STUDY AREA 8

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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 provide the roadmap for the providing service to all existing users, existing developed areas that have not yet 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 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; and
- 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. In addition to 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).

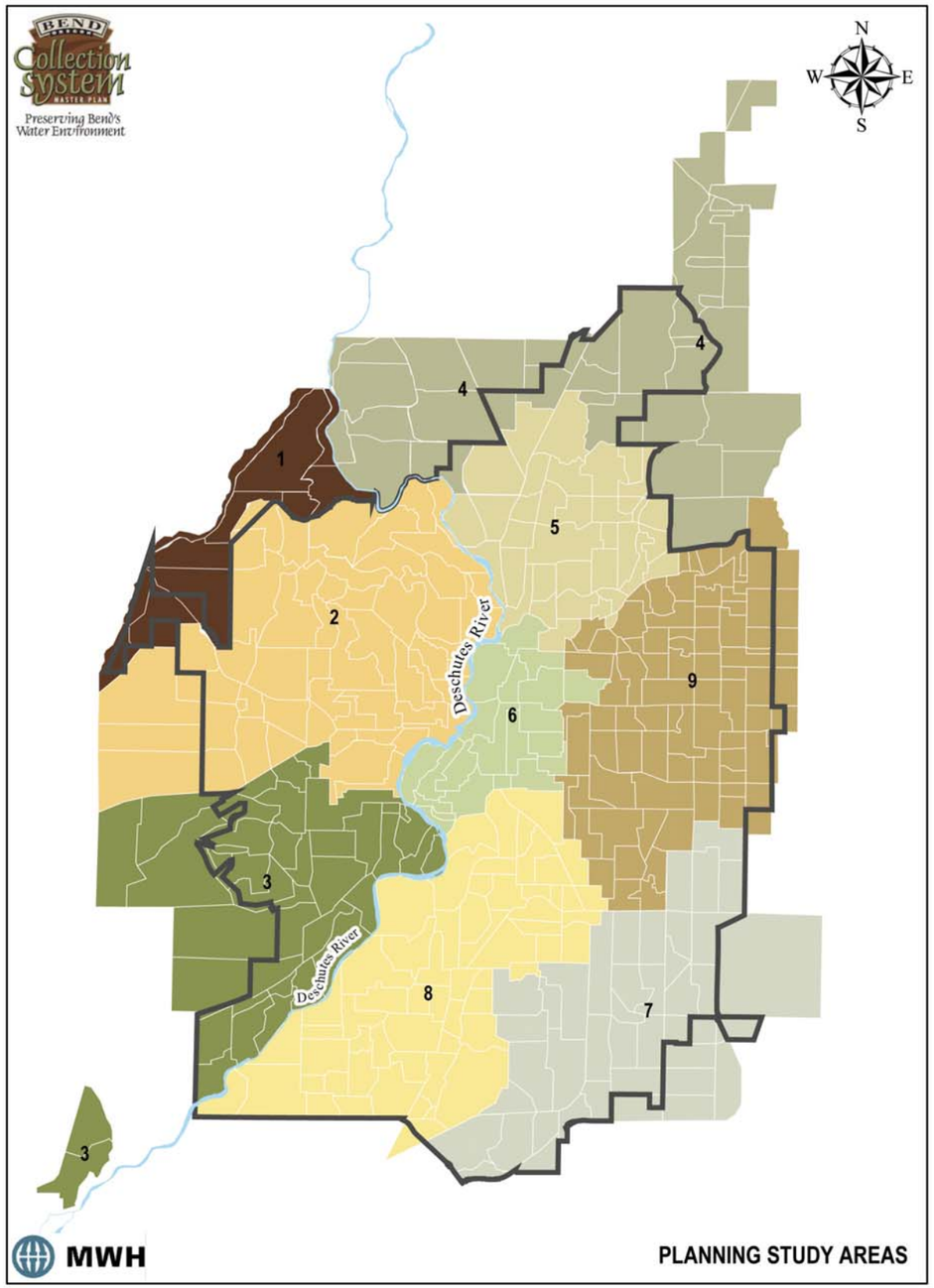

Figure 8-1 – Master Plan Study Areas

STUDY AREA 8

The planning area, which includes both the areas of the UGB and the UAR, is shown in ***Figure 8-1 – 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 8 which is the southeastern portion of the City located on the east side of the Deschutes River. This area is highlighted and labeled in ***Figure 8-1***.

Study Area 8 consists of 3,925 acres (5,278 parcels), which can be subdivided into four categories.. *Below is a summary of each category*:

1. 1,313 acres (3,061 parcels) that receive sewer service
2. 728 acres (1,013 parcels) that are developed but do not receive City sewer service (using a septic system or other type of wastewater service)
3. 1,181 acres (1,204 parcels) are undeveloped but are buildable within the UGB
4. 703 acres that are outside the UGB, or within the UGB but will not be developed, as it consists of streets, utility corridors, areas zoned as public facilities and unbuildable lands.

EXISTING SEWERS

Study Area 8 currently has 43.9 miles of sewers ranging in size from 4-inches in diameter to 24-inches in diameter. A summary of the total length of sewer by line size is summarized in ***Table 8-1***. 36.8-miles or 81% of these gravity sewers are 4, 6 and 8-inch lines serving local neighborhoods. There are only 7.1-miles of sewers that are 10-inch or larger.

Table 8-1
Study Area 8
Gravity Sewer Statistics

Line Diameter (inches)	Length		Percent of Total
	Linear Feet	Miles	
4	47	0.01	0.02
6	6,283	1.19	2.71
8	187,897	35.59	81.12
10	5,046	0.96	2.18
12	15,858	3.00	6.85
15	2,751	0.52	1.19
18	7,569	1.43	3.27
24	6,186	1.17	2.67

Note: Data summary as of May 2005

PROJECTS FOR UNSERVED AREAS

There are many areas within Study Area 8 with no sanitary service. For each of these areas, a project has been defined so that every parcel within Study Area 8 can be served.

CRITERIA FOR LATERAL SEWERS

Determination of the feasibility of gravity sewer laterals to service currently unsewered areas in the Bend system depends on several factors. 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 manhole 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 8-2 – Study Area 5 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 will be used to identify each of these projects during system development. Each project has been summarized in ***Table 8-2***. A more detailed figure of the study area proposed projects with the 2-foot topography overlay is provided in the ***Appendix***.

PUMP STATIONS

Study Area 8 currently has twelve pump stations. Detailed pump station analysis is available in TM 3.8; this section summarizes the process and results. The service area for each of these pump stations is shown in ***Figure 8-3***. A list of the pump stations is shown in ***Table 8-3***. *Table 8-3* 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 8-3*:

- 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; and
- RDII Flow –flow due to inflow into the system during heavy rainfall.

Table 8-2
Study Area 8 New Sewer Systems
Capital Project Cost Estimates Study

Project ID	Length	Diameter	Notes
8.01	8,746	8	Provides sewers to unsewered area
8.02	3,977	8	Provides sewers to unsewered area
8.03	3,076	8	Provides sewers to unsewered area
8.04	386	8	Provides sewers to unsewered area
8.05	87	8	Provides sewers to unsewered area
8.06	930	8	Provides sewers to unsewered area
8.07	402	8	Provides sewers to unsewered area Allows removal of South Village Pump Station
8.08	1,270	8	Provides sewers to unsewered area
8.09	3,341	8	Provides sewers to unsewered area
8.10	314	8	Provides sewers to unsewered area
8.11	2330	8	Provides sewers to unsewered area
8.12	3,370	8	Provides sewers to unsewered area
8.13	722	8	Provides sewers to unsewered area
8.14	452	8	Provides sewers to unsewered area
8.15	356	8	Provides sewers to unsewered area
8.16	608	8	Provides sewers to unsewered area
8.17	460	8	Provides sewers to unsewered area
8.18	783	8	Provides sewers to unsewered area
8.19	1,372	8	Provides sewers to unsewered area
8.20	2,200	8	Provides sewers to unsewered area
8.21	1,406	8	Provides sewers to unsewered area
8.22	975	8	Provides sewers to unsewered area
8.23	2,713	8	Provides sewers to unsewered area
8.24	2,880	8	Provides sewers to unsewered area
8.25	1,419	8	Provides sewers to unsewered area
8.26	284	8	Provides sewers to unsewered area
8.27	194	8	Provides sewers to unsewered area
8.28	435	8	Provides sewers to unsewered area
8.29	392	8	Provides sewers to unsewered area
8.30	522	8	Provides sewers to unsewered area
8.31	407	8	Provides sewers to unsewered area
8.32	902	8	Provides sewers to unsewered area
8.33	331	8	Provides sewers to unsewered area
8.34	1,200	8	Provides sewers to unsewered area
8.35	780	8	Provides sewers to unsewered area
8.36	930	8	Provides sewers to unsewered area

Table 8-2(contd..)
Study Area 8 New Sewer Systems
Capital Project Cost Estimates Study

8.37	1,734	8	Provides sewers to unsewered area Possible Highway bore
8.38	100	8	Provides sewers to unsewered area
8.39	98	8	Provides sewers to unsewered area
8.40	223	8	Provides sewers to unsewered area
8.41	1,077	8	Provides sewers to unsewered area
8.42	2,820	8	Provides sewers to unsewered area
8.43	3,598	8	Provides sewers to unsewered area
8.44	439	8	Provides sewers to unsewered area
8.45	198	8	Provides sewers to unsewered area
8.46	1,480	8	Provides sewers to unsewered area
8.47	623	8	Provides sewers to unsewered area
8.48	1,691	8	Provides sewers to unsewered area
8.49	639	8	Provides sewers to unsewered area
8.50	959	8	Provides sewers to unsewered area
8.51	7,951	8	Provides sewers to unsewered area
8.52	8,582	8	Provides sewers to unsewered area
8.53	563	8	Provides sewers to unsewered area
8.54	1,526	8	Provides sewers to unsewered area
8.55	702	8	Provides sewers to unsewered area

- 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.

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.

Aspen Ridge

The Aspen Ridge Pump Station serves an area of 24 acres. This station service area was not sewered in May 2005, but has recently been sewered. The potential number of dwelling units at build-out is 90. The build-out estimated base flow for this station is 12-gpm with a peak flow of 32-gpm. The force main for this pump station is manifolded with the River Canyon Pump Station Nos. 1 and 2. This is a new station that was placed into operation in 2005. It is assumed that this station will be able to meet the estimated peak flow of 32-gpm at build-out of the service area.

Table 8-3
Study Area 8 Pump Stations
Existing Installed Information

Pump Station Name	Modeled	Number Of Pumps	Firm Capacity (gpm)	Force Main	
				Diameter (in)	Length (ft)
Aspen Ridge	N	2	Note 1	Note 1	Note 1
Deschutes River Crossing	N	2	148	3	1,380
Old Mill	Y	2	300	6	1,552
Pheasant Run	N	2	125	4	1,022
Pine Ridge	N	2	180	4	715
Poplar Park	N	2	180	4	1,966
River Canyon #1	N	2	320	4	Note 1
River Canyon #2	N	2	400	6	Note 1
River Rim	N	2	150	4	3,323
South Village	Y	2	265	6	260
Tri-Peaks	N	2	120	3	1,195
Woodriver Village	N	2	240	6	2,616

Note 1: Data not available

Deschutes River Crossing

The Deschutes River Crossing Pump Station serves an area of 14 acres. This station service area is currently 35% sewered serving 27 of the 78 potential build-out dwelling units. The current (2005) estimated base flow for this station is 4-gpm with a peak hour flow of 12-gpm. The build-out estimated base flow for this station is 7-gpm with a peak flow of 19-gpm. The force main for this pump station is a 1380 foot long 3-inch line. The design velocity in this force main under firm pumping conditions is 6.7-fps. The existing station capacity of 148-gpm will meet the long-term requirements of the service area.

The velocity in the force main exceeds the planning criteria of 6.0-fps. This higher velocity causes excessive TDH resulting in a higher power usage for the pump station. It is recommended that the existing pumps be replaced with 100-gpm pumps at a future date when the existing pumps have reached their service life. The 100-gpm pumping rate will result in a velocity of 4.5-fps in the force main.

Old Mill

The Old Mill Pump Station serves an area of 344 acres. This station service area is currently 30% sewered serving 364 of the 1206 potential build-out dwelling units. The current (2005) estimated base flow for this station is 50-gpm with a peak hour flow of 184-gpm. The build-out estimated base flow for this station is 236-gpm with a peak flow of 600-gpm. The force main for this pump station is a 1552 foot long 6-inch line. The design velocity in this force main under firm pumping conditions is 3.4-fps. The design TDH for this station is currently 93-feet. The existing station capacity of 300-gpm will ***NOT*** meet the long-term requirements of the service area.

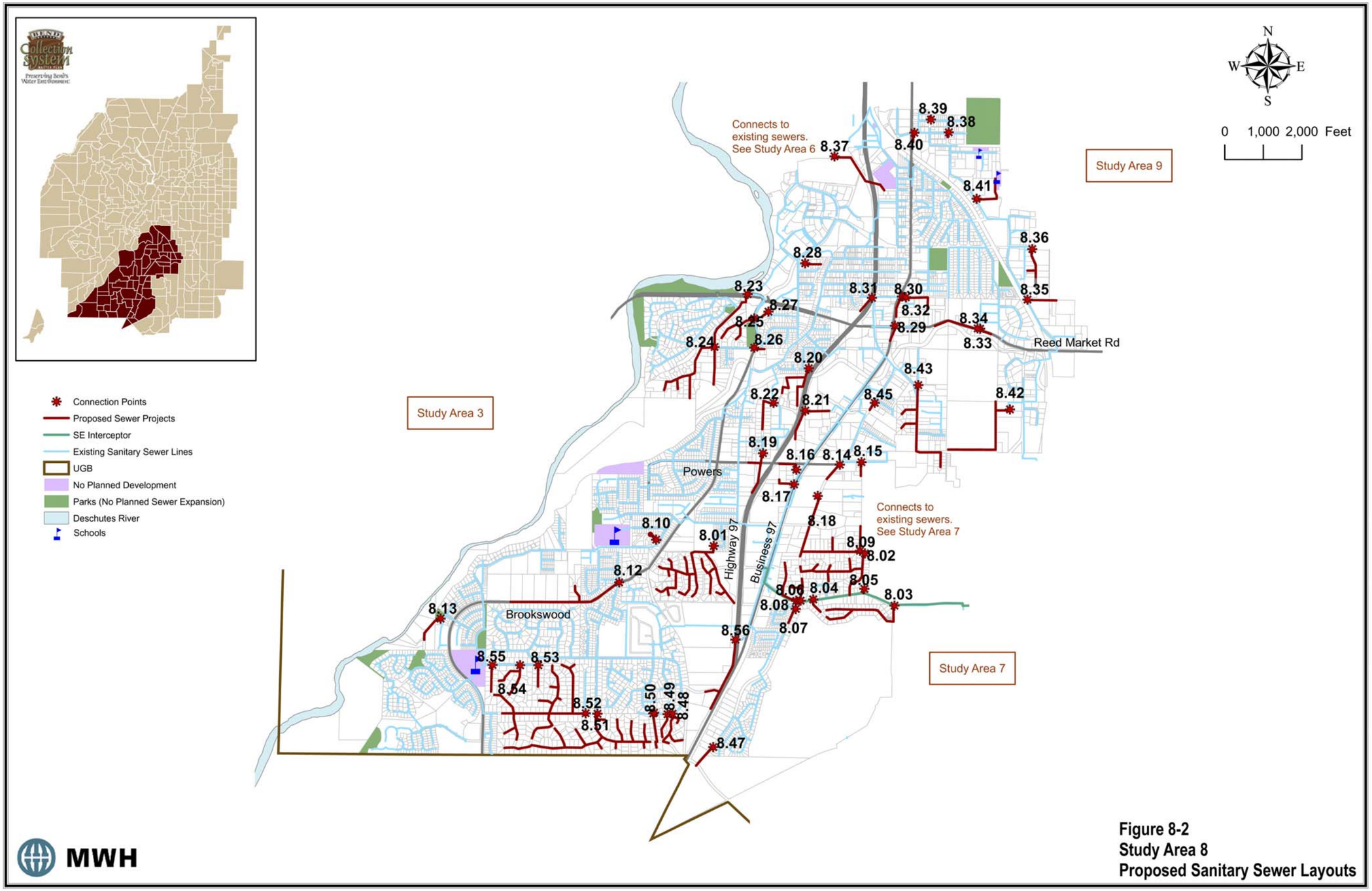

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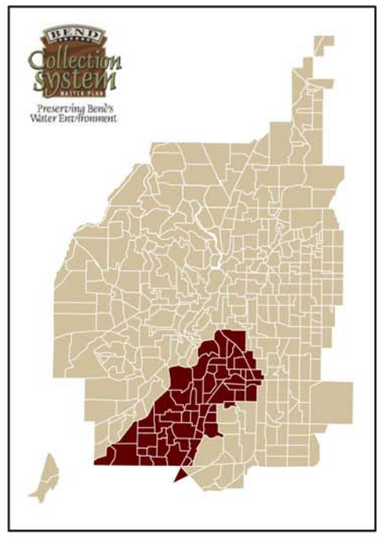
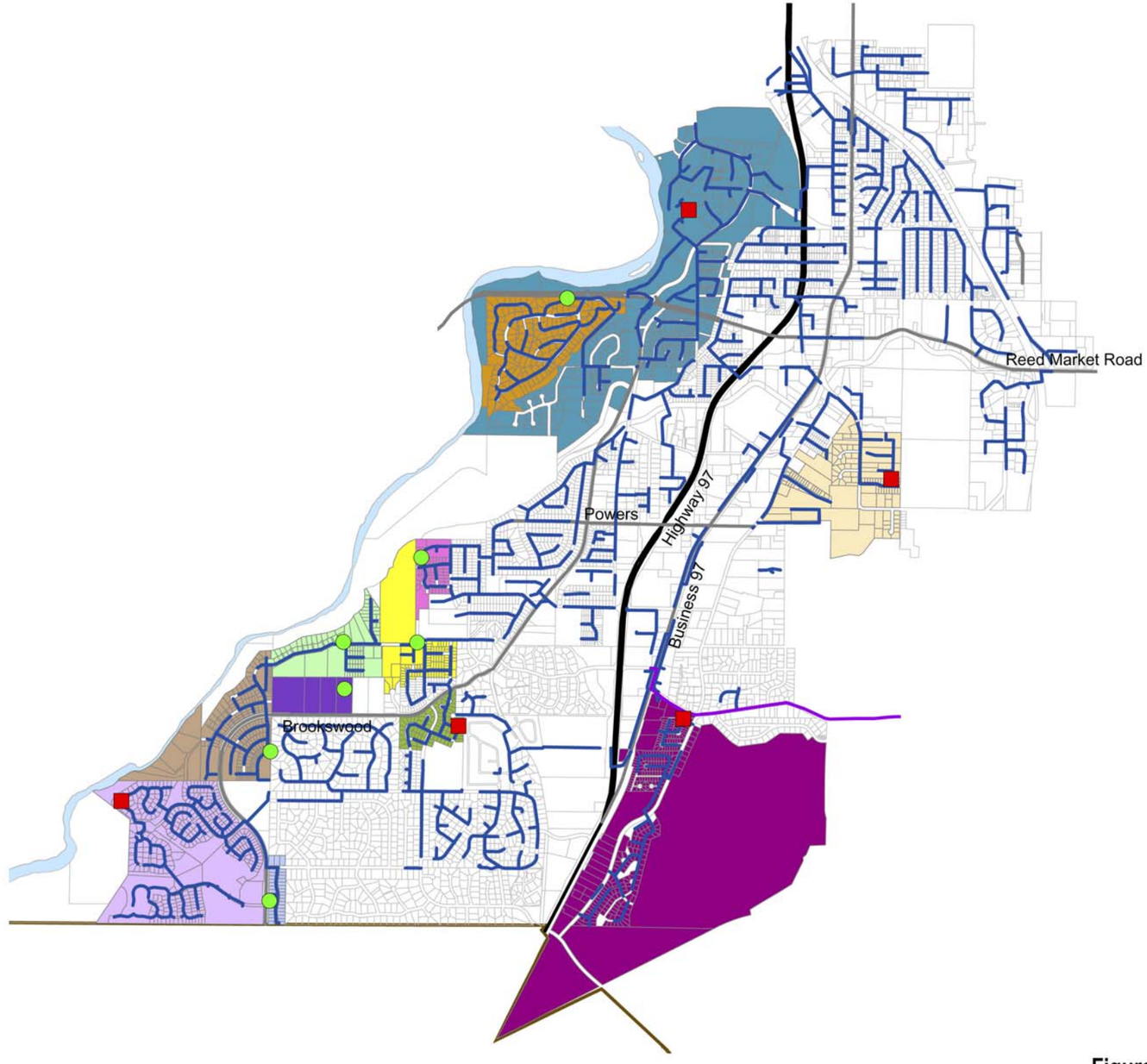
Figure 8-2
Study Area 8
Proposed Sanitary Sewer Layouts



PS Capacity Adequate
PS Capacity Upgrade Required
Southeast Interceptor
Existing Sewers
UGB
Deschutes River
Aspen Ridge
Deschutes River x-ing
Old Mill
Pheasant Run
Pine Ridge
Poplar Park
River Canyon #1
River Canyon #2
River Rim
South Village
Tri-Peaks
Woodriver Village



N
W E
S
0 1,000 2,000 Feet

MWH

Figure 8-3
Study Area 8
Current Pump Station Service Areas

Pheasant Run

The Pheasant Run Pump Station serves an area of 44 acres. This station service area is currently 19% sewered serving 40 of the 209 potential build-out dwelling units. The current (2005) estimated base flow for this station is 5-gpm with a peak hour flow of 20-gpm. The build-out estimated base flow for this station is 26-gpm with a peak flow of 68-gpm. The force main for this pump station is a 1022-foot long 4-inch line. The design velocity in this force main under firm pumping conditions is 3.2-fps. The existing station capacity of 125-gpm will meet the long-term requirements of the service area.

Pine Ridge

The Pine Ridge Pump Station serves an area of 16 acres. This station service area is currently 1% sewered serving 1 of the 86 potential build-out dwelling units. The current (2005) estimated base flow for this station is 1-gpm with a peak hour flow of 3-gpm. The build-out estimated base flow for this station is 9-gpm with a peak flow of 23-gpm. The force main for this pump station is a 715-foot long 4-inch line. The design velocity in this force main under firm pumping conditions is 4.1-fps. The existing station capacity of 180-gpm will meet the long-term requirements of the service area.

Poplar Park

The Poplar Park Pump Station serves an area of 7.4 acres. This station service area is currently 6% sewered serving 3 of the 48 potential build-out dwelling units. The current (2005) estimated base flow for this station is less than 1-gpm with a peak hour flow of 2-gpm. The build-out estimated base flow for this station is 5-gpm with a peak flow of 13-gpm. The force main for this pump station is a 1966-foot long 4-inch line. The design velocity in this force main under firm pumping conditions is 4.6-fps. The existing station capacity of 180-gpm will meet the long-term requirements of the service area.

River Canyon #1

The River Canyon #1 Pump Station serves an area of 62 acres. This station service area is currently 2% sewered serving 5 of the 296 potential build-out dwelling units. The current (2005) estimated base flow for this station is 1-gpm with a peak hour flow of 15-gpm. The build-out estimated base flow for this station is 35-gpm with a peak flow of 92-gpm. The force main for this pump station is a 4-inch line that changes to a 6-inch line at the River Canyon #2 Pump Station. This station shares the force main with the Aspen Ridge Pump Station and the River Canyon #2 Pump Station. The design velocity in this force main under firm pumping conditions is dependent on whether the Aspen Ridge or River Canyon #2 Pump Stations are pumping or not. The existing station capacity of 320-gpm will meet the long-term requirements of the service area

River Canyon #2

The River Canyon #2 Pump Station serves an area of 63 acres. This station service area is currently 18% sewered serving 57 of the 324 potential build-out dwelling units. The current (2005) estimated base flow for this station is 8-gpm with a peak hour flow of 31-gpm. The build-out estimated base flow for this station is 36-gpm with a peak flow of 94-gpm. The force main for this pump station is a 6-inch line. This station shares the force main with the Aspen Ridge Pump Station and the River Canyon #2 Pump Station. The design velocity in this force main under firm pumping conditions is dependent on whether the Aspen Ridge or River Canyon #2 Pump Stations are pumping or not. The existing station capacity of 400-gpm will meet the long-term requirements of the service area.

River Rim

The River Rim Pump Station serves an area of 156 acres. This station service area is currently 16% sewered serving 107 of the 673 potential build-out dwelling units. The current (2005) estimated base flow for this station is 15-gpm with a peak hour flow of 66-gpm. The build-out estimated base flow for this station is 74-gpm with a peak flow of 200-gpm. The force main for this pump station is a 3323 foot long 4-inch line. The design velocity in this force main under firm pumping conditions is 3.8-fps. The existing station capacity of 150-gpm will ***NOT*** meet the long-term requirements of the service area.

South Village

The South Village Pump Station serves an area of 693 acres. This station service area is currently 8% sewered serving 110 of the 1410 potential build-out dwelling units. The current (2005) estimated base flow for this station is 15-gpm with a peak hour flow of 178-gpm. The build-out estimated base flow for this station is 82-gpm with a peak flow of 330-gpm. The force main for this pump station is a 260 foot long 6-inch line. The design velocity in this force main under firm pumping conditions is 3.0-fps. The design TDH for this station is currently 42-feet. The existing station capacity of 265-gpm will ***NOT*** meet the long-term requirements of the service area.

Tri-Peaks

The Tri-Peaks Pump Station serves an area of 87 acres. This station service area is currently 19% sewered serving 86 of the 454 potential build-out dwelling units. The current (2005) estimated base flow for this station is 12-gpm with a peak hour flow of 45-gpm. The build-out estimated base flow for this station is 59-gpm with a peak flow of 150-gpm. The force main for this pump station is an 1195 foot long 3-inch line. The design velocity in this force main under firm pumping conditions is 3.2-fps. The existing station capacity of 120-gpm will ***NOT*** meet the long-term requirements of the service area.

Woodriver Village

The Woodriver Village Pump Station serves an area of 84 acres. This station service area is currently 35% sewered serving 145 of the 412 potential build-out dwelling units. The current (2005) estimated base flow for this station is 20-gpm with a peak hour flow of 62-gpm. The build-out estimated base flow for this station is 47-gpm with a peak flow of 123-gpm. The force main for this pump station is a 2616-foot long 6-inch line. The design velocity in this force main under firm pumping conditions is 2.7-fps. The existing station capacity of 240-gpm will meet the long-term requirements of the service area.

PUMP STATION UPGRADES

Pump station upgrades will be required to ensure that adequate pumping capacity is available to ensure that there are no Sanitary Sewer Overflows (SSOs) in the system. The station capacity has been developed to ensure that adequate redundancy is provided. The cost of pump station upgrades is summarized in ***Table 8-4***.

Deschutes River Crossing

The estimated build-out flow for the Deschutes River Crossing Pump Station is 19-gpm. The existing station has a capacity of 178-gpm. The force main for this pump station is a 1380 foot long 3-inch line. Under the current operating conditions, the velocity in the force main under firm pumping conditions is 6.7-fps. The velocity in the force main exceeds the planning criteria of 6.0-fps. This higher velocity causes excessive TDH resulting in a higher power usage for the pump station. It is recommended that the existing pumps be replaced with 100-gpm pumps at a future date when the existing pumps have reached

their service life. A 100-gpm pumping rate will result in a velocity of 4.5-fps in the force main, reducing the operating TDH resulting in lower power usage and satisfactory capacity through build-out of this service area.

Table 8-4
Recommended Pump Station Upgrades

Project ID	Pump Station Name	Upgrade	Cost ($)	Period
8.PS01	Deschutes River Crossing	Reduce pumping capacity to 100-gpm when pumps are replaced	-	When pumps are replaced
8.PS02	Old Mill	Installation of two new 600-gpm VFD pumps	$ 60,000	When capacity is reached
8.PS03	River Rim	Installation of new 200-gpm pumps	$40,000	When capacity is reached
8.PS04	South Village	Installation of two new 330-gpm pumps	$25,300	When capacity is reached
8.PS05	Tri-Peaks	Installation of two new 150-gpm pumps	$25,300	When capacity is reached

Old Mill

The existing station capacity of 300-gpm will not meet the long-term requirements of the service area. At some point in the future, the capacity of the pump station will need to be increased to provide adequate capacity. This can be done by installing new pumps with a peak flow capacity of 600-gpm. The existing force main will be adequate for the future flows with a peak velocity of 6.8-fps resulting at a TDH of 95-feet. It may be appropriate to install VFDs on the pumps to conserve power. The estimated cost to install pumps with a capacity of 600-gpm is $60,000.

River Rim

The existing station capacity of 150-gpm will not meet the long-term requirements of the service area. At some point in the future, the capacity of the pump station will need to be increased to provide adequate capacity. This can be done by installing two new pumps, each with a peak flow capacity of 200-gpm. The existing force main will be adequate for the future flows with a peak velocity of 5.1-fps. At this velocity, the TDH for the pumps will be 140-feet. The estimated cost to install new pumps is $40,000. Increasing the size of the force main to a 6-inch line will drop the TDH from 140-feet to 44-feet. This will provide a reduction in power costs for this station. The cost of a new 6-inch force main is $677,000. A present worth analysis was performed to evaluate the cost-effectiveness of constructing a new force main. This analysis showed that the most cost-effective alternative is to continue the use of the 4-inch force main. The City should evaluate the installation of VFDs when the pumps are upgraded to minimize power use.

South Village

The existing station capacity of 265-gpm will not meet the long-term requirements of the service area. At some point in the future, the capacity of the pump station will need to be increased to provide adequate capacity. This can be done by installing two new pumps, each with a peak flow capacity of 330-gpm. The existing force main will be adequate for the future flows with a peak velocity of 3.7-fps. At this velocity, the TDH for the pumps will be 6.5-feet. The estimated cost to install new pumps is $25,300.

Tri-Peaks

The existing station capacity of 120-gpm will not meet the long-term requirements of the service area. At some point in the future, the capacity of the pump station will need to be increased to provide adequate capacity. This can be done by installing two new pumps, each with a peak flow capacity of 150-gpm. The existing force main will be adequate for the future flows with a peak velocity of 6.8-fps. At this velocity, the TDH for the pumps will be 100-feet. The estimated cost to install new pumps is $25,300. Increasing the size of the force main to a 4-inch line will drop the TDH from 100-feet to 38-feet. This will provide a reduction in power costs for this station. The cost of a new 4-inch force main is $166,000. A present worth analysis was performed to evaluate the cost-effectiveness of constructing a new force main. This analysis showed that constructing a new force main to conserve pumping cost is not cost-effective.

REMOVAL OF EXISTING PUMP STATIONS

Each of the existing pump stations was evaluated to determine if they could be removed from service by construction of a gravity sewer. To remove the pump stations 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 only pump station that can be removed from service is shown in ***Table 8-5***.

Table 8-5
Recommended Pump Station Decommissioning

Project ID	Pump Station Name	Upgrade	Cost ($)	Period
8.PS06	South Village	Construction of 400-foot 8” trunk Sewer	$63,000	Following construction of the SE Interceptor Following construction of project 8.08
8.PS07	South Village	Removal of Pump station	$25,000	On completion of Project 8.PS08

South Village

The South Village Pump Station can be removed from service with the construction of a 400-foot 8-inch gravity sewer that discharges to the new SE Interceptor extension on Murphy Road. The estimated project cost to construct the gravity sewer to remove the station from service is $63,000. The estimated cost to remove the pump station is $25,000. 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. Growth in the area would grow at a constant growth rate until build-out of the area occurs in 2032 requiring the capacity of the station to be upgraded in 2025. Based on these assumptions, the 20-year and 50-year present values for continuing operation of the station (starting in 2006) are $230,000 and $626,000, respectively. Based on the same assumptions, the 20-year and 50-year present values for removing the pump station in 2015 are $173,000 and $178,000, respectively. This analysis shows that replacement of the pump station is cost effective, once the SE Interceptor is extended to serve the areas east of the Murphy Road Pump Station.

SYSTEM DEFICIENCIES

The City’s Collection System was evaluated to determine if there were any deficiencies under existing and build-out flows. The analysis was performed using the calibrated 2005 INFOSWMM hydraulic model. Each deficiency was analyzed to determine how the deficiency could be eliminated. Alternative methods

that were evaluated to eliminate each deficiency were: 1) Rerouting of flow to other points in the system, 2) Upsizing the existing lines and 3) Parallel sewers. The most cost effective alternative was identified as a capital project for removal of the deficiency. Capacity deficiencies under existing and build-out flows are shown schematically in ***Figure 8-4***. The line segments shown in this figure are those that were modeled in the INFOSWMM hydraulic model.

EXISTING

This analysis showed two existing capacity deficiencies in Study Area 8. These capacity deficiencies are defined as Capital Projects 8-2 and 8-7. The line segments and the breakdown of the estimated cost for the projects to correct these deficiencies are shown in ***Table 8-6.*** These projects will provide adequate capacity to meet the required capacity through system build-out.

FUTURE

The system was also evaluated under build-out flow conditions with the proposed interceptor system. Five capacity deficiencies were found in the system in addition to the two existing deficiencies. The segments of the collection system requiring improvements are Capital Projects 8-1, 8-3, 8-4, 8-5 and 8-7. The line segments and the breakdown of the estimated cost to correct the deficiencies for each of the projects are given in ***Table 8-6.***

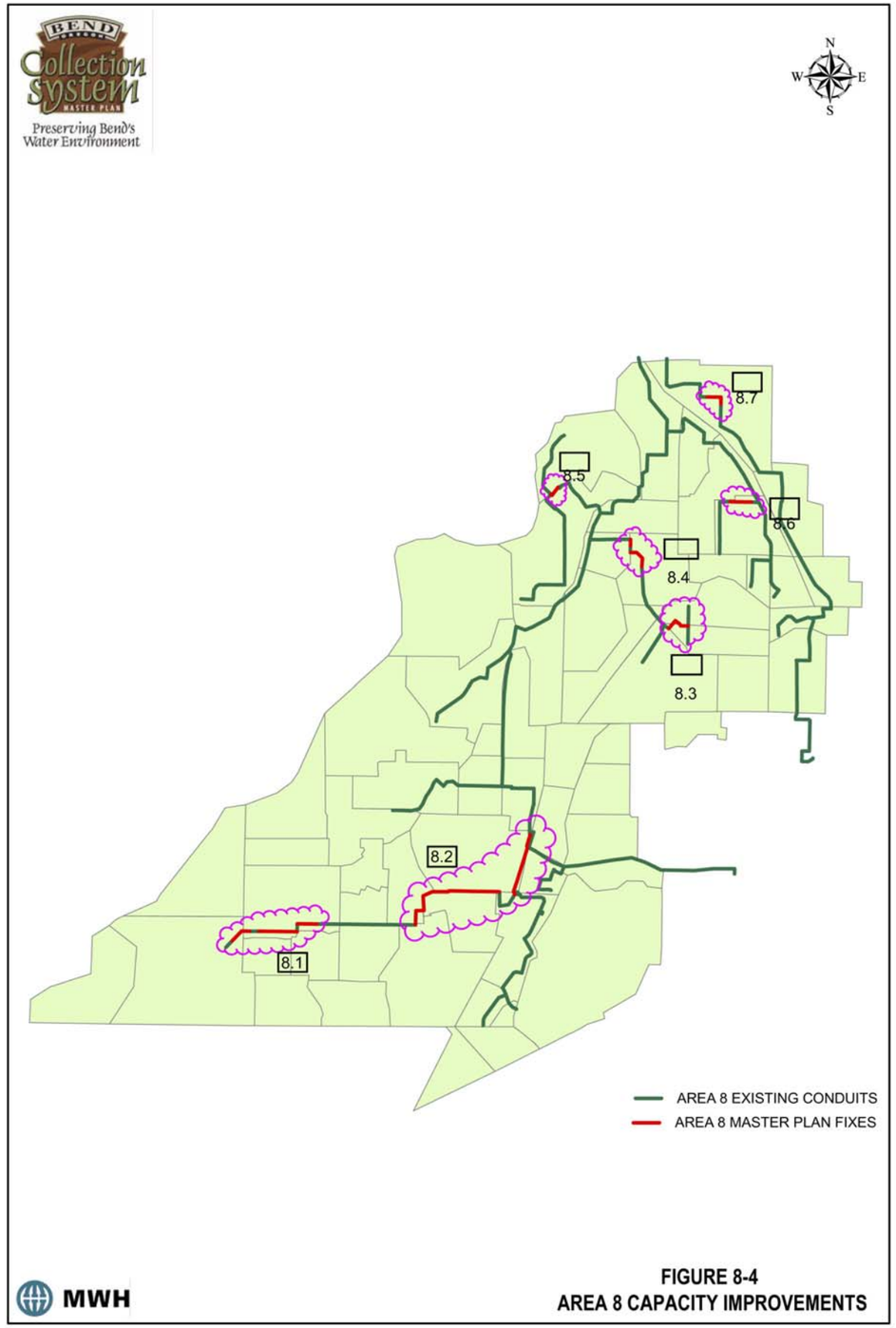


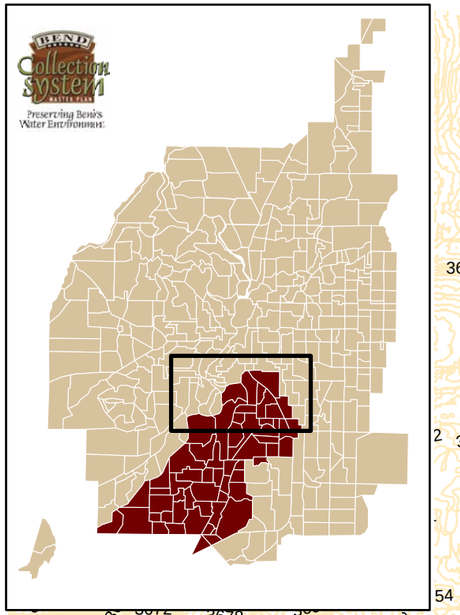
FIGURE 8-4
AREA 8 CAPACITY IMPROVEMENTS

Table 8-6
Study Area 8 System Deficiencies
Capital Project Cost Estimates

Project ID	Manhole ID From	Manhole ID To	Quantities				Unit Costs						Subtotals ($)	Total		
			Existing Diameter (in)	Upgraded Diameter (in)	Length (ft)	Manholes (#)	Materials ($/ft)	Installation ($/ft)	Bypass Pumping ($/ft)	Manholes ($/each)	Reconnection ($/each)	Restoration ($/ft)		Engr/Legal/Admin @40%	Contingency @ 30%	Total ($)
8.1	30-19-15	30-19-13	8	12	533	1	12.75	72.00	11.60	3640	1000	7.35	70,782	24,774	28,667	124,223
	30-19-12	30-19-10	10	12	962	2	12.75	72.00	11.60	3640	1000	7.35	127,754	44,714	51,740	224,208
	30-19-9	30-19-8	8	12	494	1	12.75	72.00	11.60	3640	1000	7.35	65,603	22,961	26,569	115,134
	Total	-	-	-	-	-	-	-	-	-	-	-	***264,139***	***92,449***	***106,976***	**463,565**
8.2	30-19-1	30-17-6A	12	15	1741	4	18.80	77.00	11.60	3640	1000	7.88	251,366	87,978	101,803	441,147
	31-16-2	30-17-1	15	18	80	0	17.00	87.00	11.60	3640	1000	8.40	12,248	4,287	4,960	21,495
	30-17-1	47-42-2P	12	18	1496	4	17.00	87.00	14.50	3640	1000	8.40	233,376	81,682	94,517	409,575
	30-17-6A	30-17-4	12	18	937	2	17.00	87.00	14.50	3640	1000	8.40	146,172	51,160	59,200	256,532
	30-17-4	31-16-5	12	15	208	1	18.80	77.00	11.60	3640	1000	7.88	30,031	10,511	12,163	52,704
	Total	-	-	-	-	-	-	-	-	-	-	-	***673,193***	***235,618***	***272,643***	**1,181,453**
8.3	ALS-3	34-52-3	8	10	640	2	8.85	70.00	11.60	3640	1000	7.35	81,216	28,426	32,892	142,534
	Total	-	-	-	-	-	-	-	-	-	-	-	***81,216***	***28,426***	***32,892***	**142,534**
8.4	2D12.S-1	2D12.2-2	12	15	576	1	18.80	77.00	11.60	3640	1000	7.88	83,163	29,107	33,681	145,951
	2D12.2-1	2D12-3	12	15	161	0	18.80	77.00	11.60	3640	1000	7.88	23,245	8,136	9,414	40,795
	Total	-	-	-	-	-	-	-	-	-	-	-	***106,408***	***37,243***	***43,095***	**186,746**
8.5	3_6_3	OLD_MILL	10	12	250	1	12.75	72.00	11.60	3640	1000	7.35	33,200	11,620	13,446	58,266
	Total	-	-	-	-	-	-	-	-	-	-	-	***33,200***	***11,620***	***13,446***	**58,266**
8.6	35-2-4	35-2-2	8	10	527	1	8.85	70.00	11.60	3640	1000	7.35	66,876	23,407	27,085	117,368
													66,876	***23,407***	***27,085***	**117,368**
8.7	D_26	D_24	8	10	522	1	8.85	70.00	11.60	3640	1000	7.35	66,242	23,185	26,828	116,254
	Total	-	-	-	-	-	-	-	-	-	-	-	***66,242***	***23,185***	***26,828***	**116,254**
Total All Projects																**2,266,186**

Construction Costs based on ENR-CCI of 8449

APPENDIX



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Hwy 97

Business 97

Reed Market Road

Proposed Sewer Projects
Connection Points
SE Interceptor
Existing Sanitary Sewer Lines
UGB
No Planned Development
Parks(No Planned Sewer Expansion)
Deschutes River
Schools

0 1,000 2,000 Feet

MWH

Figure A.8-1
Study Area 8
Proposed Sanitary Sewer Layouts

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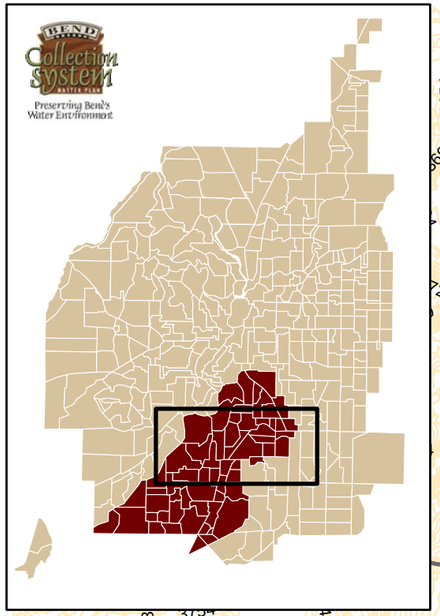

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8.15
8.16
8.17
8.18
8.10
8.01
8.09
8.02
8.12
8.05

Hwy 97
Business 97
Brookswood Rd
Hwy 97
Powers
Reed Market Road

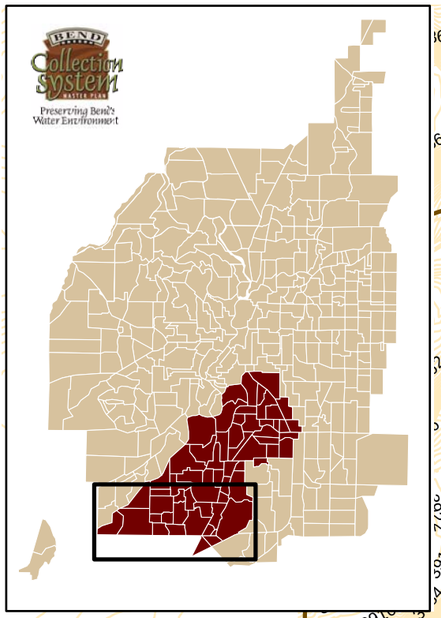
Proposed Sewer Projects
Connection Points
SE Interceptor
Existing Sanitary Sewer Lines
UGB
No Planned Development
Parks (No Planned Sewer Expansion)
Deschutes River
School

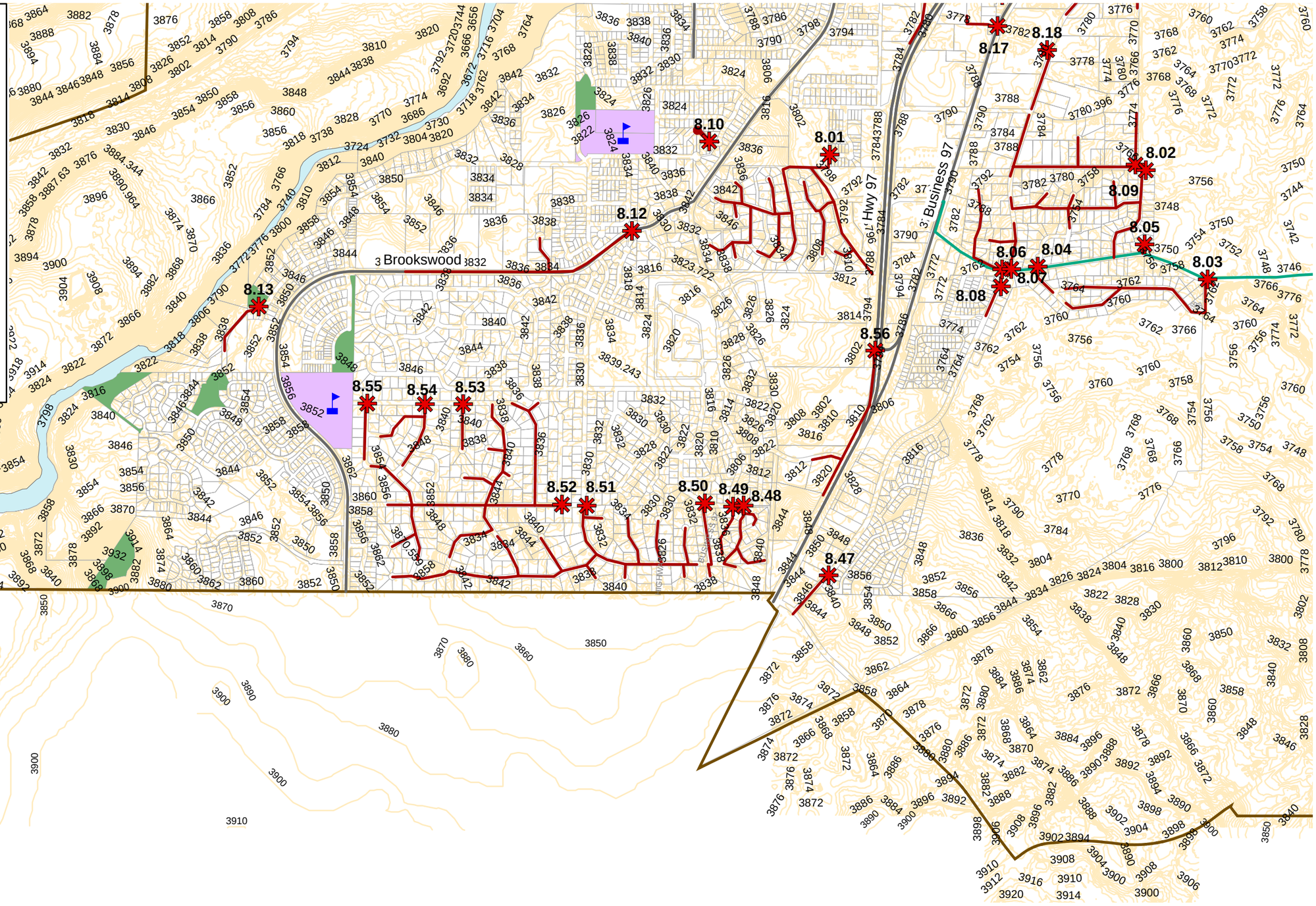
0 1,000 2,000 Feet

MWH

Figure A.8-2
Study Area 8
Proposed Sanitary Sewer Layouts

N
W E
S





Proposed Sewer Projects
Connection Points
SE Interceptor
Existing Sanitary Sewer Lines
UGB
No Planned Development
Parks (No Planned Sewer Expansion)
Deschutes River
School

0 1,000 2,000 Feet

MWH

Figure A.8-3
Study Area 8
Proposed Sanitary Sewer Layouts

N
W E
S