STUDY AREA 1

TABLE OF CONTENTS

INTRODUCTION

The City of Bend is the provider of wastewater collection and treatment service within the City of Bend Urban Growth Boundary (UGB). The 2006 Collection System Master Plan was developed in cooperation with the City of Bend Public Works Department to develop the roadmap for providing service to all existing users, existing developed areas that have not yet been connected to the system and for new development. This includes areas outside of the UGB but within the Urban Area Reserve (UAR). The key principles that the plan was based on were:

- Protect the public health and maintain the quality of the water environment within and around the City of Bend;
- Provide ongoing system capacity and reliability to minimize the risk of Sanitary Sewer Overflows (SSOs);
- Provide planning based on the approved General Plan;
- Expand existing system using a phased approach as capacity and/or service is needed;
- Provide infrastructure capacity for existing developed areas that currently are not provided with sanitary service;
- Provide gravity-based collection system, reducing operational risk and long term life-cycle operations costs for the City wastewater collection system.
- Develop a long-term plan for sanitary service within the existing UGB and UAR service areas.

The results and recommendations of the Master Plan are summarized in the 2006 Collection System Master Plan Report. As part of the Master Plan Report, nine Study Area Plans were developed to provide a detailed summary of the plans for providing sanitary service to each parcel. These plans consist of three components:

1. Projects for Unserved Areas (local gravity sewers needed to provide service to currently-developed parcels that do not have City sewer service);
2. Pump Stations (recommendations on the long-term operation of each pump station); and
3. System Deficiencies (the correction of current and long-term system capacity deficiencies).

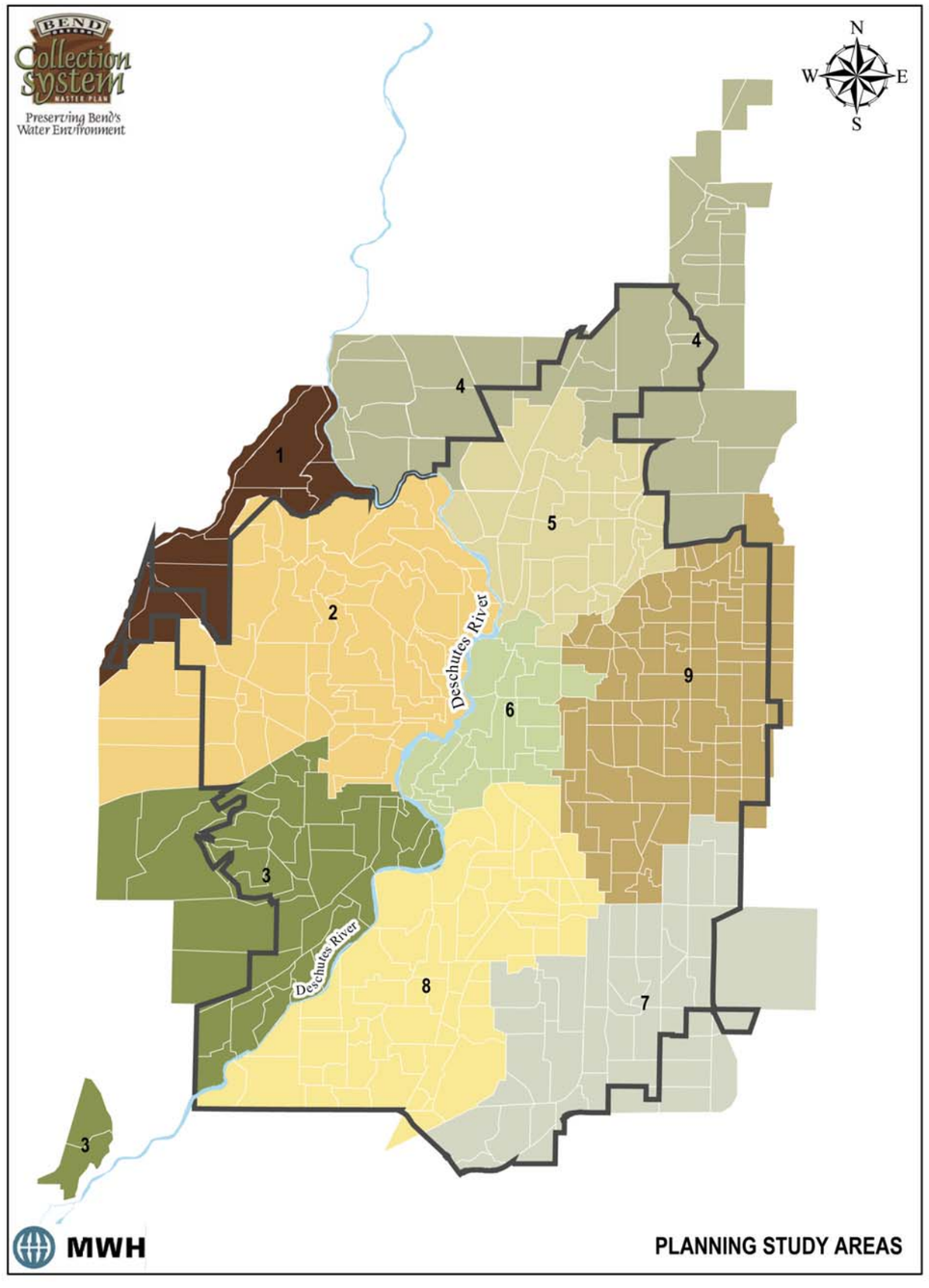
STUDY AREA 1

The planning area, which includes both the areas of the UGB and the UAR, is shown in ***Figure 1-1 – Master Plan Study Areas***. To organize and simplify the presentation of the information developed in the Master Plan, the planning area has been divided into nine Study Areas. This document provides the information for Study Area 1 which is the northwestern portion of the City located on the west side of the Deschutes River. This area is highlighted and labeled in ***Figure 1-1***.

Study Area 1 consists of 1,376 acres (131 parcels), which can be subdivided into four categories***. Below is a summary of each category*:**

1. 36 acres (19 parcels) that receive sewer service;
2. 30 acres (2 parcels) that are developed but do not receive City sewer service (using a septic system or other type of wastewater service);
3. 309 acres (110 parcels) are undeveloped but are buildable within the UGB; and
4. Approximately 1,025 acres are outside the UGB, but within the UAR. For this Master Plan, UAR lands were considered to be 70% developable.

Figure 1-1 – Master Plan Study Areas



EXISTING SEWERS

Study Area 1 currently has 1.78 miles of gravity sewers that is all 8-inches in diameter. A summary of the total length of gravity sewer by line size is summarized in ***Table 1-1***. All of these gravity sewers are 8-inch lines serving local neighborhoods.

Table 1-1
Study Area 1
Gravity Sewer Statistics

Line Diameter (inches)	Length		Percent of Total
	Linear Feet	Miles	
8	9,422	1.78	100

Note: Data summary as of May 2005.

PROJECTS FOR UNSERVED AREAS

Most of Study Area 1 has no sanitary service. For each of these areas, a project has been defined so that every parcel within the Study Area 1 UGB can be served. Service for parcels outside of the UGB was not specifically defined because the location of streets and sewer easements are not known. The flows that will be generated from parcels located in the UAR were included in the analysis of the sewer system capacity, so the build-out capacity for all of the system sewers includes the flows that will be generated in the UAR. An emphasis was placed on providing service through a gravity system, unless it was either not technically feasible or cost prohibitive

CRITERIA FOR LATERAL SEWERS

The determination of the feasibility of gravity sewer laterals to service currently unsewered areas in the Bend system depends on many factors. It is beyond the scope of a Master Plan to determine the case-by-case situation of the proposed gravity sewer extensions. Therefore, a set of guidelines were developed to determine the placement of gravity sewer laterals. These include:

- The depth of the existing connection manhole or cleanout;
- The distance from the connecting manhole to the most distant property parcel to be served;
- The average slope of the terrain between the parcel to be served and the connecting manhole;
- Diameter adequate for estimated flows;
- Minimum grades used for gravity sewers (i.e. – 8” @ 0.004 ft/ft, 12” @ 0.0028 ft/ft, etc) to allow a minimum velocity of 2 ft/sec;
- The depth of gravity sewer designs will not be driven by the existence or potential existence of basements in structures;
- Gravity sewer service is possible when the finished floor of the structure to be serviced is at least 3 feet above the invert of the main in the street; and
- Surface features or conflicting utilities that would prevent the installation of gravity sewers were not evaluated.

The existing topography within the UGB is limited to 2-foot contours. The inverts for existing manholes or cleanouts were not always available, therefore some assumptions were made regarding the feasibility of extending gravity sewers to the unsewered parcels. The proposed sanitary sewer layouts for projects to provide service to the unsewered areas within the UGB were developed within the guidelines and limitations of the available information. Confirming field work to ascertain the elevation difference between the connecting manhole and the parcel(s) to be served, along with confirmation of the connecting manhole depth, must be done prior to design of these proposed projects.

SANITARY SEWER PROJECT DEVELOPMENT

The sanitary sewer projects are shown in ***Figure 1-2 – Study Area 1 Proposed Sanitary Sewer Layout***. Each project has been given a Project ID. The Project ID is based on the number format of X-Y. This number is based on the following codes:

- X – Study Area Number
- Y – Project Number within the Study Area

This Project ID system was used to identify each of the projects during system development. Each project has been summarized in ***Table 1-2***. A more detailed figure of the study area proposed projects with the 2-foot topography overlay is provided in the ***Appendix***.

Table 1-2
Study Area 1
Proposed Sanitary Sewer System Projects

Project ID	Length (ft)	Diameter (inches)	Notes
1.01	2,110	8	This project provides service to parcels at the upstream end of the lateral, and assumes that the Shevlin PS is offline and the flows from the Shevlen PS service area go to the North Interceptor.
1.02	380	8	Removes Shevlin PS from service. This project is only possible with construction of the section of the North Interceptor west of the Deschutes River.

PUMP STATIONS

Study Area 1 currently has one pump station. Detailed pump station analysis is available in TM 3.8; this section summarizes the process and results. The service area for this pump station is shown in Figure 1-3. The design criteria for the pump station are shown in ***Table 1-3***. *Table 1-3* also identifies which pumps were included in the model. The capacity for each pump station was evaluated to determine if the existing station has adequate capacity for future growth conditions. For stations that were modeled, the dynamic peak flow determined by the InfoSWMM model was used as the peak flow. For stations that were not modeled, first the current and future service area for each station was determined. Next, the number of dwelling units and base flow for each service area was determined based on the land area and zoning based on the criteria outlined in TM 3.1 – Planning Criteria. Finally, the peak flow was calculated by applying peaking factors and an RDII flow of 150 gallons/acre/day. The following terms and peaking factors were used in the evaluation of each pump station that supports *Table 1-3*:

- Modeled – Yes means that pump station is included in the INFOSWMM hydraulic model. No means it has not been included in the model;
- Firm Capacity – The firm capacity is the capacity of the station with one pump out of service to act as a redundant pump. This is a regulatory requirement;
- Base Flow –winter season flow based on area zoning;
- RDII Flow –flow due to inflow into the system during heavy rainfall;
- Peak Flow – The peak hour flow for non-modeled pumps was estimated as the base flow multiplied by a diurnal peaking factor of 1.8 and the seasonal peaking factor of 1.25 to which the RDII flow was added; and

The application of this criteria determined if the pump station will meet the build-out flow of its respective service area or not. For stations where the installed capacity will not serve the build-out flows, the time at which the stations will reach capacity was not part of this evaluation. This must be determined by the respective growth rate in each pump station's service area. The respective service area data for the estimated growth rates was not available for this evaluation.

Table 1-3
Study Area 1 Pump Station
Existing Installed Information

Pump Station Name	Modeled	Number Of Pumps	Firm Capacity (gpm)	Force Main	
				Diameter (in)	Length (ft)
Shevlin Commons	Yes	2	118	4	3000

Shevlin Commons Pump Station

The Shevlin Commons Pump Station serves an area of 140 acres. This station service area is currently at 1% sewered serving 3 of the potential build-out 458 dwelling units. The estimated build-out base flow for this service area is 52-gpm and the estimated peak hour flow is 202-gpm. The current firm capacity of 118-gpm is ***NOT*** adequate for build-out conditions. The cost to increase the capacity of the pumps for this station is estimated at $80,000.

The force main for this pump station is a 5740-foot long 4-inch line. The design velocity in this force main under firm pumping conditions is 3.0-fps. The design Total Dynamic Head (TDH) for this station is currently 126-feet. As the pump station service area reaches build-out conditions the velocity will be 4.9-fps with a TDH of 208-feet. This TDH can be reduced to 60-feet with a 6-inch diameter force main. The cost for construction of a new 6-inch force main is $809,000.

PUMP STATION UPGRADES

Pump station upgrades will be required to ensure that adequate pumping capacity is available to prevent any Sanitary Sewer Overflows (SSOs) in the system. The station capacity has been developed with consideration for providing adequate redundancy. The cost of pump station upgrades is summarized in ***Table 1-4***.

Table 1-4
Study Area 1
Recommended Pump Station Upgrades

Project ID	Pump Station Name	Upgrade	Cost ($)	Period
1.PS01	Shevlin Commons	New pumps with increased capacity	$80,000	If western portion of the North Interceptor is not constructed
1.PS02	Shevlin Commons	New 6" force main	$809,000	If western portion of the North Interceptor is not constructed

Shevlin Commons Pump Station

The current firm capacity of 118-gpm is ***NOT*** adequate for build-out conditions. The cost to increase the capacity of the pumps for this station is estimated at $80,000. The design velocity in this force main under firm pumping conditions is 3.0-fps. The design Total Dynamic Head (TDH) for this station is currently 126-feet. As the pump station service area reaches build-out conditions the velocity will be 4.9-fps with a TDH of 208-feet. This TDH can be reduced to 60-feet with a 6-inch diameter force main. The cost for construction of a new 6-inch force main is $809,000. Savings may be realized by installing VFD's on the new pumps in lieu of constructing a new force main. This analysis can be performed when the system is upgraded.

REMOVAL OF EXISTING PUMP STATIONS

To remove a pump station from service, a new gravity trunk will need to be constructed to transport the flow from the existing pump station influent sewer to another point in the collection system. The Shevlin Commons Pump Station can be removed from service are shown in ***Table 1-5***.

Table 1-5
Study Area 1
Recommended Pump Station Decommissioning

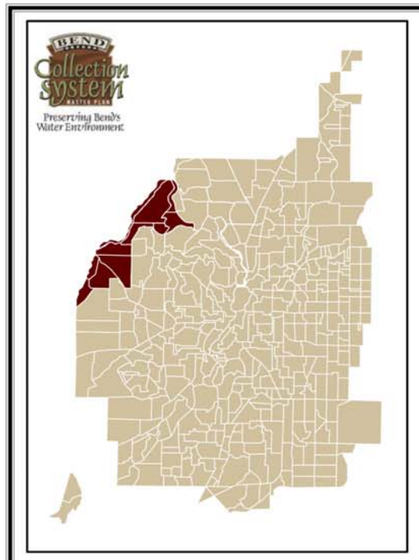
Project ID	Pump Station Name	Upgrade	Cost ($)	Period
1.PS03	Shevlin Commons	380-foot gravity sewer to North Interceptor	$72,500	Following construction of western portion of North Interceptor
1.PS04	Shevlin Commons	Removal of Pump station	$25,000	Following construction of western portion of North Interceptor

Shevlin Commons Pump Station

The Shevlin Commons Pump Station can be removed from service when the western portion of the North Interceptor between the Deschutes River and Shevlin Park is constructed. To remove the pump station from service, a 380-foot gravity sewer will need to be constructed (Project 1.02). The estimated project cost to construct the gravity sewer to remove the station from service is $72,500. The estimated cost to remove the pump station is $25,000. Both estimated costs are in 2006 dollars. A present value analysis of this project was done to determine the cost-effectiveness of this project. In this analysis it was assumed that the project would occur in the year 2015 and the area would grow at a constant rate until build-out of the area occurs in 2045. Based on these assumptions, the 20 year and 50 year present values for continuing operation of the station (starting in 2006) are $1,119,000 and $1,542,000 respectively. This includes the cost of a pump station capacity upgrade in the year 2015. Based on the same assumptions, the 20 year and 50 year present values for removing the pump station in 2015 are $197,300 and $202,400, respectively. This analysis shows that replacement of the pump station is cost effective when possible. ***Investing in the upgrade of the station should only be done if the portion of the North Interceptor west of the Deschutes River is not constructed.***

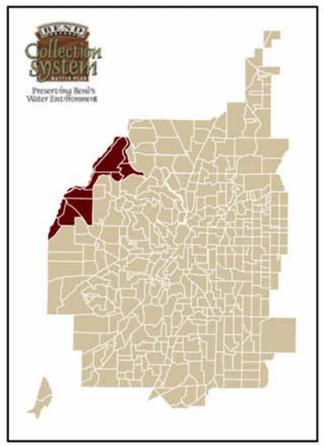
SYSTEM DEFICIENCIES

The existing system was evaluated to determine if there were any existing deficiencies. The analysis was performed using the calibrated 2005 INFOSWMM hydraulic model. The existing sanitary sewer service area is small and was not included in the model. Therefore, due to the low system flow, there are no capacity deficiencies in Study Area 1.

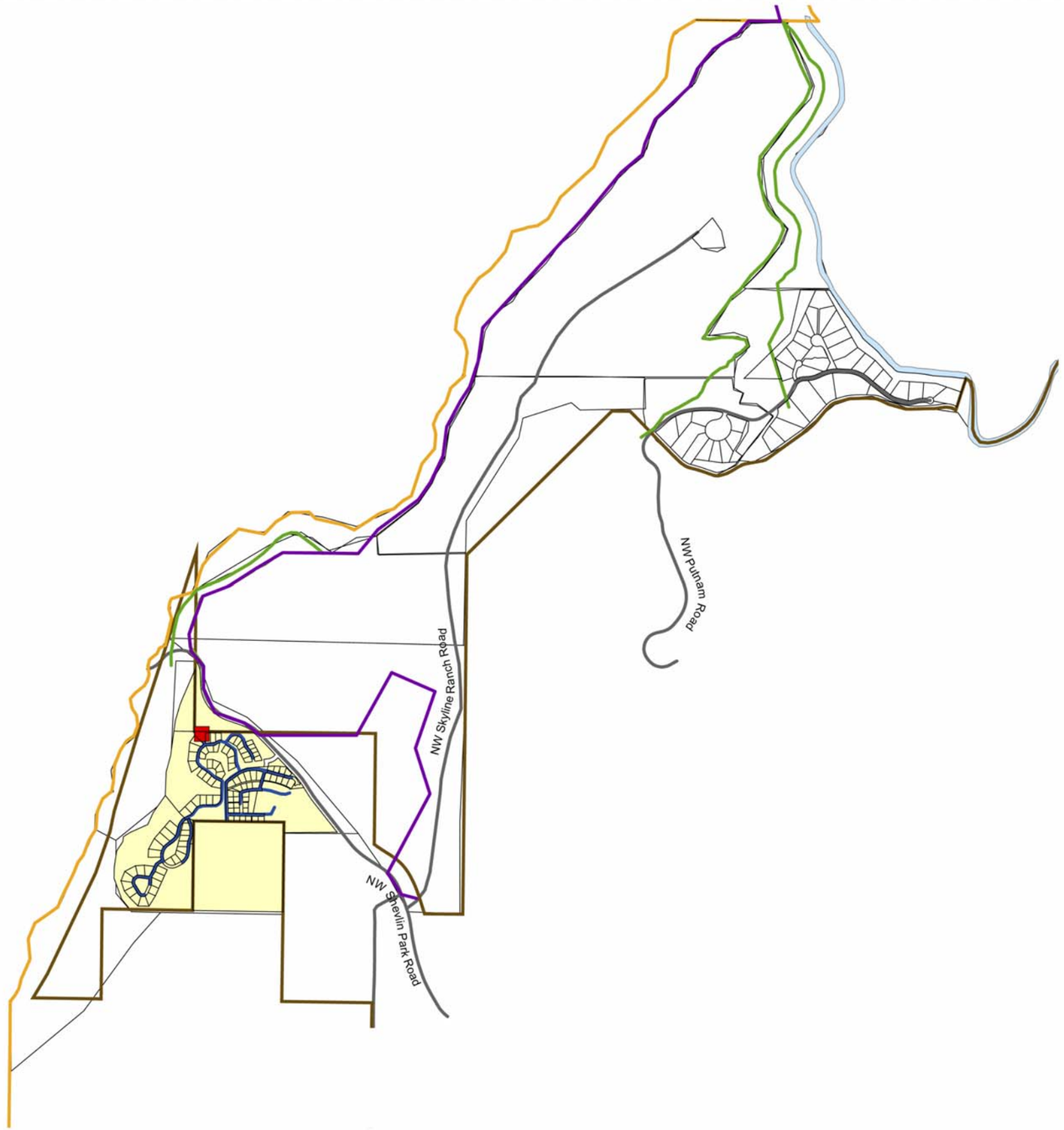


MWH

Figure 1-2
Study Area 1
Proposed Sanitary Sewer Layout



PS Capacity Upgrade Required
North Interceptor
Trunk Sewers
Existing Sewers
UAR
UGB
Shevlin Commons
Deschutes River



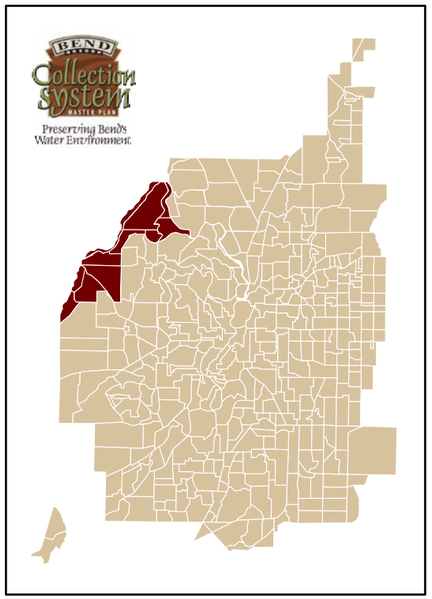
N
W E
S

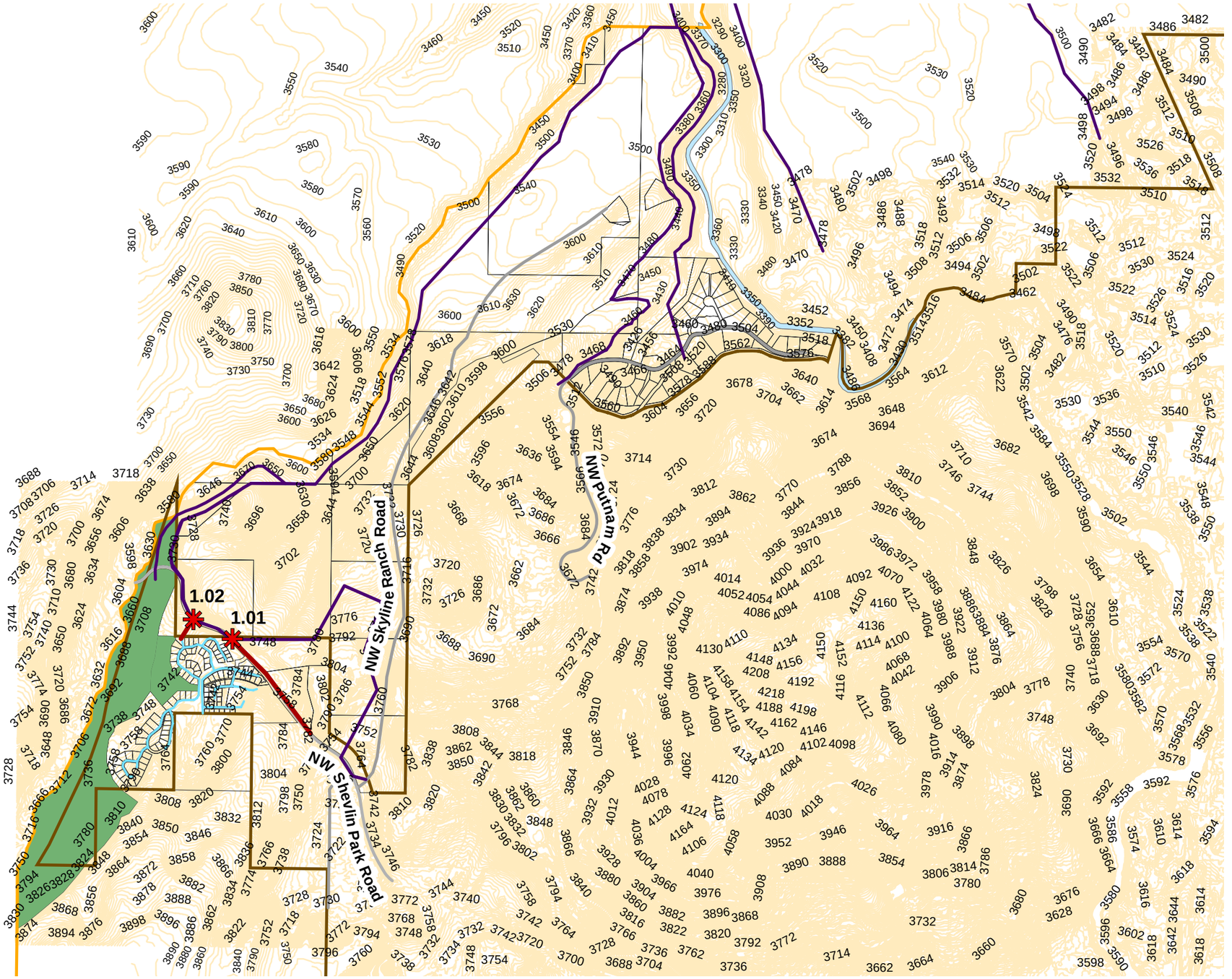
0 1,000 2,000 Feet

MWH

Figure 1-3
Study Area 1
Current Pump Station Service Areas

APPENDIX





Proposed Sewer Projects
Connection Points
North Interceptor
Existing Sanitary Sewer Lines
UGB
UAR
Parks (No Planned Sewer Expansion)
Deschutes River

0 1,000 2,000 Feet

MWH

Figure A.1-1
Study Area 1
Proposed Sanitary Sewer Layout

N
W E
S