

CITY OF BLACK DIAMOND

GENERAL SEWER PLAN

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GENERAL SEWER PLAN

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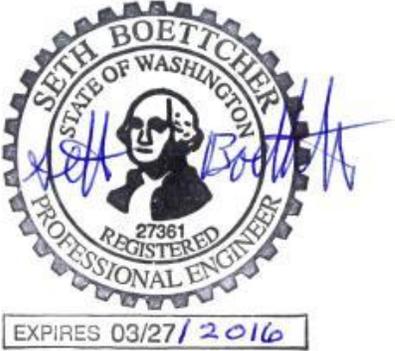
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ENGINEER'S CERTIFICATION

I hereby certify that this General Sewer Plan for the City of Black Diamond, Washington has been prepared under the supervision and direction of the undersigned, whose seal as a Licensed Professional Engineer of the State of Washington is affixed below.



Seth Boettcher, PE

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EXECUTIVE SUMMARY

This City of Black Diamond General Sewer Plan provides a long-term planning document for the City of Black Diamond's sewer system. It evaluates the system over a twenty-year planning horizon, and develops a list of recommended project improvements with a six-year financing plan. This plan has been prepared in accordance with Washington State Department of Ecology requirements as outlined in the Washington Administrative Code Chapter 173-240-050.

The City of Black Diamond owns all of the public sewer gravity lines, force mains, manholes, pump stations, and other system facilities that are within its service area. Additionally, the City maintains ownership of the transmission line leading from the Auburn-Black Diamond Road and Lake Sawyer Road intersection up to Soos Creek Water and Sewer District's Lift Station 11B which will handle the City's sewage needs well into the future.

The City and Soos Creek Water and Sewer District entered into an agreement for Soos Creek to provide conveyance of Black Diamond's wastewater flows through district facilities to the King County Waste Water Division collection system above Kent, however this obligation has now been assumed by King County Wastewater Treatment Division.

The City has an agreement with and relies on King County Wastewater Treatment Division (WTD) for regional conveyance of sewage from the discharge to the Jones Lake Pump Station to Renton and sewage treatment and disposal for our current customers and the future growth within our sewer service area. The City's agreement with King County Waste Water Division assigns the operation, maintenance and repair of the Jones Lake Pump Station, associated sewer force main and sewage trunk line that runs from the City to the Covington Pump Station to King County as regional facilities.

The City sewer system currently consists of approximately 22.1 miles of gravity mains and 2.5 miles of force mains. The City has four operating pump stations that vary in size. These sewage pump stations pump the sewage from local low areas to the City of Black Diamond gravity sewer collection system that all drains to the King County maintained regional Jones Lake Pump Station. Sewage is pumped from the Regional Jones Lake Pump Station by force main to a gravity sewer transmission main in Lake Sawyer Road S.E., which drains to the Soos Creek system and then on to King County sewer facilities.

The City sewer system currently serves a population of approximately 2516 people (932 residences). The City has recently approved two major Master Planned Developments known as Lawson Hills and The Villages for 6000 residential units cumulatively plus 1.5 million square feet of commercial/office/retail. As a result, the City is preparing to experience substantial growth. The City's sewer system currently serves about 930 residential customers plus commercial. The City's sewer system will need to be enlarged and extended to serve approximately 6,216 new residential customers plus new commercial/industrial at current growth projections. This General Sewer Plan includes an

evaluation of projected future sewer flows and proposed improvements to serve the future growth.

Wastewater flow monitoring has been conducted by both the City of Black Diamond at the Black Diamond Pump Station, as well as by King County WTD near the Covington Pump Station. Flow monitoring shows that the City sewer system is experiencing stormwater **inflow** and groundwater **infiltration** (I & I) into the sewer system at or just above the EPA threshold level for **I & I**. The City is proposing a significant annual expenditure to keep **I & I** under control as good stewardship of the City's sewer collection system.

Hydraulic modeling of the existing sewer system was completed to assess the capacity and sizing of the current system to convey flows. With the routing of new sewer flows to points in the western portion of the City the model shows that the existing sewer collection system has adequate capacity to meet the needs of the infill within the areas currently served by sewer. The model will allow the City to perform hydraulic analysis for interim connections from the Master Planned Development areas, commercial customers with very high water use or other future growth scenarios in response to specific development proposals received by the City.

The City of Black Diamond has approved the two Master Planned Developments discussed above and has negotiated and approved development agreements with the developer. The development agreements require that the developer provide all of the capacity adding projects required to serve the new developments. The City's Capital Improvement Plan includes the major local facility improvements for the un-sewered areas, maintenance projects, capacity projects, and equipment/facility improvement projects. Additionally, the proposed CIP for informational purposes also shows the planned sewage storage facility to be constructed by King County WTD to provide additional downstream conveyance capacity by reducing the peak flows. At some point beyond the 6 year period addressed in the CIP, King County will also need to construct an additional sewage transmission main from Black Diamond to points downstream in their system or provide local treatment options.

The current cash reserves are sufficient to meet the needs of the City funded portion of the planned capital program, provided that rates are set at a level so that cash reserves are protected. The financial outlook for the sewer fund will be stable. As King County raises their rates, Black Diamond will need to pass on those rate increases to Black Diamond customers. As the customer base grows, the cost of service per customer goes down. Once the number of sewer customers about doubles, revenue will exceed costs and funds can begin to be directed toward picking up the funding of the Public Works Director and Public Works Administrative Assistant positions.

The City of Black Diamond is committed to providing reliable quality service to its customers. The City is anticipating substantial growth in population over the next twenty-year planning period and this plan provides a means for ensuring the City sewer system is able to accommodate current and future customers at stable local rates.

ACRONYMS & DEFINITIONS

AAF Average Annual Flow	Average flow computed from year-long flow records and most commonly expressed in terms of millions of gallons per day.
ADF Average Design Flow (Maximum Month)	Average monthly flow of the maximum month, estimated for the design year of the sewage works.
ADWF Average Dry Weather Flow	ADWF is the sewage flow for an average day occurring in dry weather months of May through October and represents the baseline of sewage flow for the service area including infiltration and inflow during that season.
AWWF Average Wet Weather Flow	AWWF Average daily flow occurring in wet weather months of November through April
BOD Biochemical Oxygen Demand	A measurement of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter, typically measured over a 5-day period. This characteristic defines the strength of a wastewater and often determines the type and degree of treatment which must be provided to produce a required effluent quality.
City	City of Black Diamond
Combined Sewer	A sewer which receives both wastewater and storm or surface water. Combined sewers are not allowed in the City of Black Diamond.
Diurnal Curve	The curve or graphical representation of the cyclical rise and fall of wastewater flow during a 24-hour period in response to variation in water usage. When used in a general sense, it does not include inflow from storm events.
DAILY FLOW	The amount of flow pumped from the Black Diamond Pump Station at Jones Lake in one day as recorded by King County
DOE	Washington State Department of Ecology
DOH	Washington State Department of Health

ACRONYMS & DEFINITIONS

ERU	Equivalent Residential Unit = 187 gallons of sewage generated per household per day. This figure is the average of water metered during the wet season months by the residential customers. <i>Discussion: In recent years the tiered water rates, improved plumbing fixtures and the economy has reduced household water consumption. It is expected that the City will reduce the ERU figure for the water system with the next update of the water comprehensive plan.</i>
Fecal Coliform	The group of coliform bacteria of fecal origin. <i>Escherichia coli</i> is generally used as the measure of fecal contamination.
Firm Capacity	The available capacity when the largest unit is out of service.
Force Main	A sewer pipeline that flows full under pressure, discharging from a pump station (as opposed to an inverted siphon).
Fps	Feet per second
GPM	Gallons per minute
I & I	Infiltration and inflow
Infiltration	Groundwater that enters the sewer system through such methods as cracks, pipe joints, or porous pipe.
Inflow	Surface water that enters the sewer system through such methods as manhole covers or illegal connections such as footing drains, roof drains, area drains, and sump pumps.
Interceptor	A sewer that receives flow from a number of main or trunk sewers, force mains, etc.
Inverted Siphon	A sewer that dips below the hydraulic grade line to avoid an obstruction such as a creek or canyon.
MDF Maximum Daily Flow	Greatest total flow in a single day
MG	Million Gallons
MGD	Million gallons per day
PCC	Palmer Coking Coal Company

ACRONYMS & DEFINITIONS

Peak Wet Weather Flow PWWF	The largest 60 minute flow rate over a 60 minute period from the study data set.
Peak Design Flow	Largest estimated flow rate sustained over a 60-minute period in the design year of the sewage works.
Sewage	The water-carried human wastes from residences, buildings, industrial establishments or other places together with such industrial wastes or underground, surface, storm, or other water, as may be present. The terms sewage and wastewater are used interchangeably.
SS	Suspended Solids
SSMH	Sanitary Sewer Manhole
STEP	Septic Tank Effluent Pump
Suspended Solids	An approximate measure of the quantity of sludge that will be removed from wastewater by sedimentation (clarification), typically expressed as mg/l. Suspended solids include solids that will settle to the bottom of a cone-shaped container in a 60-minute period.
Volatile Suspended Solids	The organic content of suspended solids. Volatile solids are that portion which will oxidize & be driven off as gas at 600 degrees C.
Wastewater	See sewage.
WTD	Wastewater Treatment Division (King County)
WWTP Wastewater Treatment Plant	A water pollution control facility engineered and constructed to remove pollutants from wastewater.

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1.0 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

This “General Sewer Plan” provides a collection, measurement, inventory update, mapping and compilation of the relevant information on the City’s existing sanitary sewer program and recommends a comprehensive sanitary sewer plan for the City. This plan presents capital facilities needed to accommodate existing and future growth, and proposes strategies to address Sewer system needs consistent with the Black Diamond Comprehensive Plan and compatible with local needs and values.

The following are some of the primary topics covered within this plan:

- Sewer System Inventory
- Planning for Growth
- Sewer Model of Existing Conditions
- Sewer Model of Future Conditions
- Identification of System Deficiencies
- Recommendation of Capital Projects
- Financial Outlook and Recommendations

1.2 REGULATORY REQUIREMENTS

This General Sewer Plan has been prepared in conformance with the requirements for the preparation of general sewer plans as outlined in Washington Administrative Code (WAC) 173-240-050. Approval of this plan is required by the Department of Ecology (DOE).

It is the City’s intent to comply with the Clean Water Act and any water quality management plan that may be adopted under the Federal Water Pollution Control Act as amended. The adoption of this General Sewer Plan is in keeping with good environmental practice. Providing for a well functioning local sewer collection utility will help protect local creeks, lakes and wetlands.

This General Sewer Plan was reviewed by the local SEPA official. A Declaration of Non Significance was issued on September 12, 2012. No comments were received from an individual or another agency. A copy of the SEPA checklist, the Declaration of Non Significance and the affidavit of publication are included in **Appendix A SEPA Determination and Checklist**.

This General Sewer Plan is also consistent with the Growth Management Act. Although the King County Sewer Transmission main from Black Diamond passes outside the Urban Growth Area to carry City sewage to King County regional sewer facilities, the City does not allow any sewer connections outside of the Urban Growth Area or outside the City sewer service area.

The design of local sewer systems will follow the practices described in the Department of Ecology’s Criteria for Sewage Works Design (Orange book) and more specifically the

1.0 INTRODUCTION

City's most recent publication of the Black Diamond Engineering Design and Construction Standards.

1.3 LOCATION

The City of Black Diamond is located approximately 30 miles southeast of Seattle, Washington. Black Diamond community was established in 1880 and developed as a coal mining town over the next fifty years. Black Diamond was incorporated as a city in 1959. The City is located along State Route 169, just west of the Cascade Mountains. **Figure 1.1 Vicinity Map (Washington State)** illustrates the location of Black Diamond in the State of Washington. **Figure 1.2 Vicinity Map (King County)** illustrates the location of Black Diamond within King County.



Figure 1.1 Vicinity Map (Washington State)

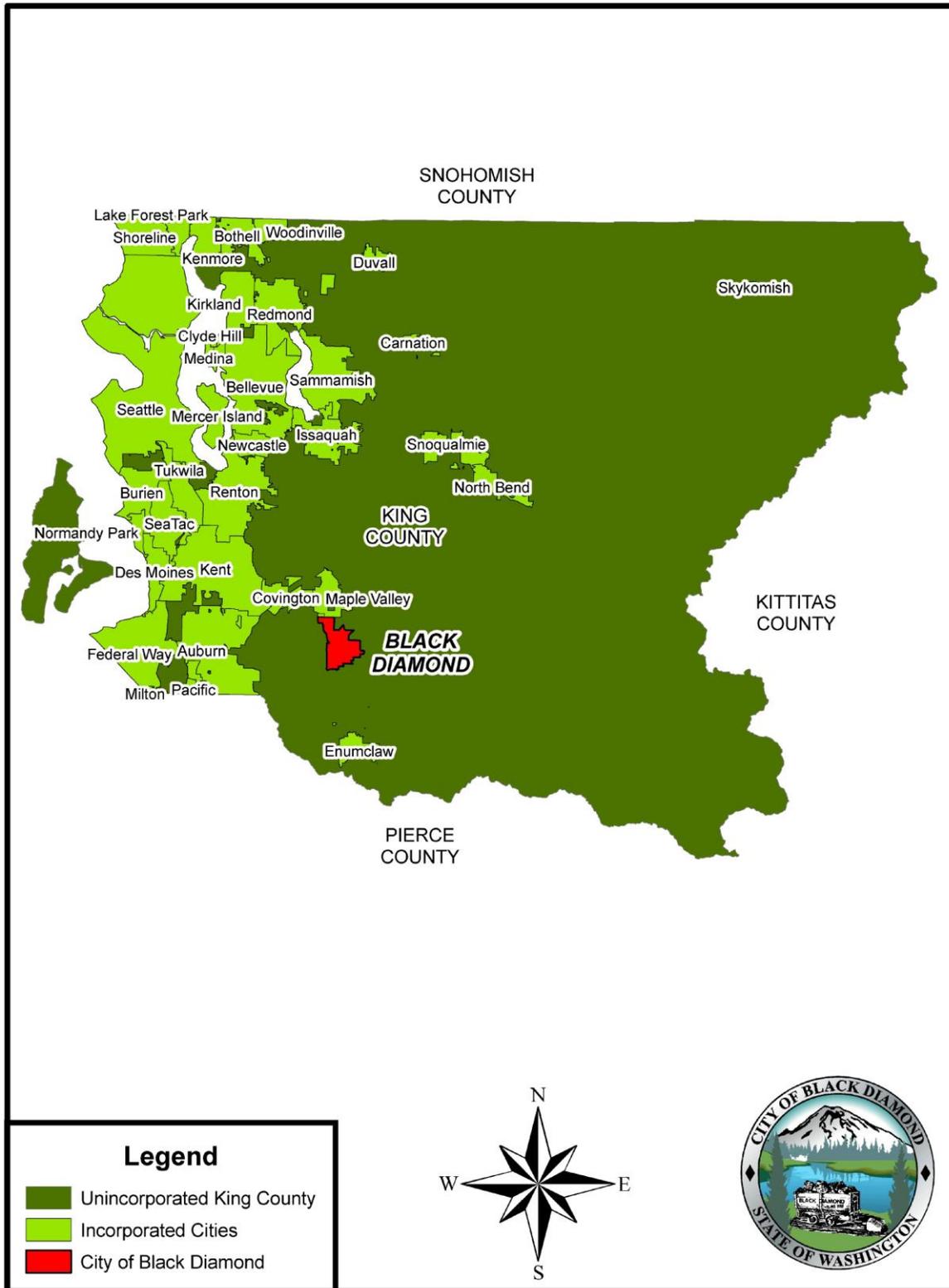


Figure 1.2 Vicinity Map (King County)

1.4 OVERVIEW OF EXISTING SYSTEM

A summary of the City’s sewer system is included in *Table 1.1 Sewer System Summary*.

Table 1.1 Sewer System Summary

DESCRIPTION	DATA
Total length of gravity mains	116,500 ft (22.1 miles)
Total length of force mains	13,300 ft (2.5 miles)
Number of sewer manholes	485
Number of pump stations	4
Jones Lake Basin Service Area ¹	897.14 acres
Rock Creek Basin Service Area ¹	749.04 acres
West Black Diamond Basin Service Area ¹	1,624.17 acres
East Black Diamond Basin Service Area ¹	432.43 acres
Area currently served	692.65 acres
Jones Lake Basin Remaining Developable Area ²	156.03 acres

1.5 ENVIRONMENTAL REVIEW

This General Sewer Plan has undergone an environmental review as required by WAC 173-240-050(3). A copy of the environmental determination for this General Sewer Plan has been included in **Appendix A – SEPA Determination and Checklist**.

¹ Refer to Figure 7.1 – Sewer Collection Basin Planning Areas

² Refer to Figure 7.2 – Potential Development within the Jones Lake Basin

2.0 SEWER SERVICE AREA

2.1 SERVICE AREA

The City of Black Diamond's existing sanitary sewer service area consists of all areas within the Urban Growth Boundary, except for the area around Lake Sawyer that is served by the Soos Creek Water and Sewer District. See **Figure 2.1 Black Diamond Sewer Service Area**. There are no proposed changes to the City's Sewer service area.

2.2 ADJACENT PURVEYORS

The Soos Creek Water and Sewer District is an adjacent purveyor to the City of Black Diamond Sewer System. **Figure 2.1 Black Diamond Sewer Service Area** shows the location of sewer purveyors adjacent to the Black Diamond Service Area.

The Soos Creek Water and Sewer District has been serving south King County since 1939. Formerly Water District 58 and Cascade Sewer District, the two merged in 1987. The Soos Creek Water and Sewer District encompasses over 35 square miles and provides water and sewer service to almost 100,000 people in southeast King County. The sanitary sewer system includes 30 pump stations. The sewer system conveys wastewater to the King County facilities in Kent and ultimately to the King County Wastewater Treatment Plant in Renton for treatment and disposal.

2.3 SEWERAGE COORDINATION AGREEMENTS

KING COUNTY WASTE WATER TREATMENT DIVISION

The City of Black Diamond entered into an agreement with King County WTD (then known as Metro) on September 12, 1990 to provide for regional conveyance and treatment of all sewage from Black Diamond after the failure of the City's treatment plant that discharged into the Rock Creek core wetland complex. The abandonment of the City sewage treatment plant and connection to the King County regional sewer system was funded by a DOE grant and an EPA grant. The agreement specifies that the City owns and King County operates, maintains, repairs, replaces and improves as needed the Black Diamond Pump Station at Jones Lake and force main to Lake Sawyer Road SE and the sewage trunk line that runs from the City to the Soos Creek Sewer District System. The City's agreement with King County runs until July 2036. A copy of the interagency agreement between the City and King County WTD and amendments thereto is included in **Appendix B – King County Metro Agreement for Disposal**.

SOOS CREEK WATER & SEWER DISTRICT

The City of Black Diamond entered into an interagency agreement with the Soos Creek Water and Sewer District on September 5, 1990 to relay Black Diamond sewage to the King County Waste Water Division facilities and it was later amended on April 21, 1999. The agreement and the amended agreement are included in **Appendix C – Soos Creek, King County, Black Diamond: Conveyance of Black Diamond Wastewater Flows**.

2.0 SEWER SERVICE AREA

The agreement was entered into after the failure of the City's treatment plant and the agreement outlines that the Soos Creek Water and Sewer District will provide for conveyance of Black Diamond Wastewater Flows through district facilities to the King County regional collection facilities. The agreement allows for conveyance of flows in the amount of 990,000 gallons per day (equivalent to a population equivalent of 3,600 assuming flows of 275 gallons per capita per day).

KING COUNTY / SOOS AGREEMENT

In 2006, King County entered into an agreement with the Soos Creek Water and Sewer District, assuming Black Diamond's obligations to Soos Creek Water and Sewer District, for wheeling of sewage through the Soos Creek system (see **Appendix D – Soos Creek Agreement for the Conveyance of Sewage**). In July of 2010 King County did in fact assume the Black Diamond obligations to Soos Creek for sewage conveyance. With King County taking over Black Diamond's obligations to the Soos Creek Sewer District for conveyance of Black Diamond Flows to County facilities in July 2010, the implications of Black Diamond's agreement with Soos Creek are largely irrelevant. As a housekeeping and clarity measure, the City will amend its agreements with King County and Soos Creek to reflect the current operation, practice and agreement between Black Diamond and Soos Creek Water and Sewer District.

2.0 SEWER SERVICE AREA

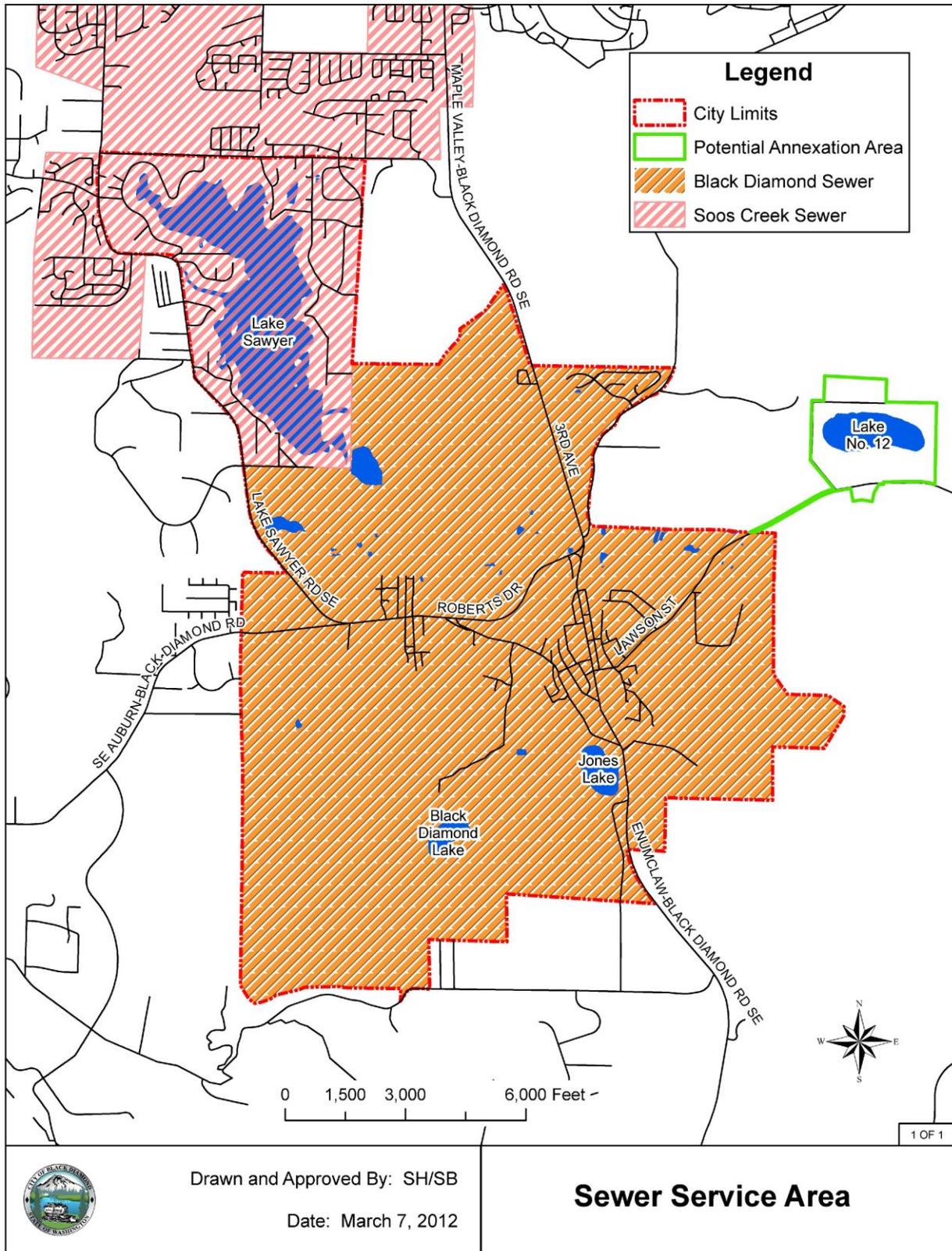


Figure 2.1 Black Diamond Sewer Service Area

2.4 PHYSICAL ENVIRONMENT³

Planning for the future sanitary sewer system requires a basic understanding of the physical environment of the area. A working knowledge is useful in identifying any constraints which may affect the development of the sewer system. Physical characteristics which influence planning and design include topography, geology and soils, surface water, wetlands and climate. Descriptions of these characteristics, as well as a summary of mining lands and environmentally sensitive areas in the City are as follows:

2.4.1 TOPOGRAPHY

The City is situated on an upland plateau bounded on the south and southeast by the Green River and on the northeast by the Cascade Range. Depressions and hummocks characterize the rolling glacial terrain. **Figure 2.2 Black Diamond Topography** shows the topographic characteristics within the City.

The Black Diamond Sewer Service area is divided from the northwest to the southeast by Rock Creek and the Rock Creek core wetland complex. The area northeast of the Rock Creek drainage rises significantly and can easily be served by gravity to the low area (in the Palmer Coking Coal Company (PCC) gravel pit) dividing the City's sewer service area. The area to the southwest of the Rock Creek Drainage system gently rises to an upland plateau with high elevations around 600 to 770 feet. Between the gentle rises in the plateau are depressions that limit gravity collection of sewage from this area to the Rock Creek area or to the Jones Lake area. The low point nearest the largest developable area of land is on the western boundary of the sewer service about one quarter mile north of the southwest corner of the city. Elevations within the existing City limits vary between approximately 500 feet at Morganville to 1,000 feet at the eastern perimeter. Most of the existing buildings within the City are located at lower elevations, between approximately 500 and 700 feet.

³ City of Black Diamond, [City of Black Diamond Water System Plan](#), 2008.

2.0 SEWER SERVICE AREA

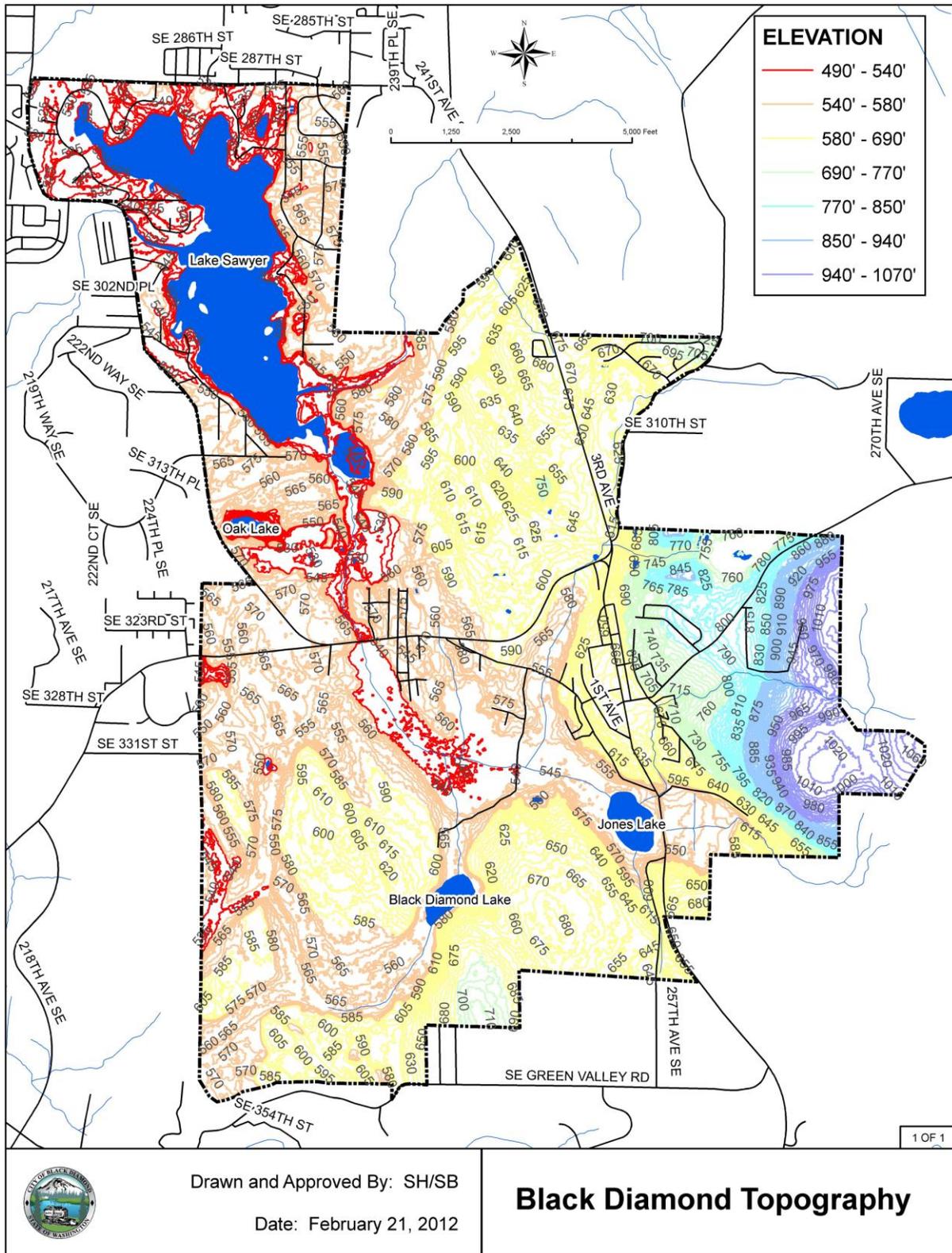


Figure 2.2 Black Diamond Topography

2.4.2 GEOLOGY

The surficial geology and landforms in the Black Diamond area, located on the Covington Drift Plain, are the result of the most recent regional glaciation, the Vashon Stage of the Fraser glaciation. The Vashon ice sheet completely melted from the Black Diamond area approximately 10,000 years ago. During the maximum extent of the Vashon Stage, the planning area was covered with up to 2,000 feet of ice.

Since the last glaciation, urbanization, rural development, logging, gravel mining activities, erosion, and sedimentation have modified the land surface. Weathering and erosion of native soils has resulted in the development of topsoil and colluvium at the ground surface. The topsoil in undeveloped areas consists of a few inches of silt and sand with decayed roots and leaves. The weathered soils underlying the topsoil consists of silty sand and gravel with roots, generally extending 2 to 6 feet. Topographic depressions and low gradient stream channels have accumulated soft organic silt and peat. In general, the areas underlain by organic silt and peat are within wetland areas.

Vashon recessional outwash mantels much of the west portion of the City. The soil consists of sand and gravel with variable amounts of silt and cobbles deposited by the rivers emanating from the melting front of the Vashon ice sheet.

Vashon till is at the ground surface in some areas of the east portion of the City. Till consists of unstratified silt, sand, gravel and cobbles that are in a very dense condition because of being overridden by the glacial ice. Till is usually 20 to 40 feet thick and probably underlies the recessional outwash but may be absent where eroded during deglaciation meltwater runoff episodes.

Pre-Vashon glacial and interglacial sediments underlie the Vashon till in the west portion of the City area where bedrock is deep. The pre-Vashon glacial and interglacial sediments consist of inter-bedded and/or stratified silt, gravel and till. These soils are not exposed at the ground surface in the City, but are exposed in the upper walls of the Green River gorge, south of the City, and are penetrated by water wells in the west portion of the area.

Bedrock of the Puget Group underlies the City and surrounding area. The bedrock is locally exposed at the surface in the east portion of the area and in the walls of the Green River gorge. The bedrock consists of sedimentary sandstone, mudstone, shale and coal. Based on elevations of surface exposures and the interpretation of well water logs by Icicle Creek Engineering, Inc., bedrock underlies the property at a depth of 200 feet or more in the west portion of the City.

2.4.3 SOILS

Figure 2.3 Black Diamond Soils Figure 2.3 shows the various major soil type groups found in the City of Black Diamond. The darker shades of the same color represent the same soil type but steeper slopes. The various soil types are discussed in more detail below. For technical information about soils, refer to **Appendix E – Soil Descriptions**.

Everett Series Soil Most of western Black Diamond has an Everett Series soil type. This soil typically contains various grades of gravelly sand or sandy gravels with very little gravelly loamy sand top soil. These areas are very well drained. The water tables are typically deeper than 15 feet except in low elevations near Lake Sawyer, Oak Lake, Frog

2.0 SEWER SERVICE AREA

Lake or Horseshoe Lake. Typically drainage is very good and water tables in the range of normal depth of sewer collection systems are non-existent.

Alderwood Series Soil The area through the middle of the City north and south of the Rock Creek core wetland complex has an Alderwood Series Soil type. These soils are characterized by approximately 3' to 5' of gravelly sandy loam overlying very dense and slowly permeable glacial till. Where the slopes are shallow the ground water will tend to perch on the glacial till and drain laterally subsurface during high winter water table conditions. Wherever there are local depressions, wetlands tend to form.

The soils along the Rock Creek wetlands and the Ginder Creek wetlands are either **Billingham Silt Loams or Seattle Muck.**

Beausite Series Soil The soils on the higher elevations in the old part of Black Diamond and the higher elevations in east Black Diamond have a Beausite soil type. These soils are characterized by gravelly loams and gravelly sandy silt loams over impermeable sandstone. Since the underlying restricting layer is impermeable and the overlying soil is typically slowly permeable the high winter water tables tend to rise close to the surface. The runoff from the Beausite soil areas is typically very high during high winter water table conditions.

Indianola Series Soil *Figure 2.3 Black Diamond Soils* shows there is small spot of Ragnar-Indianola series soil in the Morganville area. Actually the Indianola series soil covers much more of the Morganville area than the map shows but both the Everett and Indianola series soil in this area are well drained soils with deep water tables. An Indianola Series soil is characterized by 18 inches of light brown loamy medium sand over clean medium to fine sand. The east edge of the Indianola soils transitions to Alderwood approximately 200 to 300 feet east of the east boundary of the cemetery.

2.0 SEWER SERVICE AREA

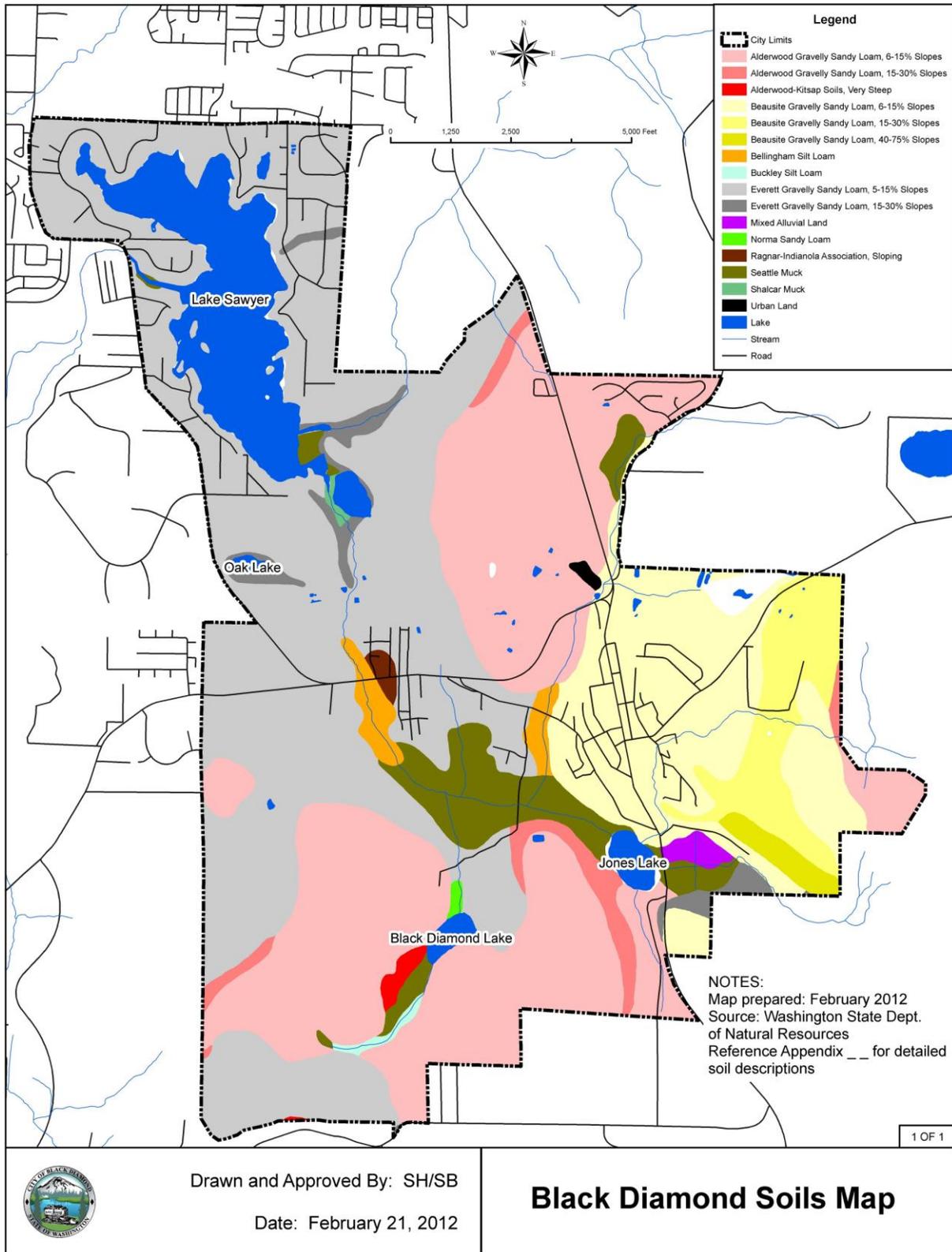


Figure 2.3 Black Diamond Soils (refer to Appendix E – Soil Descriptions)

2.4.4 SURFACE WATERS

The City's service area lies within the Duwamish/Green River drainage basin. A number of lakes, wetlands, and creeks lie within the service area. Black Diamond Lake and Jones Lake are located in the southern part of the City limits. Ginder Lake and Lake No. 12 are located east of the City limits. Two smaller lakes, Oak Lake and Frog Lake, are located within the western part of the City limits. Lake Sawyer is one of the largest lakes in terms of size and volume in the Green River basin and it discharges to Covington Creek which in turn discharges to Big Soos Creek. The Big Soos Creek flows into the Green River near the City of Auburn. Lake levels of Lake Sawyer are controlled by a privately owned and operated concrete dam near the intersection of SE 296th Street East and 224th Ave SE.

Rock Creek is the principal drainage basin in the City and flows west from Jones Lake area and then north to Lake Sawyer just west of Morganville. Ginder Creek, Lawson Creek and three smaller tributary creeks drain into Rock Creek.

The Green River originates in the western Cascade range approximately 30 linear miles east of the City. The Green River flows westerly about a quarter mile south of the Green Valley Road south of the City. Flows in the river result largely from rainfall runoff and snowmelt but now glacial flows from Mount Rainier contribute to the Green River. Flows are regulated approximately 20 miles upstream of the City by a flood control structure operated by the Corps of Engineers known as the Howard Hanson Dam. Approximately 3 miles downstream from the dam, the City of Tacoma operates a water intake structure capable of diverting water to the McMillin Reservoir near South Hill Puyallup.

2.4.5 CLIMATE

Annual precipitation ranges from 45 to 70 inches, averaging approximately 55 inches. More than 80% of the precipitation occurs October through May and 50% from November through February. Total evaporation averages approximately 25 inches per year with approximately 75% occurring during the months of May through August. Precipitation and evaporation were measured at the Landsburg weather station located approximately 5 miles north northeast of the City of Black Diamond.

Available temperature data is also from the Landsburg weather station. Low temperatures in December and January average 30° to 33° F and the highs range from 41° to 46° F. In July and August the average low temperature is approximately 50° F and the high 75° F. The lowest recorded temperature from 1976 to 1993 was 0° F in February 1989 and the highest recorded temperature was 102° F in August 1981 and May 1983.

2.4.6 MINING ACTIVITY

There are many abandoned, underground mines present in the Black Diamond area that have been documented by the State. The John Henry Coal Mine adjacent and northeast of the city is still under permit but has been inactive for over 10 years. The mining company is now under an order to proceed with mine reclamation activities. Projects located in the vicinity of abandoned coal mines may require geotechnical evaluation to determine the risks that an abandoned underground coal mine might present.

2.0 SEWER SERVICE AREA

PCC has an active gravel pit in the area noted as light industrial on the land use and zoning maps, see **Figure 2.6 Black Diamond Future Land Use** and **Figure 2.7 Black Diamond Zoning**.

2.4.7 ENVIRONMENTALLY SENSITIVE AREAS

The Black Diamond Municipal Code Chapter 19.10 establishes regulations for development in environmentally sensitive areas. Specific information on the location and extent of sensitive areas within the City can be obtained from the City while sensitive area information for other areas is available from King County.

Environmentally sensitive areas include wetlands, fish and wildlife habitat conservation areas and geologically hazardous areas. Geologically hazardous areas include areas that are not suitable to development due to their susceptibility to erosion, sliding, earthquake or other geological events. Fish and wildlife conservation areas within the City include Rock Creek and Ginder Creek corridors, open water ponds, lakes and riparian forests. Geologically hazardous areas include steep slope and past coal mine working areas.

The City's Sensitive Areas ordinance increased buffers to all wetlands and establishes mitigation requirements where impacts cannot practically be avoided. See **Figure 2.4 Wetlands & Wetland Buffers Map**. The wetlands within the Master Planned Developments have already been identified, flagged and ground survey located so that development planning can avoid most impacts.

2.4.8 PUBLIC WATER SERVICE

The City of Black Diamond owns and operates a municipal public water system serving a population of approximately 2600 people plus commercial customers (approximately 1130 ERU) covering the same service area as the City sewer service area. **Figure 2.5 Public Water Service** shows the City water service area, the extent of the existing water distribution system, wells, water reservoirs and water pump stations. The City has enough water supply to provide the buildout of the water service area within the City. The Black Diamond water system has excess water storage capacity to meet the needs for the next 20 years of development. The City has an intertie with the City of Tacoma Pipeline providing the City with back up redundant water supply. The City's water system comprehensive plan was accepted by the Black Diamond City Council and approved by King County and the Department of Health in 2009. See **Figure 2.5 Public Water Service**.

2.0 SEWER SERVICE AREA

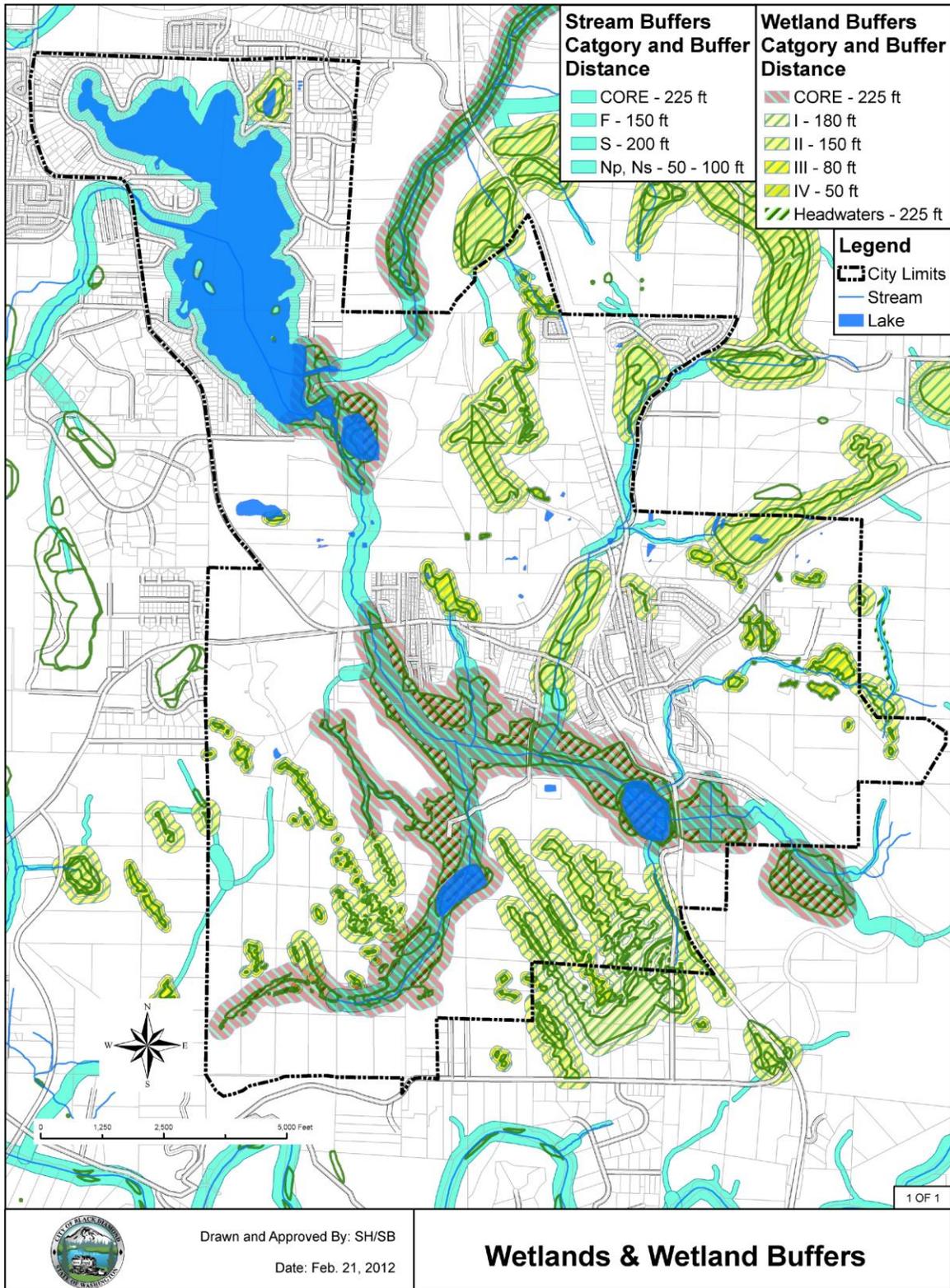
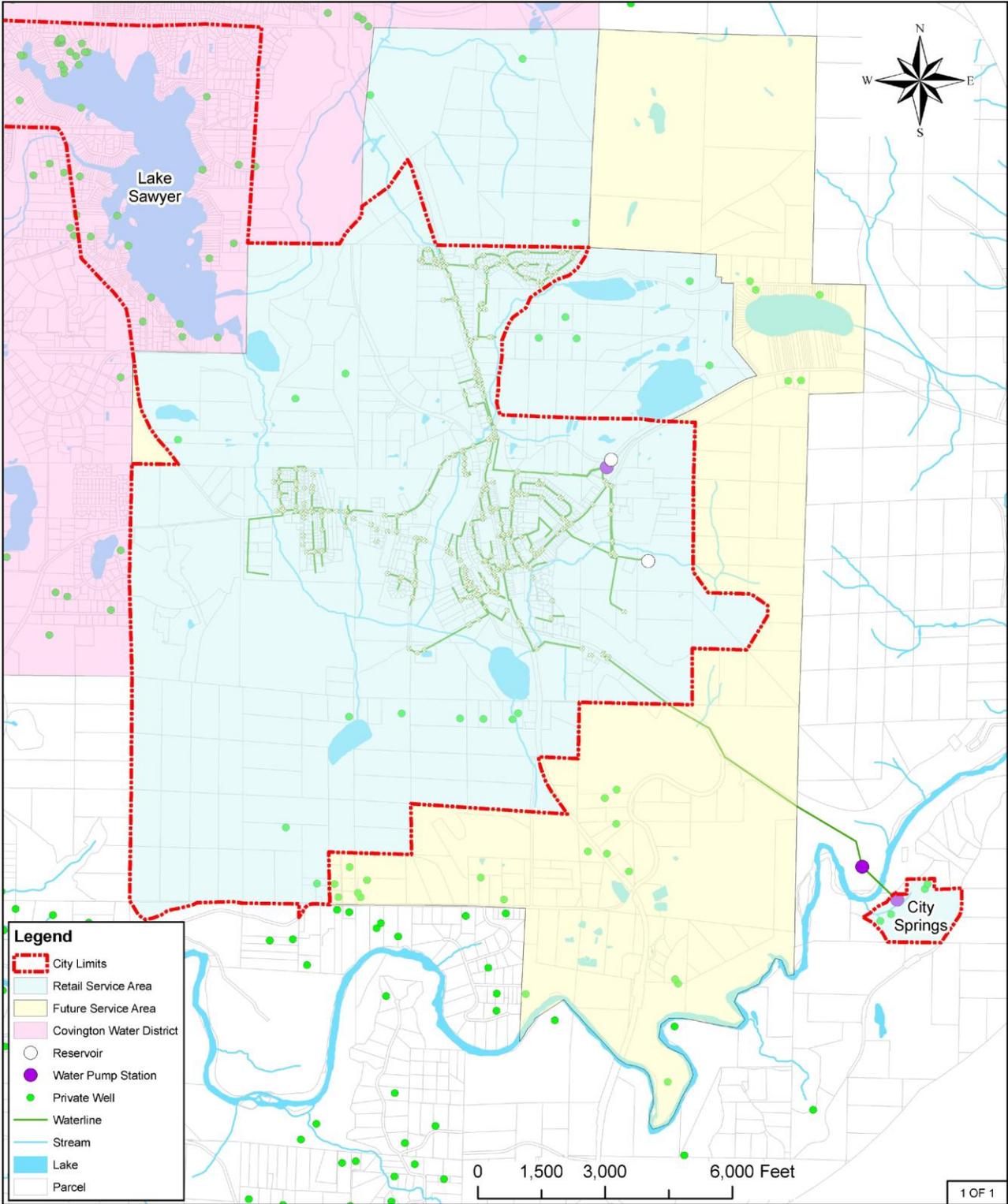


Figure 2.4 Wetlands & Wetland Buffers Map

2.0 SEWER SERVICE AREA



Drawn and Approved By: SH/SB
 Date: November 7, 2012

**Public Water Service
 and Private Wells**

Figure 2.5 Public Water Service

2.5 LAND USE & ZONING

Land use and zoning play an important role in determining growth patterns, and therefore future sewer system development patterns and requirements. Future land use, variations in use, and changing population densities, as determined by applicable zoning ordinances, can significantly impact the City of Black Diamond's future sewer system development patterns and needs.

Figure 2.6 Black Diamond Future Land Use is the proposed land use for the City as included in the City of Black Diamond Comprehensive Plan. This figure shows designated land use within incorporated Black Diamond and the portions of unincorporated King County that are planned for master developments and may be annexed into the City in the future. Current land uses are primarily residential uses, with some light industrial and commercial areas. The majority of the future development within the time frame of this plan in the City of Black Diamond will be in the Master Planned Development zoned areas. The planning for those areas is more specifically defined in the Master Planned Development Applications that have been approved. See **Appendix F – Proposed MPD Land Use from Development Agreements**.

Figure 2.7 Black Diamond Zoning includes the City's zoning as adopted by the City in June 2009. Zoning definitions are as follows:

B/IP – Business/Industrial Park
CC – Community Commercial District
I – Industrial District
MDR8 – Medium Density Residential District
MPD – Master Planned Development
NC – Neighborhood Center
PUB – Public
R4 – Single-Family Residential District: 4 dwelling units per acre maximum
R6 – Single-Family Residential District: 6 dwelling units per acre maximum
TC – Town Center

Zoning details can be found in the Black Diamond Municipal Code under Title 18 "Zoning".

Figure 2.8 King County Land Use includes the designated land uses for the area of unincorporated King County surrounding Black Diamond.

Figure 2.9 King County Zoning includes the zoning designations as defined by King County for the area of unincorporated King County surrounding Black Diamond.

2.0 SEWER SERVICE AREA

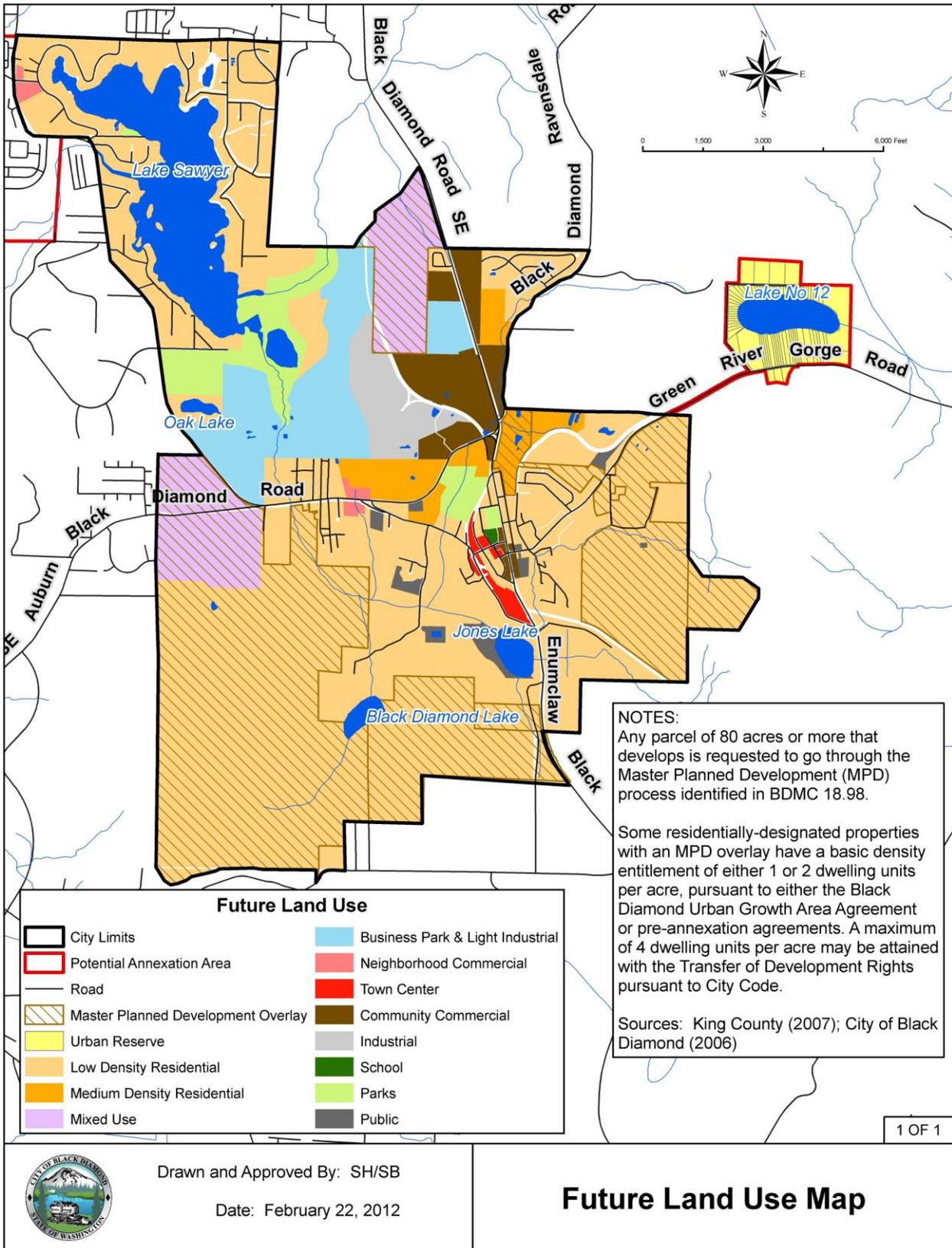
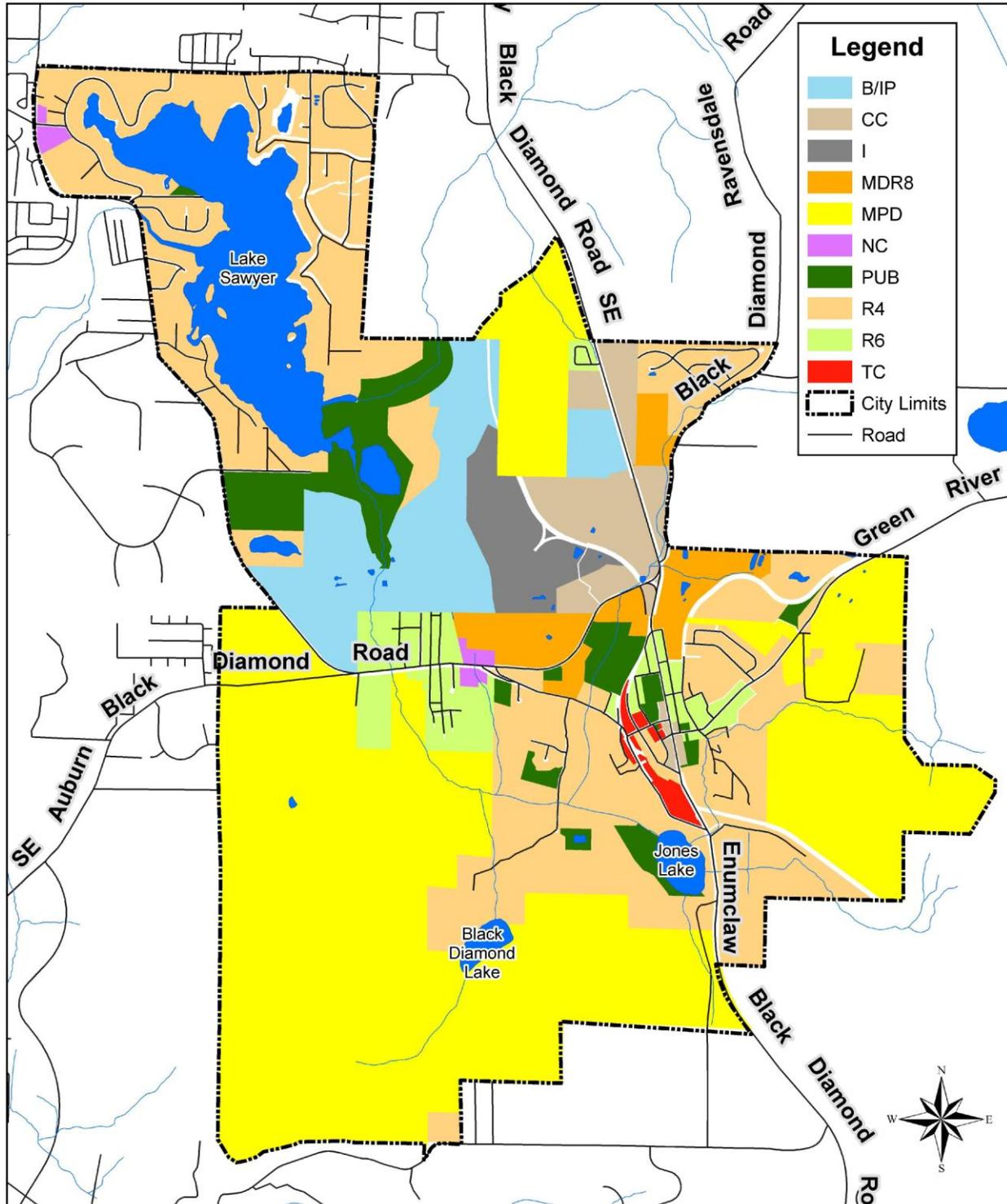


Figure 2.6 Black Diamond Future Land Use

2.0 SEWER SERVICE AREA



Map updated: November 2012



City of Black Diamond Zoning Map

Figure 2.7 Black Diamond Zoning

CURRENT KING COUNTY LAND USE

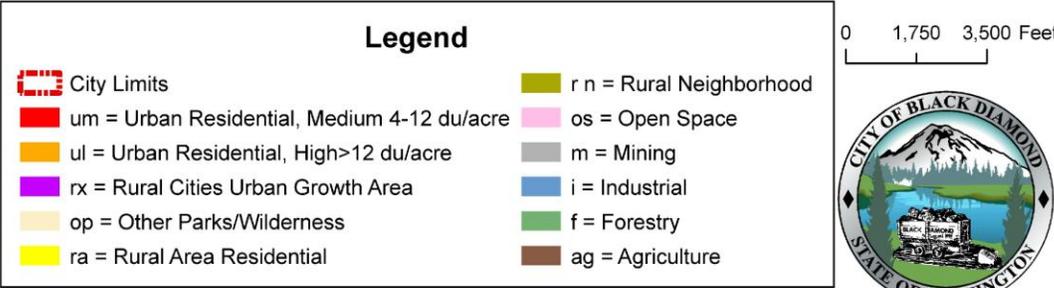
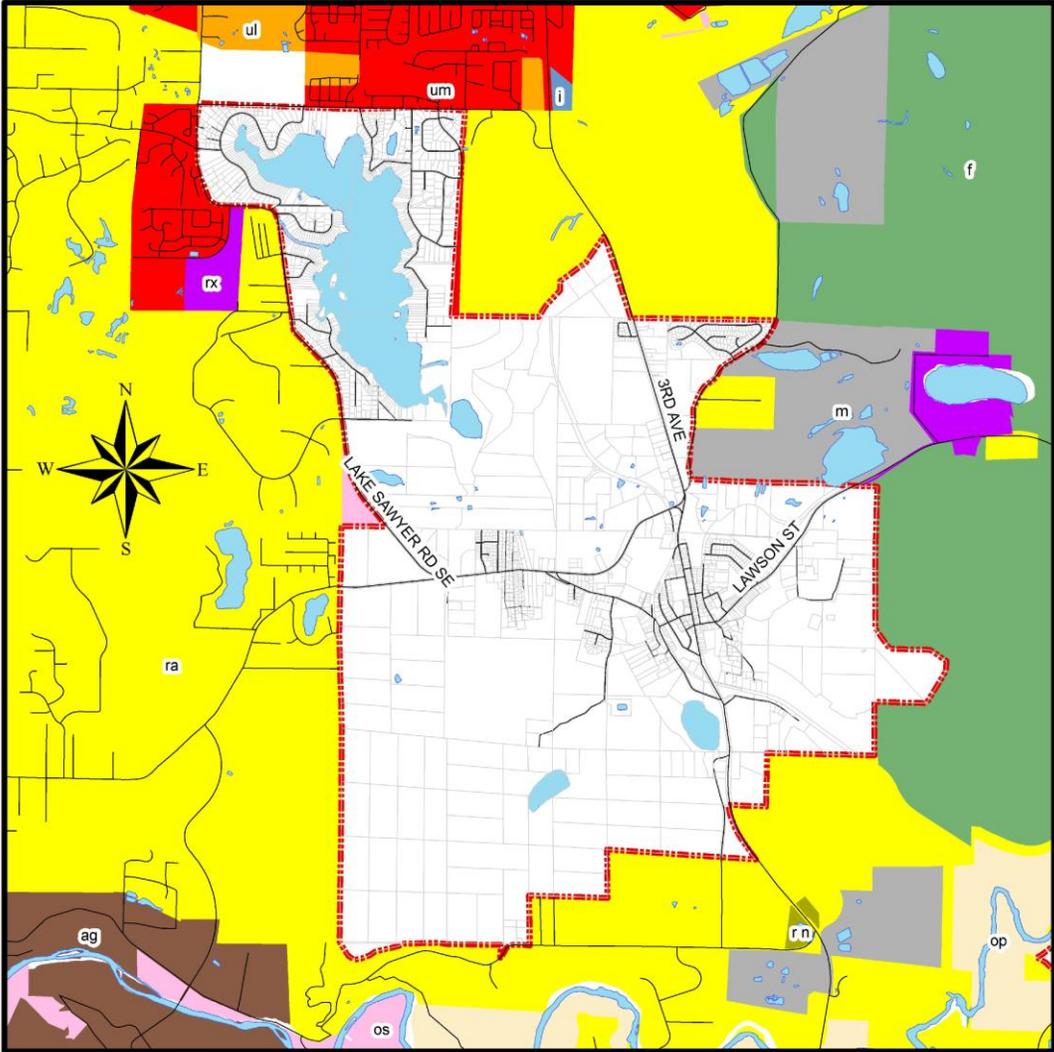
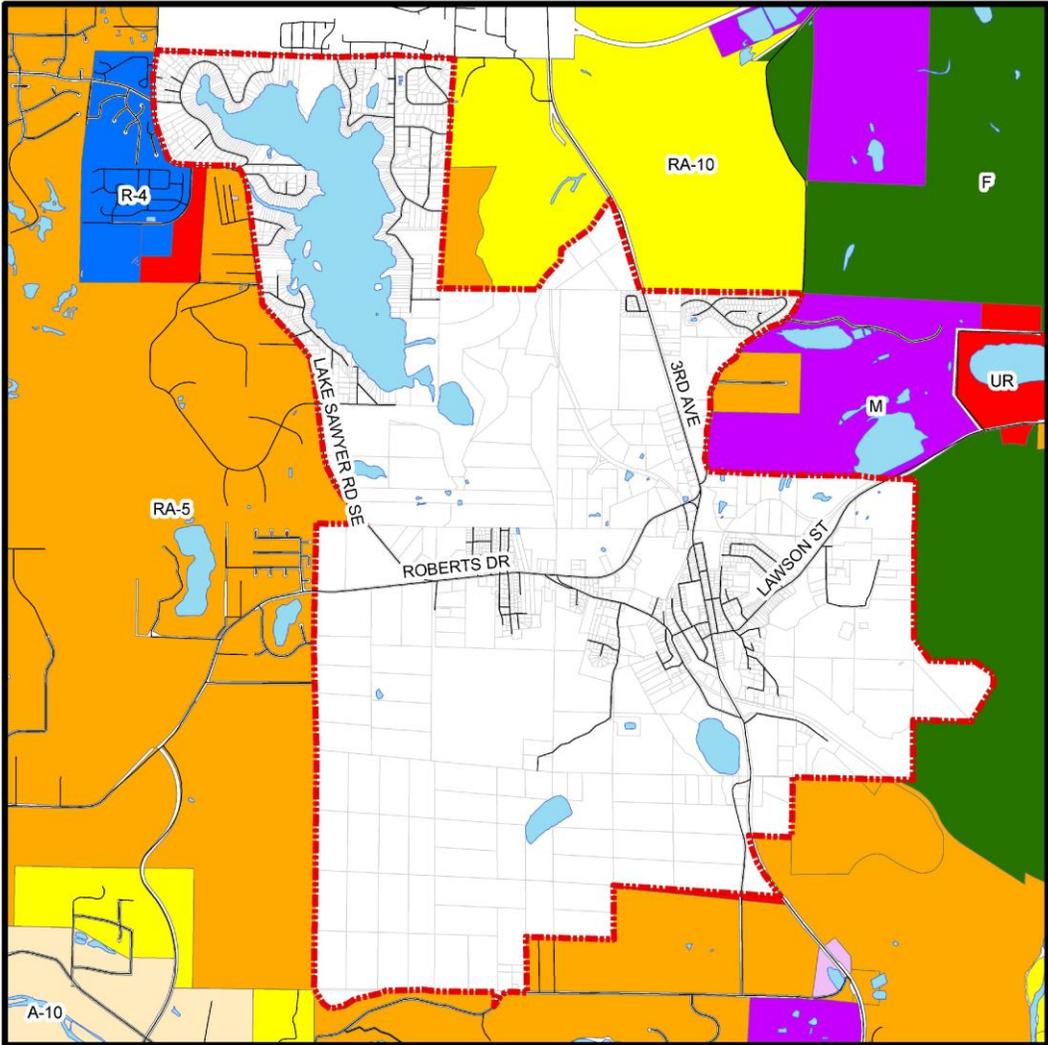


Figure 2.8 King County Land Use

CURRENT KING COUNTY ZONING



Legend

- City Limits
- R-4 = Residential, four DU per acre
- RA-5 = Rural Area, one DU per 5 acres
- RA-10 = Rural Area, one DU per 10 acres
- A-10 = Agricultural, one DU per 10 acres
- UR = Urban Reserve, one DU per 5 acres
- M = Mineral
- F = Forest
- Lake

Figure 2.9 King County Zoning

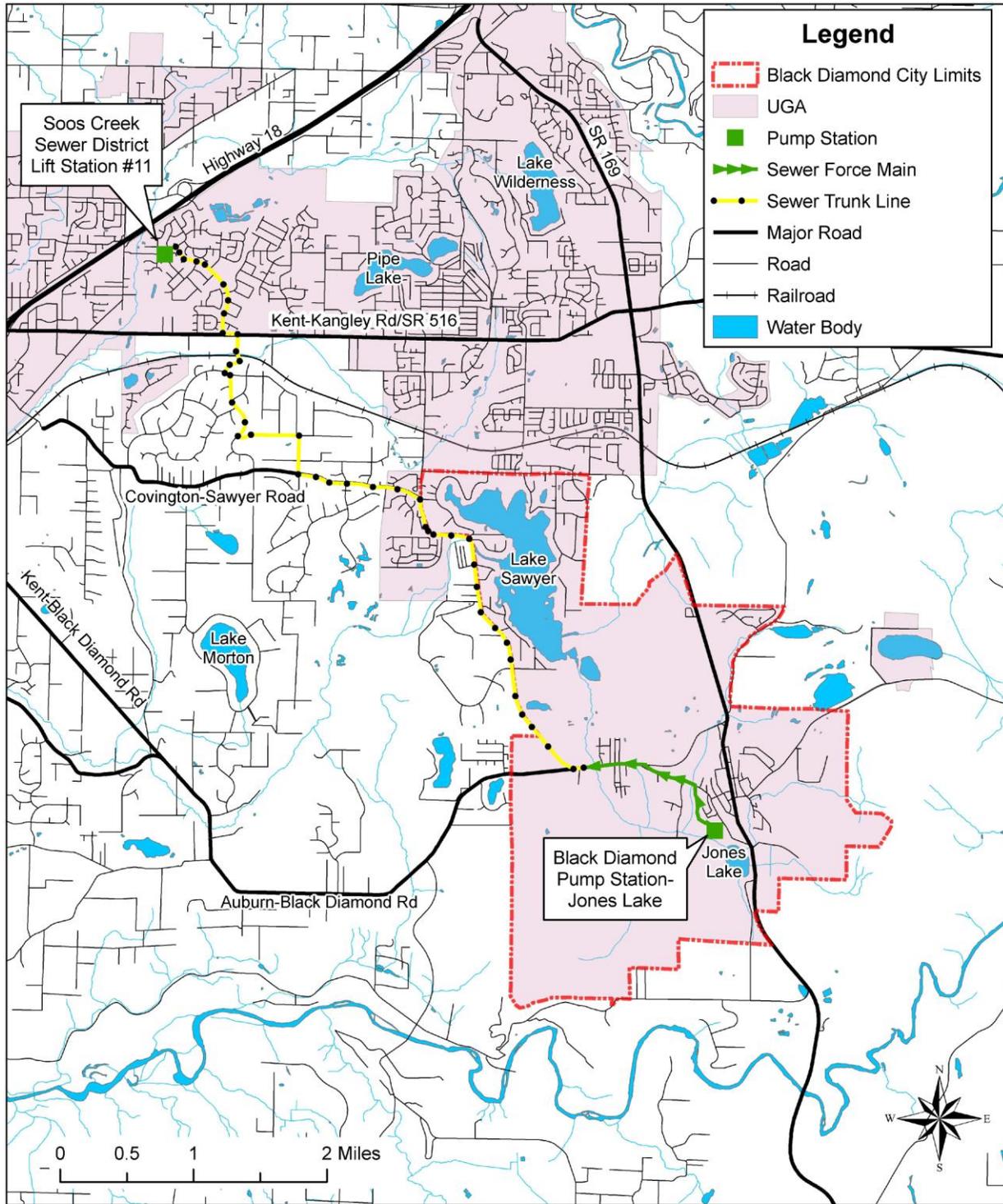
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3.0 EXISTING FACILITIES

3.1 SEWER SYSTEM OWNERSHIP

The City of Black Diamond owns all of the public sewer gravity lines, force mains, manholes, pump stations, and other system facility that are located within its service area. Additionally, the City maintains ownership of the transmission line leading from the Black Diamond to the Covington pump station located within the Soos Creek Water & Sewer District sewer service area (**See Figure 3.1 City-Owned Facilities**).

3.0 EXISTING FACILITIES



**City-Owned
King County Operated
and Maintained Facilities**
Figure 3.1 City-Owned Facilities

3.0 EXISTING FACILITIES

3.2 SEWER SYSTEM OPERATION & MAINTENANCE

King County WTD has the responsibility, by contract (see **Appendix B – King County Metro Agreement for Disposal**), to operate, maintain and repair the Black Diamond Pump Station at Jones Lake and sewer force main and sewage trunk line that runs from the City to Soos Creek until July 2036 (See Figure 3.1 City-Owned Facilities). All other local public sewer facilities within the City’s service area are operated and maintained by the City of Black Diamond.

3.3 HISTORY OF SEWER SYSTEM⁴

The residents of Black Diamond used individual on-site septic systems from the 1860’s when Black Diamond was settled until the mid 1980’s. In the 1960’s the City initiated plans for the first public sewer system after public health concerns arose from approximately 500 failing septic systems. Several studies were completed between 1970 and 1981 and in 1981 the city accepted a sewerage plan which included a city-wide collection system and an aerated lagoon treatment plant. Construction of the collection system and treatment plan was mainly accomplished between 1981 and 1983 with an EPA Innovative and Alternative grant.

After a substantial commitment had been made to the treatment plant project and the original plant design, the City was informed that the permits necessary to construct the marsh portion of the treatment could not be obtained. The facility was redesigned and included a natural marsh, which was classified as “innovative” technology by the Environmental Protection Agency (EPA) and was funded through an EPA grant. In 1984 it was determined that the natural marsh was not operating efficiently and was causing intense algae blooms downstream in Lake Sawyer. The EPA hired consultants to evaluate the situation and it was concluded that the natural marsh system had failed to remove phosphorous as designed. DOE then ordered that the treatment plant be upgraded or the outfall to Rock Creek (which drains to Lake Sawyer) be abandoned. The situation was again evaluated and it was recommended that the City abandon the improperly functioning treatment plant and construct a connection to the King County WTD system through Soos Creek Water and Sewer District, funded by a Modification or Replacement Grant from EPA and DOE. This connection was constructed in 1992 and the treatment plant was taken out of service later that same year.

3.4 INVENTORY OF EXISTING FACILITIES

PIPES

The City has approximately 24.5 miles of sewer pipes, including collection lines, trunk lines, and force mains. There are approximately 2.5 miles of force main throughout the system. A majority of the system is 8-inch diameter gravity main, totaling over 13 miles.

Table 3.1 Gravity Sewer Pipes summarizes gravity pipes by diameter. **Table 3.2 Sewer Force Mains** summarizes force mains by diameter.

⁴ “City of Black Diamond, Comprehensive Sewer System Plan” 2002

3.0 EXISTING FACILITIES

Table 3.1 Gravity Sewer Pipes

SIZE	LINEAL FEET (APPROX.)
6"	1,900
8"	68,700
10"	5,700
12"	11,100
15"	26,800
18"	2,300
TOTAL	116,500

Table 3.2 Sewer Force Mains

SIZE	LINEAL FEET (APPROX.)
2.5"	4,300
4"	1,200
6"	3,300
10"	3,800
12"	700
TOTAL	13,300

Figure 3.2a System Map (1 of 2), Figure 3.2b System Map (2 of 2) are overall system maps showing the general layout and configuration of the sewer system.

Appendix G – System Maps contains a large-scale version of the maps.

MANHOLES

There are 485 manholes throughout the City's sewer system. The majority of these manholes were constructed in the early 1980's.

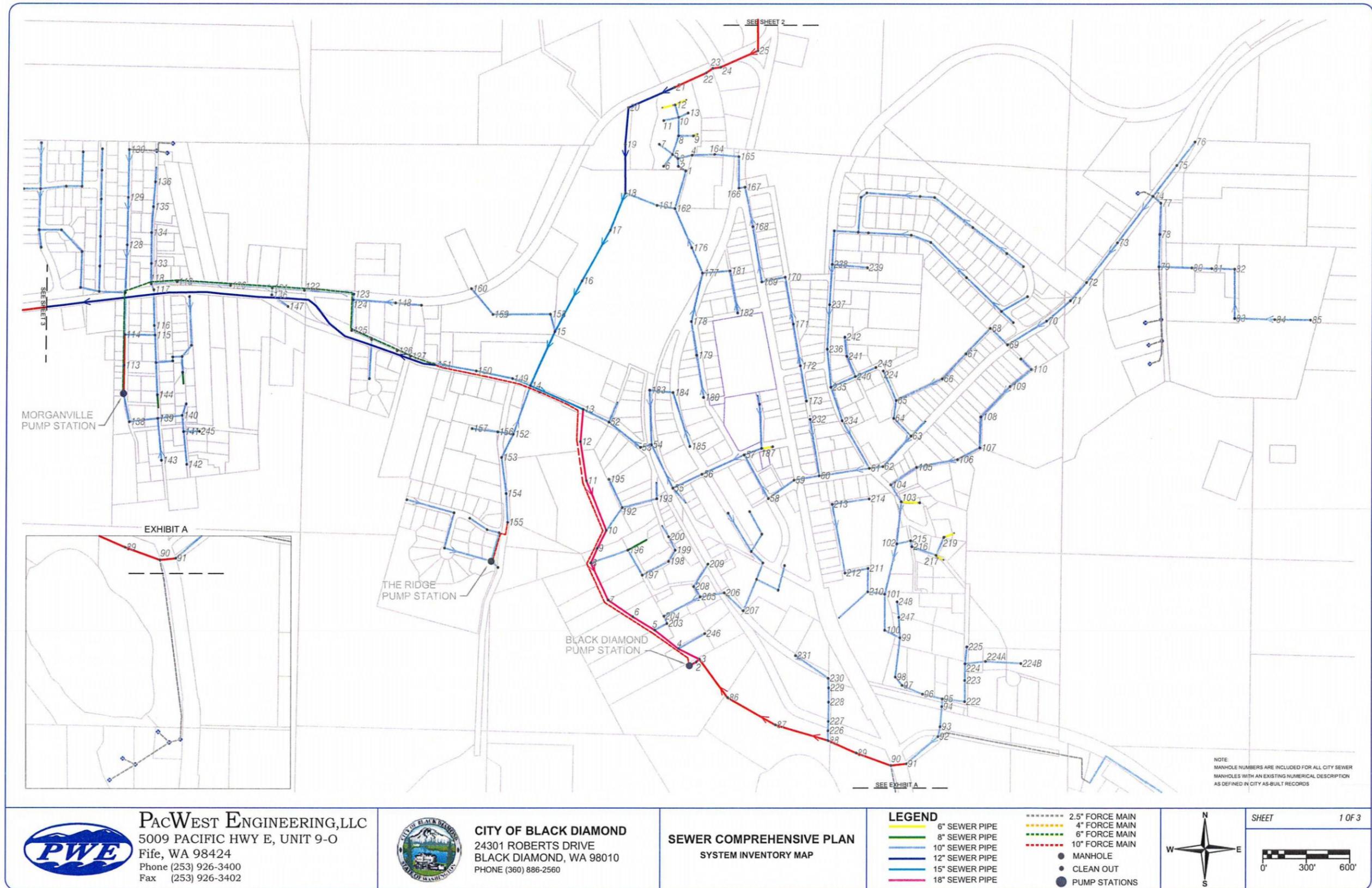
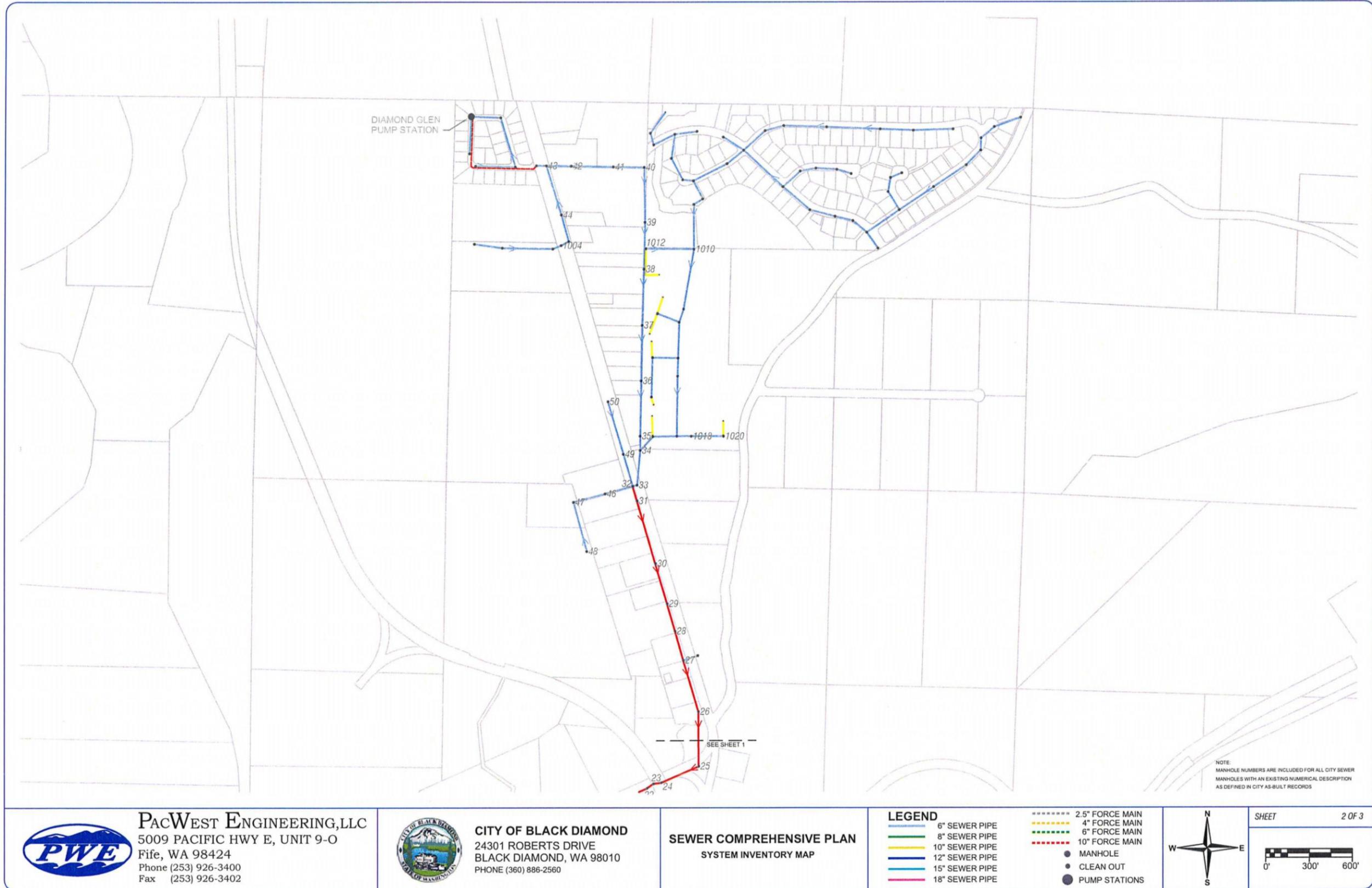


Figure 3.2a System Map (1 of 2)

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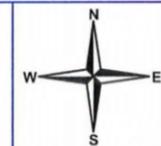


CITY OF BLACK DIAMOND
 24301 ROBERTS DRIVE
 BLACK DIAMOND, WA 98010
 PHONE (360) 886-2560

SEWER COMPREHENSIVE PLAN
 SYSTEM INVENTORY MAP

LEGEND

- 6" SEWER PIPE
- 8" SEWER PIPE
- 10" SEWER PIPE
- 12" SEWER PIPE
- 15" SEWER PIPE
- 18" SEWER PIPE
- - - - - 2.5" FORCE MAIN
- - - - - 4" FORCE MAIN
- - - - - 6" FORCE MAIN
- - - - - 10" FORCE MAIN
- MANHOLE
- CLEAN OUT
- PUMP STATIONS



SHEET 2 OF 3

Figure 3.2b System Map (2 of 2)

3.0 EXISTING FACILITIES

PUMP STATIONS

There are four public pump stations within the City of Black Diamond that serve properties that are too low in elevation to be served by typical gravity sewer. The location of these pump stations are shown on **Figure 3.2a System Map**. Details regarding the age and capacity of the pump stations are included in **Table 3.3 Pump Stations**.

Table 3.3 Pump Stations

PUMP STATION	YEAR BUILT	PUMPS	APPROX. CAPACITY
RIDGE P.S.	1993	Two 1.5 HP pumps	105 GPM
DIAMOND GLEN P.S.	1981	Two 1.5 HP pumps	94 GPM
MORGANVILLE P.S.	1980 (new pumps and electrical in mid-1990's)	Two 20 HP pumps	313 GPM
JONES LAKE P. S. aka BLACK DIAMOND P.S.	1992	Two 50 HP pumps	1,180 GPM
OLD LAWSON STEP SYSTEM	Unknown	One ½ HP pump	20 GPM

INDIVIDUAL PRESSURE SEWERS⁵

There are currently approximately 13 individual septic tank effluent pumps that pump into a small diameter pressure sewer force mains before discharging into the City's gravity sanitary sewer system. These pressure sewers use septic tank effluent pumps to discharge into the gravity sewer collections system while solids are allowed to settle in a septic tank. These arrangements are used to serve individual collections which are otherwise too low in elevation or remote to be connected to the City's gravity collection system. The City is responsible for maintaining these pumps and septic tanks, and the septic tanks are pumped approximately every four years.

TREATMENT & DISPOSAL

As previously mentioned, the City of Black Diamond abandoned their wastewater treatment plant in 1992. Since that time, Black Diamond sewage has been conveyed from the Black Diamond Pump Station at Jones Lake, through an approximately 7 mile city owned trunk line to the Covington Pump Station within the Soos Creek Water and Sewer District. The Black Diamond sewage then flows through Soos Creek Water and Sewer District facilities to King County Facilities in Kent where the sewage is pumped to King County Waste Water Division's Renton Wastewater Treatment Plant for final treatment and disposal.

⁵ "City of Black Diamond, Comprehensive Sewer System Plan" 2002

3.5 ODOR AND CORROSION

The City's sewer collection system has not had a major odor problem. The pump stations will tend to turn slightly anaerobic in the late summer and generate a small amount of hydrogen sulfide gas. The City has not received any complaints, but occasionally odors have been noticed on the sidewalk near the intersection of Abrams and Morgan Street in the late summer, but only when the Abrams pump station happens to be running. The City is not planning any odor control project at this time.

Most of the City's grinder pumps discharge into manhole 90 and manhole 92. These manholes show slight signs of a corrosive environment. There is no need for mitigating actions on these two manholes in the next six years. The manholes that accept discharges from pump stations are also in reasonably good condition. The City is not planning any manhole rehabilitation due to corrosion or any corrosion control actions.

4.0 POPULATION & GROWTH

4.1 CURRENT POPULATION

The 2011 population within the City of Black Diamond is 4,180 per the Washington State Office of Financial Management (OFM). Approximately 1,500 people of this total amount are located in the Lake Sawyer area and are not included in the City of Black Diamond's sewer service area.

4.2 CITY DEVELOPMENT AND GROWTH

The City of Black Diamond was established in the late 1800's as a coal mining town and developed into various clusters of urban level development separated by lower density or opens space. The city encompasses approximately 4,500 acres or 7.1 square miles which includes the Lake Sawyer area. This portion of the City was annexed in 1998 and has a population of approximately 1,500. The Lake Sawyer area is currently served by the Soos Creek Water & Sewer District and is not included in the Black Diamond Sewer Service Area.

LAKE 12 AREA The city in recent years has annexed all of its urban growth area except for the area around Lake 12 (**See Figure 2.1 Black Diamond Sewer Service Area**). The area around Lake 12 was developed as vacation homes on wells and septic systems. Most of the homes now are lived in year around. King County would like to see this area served by sewer because of water quality problems in the Lake and the risk to contamination of the local wells. Currently there are approximately 40 to 50 homes around the lake. The city has not been interested in annexing this area because of the poor road conditions, lack of water system infrastructure, disconnected location from the City and the lack of sewers.

LAWSON HILLS MPD In June of 2009 the City ended a moratorium that had been in place for many years prohibiting development of Master Planned Developments and large subdivisions. When the moratorium was lifted, Yarrow Bay Development Inc. submitted two large Master Planned Developments. "Lawson Hills at Black Diamond" is a master planned community which includes approximately 1,200 new residential units, as well as retail development. "Lawson Hills at Black Diamond" is located on over 325 acres, east of Highway 169 and south of Lawson Street. See Appendix F and K

VILLAGES MPD The second large scale development that was submitted to the City in the summer of 2009 is "The Villages at Black Diamond". This master planned community includes 4,800 new residential units at build out, as well as retail, office, and other amenities. "The Villages at Black Diamond" is located on 950 acres, west and south of Rock Creek and the Rock Creek core wetland complex. Both Master Planned Developments also have a separate commercial portion of development on the north edge of the city west of State Route 169. See **Appendix F Proposed MPD Land Use from Development Agreements** and **Appendix K MPD Site Plans from Development Agreements**.

4.0 POPULATION & GROWTH

After the public hearings and environmental review process, the city council unanimously approved both Master Planned Developments in August 2010. The Development Agreements for both Master Planned Developments were approved by the city council in December 2011. Although there are pending legal actions, financing challenges and uncertain economic markets; this General Sewer Plan assumes that the projects are expected to move forward with initial development starting with infrastructure construction in 2012 and home permitting and construction in approximately 2013. (*Note: As time has passed since the General Sewer Plan effort was started the development has not progressed as projected. The infrastructure construction is now (Dec 2012) expected to be constructed in 2013 and the first homes constructed in 2014.*)

As the City may face rapid growth, this plan will address efficient collection of sewage within Black Diamond as well as possible interim solutions to conveying sewage to King County Regional Facilities.

4.3 PROJECTED POPULATION GROWTH

The number of sewer equivalent residential units expected to be added to the sewer system was projected for the twenty-year planning horizon. The new yearly ERU connections were developed based on the best estimates received by the Master Developer of the Villages MPD and Lawson Hills MPD plus a very small amount of infill connections from other areas of the city for the 20 year planning period. This General Sewer Plan anticipates that the Master Planned Developments will reach build-out within the 20 year time frame of this plan. This growth rate is consistent with the Comprehensive Plan. The City of Black Diamond growth has been nearly stagnant for 5 years and prior to that growth has been severely limited by infrastructure issues and limited land available for development. In two years, the sewer system is expected to experience substantial growth depending on the housing market and economic conditions.

Assumptions included in this General Sewer Plan for these large-scale developments are based on conversations with the proposed development company and are subject to change based on the actual rate development occurs. As previously mentioned, the Lawson Hills Development consists of 1,200 residential units at build-out plus commercial development. The Villages at Black Diamond development consists of 4,800 residential units at build-out plus commercial development.

As a result of the substantial population growth projected for the City of Black Diamond, the anticipated growth rates associated with the proposed development were utilized in the preparation of this General Sewer Plan, rather than the growth targets included in the King County Annual Growth Report. These population projections are included in **Table 4.1 Projected Populations & ERU's**. ERU's Population projections utilized in the sewer system analysis does not include the population of approximately 1,500 persons within the Lake Sawyer Area as this area is currently being served by the Soos Creek Water & Sewer District.

The sewage service demand of each customer class can be expressed in terms of equivalent residential units (ERU's) for planning purposes. One ERU is equal to the sewage generated from an average single family residence.

4.4 PROJECTED COMMERCIAL, INDUSTRIAL, INSTITUTIONAL GROWTH

In the next 20 years, this plan projects development of 250 acres of commercial, industrial and institutional growth. Of this growth, 145 acres will be in the Master Planned Developments, and the remaining commercial/industrial growth is expected on approximately 68 acres of PCC property and 37 acres of commercial property along SR 169 that could drain to the Rock Creek basin. A factor of 2,500 gallons per acre per day (gpad) and 187 gpd/ERU (See Section 5.3) was used to determine the ERU's of sewage service demand. The commercial growth shown in the **Table 4.1 Projected Populations & ERU's** was assumed to be on a steady basis at about 256 ERU's per year after the residential population begins to build up. The commercial growth also shows an initial surge with the MPD's then a surge on non MPD property and then a late surge from the MPD's.

Table 4.1 Projected Populations & ERU's

CURRENT		TOTAL ERU	RESIDENTIAL	OTHER	POPULATION	
		1,130	932	198	2,516	
Year	MPD Residential	Infill Residential	MPD Commercial, Industrial, Institutional	Infill Commercial, Industrial, Institutional	Cumulative ERU's	Population on City Sewer
2012	0	3			1,133	2,525
2013	256	3			1,392	3,224
2014	256	10			1,658	3,942
2015	256	10			1,924	4,660
2016	447	10			2,381	5,894
2017	221	10	256		2,868	6,518
2018	225	10	256		3,359	7,152
2019	224	10	217	40	3,850	7,784
2020	224	10	137	120	4,341	8,416
2021	224	10	137	120	4,832	9,048
2022	461	10	137	120	5,560	10,319
2023	458	10	57	200	6,285	11,583
2024	458	10	110	147	7,010	12,847
2025	458	10	110	147	7,735	14,110
2026	458	10	110	147	8,460	15,374
2027	458	10	110	147	9,185	16,637
2028	458	10	157	100	9,910	17,901
2029	458	10	210	47	10,635	19,165
2030		25	5		10,660	19,219
2031		25	5		10,685	19,273
TOTAL	6,000	216	2,014	1,335		

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5.0 EXISTING WASTEWATER FLOWS

5.1 CUSTOMER TYPES

Most all of the sewage flows on the Black Diamond sewer system come from residential customers. Of the 1,130 Equivalent Residential Units connected 932 connections are residences. The remaining 198 ERU's of sewer service connections are commercial, schools and public buildings.

The one industry within the City limits is the Palmer Coking Coal (PCC) gravel pit. Although they do wash gravel they do not discharge the wash water into the sanitary sewer. The PCC industrial business has a NPDES industrial discharge permit with DOE. All of the industrial zoned property within the City is owned by PCC. PCC is expecting to have the remaining gravel mined out of the industrial zoned property in the next 15 to 20 years. PCC has about 115 acres of commercial and industrial vacant property that currently outside the active mining area. Once the Pipeline road and other infrastructure is installed through the middle of this area some level of commercial/industrial development is expected. It is not certain what types of industry or commercial might locate on this property, but the City might encourage a water-intensive business as the City has excess water supply. A factor of 2500 gpad was used to project the flows from the commercial and industrial land expected to develop within the 20 year time frame.

5.2 HISTORIC SEWER FLOWS

This plan uses the sewer flow records from the Black Diamond Pump Station at Jones Lake as that is the point where the responsibility shifts from the City to King County. These flows are graphically displayed in **Figure 5.1 Daily Average Flows (MGD)** below.

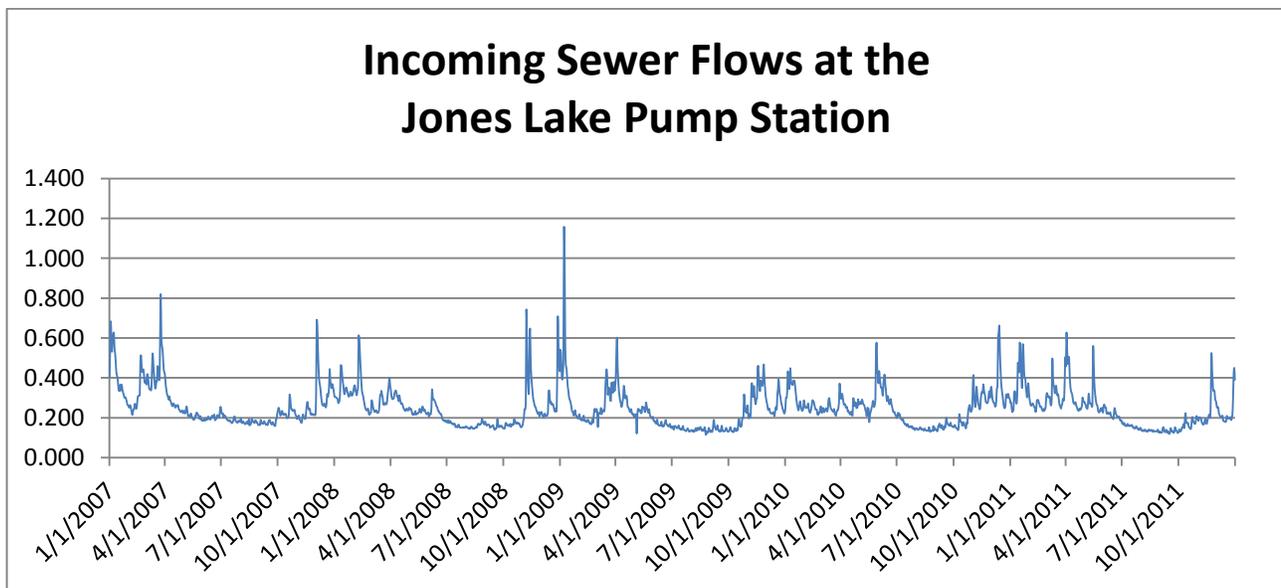


Figure 5.1 Daily Average Flows (MGD)

5.0 EXISTING WASTEWATER FLOWS

Table 5.1 Historic Flows summarizes historical sewer flows for the Black Diamond Sewer system, measured at the Black Diamond Pump Station at Jones Lake. Data summarized in this **Table 5.1 Historic Flows** is from the year 2007 through 2011.

Table 5.1 Historic Flows⁶

FLOW TYPE	FLOW IN GPD	GPD / ERU
Average Dry Weather Flow	163,540	
Average Wet Weather Flow	286,520	
Base Flow	211,310	187
Average Annual Flow	244,990	217
Average Day of the Max Month Flow	437,097	
Maximum Daily Flow	1,139,330	
Peak Hour Flow	1,580,000	
EPA peak flow threshold	839,000	

Discussion of Table 5.1 Flow Parameters

Average Dry Weather Flow Dry weather flows were calculated as an average for the typical dry weather period of July 1st – October 31st from 2007 through 2011. It might be noted that the dry weather flow is less than the base flow figure of 187 gallons per ERU per day. This may explained by:

- The main reason for the dramatically lower flows in the summer is due to the lower water tables and periods of no rain which greatly reduces inflow and infiltration
- Not all water used within the home turns into wastewater. 10 to 15% is lost through evaporation in house plant watering, showering, cleaning, dishwashing, and clothes washing, cooking and consumption.
- The use of household water and sewer during the summer months may be lower due to fewer showers and clothes washing when school is out.
- The school is closed in the summer.
- There are typically many people on vacation and out of town in the summer.

⁶ Flow data utilized for Figure 5.1, Table 5.1 and 5.2 comes from 2008 -2011 flows as recorded by King County at the Black Diamond Pump Station at Jones Lake. 2007 flow data is from the from King County flow monitoring station in Covington just prior to discharge to the Soos Creek pump station and the data has been adjusted to reflect the I & I between Black Diamond and Covington.

5.0 EXISTING WASTEWATER FLOWS

- There may be lower water use due to residents enjoying outdoor eating and using more disposable plates therefore using less kitchen water.
- Black Diamond has had higher vacancy rates and empty homes in recent years showing lower usage than the number of connections might predict.
- Some businesses have closed and the restaurants used to have a much more robust business in the summer months.

It is expected that the Average Dry Weather Flow will be closer to the Base Flow as the economy improves.

Base Flow Using the 187 gpd / ERU and the City's current number of sewer connections the theoretical amount of sewage generated each day would be 187 gpd/ERU x 1130 ERU = 211,310 gpd. This is a slightly conservative figure.

Average Wet Weather Flow Wet weather flows were calculated as an average for the typical wet weather period of November 1st – June 30th from 2007 through 2011. The Average Wet Weather Flow is about 35% greater than the base flow.

Average Annual Flow The Average Annual Flow of 245,000 gpd was calculated from the flow data from 2007 – 2011. The Average Annual Flow figure is sometimes used in financial analysis for sewer utilities.

Average Day of the Maximum Month The Average Flow for the Maximum Month is typically used for treatment plant analysis and design.

Maximum Daily Flow The largest City sewer trunk line carrying 90 to 95 % of the City sewer flows has a capacity of 2,800,000 gpd or about 2.5 times the capacity of the Maximum Daily Flow recorded on Jan 7, 2009. This peak day flow occurred after back to back 2 year storms which would be a probability of about a 25 year storm event

EPA Peak Flow Threshold

The United States Environmental Protection Agency released Ecology Publication 97-03, *Inflow/Infiltration: I & I Analysis and Project Certification*, in May 1985. This document establishes the rate of 275 gallons per capita per day (gpcd) as the threshold between systems with excessive and non excessive I & I. This volume per capita identified by EPA is about 4 times what a typical residential flow would be with no I&I or what is commonly known as "base flow". Applying this factor to all sewer connections commercial or residential on an Equivalent Residential Unit basis and 2.7 persons per household yields the EPA threshold figure. (1130 x 2.7 x 275) = 839,000 gpd)

5.0 EXISTING WASTEWATER FLOWS

Table 5.2 Top Ten Highest Sewer Flows^{7, 8}

RANK	FLOW (GPD)	DATE
1	1,139,330	1/7/09
2	990,825	1/8/09
EPA threshold	839,000	----
3	819,811	3/25/07
4	743,396	11/7/08
5	708,827	12/28/08
6	691,509	12/3/07
7	683,962	1/3/07
8	659,434	12/4/07
9	658,459	12/14/10
10	647,170	11/13/08

Table 5.2 Top Ten Highest Sewer Flows lists the ten highest flows for the period between January 2007 and August 2011. Earlier past records show that several major storm events have resulted in peak flows higher than the January 7, 2009 1.1 mgd peak day event. This plan did not evaluate the circumstances or recurrence level of the earlier events. Several illegal storm water connections have been located and disconnected in recent years and improvements to storm water systems may also explain the improvement in peak day events. The review of the peak day events does show that the existing City sewer collection system still has an I & I problem that will require continued diligence to keep under control. The Maximum Daily Flow event was preceded by 3 days of significant rain storms, and then a storm of 2.8 inches of rain hit on the January 7. Evaluation of this storm event shows recurrence probability of the entire storm event is approximately a 25 year event. This type of storm tends to produce higher levels of I & I because the period of rain leading up to the storm raises the water tables so when the larger event hits at the end more water turns to runoff and raises the water tables even higher increasing infiltration and inflow greatly.

5.3 EQUIVALENT RESIDENTIAL UNIT (ERU)

To determine the amount of average sewage flow generated from a typical residence in Black Diamond, the number of single family residences divided by the water use records for all of the single family residences over the 2011 year divided by 365 days. This resulted in an ERU figure of 187 gallons per day per residence. While this figure does include some irrigation, it has been noted that irrigation has been much lower in recent wet

⁷ Flows as recorded by King County at the Jones Lake Pump Station.

⁸ Flow data from the Jones Lake Pump Station not available for November 7, 2008. Amount calculated using a factor of 1.06 less than flow recorded by King County at Soos Creek's Lift Station #11. The 1.06 factor was determined from existing data by calculating an average difference between wet weather flows recorded at the Soos Creek station and the Jones Lake station.

5.0 EXISTING WASTEWATER FLOWS

summers and since the implementation of tiered water rates. As the economy improves water and sewer use is expected to increase as well. The most recent year of data was used to reflect the most current water and sewer use trends. It is apparent that in recent years the tiered water rates, improved plumbing fixtures and the economy has reduced household water consumption. It is expected that the City will reduce the ERU figure for the water system with the next update of the water comprehensive plan. The sewer ERU calculations for Black Diamond matches up with King County's RCE figure (Residential Customer Equivalent). A RCE is the same as an ERU, just King County's label for the same thing.

5.4 DISTRIBUTION OF DAILY FLOWS

Figure 5.2 Diurnal Curve represents the expected peaks during the day on an average wet weather day.

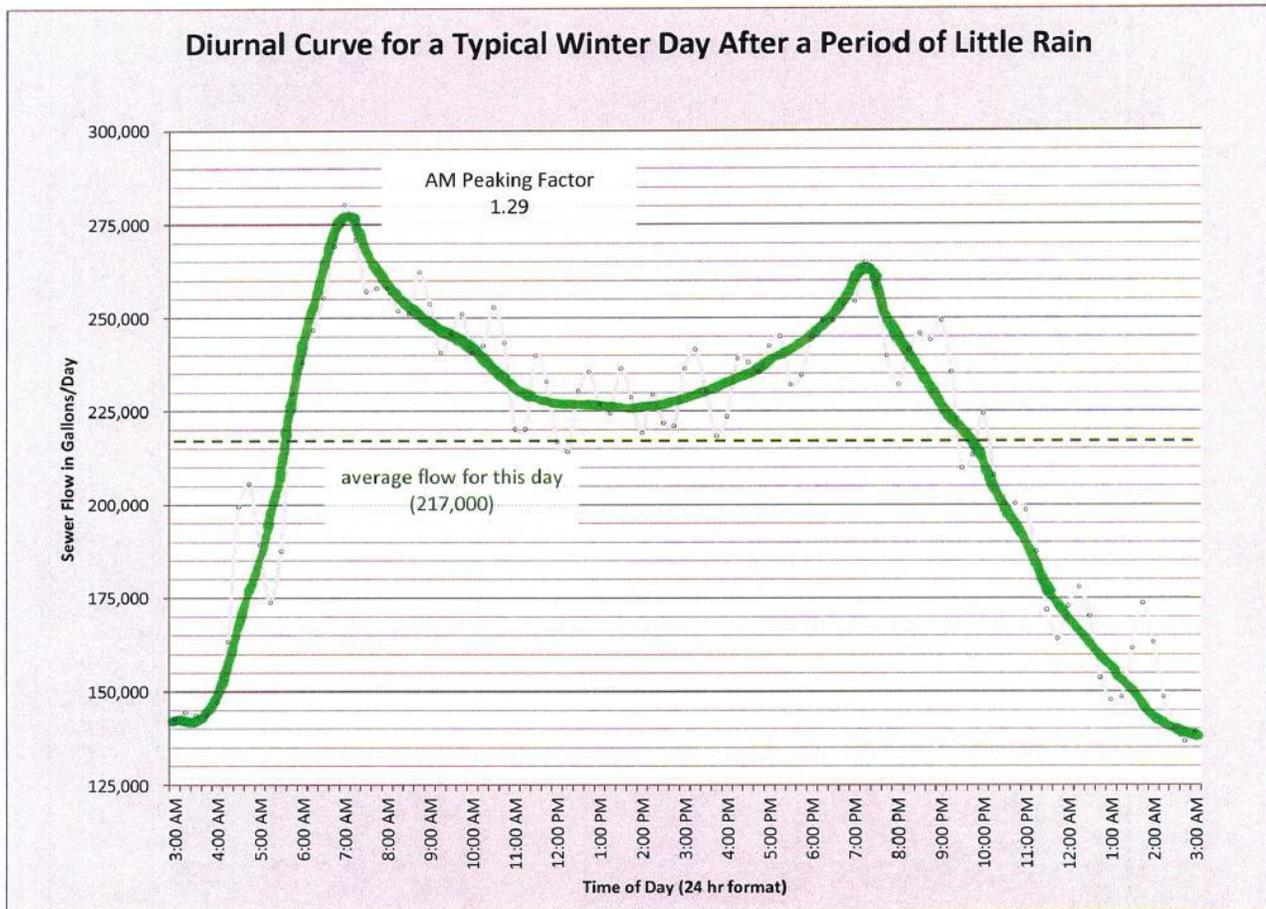


Figure 5.2 Diurnal Curve

5.5 INFILTRATION / INFLOW

Infiltration & Inflow (I & I) is the volume of wastewater that enters the sanitary sewer system from the ground through pipe joints and cracks or from other points of entry such as manholes, cross connections, and storm or yard drains. The amount of I & I can be significant at times in some wastewater systems, particularly during months when

5.0 EXISTING WASTEWATER FLOWS

precipitation is the highest. The addition of Infiltration and Inflow can produce heavy peak flows in the sewer system during large rain events. The resultant flows must be received, handled without pump station or local collection overflow, and then treated and conveyed through the treatment plant without affecting the treatment process. I & I into the collection system increases the cost needs for the sewer system as a whole.

The top 10 peak flow events shows that in recent years the City has exceeded the EPA peak flow threshold during one storm event. (See **Table 5.2 Top Ten Highest Sewer Flows**) A comparison to statistical storm events of the major early January 2009 storm shows a recurrence probability of about 25 years. The data tends to show that the largest peaks are associated with time frames when the water tables are high and then a series of wet days accompanied by a large storm. These peak flows are therefore most probably associated with primarily inflow (stormwater discharges from direct connections) boosted by high water tables and some additional infiltration that is only introduced when low areas begin to flood. While the City needs to diligently work to control I & I in the Jones Lake basin, this peak will be less significant to the peak flows for the City as a whole as the City controls the degradation of the existing sewer and constructs high quality tight sewer collection systems as it grows.

Past Inflow and Infiltration Reduction Efforts and Recommendations

Over the past 10 years the City has had limited staff and budget to deal with inflow and infiltration. More recently the City has set aside funding to deal with I / I and has started on initial investigation efforts. The City should prioritize an Infiltration and Inflow program with the following goals in mind:

- Avoid capacity replacement of existing sewer mains
- Preserve the structural integrity of the existing sewer system
- Compare I / I costs to the costs of diverting sewer flows to where capacity is available
- Share the cost of this system maintenance with new connections to the existing system

The City shall establish an annual Infiltration and Inflow program that may include some or all of the following:

1. System Investigation Including Manhole inspections, sewer videos, smoke testing, and flow monitoring
2. Manhole repairs determined from investigation
3. Require homeowners to repair or replace their side sewers that are contributing to Infiltration.
4. Require illegal storm water connections to the sanitary sewer system to be disconnected
5. Regularly evaluate and consider new construction standards that will minimize Inflow and Infiltration.
6. Monitor manholes in areas with flooding potential and seal all manholes that have the potential of being flooded.
7. Seek to improve area drainage with extending the storm water systems to keep water tables in urban areas under control.

5.0 EXISTING WASTEWATER FLOWS

In 2012, I & I activities have identified 10 manholes to rehabilitate in 2013. In 2013, the City expects to TV several sections of sewer in search of inflow connections and pipe problems for action the following year. The investigation effort of one year will lead to the rehabilitation projects of the next year. The City expects to keep the existing sewer collection system from further degradation and expects to hold I & I from the Jones Lake Basin at approximately current levels.

5.0 EXISTING WASTEWATER FLOWS

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6.0 EXISTING SYSTEM EVALUATION

6.1 SYSTEM CAPACITY EVALUATION

A hydraulic model of the Black Diamond municipal sewer system was developed in conjunction with this update to the City's General Sewer Plan. The model was initially developed by Pacific West Engineering using GIS-based manhole and invert information, existing as-built data and field investigations. System flows were assigned and modeled using the diurnal curve shown in **Figure 6.2 Projected Diurnal Factor for Master Planned Development** and the model criteria shown in **Table 6.1 Model Assumptions**. Flows were distributed based on ERU and unit counts from billing records and field investigations and converted into Service Areas which are areas of similar or synergistic flows (**Figure 6.1 Existing Sewer Trunk Line Capacity and Sub-basins**). Since the initial construction the City has assumed ownership of the model and has converted from HYDRA (the original math engine) to SewerCAD. The City will maintain and use the model to test the impacts of various development scenarios and growth assumptions. In addition, the model will be used to plan and manage the Capital Facility Plan and to evaluate the effectiveness of the I & I reduction program.

Figure 6.1 Existing Sewer Trunk Line Capacity and Sub-basins shows the main sewer trunk lines of the City's existing sewer collection system and the sub-basins they serve. The limiting section of each trunk line was identified and labeled. All of the trunk lines of the existing sewer collection system have more than enough capacity to serve the infill within the Jones Lake Basin. **Figure 6.1 Existing Sewer Trunk Line Capacity and Sub-basins**

6.0 EXISTING SYSTEM EVALUATION

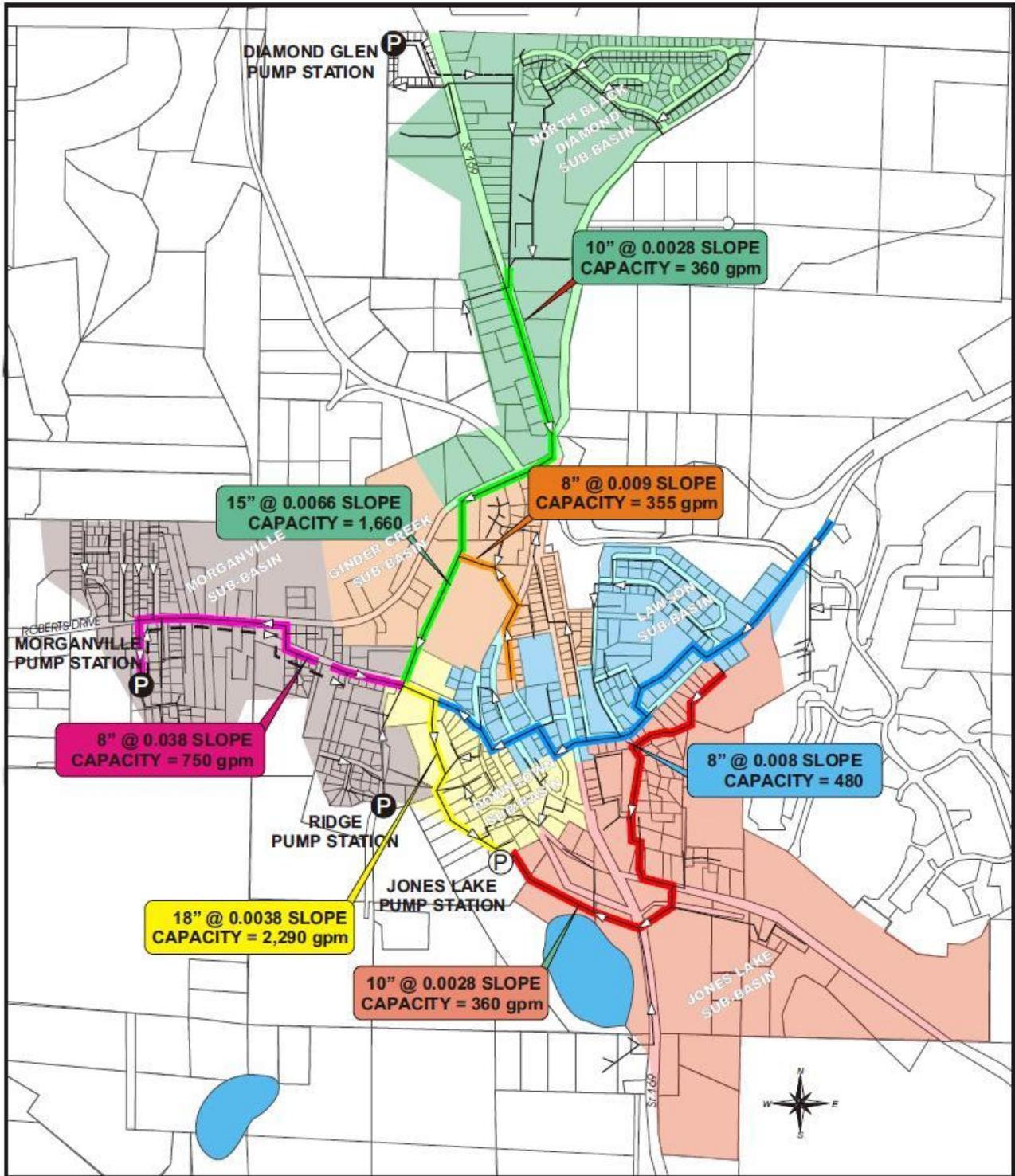


Figure 6.1 Existing Sewer Trunk Line Capacity and Sub-basins

6.0 EXISTING SYSTEM EVALUATION

6.2 MODEL ASSUMPTIONS

The following assumptions were utilized in the development of the sewer model:

Table 6.1 Model Assumptions

SYSTEM ELEMENT	ASSUMPTION
Gravity Pipes	<ul style="list-style-type: none">• Manning's n = 0.013 (PVC) ; 0.013 (RCP); 0.013 (DI)<ul style="list-style-type: none">• Minimum Velocity = 2.0 fps• d/D = 0.8• Pipe diameters and inverts were taken from as-built records
Manholes	<ul style="list-style-type: none">• Manhole rim elevations were collected by GPS or approximated using available as-built records or digitized contour elevations.• Pipe inverts were taken from as-built records
Force mains	<ul style="list-style-type: none">• Hazen & Williams Coefficient "C" = 100

6.3 SIMULATION OF FLOWS

In analyzing sewer systems, it is important to consider peaks and lows throughout the day. A diurnal curve represents hourly flows for the system as a whole.

Figure 6.2 Projected Diurnal Factor for Master Planned Development shows a diurnal curve similar to that used in the sewer model to represent Black Diamond's daily flows. This diurnal curve is representative of urban bedroom communities with very little commercial development. The City should re-evaluate the flow characteristics in the City after a substantial amount of commercial development has been added to the City.

6.0 EXISTING SYSTEM EVALUATION

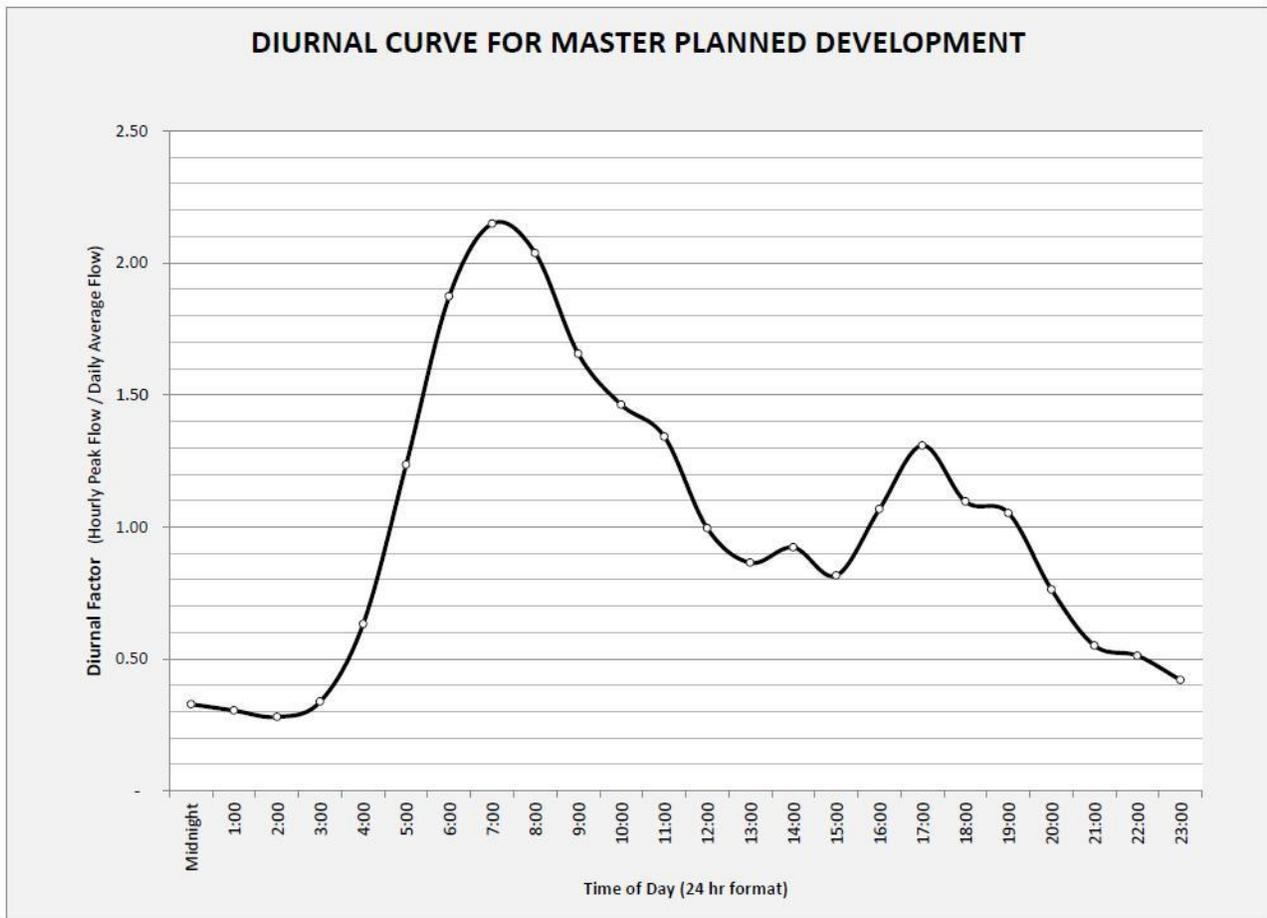


Figure 6.2 Projected Diurnal Factor for Master Planned Development⁹

Two types of flow are simulated in the sewer model – average day flow for both dry weather conditions and wet weather conditions. Inflow and Infiltration flows were distributed throughout the system in terms of gallons per mile of pipe per day. Sewage flows are intended to reflect existing sewer conditions.

Flows were distributed throughout the existing system based on actual demands from water billing records. Flows were refined and calibrated to match measured flow data at the Jones Lake Pump Station.

6.4 EXISTING SYSTEM MODEL RESULTS

Collection system constraints.

1. **Gravity sewer mains.** The sewer system capacity analysis demonstrates that the existing system has sufficient capacity to handle current flow conditions. Additionally the main trunk lines of the existing sewer collection system also

⁹ A composite from municipal sanitary sewer systems with similar land use types, sizes and customers – from RH2 Engineering.

6.0 EXISTING SYSTEM EVALUATION

have more than enough excess capacity to handle all of the infill within the area of the existing system as defined by the Jones Lake Basin in **Figure 7.1**

Sewer Collection Basin Planning Areas to buildout.

2. MPD Growth The existing 18 inch sewer trunk line north of the Jones Lake Pump Station does not have enough capacity to handle all of the growth from the MPD's. The 10 inch sewer trunk line running east of the Jones Lake Pump station also does not have enough capacity for all of the flows from the future Lawson Hills MPD. Rather than reconstruct these sewer lines or construct new lines along and across wetlands to Jones Lake, this General Sewer Plan collects most all of the new growth flows to a new connection point with King County Regional Facilities in western Black Diamond.
3. Interim Connection Although the main sewer trunk lines leading to the Jones Lake Pump Station are not large enough to carry all of the flows from the MPD's, there is sufficient excess conveyance capacity in the existing sewer collection system to allow connection of sewer flows from the MPD's on an interim basis. Additional modeling and the time frames will need to be evaluated for interim connections to the existing sewer collection system as well as coordination with King County. Although interim connections to the existing sewer collection system will be considered, the construction of the sewer collections system according to the sewer collection conceptual plan required by this plan must be provided for by the developer at the developer's expense.
4. Areas beyond the existing sewer collection system The areas on the west and south side of Rock Creek do not have any collection system available. A collection system and pump station will need to be constructed. Additional sewer system modeling will be required to determine the sizing of the major collection trunk lines, pump stations and force mains with the engineering reports for the first phases of development.

The area around the PCC gravel pit does not have any collection system available. A collection system and pump station will need to be constructed. Additional sewer system modeling will be required to determine the sizing of the major collection trunk lines, pump stations and force mains with the engineering reports for the first phases of development.

The Lawson Hills area east of the old part of Black Diamond has sewer collection lines stubbed out to it but some of the lines do not have adequate capacity to handle the entire development. Additional modeling will be required to analyze interim connections and inverted siphon sizing and configuration.

5. Downstream Constraints Although there are future limitations to the existing King County waste water conveyance system downstream of Black Diamond's sewer collection system, the County has the capital planning in place and the contractual obligation to construct the facilities needed to provide capacity for the City of Black Diamond as the city grows. The City of Black Diamond has been periodically providing King County with updates of growth

6.0 EXISTING SYSTEM EVALUATION

projections as the Master Planned Developments continue to move through the permitting process so that King County can plan for capacity upgrades as needed for the City's growth needs and according to City's agreement with King County. King County evaluates their sewer system needs each year and updates their capital improvement plan accordingly. With the completion of the City's General Sewer Plan and the progress of the Villages Master Planned Development, needed improvements to the county regional system are expected to be added to the King County Capital Improvement Plan with the next update.

7.0 EVALUATION OF FUTURE CONDITIONS

7.1 FUTURE GROWTH

As previously discussed in this plan, there are two large-scale Master Planned Developments proposed within the City of Black Diamond's sewer service area. These developments are the 'Lawson Hills' MPD and 'The Villages' MPD. The City currently serves 1,130 equivalent residential units (ERU's) and this number is projected to grow to about 10,685 ERU's of sewer connections over the next twenty years. The primary driver of growth will be the Master Planned Development projects. There will be some infill growth in the old part of Town but the City is also expecting that some of the growth potential in the old part of Black Diamond will be purchased by the Master Planned Developer for the Transfer of Development Rights as needed for their projects.

7.2 BASIN PLANNING AREAS

Currently all of the sewage generated in Black Diamond is collected to one point and discharged to King County maintained regional facilities at the Jones Lake Pump Station. One of the main considerations for accommodation of the future growth into the City sewer collection system planning is the location where the growth is occurring. It is estimated that 66% of the MPD growth will be in west Black Diamond on the south and east side of Rock Creek and the Rock Creek core wetland complex. The topography of the City of Black Diamond lends itself to gravity collection of sewer to two new low collection points both in western Black Diamond. See also the topography discussion in Chapter 2. **See Figure 7.1 Sewer Collection Basin Planning Areas**

The **Rock Creek Basin** is 749.04 acres and is largely unsewered. Most of the basin is an active gravel mine and gravel processing operation. The mining of the remaining gravel is expected to take another 15 years. Eventually this gravel mine area is expected to develop but probably after the time frame of this plan. The Lawson Hills MPD and the Villages MPD have about 770,000 square feet of future commercial development areas designated in the northern part of this basin with a small amount of multi-family. This commercial area is expected to develop in the time frame of this plan. The MPD development at the north end of this basin is expected to generate about 2200 ERU's of sewage. Additionally, the City is planning for approximately 100 ERU's of commercial / industrial development in the eastern portion of this basin. **Appendix F Proposed Land Use from Development Agreements** shows the northern MPS parcels approved for development within this basin.

The pump station location in this basin shown in **Figure 7.3 Future Capacity Projects** was selected for the following reasons:

- The general pump station location has already been cleared during the mining of the surrounding area
- The entire sewerable area of this basin can gravity to the pump station location.

7.0 EVALUATION OF FUTURE CONDITIONS

- The pump station location is in a flat gravel outwash area which will provide opportunity to incorporate an overflow containment area that will not discharge into Rock Creek.

The City should consider interim connection of the initial MPD sewer flows to the Jones Lake Basin rather than adding the cost of operation and maintenance of the Rock Creek Pump Station prematurely. Interim connections of new sewer flows from the Rock Creek Basin to the Jones Lake basin sewer collection system will need to be evaluated further to determine if there is available conveyance capacity from the north portion of the Jones Lake basin to the Jones Lake Pump Station.

The **West Black Diamond basin** is undeveloped but is approved for approximately 4660 residential units plus 1100 ERU's of sewer for commercial development for a total of 5760 ERU's of sewer. The area of the West Black Diamond basin is 1,624.17 acres. A pump station will be required to pump to King County Facilities.

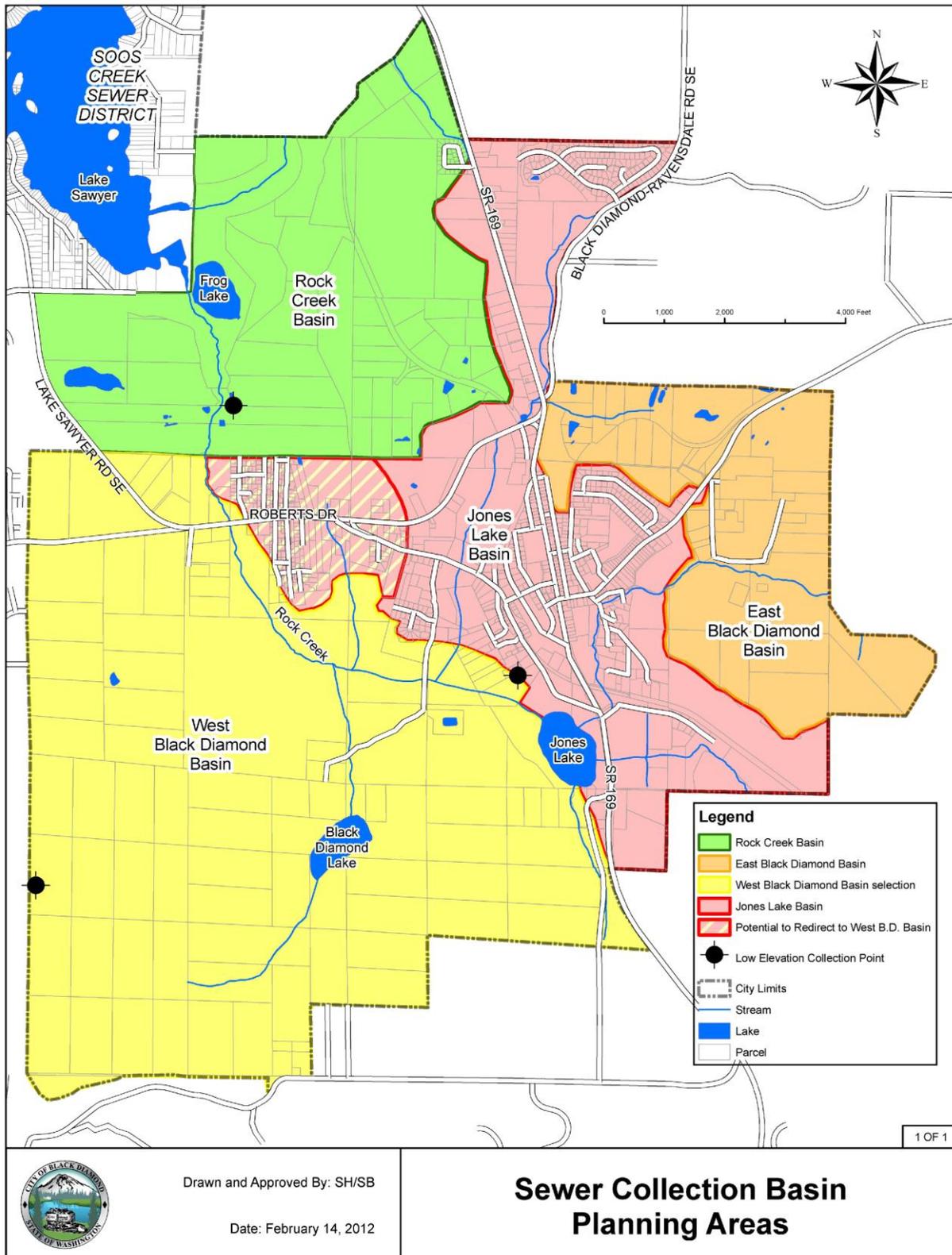
The pump station 1 location shown in **Figure 7.3 Future Capacity Projects** was chosen for the following reasons:

- The low point and the best point for central collection of the basin is on the western boundary of this basin
- 90% of the basin can drain by gravity to low point at the pump station 1 location.
- The location is in a gravel outwash area and will present minimal risk to surface water if there ever was an overflow at the pump station site. It is recommended that a surface overflow containment be constructed to prevent overland flow of sewage should an overflow ever occur.
- The proposed location is outside of all sensitive area buffers. Although the sensitive areas map shows a surface water flow path near the pump station 1 location, on site investigations of the area to the west show no evidence of surface water flows even during heavy rain events. The topographic creek channel is a historic creek channel and does not carry surface water (**see Figure 7.1 Sewer Collection Basin Planning Areas**).

•

The far eastern portion of the West Black Diamond Basin will not be developed for many years, (15 years + or -). As the Master Planned Develop is further along and in future updates of the General Sewer Plan the sewer service to the far eastern area of this basin should be reviewed comparing the impacts costs and benefits of directing the sewage to the Jones Lake Pump Station by gravity (Coordination with King County) or pumping the small area to the west to the gravity sewer trunk line 4.

7.0 EVALUATION OF FUTURE CONDITIONS



Drawn and Approved By: SH/SB

Date: February 14, 2012

Sewer Collection Basin Planning Areas

Figure 7.1 Sewer Collection Basin Planning Areas

7.0 EVALUATION OF FUTURE CONDITIONS

The **East Black Diamond** basin is largely undeveloped. Existing gravity sewer is available at the lower western boundary of this area. If this area is connected to the closest existing sewer, the flow would be directed to the Jones Lake Pump Station in the sewer trunk line that roughly follows Lawson Creek. However this trunk line does not have the capacity to accept all of the flows from the Lawson Hills MPD. The East Black Diamond Basin sewer flows could easily be routed to any basin in the City. So the decision of where to direct the flows from this basin should be related to the impact to the existing collection system and King County capacity considerations. The area of the East Black Diamond basin is 432.43 acres.

The area of the **Jones Lake Basin** is 897.14 acres. **Figure 7.2 Potential In-fill Development - Jones Lake Basin** shows that is a small percentage of remaining developable land remaining in the Jones Lake Basin. Additionally large areas of the Jones Lake Basin are sending areas for the Transfer of Development Rights to the Master Planned Development areas. This is expected to reduce the redevelopment to higher densities in the old part of Black Diamond. The Jones Lake Pump Station is partially within a wetland. This plan recommends directing all new development outside of the Jones Lake Basin direct to King County facilities. As stated in chapter 6 the existing sewer collection system has excess capacity. The City may consider interim connection of sewer flows from the Master Planned Developments to the Jones Lake Basin system as long as existing collection system capacity issues are mitigated.

The City may redirect the Morganville area (see cross hatched area in **Figure 7.3 Future Capacity Projects**) to the West Black Diamond Basin if the capacity is needed in the Jones Lake Pump Station or other part of the Jones Lake Collection system.

7.0 EVALUATION OF FUTURE CONDITIONS

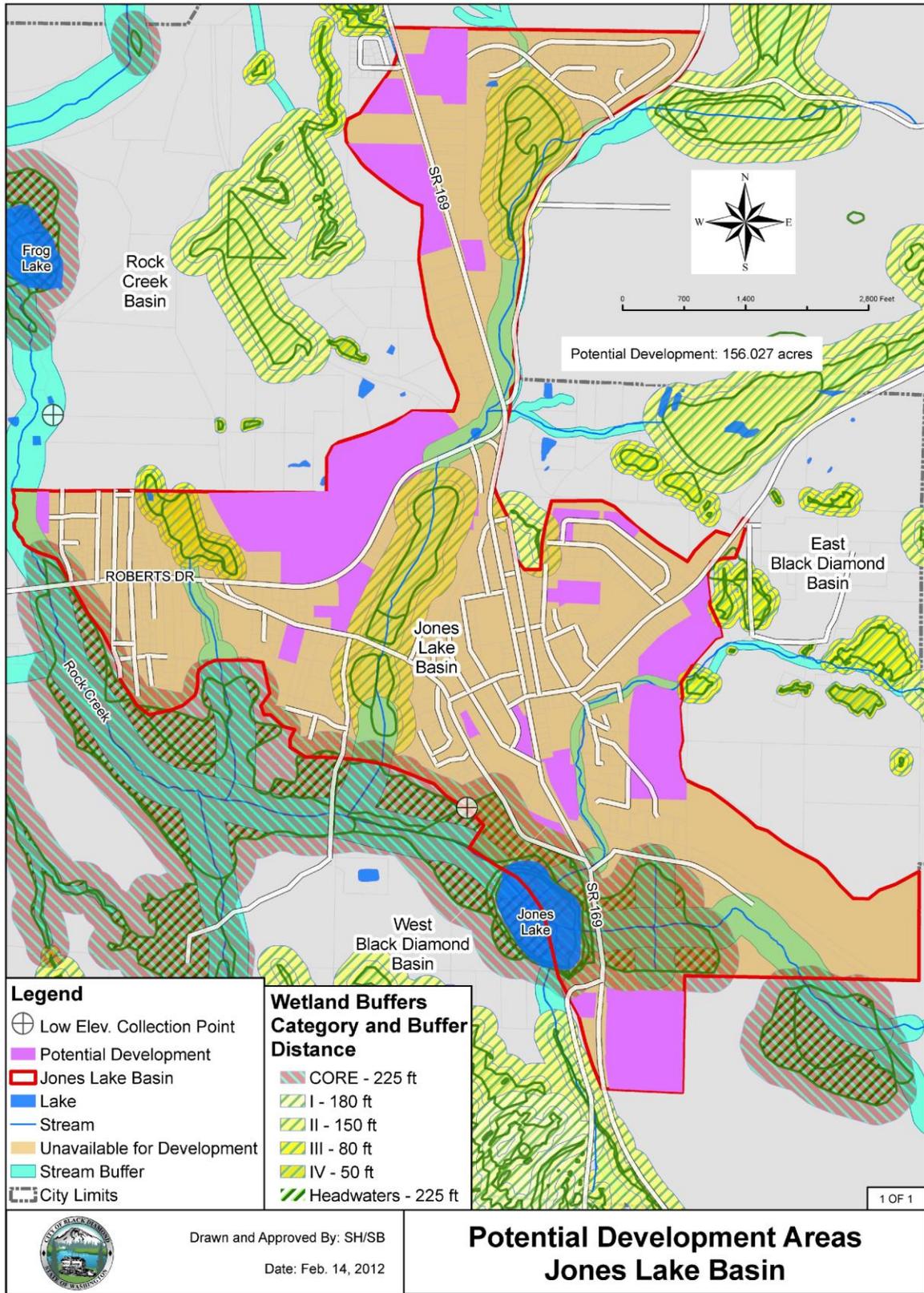


Figure 7.2 Potential In-fill Development - Jones Lake Basin

7.0 EVALUATION OF FUTURE CONDITIONS

7.3 POINTS OF DISCHARGE TO KING COUNTY FACILITIES

Currently all of the City sewage flows are discharged to King County facilities at the Jones Lake Pump Station. Since the Master Planned Developments are shifting into major new undeveloped areas, a second point of connection to King County Regional Facilities was considered. The following are points of consideration applicable to this decision:

1. The City has a right to apply for a second point of connection to the King County Regional Sewer System as provided for in section 1.b of the King County Wastewater Division's agreement with the City of Black Diamond for sewage disposal.
2. The large majority of all sewage from future growth will be directed to one of two central low points (see **Figure 7.1 Sewer Collection Basin Planning Areas**) in western Black Diamond by the nature the topography. **Figure 7.3 Future Capacity Projects** shows the proposed pump station locations and main sewer trunk line routings. Pump Station 1 is on the opposite side of the wide core wetland from the Jones Lake Pump Station. Furthermore additional areas currently flowing to the Jones Lake basin can easily be rerouted to a number of points in western Black Diamond.
3. A second western connection point to King County Facilities will avoid unnecessary construction disruption to existing neighborhoods by avoiding reconstructing major key sewer trunk lines in and adjacent to sensitive areas.
4. The Villages MPD contemplates a sewer connection direct to King County Regional Facilities.
5. The Lawson Hill MPD sewer planning route F is also compatible with a second point of connection to King County regional facilities in western Black Diamond.
6. A second point of connection to King County regional facilities avoids unnecessary double pumping of sewage flows. If the sewer flows are pumped to Jones Lake, the sewage then must be pumped again back out west where most of the sewage flow was generated.
7. The City does not want to pump large volumes of sewage to the Jones Lake Pump Station, which is located in the City core wetland complex.

7.4 COMPATIBILITY WITH CITY COMPREHENSIVE PLAN AND APPROVED MASTER PLANNED DEVELOPMENT PROJECTS AND AGREEMENTS

Early City sewer planning efforts reflect the collection point decisions discussed in **7.2 BASIN PLANNING AREAS**. The City's Comprehensive Plan (see **Appendix J – Comprehensive Plan Figure 8.2 – Sewer Capacity Projects**) reflects the same general sewer collection plan as discussed in **Section 7.2 BASIN PLANNING AREAS**.

The Master Planned Developments were reviewed and approved in accordance with the City Comprehensive Plan. The Master Planned Development applications show their sewer service plans in more detail and include interim projects, alternative projects and commitments to the City's planned routing for sewer collection. See **Appendix H Conceptual MPD Sewer Plans**

7.0 EVALUATION OF FUTURE CONDITIONS

7.5 COMPATIBILITY WITH KING COUNTY CAPACITY PROJECTS

The Black Diamond pump Station at Jones Lake has a pumping capacity of approximately 1.7 mgd. The gravity trunk line from Black Diamond to the Soos Creek Water and Sewer District facilities has an approximate capacity limit of 1.7 mgd. Recognizing the future capacity limitations of the regional sewer system, King County has planned improvements to address the capacity needs for the City. The first capacity improvement project planned by King County Wastewater Division will be the design, construction, ownership, and operation of a proposed sewage storage facility to reduce peak flow discharges (see **Appendix I – Task 360: Alternatives Analysis Report**). King County's initial pre-design report identified five alternatives and concepts for storage. All of these alternatives were located around the Jones Lake Pump Station. The City has suggested several alternatives for sewer equalization storage in western Black Diamond that have been unacceptable to King County because of operational issues. The City staff, City Council, and City consultants support a western storage option for the following reasons:

1. The City's core wetland, buffer and Sensitive areas ordinance is not respected by a storage option in the Jones Lake area which will have a significant impact to the wetland and the buffer.
2. A large construction project in the Jones Lake area is likely to be disruptive to and have a significant adverse impact to the existing neighborhood.
3. Sewer overflows at the Jones Lake site, discharge into the core wetland and will be irretrievable causing degradation to the Rock Creek core wetland complex and contributing to phosphorus loading to Lake Sawyer. A sewer overflow on the gravelly soils in western Black Diamond would soak into the soil and the solids could be cleaned up. Any spilled wastewater would be treated to some degree before reaching a water table. Overflows from a western sewer storage option would have less of an environmental impact than a sewer storage facility at the Jones Lake Pump Station.
4. The City's preferred point of discharge to King County Facilities may not be possible if King County locates their sewage storage facility at Jones Lake. Locating the sewer storage facility at Jones Lake adversely affects the sewer system planning summarized above in section 7.3 and introduces negatives to the local sewer system planning points 7.3.1- 4.
5. Beyond local concerns and from a regional sewer customer perspective the Jones Lake storage location will be a more costly project in the following respects:
 - Higher property acquisition costs (10 owners vs. one willing seller)
 - Higher wetland mitigation costs (x acres vs. zero acres at west location)
 - Higher construction costs (soft organic soil conditions and high water water table conditions as compared to gravel in the west location)
6. The western storage location provides a long term advantage to King County and all of the regional customers in the following respect: According to King County planning documents, a Pump Station in the western location will be needed at some point. Alternatively the locating of the storage facility adjacent to the Rock Creek core wetland complex may also introduce an additional future project of an upgrade to the Jones Lake Pumping Facility and additional construction in the buffer for additional sewer force main in the very area the City is trying to protect.

7.0 EVALUATION OF FUTURE CONDITIONS

The City and King County are committed to resolving the sewer connection point and the location of the King County sewage storage location project upon completion of this local sewer planning effort. Various engineering reports regarding the siting of the sewer storage facility can be found in **Appendix I – Task 360: Alternatives Analysis Report**.

ALTERNATIVES

Another alternative to King County Downstream Capacity Improvements would be a local sewage treatment plant owned and operated by the City. Sewage Treatment Technology has increased tremendously since the 1980's. Drinking water quality treatment levels are now possible. Small footprint, efficient treatment systems with off-the-shelf design are available. Advantages to a City-owned treatment plant are:

- Local high wage jobs
- High-quality water that could be used to improve the local aquatic environment
- Local control and protection of sensitive areas and neighborhoods
- Improved City finances

Any consideration of a local City owned sewage treatment plant would require agreement between King County and the City and an amendment to the City's contract which commits the City to delivering all sewage collected to King County through 2036.

7.6 FUTURE WASTEWATER FLOWS

Population projections and ERU projections were previously included in

Table 4.1 Projected Populations & ERU's-. With the implementation of a good Inflow and Infiltration program and with superior collection system construction in primarily gravel outwash areas of low water table, the current I & I issue will diminish in significance to the total future sewer flows from the City of Black Diamond. The City expects to be able to keep the existing sewer collection from further degradation and may be able to reduce the I & I peak from the old part of the City with the implementation of the I & I program recommendations. The flows from the Jones Lake Basin are expected to grow very slowly. The City also has the ability to redirect major portions of the Jones Lake basin to west if necessary.

Water Conservation

The City has an adopted water conservation plan in the City's Water Comprehensive Plan with a goal of reducing customer demand by 1% per year for the 6 years of the plan. The City has also by development agreement required the Master Planned Developer of the Villages and Lawson Hills to implement a water conservation plan by limiting irrigated areas and utilizing efficient plumbing fixtures. The intent of the water conservation plan is to reduce the current existing average water use of 187 gpd per ERU by 10%. The Development Agreement also requires monitoring and update of the water conservation plan if the goals are not met and further monitoring until the goal is met. This plan assumes 187 gpd for flow growth as a conservative figure for planning purposes. In the next general sewer plan update the City should re-evaluate the base flow per ERU to determine the effectiveness of conservation efforts.

Flow estimates from all other basins.

The city expects to be able to construct and maintain a high quality tight sewer system and is therefore estimating I & I to be controlled at 700 gallons per developed acre per day.

7.0 EVALUATION OF FUTURE CONDITIONS

This will result in a peak day flow from the entire City sewer service area (new development plus the flows from the existing system) of 3,534,000 gpd. In the next general sewer plan update the City should re-evaluate the effectiveness of the I & I program and the degradation levels of the newly constructed sewers and adjust the I & I figures in the sewer flow projections.

Table 7.1 Projected Future Flows from Black Diamond Sewer Area in 2031
(see assumptions below)

FLOW DESCRIPTION	FLOWS FROM NEW DEVELOPMENT	FLOWS FROM ENTIRE SEWER SERVICE AREA
BASE FLOW	1,800,000 gpd	2,000,000 gpd
ANNUAL DAILY AVERAGE	2,100,000 gpd	2,300,000 gpd
MAXIMUM DAILY	2,400,000 gpd	3,500,000 gpd
PEAK HOUR	3,600 gpm	4,700gpm

These figures were generated based on the following assumptions and data:

- Population, development and ERU's as projected in **Table 4.1 Projected Populations & ERU's** at the build out year.
- Base Flow was estimated based on 187 gpd / ERU
- Annual Daily Average Flow was estimated based on 217 gallons per day. This is a conservative estimate as the annual average for new development is based on the annual average for the current leaky system
- The Maximum Daily Flow was estimated based on 924 developed acres and 700 gallons per acre per day to account for I & I and additive to base flow. For the existing flows the current maximum day of 1,100,000 gpd was added to the New development max daily flow
- The peak hour flow for new development was estimated using a peaking factor of 2.5 applied to the average daily flow. The peaking factor from the Water Agency Design Guidelines was compared to the Department of Ecology Sewage Works Design Figure C1-1. Since the two methods yielded similar results, the average and minimum peaking factor of 2.5 was used. Within continuing reinvestment in the existing sewer system and implementation of the I & I program the City is expecting to keep the existing sewer system from degrading further. To determine the Peak Hour Flow for growth plus development, the highest peak hour from the study data set was added to the Peak Hour Flow from new development.

7.0 EVALUATION OF FUTURE CONDITIONS

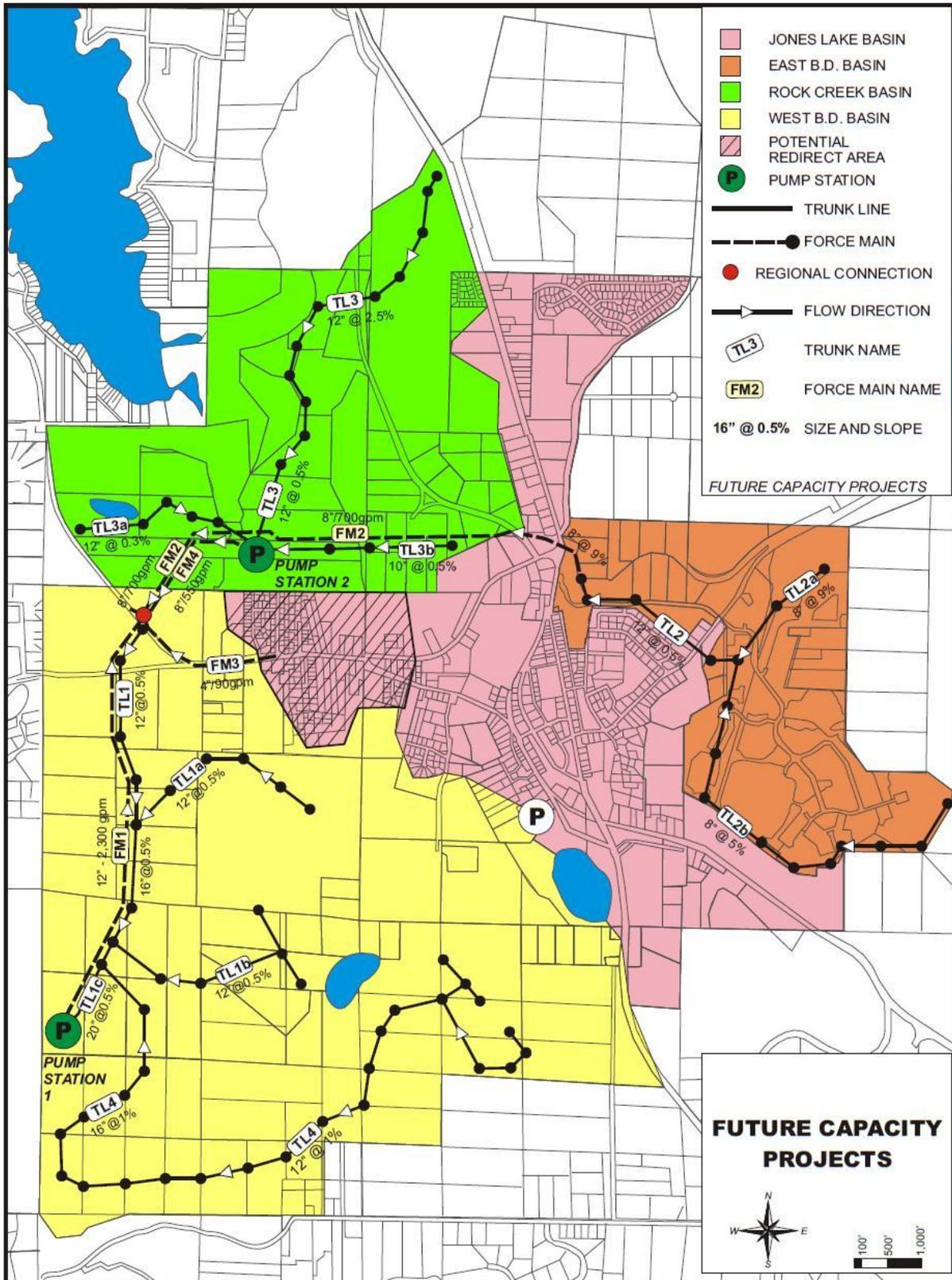


Figure 7.3 Future Capacity Projects

7.0 EVALUATION OF FUTURE CONDITIONS

Future Capacity Project Planning

The trunk line alignments shown in **Figure 7.3 Future Capacity Projects** were planned to minimize excavation depth, serve the developable area and avoid crossing wetlands or buffers if possible. The slopes were averaged over major sections of sewer trunk line. Sewer Trunk lines were sized to carry the buildout flows from the basin areas. The sewer force main labeling in **Figure 7.3 Future Capacity Projects** shows the peak hour flows generated in each basin at the end of the planning period and the appropriate size of force main to carry the flows from that basin. The sewer force mains were sized at a minimum size of that will flush the line at least once per day with a scouring flow of two feet per second and no more than 8 feet per second for a maximum flow velocity. The **Table 7.2 Force Main Flow Rates** identifies the capacities of various force main sizes.

Table 7.2 Force Main Flow Rates

Size	Minimum Flow (gpm)	Maximum Flow (gpm)
4"	78	300
6"	175	690
8"	320	1,250
12"	710	2,800

7.7 PLANNING LOCAL SEWER TRUNK LINE COLLECTION

Table 7.3 Projected Future Trunk Line Capacities

Trunk Line		Capacity in GPM (assuming capacity = 70% full)
TL 1	16" @ 0.5%	1,730 gpm
TL 1a	12" @ 0.5%	795 gpm
TL 1b	12" @ 0.5%	795 gpm
TL 1c	20" @ 0.5%	3,125 gpm
TL 2	12" @ 0.5%	795 gpm
TL 2a	8" @ 0.5%	265 gpm
TL 2b	8" @ 9.0%	1,145 gpm
TL 3	12" @ 0.5%	795 gpm
TL 3a	12" @ 0.3%	620 gpm
TL 3b	10" @ 0.5%	485 gpm
TL 4	16" @ 1.0%	2,430 gpm

7.0 EVALUATION OF FUTURE CONDITIONS

7.8 TRUNK LINE FLOWS

**Table 7.4 Projected Future Flows from Black Diamond Trunk Lines
(see assumptions below)**

2017 Flows		
	Daily Average	Peak Hour
FM 1	*320,000 gpd	556 gpm
FM 2	0	0
FM 3	0	0
FM 4	0	0
TL 1	320,000 gpd	556 gpm
TL 2	0	0
TL 3	0	0
TL 4	0	0
<i>* Because the new sewer system will have very little I & I, base flow was used for Daily Average</i>		
2023 Flows		
	Daily Average	Peak Hour
FM 1	**823,500 gpd	1,430 gpm
FM 2	0	0
FM 3	0	0
FM 4	276,500 gpd	512 gpm
TL 1	823,500 gpd	1,430 gpm
TL 2	0	0
TL 3	276,500 gpd	512 gpm
TL 4	0	0
<i>** Used base flow and a 10% degradation factor</i>		
End of Planning Period Flows – 2031		
Expected Flows from Various Basins	Daily Average	Peak Hour
West Black Diamond Basin – FM 1	1,320,000 gpd	***2,290 gpm
East Black Diamond Basin – FM 2	405,000 gpd	***704 gpm
Morganville Sub-Basin – FM 3	42,100 gpd	90 – 120 gpm
Rock Creek Basin – FM 4	304,000 gpd	***550 gpm
TL 1	790,000 gpd	1,143 gpm
TL 2	405,000 gpd	704 gpm
TL 3	304,000 gpd	530 gpm
TL 4	530,000 gpd	1,144 gpm

***Note that the Peak Hour flows in **Table 7.4 Projected Future Flows from Black Diamond Trunk Lines** reflect the sewage flows coming from the various basins at the end of the planning period. There will be some attenuation through the pump stations and the flow rates of the pumps will control the actual peak hour flows delivered.

8.0 SYSTEM OBJECTIVES AND POLICIES

8.1 CURRENT EXISTING SYSTEM OBJECTIVES AND POLICIES

The City has previously established objectives and policies to guide the growth, operation, and maintenance of the City's sewer utility and incorporated them into the City's Comprehensive Plan. This plan suggests several new policies and or changes to existing code.

New policies that should be considered:

New Policy 1: Capital Facility Charges for Commercial development shall be charged on an ERU basis consistent with King County methodology.

Discussion: This will provide equity between commercial and residential and be consistent with capital facility charges for the water department. Lot area and the number of bathrooms are not good predictors of the volume of sewage that can be generated from a Commercial establishment.

New Policy 2: Monthly sewer rates for any residential customer shall be the same regardless of the housing type.

Discussion: Each housing type whether town house, mobile home, apartment, or detached single family homes inhabit a variety of family sizes with a variety of sewage use habits and variety of plumbing efficiency. Additionally, most all residential customers have similar use patterns and similar sewage strength which impact the sewer system in much the same way.

New Policy 3: The Cash Reserves for the Sewer Operating Fund should be equivalent to 3 months of operating expenses.

New Policy 4: A minimum \$200,000 minimum reserve should be established for the Capital Fund.

New Policy 5: Establish a goal of dedicating 5% of the Operations Budget to the Capital Fund on a yearly basis to fund Repair and Replacement Projects.

New Policy 6: As the City continues with I & I efforts and if it becomes apparent that significant stormwater contributions to the sewer

8.0 SYSTEM OBJECTIVES AND POLICIES

system is coming from failing side sewers, the City should adopt a side sewer reconstruction assistance fund and require replacement of deteriorated side sewers.

New Policy 7: Update the capital facility charge and base the charge on the amount of expected sewage use by equivalent residential unit of sewage flow (ERU).

Discussion: The current city code is based more on lot sizes and building sizes rather than actual sewage flow produced. The current code can under estimate sewage flows that will actually be generated from businesses and high density housing.

New Policy 8: Capital Facility Charges for residential housing shall be based on an equivalent residential unit (ERU). The determinations of equivalent residential units shall be consistent with King County's methodology.

Discussion: Residential use patterns are typically all the same and therefore generate peaks to the system at about the same time. The City should be consistent with King County in the methodology for the accounting of sewer capacity. The lot area component of current code does not predict the amount of sewage from a residence.

9.0 CAPITAL IMPROVEMENT PLAN

9.1 PROJECT IDENTIFICATION METHODOLOGY

This chapter presents the proposed projects and schedule for the City of Black Diamond's Capital Improvement Plan (CIP). This Capital Improvement Plan does not address local sewer collection facilities that will be by developer extension with implementing subdivisions. The projects were selected to address repair and replacement needs, routing flows for:

- the most efficient collection of sewage
- meet the needs of expected growth
- avoid undue disruption of existing neighborhoods
- minimize the upgrades of existing sewer mains
- and minimize the impacts to wetlands and buffers

The major capacity adding developer funded projects are also shown in this plan as the City will direct the primary aspects of design of these facilities. The City retains the flexibility to reschedule, expand, or reduce the projects included in the CIP and to add new projects to the CIP, as best determined by the City when new information becomes available for review and analysis. For example: the Infiltration and Inflow Program may identify a section of sewer that will warrant and require total replacement. Should such a section of severely damaged sewer be discovered, the City will reprioritize the Capital Improvement Plan to address the issue.

9.2 PROJECT COST ESTIMATES

The cost estimates for the Capital Program are based on general comparisons to recent construction costs to develop a general cost per foot for various size sewers or cost per pump station depending on the size. An additive 45% factor was added for design, permitting, project management, inspection, overhead, project administration, surveying and contingency. Final project costs will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, the final project scope and schedule, engineering design, and other variable factors.

9.3 RECOMMENDED PROJECTS

In general, the existing collection system for the City of Black Diamond is performing adequately to meet system needs. The top priorities to be addressed are implementing a strong Infiltration and Inflow program and providing oversight of the major developer improvements for the western Black Diamond basin to meet the needs of future growth. Detailed project descriptions are included below.

Projects have been developed from a variety of sources including: the City's recently updated Comprehensive Plan (see **Appendix J – Comprehensive Plan Figure 8.2 – Sewer Capacity Projects**); utility planning documents prepared by representatives for the 'Lawson Hills MPD' and 'The Villages MPD' (see **Appendix H – Conceptual MPD Sewer**

Plans and Appendix K – MPD Site Plans from Development Agreements); the City’s previous General Sewer Plan (on file with the City Clerk); planning studies completed by King County Wastewater Treatment Division (see **Appendix I – Task 360: Alternatives Analysis Report**); and staff investigations conducted in support of the analysis and modeling efforts of the existing system. All efforts have been made to respect these previous efforts and to dovetail these recommendations in with all other recommendations included in this plan. This document is intended to be consistent with rather than conflict with the City’s other planning documents such as the overall Comprehensive Plan.

It is intended that this General Sewer Plan contain an inclusive list of recommended system improvements; however additional projects may need to be added or removed from the list as growth occurs and/or conditions change.

Projects have been categorized as: Wastewater Treatment Improvements; System Rehabilitation Projects; or System Capacity Improvements.

WASTEWATER TREATMENT IMPROVEMENTS

Complete close out of the Old Treatment Plant

The previous owner (PCC) of the sewer lagoon site has the right to repurchase the property once the City is no longer using the property for sewer treatment purposes and has requested the City return the property according to the purchase and sale agreement conditions. (See **Appendix L – Statutory Warranty Deed – Palmer Coking Coal Company**) The City has been using the old sewage treatment plant to treat the remaining bio-solids. A period of anaerobic treatment is now complete. The bio-solids in the bottom of the old sewer lagoon need to be tested and a determination made as to remaining treatment and disposal options. Once the remaining bio-solids have been properly tested and approved for final disposal, the City will permit for trucking or process a permit for land application. Once the bio-solids are removed and the site meets environmental standards, the property can be turned back over to PCC.

SYSTEM REHABILITATION PROJECTS

Inflow / Infiltration Annual Program

In 2011, the City had a sewer maintenance company photo inspect most of the city’s sewer manholes and some of the suspect sewer mains. Although the City anticipated finding some major inflows or infiltration leaks, the investigation indicates that there are multiple small inflows and infiltration leaks throughout the system. The good news is that the main structural integrity of the City’s sewer system is in reasonable condition. The challenge will be to continue to investigate the condition of portions of the sanitary sewer system, looking for ways to efficiently reduce inflow and infiltration. Repairs and improvements to the system shall than be addressed through an annual I & I program. The first area of focus will be manhole sealing. The City staff recently has had some training in manhole repair techniques.

The continuing investigation of the sewer system may utilize such techniques as smoke testing; dye testing; visual inspection of manholes and/or pipe video. Flow monitoring

may also be helpful in determining major areas of I & I but recent investigation does not show that one area of the sewer system is significantly better or worse than another area of the sewer collection system. The control of I & I inflow into the system will stabilize the flows from the older portions of the City's sewer collection system and prevent further degradation of the sewer collection system. There are a variety of rehabilitation/repair techniques that the city may utilize to address the I & I flows into the system. The City may wish to use a combination of the following techniques based on the location and severity of I & I inflows discovered through on-going annual investigations.

- **Manhole Rehabilitations** - manhole grouting, spray-on cement liners; epoxy liners; manhole inserts; cure-in-place liners; manhole lid replacement.
- **Pipe Rehabilitation / Replacement** – Pipe replacement (dig & replace); Trenchless methods (pipe bursting, cure-in-place pipe liner, slip liner, fold and form liner). This is probably only cost effective where sewer main are in extremely bad condition where water tables are high.
- **Private side sewer replacement** - City staff suspects that many of the original sewer connections only went as far as the septic tanks when the conversion was made to sewers in the 80's. There may be portions of old clay side sewers that are contributing ground water infiltration into the sewer system.
- **Enforcement Actions to Disconnect Illegal Stormwater Connections** There may be many private side sewers that have storm water connections to the sanitary sewer system. If these can be identified through smoke testing or other methods, they should be disconnected.

Cedarbrook Sewer Main Repairs.

Morgan Creek, a 129-lot residential development, lies in the northeast portion of the City. Sewage from this development flows into a sewer main draining to the south through the Cedarbrook Mobile Home Park. The Cedarbrook Sewer Main was never dedicated to the City. The sewer main through Cedarbrook Mobile Home Park was constructed next to a large wetland connected to Ginder Creek. More investigation is needed to determine the condition of the sewer line, provide adequate access for maintenance, and improve manholes to protect the sewer system from surface water inflow. Relocation of the sewer main may also be part of the solution.

The Cedarbrook Mobile Home Park owner is interested in redevelopment of the Mobile Home Park. Any redevelopment of the Mobile Home Park would require upgrades and potentially reconstruction of the sewer collection system on this property. The necessary repairs, easements and or reconstruction may be completed with the redevelopment of the Cedarbrook Mobile Home Park. If the Mobile Home Park remains long term, the City will eventually need to address the informal discharge of public sewer through the private sewer mains and the condition of the private sewer mains.

SYSTEM CAPACITY IMPROVEMENTS

Extensive work has been completed in recent years to determine the best plan for collection of sewage to serve the proposed growth. All efforts have been made to respect these previous efforts and to dovetail these recommendations in with protecting existing

9.0 CAPITAL IMPROVEMENT PLAN

neighborhoods, preserving sensitive areas and their buffers, and avoiding the cost of replacing existing infrastructure and all other recommendations included in this plan.

Figure 7.3 Future Capacity Projects¹⁰ illustrates the major projects proposed to serve future capacity needs of the undeveloped sewer basins in the City. The improvements shown in **Figure 7.3 Future Capacity Projects** identify the City's preferred best plan for the collection of sewage and are consistent with the City's Comprehensive Plan.

NPS1 (New Pump Station #1): New Pump Station #1 will receive flows from 'The southwestern portion of the City, primarily the 'Villages MPD' (Trunk line #1 & Trunk line #4). From here, sewer flows will be pumped north to the proposed King County storage facility at a location proposed by the City of Black Diamond and acceptable to the Villages Developer west of Lake Sawyer Road. The pump station shall be designed to pump 1,450,000 gpd daily average flow and 2,450 gpm.

NPS2 (New Pump Station #2): New Pump Station #2 will ultimately receive flows 'The North Triangle' (Trunk line #3) and the PCC gravel pit basin. From here, sewer flows will be pumped to the King County proposed storage facility. Pump Station #2 is not expected to be constructed until the development of the PCC gravel pit. Other interim facilities may be considered as long as the ultimate sewer collection plan is not compromised. The ultimate pump station shall be designed for 530,000 gpd average daily flow and a peak hour flow of 940 gpm. Once 10% to 20% of the industrial area in the Rock Creek Basin has been developed, flow generation projections for this basin should be re-evaluated.

Trunk Line #1: Trunk Line #1 will collect sewage from the initial phases of 'The Villages MPD' in western Black Diamond and route the sewage to NPS1. The main stem of this trunk line is 12" diameter and the last segments are 16" and 20" before discharging to the NPD1. Trunk Line #1 system has two 12 inch contributing sub trunk lines 1a and 1b segments on the main stem. The total trunk line 1 system is 13,850 feet and has an average slope of about 0.5%.

Trunk Line #2: Trunk Line #2 will collect sewage from the East Black Diamond Basin ('Lawson Hills MPD') along the south boundary of the basin. The middle section of this trunk line has a 0.5% slope before the steep pitch down the Lawson Parkway to a Force Main #2 that routes the sewage from SR 169 to King County regional facilities in Lake Sawyer Road SE. Trunk Line #2 is estimated to be 12,200 lineal feet of 8 inch sewer main and 1500 feet of 12-inch sewer main. The sewer main must go under Lawson Creek at the south end of Botts Drive.

Trunk Line #3: Trunk Line #3 will collect sewage from the north triangle and portions of the Morgan Kame Pit delivering sewage to NPS2. Trunk Line #3 is estimated to be 7000 lineal feet of 12-inch sewer. Because NPS2 will not be constructed for many years, the City will accept an interim pump station above the Morgan Kame Terrace Mine to service the north portion of the city and pump the sewage to the existing sewer main in SR 169 to provide interim sewer service until the mining is complete and the mined out area is

¹⁰ Source: Final EIS – The Villages Master Planned Development

9.0 CAPITAL IMPROVEMENT PLAN

developed depending on available capacity in the existing SR-169 10 inch sewer trunk line. The Trunk line 3 system has two other contributing trunk lines 3a and 3b in the east and west portion of the Rock Creek Basin. The total footage of the trunk line 3 system is 12,800 lineal feet.

Trunk Line #4: Trunk Line #4 will collect sewage from the south area of the West Black Diamond Basin (later phases of 'The Villages MPD') and deliver the sewage to the west to NPS1. Trunk Line #4 is estimated to be about 14,750 lineal feet of 12-inch and 16 inch sewer main at an average of 0.5%. Some of the south east portion of the City can be serviced by gravity directly to the King County Pump station at Jone Lake as an alternative. If the City were to consider routing the south east area of the city to the Jones Lake facility, the City would need to reassess this concept based on the capacity of the County facility in future years and the ability to acquire needed easements.

Force Main #1: Force Main #1 will deliver sewage from NPS1 to the proposed King County storage facility on Lake Sawyer Road. The force main is estimated to be about 6600 lineal feet.

Force Main #2: Force Main #2 will deliver sewage from the 'Lawson Hills MPD' gravity line to the proposed storage facility on Lake Sawyer Road. Portions of this force main would operate as an inverted sewer pressure siphon. Force Main #2 is sized at 8 inches and will follow the future pipeline road. No gravity direct connections will be allowed below 5th Street. The total length of Force Main #2 is 7800 feet.

Force Main #3: Force Main #3 is the rerouting of the sewer flows from the Morganville area to the western sewage storage tank site. Currently, sewage flows for the Morganville area are pumped from the Morganville Pump Station to the Black Diamond Pump Station at Jones Lake via a combination of approximately 3,200 lineal feet of force main and approximately 3,200 lineal feet of gravity sewer. Force Main #3 is 2100 feet of 6 inch force main in Roberts Drive and Lake Sawyer Road SE, rerouting Morganville sewage flows to a western connection to King County regional facilities). Rerouting Morganville flows will provide for additional capacity at the Black Diamond Pump Station for any infill in the Jones Lake basin if needed.

Force Main #4: Force Main #4 will deliver sewage from the Rock Creek Basin to the western connection to King County regional facilities. The force main is 2100 feet and sized as an 8 inch force main.

Storage Project #1: A 750,000 gallon wastewater storage facility is proposed to be constructed by the King County Wastewater Treatment Division to reduce peak flows and extend the capacity of the downstream regional conveyance system. This project is included in the City's capital Improvement Program only because the location has such a significant impact to the City's sewer capacity project planning and is of high interest to the local policy makers because of the impact to wetlands. This project is considered part of King County's regional system and as such will be funded by King County. For additional details, refer to **Section 7.5 Compatibility with King County Capacity Projects.**

9.0 CAPITAL IMPROVEMENT PLAN

Table 9.1 Capital Improvement Plan

PROJECT	ESTIMATED TOTAL COST	2012	2013	2014	2015	2016	2017	2018-2031
		Costs are in 2010 Dollars						
Decommission the Old Treatment Plant	\$30,000	\$10,000	\$20,000					
Morganville Sewer Pump station rehab.	\$80,000	\$80,000						
Inflow/Infiltration Annual Program	\$180,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	reassess
Cedarbrook Sewer Main Repairs	\$ 250,000					\$250,000		
Morganville Sewer Reroute to the west; Force main #3	\$460,000						\$460,000	
PW Building, Vac Truck, Shop & Materials storage Handling	\$300,000						\$300,000	\$50,000/yr saving plan
New Pump Station #1	\$1,500,000			\$ 1,500,000				
New Pump Station #2	\$1,500,000							\$1,500,000
Trunk Line #1	\$3,700,000			\$3,700,000				
Trunk Line #2	\$2,800,000							\$2,800,000
Trunk Line #3	\$3,400,000							\$3,400,000
Trunk Line #4	\$ 4,000,000							\$ 4,000,000
Force Main #1	\$ 1,000,000			\$ 1,000,000				
Force Main #2	\$ 1,100,000							\$1,100,000
Force main #4	\$300,000							\$300,000
Storage Project #1	King County							
TOTALS		\$120,000	\$50,000	\$5,300,000	\$30,000	\$280,000	\$790,000	No total as new projects will be identified

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10.0 FINANCES

10.1 SEWER FUND STRUCTURE

The City of Black Diamond operates with two sewer-related funds, as follows: Fund 407 – Wastewater Operating Fund; and Fund 408 – Wastewater Capital Fund. All expenses for on-going day to day services and costs of running the utility are funded by monthly service charges to the City's wastewater customers.

The effective and successful implementation of the sewer operations and maintenance activities and a successful reinvestment and improvement of the existing wastewater system is dependent on sound policies and adequate revenues to support the utility. This Plan presents a financial outlook of both the sewer operations and maintenance fund and the sewer capital improvement fund for a growth and no growth scenario.

The basis for analyzing the Finances for the Sewer Utility are:

1. The accounting history of the Operation and Maintenance Costs
2. The revenue history generated from existing customers
3. Growth projection assumptions from **Table 4.1 Projected Populations & ERU's**
4. The current amount of cash reserves
5. The future obligations identified in Chapter 9.0 in the Capital Improvement Plan, **Table 9.1 Capital Improvement Plan** and the associated revenue sources identified in **Table 10.1 CIP Project Costs & Funding Sources**.
6. The full cost of any King County Wastewater Division increase will be passed on to the customer. In the analysis the King County rates are assumed fixed for greater simplicity in analyzing local finances. King County Waste Water Treatment Division has planned rate increases of 10 percent in 2015 and 1 percent from 2016 – 2018. Though changes to King County sewage disposal rates are not known beyond 2018 it should be expected that they will not remain fixed over time.
7. No changes to staffing level are included in the in either scenario, however;
 - a. Layoffs or rate increases or both will be needed in the no growth scenario.
 - b. Additional staff will be needed in the growth scenario.
8. Both the growth and no growth scenario end the Yarrow Bay funding of Public Works positions through the funding agreement in the middle of 2014.
9. Supplies and other expenditures not linked to growth are increased at a 3% inflation rate.
10. Growth related expenditures like utility tax are increased at the rate of growth
11. Wages are increased at 1% per year.
12. Operation and Maintenance costs will increase by 2 to 3 % per year.
13. Infill growth will pay the current minimum capital facility charge to connect at \$1600 per ERU.

14. In the no growth scenario, the Morganville Reroute and the Cedarbrook Sewer Project are delayed beyond the six years and the Public Works Facility and Equipment Project is reduced to \$50,000.
15. The MPD growth will not be paying capital facility charges as the developer will not be utilizing the existing sewer system and will be constructing their own facilities to deliver sewage direct to the Regional King County System.

10.2 CIP FUNDING

The City of Black Diamond is planning to experience significant population growth as the result of two master planned developments (MPD's). This General Sewer Plan anticipates routing sewer in new trunk lines, pump stations and force mains direct to King County facilities. According to the Development Agreement approved by the City Council, the developer will fund and construct the needed capacity additions independent of the existing City sewer system. If the developer temporarily utilizes existing facilities, they will be responsible for any impact to the existing sewer system. The Development agreement therefore appropriately exempts the MPD's from the City Capital Facility Charge. **Table 10.1 CIP Project Costs & Funding Sources** summarizes the City's CIP project list, including estimated project costs and possible funding sources.

Table 10.1 CIP Project Costs & Funding Sources

PROJECT	ESTIMATED COST (2011 DOLLARS)	TYPE OF FUNDING	CITY CAPITAL FUNDING	DEVELOPER FUNDING
Preserve & Protect Old Treatment Plant for Future Use	\$30,000	Rates and Cash Reserves	\$30,000	
Morganville Pump Station Upgrade	\$80,000	Rates and Cash Reserves	\$80,000	
Inflow/Infiltration Annual Program	\$30,000 / year	Rates, Cash Reserves & I & I program	\$180,000	
Cedarbrook Sewer Main Repairs	\$250,000	City/Developer/CFC	\$250,000	
Morganville sewer reroute to west Force Main #3	\$460,000	City rates & cash reserves	\$460,000	Partial funding a possibility
New Pump Station #1	\$1,500,000	Developer		\$1,500,000
New Pump Station #2	\$1,500,000	Developer		\$1,500,000
Trunk Line #1	\$3,700,000	Developer		\$3,700,000
Trunk Line #2	\$2,800,000	Developer		\$2,800,000
Trunk Line #3	\$3,400,000	Developer		\$3,400,000
Trunk Line #4	\$4,000,000	Developer		\$4,000,000
Force Main #1	\$1,000,000	Developer		\$1,000,000
Force Main #2	\$1,100,000	Developer		\$1,100,000
Force Main #4	\$300,000	Developer		\$300,000
Storage Project #1	King County	King County		--
Public Works Facilities and Equipment	\$300,000 in first 6 years, then reassess	City Rates, Cash Reserves and Gen Facility charge	\$300,000	
		TOTAL	\$1,300,000	\$19,300,000

10.3 FINANCE OUTLOOK WITH NO MPD GROWTH

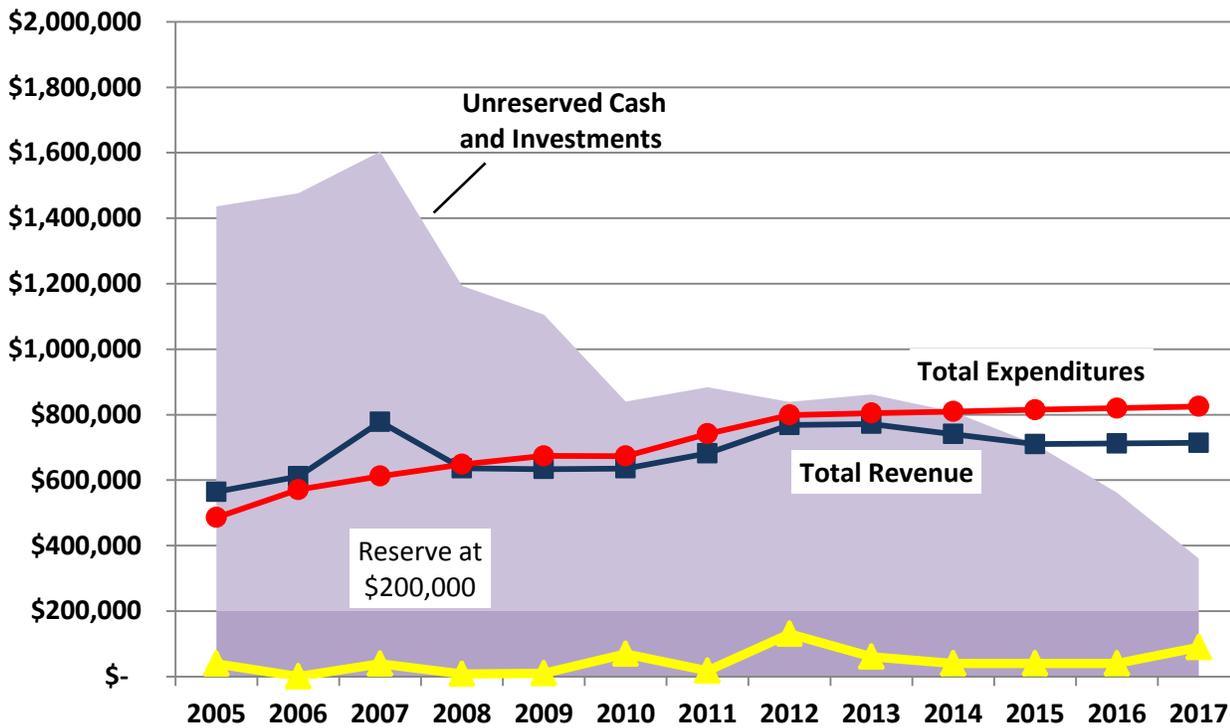


Figure 10.1 Finance Outlook with No MPD Growth

Financial information for the previous six years 2005 – 2011 and the current budget year was reviewed to evaluate the past performance of the utility. The City’s sewer utility has traditionally operated with a significant reserve and has no debt. A summary of historical revenue and expenses for years 2005- 2011 are included in **Appendix M – Historical Financial Summary**. The sewer utilities finances have been fairly stable but with rising costs and insufficient rate increases to cover the rising costs the utility began to lose money in 2008. The Operating fund has been subsidized by the Capital Fund the past 2 years. Although some small rate increases passed the utility continued to operate in the red to the present. As the Sewer Utility was the only fund in the City with cash reserves set aside and other funds have not had the funds available for large expenditures, the Sewer Utility has loaned money to other funds which are now paying back the loans over a period of years. The drop in cash in the capital fund from 2007 to 2010 is due to these loans.

With no growth and the support from the Master Planned Developer going away it is apparent that substantial rate increases and some layoffs will be needed to make up the \$ deficit and provide a 5% support of the capital program for repair and replacement projects. This financial picture of the Wastewater Utilities situation is not detailed enough to set rates. This analysis provides an overall picture of the health of the Wastewater Utility. The Capital Fund cash level gives the City a year or two of time to see what growth levels will be in order to set the rates for the long term. A no growth scenario shows that available funds will be depleted if rates are not raised in the near future.

10.4 FINANCE OUTLOOK WITH MPD GROWTH

The following graph shows the expected growth in revenues and expenditures for the sewer utility over the next 6 years.

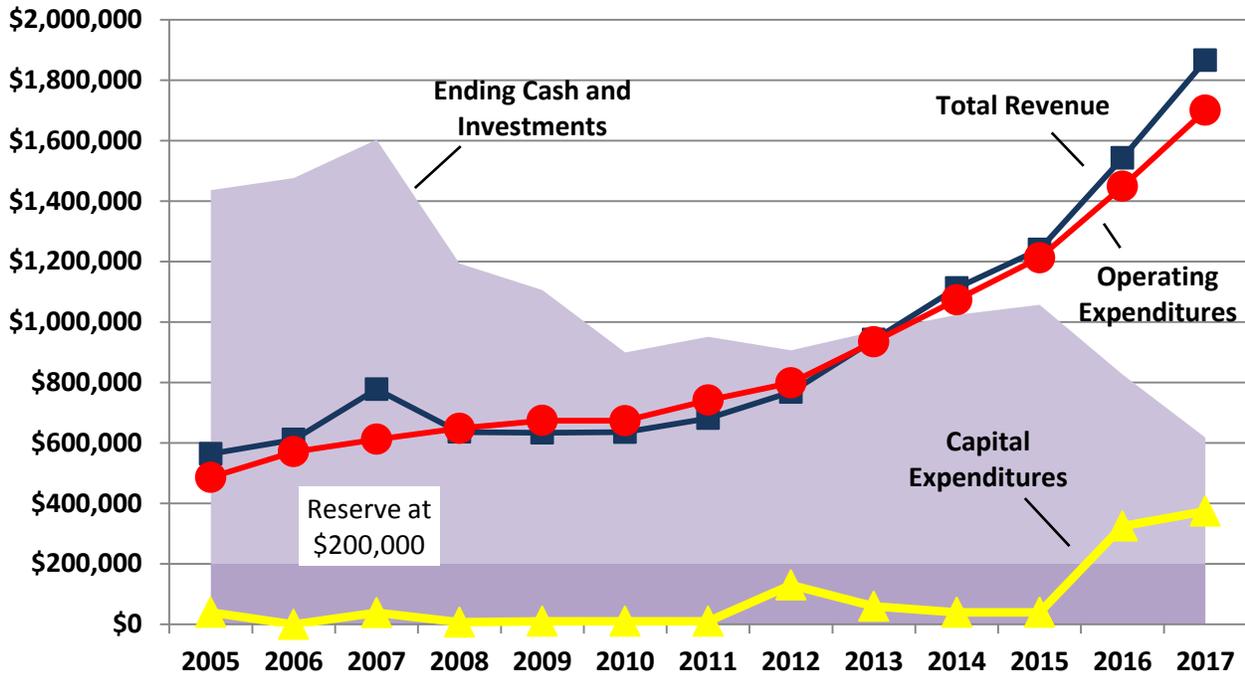


Figure 10.2 Finance Outlook with MPD Growth

Note that in year 2013 the utility no longer is losing money but begins to generate a small amount of funds needed for contribution to the CIP for Repair and Replacement projects. It is recommended that the surplus initially go toward funding the Public Works Director Position and the Public Works Technical Assistant. Once those positions are fully funded, then a small percentage of funds should be transferred to the capital fund for repair and replacement of existing infrastructure. The goal should be to reach a point of contributing approximately 5 % of the Operation and Maintenance budget to the Capital Fund for repair and replacement. Although the cash reserves declines over the 6 years of this plan, additional City project burden in the future is expected to be small.

Table 10.2 Local Monthly Cost per Service – 6 Year Outlook

Year Ending	Revenue	*Operating Expenses	Local Operating Expenses	ERU's	Monthly Local Collection Cost per Service
2012	\$768,162	\$799,000	\$308,184	1,133	\$22.67/ERU
2013	\$941,237	\$934,752	\$331,738	1,392	\$19.86/ERU
2014	\$1,112,441	\$1,073,564	\$355,318	1,658	\$17.86/ERU
2015	\$1,239,598	\$1,212,446	\$378,969	1,924	\$16.41/ERU
2016	\$1,542,697	\$1,448,545	\$417,096	2,381	\$14.60/ERU
2017	\$1,865,693	\$1,699,977	\$457,559	2,868	\$13.29/ERU

* Includes King County Metro sewer charges

Note that the trend for the cost of service per ERU is going down over time. This trend is expected to continue as the new infrastructure will require very little maintenance and the larger customer base will provide greater economy of scale over time. Since the City does not need to issue loans to implement the capital improvement plan and the improvements can be funded by cash without dropping the reserves below \$200,000, no additional expense for capital improvements was added to the cost of service.

10.5 MONTHLY SEWER SERVICES RATES

User rates should be set to cover the cost operations, maintenance and administrative costs for the sewer utility and a portion of the capital improvement plan associated with repair and replacement. The monthly charges are set at a fixed rate for each residential equivalent except that commercial accounts also pay for the amount of sewage discharged to the sewer system. (Water meter flow less any irrigation if metered separately).

The largest portion of the user rates is the King County Wastewater Treatment Division portion of the bill (\$36.10/month) that covers the transport of sewage from Black Diamond to Redmond and the treatment and discharge of the waste water once it gets there. Costs associated with King County’s sewage conveyance and treatment services are passed through to the City’s sewer customers and are covered by City’s user rates. The City shows the component of the City charge that is from King County on the customer’s bill. A residential sewer bill in Black Diamond currently is \$55.26/month.

Table 10.3 Current Sewer User Rates 2012 The cost breakdown is provided for each of the components – King County WTD, and Black Diamond. Lifeline relief is a program offered by the City of Black Diamond which provides utility rate reductions for up to 50% for water, sewer, and stormwater charges for qualifying residents (low-income seniors and low-income disabled residents).

Table 10.3 Current Sewer User Rates 2012

RATE COMPONENT	MONTHLY CHARGE	LIFELINE RELIEF RATES
King County WTD	\$36.10	\$36.10
Black Diamond Sewer	\$19.16	\$9.58
Total	\$55.26	\$45.68
All users, other than detached single family homes, are also charged for the water consumed in excess of 750 cubic feet per month, at a rate of \$5.36 per one hundred cubic feet.		

Rate increases and or growth is needed in order generate enough funds to direct money back to the Capital Fund to support Repair and Replacement projects. **Table 10.4 Local Monthly Cost Per Service – 6 Year Outlook** shows that the cost of local sewer collection service will actually go down as many new customers will be added to new low maintenance infrastructure.

Table 10.4 Local Monthly Cost Per Service – 6 Year Outlook

Year Ending	Revenue	*Operating Expenses	Local Operating Expenses	ERU's	Monthly Local Collection Contribution
2012	\$768,162	\$799,000	\$308,184	1,133	\$22.67
2013	\$941,237	\$934,752	\$331,738	1,392	\$19.86
2014	\$1,112,441	\$1,073,564	\$355,318	1,658	\$17.86
2015	\$1,239,598	\$1,212,446	\$378,969	1,924	\$16.41
2016	\$1,542,697	\$1,448,545	\$417,096	2,381	\$14.60
2017	\$1,865.693	\$1,699,977	\$457,559	2,868	\$13.29

* Includes King County Metro sewer charges

Note that the trend for the cost of service per ERU is going down over time. This trend is expected to continue as the new infrastructure will require very little maintenance and the larger customer base will provide greater economy of scale over time. Since the City does not need to issue loans to implement the capital improvement plan and the improvements can be funded by cash without dropping the reserves below \$200,000, no additional expense for capital improvements was added to the cost of service.

10.6 CAPITAL FACILITY CHARGES

Capital Facility Charges (also known as Connection charges) fund system improvements required as a result of new growth. These are one time charges are collected at the time of building permitting. These funds are deposited directly to the Capital Improvement Fund and used for capacity adding projects. This plan recommends adjusting how the sewer connection charges are levied. The current code is based on a minimum fee plus lot area or square footage and number of bathrooms in commercial buildings. This plan

recommends keeping the Capital Facility Charges (Connection Charges) for sewer at the current minimum level but shifting to an Equivalent Residential Unit as a base for calculation of the fee. The Capital Facility charge recommended is \$1600 per ERU. Additional funding sources such as grants and loans occasionally may supplement the Capital Fund.

10.7 CURRENT CAPITAL FACILITY CHARGE AND RECOMMENDATION

The current Connection Charge for residential is based on \$0.14 (fourteen cents) per square foot of lot area with a minimum charge of \$1600. Any lot smaller than 11,428 square feet would pay \$1,600 for a sewer connection. Whereas most city sized lots are less than 11,428 square feet and would pay \$1600 for a sewer connection, this plan accepts \$1600 per ERU as a fixed Capital Facility Charge for residential connections. The current amount of Capital Funds, expected capital revenue and capital project balance out fairly well leaving a \$350,000 emergency reserve. Since the recommended changes in Capital Facility charges are not adjusting the amount collected but rather fixing the amount to Equivalent Residential Units and removing some variables that are only loosely tied to the amount of sewage generated and the capital program is in balance, a further Capital Facility Charge study is not recommended.

The existing sewer system has adequate hydraulic capacity to serve all of the expected infill; therefore additional capacity adding projects for the infill in the Jones Lake basin is not anticipated. Needed capacity outside the Jones Lake Basin will be entirely funded by the Master Planned Development developer. The City should hire a consultant to evaluate the capital facility charge level at the next major update of the sewer capital improvement plan.

Table 10.5 Recommended Sewer Capital Facility Charges

CUSTOMER TYPE	CAPITAL FACILITY CHARGE
Single Family Residential	\$1,600 per ERU
Multi-Family Residential	\$1600 per ERU
Commercial, Industrial, & Public Buildings	\$1600 per ERU for each business plus \$1600 per ERU of the maximum sewage use for that business.
Recreational Vehicle Connections	\$50 plus the cost of inspection by city staff as set forth in the City's fee schedule. Unit must be equipped with a locking device provided by the applicant and approved by the public works supervisor

10.8 SUMMARY, FINDINGS, AND CONCLUSIONS

1. Without growth significant rate increases and layoffs will be necessary.
2. Capital Facility Charges should be set at the minimum level of \$1600 per ERU and other variables eliminated
3. 5% of the Operations Budget needs to be dedicated to the Capital Fund on a yearly basis to fund Repair and Replacement Projects.
4. A \$200,000 minimum reserve should be established for the Capital Fund
5. The City should complete a rate study after the first year of home sales in the MPDs. The City will then have a better idea of future growth rates and can plan accordingly.

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