping will increase with any additional cost to the school to assist the City constructing a pump station or gravity line.

Table 6 NPW Cost Comparison for Sam Barlow HS Wastewater Pump Station Master Plan City of Gresham

Pump Station Option	Annual O&M	Capital Expenditures (Present Worth)			Net Present Worth
		2010	2035	2055	
Continue Hauling Wastewater (\$50k/year)	-	-	-	-	\$1,329,000
Construct PS at School	\$150,000	\$649,000	\$22,000	\$12,000	\$931,000 ⁽¹⁾

⁽¹⁾ Table does not show costs to continue pumping for 2008 and 2009, as included in total NPW

5.0 SUMMARY & RECOMMENDATIONS

5.1 City Areas

To provide service to the areas unable to discharge to the City system, it is recommended that the City install a pump station on 282nd Avenue and create a capital improvements plan for the gravity sewer lines to be constructed. The concept of a pump station adjacent to 282nd Avenue appears to be a good solution for serving all areas of concern. Whether the pump station is located within the current City limits or near the Beaver Creek crossing depends on how critical it is to provide services to the parcels outside current City limits. To adequately plan for potential expansion of the urban growth boundary and to ensure all properties in the vicinity are able to connect to a sewer system, it is recommended that the pump station be located near the crossing of Beaver Creek. Though it requires larger pumps, the estimate for this pump station is only \$95,000 (20%) higher than construction of a pump station within City limits. Constructing a second pump station on Lusted Road is not recommended due to the higher associated costs.

OPTION 2

By prioritizing the gravity sewer mains needed for serving these areas, the City can separate capital improvements into more manageable, economical projects. In particular, the gravity line along Beaver Creek may not be a high priority, as the area it serves is not very developed (especially the 17-acre parcel south of Lusted Road). A sewer system to serve the partially developed subdivision may be a higher priority, as this area is experiencing infill. However, the gravity line along Beaver Creek may become a higher priority if the school installs a pump station and needs to discharge to this sewer line.

Table 7 presents a potential capital improvements plan. Because the proposed infrastructure benefits many properties, the City may anticipate funding these projects as part of a local improvements district (LID) or local utility district (LUD), from which a group of

land owners agree to the project and set rates to collect for funding. By over-sizing the 282nd Avenue Pump Station to accommodate future flows from undeveloped areas, the City may want to create a payback agreement, in which the total cost of the project is shared among landowners of the properties connected to the new system.

Table 7 Potential Capital Improvements Plan for 282nd Ave. Pump Station Wastewater Pump Station Master Plan City of Gresham	
Project	Capital Cost
Pump Station & Gravity System (2010)	
Pump Station & Force Main at 282nd Avenue near Beaver Creek	\$637,000
Gravity System to Partially Developed Subdivision	\$211,000
Total Project Cost	\$848,000
7-Acre Area Gravity System (2015)	
Gravity Line to 7-Acre Area	\$342,000
17-Acre Area Gravity System (2035)	
Extend Gravity Line along Beaver Creek	\$343,000
Gravity System for 17-Acre Area ⁽¹⁾	\$211,000
Total Project Cost	\$554,000
⁽¹⁾ May be constructed concurrent with development	

5.2 Sam Barlow High School

As seen in Table 6, the 50-year NPW cost comparison results in a lower cost to construct a pump station at the Sam Barlow High School than continuing hauling sewage. The cost to haul wastewater may also significantly increase due to higher fuel prices, as experienced in the last few years. It is therefore recommended that the school consider installing a pump station at the school to offset costly hauling. Additional information such as the location and elevation of the existing wastewater holding tank and actual peak wastewater flows will provide additional information to refine the scope of this project.

Should the school decide to pump its wastewater, it will require a connection to the new City pump station. As recommended above, this includes the construction of a gravity line along Beaver Creek. Depending on the timing of construction, the City may not have this line installed when the school needs to connect. The City and school may want to develop a cost sharing approach for the construction of this piping.